

**PRELIMINARY ECOLOGICAL SURVEY FOR PROPOSED
CONCENTRATED SOLAR PARK (CSP) &
PTHOTOVOLTAIC (PV) PLANTS;
SAND DRAAI 391,
NORTHERN CAPE PROVINCE**



Compiled for: **Royal HaskoningDHV**

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1. BACKGROUND INFORMATION

Solafrica Photovoltaic Energy (Proprietary) Limited ("Solafrica") proposes a 150 MW Concentrated Solar Plant (CSP), based on a technology to be selected after the technical assessment of a feasibility study, with options to add, under subsequent phases, an additional 150 MW parabolic trough CSP plant and 125 MW PV facility in build-out of the project site situated on the Farm Sand Draai 391 in the Northern Cape province of South Africa. Solafrica's intends to develop a CSP plant with significant amounts of thermal storage. Solafrica appointed Royal HaskoningDHV formerly trading as SSI Engineers & Environmental Consultants (Pty) (Ltd) to undertake the environmental authorization (Basic Assessment and EIA) for the construction of the CSP and PV plants (henceforth called the Sand Draai CSP)

The purpose of this document is to highlight potential impacts on the biodiversity of the project mainly from a desktop potential and basic vegetation type and faunal (mammals, reptiles and amphibian) perspective. A separate specialist avifaunal (bird) assessment is being conducted for the project.

1.1 Objectives of the Preliminary Ecological Survey

- To provide a description of the vegetation as well as fauna with special emphasis of threatened plant or animal species occurring or likely to occur on the proposed Sand Draai CSP.
- To describe the available habitats on site including areas of important conservation value or areas most likely to form important habitat for remaining threatened plant and animal species on or around the proposed Sand Draai CSP.

1.2 Scope of study

- A preliminary ecological (Desktop) survey with special emphasis on the current status of threatened plant and animal species (Red Listed/Data Species), within the proposed Sand Draai CSP site using historic as well as published literature and distribution records.
- An assessment of the ecological habitats, evaluating conservation importance and significance with special emphasis on the current status of threatened plant and animal species (Red Data/Listed Species), within the proposed Sand Draai CSP site.
- To compile a preliminary sensitivity map for the proposed Sand Draai CSP site.
- Documentation of the findings of the study in a report.

1.3 Constraints of study

- Restricted to a desktop study.
- Limitation of the available data bases for the area. Inadequate coverage of the area during the South African Frog Atlas Project (SAFAP) as well as South African Reptile Conservation Assessment (SARCA).

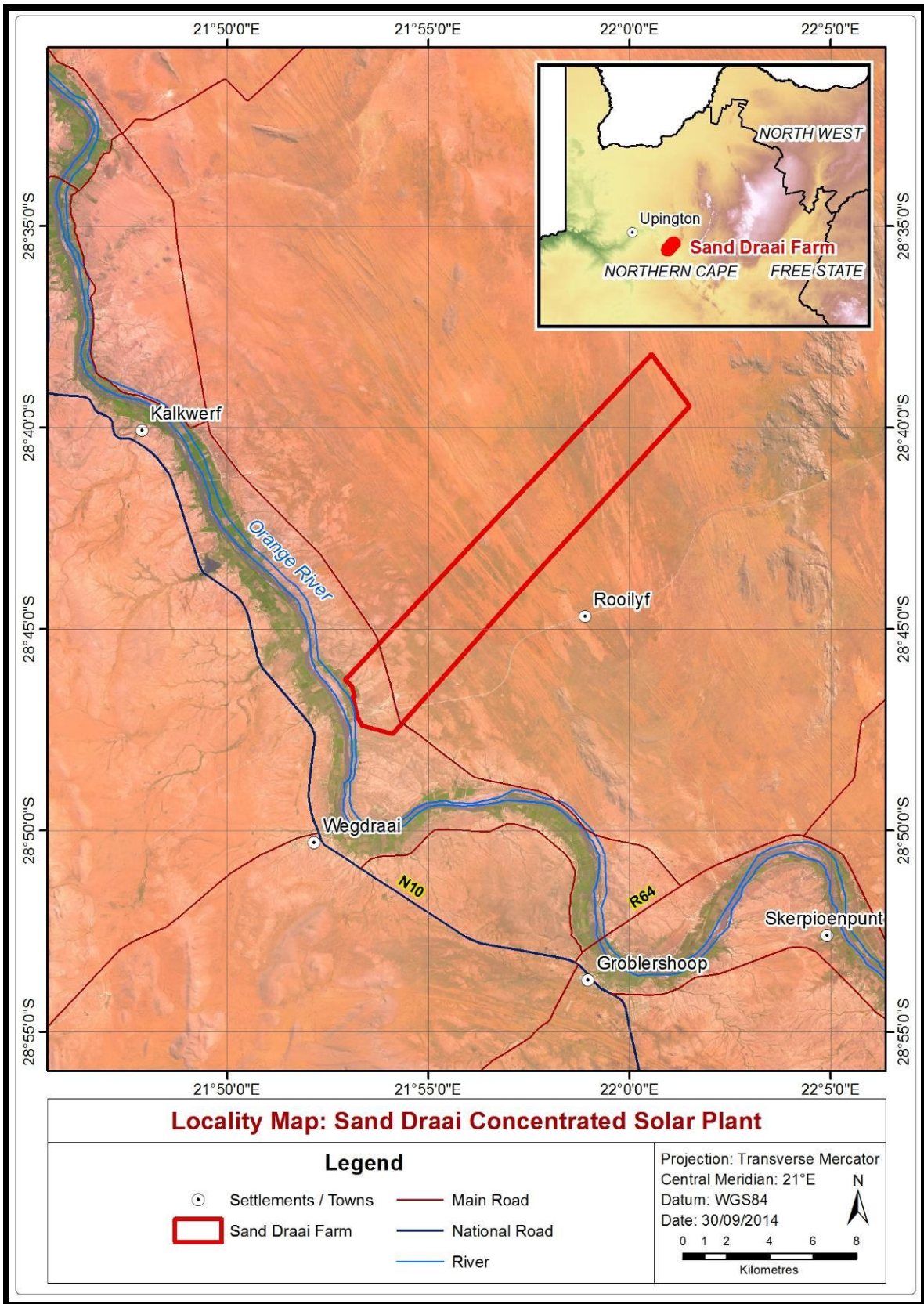


Figure1. Locality map of the proposed Sand Draai CSP
Sand Draai CSP: Preliminary Ecological Survey

2. METHODOLOGY

2.1 Predictive methods

A 1:50 000 map of the study area was provided showing existing infrastructure and the proposed CSP site. This was used as far as possible in order to identify potential "hot-spots" along the corridors, e.g. Patches of undisturbed vegetation, Gariiep (Orange) River, non-perennial drainage lines and rocky hills and inselbergs. Satellite imagery of the area was obtained from Google Earth™ was studied in order to get a three dimensional impression of the topography and land use.

2.2 Literature Survey

A detailed literature search was undertaken to assess the current status of the vegetation as well as threatened plant species as well as fauna that have been historically known to occur in the Groblershoop study area (2822 CA, 2821 CD & 2821 DD) quarter degree grid cells, within which the proposed Sand Draai CSP site is located. The literature search was undertaken utilizing *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description as well as *National Red List of Threatened Plants of South Africa* (Raimondo *et al*, 2009) as well as the internet using POSA (<http://posa.sanbi.org>) accessed on the 24th of September 2014. *The Mammals of the Southern African Subregion* (Skinner & Chimimba 2005) and *The Red Data Book of the Mammals of South Africa: A Conservation Assessment* (Friedmann and Daly (editors) 2004) as well as ADU's MammalMAP (http://vmus.adu.org.za/vm_sp_list.php) accessed on the 28th of September 2014) for mammals. *A Complete Guide to the Frogs of Southern Africa* (du Preez & Carruthers 2009) and *The Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland* (Minter *et al*. 2004) for amphibians as well as SAFAP FrogMAP (<http://vmus.adu.org.za>). *The Field Guide to the Snakes and other Reptiles of Southern Africa* (Branch 2001) and *South African Red Data Book-Reptiles and Amphibians* (Branch 1988) as well as SARCA (<http://sarca.adu.org.za>) accessed on the 28th of September for reptiles.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Location

The project site is located on the north-east end of an existing farm (Sand Draai) near the town of Groblershoop in the Northern Cape Province of South Africa (see Figure 1). A provincial gravel road (MR874 Gariep Road) runs through the farm property connecting with the N8 (national road). The N8 is accessible from Kimberley or via the N10 (national road) running from Britstown to Upington where it interfaces with the N14. It is situated east the lower portion of the Gariep (Orange) River, approximately 70 km southeast of the town of Upington. In this section of the river, the channel becomes wider with a large number of agricultural activities (mostly planting of grapes) present along the floodplain areas of the river.

The study area is located within the arid region of South Africa and annually receives approximately 108 mm of rain (Figure 2). Most rainfall occurs during the months of February and March (end summer-autumn). During the winter months (June, July, August) and spring (September) the average annual rainfall is 0 mm with the highest (32mm) in March. The monthly distribution of average daily maximum temperatures indicates that the average midday temperatures in summer ranges from 5°C in October to 33°C in March. The area is the coldest during July when the mercury drops to 0°C on average during the night (http://www.saexplorer.co.za/south-africa/climate/groblersdal_climate.asp).

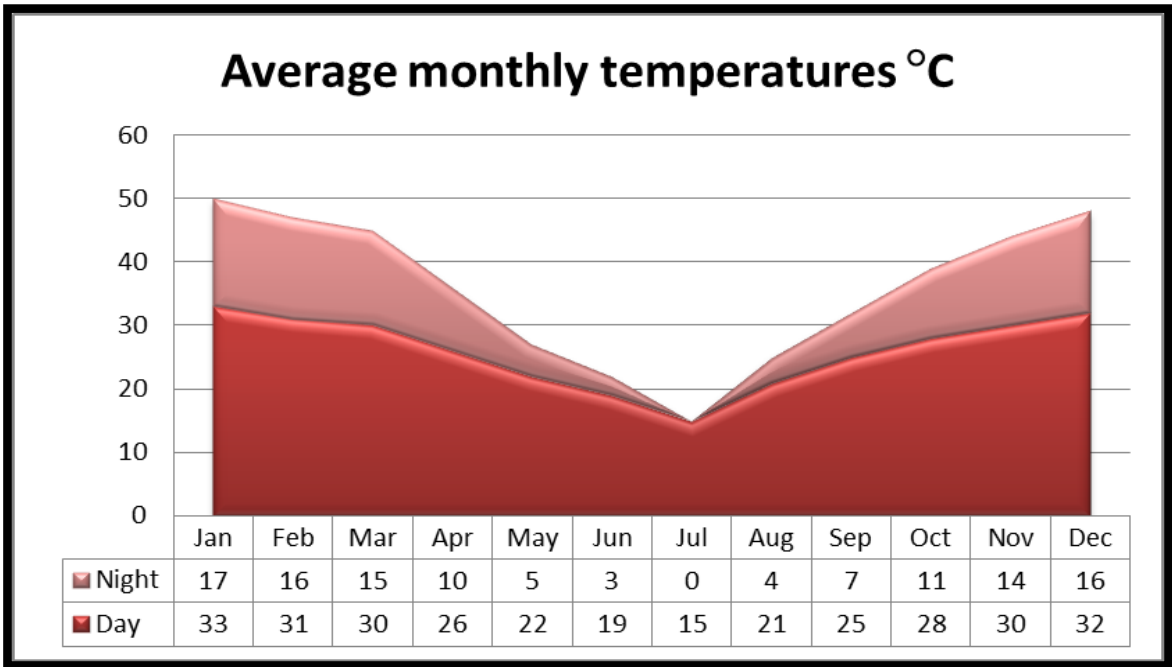
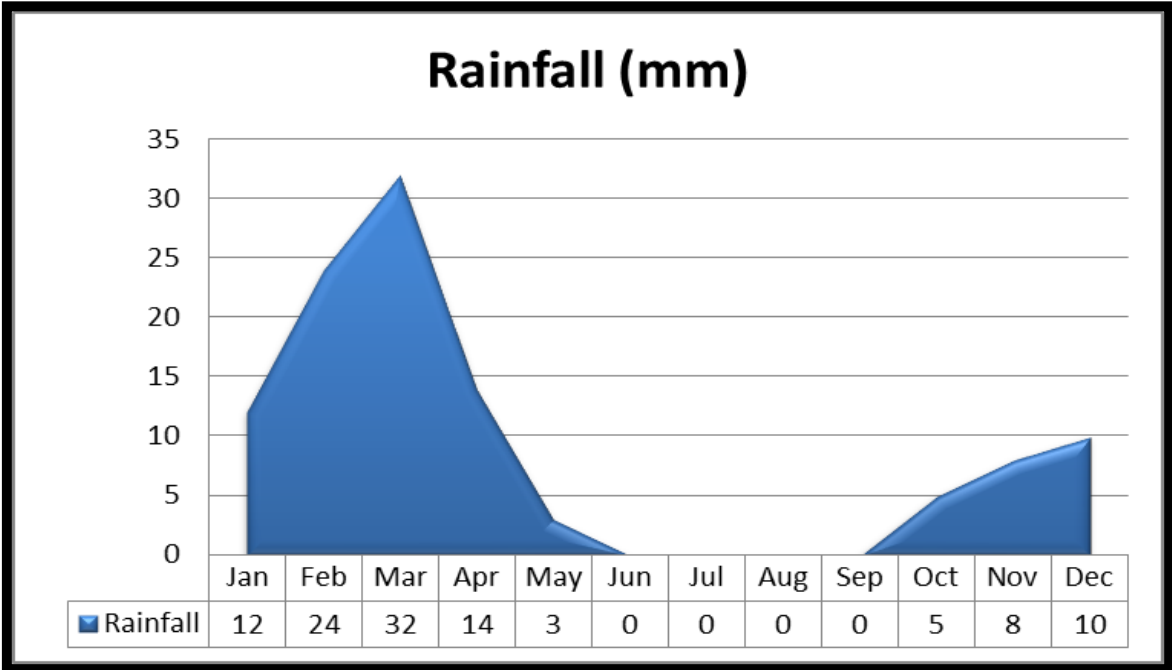


Figure2. Average monthly rainfall and temperatures for the study area.

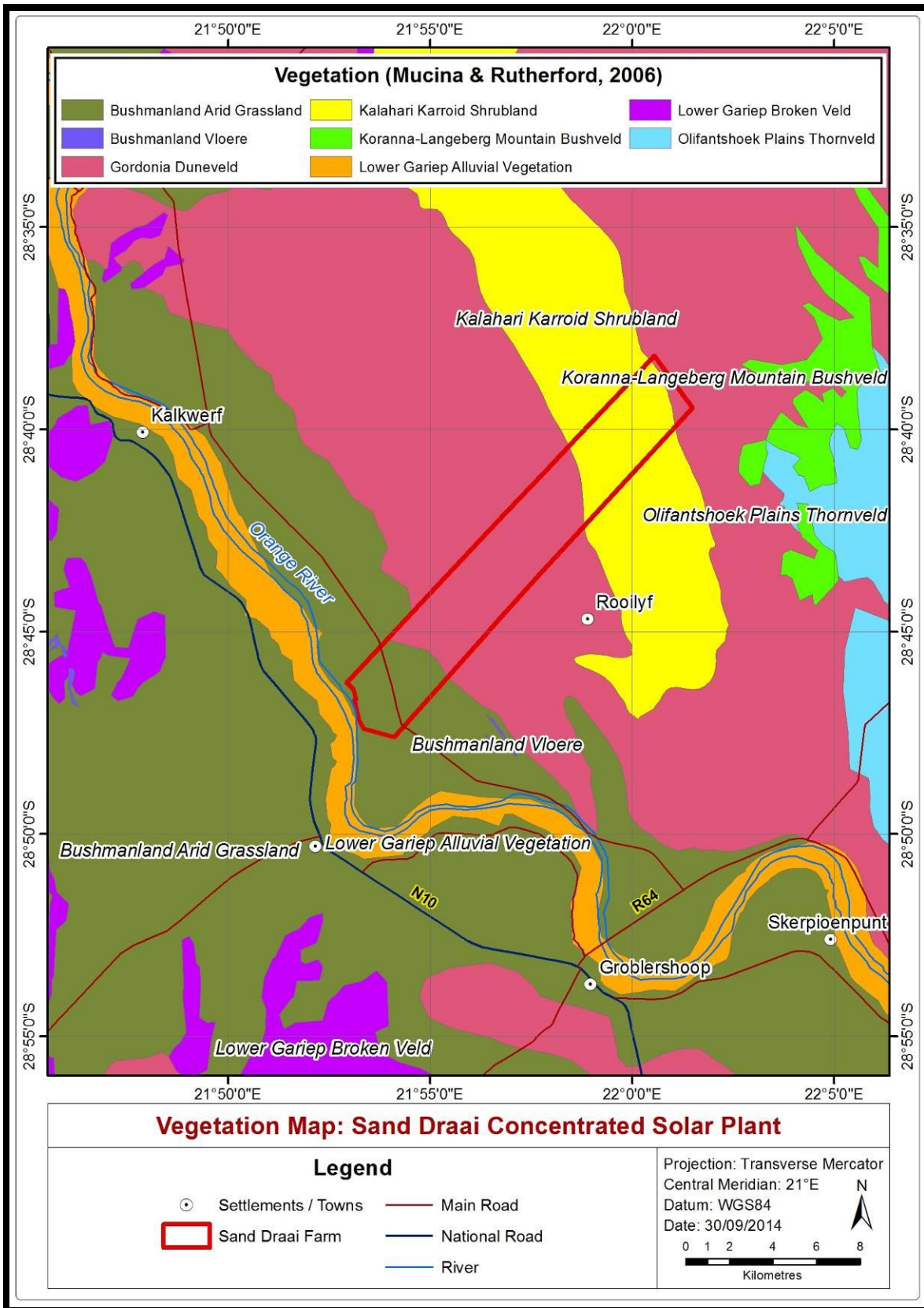


Figure3. Vegetation map for the proposed Sand Draai CSP.
Sand Draai CSP: Preliminary Ecological Survey

3.2 Vegetation

The study area is located within four vegetation types as defined by Mucina & Rutherford (2006) namely the **Bushmanland Arid Grassland (NKb3)**, **Gordonia Duneveld (SVkd1)**, Kalahari **Karroid Shrubland (NKb5)**, and the **Lower Gariep Alluvial vegetation (AZa3)** situated within the floodplain of the Gariep River (Figure 3 above).

3.2.1 Bushmanland Arid Grassland (NKb3)



The Bushmanland Arid Grassland is characterised by extensive to irregular plains on slightly sloping plateau vegetated grassland dominated by white grasses (*Stipagrostis* spp.) giving the vegetation type the character of semi-desert 'steppe'. In places low shrubs of *Salsola* sp. change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected. The dominance of the tall shrubs *Lycium cinereum*, *Rhigozum trichotomum*, the dwarf shrub *Aptosimum spinescens*, the grasses *Stipagrostis uniplumis*, *Enneapogon desvauxii*, *Cenchrus ciliaris* and *Aristida congesta*.

The geology of the vegetation unit comprises recent (Quaternary) alluvium and calcrete. Superficial deposits of the Kalahari Group are present in the east. The extensive Paleozoic diamictites of the Dwyka Group also outcrop in the area as do gneisses and meta-sediments of the Mokolian Age. This vegetation type occurs on freely drained, red-yellow apedal soil, with a high base status and <300mm deep and is sparsely vegetated and consists of irregular and slightly sloping plateau and plains grasslands. Very little of this vegetation type has been transformed and the area is mostly used for grazing by domestic livestock and game.

Important taxa (Mucina & Rutherford 2006):

Tridentea dwequensis; *Dinteranthus pole-evansii*; *Larryleachia dinteri*; *L. marlothii*; *Ruschia kenhardtensis*; *Lotononis oligocephala*; *Nemesia maxii*

Alien and invasive species within this vegetation type:

Prosopis glandulosa, *Opuntia* spp

Indigenous bush encroacher:

Acacia melifera subsp. *detinens*

Conservation status: Least threatened vegetation type with a conservation target of 21%. Only small patches statutorily conserved in Augrabies Falls National Park and Goegab. Nature Reserve Very little of this area has been transformed and erosion is low to very low (Mucina & Rutherford 2006).

3.2.2 *Gordonia Duneveld (SVkd1)*



The *Gordonia Duneveld (SVkd1)* consists of parallel dunes on deep Aeolian sand underlain by superficial silicretes and Calcretes of the Cenozoic Kalahari Group with flat areas between the dunes, the latter between 3-8m above the plains. The vegetation is dominated by open shrub-land with ridges of grassland dominated by *Stipagrostis amabilis* on the dune crests and *Acacia haematoxylon* on the dune slopes, also with the bush encroacher *Acacia mellifera* subsp. *detinens* on the lower slopes and *Rhigozum trichotomum* in the interdune straten (Mucina & Rutherford 2006).

Important taxa-Kalahari Endemics (Mucina & Rutherford 2006):

Small trees/shrubs	<i>Acacia haematoxylon</i>
Grasses	<i>Stipagrostis amabilis; Anthephora argentea; Megaloprotachnes albescens</i>
Forbs	<i>Helichrysum arenicola; Kohautia ramosissima; Neuradopsis austro-africana</i>

Alien species within this vegetation type:

<i>Prosopis glandulosa; Atriplex nummularia</i>

Conservation status: Least threatened with a target of 16% conserved. Some 14% statutorily conserved in the Kgalagadi Transfrontier Park. Very little is transformed and erosion is generally low, but some areas with spectacular destabilization of normally vegetated dunes through local overstocking.

3.2.3 Kalahari Karroid Shrubland (NKb5)



The Kalahari Karroid Shrubland is dominated by low karroid shrubland on flat, gravel plains. The vegetation is characterised by low karroid shrubs and is indicative of a transition zone between the deep Kalahari sand and the Karoo shrublands. The vegetation is dominated by the small trees/tall shrubs *Acacia mellifera*, *Boscia foetida*, *Rhigozum trichotomum*, *Parkinsonia africana* the low shrub *Hermannia spinosa*, the grasses *Aristida adscensionis*, *Enneapogon desvauxi*, *Stipagrostis uniplumis*, *Aristida cangesta* and the forbs *Dicoma capensis* and *Chamaesyce inaquilatera*.

The geology is characterised by Cenozoic Kalahari Group sands and small patches of calcrete outcrops and screes on scarps of intermittent rivers (mekgacha). In places Dwyka tillites outcrop. The soils are deep (>300mm), red-yellow, apedal, freely drained with a high base status (Mucina & Rutherford 2006).

Important taxa (Mucina & Rutherford 2006):

Grasses	<i>Dinebra retroflexa</i>
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Alien species within this vegetation type:

<i>Prosopis glandulosa</i> ; <i>Opuntia</i> spp.
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Conservation status: Least threatened with a conservation target of 21%. Very little is statutorily conserved in the Augrabies Falls National Park. Although only a small area has been transformed many of the belts of this vegetation type were preferred routes for early roads, thus promoting the introduction of alien plants, especially *Prosopsis* spp. Erosion is very low (Mucina & Rutherford 2006).

3.2.4 Lower Gariep Alluvial vegetation (AZa3)



The vegetation of the Lower Gariep Alluvial vegetation (AZa3) type comprises alluvial terraces and small riverine “islands” with riparian thickets mostly dominated by *Ziziphus mucronata*, *Acacia karroo*, *Salix mucronata*, *Euclea pseudebenus* and *Phragmites australis*. Grasslands occurring on the flat alluvial are periodically flooded and also forms part of this complex vegetation type. These grasslands are mostly dominated by *Cynodon dactylon*, *Setaria verticillata* and *Cenchrus ciliaris*. Due to the unpredictable flooding events the riparian areas have a high disturbance regime and soil movement. Grass cover varies both spatially and temporally. A number of alien plants occur along these riparian embankments. Recent alluvial deposits of the Orange River supporting soil forms such as Dundee and Oakleaf. The Orange River cuts through a great variety of Pre-cambian metamorphic rocks. The Orange River is subjected to floods, especially in summer, as a result of high precipitation on the highveld. The soil of these areas (mainly from the Ia land type) are very fertile resulting in various grapes and other crops being planted along the Gariep (Orange) River (Mucina & Rutherford 2006).

Alien species within this vegetation type:

Salix babylonica; *Prosopis glandulosa*.

Conservation status: Endangered with a conservation target of 31% with only 6% statutorily conserved in the Richtersveld and Augrabies Falls National Parks. Some 50% transformed for agricultural purposes (vegetables and grapes) or alluvial diamond mining. *Psosopis* spp., *Nicotiana glauca* and *Argemone ochroleuca* can invade the alluvia in disturbed places (Mucina & Rutherford 2006).

3.3 Red Data/Protected Species



Figure4 A few scattered protected Shepherd's Trees (*Boscia albitrunca*) have been recorded during previous surveys around the Sand Draai-Groblershoop area.

Table1. Protected tree species of the study area.

Species name	Common Name	Recorded in study area
<i>Acacia erioloba</i>	Camel thorn	✓
<i>Acacia haematoxylon</i>	Grey camel thorn	✓
<i>Boscia albitrunca</i>	Shepherd's tree	✓

In terms of the National Forests Act 1998 (Act No 84 of 1998) the Camel Thorn (*Acacia erioloba*), Grey Camel Thorn (*Acacia haematoxylon*) and Shepherd's Tree (*Boscia albitrunca*) has been identified and declared as protected. The Department of Water Affairs and Forestry (now Department of Forestry and Fisheries) developed a list of protected tree species. In terms of Section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization. The Department of Agriculture, Forestry and Fisheries (DAFF) will have to be approached to obtain the required permits for the removal of any protected tree species. A list of red data and endemic species for the Northern Cape Province is included in the Appendix (see Table 8) while a list of possible red data species for the study area is included as Table 2 below:

Table2. List of possible red data and endemic species for the Sand Draai-Groblershoop area (red=confirmed during previous surveys in the area).

Genus	Species	Family	Endemism	National Status	Assessment Rationale
Acacia	erioloba	FABACEAE	NOT	Declining	Concerns have been raised over the large volumes of <i>A. erioloba</i> wood being removed for commercial sale of firewood. Many trees are also killed as a result of bush encroachment control through pesticides. A study conducted in the Northern Cape indicated that at present only dead trees are being harvested for firewood and only a very small percentage of the study area (less than 2%) was affected by clearing of <i>A. erioloba</i> .
Anacampseros	scopata	PORTULACACEAE	SA	Rare	A habitat specialist, this species is not threatened due to the inaccessibility of its habitat.
Cleome	conrathii	CAPPARACEAE	SA	NT	Known from 8 locations and potentially threatened by urbanisation, invasive alien plants, incorrect fire regimes, overgrazing and trampling, erosion and incorrect fire regimes.
Gethyllis	namaquensis	AMARYLLIDACEAE	FSA	VU	This is a Northern Namaqualand and Southern Namibian endemic, suspected to occur in less than 100 locations. Subpopulations are small (typically less than 20 plants). There are a few large subpopulations but these are never larger than 1000 individuals. We suspect that there are fewer than 10 000 plants in total. There is an ongoing decline as a result of harvesting for food and horticultural purposes.
Dinteranthus	pole-evansii	MESEMBRYANTHEMACEAE	SA	VU	A restricted range species (EOO 10 km ²), known from only two locations from fewer than 1000 mature individuals and potentially threatened by livestock overgrazing.
Dinteranthus	wilmotianus	MESEMBRYANTHEMACEAE	FSA	NT	EOO less than 10 000 km ² , suspected to occur at between 10 and 20 locations. This species is experiencing ongoing decline due to crop farming and livestock overgrazing and trampling.
Felicia	deserti	ASTERACEAE	SA	DD	Known only from 2 old (pre 1925) highly disjunct collections, one from Keimos in the Upington dist the other from the Khamiesberg. No habitat information known.

Table3. Vegetation status of different vegetation types (Mucina & Rutherford 2006).

VEGETATION TYPE	NATIONAL STATUS	REMAINING	CONSERVATION TARGET	FORMALLY CONSERVED
Bushmanland Arid Grassland (NKb3)	Least Threatened	99%	20%	0.1%
Gordonia Duneveld (SVkd 1)	Least Threatened	99.8%	16%	14.2%
Kalahari Karroid Shrubland (NKb 5)	Least Threatened	99.2%	21%	0.1%
Lower Gariep Alluvial vegetation (AZa3)	Endangered	50%	31%	6%

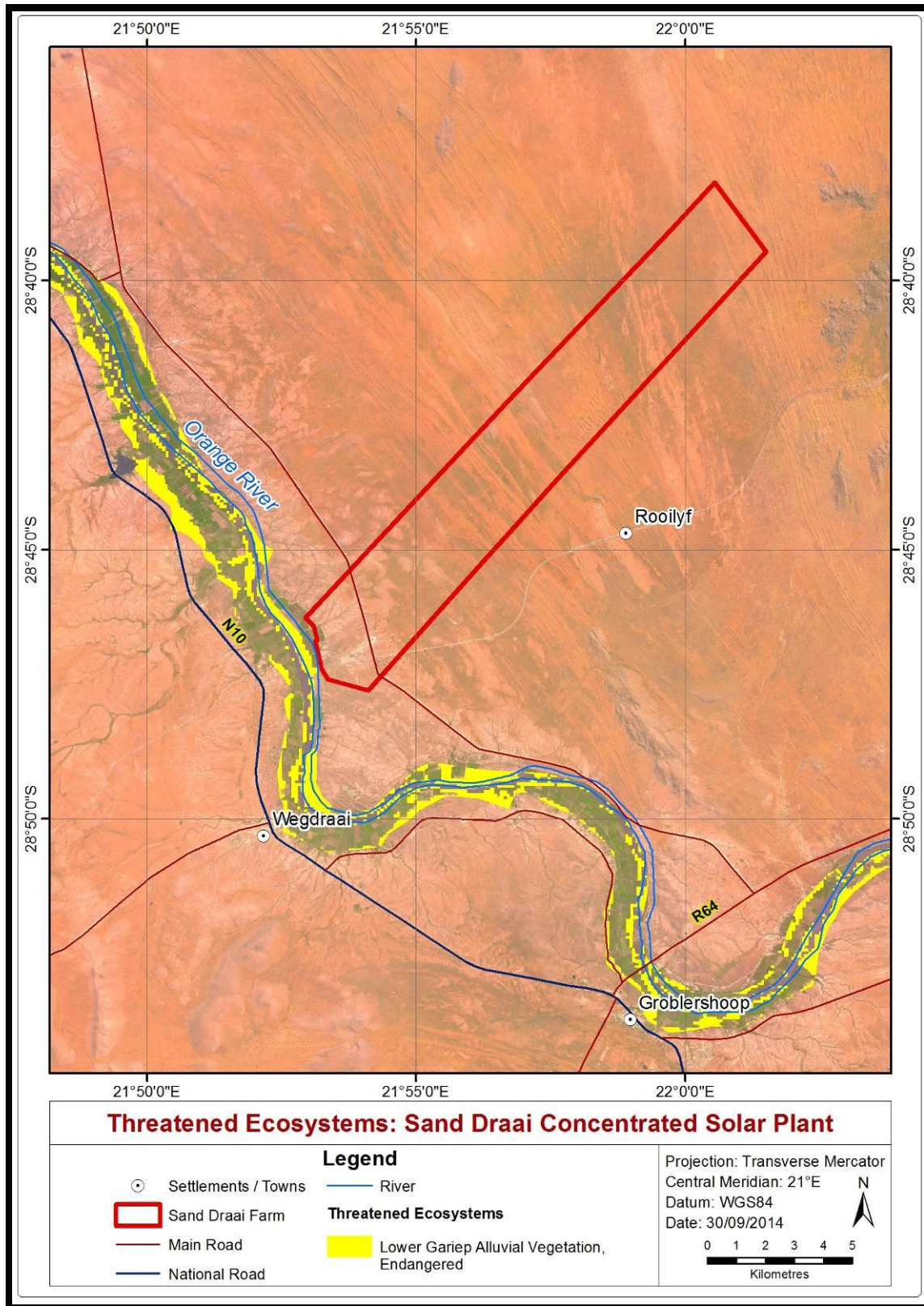


Figure5. Sand Draai site in relation to any threatened ecosystems (SANBI GIS layer).

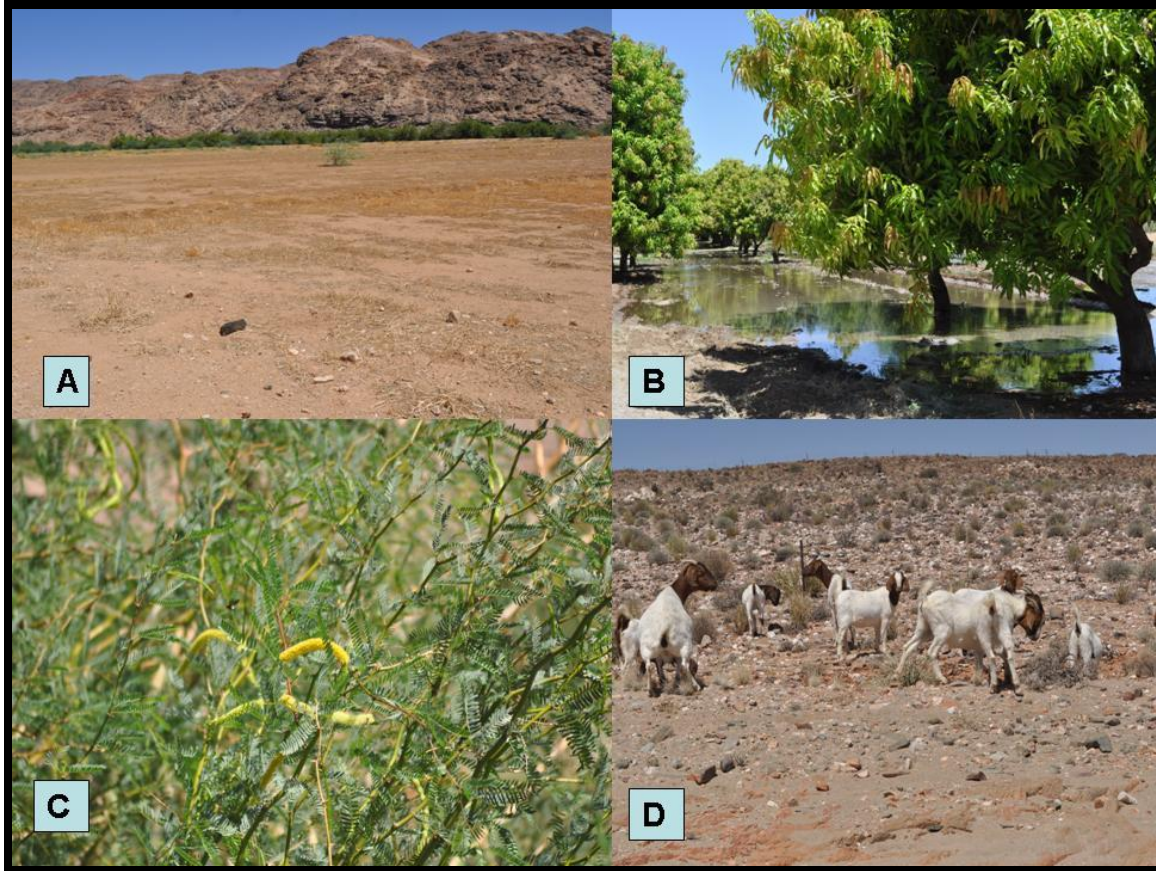


Figure 6. A conglomerate of photographs displaying the current impacts on the vegetation around the Sand Draai site. A: Large sections adjacent to the Gariep (Orange) River have been transformed by the ploughing of lands. **B:** Existing agricultural activities including vegetable and fruit (Mango) and grape orchards occur within the floodplain of the Gariep River. **C:** Extensive alien vegetation invasion especially along the riparian zone of the Gariep River as well as to a lesser extent along the non-perennial drainage lines. Vast stands of *Prosopis glandulosa* var. *tooreyana* occur within the macro-channel embankments of the Gariep River and old lands/orchards. **D:** Livestock grazing activities including goats and cattle have a high impact on the sparse karroid vegetation.

3.4 Land Degradation

The study area is located within an area where soil erosion is regarded as insignificant with low to medium veld degradation. Most of these areas are flat while deep sand occurs on the duneveld areas. As a result little erosion is present. The smaller drainage channels or non-perennial drainage lines that occur scattered throughout the south-western portions of the site contribute somewhat to erosion especially during (infrequent) flash floods. The areas are mostly utilised for grazing by game and domestic animals, thus in some areas signs of overgrazing are evident, though not large areas. The riverine areas belonging to the Lower Gariep Alluvial vegetation (AZa3) are the areas that are mostly affected by agricultural activities with close to 50% of the area transformed. The Lower Gariep Alluvial vegetation (AZa3) unit falls within an "Endangered" ecosystem.

3.5 Discussion

The vegetation of the study area is associated with the arid section of the rainfall gradient and occurs on sandy soil while alluvial soil is present in the riparian zone. The topography varies from low-lying plateau areas, flat plains to deep red sandy dunes between 3-9m tall. The area is regarded by some scientists as a transitional area between the Kalahari and the Nama-karoo. The vegetation comprises small trees/tall shrubs with the grass layer the most prominent. The dune areas have scattered small to medium-sized trees. The Bushmanland Arid Grassland (NKb3), Gordonia Duneveld (SVkd 1), and Kalahari Karroid Shrubland (NKb 5) vegetation types are all three regarded as being "least threatened" in terms of the conservation of these vegetation types. The presence of protected tree species *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca* have been confirmed in these vegetation types. The destruction of these species will therefore have to be prevented. These areas are regarded as having a moderate floristic status. The Lower Gariep Alluvial vegetation (AZa3) is structurally complex comprising dense riverine vegetation, short open grassland on floodplains, bare rocks in the riverbed and dense reed beds in some areas. This vegetation type is subject to large scale degradation and is as a result regarded as "endangered" and therefore has a high conservation status.

This region is economically important in terms of the production of grapes, meat and wool production. Tourism potential is regarded as medium to low. Very little research has been undertaken in the region that is regarded as species rich with more than 7000 plant species recorded. All four vegetation types present are poorly protected although large sections are still natural.

3.6 Conclusion

The largest part of the vegetation of the study area is not threatened from a conservation point of view. Sections within these different vegetation types are degraded due to human influences, while alien invasive species are present in other parts where they have displaced the natural vegetation. Suitable habitat does however exist for some red data species and have been recorded in the vicinity of the study area. The presence of three protected species has also been confirmed during a brief site visit to the area during previous surveys. In order to prevent erosion and to ensure that no endemic/red data / protected plants are destroyed a more detailed assessment of the vegetation needs to be undertaken during the 2014 summer wet season; after adequate rainfall.

4. PRELIMINARY FAUNAL HABITAT ASSESSMENT

The Nama-Karoo and Succulent Karoo, now almost devoid of large wild ungulates, holds some 10 million Sheep (*Ovis aries*) and Goats (*Capra hircus*). The once plentiful and diverse set of nomadic herbivores has been replaced by large encamped herds of small livestock with specialist feeding habits. Nearly 200 years of this treatment has had a devastating effect on the Karoo soils and vegetation. Prolonged heavy grazing is considered to suppress shoot/root formation and flowering in the Nama-Karoo and Succulent-Karoo flora, which leads to compositional changes and depletion and thinning out of the vegetation, particularly those components that the sheep find palatable (Milton *et al.* 1994). Changes in the structure and composition of the vegetation affect the associated fauna. Thinning of the already sparse vegetation layer has greatly accelerated rates of soil erosion. Although conditions have improved since the 1950's, vegetation changes in the Nama-Karoo and Succulent-Karoo are now difficult or even impossible to reverse. The changed herbivore community and the resultant impacts on the vegetation has led to lower productivity of karroid vegetation. This, in turn, is thought to have affected the food chain and ultimately reduced the density of tertiary predators, particularly mammals as well as large eagles. High livestock densities also pose considerable threat to wildlife, since high numbers of domesticated animals generally cause a displacement of game, as there is less suitable habitat available. Furthermore, wild predators and scavengers such as the Black-backed Jackal, Caracal, Leopard and the Cape vulture have been eradicated by livestock farmers who see these animals as a threat to their livelihoods. Poisoned carcasses are often used for this purpose; this method is indiscriminate and therefore poses considerable threat to all predators and scavengers; especially the threatened White-backed and Lappet-faced Vultures. Poaching and illegal hunting (dogs) are further reducing the remnant faunal populations.

No comprehensive faunal surveys or site visits have been conducted and species lists provided below are of species most likely to occur on the site compiled from previous surveys conducted in the Northern Cape area, virtual museums as well as published literature.

4.1 Mammals

The area is currently utilised for pastoral livestock grazing activities as well as extensive agricultural activities adjacent to the Gariep (Orange) River. The baiting and non-selective killing of predators has a negative impact on remaining populations. The use of wire snares as well as hunting dogs for high intensity poaching activities will significantly affect remaining mammal species such as rabbits and mongooses. Smaller mammal species are extremely vulnerable to snares and poaching activities as well as feral cats and dogs. Furthermore, goat and cattle grazing observed within the study area influences the existence of small mammals in the area. According to Bergstrom (2004), the presence of livestock has a negative effect on both small mammal species richness and abundance. Secondary access roads and vehicles around the site as well as major road networks increase the risk of road fatalities of smaller mammal species such as the Yellow mongoose (*Cynictis penicillata*), scrub hares (*Lepus saxatilis*) and South African ground squirrels (*Xerus inauris*) as well as larger burrowing mammals such as Aardvark (*Orycteropus afer*), Porcupines (*Hysterix africae australis*) and Bat-eared Foxes (*Octocyon megalotis*).

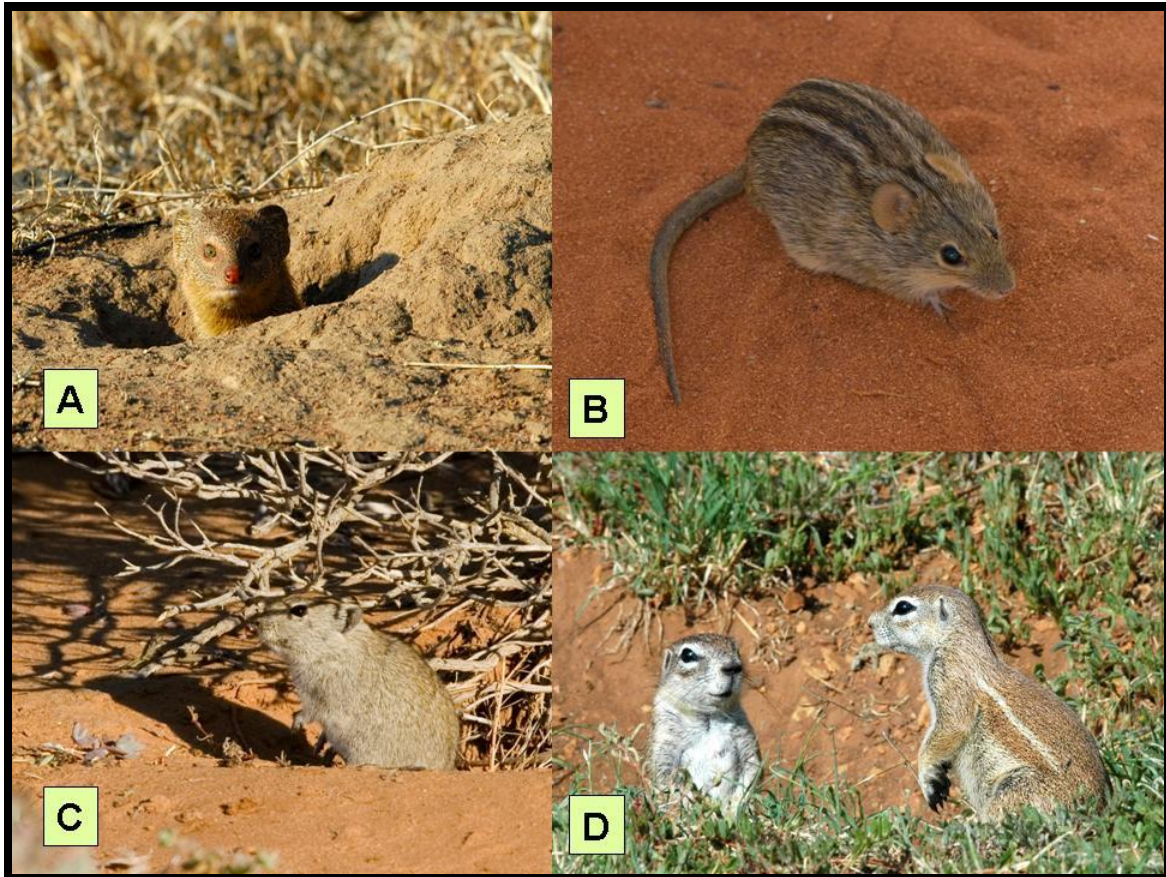


Figure 7. Small mammal species likely to occur on the site include: **A:** Yellow Mongoose (*Cynictis penicillata*); **B:** Xeric Four-striped Grass Mouse (*Rhabdomys pumilio*); **C:** Brant's Whistling Rat (*Parotomys brantsii*) and **D:** South African Ground Squirrel (*Xerus inauris*). Photographs courtesy of Prof. G.D. Engelbrecht University of Limpopo.

Various mammal species are likely to occur within the study area. A probable mammal species list of mammals that are likely to occur in study area according to Skinner & (Chimimba 2006) with the assigned level of threat facing each particular species is included in Table 4 below. A map was used to correlate the occurrence of the Red Data species with their approximate occurrence within the study area. According to Friedman & Daly (2004) and Skinner & Chimimba (2006), the majority of species within the study area are common and widespread and listed as species of least concern.

Table4. Mammal species recorded from the study area according to MammalMAP as well as published distribution records (SKinner & Chimimba 2006).

Family	Genus	Species	Subspecies	Common name	Red list category
Bathyergidae	<i>Cryptomys</i>	<i>hottentotus</i>		Southern African Mole-rat	Not listed
Bovidae	<i>Alcelaphus</i>	<i>caama</i>		Red Hartebeest	Not listed
Bovidae	<i>Antidorcas</i>	<i>marsupialis</i>		Springbok	Not listed
Bovidae	<i>Connochaetes</i>	<i>taurus</i>	<i>taurus</i>	Blue Wildebeest	Not listed
Bovidae	<i>Damaliscus</i>	<i>pygargus</i>	<i>phillipsi</i>	Blesbok	Not listed
Bovidae	<i>Kobus</i>	<i>ellipsiprymnus</i>	<i>ellipsiprymnus</i>	Waterbuck	Not listed
Bovidae	<i>Oryx</i>	<i>gazella</i>		Gemsbok	Not listed
Bovidae	<i>Raphicerus</i>	<i>campestris</i>		Steenbok	Not listed
Bovidae	<i>Taurotragus</i>	<i>oryx</i>		Common Eland	Not listed
Canidae	<i>Otocyon</i>	<i>megalotis</i>		Bat-eared Fox	Not listed
Herpestidae	<i>Cynictis</i>	<i>penicillata</i>		Yellow Mongoose	Not listed
Manidae	<i>Manis</i>	<i>temminckii</i>		Ground Pangolin	Near-Threatened
Muridae	<i>Aethomys</i>	<i>namaquensis</i>		Namaqua Rock Mouse	Least Concern
Muridae	<i>Desmodillus</i>	<i>auricularis</i>		Cape Short-tailed Gerbil	Not listed
Muridae	<i>Gerbillurus</i>	<i>paeba</i>		Paeba Hairy-footed Gerbil	Not listed
Muridae	<i>Gerbillurus</i>	<i>vallinus</i>		Brush-tailed Hairy-footed Gerbil	Not listed
Muridae	<i>Mastomys</i>	<i>coucha</i>		Southern African Mastomys	Not listed

Muridae	<i>Rhabdomys</i>	<i>pumilio</i>		Xeric Four-striped Grass Rat	Not listed
Muridae	<i>Tatera</i>	<i>brantsii</i>		Highveld Gerbil	Least Concern
Mustelidae	<i>Ictonyx</i>	<i>striatus</i>		Striped Polecat	Not listed
Nesomyidae	<i>Malacothrix</i>	<i>typica</i>		Large-eared African Desert Mouse	Not listed
Orycteropodidae	<i>Orycteropus</i>	<i>afer</i>		Aardvark	Not listed
Soricidae	<i>Crocidura</i>	<i>cyanea</i>		Reddish-gray Musk Shrew	Not listed
Soricidae	<i>Crocidura</i>	<i>hirta</i>		Lesser Red Musk Shrew	Not listed



Figure8. A collage of photographs displaying the threatened mammal species likely to occur on and around the Sand Draai CSP site. A: South African Hedgehog (*Aterix frontalis*); **B:** Ground Pangolin (*Manis temminckii*); **C:** Honey Badger (*Mellivora capensis*) photographs courtesy of Prof G.D. Engelbrecht and **D:** Black-footed or Small Spotted Cat (*Felis nigripes*). Photograph taken by Beryl Wilson in the Benfontein Nature Reserve near Kimberley

Table5. Mammal species of conservation importance possibly occurring on the proposed site (using habitat availability and distribution as an indicator of presence)

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Erinaceidae	<i>Atelerix</i>	<i>frontalis</i>		South African Hedgehog	Near Threatened	0
Hyaenidae	<i>Hyaena</i>	<i>brunnea</i>		Brown Hyaena	Near Threatened	0
Macroscelididae	<i>Elephantulus</i>	<i>intufi</i>		Bushveld Elephant-shrew	Data Deficient	0
Manidae	<i>Manis</i>	<i>temminckii</i>		Pangolin	Vulnerable	0
Mustelidae	<i>Mellivora</i>	<i>capensis</i>		Honey Badger	Near Threatened	0
Petromuridae	<i>Petromus</i>	<i>typicus</i>		Dassie Rat	Near Threatened	0
Rhinolophidae	<i>Rhinolophus</i>	<i>denti</i>		Dent's Horseshoe Bat	Near Threatened	0
Vespertilionidae	<i>Miniopterus</i>	<i>schreibersii</i>		Schreibers' Long-fingered Bat	Near Threatened	0

Several mammal species have been downgraded since the conservation assessment undertaken by Friedman & Daly, (2004). Species downgraded to Least Concern included Dassie Rat (*Petromus typicus*), Honey Badger (*Mellivora capensis*), Geoffrey's Horeshoe Bat (*Rhinolophus clivosus*) and the Litledale's Whistling Rat (*Parotomys littedalei*) which were previously listed as 'Near Threatened'. More intensive surveys are required in order to ascertain the current conservation status of the above-mentioned threatened mammal species on the site.

4.2 Reptiles

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe even during intensive field surveys conducted over several seasons. **The majority reptile species are sensitive to severe habitat alteration and fragmentation.** Due to current agricultural activities in the area coupled with increased habitat degradation (overgrazing, soil erosion) and disturbances are all causal factors in the alteration of reptile species occurring in these areas. Rocky hills and rocky outcrops or koppies occur on and around the proposed Sand Draai site and provide favourable refuges for certain snake and lizard species (rupicolous species). Reptile species likely to occur within the rocky hills and koppies included Variegated Skink (*Trachylepis variegata*), Western Three-striped Skink (*Trachylepis occidentalis*), Western Rock Skink (*Trachylepis sulcata sulcata*), Southern Rock Agama (*Agama atra*) and Ancheita's Agama (*Agama anchietae*). Suitable habitat occurs for the Karoo Girdled Lizard (*Karusasaurus polyzonus*) in the rocky hills and koppies, inhabiting fissures between rocks and under loosely embedded rocks



Figure9. Rupicolous reptile species likely to occur on the site include: (A, B & C) Southern Rock Agama (*Agama atra*) occur within rocky hills and koppies, inhabiting fissures between rocks and under loosely embedded rocks and **D: Western Rock Skink (*Trachylepis sulcata sulcata*)**

Trees such as the protected large Camel Thorns (*Acacia erioloba*) and Grey camel Thorn (*Acacia haematoxylon*) offer suitable habitat for arboreal reptile species, such as the Karasburg Tree Skink (*Trachylepis sparsa*). Moribund (old abandoned or dead mounds) termite mounds offer important refuges for numerous frog, lizard and snake species. Large number of species of mammal, birds, reptiles and amphibians feed on the emerging alates (winged termites). These mass emergences coincide with the first heavy summer rains and the emergence of the majority of herpetofauna. Termite mounds also provide nesting site for numerous snakes, lizards (varanids) and frogs.



Figure 10. A conglomerate of photographs displaying the reptile species recorded from the Sand Draai study area. A: Bushveld Lizard (*Heliobolus lugubris*); **B:** Serrated Tent Tortoise (*Psammobates oculifer*); **C:** Quartz Gecko (*Pachydactylus latirostis*); **D:** Ground Agama (*Agama aculeata aculeata*); **E:** Brown House Snake (*Boaedon capensis*); **F:** Rhombic Egg-eater (*Dasypeltis scabra*); **G:** Karoo Girdled Lizard (*Karusasaurus polyzonus*); **H:** Bribon's Gecko (*Chondrodactylus bibronii*) and **I:** Spotted Barking Gecko (*Ptenopus garrulous maculatus*).

Favourable habitat exists throughout most of the study area for various snake species. Indiscriminate killing of all snake species is likely to have resulted in the disappearance of the larger and the more sluggish snake species within the study area. The frequent burning of the site will have a high impact on remaining reptiles. Fires during the winter months will severely impact on reptiles undergoing brumation, and are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Table6. A list of reptile species recorded from the 2822CA, 2821CD, 2821DD QDGC's according to ReptiMAP/SARCA.

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Agamidae	<i>Agama</i>	<i>aculeata</i>	<i>aculeata</i>	Common Ground Agama	Least Concern (SARCA 2014)	Yes
Agamidae	<i>Agama</i>	<i>atra</i>		Southern Rock Agama	Least Concern (SARCA 2014)	
Amphisbaenidae	<i>Dalophia</i>	<i>pistillum</i>		Blunt-tailed Worm Lizard	Least Concern (SARCA 2014)	
Amphisbaenidae	<i>Monopeltis</i>	<i>mauricei</i>		Maurice's Worm Lizard	Least Concern (SARCA 2014)	Yes
Colubridae	<i>Boaedon</i>	<i>capensis</i>		Brown House Snake	Least Concern (SARCA 2014)	
Colubridae	<i>Dasypeltis</i>	<i>scabra</i>		Rhombic Egg-eater	Least Concern (SARCA 2014)	
Colubridae	<i>Psammophis</i>	<i>notostictus</i>		Karoo Sand Snake	Least Concern (SARCA 2014)	
Cordylidae	<i>Karusasaurus</i>	<i>polyzonus</i>		Karoo Girdled Lizard	Least Concern (SARCA 2014)	Near Endemic
Gekkonidae	<i>Chondrodactylus</i>	<i>angulifer</i>	<i>angulifer</i>	Common Giant Ground Gecko	Least Concern (SARCA 2014)	
Gekkonidae	<i>Chondrodactylus</i>	<i>bibronii</i>		Bibron's Gecko	Least Concern (SARCA 2014)	
Gekkonidae	<i>Pachydactylus</i>	<i>capensis</i>		Cape Gecko	Least Concern (SARCA 2014)	

Gekkonidae	<i>Pachydactylus</i>	<i>latirostris</i>		Quartz Gecko	Least Concern (SARCA 2014)	
Gekkonidae	<i>Ptenopus</i>	<i>garrulus</i>	<i>maculatus</i>	Spotted Barking Gecko	Least Concern (SARCA 2014)	Yes
Lacertidae	<i>Heliobolus</i>	<i>lugubris</i>		Bushveld Lizard	Least Concern (SARCA 2014)	
Scincidae	<i>Trachylepis</i>	<i>sparsa</i>		Karasburg Tree Skink	Least Concern (SARCA 2014)	
Scincidae	<i>Trachylepis</i>	<i>sulcata</i>	<i>sulcata</i>	Western Rock Skink	Least Concern (SARCA 2014)	Yes
Scincidae	<i>Trachylepis</i>	<i>variegata</i>		Variegated Skink	Least Concern (SARCA 2014)	
Testudinidae	<i>Psammobates</i>	<i>oculifer</i>		Serrated Tent Tortoise	Least Concern (SARCA 2014)	Yes
Viperidae	<i>Bitis</i>	<i>arietans</i>	<i>arietans</i>	Puff Adder	Least Concern (SARCA 2014)	

Threatened species

According to the outdated Branch (1988b) Red Data Book as well as the updated South African Reptile Conservation Assessment (SARCA) virtual museum; no threatened species of reptile occurs within the study area. More intensive surveys conducted over the correct period are required in order to compile actual species lists for the site.

4.3 AMPHIBIANS

Amphibians are an important component of South Africa's exceptional biodiversity (Siegfried 1989) and are such worthy of both research and conservation effort. This is made additionally relevant by international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but as yet is poorly understood (Wyman 1990; Wake 1991). Amphibians have declined dramatically in many areas of the world. These declines seem to have worsened over the past 25 years and amphibians are now more threatened than either mammals or birds, though comparisons with other taxa are confounded by a shortage of reliable data.

Most frogs have a biphasic life cycle, where eggs laid in water develop into tadpoles and these live in the water until they metamorphose into juvenile frogs living on the land. This fact, coupled with being covered by a semi-permeable skin makes frogs particularly vulnerable to pollutants and other environmental stresses. Consequently frogs are useful environmental bio-monitors (bio-indicators) and may act as an early warning system for the quality of the environment

Breeding in African frogs is strongly dependent on rain, especially in the drier parts of the country where surface water only remains for a short duration. The majority of frog species in the Northern Cape Province can be classified as explosive breeders. Explosive breeding frogs utilise ephemeral or seasonally inundated grassy pans for their short duration reproductive cycles. The amphibians of the area belong to the Kalahari assemblage whose boundaries conform closely to those of the Kalahari savannas of the Northern Cape and North-West provinces. The Kalahari is distinguished especially by its deep sandy substrates, and this feature has a marked effect on the availability of surface water. This is likely to be the key factor in the biogeography of amphibians. It is significant that the sole listed indicator species is a terrestrial breeder namely the Bushveld Rain Frog (*Breviceps adspersus*). The Kalahari assemblage has low species richness, with total species accounts not exceeding 10 species per grid cell anywhere in the assemblage. Only one endemic species, the Karroo Toad *Vandijkophrynus (Bufo) gariepinus*, enters the assemblage peripherally, and no range restricted species present (Alexander *et al.*, 2004).

Extremely limited historic data for frog species occurring within the 2822CA, 2821CD, 2821DD Quarter Degree Grid Squares (<http://sarca.adu.org.za>.) Only two frog species namely Guttural Toad (*Amietophrynus gutturalis*) and Bubbling Kassina (*Kassina senegalensis*) were recorded during the previous South African Frog Atlas Project. Both these species are common and have a wide distribution range. A probable amphibian species list is presented in Table 7 below.



Figure11. A collage of frog species likely to occur on and around the Sand Draai CSP site. A: Bushveld Rain Frog (*Breviceps adpersus*); **B:** Western Olive Toad (*Amietophrynus poweri*); **C:** Tremelo Sand Frog (*Tomopterna cryptotis*); **D:** Common River Frog (*Amietia angolensis*); **E:** Guttural Toad (*Amietophrynus gutturalis*) and **F:** Bubbling Kassina (*Kassina senegalensis*).

Table7. Frog species likely to occur on the Sand Draai CSP site and adjacent areas.

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Brevicipitidae	<i>Breviceps</i>	<i>adpersus</i>	Bushveld Rain Frog	Least Concern	0
Bufo	<i>Amietophrynus</i>	<i>gutturalis</i>	Guttural Toad	Least Concern	0
Bufo	<i>Amietophrynus</i>	<i>poweri</i>	Western Olive Toad	Least Concern	0
Hyperoliidae	<i>Kassina</i>	<i>senegalensis</i>	Bubbling Kassina	Least Concern	0
Pyxicephalidae	<i>Amietia</i>	<i>angolensis</i>	Common or Angola River Frog	Least Concern	0
Pyxicephalidae	<i>Tomopterna</i>	<i>cryptotis</i>	Tremelo Sand Frog	Least Concern	0

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES



Figure12. The Giant Bullfrog has been recorded from adjacent grid squares to the east of the Sand Draai site breeding in seasonally inundated pans or depressions.

Giant Bullfrog (*Pyxicephalus adspersus*)

The Giant Bullfrog is currently assigned as a near-threatened species (IUCN Red List category) (Minter et al. 2004). Giant Bullfrogs have been recorded to the south (Brandvlei) as well as to the north of Augrabies National Park during previous surveys as well as during the South African Frog Atlas Project (SAFAP). Specimens recorded were of road fatalities, migrating adult males as well as a breeding locality in the Prieska area. Bullfrog density commonly varies within certain habitats (open grassland/karroid habitat). High densities are often associated with specific microhabitats or patches (hygrophytic or aquatic ephemerophytic grass and sedge dominated pans) that can be identified and randomly sampled. More intensive surveys conducted after sufficient rainfall are required to determine the presence of Giant Bullfrogs and other frogs species on the site.

5. SENSITIVE HABITATS

5.1 The Gariep (Orange) River, Non-Perennial Drainage Lines and associated Riparian Zone



Rivers and streams/drainage lines are longitudinal systems with impacts affecting both upstream and downstream habitat. The entire seasonally inundated or non-perennial drainage lines and their associated indigenous dominated riparian vegetation must be considered as sensitive habitats. **Any impact on the riverine area within the study area is therefore also likely to impact on upstream and downstream areas.** Riparian zones have the capacity to act as biological corridors connecting areas of suitable habitat in birds (Whitaker & Metevecchi, 1997), mammals (Cockle & Richardson 2003) reptiles and amphibians (Maritz & Alexander 2007). Riparian zones may act as potential refugia for certain fauna and could allow for possible re-colonisation of rehabilitated habitats. The riparian vegetation plays a vital role in the re-colonisation of aquatic macro-invertebrates as well as reptiles and amphibians (Maritz & Alexander 2007).

The riparian vegetation provides vital refuge, foraging and migratory passages for species migrating to and away from the rivers. The riparian zone comprises plant communities contiguous to and affected by surface and subsurface hydrological features of perennial or intermittent water bodies (rivers and streams). The riparian vegetation is dependant on the river for a number of functions including growth, temperature control, seed dispersal, germination and nutrient enrichment. Riparian vegetation comprises a distinct composition of species, often different from that of the surrounding terrestrial vegetation. Tree species are positioned according to their dependence or affinity for water, with the more mesic species (water-loving) being located closest to the river channel, often with their roots in the water, and the less water-loving terrestrial species further away from the river.

The riparian zone, of which vegetation is a major component, has a number of important functions including:

- enhancing water quality in the river by the interception and breakdown of pollutants;
- interception and deposition of nutrients and sediments;
- stabilisation of riverbanks and macro-channel floor;
- flood attenuation;
- provision of habitat and migration routes for fauna and flora;
- provision of fuels, building materials and medicines for communities (if done on a sustainable basis); and
- recreational areas (fishing - rod and line not shade or gill nets; bird watching; picnic areas etc.).

All rivers including the Gariep (Orange) River as well as several smaller non-perennial drainage lines must be considered as a **sensitive habitats** due to ecological functioning as well as providing suitable habitat as well as biological or dispersal corridors for remaining faunal species.

5.2 Rocky Hills and Koppies



The entire rocky hills and koppies must be considered as sensitive habitats which provides important habitat for several amphibian, reptile and mammal species. Ridges and koppies are characterized by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. The temperature and humidity regimes of microsites vary on both a seasonal and daily basis (Samways & Hatton, 2000). Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes (Lowrey & Wright, 1987). Variation in aspect, soil drainage (Burnett *et al.*, 1998) and elevation/altitude (Primack, 1995) have been found to be especially important predictors of biodiversity. It follows that ridges will be characterized by a particularly high biodiversity, as such their protection will contribute significantly to the conservation of biodiversity in the area as well as the rest of the Northern Cape Province.

For example, a wide variety of bird groups utilize ridges, koppies and hills for feeding, roosting and breeding. These groups include some owls, falcons, nightjars, swifts, swallows, martins, larks, chats, thrushes, cisticolas, pipits, shrikes, starlings, sunbirds, firefinches, waxbills, buntings, canaries, eagles and vultures.

Ridges provide important habitat for sensitive species such as bats (roosting sites) and the eastern rock elephant shrew. Ridges and kloofs also form caves, an important habitat for highly specialized animals, e.g. bats. Variable microclimate conditions have resulted in a vast array of invertebrate communities associated with the high plant diversity characterizing ridges. Hills and koppies generally have more insects (both in terms of individuals and species) than the immediate surroundings (Samways & Hatton, 2000). All rocky hills and koppies as well as major rocky outcrops must be considered as a **sensitive habitats** with unique vegetation (*Hoodia gordonii*) as well as fauna (rupicolous species including the Dassie Rat, Rock Hyrax, Klipspringer).

From the desktop study using inter alia aerial photographs and Google Earth™ imagery the following four sensitivity categories of areas were identified:

- High:** Areas with high species richness and habitat diversity comprising natural indigenous plant species. These areas are ecologically valuable and important for ecosystem functioning. These areas should be avoided wherever possible.
- Medium:** An area with a relatively natural species composition; not a threatened or unique ecosystem; moderate species and habitat diversity. Development could be considered with limited impact on the vegetation / ecosystem.
- Low-medium:** Areas with relatively natural vegetation, though a common vegetation type. Could be developed with mitigation and expected low impact on ecosystem
- Low:** A totally degraded and transformed area with a low habitat diversity and ecosystem functioning; no viable populations of natural plants. Development could be supported with little to no impact on the natural vegetation / ecosystem.

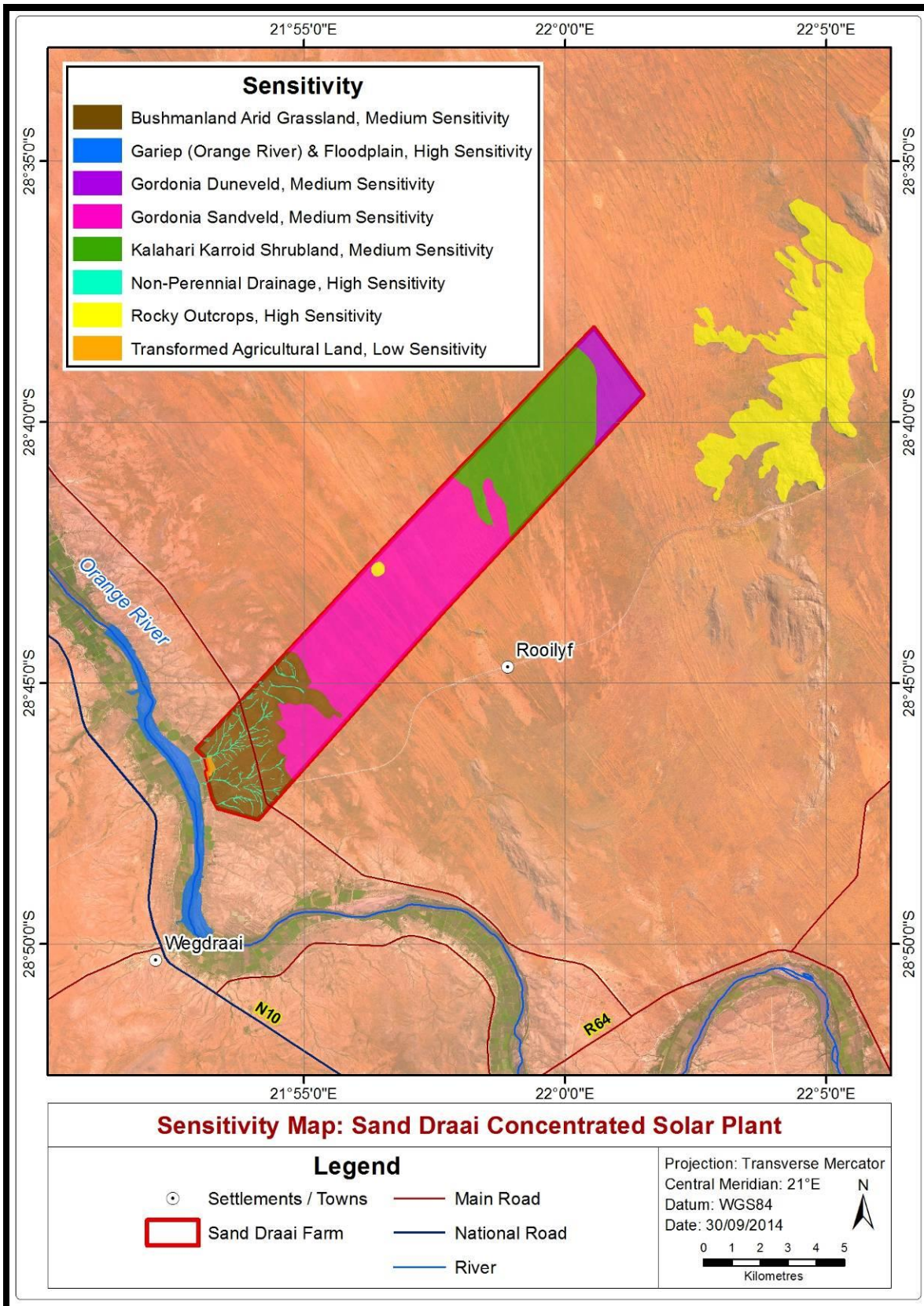


Figure12. Preliminary sensitivity map for the proposed Sand Draai CSP.

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8. APPENDIX

Table8. A list of red data and endemic species for the Northern Cape Province.

Download from POSA on September 24, 2014, 14:52 am			
SA Threat Status: Rare			
SA Endemic: Yes			
Location: Northern Cape			
Family	Species	Threat status	SA Endemic
ACANTHACEAE	<i>Acanthopsis spathularis</i> (E.Mey.) Schinz	Rare	Yes
ACANTHACEAE	<i>Monechma saxatile</i> Munday	Rare	Yes
AMARYLLIDACEAE	<i>Brunsvigia pulchra</i> (W.F.Barker) D.& U.Müll.-Doblies	Rare	Yes
AMARYLLIDACEAE	<i>Gethyllis gregoriana</i> D.Müll.-Doblies	Rare	Yes
AMARYLLIDACEAE	<i>Gethyllis lata</i> L.Bolus subsp. <i>lata</i>	Rare	Yes
AMARYLLIDACEAE	<i>Haemanthus dasyphyllus</i> Snijman	Rare	Yes
AMARYLLIDACEAE	<i>Hessea pilosula</i> D.& U.Müll.-Doblies	Rare	Yes
AMARYLLIDACEAE	<i>Hessea pulcherrima</i> (D.& U.Müll.-Doblies) Snijman	Rare	Yes
AMARYLLIDACEAE	<i>Hessea stenosphon</i> (Snijman) D.& U.Müll.-Doblies	Rare	Yes
AMARYLLIDACEAE	<i>Strumaria karooica</i> (W.F.Barker) Snijman	Rare	Yes
AMARYLLIDACEAE	<i>Strumaria merxmulleriana</i> (D.& U.Müll.-Doblies) Snijman	Rare	Yes
AMARYLLIDACEAE	<i>Strumaria picta</i> W.F.Barker	Rare	Yes
AMARYLLIDACEAE	<i>Strumaria pubescens</i> W.F.Barker	Rare	Yes
AMARYLLIDACEAE	<i>Strumaria pygmaea</i> Snijman	Rare	Yes
AMARYLLIDACEAE	<i>Strumaria villosa</i> Snijman	Rare	Yes
AMARYLLIDACEAE	<i>Strumaria watermeyeri</i> L.Bolus subsp. <i>botterkloofensis</i> (D.& U.Müll.-Doblies) Snijman	Rare	Yes
AMARYLLIDACEAE	<i>Strumaria watermeyeri</i> L.Bolus subsp. <i>watermeyeri</i>	Rare	Yes
ANTHERICACEAE	<i>Chlorophytum lewisiae</i> Oberm.	Rare	Yes
APIACEAE	<i>Annesorhiza lateriflora</i> (Eckl. & Zeyh.) B.-E.van Wyk	Rare	Yes

APIACEAE	<i>Chamarea snijmaniae</i> B.L.Burt	Rare	Yes
APOCYNACEAE	<i>Pectinaria articulata</i> (Aiton) Haw. <i>subsp. articulata</i>	Rare	Yes
APOCYNACEAE	<i>Quaqua bayeriana</i> (Bruyns) Plowes	Rare	Yes
APOCYNACEAE	<i>Quaqua cincta</i> (C.A.Lüekh.) Bruyns	Rare	Yes
APOCYNACEAE	<i>Quaqua inversa</i> (N.E.Br.) Bruyns	Rare	Yes
APOCYNACEAE	<i>Quaqua pallens</i> Bruyns	Rare	Yes
APOCYNACEAE	<i>Tromotriche herrei</i> (Nel) Bruyns	Rare	Yes
ASPHODELACEAE	<i>Aloe broomii</i> Schönland var. <i>tarkaensis</i> Reynolds	Rare	Yes
ASPHODELACEAE	<i>Aloe dabenorisana</i> Van Jaarsv.	Rare	Yes
ASPHODELACEAE	<i>Bulbine disimilis</i> G.Will.	Rare	Yes
ASPHODELACEAE	<i>Bulbine fragilis</i> G.Will.	Rare	Yes
ASPHODELACEAE	<i>Bulbine torta</i> N.E.Br.	Rare	Yes
ASPHODELACEAE	<i>Haworthia venosa</i> (Lam.) Haw. <i>subsp. granulata</i> (Marloth) M.B.Bayer	Rare	Yes
ASPHODELACEAE	<i>Trachyandra aridimontana</i> J.C.Manning	Rare	Yes
ASPHODELACEAE	<i>Trachyandra gracilentia</i> Oberm.	Rare	Yes
ASTERACEAE	<i>Amphiglossa celans</i> Koekemoer	Rare	Yes
ASTERACEAE	<i>Athanasia hirsuta</i> Thunb.	Rare	Yes
ASTERACEAE	<i>Cineraria alchemilloides</i> DC. <i>subsp.</i> <i>alchemilloides</i>	Rare	Yes
ASTERACEAE	<i>Cineraria lobata</i> L'Hér. <i>subsp.</i> <i>lasiocaulis</i> Cron	Rare	Yes
ASTERACEAE	<i>Cullumia rigida</i> DC.	Rare	Yes
ASTERACEAE	<i>Eriocephalus grandiflorus</i> M.A.N.Müll.	Rare	Yes
ASTERACEAE	<i>Euryops marlothii</i> B.Nord.	Rare	Yes
ASTERACEAE	<i>Euryops petraeus</i> B.Nord.	Rare	Yes
ASTERACEAE	<i>Helichrysum jubilatum</i> Hilliard	Rare	Yes
ASTERACEAE	<i>Oedera nordenstamii</i> (K.Bremer) Anderb. & K.Bremer	Rare	Yes
ASTERACEAE	<i>Othonna diversifolia</i> (DC.) Sch.Bip.	Rare	Yes
ASTERACEAE	<i>Othonna herrei</i> Pillans	Rare	Yes
ASTERACEAE	<i>Othonna lepidocaulis</i> Schltr.	Rare	Yes
ASTERACEAE	<i>Othonna pavelkae</i> Lavranos	Rare	Yes
ASTERACEAE	<i>Phaneroglossa bolusii</i> (Oliv.) B.Nord.	Rare	Yes
ASTERACEAE	<i>Phymaspermum schroeteri</i> Compton	Rare	Yes
ASTERACEAE	<i>Pteronia anisata</i> B.Nord.	Rare	Yes

ASTERACEAE	<i>Pteronia elata</i> B.Nord.	Rare	Yes
ASTERACEAE	<i>Senecio muirii</i> L.Bolus	Rare	Yes
ASTERACEAE	<i>Trichogyne lerouxiae</i> Beyers	Rare	Yes
ASTERACEAE	<i>Troglophyton acocksianum</i> Hilliard	Rare	Yes
ASTERACEAE	<i>Ursinia dregeana</i> (DC.) N.E.Br.	Rare	Yes
BRASSICACEAE	<i>Heliophila cornellsbergia</i> B.J.Pienaar & Nicholas	Rare	Yes
BRASSICACEAE	<i>Heliophila namaquensis</i> (Marais) Al-Shehbaz & Mummenhoff	Rare	Yes
BRASSICACEAE	<i>Heliophila schulzii</i> Marais	Rare	Yes
CAMPANULACEAE	<i>Wahlenbergia buseriana</i> Schltr. & Brehmer	Rare	Yes
CAMPANULACEAE	<i>Wahlenbergia minuta</i> Brehmer	Rare	Yes
COLCHICACEAE	<i>Colchicum huntleyi</i> (Pedrola, Membrives, J.M.Monts. & Caujapé) J.C.Manning & Vinn.	Rare	Yes
COLCHICACEAE	<i>Colchicum vanjaarsveldii</i> (U.Müll.-Doblies, Hähnl., U.U.Müll.-Doblies & D.Müll.-Doblies) J.C.Manning & Vinn.	Rare	Yes
CRASSULACEAE	<i>Adromischus humilis</i> (Marloth) Poelln.	Rare	Yes
CRASSULACEAE	<i>Adromischus phillipsiae</i> (Marloth) Poelln.	Rare	Yes
CRASSULACEAE	<i>Crassula columella</i> Marloth & Schönland	Rare	Yes
CRASSULACEAE	<i>Crassula exilis</i> Harv. subsp. <i>exilis</i>	Rare	Yes
CRASSULACEAE	<i>Crassula minuta</i> Toelken	Rare	Yes
CRASSULACEAE	<i>Crassula multiceps</i> Harv.	Rare	Yes
CRASSULACEAE	<i>Crassula namaquensis</i> Schönland & Baker f. subsp. <i>comptonii</i> (Hutchinson & Pillans) Toelken	Rare	Yes
CRASSULACEAE	<i>Crassula pellucida</i> L. subsp. <i>spongiosa</i> Toelken	Rare	Yes
CRASSULACEAE	<i>Crassula roggeveldii</i> Schönland	Rare	Yes
CRASSULACEAE	<i>Crassula vestita</i> Thunb.	Rare	Yes
CRASSULACEAE	<i>Tylecodon atropurpureus</i> Bruyns	Rare	Yes
CRASSULACEAE	<i>Tylecodon boddleyi</i> Van Jaarsv.	Rare	Yes
CRASSULACEAE	<i>Tylecodon buchholzianus</i> (Schuldt & P.Stephan) Toelken subsp. <i>fasciculatus</i> G.Will.	Rare	Yes

CRASSULACEAE	<i>Tylecodon decipiens</i> Toelken	Rare	Yes
CRASSULACEAE	<i>Tylecodon ellaphieae</i> Van Jaarsv.	Rare	Yes
CRASSULACEAE	<i>Tylecodon hirtifolius</i> (W.F.Barker) Toelken	Rare	Yes
CRASSULACEAE	<i>Tylecodon kritzingeri</i> Van Jaarsv.	Rare	Yes
CRASSULACEAE	<i>Tylecodon nigricaulis</i> G.Will. & Van Jaarsv.	Rare	Yes
CRASSULACEAE	<i>Tylecodon sulphureus</i> (Toelken) Toelken var. <i>armianus</i> Van Jaarsv.	Rare	Yes
CRASSULACEAE	<i>Tylecodon tuberosus</i> Toelken	Rare	Yes
CRASSULACEAE	<i>Tylecodon viridiflorus</i> (Toelken) Toelken	Rare	Yes
ERICACEAE	<i>Erica philippioides</i> Compton	Rare	Yes
ERIOSPERMACEAE	<i>Eriospermum armianum</i> P.L.Perry	Rare	Yes
ERIOSPERMACEAE	<i>Eriospermum ernstii</i> P.L.Perry	Rare	Yes
ERIOSPERMACEAE	<i>Eriospermum filicaule</i> P.L.Perry	Rare	Yes
ERIOSPERMACEAE	<i>Eriospermum macgregoriorum</i> P.L.Perry	Rare	Yes
ERIOSPERMACEAE	<i>Eriospermum pusillum</i> P.L.Perry	Rare	Yes
ERIOSPERMACEAE	<i>Eriospermum ramosum</i> P.L.Perry	Rare	Yes
ERIOSPERMACEAE	<i>Eriospermum ratelpoortianum</i> P.L.Perry	Rare	Yes
EUPHORBIACEAE	<i>Euphorbia albertensis</i> N.E.Br.	Rare	Yes
EUPHORBIACEAE	<i>Euphorbia hallii</i> R.A.Dyer	Rare	Yes
EUPHORBIACEAE	<i>Euphorbia pentops</i> A.C.White, R.A.Dyer & B.Sloane	Rare	Yes
EUPHORBIACEAE	<i>Euphorbia quadrata</i> Nel	Rare	Yes
FABACEAE	<i>Aspalathus tridentata</i> L. subsp. <i>fragilis</i> R.Dahlgren	Rare	Yes
FABACEAE	<i>Crotalaria pearsonii</i> Baker f.	Rare	Yes
FABACEAE	<i>Lebeckia grandiflora</i> Benth.	Rare	Yes
FABACEAE	<i>Lotononis anthyllopsis</i> B.-E.van Wyk	Rare	Yes
FABACEAE	<i>Lotononis arenicola</i> Schltr.	Rare	Yes
FABACEAE	<i>Otholobium pustulatum</i> C.H.Stirt.	Rare	Yes
FABACEAE	<i>Polhillia involucrata</i> (Thunb.) B.-E.van Wyk & A.L.Schutte	Rare	Yes
GERANIACEAE	<i>Pelargonium confertum</i> E.M.Marais	Rare	Yes
GERANIACEAE	<i>Pelargonium desertorum</i> Vorster	Rare	Yes
GERANIACEAE	<i>Pelargonium quarciticola</i> Meve &	Rare	Yes

	<i>E.M.Marais</i>		
HYACINTHACEAE	<i>Daubenya alba A.M.van der Merwe</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia barkeriana U.Müll.-Doblies, B.Nord. & D.Müll.-Doblies</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia buchbergensis Dinter</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia concordiana Schltr. ex W.F.Barker</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia congesta W.F.Barker</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia kliprandensis W.F.Barker</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia nordenstamii W.F.Barker</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia polypodantha Schltr. ex W.F.Barker</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia valeriae G.D.Duncan</i>	Rare	Yes
HYACINTHACEAE	<i>Lachenalia verticillata W.F.Barker</i>	Rare	Yes
HYACINTHACEAE	<i>Ornithogalum pullatum F.M.Leight.</i>	Rare	Yes
HYPOXIDACEAE	<i>Saniella occidentalis (Nel) B.L.Burtt</i>	Rare	Yes
HYPOXIDACEAE	<i>Spiloxene nana Snijman</i>	Rare	Yes
IRIDACEAE	<i>Aristea inaequalis Goldblatt & J.C.Manning</i>	Rare	Yes
IRIDACEAE	<i>Babiana framesii L.Bolus</i>	Rare	Yes
IRIDACEAE	<i>Babiana lobata G.J.Lewis</i>	Rare	Yes
IRIDACEAE	<i>Babiana praemorsa Goldblatt & J.C.Manning</i>	Rare	Yes
IRIDACEAE	<i>Babiana tanquana J.C.Manning & Goldblatt</i>	Rare	Yes
IRIDACEAE	<i>Babiana virginea Goldblatt</i>	Rare	Yes
IRIDACEAE	<i>Devia xeromorpha Goldblatt & J.C.Manning</i>	Rare	Yes
IRIDACEAE	<i>Ferraria brevifolia G.J.Lewis</i>	Rare	Yes
IRIDACEAE	<i>Ferraria ovata (Thunb.) Goldblatt & J.C.Manning</i>	Rare	Yes
IRIDACEAE	<i>Geissorhiza corrugata Klatt</i>	Rare	Yes
IRIDACEAE	<i>Geissorhiza divaricata Goldblatt</i>	Rare	Yes
IRIDACEAE	<i>Geissorhiza inaequalis L.Bolus</i>	Rare	Yes
IRIDACEAE	<i>Geissorhiza namaquensis W.F.Barker</i>	Rare	Yes
IRIDACEAE	<i>Gladiolus deserticola Goldblatt</i>	Rare	Yes
IRIDACEAE	<i>Gladiolus kamiesbergensis G.J.Lewis</i>	Rare	Yes
IRIDACEAE	<i>Gladiolus salteri G.J.Lewis</i>	Rare	Yes
IRIDACEAE	<i>Hesperantha flava G.J.Lewis</i>	Rare	Yes

IRIDACEAE	<i>Hesperantha glabrescens</i> Goldblatt	Rare	Yes
IRIDACEAE	<i>Hesperantha quadrangula</i> Goldblatt	Rare	Yes
IRIDACEAE	<i>Hesperantha teretifolia</i> Goldblatt	Rare	Yes
IRIDACEAE	<i>Ixia amethystina</i> J.C.Manning & Goldblatt	Rare	Yes
IRIDACEAE	<i>Ixia brevituba</i> G.J.Lewis	Rare	Yes
IRIDACEAE	<i>Lapeirousia dolomitica</i> Dinter subsp. <i>lewisiana</i> (B.Nord.) Goldblatt	Rare	Yes
IRIDACEAE	<i>Lapeirousia tenuis</i> (Goldblatt) Goldblatt & J.C.Manning	Rare	Yes
IRIDACEAE	<i>Moraea contorta</i> Goldblatt	Rare	Yes
IRIDACEAE	<i>Moraea fenestralis</i> (Goldblatt & E.G.H.Oliv.) Goldblatt	Rare	Yes
IRIDACEAE	<i>Moraea fragrans</i> Goldblatt	Rare	Yes
IRIDACEAE	<i>Moraea louisabolusiae</i> Goldblatt	Rare	Yes
IRIDACEAE	<i>Moraea namaquamontana</i> Goldblatt	Rare	Yes
IRIDACEAE	<i>Moraea rivulicola</i> Goldblatt & J.C.Manning	Rare	Yes
IRIDACEAE	<i>Moraea verecunda</i> Goldblatt	Rare	Yes
IRIDACEAE	<i>Moraea vespertina</i> Goldblatt & J.C.Manning	Rare	Yes
IRIDACEAE	<i>Moraea virgata</i> Jacq. subsp. <i>karooica</i> (Goldblatt) Goldblatt	Rare	Yes
IRIDACEAE	<i>Romulea hantamensis</i> (Diels) Goldblatt	Rare	Yes
IRIDACEAE	<i>Romulea viridibracteata</i> M.P.de Vos	Rare	Yes
IRIDACEAE	<i>Sparaxis pillansii</i> L.Bolus	Rare	Yes
IRIDACEAE	<i>Tritonia florentiae</i> (Marloth) Goldblatt	Rare	Yes
IRIDACEAE	<i>Tritonia kamisbergensis</i> Klatt	Rare	Yes
MALVACEAE	<i>Anisodontea malvastroides</i> (Baker f.) Bates	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Antimima emarcescens</i> (L.Bolus) H.E.K.Hartmann	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Antimima lawsonii</i> (L.Bolus) H.E.K.Hartmann	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Antimima lodewykii</i> (L.Bolus) H.E.K.Hartmann	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Antimima lokenbergensis</i> (L.Bolus) H.E.K.Hartmann	Rare	Yes

MESEMBRYANTHEMACEAE	<i>Astridia herrei</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Astridia speciosa</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Cephalophyllum fulleri</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Cheiridopsis amabilis</i> S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Cheiridopsis campanulata</i> G.Will.	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Cheiridopsis glomerata</i> S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Cheiridopsis purpurea</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum auriflorum</i> Tischer subsp. <i>auriflorum</i>	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum auriflorum</i> Tischer subsp. <i>turbiniforme</i> (Rawé) S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum bolusiae</i> Schwantes subsp. <i>bolusiae</i>	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum caroli</i> Lavis	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum carpianum</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum concavum</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum concordans</i> G.D.Rowley	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum ernstii</i> S.A.Hammer subsp. <i>ernstii</i>	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum frutescens</i> Schwantes	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum globosum</i> (N.E.Br.) N.E.Br.	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum hermarium</i> (S.A.Hammer) S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum irmae</i> S.A.Hammer & Barnhill	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum lithopsoides</i> L.Bolus subsp. <i>koubergense</i> (L.Bolus) S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum longibracteatum</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum meyeri</i> N.E.Br.	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum reconditum</i> A.R.Mitch. subsp. <i>buysianum</i> (A.R.Mitch. & S.A.Hammer) S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum subterraneum</i> T.Smole & T.Jacobs	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum swanepoelianum</i> Rawé subsp. <i>swanepoelianum</i>	Rare	Yes

MESEMBRYANTHEMACEAE	<i>Conophytum tantillum</i> N.E.Br. subsp. <i>eenkokerense</i> (L.Bolus) S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum tantillum</i> N.E.Br. subsp. <i>inexpectatum</i> S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum tantillum</i> N.E.Br. subsp. <i>tantillum</i>	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum vanheerdei</i> Tischer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum velutinum</i> Schwantes subsp. <i>polyandrum</i> (Lavis) S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum velutinum</i> Schwantes subsp. <i>velutinum</i>	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Conophytum verrucosum</i> (Lavis) G.D.Rowley	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Dorotheanthus booyseii</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Dorotheanthus maughanii</i> (N.E.Br.) Ihlenf. & Struck	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Lampranthus gracilipes</i> (L.Bolus) N.E.Br.	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Lithops geyeri</i> Nel	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Mitrophyllum roseum</i> L.Bolus	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Nelia pillansii</i> (N.E.Br.) Schwantes	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Nelia schlechteri</i> Schwantes	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Odontophorus angustifolius</i> L.Bolus subsp. <i>angustifolius</i>	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Odontophorus angustifolius</i> L.Bolus subsp. <i>protoparcoides</i> S.A.Hammer	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Odontophorus marlothii</i> N.E.Br.	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Phyllobolus amabilis</i> Gerbaulet & Struck	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Phyllobolus garipeensis</i> Gerbaulet & Struck	Rare	Yes
MESEMBRYANTHEMACEAE	<i>Schwantesia pillansii</i> L.Bolus	Rare	Yes
OPHIOGLOSSACEAE	<i>Ophioglossum bergianum</i> Schldl.	Rare	Yes
OXALIDACEAE	<i>Oxalis cathara</i> T.M.Salter	Rare	Yes
OXALIDACEAE	<i>Oxalis inconspicua</i> T.M.Salter	Rare	Yes
OXALIDACEAE	<i>Oxalis lichenoides</i> T.M.Salter	Rare	Yes
OXALIDACEAE	<i>Oxalis louisae</i> T.M.Salter	Rare	Yes
OXALIDACEAE	<i>Oxalis psammophila</i> G.Will.	Rare	Yes

OXALIDACEAE	<i>Oxalis purpurata</i> Jacq.	Rare	Yes
OXALIDACEAE	<i>Oxalis reflexa</i> T.M.Salter	Rare	Yes
OXALIDACEAE	<i>Oxalis stenoptera</i> Turcz. var. <i>stenoptera</i>	Rare	Yes
OXALIDACEAE	<i>Oxalis stenoptera</i> Turcz. var. <i>undulata</i>	Rare	Yes
OXALIDACEAE	<i>Oxalis tenuipes</i> T.M.Salter var. <i>tenuipes</i>	Rare	Yes
OXALIDACEAE	<i>Oxalis virginica</i> Jacq.	Rare	Yes
POACEAE	<i>Dregeochloa calviniensis</i> Conert	Rare	Yes
PORTULACACEAE	<i>Anacampseros scopata</i> G.Will.	Rare	Yes
PORTULACACEAE	<i>Avonia mallei</i> G.Will.	Rare	Yes
RHAMNACEAE	<i>Phyllica pearsonii</i> Pillans	Rare	Yes
SCROPHULARIACEAE	<i>Chaenostoma longipedicellatum</i> (Hilliard) Kornhall	Rare	Yes
SCROPHULARIACEAE	<i>Nemesia saccata</i> E.Mey. ex Benth.	Rare	Yes
SCROPHULARIACEAE	<i>Polycarena filiformis</i> Diels	Rare	Yes
SCROPHULARIACEAE	<i>Reyemia chasmanthiflora</i> Hilliard	Rare	Yes
SCROPHULARIACEAE	<i>Selago diabolica</i> Hilliard	Rare	Yes
SCROPHULARIACEAE	<i>Selago farrago</i> Hilliard	Rare	Yes
SCROPHULARIACEAE	<i>Selago florifera</i> Hilliard	Rare	Yes
SCROPHULARIACEAE	<i>Selago thermalis</i> Hilliard	Rare	Yes
SCROPHULARIACEAE	<i>Zaluzianskya acrobareia</i> Hilliard	Rare	Yes
SCROPHULARIACEAE	<i>Zaluzianskya inflata</i> Diels	Rare	Yes
SCROPHULARIACEAE	<i>Zaluzianskya mirabilis</i> Hilliard	Rare	Yes
TECOPHILAEACEAE	<i>Cyanella cygnea</i> G.Scott	Rare	Yes
TECOPHILAEACEAE	<i>Walleria gracilis</i> (Salisb.) S.Carter	Rare	Yes

Table9. Mammal species historically recorded in the area according to Skinner & Chimimba (2005). Actual species lists will most likely contain far fewer species due to high levels of habitat transformation and degradation as well as high levels of human disturbances (hunting and poaching activities). This is especially pertinent to the larger mammal species including predatory species which are considered problem animals to adjacent livestock farmers.

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS (Skinner & Chimimba 2005)
Cape Serotine Bat	<i>Neoromicia capensis</i>	Least Concern
Egyptian Slit-faced Bat	<i>Nycteris thebiaca</i>	Least Concern
Geoffrey's Horseshoe Bat	<i>Rhinolophus clivosus</i>	Least Concern
Egyptian Free-tailed Bat	<i>Tadarida aegyptiaca</i>	Least Concern
Reddish-grey Musk Shrew	<i>Crocidura cyanea</i>	Data Deficient
Cape Hare	<i>Lepus capensis</i>	Least Concern
*Scrub Hare	<i>Lepus saxatilis</i>	Least Concern
Namaqua Rock Mouse	<i>Aethomys namaquensis</i>	Least Concern
Short-tailed Gerbil	<i>Desmodillus auricularis</i>	Least Concern
Hairy-footed Gerbil	<i>Gerbillurus paeba</i>	Least Concern
Spectacled Dormouse	<i>Graphiurus ocularis</i>	Least Concern
Large-eared Mouse	<i>Malacothrix typica</i>	Least Concern
Multimammate Mouse	<i>Mastomys coucha</i>	Least Concern
Karoo Bush Rat	<i>Otomys unisulcatus</i>	Least Concern
Brant's Whistling Rat	<i>Parotys bransii</i>	Least Concern
Littledale's Whistling Rat	<i>Parotomys littledalei</i>	Least Concern
Dassie Rat	<i>Petromus typicus</i>	Least Concern
Pygmy Rock Mouse	<i>Pteromyscus collinus</i>	Least Concern
Striped Mouse	<i>Rhabdomys pumillio</i>	Least Concern
Round-eared Elephant-Shrew	<i>Marcoscelides proboscideus</i>	Least Concern
*Cape Ground Squirrel	<i>Xerus inauris</i>	Least Concern
Springhare	<i>Pedetes capensis</i>	Least Concern
*Porcupine	<i>Hystrix africaeaustralis</i>	Least Concern
*Rock Hyrax	<i>Procavia capensis</i>	Least Concern
Suricate	<i>Suricata suricatta</i>	Least Concern
Small Grey mongoose	<i>Galerella pulverulenta</i>	Least Concern
Yellow Mongoose	<i>Cynictis penicillata</i>	Least Concern

Striped Polecat	<i>Ictonyx striatus</i>	Least Concern
Small-spotted Genet	<i>Genetta genetta</i>	Least Concern
African Wild Cat	<i>Felis silverstris</i>	Least Concern
Black-footed Cat	<i>Felis nigripes</i>	Vulnerable C2a(i)
*Black-Backed Jackal	<i>Canis mesomelas</i>	Least Concern
Caracal	<i>Caracal caracal</i>	Least Concern
Honey Badger	<i>Mellivora capensis</i>	Lower Risk/ Least Concern
Bat-eared Fox	<i>Otocyon megalotis</i>	Least Concern
Leopard	<i>Panthera pardus</i>	Least Concern
Cape Fox	<i>Vulpes chama</i>	Least Concern
Aardwolf	<i>Proteles critatus</i>	Least Concern
Common Duiker	<i>Sylvicapra grimmia</i>	Least Concern
*Steenbok	<i>Raphicerus campestris</i>	Least Concern
Klipspringer	<i>Oreotragus oreotragus</i>	Least Concern
Springbok	<i>Antidorcas marsupialis</i>	Least Concern
Gemsbok	<i>Oryx gazella</i>	Least Concern
Aardvark	<i>Orycteropus afer</i>	Least Concern
Chacma Baboon	<i>Papio hamadryas</i>	Least Concern

Table10. Reptile species likely to occur on the site using habitat availability as an indicator for possible species presence.

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Agamidae	<i>Agama</i>	<i>aculeata</i>	<i>aculeata</i>	Common Ground Agama	Not Evaluated	0
Agamidae	<i>Agama</i>	<i>anchietae</i>		Anchieta's Agama	Not Evaluated	0
Agamidae	<i>Agama</i>	<i>atra</i>		Southern Rock Agama	Not Evaluated	0
Colubridae	<i>Boaedon</i>	<i>capensis</i>		Brown House Snake	Not Evaluated	0
Colubridae	<i>Psammophis</i>	<i>notostictus</i>		Karoo Sand Snake	Not Evaluated	0
Colubridae	<i>Telescopus</i>	<i>semiannulatus</i>	<i>polystictus</i>	Damara Tiger Snake	Not Evaluated	0
Cordylidae	<i>Karusasaurus</i>	<i>polyzonus</i>		Karoo Girdled Lizard	Not Evaluated	0
Elapidae	<i>Naja</i>	<i>nivea</i>		Cape Cobra	Not Evaluated	0
Gekkonidae	<i>Chondrodactylus</i>	<i>angulifer</i>	<i>angulifer</i>	Common Giant Ground Gecko	Not Evaluated	0
Gekkonidae	<i>Chondrodactylus</i>	<i>bibronii</i>		Bibron's Gecko	Not Evaluated	0
Gekkonidae	<i>Lygodactylus</i>	<i>bradfieldi</i>		Bradfield's Dwarf Gecko	Not Evaluated	0
Gekkonidae	<i>Pachydactylus</i>	<i>montanus</i>		Namaqua Mountain Gecko	Not Evaluated	0
Gekkonidae	<i>Pachydactylus</i>	<i>rugosus</i>		Common Rough Gecko	Not Evaluated	0
Gekkonidae	<i>Ptenopus</i>	<i>garrulus</i>	<i>maculatus</i>	Spotted Barking Gecko	Not Evaluated	0

Lacertidae	<i>Pedioplanis</i>	<i>inornata</i>		Plain Sand Lizard	Not Evaluated	0
Lacertidae	<i>Pedioplanis</i>	<i>lineoocellata</i>	<i>lineoocellata</i>	Spotted Sand Lizard	Not Evaluated	0
Leptotyphlopidae	<i>Namibiana</i>	<i>occidentalis</i>		Western Thread Snake	Not Evaluated	0
Scincidae	<i>Acontias</i>	<i>lineatus</i>		Striped Dwarf Legless Skink	Not Evaluated	0
Scincidae	<i>Trachylepis</i>	<i>occidentalis</i>		Western Three-striped Skink	Not Evaluated	0
Scincidae	<i>Trachylepis</i>	<i>sparsa</i>		Karasburg Tree Skink	Not Evaluated	0
Scincidae	<i>Trachylepis</i>	<i>spilogaster</i>		Kalahari Tree Skink	Not Evaluated	0
Scincidae	<i>Trachylepis</i>	<i>sulcata</i>		Western Rock Skink	Not listed	0
Scincidae	<i>Trachylepis</i>	<i>sulcata</i>	<i>sulcata</i>	Western Rock Skink	Not Evaluated	0
Scincidae	<i>Trachylepis</i>	<i>variegata</i>		Variegated Skink	Not Evaluated	0
Viperidae	<i>Bitis</i>	<i>arietans</i>	<i>arietans</i>	Puff Adder	Not Evaluated	0

Table 11. List of frog species recorded during the South African Frog Atlas Project (SAFAP) and of species likely to occur on the site according to Minter *et al.* 2004.

Common Name	Species	Breeding Requirements
Common River Frog	<i>Amietia (Afrana) angolensis</i>	Rivers and permanent water (springs, ponds and farm dams).
Cape River Frog	<i>Amietia (Afrana) fuscigula</i>	Permanent waterbodies including springs, farm dams and rivers
Bushveld Rain Frog	<i>Breviceps adpersus</i>	Terrestrial breeder eggs deposited in an underground chamber.
Marbled Rubber Frog	<i>Phrynomantis annectens</i>	Associated with granitic inselbergs and rocky outcrops. Seasonal pools of rainwater trapped in these rocky outcrops provide breeding habitat.
Giant Bullfrog	<i>Pyxicephalus adpersus</i>	Seasonally inundated pans or depressions.
Tremelo Sand Frog	<i>Tomopterna cryptotis</i>	Shallow permanent streams or vleis in grassland.
Tandy's Sand Frog	<i>Tomopterna tandyi</i>	Small streams, pans, temporary rainpools and is commonly associated with farm dams.
Bubbling Kassina	<i>Kassina senegalensis</i>	Open vleis, pans, dams in grassland
Boettger's Caco	<i>Cacosternum boettgeri</i>	Marsh, vleis, inundated grassland
Karoo Toad	<i>Vandijkophrynus (Bufo) gariepinus</i>	Permanent and temporary waterbodies such as streams, dams. Roadside rainpools, quarries, pans, seepages and spongy bogs.
Guttural Toad	<i>Amietophrynus (Bufo) gutturalis</i>	Open vleis, pans, ponds, dams, slow streams
Western Olive Toad	<i>Amietophrynus (Bufo) poweri</i>	Open vleis, pans, ponds, dams, slow streams
Common Platanna	<i>Xenopus laevis</i>	Open vleis, pans, ponds, dams, slow streams