

**ZONNEQUA WIND FARM NEAR KLEINSEE:
FAUNA & FLORA SPECIALIST IMPACT ASSESSMENT REPORT**



**PRODUCED FOR SAVANNAH ENVIRONMENTAL
ON BEHALF OF GENESIS ZONNEQUA WIND (PTY) LTD**

BY



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EXECUTIVE SUMMARY

Genesis Zonnequa Wind (Pty) Ltd is proposing the development of the Zonnequa Wind Farm and associated infrastructure on a site located approximately 19 km south-east of Kleinsee in the Northern Cape Province. The wind farm will have a contracted capacity of up to 140MW generated by up to 56 wind turbines. Savannah Environmental is conducting the required authorisation process and has appointed 3Foxes Biodiversity Solutions to provide a specialist terrestrial fauna and flora specialist impact assessment study of the proposed development as part of the BA process.

A desktop review of the available information as well as several site visits were conducted in order to characterise and map the ecological features of the site and derive an ecological sensitivity map for the site. The assessment revealed that the Zonnequa site consists of two vegetation types which can be broken down into three plant communities. The central low-lying area that splits the site in a north-south direction consists of the Namaqualand Salt Pans vegetation type while there is more typical Namaqualand Strandveld present on either side of this area. Based on detailed vegetation surveys conducted across the area, the Strandveld can be divided into two plant communities, taller Dune Strandveld on deeper usually more mobile sands and more typical Namaqualand Strandveld on the flatter areas usually with more finely-textured soils. The field assessment also indicates that the Namaqualand Salt Pans unit as mapped by the VegMap, does not represent this unit but rather a strandveld community associated with the coarse white sands that characterise this area. As a result, it is clear that this habitat is not currently operating as a hydrological feature and it is not considered as sensitive as it would be if it represented a more typical salt pan habitat. While some development in this area is considered acceptable, it is a relatively restricted habitat with the result that the total footprint within this habitat should be kept in proportion to its abundance to ensure that cumulative impacts on this habitat remain acceptable. The layout assessed has an acceptable footprint in this area and the likely impact on this area is considered acceptable.

In terms of fauna, there are relatively few species of concern that are likely to be present at the site. This is in part due to the low range of habitats present at the site, most notably the lack of rocky outcrops. The major impact on fauna would be direct habitat loss of less than 50ha as well as some low-level operation phase disturbance resulting from maintenance activities and turbine noise. There are no local populations of fauna within the site that are likely to be compromised by the development as the total footprint is relatively low in proportion to the overall extent of the site and there are still extensive areas within and adjacent to the site that would not be affected.

The site does not contain any CBAs and there is a small area of ESA in the southwestern corner of the site. A significant long-term impact on the ESA is highly unlikely and the impact of the development on broad-scale ecological processes would be low. The site does

not fall within a Northern Cape Protected Area Expansion Strategy Focus Area. The development is thus seen as being compatible with the long-term desired future land use options for the area.

Ecological Impact Statement:


The Zonnequa Wind Farm site is considered to represent a broadly suitable environment for wind farm development. There are no specific long-term impacts likely to be associated with the wind farm that cannot be reduced to an acceptable level through mitigation and avoidance, including a very low post-mitigation impact on ESAs and no impact on and CBAs. Consequently, there are no high residual impacts or fatal flaws associated with the development and it can be supported from a terrestrial ecology perspective. It is therefore the reasoned opinion of the specialist that the Zonnequa Wind Farm should therefore be authorised, subject to the implementation of the recommended mitigation measures.

NEMA 2014 CHECKLIST - APPENDIX 6 OF THE EIA REGULATIONS, 2014 (AS AMENDED)

Section		NEMA 2014 Regulations (as amended) for Specialist Studies	Position in report (pg.)	check
1	1	A specialist report prepared in terms of these Regulations must contain—		
	(a)	details of-		
		(i) the specialist who prepared the report; and	5	✓
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	7	✓
	(b)	a declaration that the person is independent in a form as may be specified by the competent authority;	7	✓
	(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1	✓
		(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.3	✓
		(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 3.4	✓
	(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1.3	✓
	(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2	✓
	(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 3.7	✓
	(g)	an identification of any areas to be avoided, including buffers;	Section 3.7	✓
	(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 3.7	✓
	(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3	✓
	(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;;	Section 3	✓
	(k)	any mitigation measures for inclusion in the EMPr	Section 6	✓
	(l)	any conditions for inclusion in the environmental authorisation;	N/A	
	(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6	✓
	(n)	a reasoned opinion		
		(i) whether the proposed activity, activities or portions thereof should be authorised; and	Section 7	✓

Section	NEMA 2014 Regulations (as amended) for Specialist Studies	Position in report (pg.)	check
	(iA) regarding the acceptability of the proposed activity or activities	Section 7	✓
	(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMP, and where applicable, the closure plan;	Section 7	✓
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	See main EIA report	✓
(p)	a summary and copies of any comments that were received during any consultation process and where applicable all responses thereto; and	See main EIA report	✓
(q)	any other information requested by the competent authority.	N/A	
2	Where a proposed development and the geographical area within which it is located has been subjected to a pre-assessment using a spatial development tool, and the output of the pre-assessment in the form of a site specific development protocol has been adopted in the prescribed manner, the content of a specialist report may be determined by the adopted site specific development protocol applicable to the specific proposed development in the specific geographical area it is proposed in.	N/A	✓

SHORT CV/SUMMARY OF EXPERTISE – SIMON TODD

 <p>3Foxes Biodiversity Solutions ECOLOGICAL SPECIALIST SERVICES Assessment/Management/Research</p>	<p>Simon Todd <u>Pr.Sci.Nat</u> Director & Principle Scientist C: 082 3326502 O: 021 782 0377 Simon.Todd@3foxes.co.za</p> <p>60 Forrest Way <u>Glencairn</u> 7975</p>	<p>Ecological Solutions for People & the Environment</p>
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Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country, but with a focus on the three Cape provinces. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.

Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.

Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.

Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.

Recent experience and relevant projects include the following:

- Kap Vley Wind Energy Facility near Kleinsee. CSIR, 2018.
- Eskom Kleinsee 300MW WEF. Savannah Environmental, 2012.
- Project Blue Wind and Solar Energy Facility, Near Kleinsee. Savannah Environmental, 2012.
- G7 Richtersveld Wind Farm. Environmental Resources Management (ERM), 2011.
- Preconstruction Walk-Through of the Juno-Gromis 400kV Power Line. Nsovo Environmental 2016.
- West Coast Resources Mine Expansion. Myezo Environmental. 2016.
- Tormin Mineral Sands Inland and Coastal Mining expansion. SRK. 2016.

SPECIALIST DECLARATION

I, ..Simon Todd....., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

-
- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- 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, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I 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;
- I 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;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the specialist: _____

Name of Specialist: ____Simon Todd_____

Date: ____10 October 2018_____

1 INTRODUCTION

Genesis Zonnequa Wind (Pty) Ltd is proposing the development of the Zonnequa Wind Farm and associated infrastructure on a site located approximately 19 km south-east of Kleinsee within the Nama Khoi Local Municipality and the Namakwa District Municipality in the Northern Cape Province. The wind farm will have a contracted capacity of up to 140MW generated by up to 56 wind turbines. Genesis Zonnequa Wind (Pty) Ltd has appointed Savannah Environmental as the independent Environmental Assessment Practitioner (EAP) to undertake the required environmental authorisation process for the proposed Zonnequa Wind Farm. As the site falls within the Springbok REDZ, a Basic Assessment process is required for authorisation in accordance with GN114. Savannah Environmental has appointed 3Foxes Biodiversity Solutions to provide a specialist terrestrial fauna and flora specialist impact assessment study of the proposed development as part of the BA process.

The purpose of the terrestrial fauna and flora specialist Basic Assessment study is to describe and detail the ecological features of the proposed site, provide an assessment of the ecological sensitivity of the site, and identify and assess the likely impacts associated with the proposed development on the site. A desktop review of the available ecological information for the area as well as a number of site visits and a field assessment is used to identify and characterise the ecological features of the site. This information is used to derive an ecological sensitivity map that presents the ecological constraints for development at the site. Impacts are assessed for the construction, operation, and decommissioning phases of the development. Cumulative impacts on the broader area are also considered and assessed. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the Environmental Management Programme (EMPr) for the development. The full scope of the study is detailed below and is in accordance with Appendix 6 - GN R326 of the EIA Regulations of 2014 as amended (which came into effect on 7 April 2017).

1.1 SCOPE OF STUDY

The study includes the following activities:

- a description of the environment that may be affected by a specific activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of environmental issues and potential impacts (including the assessment of direct, indirect and cumulative impacts) that have been identified;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts;
- an indication of the methodology used in determining the significance of potential environmental impacts;

- an assessment of the significance of direct, indirect and cumulative impacts of the development;
- a description and comparative assessment of all alternatives including cumulative impacts;
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the EMPr;
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;
- a description of any assumptions uncertainties, limitations and gaps in knowledge; and
- an environmental impact statement which contains:
 - a summary of the key findings of the environmental impact assessment;
 - an assessment of the positive and negative implications of the proposed activity; and
 - a comparative assessment of the positive and negative implications of identified alternatives.

General considerations for the study included the following:

- Disclose any gaps in information (and limitations in the study) or assumptions made.
- Identify recommendations for mitigation measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the EMPr for faunal or flora related issues.
- The assessment of the potential impacts of the development and the recommended mitigation measures provided have been separated into the following project phases:
 - Planning and Construction
 - Operation
 - Decommissioning

1.2 ASSESSMENT APPROACH

This assessment is conducted according to Appendix 6 – GN R326 EIA Regulations, as amended in terms of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), as well as best-practice guidelines and principles for biodiversity assessments as outlined by Brownlie (2005) and De Villiers *et al.* (2005).

In terms of NEMA, this assessment demonstrates how the proponent intends to comply with the principles contained in Section 2 of NEMA, which amongst other things, indicates that environmental management should:

- (In order of priority) aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity (Figure 1);

- Avoid degradation of the environment;
- Avoid jeopardising ecosystem integrity;
- Pursue the best practicable environmental option by means of integrated environmental management;
- Protect the environment as the people’s common heritage;
- Control and minimise environmental damage; and
- Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

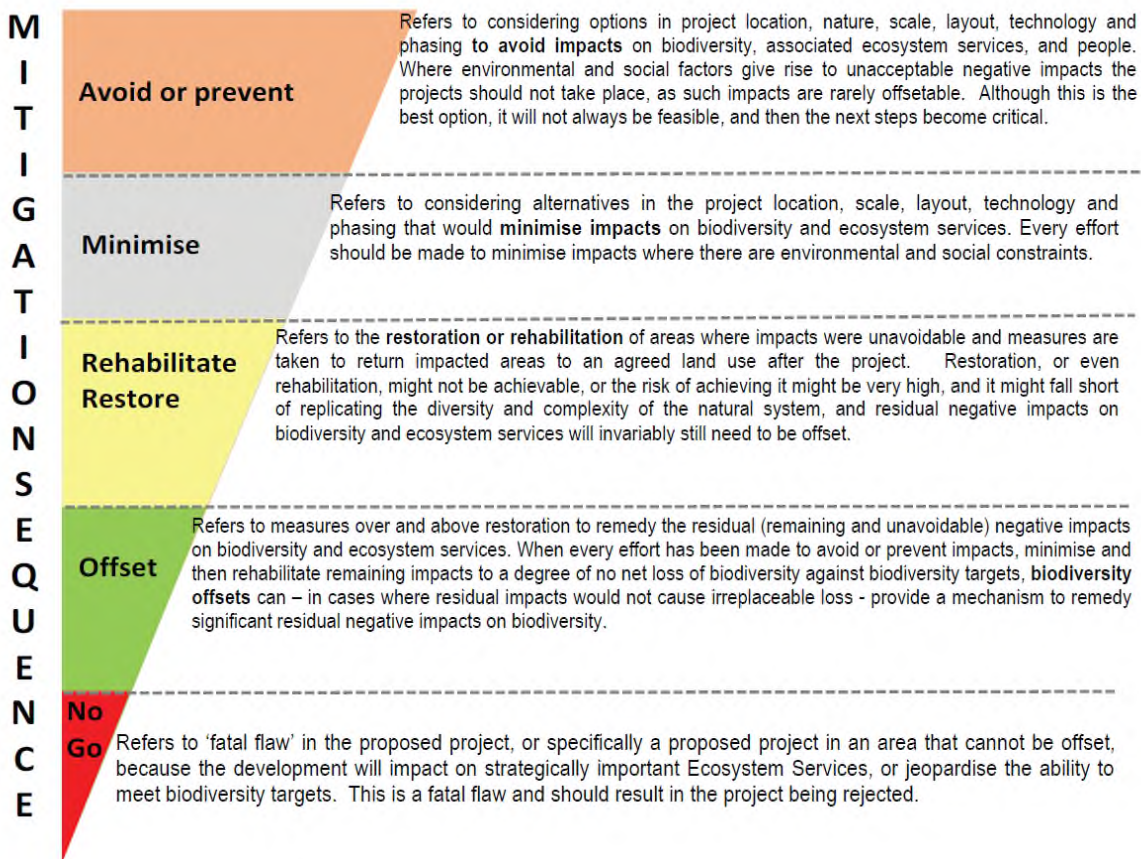


Figure 1. The mitigation hierarchy that is used to guide the study in terms of the priority of different mitigation and avoidance strategies.

Furthermore, in terms of best practice guidelines as outlined by Brownlie (2005) and De Villiers et al. (2005), a precautionary and risk-averse approach should be adopted for projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (CBAs) (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:

- The study includes data searches, desktop studies, site walkovers / field survey of the site and baseline data collection, including:
 - A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of pattern, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighboring types, soils or topography;
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc.*).

Species level

- Species of Conservation Concern (SCC) (giving location if possible using GPS)
- The viability of an estimated population size of the SCC that are present (including the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- The likelihood of other Red Data Book species, or SCC, occurring in the vicinity (including degree of confidence).

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Clarify SSC and that are known to be:
 - endemic to the region;
 - that are considered to be of conservational concern;
 - that are in commercial trade (CITES listed species); or
 - are of cultural significance.
- Provide monitoring requirements for input into the EMPr for faunal related issues.

Other pattern issues

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

- The extent of alien plant cover on the site, and 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 condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified and/or described:

- The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries).
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the BA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

1.3 RELEVANT ASPECTS OF THE DEVELOPMENT

A preferred project site with an extent of ~4434ha has been identified by Genesis Zonnequa Wind (Pty) Ltd as a technically suitable area for the development of the Zonnequa Wind Farm with a contracted capacity of up to 140MW that can accommodate up to 56 turbines. The project site comprises the following two farm portions:

- » Portion 1 of the Farm Zonnekwa 328
- » Remaining Extent of the Farm Zonnekwa 326

The Zonnequa Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 140MW:

- Up to 56 wind turbines with a maximum hub height of up to 130m. The tip height of the turbines will be up to 205m;
- Concrete turbine foundations and turbine hardstands;

- Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
- Cabling between the turbines, to be laid underground where practical;
- An on-site substation of up to 150m x 150m (2,25ha) in extent to facilitate the connection between the wind farm and the electricity grid;
- An overhead 132kV power line (assessed as a 300m power line corridor), with a servitude of 32m, to connect the wind farm to the existing Gromis Substation; this will be assessed under a separate BA study;
- Access roads to the site (with a width of up to 10m) and between project components (with a width of approximately 8m);
- A temporary concrete batching plant; and
- Operation and maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

2 METHODOLOGY

2.1 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2012 and Powrie 2012 update).
- Information on plant and animal species recorded for the wider area was extracted from the SABIF/SIBIS database hosted by SANBI. Data was extracted for a significantly larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has not been well sampled in the past.
- The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2018).

Ecosystem:

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Important protected areas expansion areas were extracted from the Northern Cape Protected Areas Expansion Strategy (NC-NPAES 2017).

- Critical Biodiversity Areas in the study area were obtained from the Northern Cape Conservation Plan (Oosthuysen & Holness 2016).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases (ReptileMap, Frogmap and MammalMap) <http://vmus.adu.org.za>.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, EWT & SANBI (2016) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as an assessment of the availability and quality of suitable habitat at the site.
- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2016), while reptiles are based on the South African Reptile Conservation Assessment (Bates et al. 2013) and amphibians on Minter et al. (2004) as well as the IUCN (2018).

2.2 SITE VISITS & FIELD ASSESSMENT

The site was visited numerous times for the study. An initial site visit was conducted on the 28th and 29th of October 2017, with a follow-up visit from 7-8 July 2018. During the site visits, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. Specific features visible on the satellite imagery of the site were also marked for field inspection and were verified and assessed during the site visit. Walk-through-surveys were conducted within representative areas across the different habitat units identified and all plant and animal species observed were recorded.

In order to obtain greater insight into the faunal community and use of the site, 12 camera traps were distributed across the Zonnequa site and the adjacent Namas site during the October 2017 site visit and retrieved in March 2018. The camera trapping data for the two sites is aggregated as they largely share the same faunal habitats and species present on one property are likely to be present on the other and vice versa.

The conditions at the time of the October 2017 site visit were fairly dry as it was a low rainfall season and while conditions were adequate to assess the perennial component of the vegetation, annuals and geophytes were scarce and could not be adequately sampled. During the July 2018 site visit, the conditions were very good for annuals and geophytes

and the previous shortcomings with the 2017 field assessment could be addressed. As a result of these different site visits, there are few limitations with regards to the field assessment and the results are considered reliable and comprehensive.

2.3 SENSITIVITY MAPPING & ASSESSMENT

An ecological sensitivity map of the site was produced by integrating the results of the site visits with the available ecological and biodiversity information in the literature and various spatial databases as described above. As a starting point, mapped sensitive features such as wetlands, drainage lines, rocky hills and pans were collated and buffered where appropriate to comply with legislative requirements or ecological considerations. Additional sensitive areas were then identified from the satellite imagery of the site and delineated. All the different layers created were then merged to create a single coverage. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

Sensitivity	Description
Low	Units with a low sensitivity where there is likely to be a low impact on ecological processes and terrestrial biodiversity. This category represents transformed or natural areas where the impact of development is likely to be local in nature and of low significance with standard mitigation measures.
Medium	Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impacts such as erosion low. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
High	Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
Very High/No-Go	Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

2.4 LIMITATIONS & ASSUMPTIONS

The current study consisted of several site visits across different seasons and times of year, which serves to reduce the limitations associated with the field assessment. In addition, extensive fieldwork has also been conducted on the adjacent proposed Kap Vlei Wind Farm as well as the Eskom 300MW Kleinsee Wind Farm and this information is used to inform the current study where relevant. Consequently, the vegetation of the site is considered well-characterised and there are few limitations in this regard.

In terms of fauna, active searches were conducted for reptiles and amphibians while camera trapping over more than four months was conducted for mammals. In addition, the faunal community of the area is informed by the results of previous work on adjacent sites as described above. Some fauna are rare or difficult to observe in the field, with the result that their potential presence at the site was evaluated based on the literature, their habitat preferences and distribution in the wider area according to the available databases. In order to ensure a conservative approach in this regard, the species lists derived for the site from the literature were obtained from an area significantly larger than the study site.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

3.1 BROAD-SCALE VEGETATION PATTERNS

The national vegetation types which occur at the site are briefly described below. The common and characteristic species associated with each as described in Mucina & Rutherford (2006) is not repeated here as the actual vegetation as observed at the site is described in Section 3.6.

Namaqualand Strandveld

The majority of the site falls within the Namaqualand Strandveld vegetation type. This vegetation type occurs in the Northern and Western Cape Provinces from the southern Richtersveld as far south as Donkins Bay. Especially in the north of this unit it penetrates up to 40km inland and approaches the coast only near the river mouths of the Buffels, Swartlintjies, Spoeg, Bitter and Groen Rivers. In the south of the unit it is variably narrow and approaches the coast more closely. It consists of flat to undulating coastal penepain. The vegetation consists of a low species richness shrubland dominated by a plethora of erect and creeping succulent shrubs as well as woody shrubs and in wet years annuals are also abundant. It is associated with deep red or yellowish-red Aeolian dunes and deep sand overlying marine sediments and granite gneisses. The area is a combination of Ah, Ae, Af, Ai and Ag land types. Mucina and Rutherford list eight endemic species for this vegetation type. Namaqualand Strandveld is classified as Least Threatened and about 10% of this

vegetation type has been lost mainly to coastal mining for heavy metals and it is not currently listed. In general, this is not considered to be a highly sensitive vegetation type as it is fairly extensive and generally has a low abundance of species of conservation concern. There may however be specific habitats present that are of limited extent and contain specialised associated species. Within the site, this unit occurs in two broad bands separated by the low-lying valley which traverses the centre of the site and which is classified as Namaqualand Salt Pans.

Namaqualand Salt Pans

The low-lying area which crosses the site in a north-south direction is mapped as the Namaqualand Salt Pans vegetation type. Namaqualand Salt Pans occurs in the Northern and Western Cape on the coastal plain including the Sonnekwa, Hindevlei, Bloupan, Dryerspan, and Soutpan as well as parts of the Olifants River mouth. This unit occupies the flat surfaces of depressions, mostly without vegetation and only occasionally covered with sparse salt-tolerant succulent shrubs. Namaqualand Salt Pans are nearly permanently dry and especially in the Kleinsee area they disappear and are buried under layers of wind-borne sand. This vegetation type is considered to be Least Threatened and has experienced limited impact resulting in transformation to date. While the low-lying valley that traverses the site may have had its origin as a salt pan type feature, it clearly does not correspond to this feature today and cannot be considered to be a salt pan any longer as it is well-vegetated and the original basement is no longer apparent, except where it has been uncovered by excavation. As this is not a common vegetation unit in the area and offers different habitat to the surrounding sandy areas, it is considered more sensitive than the surrounding areas. While some development in this unit is considered acceptable, it is vulnerable to cumulative impact due to its low extent and the development footprint in this unit should be in proportion to its abundance at the site and not higher.

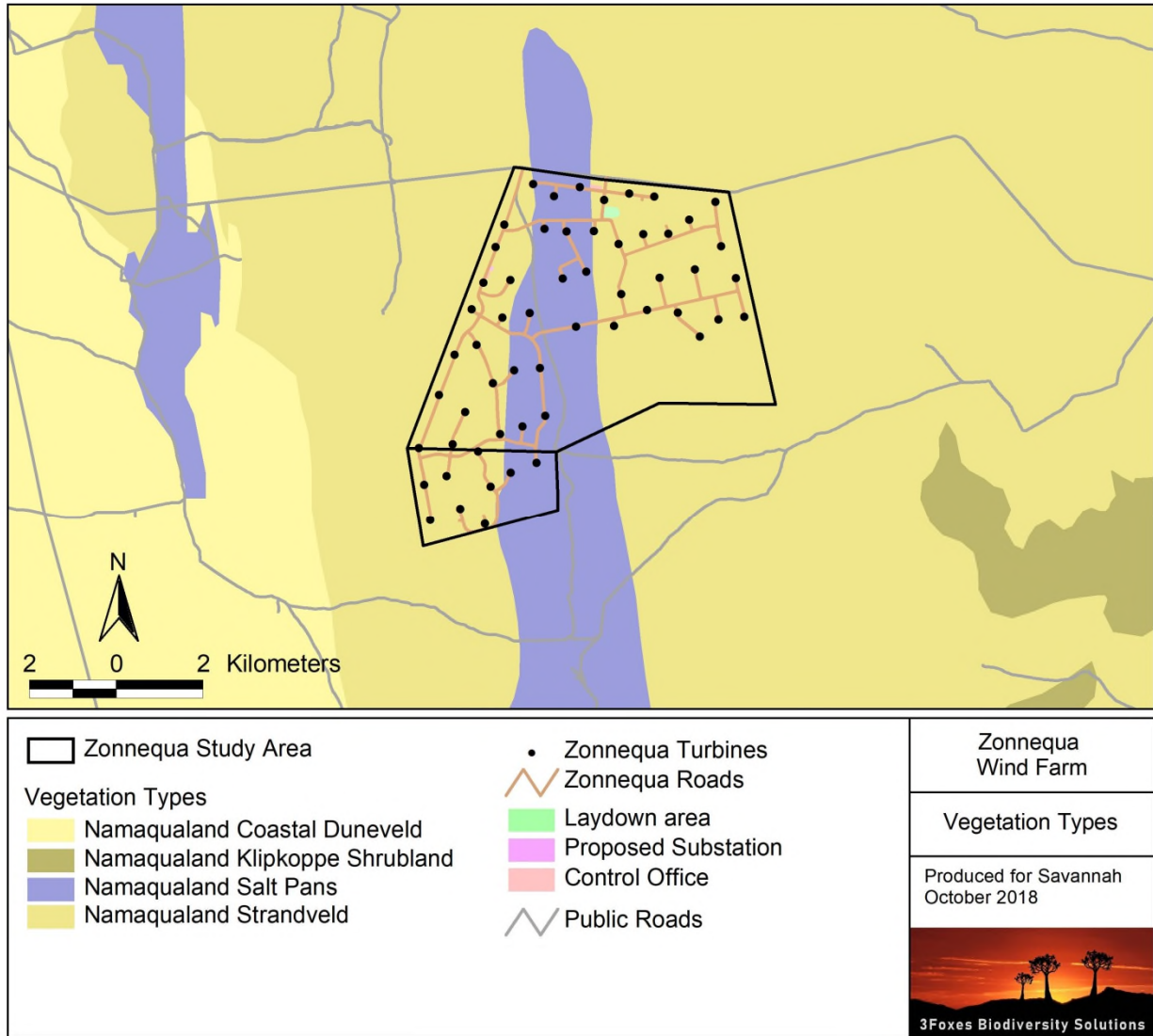


Figure 2. The national vegetation map (Mucina & Rutherford, 2006 & 2012 Powrie update) for the Zonnequa Wind Farm project site.

3.2 LISTED PLANT SPECIES

More than 500 plant species have been recorded from the broader area from Komaggas in the east to Kleinsee in the west. This includes 25 species of conservation concern of which three can be confirmed present at the site. This includes, *Leucoptera nodosa* (NT), *Wahlenbergia asparagoides* (VU) and *Babiana hirsuta* (NT). However, the abundance of these species is low across most of the site and the local populations would not be compromised by the development. The site is not considered to hold locally or regionally important populations of these species.



Figure 3. Common plant species of concern present at the site include *Leucoptera nodosa* which occurs in the Strandveld on the western side of the site and *Babiana hirsuta* which occurs on deep sands at a low density across the site.

3.3 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

The extract of the Northern Cape Critical Biodiversity Areas Map for the study area is illustrated below in Figure 4. Such biodiversity assessments identify Critical Biodiversity Areas (CBAs) which represents biodiversity priority areas, and are considered to be areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives.

The majority of the site lies within "Other Natural Areas" which are areas of natural vegetation which have not been identified as being required to meet the biodiversity targets

underlying the conservation plan. There is a small area classified as an Ecological Support Area present in the southwest of the site. Given the very low footprint of the wind farm located within the ESA, it is highly unlikely that the wind farm development would result in significant impact on the ESA or compromise the functioning of the ESA in any way. In addition, the Zonnequa area has not been identified as falling within a Northern Cape Protected Area Expansion Strategy (NC-PAES) focus area (Figure 5) and has therefore not been identified as an important area for future conservation area expansion. Given the low significance of the site for CBAs and future conservation expansion, the development is considered compatible with future desirable land-use options for the area and a significant impact on CBAs and broad-scale ecological functioning of the area would be low.

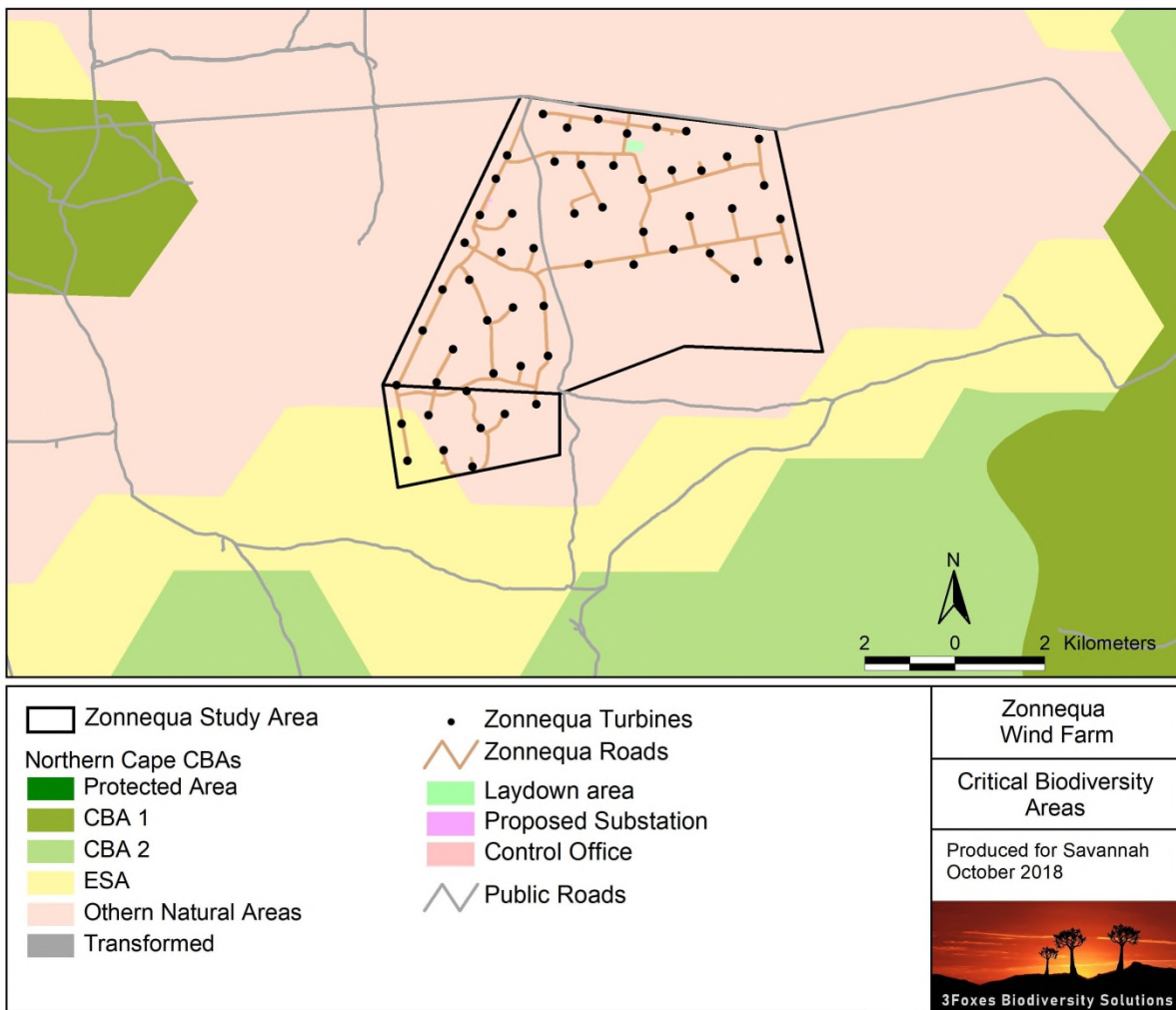


Figure 4. Extract of the Northern Cape Critical Biodiversity Areas map (2017) for the project site, showing that the majority of the site is classified as “other natural areas”, with a small area of Ecological Support Area (ESA) in the southwest corner of the site.

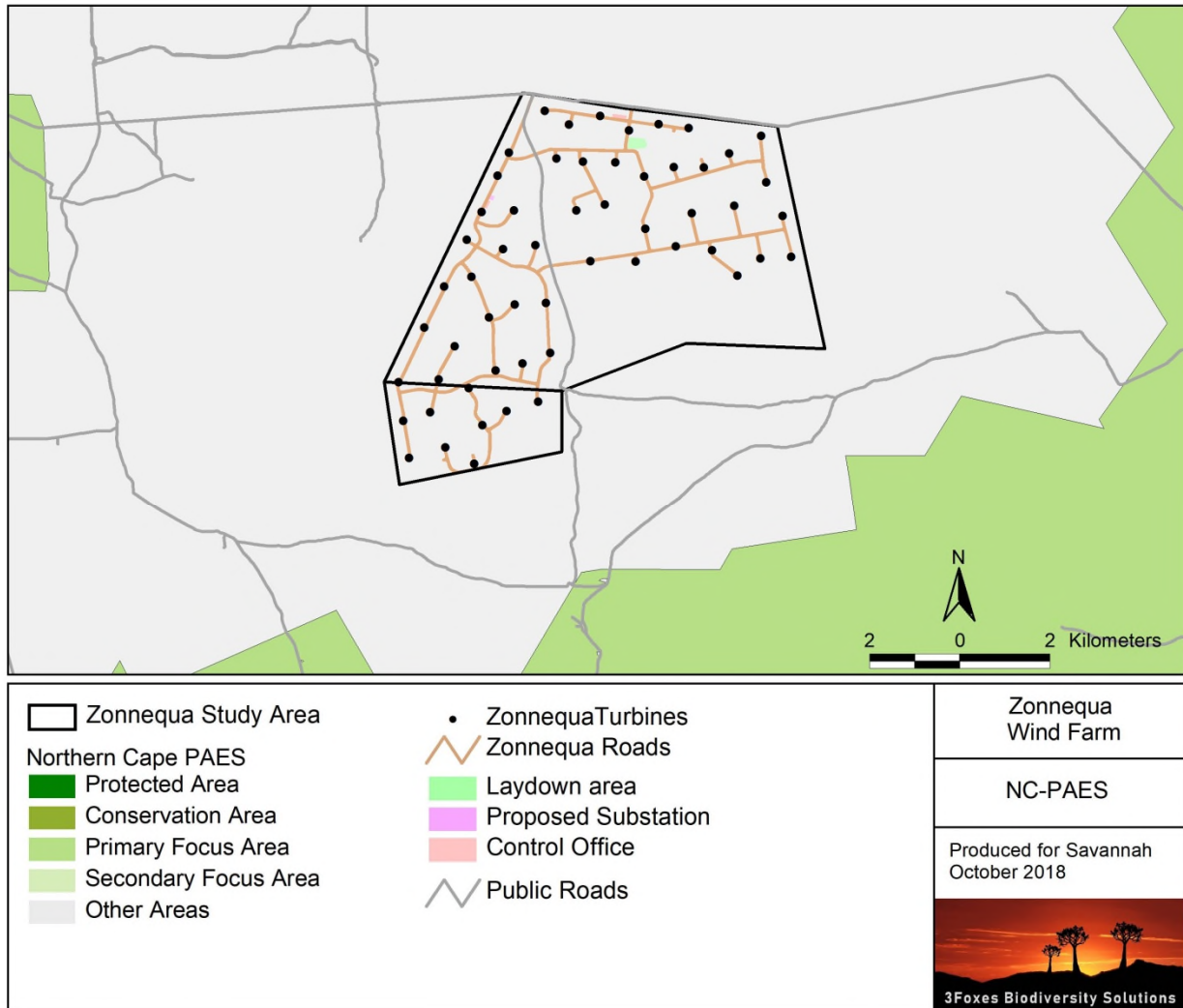


Figure 5. Northern Cape Protected Area Expansion Strategy Focus Areas map for the broader study area, showing that development does not impact on an area identified as a priority for future conservation expansion.

3.4 CUMULATIVE IMPACTS

Although there are a number of the different proposed renewable energy facilities in the broader area around the Zonnequa site (Figure 6), not all of these are within a similar environment and would not affect the same range of habitats as present at the Zonnequa site. To the east of the Zonnequa site is the Kap Vley Wind Farm which has a footprint of approximately 130ha which is distributed between sand fynbos, strandveld and Namaqualand Klipkoppe habitat types. The Kap Vley site is considered considerably more sensitive than the Zonnequa site due to the exceptional habitat diversity present in the Kap Vley area associated with the rocky hills and presence of dunes overlying rocky areas and

the very high abundance of species of conservation concern in that area, which is not replicated on the Zonnequa site, which is restricted to the lower sensitivity sandy strandveld habitats. To the west of the Zonnequa site is the Eskom Kleinzee 300MW wind farm which would have an approximate footprint of 250ha, restricted largely to the Namaqualand Coastal Duneveld vegetation type. Adjacent and to the south of the Zonnequa site is the Namas Wind Farm which would have a similar footprint to the Zonnequa Wind Farm. The Namas Wind Farm shares many of the same habitats as the Zonnequa site, but is closer to the coast and includes a significant area of Namaqualand Coastal Duneveld that is not present on the Zonnequa site. However, none of these projects have been built and existing impact in the area is largely restricted to the coastal forelands where diamond mining has had a significant impact on this environment. There are also a number of diamond mines on ancient alluvial terraces along the Buffels River north of the site. Overall, existing impacts on the coastal plain away from the actual coastline are relatively low and the contribution of the anticipated 40-50ha footprint of the Zonnequa WEF is not considered highly significant in the context of the receiving environment.

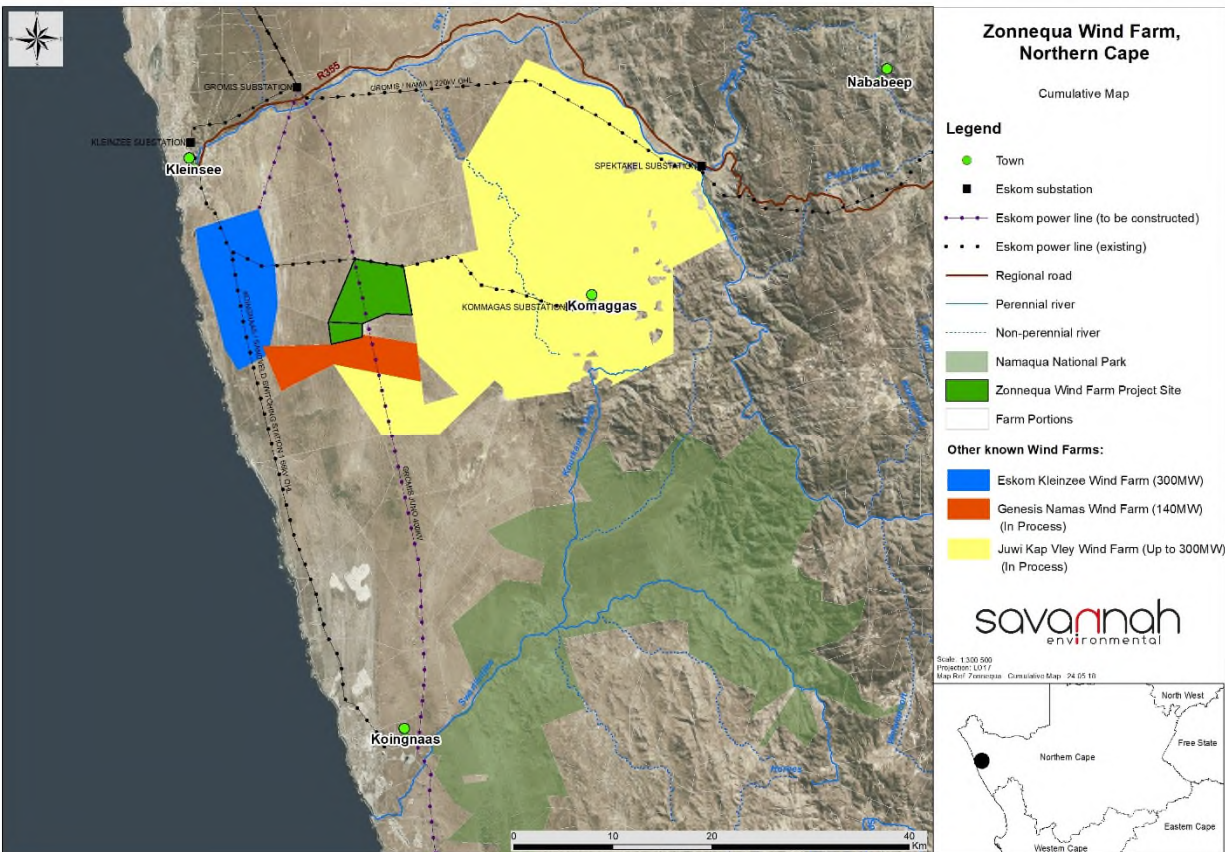


Figure 6. Map illustrating the affected farm portions of known and approved wind energy projects within 30km radius of the Zonnequa Wind Farm site (provided by Savannah Environmental).

3.5 FAUNAL COMMUNITIES

Mammals

Mammals captured by the camera traps include, in order of decreasing abundance, Steenbok, Cape Hare, Cape Fox, Bat-eared fox, Striped Polecat, Suricate, Cape Porcupine, Common Duiker, Honey Badger, Small Spotted Genet, Grey Mongoose, Caracal, Yellow Mongoose, African Wild Cat and Slender Mongoose (Figure 7, Figure 8). More than half the observations are from Steenbok and Cape Hare, with Cape Fox, Bat-eared fox, Striped Polecat, Suricate and Cape Porcupine being moderately abundant and the remaining species uncommon. This represents a fairly typical mammalian community and is similar to that obtained at other sites along the West Coast. A notable absence is the Black-backed Jackal which occurs in the area but is likely absent as a result of persecution. Small mammals observed or caught in the area with Sherman traps include Hairy-footed Gerbil, Western Rock Elephant Shrew, Namaqua Rock Mouse, Four-striped Mouse, Karoo Bush Rats and Brants' Whistling Rat.

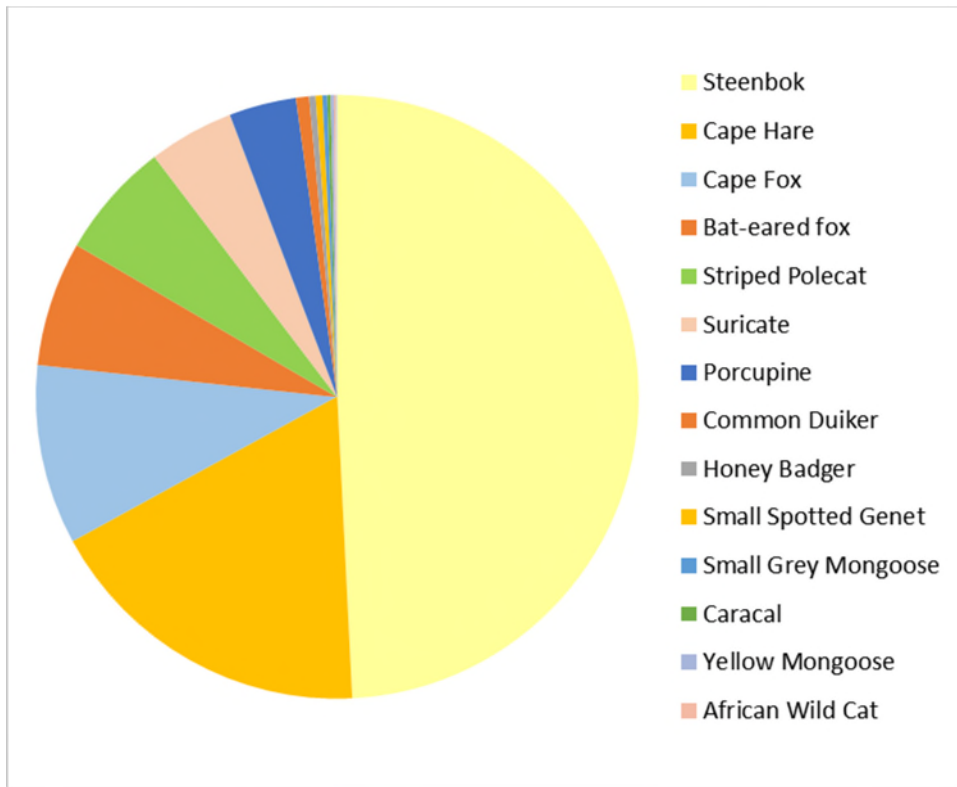


Figure 7. Pie chart showing the relative abundance of mammals at the Zonnequa site based on more than 1100 camera trap observations at the site.

Apart from the species that were observed and can be confirmed present at the site, four red-listed SCC are known from the wider area. This includes the Leopard *Panthera pardus* (Vulnerable), Litledale's Whistling Rat *Parotomys littedalei* (Near Threatened), African Clawless Otter *Aonyx capensis* (Near Threatened) and Grants' Golden Mole *Eremitalpa granti granti* (Vulnerable). It is not likely that either the Leopard or Otter are present at the site on account of human disturbance or lack of suitable habitat. Golden Moles are confirmed present at the site, but it is not clear if these are the more common Cape Golden Mole or Grants' Golden Mole. These subterranean animals 'swim' through the soft sand and hardened surfaces such as roads would pose a significant obstacle for movement. In addition, they also use subtle vibrations in the soil to detect their prey and it is possible that noise and vibration transferred from the turbines to the soil would have a negative impact on the local populations of golden moles. There have however been no studies to date on the impacts of vibration and noise on golden moles and so this remains an unknown.

The major impacts on mammals would occur during the construction phase when there would be significant noise and disturbance generated at the site. However, in the long-term, impacts on mammals would be low as additional habitat loss would be minimal and the resident species would be those that are tolerant of human activity and a modified landscape and it is unlikely that any species would be significantly affected by the wind farm development.

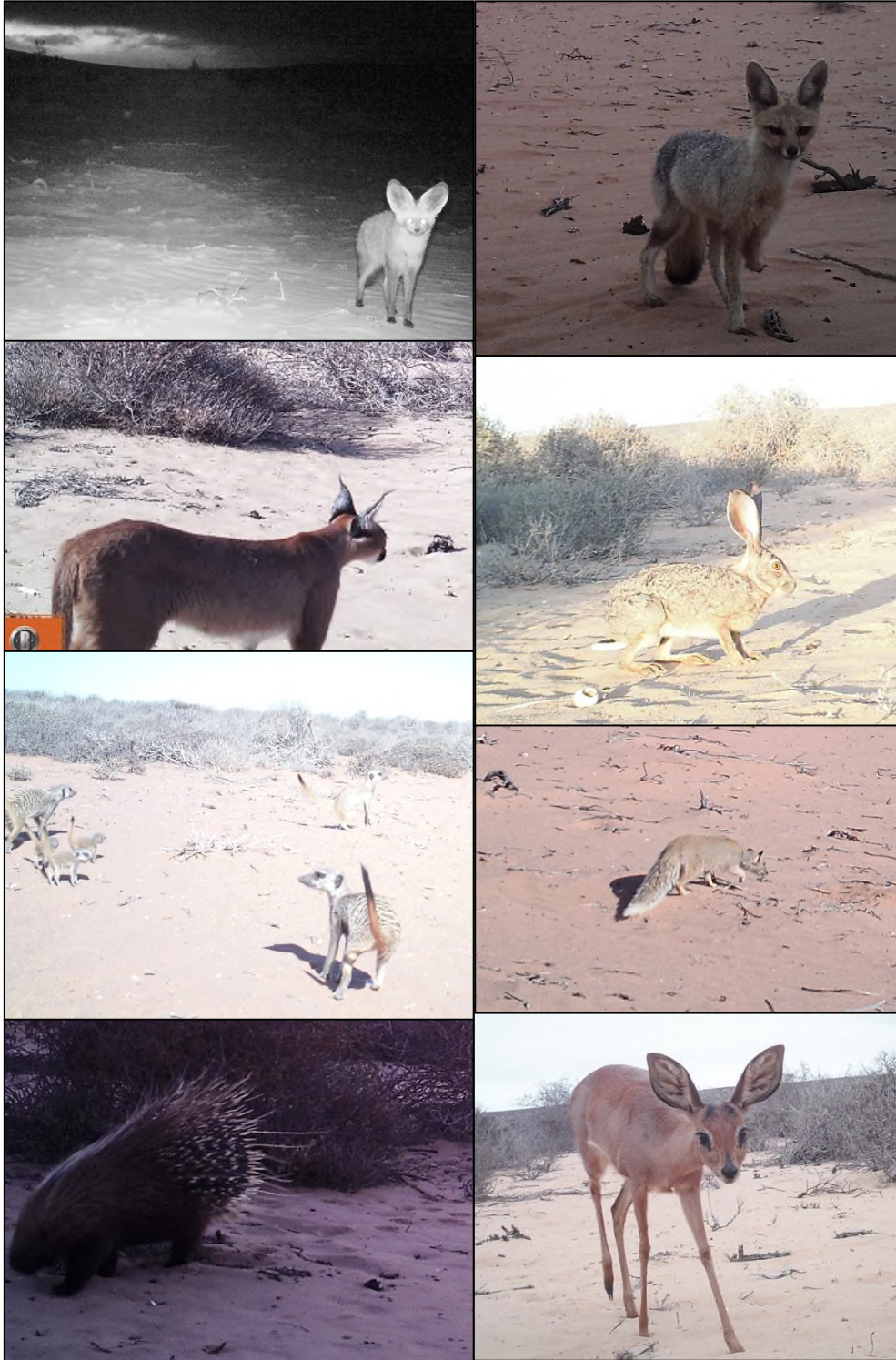


Figure 8. Examples of camera trap images from the site. Clockwise from bottom left, cape Porcupine, Suricate, Caracal, Bat-eared Fox, Cape Fox, Cape Hare, Yellow Mongoose and Steenbok. The Cape Fox pictured top right has an amputated front leg, likely the result of being caught in a gin trap.

Reptiles

A list of Reptiles known from the vicinity of the Zonnequa site, based on records from the ReptileMap database is provided in Appendix 3 of this report and indicates that as many as 45 species are known to occur in the wider area. No SCC have however been recorded from the area although it is possible that the Speckled Padloper *Chersobius signatus* (Vulnerable) is present in the area, there is no rocky habitat available at the site for this species and as a result it is not likely to be present. Namaqualand is however known as a centre of endemism and diversity for reptiles and the wider area has a high diversity and abundance of local endemics. This appears to be generated at least partly through the high habitat diversity of the area, which includes rocky hills, heuweltjie veld on fine-textured firm soils, loose sands and dunes, stable and vegetated dunes, well-vegetated drainage lines etc. Within the Zonnequa site, habitat diversity is however low and restricted to various sandy substrates from firm sand lowlands to fairly loose dunes, with the result that species associated with rocky outcrops would be absent from the site.

Species observed at the site (Figure 9) include Angulate Tortoise, Giant Desert Lizard, Common Giant Ground Gecko, Knox's Desert Lizard, Common Sand Lizard, Cape Skink, Coastal Dwarf Legless Skink, Namaqua Sand Lizard, Pink Blind Legless Skink, Dwarf Beaked Snake and Many-horned Adder. For most species the major impact of the development would be loss of habitat equivalent to the footprint of the development. For most species this is not considered highly significant as there are large intact tracts of similar habitat available in the area. Subterranean species associated with sandy substrates may be vulnerable to habitat disruption due to the construction of roads which may fragment the continuity of the sandy substrate. However, overall, the impacts of the development on reptiles are likely to be of local significance only as there are no species with a very narrow distribution range or of high conservation concern present at the site which may be compromised by the development.



Figure 9. Common reptiles at the Zonnequa site include the Angulate Tortoise, Giant Desert Lizard and two colour morphs of the Coastal Dwarf Legless Skink *Acontias litoralis*, a West Coast endemic.

Amphibians

There is no natural permanent or even seasonal standing water at the Zonnequa site, which is due to the sandy substrate and consequent lack of drainage features where water can gather. As a result, the amphibian community at the site is restricted to species which are relatively independent of water and is consequently of low diversity. The only species confirmed present in the immediate area is the Namaqua Rain Frog which appears to be relatively widespread within the coastal strandveld vegetation types on sandy soils. Other species which are possibly present include the Cape Sand Frog *Tomopterna delalandii* and the Desert Rain Frog *Breviceps macrops* which is classified as Vulnerable. The Desert Rain Frog is however restricted to the coastline and is not known to occur as far inland as the Zonnequa site. Given the paucity of important amphibian habitats at the site and the low diversity of amphibians, a significant impact on amphibians is not likely.

3.6 ZONNEQUA WIND FARM SITE DESCRIPTION

It is difficult to map the different habitats or plant communities present at the Zonnequa site based on satellite imagery alone due to the homogenous sands of the area and the similar cover and structure of the vegetation. There are some exceptions such as the areas which are mapped in the VegMap as Namaqualand Salt Pans, which in the study area have been overlain with marine sands, but are still easily visible on account of the underlying white sands and calcrete. In order to better inform the vegetation baseline of the site, 30 vegetation samples were collected from a broader study area which includes the Zonnequa site as well as the adjacent Namas site. This is considered a useful approach as it allows the vegetation of the site to be interpreted in a broader context.

Although the specific sites that were sampled in the field were chosen randomly, the sample points were purposely distributed across the wider area to capture the range of habitats present and ensure spatial representivity. In order to identify and understand the different plant communities present, the information from the 30 sample sites was subject to cluster analysis, which identifies and groups plots with similar species composition together in a hierarchical structure. The groups resulting from the cluster analysis were then mapped to illustrate the spatial distribution of the communities identified. The cluster analysis and map are illustrated below in Figure 10 and Figure 11.

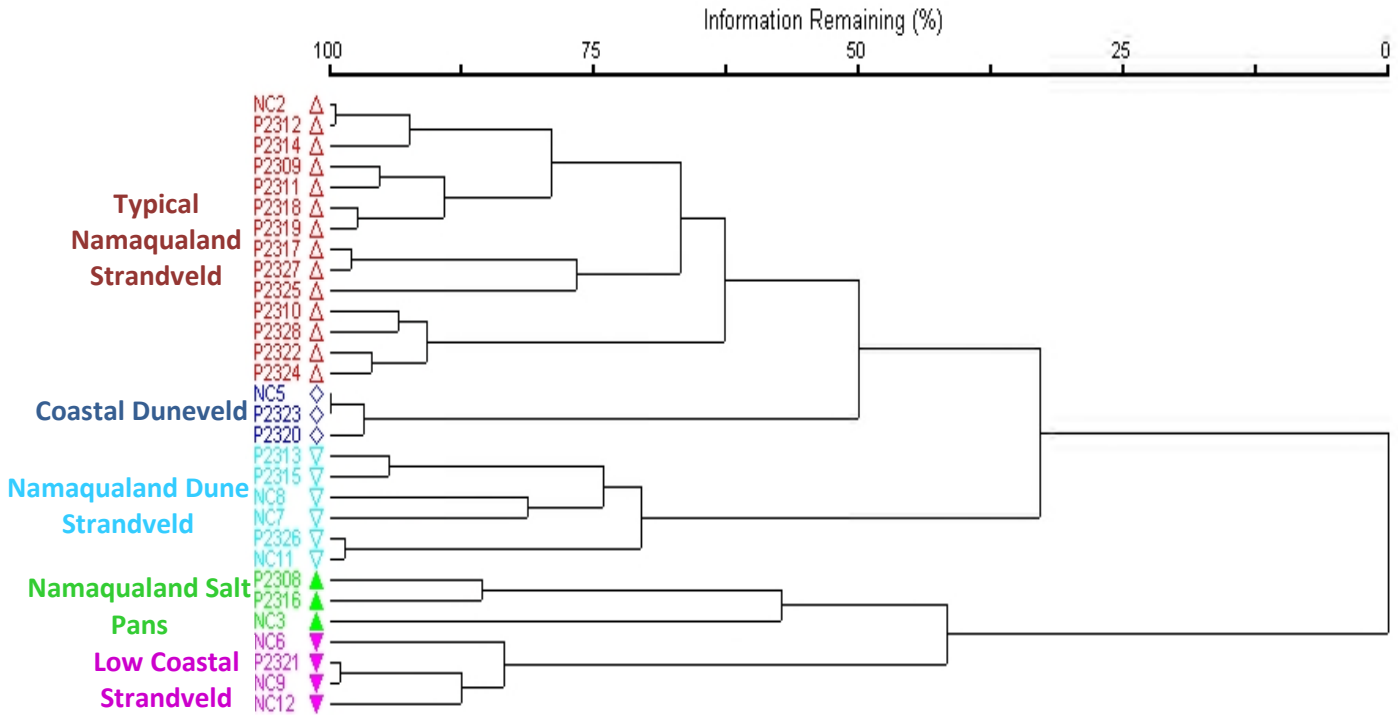


Figure 10. Cluster analysis showing the different plant communities that were identified among the plots that were sampled at the Zonnequa site and in the adjacent areas. The number of communities that can be recognised is essentially arbitrary and the main difference among the plots lies at the first level division. For the current purposes, five communities were recognised and named as above, but only three of these are present within the Zonnequa site.

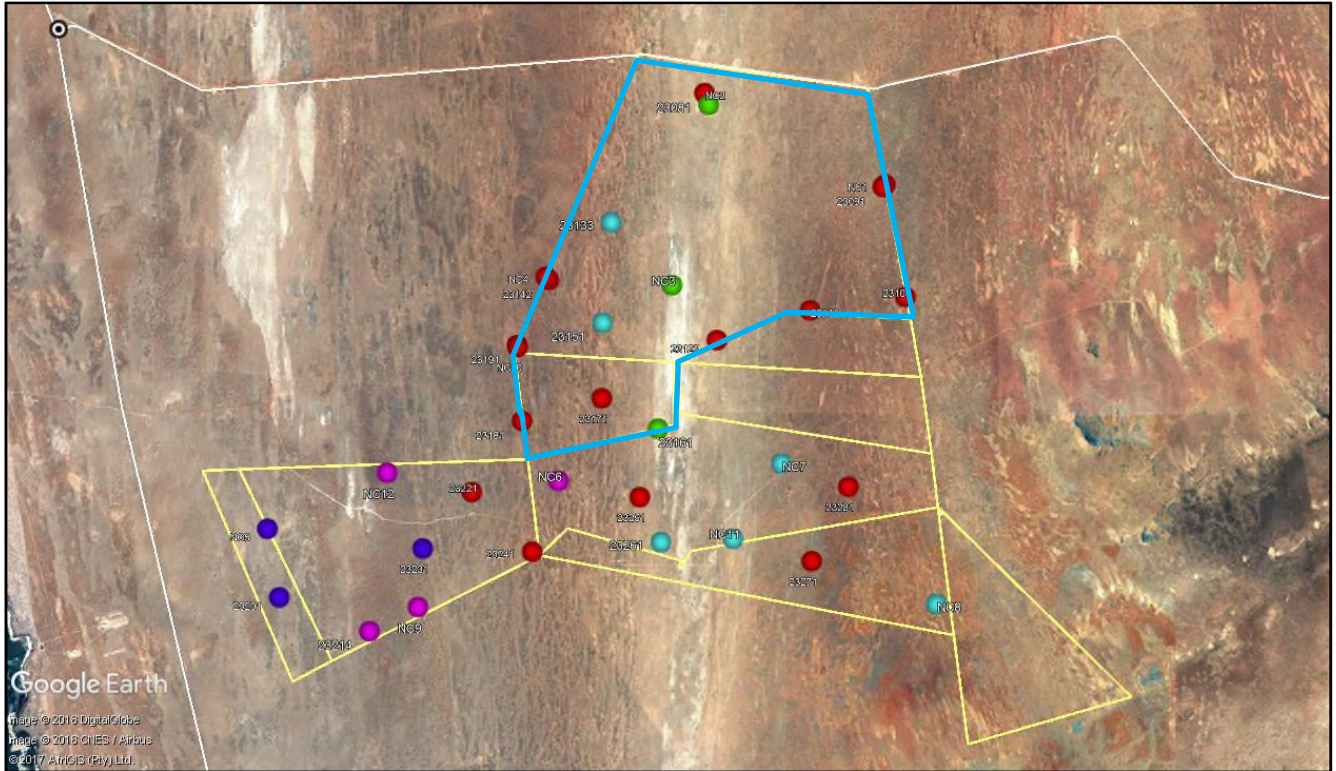


Figure 11. Map showing the distribution of the different plant communities or groups identified above in the cluster analysis.

The cluster analysis illustrates a few patterns of note that can be observed on the above map (Figure 11). The plots from the western part of the broader study area form two relatively distinct clusters (blue and purple), while there is also clearly a cluster associated with the shallow sands overlying calcrete in the mid-section of the site (green) as well as a cluster on large dunes (blue) and the remaining cluster (red) which represents more typical strandveld on flatter areas. The communities present in the west of the broader study area (Community 1 and Community 2) are restricted to the Namas site and do not occur on the Zonnequa site. Each of the three habitats identified above as present on the Zonnequa site are illustrated below with pictures of these habitats from the Zonnequa site and are described in more detail with characteristic species below.

Community 3. Strandveld on Namaqualand Salt Pans



The vegetation of the areas classified as Namaqualand Salt Pans is well supported as an independent unit in this study, however, it is also clear that the naming is not appropriate and the unit should be called something else as the vegetation does not correspond with a salt pan environment. These areas occur on shallow white sands overlaying weathered calcrete or lime. Water does not collect in these areas as evidenced by observation and the fact that most of the farm houses in the study area are located within this habitat. Although they are currently freely drained they may once have represented salt pans that have been overlain with wind-blown sands. Typical and dominant species include *Amphibolia rupis-arcuatae*, *Euphorbia brachiata*, *Othonna sedifolia*, *Asparagus capensis*, *Zygophyllum morgsana*, *Ruschia goodiae*, *Cheirodopsis denticulata*, *Aridaria nociflora*, *Othonna cylindrica* and *Ruschia sp.*. As this is a habitat of limited extent and offers features that are not found elsewhere in the area, it is considered more sensitive than the surrounding Strandveld and the overall development footprint in this habitat should be kept low, but some development in these areas is considered acceptable.

Community 4. Namaqualand Dune Strandveld



There is a distinct plant community associated with the larger, more mobile dune fields of the site (mapped as light blue sites in Figure 11). These areas are more dynamic than the areas of flatter strandveld and have areas of alternating low cover associated with areas of greater sand movement and areas of taller vegetation occurring in the dune slacks and other more stable situations. Typical and dominant species include *Zygophyllum morgsana*, *Searsia longispina*, *Tripteris oppositifolia*, *Cladoraphis cyperoides*, *Othonna sedifolia*, *Conicosia pugioniformis*, *Asparagus lignosus*, *Hermannia sp. nov.*, *Babiana hirsuta*, *Leucoptera nodosa*, *Eriocephalus racemosus*, *Asparagus capensis*, *Lycium cinereum*, *Lebeckia spinescens*, *Tetragonia spicata* and *Diospyros ramulosa*. These areas are considered somewhat more sensitive than the typical surrounding Strandveld due to the large dunes which are vulnerable to disturbance. No specific avoidance of this habitat is recommended, but some additional mitigation is likely to be required to reduce wind erosion risk during the construction phase.

Community 5. Typical Namaqualand Strandveld



The majority of the site consists of typical Namaqualand Strandveld on gently undulating plains. These areas are fairly homogenous but there are some shifts in the dominance of the different plant species present depending on soil texture, depth etc. Typical and dominant species include *Zygophyllum morgsana*, *Tripteris oppositifolia*, *Asparagus capensis*, *Othonna sedifolia*, *Hermannia sp.*, *Lebeckia spinescens*, *Eriocephalus racemosus*, *Searsia longispina*, *Leipoldtia sp.*, *Cladoraphis cyperoides*, *Salvia lanceolata*, *Anthospermum spathulatum*, *Tetragonia spicata*, *Ruschia sp.*, *Helichrysum hebelepis*, *Wahlenbergia asparagoides*, *Asparagus lignosus* and *Euphorbia burmannii*. This is the dominant habitat at the site and comprises the majority of the study area. This is not considered to be a sensitive habitat and while some SCC are present, a significant impact on the local populations of these species is not likely as this is a widespread vegetation type.

3.7 ZONNEQUA WIND FARM SENSITIVITY ASSESSMENT

The sensitivity map for the project site is depicted below in Figure 12. The whole site consists of Namaqualand Strandveld considered to be of Low or Moderate sensitivity. Development in these areas would generate low ecological impacts as these habitats are widely available in the area. The areas classified as Namaqualand Salt Pans are clearly not salt pans and while the vegetation survey confirmed that they are well-differentiated from

the adjacent strandveld, they are not currently acting as hydrological features and hence they are not considered to be as sensitive as pans would be. Development within these areas is considered acceptable, but should be limited to some degree as this is not a very extensive habitat type with the result that it is considered more vulnerable to cumulative impacts. There are no parts of the site which have been identified as being of high or very high sensitivity and which should specifically be avoided by the development. Overall the development is likely to generate moderate pre-mitigation impacts which in most cases can be reduced to low impacts after the implementation of the recommended mitigation.

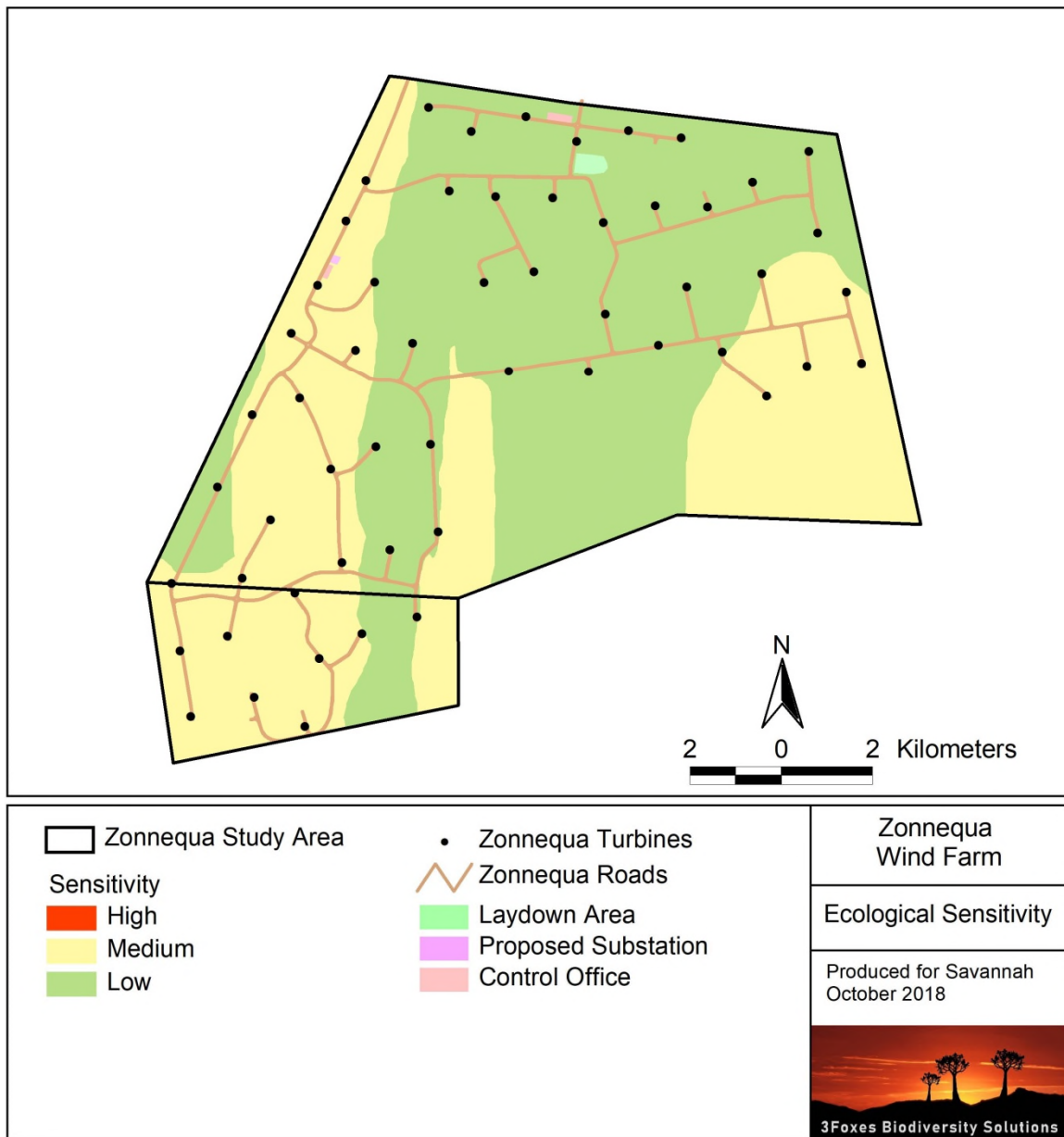


Figure 12. Ecological sensitivity map for the Zonnequa Wind Farm project site.

4 ASSESSMENT & SIGNIFICANCE CRITERIA

Direct, indirect and cumulative impacts of the issues identified in this report are assessed in terms of the following criteria:

- The **nature** which includes a description of what causes the effect what will be affected and how it will be affected.
- The **extent** wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 is assigned as appropriate (with 1 being low and 5 being high):
- The **duration** wherein it is indicated whether:
 - the lifetime of the impact will be of a very short duration (0- 1 years) - assigned a score of 1.
 - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2.
 - medium-term (5-15 years) - assigned a score of 3
 - long term (> 15 years) - assigned a score of 4; or
 - permanent - assigned a score of 5
- The **magnitude** quantified on a scale from 0-10 where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way 8 is high (processes are altered to the extent that they temporarily cease) and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1-5 where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but of low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

The **significance** which shall be determined through a syntheses of the characteristics described above and can be assessed as low, medium or high;

and;

the status, which will be described as either positive, negative or neutral.

the degree to which the impact can be reversed.

the degree to which the impact may cause irreplaceable loss of resources.
the degree to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E + D + M)P$$

Where

S = significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

- **<30** points: **Low** (i.e. where this impact would not have a direct influence on the decision to develop in the area)
- **30-60** points: **Medium** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
- **>60** points: **High** (i.e. where the impact must have an influence on the decision process to develop in the area).

5 ASSESSMENT OF IMPACTS

5.1 PLANNING AND CONSTRUCTION PHASE IMPACTS

An assessment of the likely extent and significance of each impact identified above is made below.

Impact 1: Impacts on vegetation due to construction activities

The development of the Zonnequa Wind Farm would require vegetation clearing for turbines, roads, the on-site substation, internal power lines or cable trenches and other hard infrastructure. There will be a direct loss of vegetation within the development footprint, and listed and protected species are also highly likely to be impacted. The total extent of habitat loss is expected to be in the order of 40-50ha. As the abundance of species of conservation concern in the area is moderate to low, the impact on SCC is likely to be relatively low and the primary impact would be on gross habitat loss of the affected Strandveld and Duneveld vegetation types. As the surrounding landscape is still largely intact and there are no very high value plant habitats within the development footprint, post-mitigation impacts are likely to be of a Medium Significance.

Impact Nature: Impacts on vegetation will occur due to disturbance and vegetation clearing associated with the construction of the facility. In addition, it is highly likely that some loss of individuals of plants of SCC will occur.		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Medium (4)
Probability	Certain (5)	Highly Likely (4)
Significance	Medium (50)	Medium (36)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated?	This impact can only be mitigated to a certain extent as the loss of vegetation is unavoidable and is a certain outcome of the development.	
Mitigation	<ul style="list-style-type: none"> • The final layout including roads and underground cables should be subject to a preconstruction walk-through before construction commences and adjusted where required to reduce impacts on SCC and habitats of concern. • Search and Rescue of SCCs should be conducted prior to clearing activities. • Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within the demarcated construction areas etc. • All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving is to be allowed once the site has been pegged for construction. • Temporary laydown areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. • Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operation phase of the development. 	
Cumulative Impacts	The development will contribute to cumulative impacts on habitat loss and transformation in the area.	
Residual Risks	As the loss of currently intact vegetation is an unavoidable consequence of the development, the habitat loss associated with the development remains a residual impact even after mitigation and avoidance of more sensitive areas.	

Impact 2. Faunal impacts due to construction activities.

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Traffic during construction will be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. Many of these impacts can however be effectively managed or mitigated. However, faunal habitat loss cannot be mitigated and would persist for the operational lifetime of the facility. After mitigation, faunal impacts are likely to be of a Low Significance.

Impact Nature: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. Due to noise and operation of heavy machinery, faunal disturbance will extend well beyond the footprint and extend into adjacent areas. This will however be transient and restricted to the construction phase.		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (6)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium (36)	Low (28)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Although the large amounts of noise and disturbance generated at the site during construction is largely unavoidable, impacts such as those resulting from the presence of construction personnel at the site can be easily mitigated.	
Mitigation	<ul style="list-style-type: none"> • Site access should be controlled and no unauthorised persons should be allowed onto the site. • Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. 	

	<ul style="list-style-type: none"> • The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated construction site. • Fires should not be allowed on site. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All construction vehicles should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises. • If any parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks.
Cumulative Impacts	During the construction phase the activity would contribute to cumulative fauna disturbance and disruption in the area, but as there are large tracts of intact habitat in the area, it is likely that displaced fauna will have space to move about the site to avoid areas of high activity.
Residual Risks	It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.

Impact 3. Increased Soil Erosion Risk during Construction

The large amount of disturbance created during construction would leave the site vulnerable to soil erosion, especially given the sandy soils and high winds the area experiences. Normal dust suppression techniques do not work well in this environment as the major agent of erosion is wind and the soil binders that are usually used for dust suppression may not be very effective on the sandy soils. Once mobilised, the sand may suffocate the vegetation, creating additional sources of sand, allowing such erosion to propagate in the dominant wind direction. Measures to limit erosion will need to be a key element of mitigation measures at the site during construction as well as operation. Although this impact is a potentially an impact of concern it is likely that it can be mitigated to a Low Significance.

Impact Nature: Disturbance created during construction will leave the site vulnerable to erosion.		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)

Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (7)	Low (4)
Probability	Certain (5)	Likely (3)
Significance	Medium (60)	Low (24)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Moderate	Low
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	
Mitigation	<ul style="list-style-type: none"> • Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. • All roads and other hardened surfaces should have runoff control features which redirects water flow and dissipate any energy in the water that may pose an erosion risk. • Regular monitoring for erosion during construction to ensure that no erosion problems are developing as a result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All cleared areas should be revegetated with indigenous perennial species from the local area. 	
Cumulative Impacts	Erosion would contribute to degradation in the area, but as this can be well-mitigated, the contribution can be minimised.	
Residual Risks	Some erosion is likely to occur even with the implementation of erosion control measures, due to the strong winds the area experiences and the likely in difficulty in re-establishing vegetation cover in cleared areas.	

5.2 OPERATION PHASE IMPACTS

Impact 1. Faunal impacts due to operation

Although noise and disturbance levels during operation will be significantly reduced compared to construction, some noise and disturbance impacts will persist due to operational activities on the wind farm as well as noise generated by the turbines themselves. Although most fauna are likely to quickly become habituated to the presence of the turbines, some fauna may be negatively affected due to noise or other reasons and may avoid the proximity of the turbines and would therefore experience greater long-term habitat loss. This is however likely to be a small subset of the species present and this effect has not been documented in Namaqualand or elsewhere for wind farms. As the

affected areas are not considered to be of a very high faunal sensitivity, the post-mitigation operational impacts on fauna are likely to be of a Low Significance.

Impact Nature: The operation and presence of the facility may lead to disturbance or persecution of fauna within or the areas adjacent to the facility.		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low to Minor (3)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (21)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To a large extent, but some low-level residual impact due to turbine noise and human disturbance is likely.	
Mitigation	<ul style="list-style-type: none"> • No unauthorised persons should be allowed onto the site. • Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. • The collection, hunting or harvesting of any plants or animals at the site or in the surrounding areas should be strictly forbidden. • If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 	
Cumulative Impacts	The development would contribute to the cumulative disturbance for fauna, but the contribution would be low for most species and is not considered highly significant.	
Residual Risks	Turbine noise and disturbance from maintenance activities cannot be fully mitigated but occur at a low level with the result that most species are likely to be able to adapt to the new environment.	

Impact 2. Negative impact on ESAs, CBAs and broad-scale ecological processes.

The small proportion of the development lies within an ESA but no parts of the site are within a CBA. The development of the Zonnequa Wind Farm will have minimal impact on CBAs and very minor impact on the affected ESA. No significant long-term impacts on the ESA are likely to result as a consequence of the development. With mitigation, this impact is likely to be of a Low Significance.

Impact Nature: Development of the wind farm may impact ESAs and broad-scale ecological processes such as the ability of fauna to disperse.		
	Without Mitigation	With Mitigation
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low-Minor (3)
Probability	Probable (3)	Improbable (2)
Significance	Low (30)	Low (16)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Only partly, as a significant proportion of the impact results from the presence and operation of the wind farm which cannot be mitigated.	
Mitigation	An open space management plan should be developed for the site, which should include the management of biodiversity within the affected areas, as well as that in the adjacent intact strandveld on the affected land portions.	
Cumulative Impacts	The development would potentially contribute to habitat degradation and the loss of landscape connectivity and ecosystem function within the area, but this is likely to be relatively low as most species are likely to be able to modify their behaviour to account for this and only a small proportion of species is likely to be sensitive to the presence of the turbines.	
Residual Risks	The presence and operation of the facility will generate a continuous low-level impact on some fauna, but this is not likely to be of high consequence.	

Impact 3. Increased Soil Erosion Risk during Operation

The large amount of disturbance created during construction would leave the site vulnerable to soil erosion for many years into the operation phase, especially given the sandy soils and high winds the area experiences. The soil disturbance associated with the development will render the impacted areas vulnerable to wind erosion and measures to limit erosion will

need to be a key element of mitigation measures at the site. Although this impact is of potential concern it can be mitigated to a Low Significance.

Impact Nature: Disturbance created during construction will leave the site vulnerable to erosion for several years into the operation phase.		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (6)	Low (4)
Probability	Certain (5)	Likely (3)
Significance	Medium (55)	Low (24)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Moderate	Low
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	
Mitigation	<ul style="list-style-type: none"> Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. All roads and other hardened surfaces should have runoff control features which redirects water flow and dissipate any energy in the water which may pose an erosion risk. Regular monitoring for erosion during operation to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. There should be follow-up rehabilitation and revegetated of any remaining bare areas with indigenous perennial shrubs and succulents from the local area. 	
Cumulative Impacts	Erosion would contribute to degradation in the area, but as this can be well-mitigated, the contribution can be minimised.	
Residual Risks	Some erosion is likely to occur even with the implementation of erosion control measures, due to the strong winds the area experiences and the likely difficulty in re-establishing vegetation cover in cleared areas.	

5.3 DECOMMISSIONING PHASE IMPACTS

Impact 1. Faunal Impacts due to decommissioning

The impacts on fauna at decommissioning would be similar to those at construction, but of a lower severity as the activity will be taking place within the development footprint. The increased levels of noise, pollution, disturbance and human presence during decommissioning will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during this period as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the decommissioning activities and might be killed. Vehicular traffic would be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the decommissioning phase as a result of the large number of personnel that are likely to be present. This would however be a transient impact which would ultimately result in an increase in available habitat for some fauna. After mitigation, faunal impacts due to decommissioning are likely to be of a Low Significance.

Impact Nature: The decommissioning of the facility may lead to disturbance or persecution of fauna within or the areas adjacent to the facility.		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (15)
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To a large extent, but disturbance will occur regardless.	
Mitigation	<ul style="list-style-type: none"> • No unauthorised persons should be allowed onto the site. • Any potentially dangerous fauna such snakes or fauna threatened by the decommissioning activities should be removed to a safe location. • The collection, hunting or harvesting of any plants or animals at the site or in the surrounding areas should be strictly forbidden. • If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of 	

	<p>the spill.</p> <ul style="list-style-type: none"> All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
Cumulative Impacts	Ultimately, decommissioning would restore some habitat for fauna and so in the long-term this would provide a positive outcome for fauna.
Residual Risks	As the intact habitats at the site will not be significantly affected, residual risks on fauna would be very low.

Impact 2. Soil Erosion Risk due to Decommissioning.

The removal and clearing of the site infrastructure would create some soil disturbance which would leave these areas vulnerable to erosion, which if left unchecked could spread significantly. The disturbed areas should be rehabilitated at decommissioning with indigenous species sourced from the local environment to reduce this risk. Although this is an impact of potential concern it can be well mitigated to a Low Significance.

Impact Nature: Decommissioning of the site will create a lot of disturbance at the site which will leave the site vulnerable to erosion.		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (5)	Low (4)
Probability	Highly Probable (4)	Improbable (3)
Significance	Medium (40)	Low (24)
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Low	No
Can impacts be mitigated?	Yes, with the proper erosion control and management, erosion can be reduced to a low level.	
Mitigation	<ul style="list-style-type: none"> Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. Regular monitoring for erosion after decommissioning for at least 5 years to ensure that no erosion problems have developed as a result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 	

	<ul style="list-style-type: none">All cleared areas resulting from decommissioning should be revegetated with indigenous perennial species from the local area.
Cumulative Impacts	The decommissioning of the development would potentially result in some erosion which would contribute to habitat degradation in the area, but this risk can be reduced to a low level.
Residual Risks	It is likely that some soil erosion will occur regardless of the mitigation implemented, due to the high winds that the area experiences. However, this can be reduced to a low level and residual risks can be reduced to an acceptable level.

5.4 CUMULATIVE IMPACTS

Cumulative Impact on Habitat loss and ecological functioning

The Zonnequa Wind Farm will result in approximately 40-50ha of habitat loss and fragmentation of the receiving environment. In addition, there are several other planned wind energy developments in the wider area. Although each may generate an acceptable, low impact when considered alone, this does not account for the potential for cumulative impacts to generate significant impacts on fauna and flora as well as future conservation-use options for the wider area. Although the affected vegetation types are not listed ecosystems, they are not well protected. With mitigation, this impact is likely to be of a Low Significance.

Nature: The development of the Zonnequa Wind Farm will potentially contribute to cumulative habitat loss and other cumulative impacts in the wider Kleinsee-coastal plain area.		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Extent	Local (1)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low(4)	Medium (5)
Probability	Improbable (2)	Probable (3)
Significance	Low (18)	Medium (33)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated	Yes, to a large degree, but through direct avoidance with little other avenue for mitigation.	
Mitigation:		
<ul style="list-style-type: none"> Promote sustainable land use practices in the area and especially on wind farm properties to improve the quality of the habitat for fauna and flora. Reducing grazing pressure on the wind farm properties is identified as a particularly important mitigation measure to improve habitat quality. Ensure that the alien management plan and erosion management plan are effectively implemented at the site. 		

6 CONCLUSION & RECOMMENDATIONS

The Zonnequa site consists of two vegetation types, the so called Namaqualand Salt Pans in the centre of the site and the more typical Namaqualand Strandveld on either side of this area. The field assessment indicates that the Namaqualand Salt Pans unit as mapped by the VegMap, does not represent this unit but rather a strandveld community associated with the coarse white sands that characterise this area. As a result, it is clear that this habitat is not currently operating as a hydrological feature and it is not considered as sensitive as it would be if it represented a more typical salt pan habitat. While some development in this area is considered acceptable, it is a relatively restricted habitat with the result that the total footprint within this habitat should be kept in proportion to its abundance as is the case with the assessed layout.

In terms of fauna, there are relatively few species of concern that are likely to be present at the site. This is in part at least due to the low range of habitats present at the site, most notably the lack of rocky outcrops. The major impact on fauna would be direct habitat loss of approximately 40-50ha as well as some low-level operation phase disturbance resulting from maintenance activities and turbine noise. There are no local populations of fauna within the site that are likely to be compromised by the development as the total footprint is relatively low in proportion to the overall extent of the site and there are still extensive areas within and adjacent to the site that would not be affected.

The site does not contain any CBAs and there is a small area of ESA in the southwestern corner of the site. A significant long-term impact on the ESA is highly unlikely and the impact of the development on broad-scale ecological processes would be low. The site does not fall within a Northern Cape Protected Area Expansion Strategy Focus Area. The development is thus seen as being compatible with the long-term desired future land use options for the area.

Ecological Impact Statement:

The Zonnequa Wind Farm site is considered to represent a broadly suitable environment for wind farm development. There are no specific long-term impacts likely to be associated with the wind farm that cannot be reduced to an acceptable level through mitigation and avoidance, including a very low post-mitigation impact on ESAs and no impact on and CBAs. Consequently, there are no high residual impacts or fatal flaws associated with the development and it can be supported from a terrestrial ecology perspective. It is therefore the reasoned opinion of the specialist that the Zonnequa Wind Farm should therefore be authorised, subject to the implementation of the recommended mitigation measures.

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8 APPENDIX 1. LIST OF PLANT SPECIES

Species List of plants known from the broader area around the Zonnequa Wind Farm.

Family	Genus	Species	IUCN	Family	Genus	Species	IUCN
Acanthaceae	<i>Acanthopsis</i>	<i>glabra</i>		Acanthaceae	<i>Justicia</i>	<i>cuneata</i>	
Acanthaceae	<i>Justicia</i>	<i>spartioides</i>		Acanthaceae	<i>Petalidium</i>	<i>parvifolium</i>	
Agavaceae	<i>Chlorophytum</i>	<i>undulatum</i>		Aizoaceae	<i>Amphibolia</i>	<i>rupis-arcuatae</i>	
Aizoaceae	<i>Amphibolia</i>	<i>succulenta</i>		Aizoaceae	<i>Antimima</i>	<i>alborubra</i>	LC
Aizoaceae	<i>Antimima</i>	<i>compacta</i>	LC	Aizoaceae	<i>Antimima</i>	<i>microphylla</i>	DD
Aizoaceae	<i>Antimima</i>	<i>oviformis</i>	DD	Aizoaceae	<i>Antimima</i>	<i>paripetala</i>	LC
Aizoaceae	<i>Antimima</i>	<i>schlechteri</i>	LC	Aizoaceae	<i>Arenifera</i>	<i>pungens</i>	LC
Aizoaceae	<i>Arenifera</i>	<i>stylosa</i>	LC	Aizoaceae	<i>Cephalophyllum</i>	<i>ebracteatum</i>	LC
Aizoaceae	<i>Cephalophyllum</i>	<i>herrei</i>	VU	Aizoaceae	<i>Cephalophyllum</i>	<i>inaequale</i>	LC
Aizoaceae	<i>Cephalophyllum</i>	<i>regale</i>	LC	Aizoaceae	<i>Cephalophyllum</i>	<i>rigidum</i>	LC
Aizoaceae	<i>Cheiridopsis</i>	<i>denticulata</i>	LC	Aizoaceae	<i>Cheiridopsis</i>	<i>robusta</i>	LC
Aizoaceae	<i>Cleretum</i>	<i>bellidiforme</i>	LC	Aizoaceae	<i>Cleretum</i>	<i>rourkei</i>	LC
Aizoaceae	<i>Conicosia</i>	<i>elongata</i>	LC	Aizoaceae	<i>Conicosia</i>	<i>pugioniformis</i>	LC
Aizoaceae	<i>Conophytum</i>	<i>auriflorum</i>	LC	Aizoaceae	<i>Conophytum</i>	<i>bilobum</i>	NE
Aizoaceae	<i>Conophytum</i>	<i>frutescens</i>	LC	Aizoaceae	<i>Conophytum</i>	<i>hians</i>	LC
Aizoaceae	<i>Conophytum</i>	<i>meyeri</i>	LC	Aizoaceae	<i>Conophytum</i>	<i>pageae</i>	LC
Aizoaceae	<i>Conophytum</i>	<i>saxetanum</i>	LC	Aizoaceae	<i>Conophytum</i>	<i>uviforme</i>	LC
Aizoaceae	<i>Drosanthemum</i>	<i>floribundum</i>	LC	Aizoaceae	<i>Drosanthemum</i>	<i>hispidum</i>	LC
Aizoaceae	<i>Drosanthemum</i>	<i>inornatum</i>	LC	Aizoaceae	<i>Drosanthemum</i>	<i>luederitzii</i>	LC
Aizoaceae	<i>Drosanthemum</i>	<i>oculatum</i>	LC	Aizoaceae	<i>Eberlanzia</i>	<i>cyathiformis</i>	LC
Aizoaceae	<i>Eberlanzia</i>	<i>dichotoma</i>	LC	Aizoaceae	<i>Eberlanzia</i>	<i>gravida</i>	LC
Aizoaceae	<i>Eberlanzia</i>	<i>schneideriana</i>	LC	Aizoaceae	<i>Galenia</i>	<i>collina</i>	LC
Aizoaceae	<i>Galenia</i>	<i>crystallina</i>		Aizoaceae	<i>Galenia</i>	<i>crystallina</i>	LC
Aizoaceae	<i>Galenia</i>	<i>fruticosa</i>	LC	Aizoaceae	<i>Galenia</i>	<i>meziana</i>	LC
Aizoaceae	<i>Galenia</i>	<i>namaensis</i>	LC	Aizoaceae	<i>Galenia</i>	<i>papulosa</i>	LC
Aizoaceae	<i>Galenia</i>	<i>pubescens</i>	LC	Aizoaceae	<i>Galenia</i>	<i>sarcophylla</i>	LC
Aizoaceae	<i>Galenia</i>	<i>secunda</i>	LC	Aizoaceae	<i>Hallianthus</i>	<i>planus</i>	LC
Aizoaceae	<i>Jordaaniella</i>	<i>cuprea</i>	LC	Aizoaceae	<i>Jordaaniella</i>	<i>dubia</i>	LC
Aizoaceae	<i>Jordaaniella</i>	<i>spongiosa</i>	LC	Aizoaceae	<i>Jordaaniella</i>	<i>uniflora</i>	NT
Aizoaceae	<i>Lampranthus</i>	<i>brachyandrus</i>	DD	Aizoaceae	<i>Lampranthus</i>	<i>densipetalus</i>	LC
Aizoaceae	<i>Lampranthus</i>	<i>otzenianus</i>	LC	Aizoaceae	<i>Lampranthus</i>	<i>suavissimus</i>	DD
Aizoaceae	<i>Leipoldtia</i>	<i>alborosea</i>	LC	Aizoaceae	<i>Leipoldtia</i>	<i>calandra</i>	LC
Aizoaceae	<i>Leipoldtia</i>	<i>frutescens</i>	VU	Aizoaceae	<i>Leipoldtia</i>	<i>laxa</i>	LC
Aizoaceae	<i>Leipoldtia</i>	<i>schultzei</i>	LC	Aizoaceae	<i>Leipoldtia</i>	<i>uniflora</i>	LC
Aizoaceae	<i>Malephora</i>	<i>framesii</i>	LC	Aizoaceae	<i>Malephora</i>	<i>purpureo-crocea</i>	LC
Aizoaceae	<i>Mesembryanthemum</i>	<i>amplectens</i>		Aizoaceae	<i>Mesembryanthemum</i>	<i>brevicarpum</i>	
Aizoaceae	<i>Mesembryanthemum</i>	<i>deciduum</i>		Aizoaceae	<i>Mesembryanthemum</i>	<i>dinteri</i>	
Aizoaceae	<i>Mesembryanthemum</i>	<i>hypertrophicum</i>		Aizoaceae	<i>Mesembryanthemum</i>	<i>junceum</i>	
Aizoaceae	<i>Mesembryanthemum</i>	<i>neglectum</i>		Aizoaceae	<i>Mesembryanthemum</i>	<i>neofoliosum</i>	

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Aizoaceae	<i>Mesembryanthemum</i>	<i>oculatum</i>		Aizoaceae	<i>Mesembryanthemum</i>	<i>pellitum</i>	LC
Aizoaceae	<i>Mesembryanthemum</i>	<i>prasinum</i>		Aizoaceae	<i>Mesembryanthemum</i>	<i>quartziticola</i>	
Aizoaceae	<i>Mesembryanthemum</i>	<i>serotinum</i>		Aizoaceae	<i>Mesembryanthemum</i>	<i>sinuosum</i>	
Aizoaceae	<i>Mesembryanthemum</i>	<i>spinuliferum</i>		Aizoaceae	<i>Mesembryanthemum</i>	<i>subnodosum</i>	
Aizoaceae	<i>Mesembryanthemum</i>	<i>trichotomum</i>		Aizoaceae	<i>Meyerophytum</i>	<i>meyeri</i>	LC
Aizoaceae	<i>Mitrophyllum</i>	<i>clivorum</i>	LC	Aizoaceae	<i>Nelia</i>	<i>pillansii</i>	LC
Aizoaceae	<i>Ruschia</i>	<i>breekpoortensis</i>	LC	Aizoaceae	<i>Ruschia</i>	<i>brevibracteata</i>	DD
Aizoaceae	<i>Ruschia</i>	<i>caroli</i>	LC	Aizoaceae	<i>Ruschia</i>	<i>fugitans</i>	DD
Aizoaceae	<i>Ruschia</i>	<i>geminiflora</i>	VU	Aizoaceae	<i>Ruschia</i>	<i>goodiae</i>	LC
Aizoaceae	<i>Ruschia</i>	<i>lerouxiae</i>	LC	Aizoaceae	<i>Ruschia</i>	<i>leucosperma</i>	LC
Aizoaceae	<i>Ruschia</i>	<i>nieuwerustensis</i>	LC	Aizoaceae	<i>Ruschia</i>	<i>subpaniculata</i>	LC
Aizoaceae	<i>Ruschia</i>	<i>versicolor</i>	LC	Aizoaceae	<i>Stoebertia</i>	<i>beetzii</i>	LC
Aizoaceae	<i>Stoebertia</i>	<i>frutescens</i>	LC	Aizoaceae	<i>Stoebertia</i>	<i>utilis</i>	
Aizoaceae	<i>Tetragonia</i>	<i>distorta</i>	DD	Aizoaceae	<i>Tetragonia</i>	<i>echinata</i>	LC
Aizoaceae	<i>Tetragonia</i>	<i>fruticosa</i>	LC	Aizoaceae	<i>Tetragonia</i>	<i>microptera</i>	LC
Aizoaceae	<i>Tetragonia</i>	<i>pillansii</i>	VU	Aizoaceae	<i>Tetragonia</i>	<i>sarcophylla</i>	LC
Aizoaceae	<i>Tetragonia</i>	<i>spicata</i>	LC	Aizoaceae	<i>Tetragonia</i>	<i>verrucosa</i>	LC
Aizoaceae	<i>Tetragonia</i>	<i>virgata</i>	LC	Aizoaceae	<i>Wooleya</i>	<i>farinosa</i>	VU
Amaranthaceae	<i>Atriplex</i>	<i>cinerea</i>	NE	Amaranthaceae	<i>Atriplex</i>	<i>vestita</i>	LC
Amaranthaceae	<i>Hermbstaedtia</i>	<i>glauca</i>	LC	Amaranthaceae	<i>Manochlamys</i>	<i>albicans</i>	LC
Amaranthaceae	<i>Salsola</i>	<i>aphylla</i>	LC	Amaranthaceae	<i>Salsola</i>	<i>sericata</i>	LC
Amaranthaceae	<i>Salsola</i>	<i>zeyheri</i>	LC	Amaranthaceae	<i>Sarcocornia</i>	<i>natalensis</i>	LC
Amaranthaceae	<i>Sarcocornia</i>	<i>pillansii</i>	LC	Amaryllidaceae	<i>Brunsvigia</i>	<i>bosmaniae</i>	LC
Amaryllidaceae	<i>Gethyllis</i>	<i>britteniana</i>		Amaryllidaceae	<i>Gethyllis</i>	<i>britteniana</i>	DD
Amaryllidaceae	<i>Gethyllis</i>	<i>britteniana</i>	LC	Amaryllidaceae	<i>Gethyllis</i>	<i>grandiflora</i>	LC
Amaryllidaceae	<i>Haemanthus</i>	<i>coccineus</i>	LC	Amaryllidaceae	<i>Haemanthus</i>	<i>crispus</i>	LC
Amaryllidaceae	<i>Haemanthus</i>	<i>pubescens</i>	LC	Amaryllidaceae	<i>Haemanthus</i>	<i>unifoliatus</i>	LC
Amaryllidaceae	<i>Hessea</i>	<i>breviflora</i>	LC	Amaryllidaceae	<i>Strumaria</i>	<i>prolifera</i>	LC
Amaryllidaceae	<i>Strumaria</i>	<i>truncata</i>	LC	Anacampserotaceae	<i>Anacampseros</i>	<i>bayeriana</i>	
Anacampserotaceae	<i>Anacampseros</i>	<i>filamentosa</i>		Anacampserotaceae	<i>Anacampseros</i>	<i>lanceolata</i>	
Anacampserotaceae	<i>Avonia</i>	<i>albissima</i>		Anacardiaceae	<i>Searsia</i>	<i>glauca</i>	
Anacardiaceae	<i>Searsia</i>	<i>incisa</i>		Anacardiaceae	<i>Searsia</i>	<i>laevigata</i>	
Anacardiaceae	<i>Searsia</i>	<i>populifolia</i>		Anacardiaceae	<i>Searsia</i>	<i>undulata</i>	
Apiaceae	<i>Capnophyllum</i>	<i>africanum</i>	NT	Apiaceae	<i>Cynorhiza</i>	<i>typica</i>	LC
Apocynaceae	<i>Ceropegia</i>	<i>occidentalis</i>	NT	Apocynaceae	<i>Microloma</i>	<i>namaquense</i>	LC
Apocynaceae	<i>Microloma</i>	<i>sagittatum</i>	LC	Apocynaceae	<i>Microloma</i>	<i>tenuifolium</i>	LC
Apocynaceae	<i>Quaqua</i>	<i>armata</i>	LC	Apocynaceae	<i>Tromotriche</i>	<i>aperta</i>	LC
Asparagaceae	<i>Asparagus</i>	<i>capensis</i>	LC	Asparagaceae	<i>Asparagus</i>	<i>capensis</i>	LC
Asparagaceae	<i>Asparagus</i>	<i>fasciculatus</i>	LC	Asparagaceae	<i>Asparagus</i>	<i>juniperoides</i>	LC
Asphodelaceae	<i>Aloe</i>	<i>arenicola</i>	NT	Asphodelaceae	<i>Aloe</i>	<i>framesii</i>	NT
Asphodelaceae	<i>Bulbine</i>	<i>mesembryanthoides</i>	LC	Asphodelaceae	<i>Bulbine</i>	<i>praemorsa</i>	LC
Asphodelaceae	<i>Bulbinella</i>	<i>divaginata</i>	LC	Asphodelaceae	<i>Bulbinella</i>	<i>gracilis</i>	LC
Asphodelaceae	<i>Gasteria</i>	<i>pillansii</i>	LC	Asphodelaceae	<i>Trachyandra</i>	<i>bulbinifolia</i>	LC
Asphodelaceae	<i>Trachyandra</i>	<i>ciliata</i>	LC	Asphodelaceae	<i>Trachyandra</i>	<i>involucrata</i>	LC

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Asphodelaceae	<i>Trachyandra</i>	<i>paniculata</i>	LC	Asphodelaceae	<i>Trachyandra</i>	<i>patens</i>	LC
Asphodelaceae	<i>Trachyandra</i>	<i>revoluta</i>	LC	Asphodelaceae	<i>Trachyandra</i>	<i>zebrina</i>	LC
Asteraceae	<i>Adenoglossa</i>	<i>decurrens</i>	LC	Asteraceae	<i>Amellus</i>	<i>alternifolius</i>	LC
Asteraceae	<i>Amellus</i>	<i>coilopodius</i>	LC	Asteraceae	<i>Amellus</i>	<i>flosculosus</i>	LC
Asteraceae	<i>Amellus</i>	<i>microglossus</i>	LC	Asteraceae	<i>Amellus</i>	<i>tenuifolius</i>	LC
Asteraceae	<i>Amphiglossa</i>	<i>tomentosa</i>	LC	Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	LC
Asteraceae	<i>Arctotis</i>	<i>auriculata</i>	LC	Asteraceae	<i>Arctotis</i>	<i>decurrens</i>	DD
Asteraceae	<i>Arctotis</i>	<i>diffusa</i>	LC	Asteraceae	<i>Arctotis</i>	<i>fastuosa</i>	LC
Asteraceae	<i>Arctotis</i>	<i>leiocarpa</i>	LC	Asteraceae	<i>Arctotis</i>	<i>revoluta</i>	LC
Asteraceae	<i>Athanasia</i>	<i>flexuosa</i>	LC	Asteraceae	<i>Berkheya</i>	<i>fruticosa</i>	LC
Asteraceae	<i>Bolandia</i>	<i>elongata</i>	LC	Asteraceae	<i>Chrysocoma</i>	<i>longifolia</i>	LC
Asteraceae	<i>Chrysocoma</i>	<i>puberula</i>	LC	Asteraceae	<i>Chrysocoma</i>	<i>schlechteri</i>	LC
Asteraceae	<i>Cotula</i>	<i>barbata</i>	LC	Asteraceae	<i>Cotula</i>	<i>coronopifolia</i>	LC
Asteraceae	<i>Cotula</i>	<i>leptalea</i>	LC	Asteraceae	<i>Crassothonna</i>	<i>cacalioides</i>	LC
Asteraceae	<i>Crassothonna</i>	<i>cylindrica</i>	LC	Asteraceae	<i>Crassothonna</i>	<i>floribunda</i>	LC
Asteraceae	<i>Crassothonna</i>	<i>sedifolia</i>	LC	Asteraceae	<i>Didelta</i>	<i>carnosa</i>	LC
Asteraceae	<i>Dimorphotheca</i>	<i>pluvialis</i>	LC	Asteraceae	<i>Dimorphotheca</i>	<i>polyptera</i>	LC
Asteraceae	<i>Dimorphotheca</i>	<i>sinuata</i>	LC	Asteraceae	<i>Eriocephalus</i>	<i>microphyllus</i>	LC
Asteraceae	<i>Eriocephalus</i>	<i>racemosus</i>	LC	Asteraceae	<i>Eriocephalus</i>	<i>racemosus</i>	LC
Asteraceae	<i>Eriocephalus</i>	<i>scariosus</i>	LC	Asteraceae	<i>Euryops</i>	<i>dregeanus</i>	LC
Asteraceae	<i>Felicia</i>	<i>dregei</i>	LC	Asteraceae	<i>Felicia</i>	<i>dubia</i>	LC
Asteraceae	<i>Felicia</i>	<i>hyssopifolia</i>	LC	Asteraceae	<i>Felicia</i>	<i>merxmulleri</i>	LC
Asteraceae	<i>Felicia</i>	<i>tenella</i>	LC	Asteraceae	<i>Gazania</i>	<i>heterochaeta</i>	LC
Asteraceae	<i>Gazania</i>	<i>leiopoda</i>	LC	Asteraceae	<i>Gazania</i>	<i>rigida</i>	LC
Asteraceae	<i>Gazania</i>	<i>splendidissima</i>	NT	Asteraceae	<i>Gorteria</i>	<i>diffusa</i>	
Asteraceae	<i>Gorteria</i>	<i>diffusa</i>	LC	Asteraceae	<i>Helichrysum</i>	<i>hebelepis</i>	LC
Asteraceae	<i>Helichrysum</i>	<i>leontonyx</i>	LC	Asteraceae	<i>Helichrysum</i>	<i>marmarolepis</i>	NT
Asteraceae	<i>Helichrysum</i>	<i>micropoides</i>	LC	Asteraceae	<i>Helichrysum</i>	<i>pumilio</i>	
Asteraceae	<i>Helichrysum</i>	<i>pumilio</i>	LC	Asteraceae	<i>Hirpicium</i>	<i>echinus</i>	LC
Asteraceae	<i>Kleinia</i>	<i>cephalophora</i>	LC	Asteraceae	<i>Lasiopogon</i>	<i>muscoides</i>	LC
Asteraceae	<i>Lasiospermum</i>	<i>brachyglossum</i>	LC	Asteraceae	<i>Leucoptera</i>	<i>nodosa</i>	VU
Asteraceae	<i>Leysera</i>	<i>gnaphalodes</i>	LC	Asteraceae	<i>Leysera</i>	<i>tenella</i>	LC
Asteraceae	<i>Lopholaena</i>	<i>cneorifolia</i>	LC	Asteraceae	<i>Oncosiphon</i>	<i>grandiflorus</i>	LC
Asteraceae	<i>Oncosiphon</i>	<i>suffruticosus</i>	LC	Asteraceae	<i>Osteospermum</i>	<i>amplectens</i>	LC
Asteraceae	<i>Osteospermum</i>	<i>grandiflorum</i>	LC	Asteraceae	<i>Osteospermum</i>	<i>hyoseroides</i>	LC
Asteraceae	<i>Osteospermum</i>	<i>incanum</i>	LC	Asteraceae	<i>Osteospermum</i>	<i>monstrosum</i>	LC
Asteraceae	<i>Osteospermum</i>	<i>oppositifolium</i>	LC	Asteraceae	<i>Othonna</i>	<i>coronopifolia</i>	LC
Asteraceae	<i>Othonna</i>	<i>perfoliata</i>	LC	Asteraceae	<i>Othonna</i>	<i>retrorsa</i>	LC
Asteraceae	<i>Pegolettia</i>	<i>retrofracta</i>	LC	Asteraceae	<i>Pentatrichia</i>	<i>petrosa</i>	LC
Asteraceae	<i>Pentzia</i>	<i>incana</i>	LC	Asteraceae	<i>Pteronia</i>	<i>ciliata</i>	LC
Asteraceae	<i>Pteronia</i>	<i>divaricata</i>	LC	Asteraceae	<i>Pteronia</i>	<i>glabrata</i>	LC
Asteraceae	<i>Pteronia</i>	<i>glauca</i>	LC	Asteraceae	<i>Pteronia</i>	<i>incana</i>	LC
Asteraceae	<i>Pteronia</i>	<i>onobromoides</i>	LC	Asteraceae	<i>Pteronia</i>	<i>undulata</i>	LC
Asteraceae	<i>Rhynchosidium</i>	<i>pumilum</i>	LC	Asteraceae	<i>Senecio</i>	<i>abbreviatus</i>	LC

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Asteraceae	<i>Senecio</i>	<i>aloides</i>	LC	Asteraceae	<i>Senecio</i>	<i>arenarius</i>	LC
Asteraceae	<i>Senecio</i>	<i>cinerascens</i>	LC	Asteraceae	<i>Senecio</i>	<i>niveus</i>	LC
Asteraceae	<i>Senecio</i>	<i>sarcoides</i>	LC	Asteraceae	<i>Stoebe</i>	<i>nervigera</i>	LC
Asteraceae	<i>Ursinia</i>	<i>cakilefolia</i>	LC	Asteraceae	<i>Ursinia</i>	<i>calenduliflora</i>	LC
Asteraceae	<i>Ursinia</i>	<i>chrysanthemoides</i>	LC	Boraginaceae	<i>Lobostemon</i>	<i>glaucophyllus</i>	LC
Brassicaceae	<i>Heliophila</i>	<i>arenaria</i>	LC	Brassicaceae	<i>Heliophila</i>	<i>juncea</i>	LC
Brassicaceae	<i>Heliophila</i>	<i>lactea</i>	LC	Brassicaceae	<i>Heliophila</i>	<i>seselifolia</i>	NE
Campanulaceae	<i>Wahlenbergia</i>	<i>annularis</i>	LC	Campanulaceae	<i>Wahlenbergia</i>	<i>asparagoides</i>	VU
Campanulaceae	<i>Wahlenbergia</i>	<i>buseriana</i>	DD	Campanulaceae	<i>Wahlenbergia</i>	<i>capensis</i>	LC
Campanulaceae	<i>Wahlenbergia</i>	<i>oxyphylla</i>	LC	Campanulaceae	<i>Wahlenbergia</i>	<i>prostrata</i>	LC
Campanulaceae	<i>Wahlenbergia</i>	<i>thunbergiana</i>	LC	Caryophyllaceae	<i>Dianthus</i>	<i>namaensis</i>	
Caryophyllaceae	<i>Dianthus</i>	<i>namaensis</i>		Caryophyllaceae	<i>Dianthus</i>	<i>namaensis</i>	
Caryophyllaceae	<i>Pollichia</i>	<i>campestris</i>		Caryophyllaceae	<i>Silene</i>	<i>burchellii</i>	
Celastraceae	<i>Gymnosporia</i>	<i>buxifolia</i>	LC	Crassulaceae	<i>Adromischus</i>	<i>alstonii</i>	
Crassulaceae	<i>Adromischus</i>	<i>filicaulis</i>		Crassulaceae	<i>Adromischus</i>	<i>marianiae</i>	
Crassulaceae	<i>Cotyledon</i>	<i>orbiculata</i>	LC	Crassulaceae	<i>Cotyledon</i>	<i>orbiculata</i>	LC
Crassulaceae	<i>Cotyledon</i>	<i>papillaris</i>	LC	Crassulaceae	<i>Crassula</i>	<i>atropurpurea</i>	LC
Crassulaceae	<i>Crassula</i>	<i>barklyi</i>		Crassulaceae	<i>Crassula</i>	<i>campestris</i>	
Crassulaceae	<i>Crassula</i>	<i>cotyledonis</i>		Crassulaceae	<i>Crassula</i>	<i>elegans</i>	
Crassulaceae	<i>Crassula</i>	<i>elegans</i>		Crassulaceae	<i>Crassula</i>	<i>expansa</i>	
Crassulaceae	<i>Crassula</i>	<i>expansa</i>		Crassulaceae	<i>Crassula</i>	<i>lanceolata</i>	
Crassulaceae	<i>Crassula</i>	<i>macowaniana</i>	LC	Crassulaceae	<i>Crassula</i>	<i>muscosa</i>	
Crassulaceae	<i>Crassula</i>	<i>muscosa</i>		Crassulaceae	<i>Crassula</i>	<i>nudicaulis</i>	
Crassulaceae	<i>Crassula</i>	<i>subaphylla</i>		Crassulaceae	<i>Crassula</i>	<i>subaphylla</i>	
Crassulaceae	<i>Crassula</i>	<i>tetragona</i>		Crassulaceae	<i>Crassula</i>	<i>tomentosa</i>	
Crassulaceae	<i>Crassula</i>	<i>whiteheadii</i>	LC	Crassulaceae	<i>Tylecodon</i>	<i>buchholzianus</i>	
Crassulaceae	<i>Tylecodon</i>	<i>buchholzianus</i>		Crassulaceae	<i>Tylecodon</i>	<i>decipiens</i>	
Crassulaceae	<i>Tylecodon</i>	<i>grandiflorus</i>		Crassulaceae	<i>Tylecodon</i>	<i>pearsonii</i>	LC
Crassulaceae	<i>Tylecodon</i>	<i>reticulatus</i>		Crassulaceae	<i>Tylecodon</i>	<i>reticulatus</i>	LC
Crassulaceae	<i>Tylecodon</i>	<i>similis</i>		Cyperaceae	<i>Ficinia</i>	<i>laevis</i>	LC
Ebenaceae	<i>Diospyros</i>	<i>austro-africana</i>		Ebenaceae	<i>Euclea</i>	<i>tomentosa</i>	
Euphorbiaceae	<i>Euphorbia</i>	<i>caput-medusae</i>	LC	Euphorbiaceae	<i>Euphorbia</i>	<i>dregeana</i>	LC
Euphorbiaceae	<i>Euphorbia</i>	<i>hamata</i>	LC	Euphorbiaceae	<i>Euphorbia</i>	<i>mauritanica</i>	LC
Euphorbiaceae	<i>Euphorbia</i>	<i>phylloclada</i>	LC	Euphorbiaceae	<i>Euphorbia</i>	<i>rhombifolia</i>	LC
Euphorbiaceae	<i>Euphorbia</i>	<i>spartaria</i>	LC	Fabaceae	<i>Argyrolobium</i>	<i>velutinum</i>	VU
Fabaceae	<i>Aspalathus</i>	<i>acocksii</i>	LC	Fabaceae	<i>Aspalathus</i>	<i>acuminata</i>	LC
Fabaceae	<i>Aspalathus</i>	<i>petersonii</i>	LC	Fabaceae	<i>Aspalathus</i>	<i>pulicifolia</i>	LC
Fabaceae	<i>Aspalathus</i>	<i>quinquefolia</i>	LC	Fabaceae	<i>Aspalathus</i>	<i>spinescens</i>	LC
Fabaceae	<i>Calobota</i>	<i>angustifolia</i>	LC	Fabaceae	<i>Calobota</i>	<i>halenbergensis</i>	LC
Fabaceae	<i>Calobota</i>	<i>lotononoides</i>	NT	Fabaceae	<i>Crotalaria</i>	<i>excisa</i>	LC
Fabaceae	<i>Cullen</i>	<i>tomentosum</i>	LC	Fabaceae	<i>Faidherbia</i>	<i>albida</i>	LC
Fabaceae	<i>Indigofera</i>	<i>nigromontana</i>	LC	Fabaceae	<i>Lebeckia</i>	<i>ambigua</i>	LC
Fabaceae	<i>Lessertia</i>	<i>diffusa</i>	LC	Fabaceae	<i>Lessertia</i>	<i>falciformis</i>	LC
Fabaceae	<i>Lessertia</i>	<i>frutescens</i>	LC	Fabaceae	<i>Lessertia</i>	<i>globosa</i>	DD

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Fabaceae	<i>Lessertia</i>	<i>incana</i>	LC	Fabaceae	<i>Lotononis</i>	<i>densa</i>	DD
Fabaceae	<i>Lotononis</i>	<i>falcata</i>	LC	Fabaceae	<i>Lotononis</i>	<i>parviflora</i>	LC
Fabaceae	<i>Melolobium</i>	<i>adenodes</i>	LC	Fabaceae	<i>Vachellia</i>	<i>erioloba</i>	LC
Fabaceae	<i>Vachellia</i>	<i>karroo</i>	LC	Fabaceae	<i>Wiborgia</i>	<i>fusca</i>	LC
Fabaceae	<i>Wiborgia</i>	<i>monoptera</i>	LC	Fabaceae	<i>Wiborgia</i>	<i>obcordata</i>	LC
Fabaceae	<i>Wiborgia</i>	<i>sericea</i>	LC	Fabaceae	<i>Wiborgia</i>	<i>tetraptera</i>	LC
Frankeniaceae	<i>Frankenia</i>	<i>pulverulenta</i>	LC	Frankeniaceae	<i>Frankenia</i>	<i>repens</i>	LC
Geraniaceae	<i>Monsonia</i>	<i>ciliata</i>	LC	Geraniaceae	<i>Pelargonium</i>	<i>adriaanii</i>	VU
Geraniaceae	<i>Pelargonium</i>	<i>echinatum</i>	LC	Geraniaceae	<i>Pelargonium</i>	<i>fulgidum</i>	LC
Geraniaceae	<i>Pelargonium</i>	<i>gibbosum</i>	LC	Geraniaceae	<i>Pelargonium</i>	<i>laxum</i>	
Geraniaceae	<i>Pelargonium</i>	<i>longiflorum</i>	LC	Geraniaceae	<i>Pelargonium</i>	<i>pulchellum</i>	LC
Hyacinthaceae	<i>Albuca</i>	<i>leucantha</i>		Hyacinthaceae	<i>Albuca</i>	<i>namaquensis</i>	
Hyacinthaceae	<i>Albuca</i>	<i>unifolia</i>		Hyacinthaceae	<i>Dipcadi</i>	<i>crispum</i>	
Hyacinthaceae	<i>Drimia</i>	<i>nana</i>		Hyacinthaceae	<i>Lachenalia</i>	<i>framesii</i>	
Hyacinthaceae	<i>Lachenalia</i>	<i>krugeri</i>		Hyacinthaceae	<i>Lachenalia</i>	<i>undulata</i>	
Hyacinthaceae	<i>Lachenalia</i>	<i>valeriae</i>		Hyacinthaceae	<i>Lachenalia</i>	<i>xerophila</i>	
Hyacinthaceae	<i>Ornithogalum</i>	<i>pruinatum</i>		Hyacinthaceae	<i>Veltheimia</i>	<i>capensis</i>	LC
Hypoxidaceae	<i>Pauridia</i>	<i>scullyi</i>	LC	Iridaceae	<i>Aristea</i>	<i>dichotoma</i>	LC
Iridaceae	<i>Babiana</i>	<i>curviscapa</i>	LC	Iridaceae	<i>Babiana</i>	<i>hirsuta</i>	NT
Iridaceae	<i>Babiana</i>	<i>lanata</i>	VU	Iridaceae	<i>Babiana</i>	<i>namaquensis</i>	VU
Iridaceae	<i>Babiana</i>	<i>pubescens</i>	LC	Iridaceae	<i>Babiana</i>	<i>striata</i>	LC
Iridaceae	<i>Babiana</i>	<i>tritonoides</i>	VU	Iridaceae	<i>Ferraria</i>	<i>ferrariola</i>	LC
Iridaceae	<i>Ferraria</i>	<i>macrochlamys</i>	LC	Iridaceae	<i>Ferraria</i>	<i>schaeferi</i>	LC
Iridaceae	<i>Ferraria</i>	<i>variabilis</i>	LC	Iridaceae	<i>Gladiolus</i>	<i>scullyi</i>	LC
Iridaceae	<i>Gladiolus</i>	<i>viridiflorus</i>	LC	Iridaceae	<i>Lapeirousia</i>	<i>fabricii</i>	LC
Iridaceae	<i>Lapeirousia</i>	<i>macrospatha</i>	LC	Iridaceae	<i>Lapeirousia</i>	<i>silenoides</i>	LC
Iridaceae	<i>Lapeirousia</i>	<i>spinosa</i>	LC	Iridaceae	<i>Lapeirousia</i>	<i>tenuis</i>	LC
Iridaceae	<i>Moraea</i>	<i>fugax</i>	LC	Iridaceae	<i>Moraea</i>	<i>gawleri</i>	LC
Iridaceae	<i>Moraea</i>	<i>margaretae</i>	LC	Iridaceae	<i>Moraea</i>	<i>miniata</i>	LC
Iridaceae	<i>Moraea</i>	<i>rivulicola</i>	LC	Iridaceae	<i>Moraea</i>	<i>saxicola</i>	LC
Iridaceae	<i>Moraea</i>	<i>schlechteri</i>	LC	Iridaceae	<i>Watsonia</i>	<i>meriana</i>	LC
Juncaceae	<i>Juncus</i>	<i>acutus</i>	LC	Lamiaceae	<i>Ballota</i>	<i>africana</i>	LC
Lamiaceae	<i>Salvia</i>	<i>africana-lutea</i>	LC	Lamiaceae	<i>Salvia</i>	<i>dentata</i>	LC
Lamiaceae	<i>Salvia</i>	<i>lanceolata</i>	LC	Lamiaceae	<i>Stachys</i>	<i>flavescens</i>	LC
Lamiaceae	<i>Stachys</i>	<i>rugosa</i>	LC	Limeaceae	<i>Limeum</i>	<i>africanum</i>	LC
Limeaceae	<i>Limeum</i>	<i>africanum</i>	LC	Limeaceae	<i>Limeum</i>	<i>fenestratum</i>	LC
Lobeliaceae	<i>Monopsis</i>	<i>debilis</i>	NE	Loranthaceae	<i>Tapinanthus</i>	<i>oleifolius</i>	LC
Malvaceae	<i>Hermannia</i>	<i>amoena</i>	LC	Malvaceae	<i>Hermannia</i>	<i>cuneifolia</i>	LC
Malvaceae	<i>Hermannia</i>	<i>disermifolia</i>	LC	Malvaceae	<i>Hermannia</i>	<i>incana</i>	LC
Malvaceae	<i>Hermannia</i>	<i>paucifolia</i>	LC	Malvaceae	<i>Hermannia</i>	<i>pfeilii</i>	LC
Malvaceae	<i>Hermannia</i>	<i>tomentosa</i>	LC	Malvaceae	<i>Hermannia</i>	<i>trifurca</i>	LC
Melianthaceae	<i>Melianthus</i>	<i>elongatus</i>	LC	Molluginaceae	<i>Adenogramma</i>	<i>glomerata</i>	LC
Molluginaceae	<i>Pharnaceum</i>	<i>albans</i>	LC	Molluginaceae	<i>Pharnaceum</i>	<i>confertum</i>	LC
Moraceae	<i>Ficus</i>	<i>ilicina</i>	LC	Neuradaceae	<i>Grielum</i>	<i>grandiflorum</i>	LC

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Neuradaceae	<i>Grielum</i>	<i>humifusum</i>		Neuradaceae	<i>Grielum</i>	<i>humifusum</i>	LC
Neuradaceae	<i>Grielum</i>	<i>sinuatum</i>	LC	Oleaceae	<i>Menodora</i>	<i>juncea</i>	LC
Orchidaceae	<i>Holothrix</i>	<i>grandiflora</i>	DD	Orchidaceae	<i>Satyrium</i>	<i>erectum</i>	LC
Orobanchaceae	<i>Harveya</i>	<i>squamosa</i>	LC	Orobanchaceae	<i>Hyobanche</i>	<i>rubra</i>	LC
Orobanchaceae	<i>Hyobanche</i>	<i>sanguinea</i>	LC	Oxalidaceae	<i>Oxalis</i>	<i>crocea</i>	VU
Oxalidaceae	<i>Oxalis</i>	<i>exserta</i>	LC	Oxalidaceae	<i>Oxalis</i>	<i>flava</i>	
Oxalidaceae	<i>Oxalis</i>	<i>obtusa</i>	LC	Plumbaginaceae	<i>Dyerophytum</i>	<i>africanum</i>	LC
Plumbaginaceae	<i>Limonium</i>	<i>dregeanum</i>	LC	Poaceae	<i>Chaetobromus</i>	<i>involucratus</i>	LC
Poaceae	<i>Chaetobromus</i>	<i>involucratus</i>	LC	Poaceae	<i>Chaetobromus</i>	<i>involucratus</i>	LC
Poaceae	<i>Cladoraphis</i>	<i>cyperoides</i>	LC	Poaceae	<i>Cladoraphis</i>	<i>spinosa</i>	LC
Poaceae	<i>Ehrharta</i>	<i>barbinodis</i>	LC	Poaceae	<i>Ehrharta</i>	<i>brevifolia</i>	LC
Poaceae	<i>Ehrharta</i>	<i>calycina</i>	LC	Poaceae	<i>Ehrharta</i>	<i>delicatula</i>	LC
Poaceae	<i>Ehrharta</i>	<i>longiflora</i>	LC	Poaceae	<i>Ehrharta</i>	<i>longifolia</i>	LC
Poaceae	<i>Ehrharta</i>	<i>pusilla</i>	LC	Poaceae	<i>Eragrostis</i>	<i>curvula</i>	LC
Poaceae	<i>Fingerhuthia</i>	<i>africana</i>	LC	Poaceae	<i>Pentameris</i>	<i>patula</i>	LC
Poaceae	<i>Pentameris</i>	<i>tomentella</i>	LC	Poaceae	<i>Phragmites</i>	<i>australis</i>	LC
Poaceae	<i>Schismus</i>	<i>barbatus</i>	LC	Poaceae	<i>Schismus</i>	<i>schismoides</i>	LC
Poaceae	<i>Schmidtia</i>	<i>kalahariensis</i>	LC	Poaceae	<i>Sporobolus</i>	<i>ioclados</i>	LC
Poaceae	<i>Sporobolus</i>	<i>virginicus</i>	LC	Poaceae	<i>Stipagrostis</i>	<i>ciliata</i>	LC
Poaceae	<i>Stipagrostis</i>	<i>geminifolia</i>	NT	Poaceae	<i>Stipagrostis</i>	<i>obtusa</i>	LC
Poaceae	<i>Stipagrostis</i>	<i>zeyheri</i>	LC	Poaceae	<i>Tribolium</i>	<i>utriculosum</i>	LC
Poaceae	<i>Tricholaena</i>	<i>capensis</i>	LC	Polygalaceae	<i>Polygala</i>	<i>ephedroides</i>	LC
Polygalaceae	<i>Polygala</i>	<i>scabra</i>	LC	Polygonaceae	<i>Emex</i>	<i>australis</i>	LC
Proteaceae	<i>Leucadendron</i>	<i>brunioides</i>		Proteaceae	<i>Leucospermum</i>	<i>praemorsum</i>	VU
Ptychomitriaceae	<i>Ptychomitrium</i>	<i>crispatum</i>		Restionaceae	<i>Thamnochortus</i>	<i>bachmannii</i>	LC
Restionaceae	<i>Willdenowia</i>	<i>incurvata</i>	LC	Rubiaceae	<i>Galium</i>	<i>spurium-aparine</i>	NE
Rubiaceae	<i>Nenax</i>	<i>arenicola</i>	LC	Ruscaceae	<i>Eriospermum</i>	<i>aphyllum</i>	LC
Rutaceae	<i>Diosma</i>	<i>acmaeophylla</i>	LC	Santalaceae	<i>Lacomucinaea</i>	<i>lineata</i>	
Santalaceae	<i>Thesium</i>	<i>microcarpum</i>	DD	Santalaceae	<i>Viscum</i>	<i>capense</i>	
Sapindaceae	<i>Dodonaea</i>	<i>viscosa</i>		Scrophulariaceae	<i>Diascia</i>	<i>batteniana</i>	LC
Scrophulariaceae	<i>Diascia</i>	<i>namaquensis</i>	LC	Scrophulariaceae	<i>Hebenstretia</i>	<i>namaquensis</i>	LC
Scrophulariaceae	<i>Hebenstretia</i>	<i>repens</i>	LC	Scrophulariaceae	<i>Hebenstretia</i>	<i>robusta</i>	LC
Scrophulariaceae	<i>Jamesbrittenia</i>	<i>fruticosa</i>	LC	Scrophulariaceae	<i>Jamesbrittenia</i>	<i>merxmulleri</i>	LC
Scrophulariaceae	<i>Jamesbrittenia</i>	<i>racemosa</i>	LC	Scrophulariaceae	<i>Lyperia</i>	<i>tristis</i>	LC
Scrophulariaceae	<i>Manulea</i>	<i>androsacea</i>	LC	Scrophulariaceae	<i>Manulea</i>	<i>nervosa</i>	LC
Scrophulariaceae	<i>Nemesia</i>	<i>bicornis</i>	LC	Scrophulariaceae	<i>Nemesia</i>	<i>lanceolata</i>	LC
Scrophulariaceae	<i>Nemesia</i>	<i>saccata</i>	VU	Scrophulariaceae	<i>Peliostomum</i>	<i>virgatum</i>	LC
Scrophulariaceae	<i>Phyllopodium</i>	<i>pumilum</i>	LC	Scrophulariaceae	<i>Zaluzianskyia</i>	<i>affinis</i>	LC
Scrophulariaceae	<i>Zaluzianskyia</i>	<i>benthamiana</i>	LC	Solanaceae	<i>Lycium</i>	<i>amoenum</i>	LC
Solanaceae	<i>Lycium</i>	<i>cinereum</i>	LC	Tecophilaeaceae	<i>Cyanella</i>	<i>hyacinthoides</i>	
Tecophilaeaceae	<i>Cyanella</i>	<i>orchidiformis</i>		Thymelaeaceae	<i>Passerina</i>	<i>truncata</i>	LC
Urticaceae	<i>Forsskaolea</i>	<i>candida</i>		Zygophyllaceae	<i>Roepera</i>	<i>cordifolia</i>	
Zygophyllaceae	<i>Roepera</i>	<i>morgsana</i>		Zygophyllaceae	<i>Roepera</i>	<i>spinosa</i>	
Zygophyllaceae	<i>Sisyndite</i>	<i>spartea</i>	LC				

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Amaranthaceae	<i>Atriplex</i>	<i>eardeleyae</i>		Boraginaceae	<i>Amsinckia</i>	<i>menziesii</i>	
Caryophyllaceae	<i>Spergularia</i>	<i>media</i>		Amaranthaceae	<i>Atriplex</i>	<i>cinerea</i>	
Fabaceae	<i>Medicago</i>	<i>laciniata</i>	NE	Geraniaceae	<i>Erodium</i>	<i>cicutarium</i>	
Poaceae	<i>Phalaris</i>	<i>minor</i>	NE	Poaceae	<i>Hordeum</i>	<i>murinum</i>	NE
Amaranthaceae	<i>Atriplex</i>	<i>lindleyi</i>		Amaranthaceae	<i>Atriplex</i>	<i>semibaccata</i>	
Geraniaceae	<i>Erodium</i>	<i>moschatum</i>		Brassicaceae	<i>Brassica</i>	<i>tournefortii</i>	

9 APPENDIX 2 LIST OF MAMMALS

List of Mammals know from the broad area around the Zonnequa site, based on the MammalMap Database (<http://vmus.adu.org.za>) as well as observations in the area.

Species on bold are those that can be confirmed present in the area.

Family	Genus	Species	Common name	Red list category
<i>Bathyergidae</i>	<i>Bathyergus</i>	<i>janetta</i>	Namaqua Dune Mole-rat	Least Concern
<i>Bathyergidae</i>	<i>Bathyergus</i>	<i>suillus</i>	Cape Dune Mole-rat	Least Concern
<i>Bathyergidae</i>	<i>Cryptomys</i>	<i>hottentotus</i>	Southern African Mole-rat	Least Concern
<i>Bovidae</i>	<i>Antidorcas</i>	<i>marsupialis</i>	Springbok	Least Concern
<i>Bovidae</i>	<i>Oreotragus</i>	<i>oreotragus</i>	Klipspringer	Least Concern
<i>Bovidae</i>	<i>Raphicerus</i>	<i>campestris</i>	Steenbok	Least Concern
<i>Bovidae</i>	<i>Sylvicapra</i>	<i>grimmia</i>	Bush Duiker	Least Concern
<i>Canidae</i>	<i>Canis</i>	<i>mesomelas</i>	Black-backed Jackal	Least Concern
<i>Canidae</i>	<i>Otocyon</i>	<i>megalotis</i>	Bat-eared Fox	Least Concern
<i>Canidae</i>	<i>Vulpes</i>	<i>chama</i>	Cape Fox	Least Concern
<i>Cercopithecidae</i>	<i>Papio</i>	<i>ursinus</i>	Chacma Baboon	Least Concern
<i>Felidae</i>	<i>Caracal</i>	<i>caracal</i>	Caracal	Least Concern
<i>Felidae</i>	<i>Felis</i>	<i>silvestris</i>	African Wildcat	Least Concern
<i>Felidae</i>	<i>Panthera</i>	<i>pardus</i>	Leopard	Vulnerable
<i>Herpestidae</i>	<i>Cynictis</i>	<i>penicillata</i>	Yellow Mongoose	Least Concern
<i>Herpestidae</i>	<i>Herpestes</i>	<i>pulverulentus</i>	Cape Gray Mongoose	Least Concern
<i>Herpestidae</i>	<i>Suricata</i>	<i>suricatta</i>	Meerkat	Least Concern
<i>Hyaenidae</i>	<i>Proteles</i>	<i>cristata</i>	Aardwolf	Least Concern
<i>Hystricidae</i>	<i>Hystrix</i>	<i>africaeaustralis</i>	Cape Porcupine	Least Concern
<i>Leporidae</i>	<i>Lepus</i>	<i>capensis</i>	Cape Hare	Least Concern
<i>Leporidae</i>	<i>Lepus</i>	<i>saxatilis</i>	Scrub Hare	Least Concern
<i>Leporidae</i>	<i>Pronolagus</i>	<i>rupestris</i>	Smith's Red Rock Hare	Least Concern
<i>Macroscelididae</i>	<i>Elephantulus</i>	<i>rupestris</i>	Western Rock Elephant Shrew	Least Concern
<i>Macroscelididae</i>	<i>Macroscelides</i>	<i>proboscideus</i>	Short-eared Elephant Shrew	Least Concern
<i>Muridae</i>	<i>Aethomys</i>	<i>namaquensis</i>	Namaqua Rock Mouse	Least Concern
<i>Muridae</i>	<i>Desmodillus</i>	<i>auricularis</i>	Cape Short-tailed Gerbil	Least Concern
<i>Muridae</i>	<i>Gerbilliscus</i>	<i>paeba</i>	Paeba Hairy-footed Gerbil	Least Concern
<i>Muridae</i>	<i>Otomys</i>	<i>auratus</i>	Southern African Vlei Rat	Least Concern
<i>Muridae</i>	<i>Otomys</i>	<i>unisulcatus</i>	Karoo Bush Rat	Least Concern

Muridae	Parotomys	brantsii	Brants's Whistling Rat	Least Concern
<i>Muridae</i>	<i>Parotomys</i>	<i>littledalei</i>	Littledale's Whistling Rat	Near Threatened
Muridae	Rhabdomys	pumilio	Xeric Four-striped Grass Rat	Least Concern
<i>Mustelidae</i>	<i>Aonyx</i>	<i>capensis</i>	African Clawless Otter	Near Threatened
Mustelidae	Ictonyx	striatus	Striped Polecat	Least Concern
Mustelidae	Mellivora	capensis	Honey Badger	Least Concern
Orycteropodidae	Orycteropus	afer	Aardvark	Least Concern
<i>Petromuridae</i>	<i>Petromus</i>	<i>typicus</i>	Dassie Rat	Least Concern
Procaviidae	Procavia	capensis	Rock Hyrax	Least Concern
Sciuridae	Xerus	inauris	South African Ground Squirrel	Least Concern
<i>Soricidae</i>	<i>Crocidura</i>	<i>cyanea</i>	Reddish-gray Musk Shrew	Least Concern
Soricidae	Suncus	varilla	Lesser Dwarf Shrew	Least Concern
Viverridae	Genetta	genetta	Common Genet	Least Concern

10 APPENDIX 3. LIST OF REPTILES

List of Reptiles known from the vicinity of the Zonnequa site, based on records from the ReptileMap database and observations from the area. Conservation status is from Bates et al. 2013. Species in bold are confirmed present in the area.

Family	Genus	Species	Subspecies	Common name	Red list category
Agamidae	Agama	atra		Southern Rock Agama	Least Concern
Agamidae	Agama	hispidia		Spiny Ground Agama	Least Concern
Chamaeleonidae	Bradypodion	occidentale		Western Dwarf Chameleon	Least Concern
Chamaeleonidae	Chamaeleo	namaquensis		Namaqua Chameleon	Least Concern
Colubridae	Dipsina	multimaculata		Dwarf Beaked Snake	Least Concern
Colubridae	Telescopus	beetzii		Beetz's Tiger Snake	Least Concern
Cordylidae	Karusasaurus	polyzonus		Karoo Girdled Lizard	Least Concern
Elapidae	Aspidelaps	lubricus	lubricus	Coral Shield Cobra	Not listed
Elapidae	Naja	nivea		Cape Cobra	Least Concern
Gekkonidae	Chondrodactylus	angulifer	angulifer	Common Giant Ground Gecko	Least Concern
Gekkonidae	Chondrodactylus	bibronii		Bibron's Gecko	Least Concern
Gekkonidae	Goggia	lineata		Northern Striped Pygmy Gecko	Least Concern
Gekkonidae	Pachydactylus	austeni		Austen's Gecko	Least Concern
Gekkonidae	Pachydactylus	barnardi		Barnard's Rough Gecko	Least Concern
Gekkonidae	Pachydactylus	labialis		Western Cape Gecko	Least Concern
Gekkonidae	Pachydactylus	weberi		Weber's Gecko	Least Concern
Gekkonidae	Phelsuma	ocellata		Namaqua Day Gecko	Least Concern
Gekkonidae	Ptenopus	garrulus	maculatus	Spotted Barking Gecko	Least Concern
Gerrhosauridae	Cordylosaurus	subtessellatus		Dwarf Plated Lizard	Least Concern
Gerrhosauridae	Gerrhosaurus	typicus		Karoo Plated Lizard	Least Concern
Lacertidae	Meroles	ctenodactylus		Giant Desert Lizard	Least Concern
Lacertidae	Meroles	knoxii		Knox's Desert Lizard	Least Concern
Lacertidae	Meroles	suborbitalis		Spotted Desert Lizard	Least Concern
Lacertidae	Nucras	tessellata		Western Sandveld Lizard	Least Concern
Lamprophiidae	Lamprophis	guttatus		Spotted House Snake	Least Concern

<i>Lamprophiidae</i>	<i>Prosymna</i>	<i>frontalis</i>		Southwestern Shovel-snout	Least Concern
<i>Lamprophiidae</i>	<i>Psammophis</i>	<i>crucifer</i>		Cross-marked Grass Snake	Least Concern
<i>Lamprophiidae</i>	<i>Psammophis</i>	<i>namibensis</i>		Namib Sand Snake	Least Concern
<i>Lamprophiidae</i>	<i>Psammophis</i>	<i>notostictus</i>		Karoo Sand Snake	Least Concern
<i>Lamprophiidae</i>	<i>Psammophylax</i>	<i>rhombeatus</i>	<i>rhombeatus</i>	Spotted Grass Snake	Least Concern
<i>Lamprophiidae</i>	<i>Pseudaspis</i>	<i>cana</i>		Mole Snake	Least Concern
<i>Scincidae</i>	<i>Acontias</i>	<i>litoralis</i>		Coastal Dwarf Legless Skink	Least Concern
Scincidae	Acontias	tristis		Namaqua Dwarf Legless Skink	Least Concern
<i>Scincidae</i>	<i>Scelotes</i>	<i>caffer</i>		Cape Dwarf Burrowing Skink	Least Concern
<i>Scincidae</i>	<i>Scelotes</i>	<i>sexlineatus</i>		Striped Dwarf Burrowing Skink	Least Concern
Scincidae	Trachylepis	capensis		Cape Skink	Least Concern
<i>Scincidae</i>	<i>Trachylepis</i>	<i>variegata</i>		Variegated Skink	Least Concern
<i>Scincidae</i>	<i>Typhlosaurus</i>	<i>vermis</i>		Pink Blind Legless Skink	Least Concern
Testudinidae	Chersina	angulata		Angulate Tortoise	Least Concern
<i>Testudinidae</i>	<i>Psammobates</i>	<i>tentorius</i>	<i>trimeni</i>	Namaqua Tent Tortoise	Not listed
Viperidae	Bitis	cornuta		Many-horned Adder	Least Concern
<i>Viperidae</i>	<i>Bitis</i>	<i>arietans</i>	<i>arietans</i>	Puff Adder	Least Concern

11 APPENDIX 4. LIST OF AMPHIBIANS

List of Amphibians known from the vicinity of the Zonnequa site, based on records from the FrogMap database and observations from the area. Conservation status is from Minter et al. 2004.

Family	Genus	Species	Subspecies	Common name	Red list category
<i>Brevicipitidae</i>	<i>Breviceps</i>	<i>macrops</i>		Desert Rain Frog	Vulnerable
<i>Brevicipitidae</i>	<i>Breviceps</i>	<i>namaquensis</i>		Namaqua Rain Frog	Least Concern
<i>Bufo</i>	<i>Vandijkophrynus</i>	<i>gariensis</i>	<i>gariensis</i>	Karoo Toad (subsp. <i>gariensis</i>)	Not listed
<i>Bufo</i>	<i>Vandijkophrynus</i>	<i>robinsoni</i>		Paradise Toad	Least Concern
<i>Pipidae</i>	<i>Xenopus</i>	<i>laevis</i>		Common Platanna	Least Concern
<i>Pyxicephalidae</i>	<i>Amietia</i>	<i>fuscigula</i>		Cape River Frog	Least Concern
<i>Pyxicephalidae</i>	<i>Tomopterna</i>	<i>delalandii</i>		Cape Sand Frog	Least Concern