ACCESS ROAD FOR THE DWARSRUG WEF LOCATED NEAR TO LOERIESFONTEIN IN THE NORTHERN CAPE:

FAUNA & FLORA SPECIALIST BASIC ASSESSMENT REPORT

PRODUCED FOR SAVANNAH ENVIRONMENTAL

ON BEHALF OF SOUTH AFRICAN MAINSTREAM RENEWABLE POWER (PTY) LTD

3Foxes Biodiversity Solutions

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November 2018

CONTENTS

NEMA 2014 CHECKLIST

Section		*NEMA 2014 Regulations 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	5-6	✓
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	5-6	✓
	(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	✓
	(d)	a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 2	✓
	(e)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.4	✓
	(f)	a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;	Section 3	✓
	(g)	recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;	Section 4	✓
	(h)	a description of any consultation process that was undertaken during the course of carrying out the specialist report;	See main EIA report	✓
	(i)	a summary and copies of any comments that were received during any consultation process; and	See main EIA report	✓
	(j)	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

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 in the vicinity of the site include the following:

- Kokerboom Wind Farms & Grid Connection. Fauna & Flora EIA Process. Aurecon 2017.
- Leeuwberg Wind Farms. Fauna and Flora EIA Process. SiVEST 2017
- Mainstream South Africa Dwarsrug Wind Energy Facility: Fauna & Flora Specialist Impact Assessment Report. SiVEST 2014.
- Basic Assessment Process for the Proposed Construction of the Transnet 15km 50 kV Power Line from Eskom Helios Substation to the proposed new Transnet Helios Traction Feeder Substation. Nsovo Environmental Consulting. 2014.
- Loeriesfontein Wind Energy Facility – Substation & Grid Connection. Fauna & Flora Specialist Report for Basic Assessment. Specialist Report for Savannah Environmental. 2012.
- Proposed Re-Alignment of the Authorised Power Line for The Loeriesfontein 2 Wind Energy Facility.: Fauna & Flora Specialist Report for Basic Assessment. Savannah Environmental 2014.

- Mainstream Loeriesfontein 2 Wind Energy Facility: Fauna and Flora Preconstruction Walk-Through Report. Savannah Environmental 2014.
- Mainstream Khobab Wind Energy Facility: Fauna and Flora Preconstruction Walk-Through Report. Savannah Environmental 2014.

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 November 2018_____

1 INTRODUCTION

The applicant, South African Mainstream Renewable Power Developments (Pty) Ltd, is proposing the development of an access road for the authorised Dwarsrug Wind Energy Facility (WEF) ~60km north of Loeriesfontein, in the Northern Cape Province. The proposed access road will fall within the jurisdiction of the Hantam Local Municipality and within the greater Namakwa District Municipality. Two alternative access road alternatives are being considered and are assessed. Savannah Environmental has appointed Simon Todd Consulting to provide a specialist terrestrial biodiversity impact assessment of the proposed grid connection routes as part of the required Basic Assessment (BA) process.

As part of the above BA process, this ecological specialist study details the ecological characteristics of the road alternatives and provides an assessment of the likely ecological impacts associated with the development of the proposed access road. Impacts are assessed for the pre-construction, construction, operation, and decommissioning phases of the development. 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 EMPr for the development. The full scope of study is detailed in Section 1.1 below.

1.1 SCOPE OF STUDY

The scope of 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 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 Environmental Management Programme (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 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 during 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:
    - Pre-construction
    - Construction
    - Operational
    - Decommissioning

1.2 ASSESSMENT APPROACH & PHILOSOPHY

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.

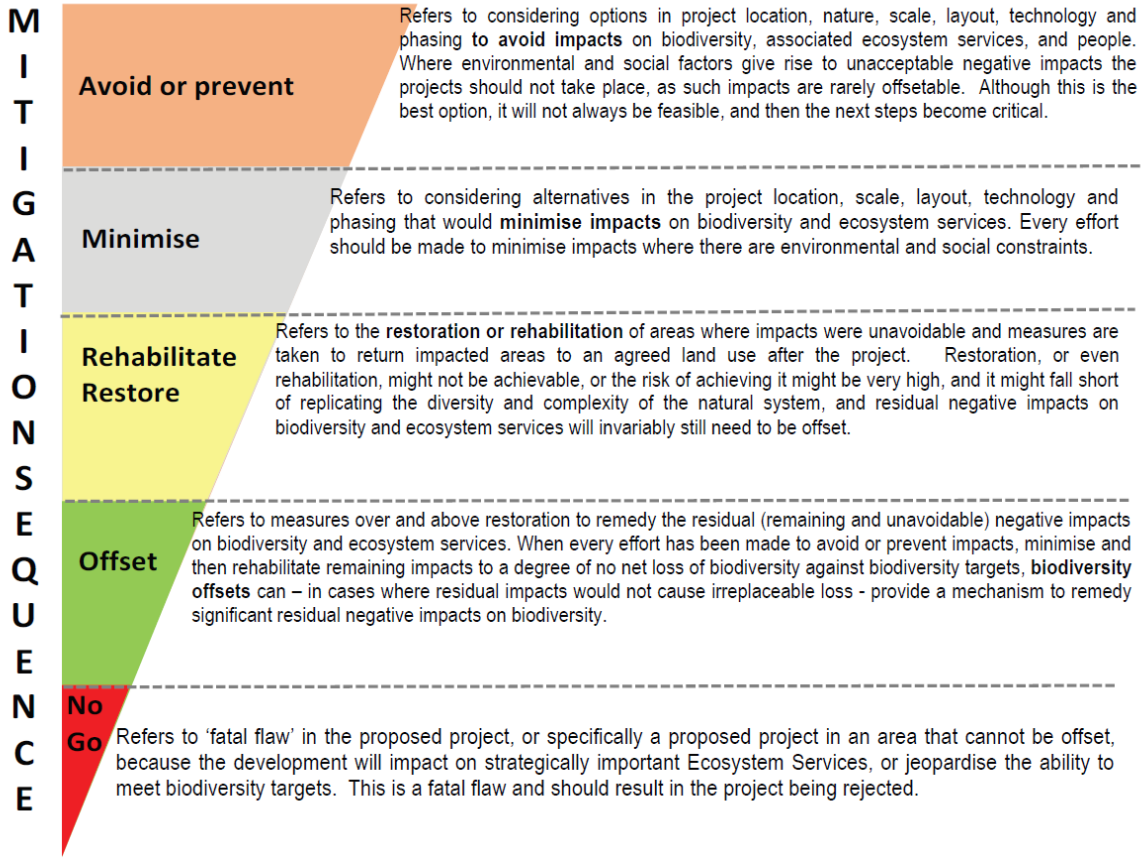

Figure 1. The mitigation hierarchy that is used to guide the study in terms of the priority of different mitigation and avoidance strategies.

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

The applicant is proposing two alternative access roads which will be assessed, including:

- Alternative 1 - Gravel road from Granaatboskolk to the project site (approx. 11.26km); and
- Alternative 2 - Gravel road from Granaatboskolk to the project site (approx. 8.20km).

The two road options are illustrated below in Figure 2.

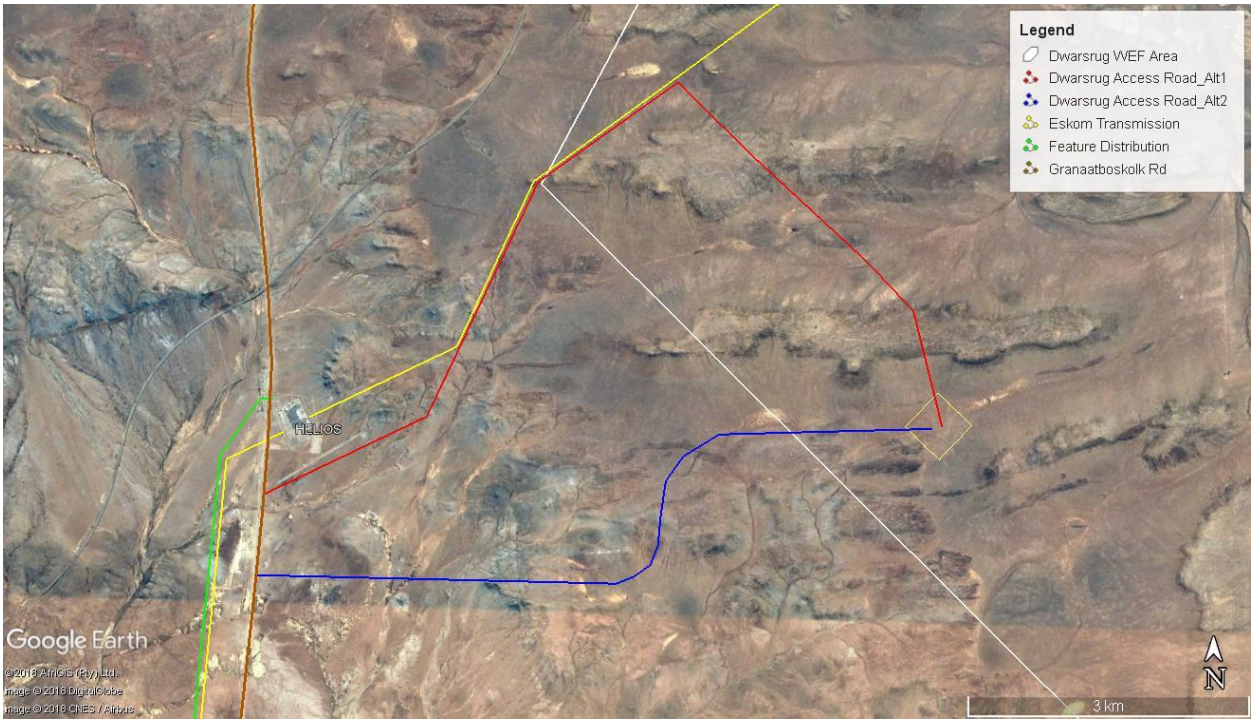

Figure 2. The two access road alternatives from the Dwarsrug WEF to the Granaatboskolk Road in the west.

1.4 LIMITATIONS & ASSUMPTIONS

The current study consisted of two site visits as well as a desktop study, which serves to significantly reduce the limitations and assumptions required for the study. The Dwarsrug site was visited as part of the original WEF study in October 2014, with a follow-up site visit on 26 October 2018 to check the access roads and verify the features present. The immediate area has also been sampled numerous times as part of various specialist studies for the different wind farms in the area including the adjacent Khobab and Loeriesfontein wind farms as well as the authorised Kokerboom and Leeuwberg series of wind farms. In terms of the existing baseline data for the area, the site is typical of many remote areas in the Northern Cape which have not been well-sampled historically with the result that the species lists derived for the area do not always adequately reflect the actual fauna and flora present at the site. This is acknowledged as

a potential limitation of the study, however it is substantially reduced by the numerous site visits that have been conducted in the area, which have taken place across several years and multiple seasons, with the result that a good baseline for the area has been developed over time. In order to further reduce this limitation, and ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study site.

2 METHODOLOGY

2.1 DATA SOURCING AND REVIEW

Data sources from the literature were consulted and used where necessary in the study including 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 VISIT

The original site visit took place in October 2014 with a follow-up site visit on 26 October 2018. During the site visits, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. A preliminary habitat map for the wind farm site had been produced prior to the site visit and this was validated in the field and modified where necessary. The habitat map also served to guide the site visit and ensure that all the different habitats visible on the satellite imagery of the site were sampled in the field and that representative samples of all the affected areas were included. Walk-through-surveys were conducted within representative areas across the different habitats units identified and all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such species. Within the context of the site, there was no perennial water present and no areas where amphibians were active at the time of the site visit. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site or included on the draft habitat map produced for the site. The follow-up site visit in October 2018 was used to verify the new access routes, when selected sections of the routes from the wind farm boundary to the Granaatboskolk Road were walked and checked in the field.

2.3 SENSITIVITY MAPPING & ASSESSMENT

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases as described above. Sensitive features such as wetlands, drainage lines and water bodies were mapped and buffered where appropriate to comply with legislative

requirements or ecological considerations. Additional sensitive areas were then identified based on the results of the site visit and delineated. Features that were specifically captured in the sensitivity map include drainage features, wetlands and dams, as well as rocky outcrops and steep slopes. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **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 impact 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. These areas are not no-go areas, however development within these areas is considered to be undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High** – 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.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

3.1 BROAD-SCALE VEGETATION PATTERNS

The national vegetation map (Mucina & Rutherford 2006) for the study area is depicted below in Figure 2. The entire site falls within the Bushmanland Basin Shrubland vegetation type. With an extent of 34 690 km^2 this is one of the most extensive vegetation types in South Africa. Bushmanland Basin Shrubland occurs on the extensive basin centred on Brandvlei and Van Wyksvlei, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt in the north to around Williston in the south. The area is characterised by slightly irregular plains dominated by a dwarf shrubland, with succulent shrubs or perennial grasses in places. The geology consists largely of mudstones and shales of the Ecca group and Dwyka tillites with occasional dolerite intrusions. Soils are largely shallow to non-existent, with calcrete present in most areas. Rainfall ranges from 100-200 mm and falls mostly during the summer months as thunder storms. As a result of the arid nature of the area, very little of this vegetation type has been affected by intensive agriculture and it is classified as Least Threatened. There are few

endemic and biogeographically important species present at the site and only *Tridentea dwequensis* is listed by Mucina and Rutherford as biogeographically important while *Cromidon minimum*, *Ornithogalum bicornutum* and *O.ovatum* subsp *oliverorum* are listed as being endemic to the vegetation type.

Other vegetation types which occur in the wider area include Hantam Karoo and Western Bushmanland Klipveld. However, neither of these vegetation types fall within the site and would not be affected by the grid connection. There are also some small pans in the area which fall within the Bushmanland Vloere vegetation type.

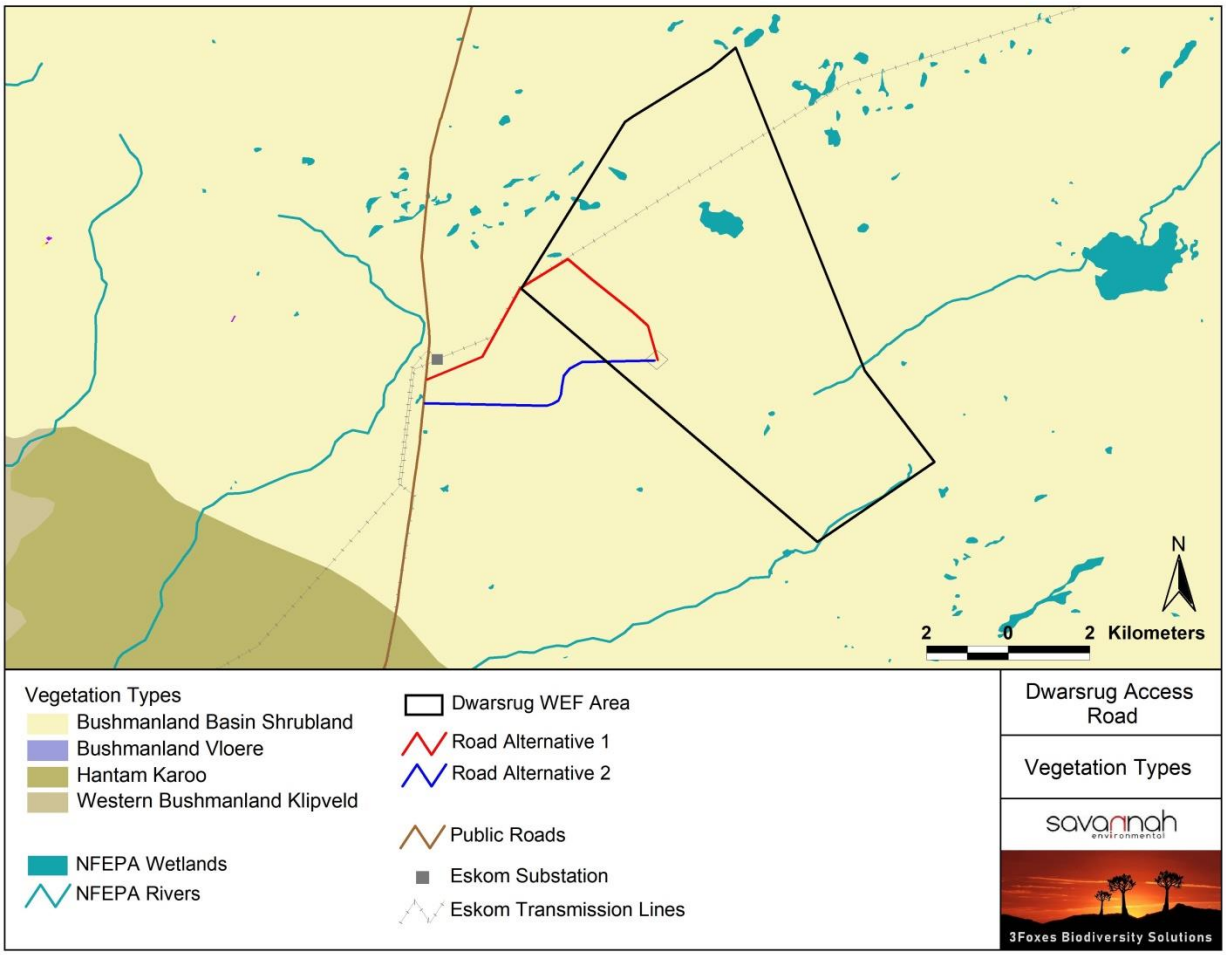

Figure 2. The national vegetation map (Mucina & Rutherford 2006/2012) for the Dwarsrug access road alternatives. Rivers and wetlands (pans) delineated by the National Freshwater Ecosystem Priority Areas Assessment (Nel et al. 2011) are also depicted.

3.2 FINE-SCALE VEGETATION PATTERNS

The site consists of flat to gently undulating open plains dominated by low shrubs or arid tussock grasses. It is typical of southwestern Bushmanland and does not contain any remarkable ecological features. The only notable features present are some low gravelly hills and some poorly developed drainage lines. There are also some small pans in the area, but these are not in proximity to the road routes. The vegetation of the site is very homogenous and shifts from shrub-dominated vegetation on gravelly soils to tussock-grass-dominated areas on sandy soils, with large areas also transitional between these extremes. The current road footprint areas are restricted to the Bushmanland Basin Shrubland habitat type with occasional drainage lines. These two habitats are described below.

Bushmanland Basin Shrubland

The majority of the site consists of low open shrubland on shallow, stony soils, typical of the Bushmanland Basin Shrubland vegetation type. Typical species include the shrubs *Pentzia incana*, *Zygophyllum lichtensteinianum*, *Asparagus capensis*, *Zygophyllum retrofractum*, *Eriocephalus spinescens*, *Aptosimum spinescens*, *Tripteris sinuata*, *Hermannia spinosa*, *Thesium lineatum*, *Felicia clavipilosa*, *Osteospermum armatum*, *Pegolettia retrofracta*, *Pteronia mucronata*, *Pteronia sordida*, *Rosenia humilis*, *Galenia fruticosa*, *Lycium pumilum* and *Salsola tuberculata*; succulent shrubs such as *Aridaria noctiflora*, *Ruschia intricata*, *Brownanthus ciliatus*, *Drosanthemum lique*, *Psilocaulon coriarium* and *Sarcocaulon patersonii* forbs such as *Aptosimum indivisum*, *Hypertelis salsoloides*, *Gazania lichtensteinii*, *Galenia sarcophylla* and *Fockea sinuata*; geophytes including *Drimia intricata* and *Moraea miniata*. Overall diversity within this vegetation type at the site is low, which can be ascribed to the aridity of the area and the poorly developed soils. Areas of higher diversity include exposed calcrete soils which contain specialist species such as *Titanopsis calcarea*, while there are also some low shale-derived hills present which have species such as *Aloinopsis luckhoffii*, *Cephalophyllum fulleri* which is listed as Rare and protected species such as *Aloe falcata*, *Aloe claviflora* and *Hoodia gordonii*.

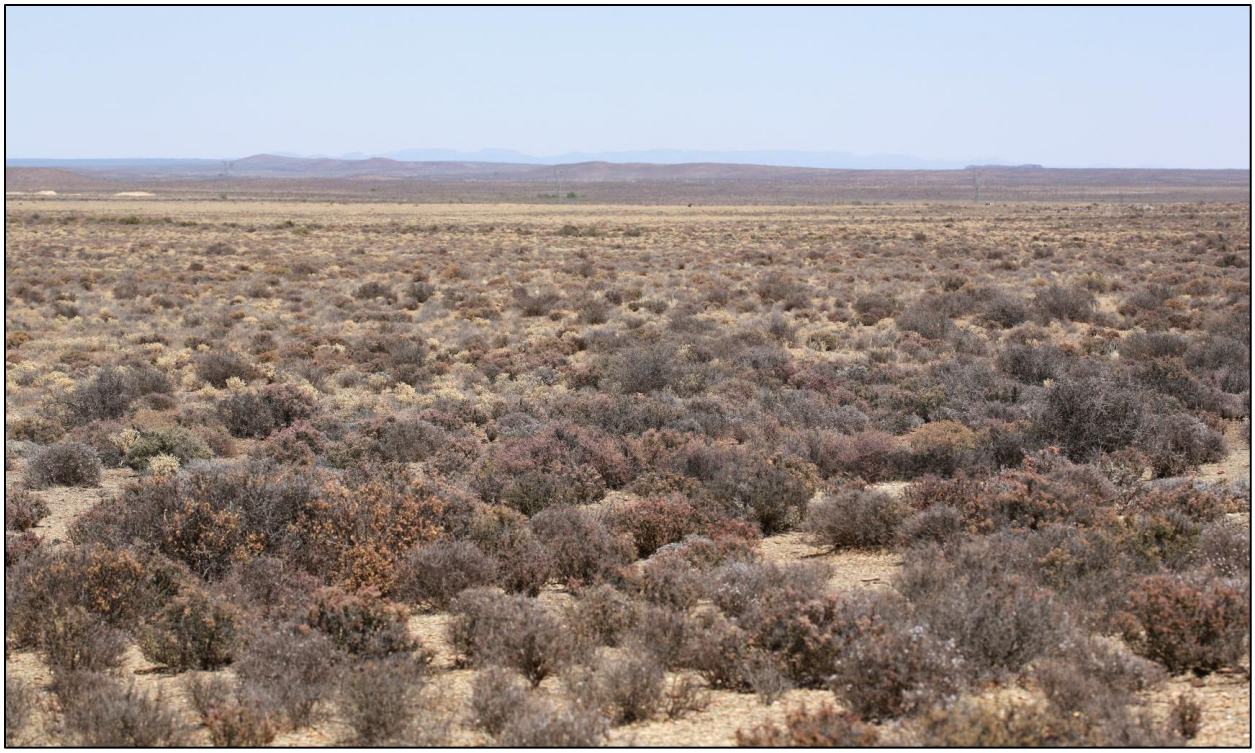

Figure 4. Typical low shrubland along Alternative 1, with woody vegetation in the foreground and the paler vegetation in the distance is dominated by *Brownanthus ciliatus*.

Figure 5. Looking over the plains near the substation and control buildings, where the access road would terminate within the Dwarsrug site.

Figure 6. Looking along the alignment of the central section of access road Alternative 2, showing the typical open shrubland of the area, with occasional Prosopis trees along a small drainage system in the distance.

Washes & Drainage Lines

The drainage lines of the site (**Error! Reference source not found.**) are not very well developed and do not have a tall woody component. Typical and dominant species include *Stipagrostis namaquensis*, *Stipagrostis obtusa*, *Osteospermum armatum*, *Arctotis fastuosa*, *Deverra denudata*, *Melianthus comosus*, *Salvia disermas*, *Lycium pumilum*, *Lycium oxycarpum*, *Galenia sarcophylla*, *Salsola aphylla* and *Sesamum capense*. Although the drainage lines are not well developed, which can be ascribed to aridity of the area, they are ecologically important because the higher cover and productivity of these areas is important for fauna forage and habitat availability and they also play an important hydrological role and regulate flow following occasional strong rainfall events. As such disturbance to these areas should be minimised as far as possible.

Figure 7. Typical small drainage line along road Alternative 1, about 1.5km from the Granaatboskolk road.

3.3 LISTED PLANT SPECIES

The study area has been very poorly sampled in the past and many of the quarter degree squares in the area have no data available. According to the SIBIS database, a total of 135 indigenous species are known from the area, of which 89 have been observed by the consultant on the site and an additional 28 species were observed that have not been recorded from the area before. Although some additional species would undoubtedly be discovered with additional sampling, the area is not species-rich and even with intensive sampling the area is not likely to demonstrate exceptional richness. Listed and protected species observed in the area include *Cephalophyllum fulleri* which is classified as Rare and a number of provincially protected species including *Aloe falcata*, *Hoodia gordonii* and *Aloinopsis luckhoffii* and *Euphorbia multiceps*.

3.4 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

The Northern Cape Critical Biodiversity Areas (CBA) map (Oosthuysen & Holness 2016) is depicted below for the study area (Figure 8). This biodiversity assessment identifies CBAs which

represent biodiversity priority 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. There are no CBAs or ESAs within the development footprint of either route alternative. As such the development would not have an impact on CBAs or ESAs. The site does not lie within a National Protected Area Expansion Strategy (NPAES) focus area and has therefore not been identified as an important area for future conservation area expansion.

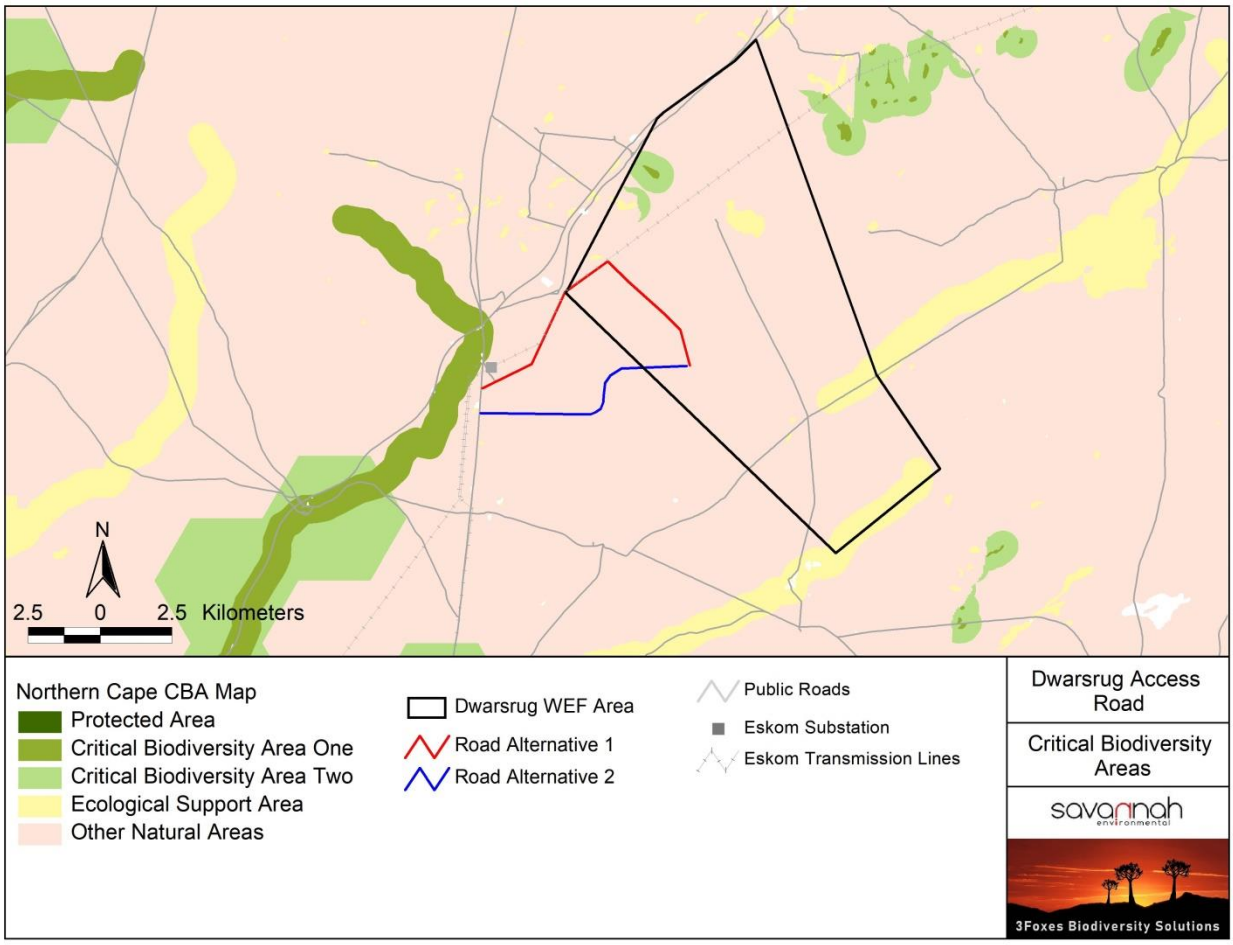

Figure 8. Critical Biodiversity Areas map of the study area, showing there are no CBAs or ESAs along the proposed road routes.

3.5 CUMULATIVE IMPACTS

A node of wind energy development is developing around the Helios Substation which would potentially generate significant local impact. However, there are no specific features of the affected area such as the presence of large drainage corridors, which would indicate that it is likely to be more important than the surrounding areas for faunal movement or landscape

connectivity. The contribution of the Dwarsrug Access Road to transformation and habitat loss would be low and would amount to a few hectares only and as such the major contributing factor to transformation in the area would be the wind and solar developments present in the area, as well as the Helios substation itself as well as the Sishen-Saldanha railway line. The contribution of the access road to cumulative impacts in the area is considered to be low. Furthermore, cumulative impacts in the area are further mitigated by the homogenous nature of the landscape in the area and the paucity of species and habitats of conservation concern in the affected areas. Cumulative impact associated with the access road is therefore considered acceptable.

3.6 FAUNAL COMMUNITIES

Mammals

The site falls within the distribution range of 40 terrestrial mammals suggesting that potential mammalian diversity at the site is quite low. Species observed in the area include Steenbok *Raphicerus campestris*, Cape Porcupine *Hystrix africaeaustralis*, Aardvark *Orycteropus afer*, Yellow Mongoose *Cynictis penicillata*, Cape Hare *Lepus capensis,* Cape Fox *Vulpes chama*, Bat-eared Fox *Otocyon megalotis* and Round-eared Elephant Shrew *Macroscelides proboscideus*. In terms of specific habitats which are likely to be of above average significance, the low ridges and drainage lines are likely to contain the highest fauna abundance and diversity.

The only listed mammal species which may occur at the site is the Black-footed cat *Felis nigripes* (Vulnerable). As this species has a broad distribution across South Africa, the limited footprint of the development is not likely to compromise the local or regional population of this species, especially given the aridity of the area and the associated very low density of this species in the area.

Reptiles

The site lies in or near the distribution range of at least 40 reptile species (Appendix 3), comprising 5 tortoises, 12 snakes, 15 lizards and skinks, 8 geckos and 1 chameleon. This is a comparatively low total, suggesting that reptile diversity at the site is likely to be low. There are no listed species which are likely to occur at the site. Species which were observed in the area include the Namaqua Sand Lizard *Pedioplanis namaquensis*, Spotted Desert Lizard *Meroles suborbitalis*, Western Sandveld Lizard *Nucras tessellata*, Southern Rock Agama *atra*, Ground Agama *aculeata* subsp. *aculeata* and Bushmanland Tent Tortoise *Psammobates tentorius verroxii*. In terms of the likely impacts of the development on reptiles, habitat loss is not likely to be highly significant as the direct footprint of the road is not likely to exceed a few hectares and this would not be significant in context of the relatively homogenous and intact surrounding landscape. There would also be some risk of collisions with vehicles with associated mortality along the access road. This can be reduced to some extent through limiting speed on the roads.

Amphibians

Given the aridity of the site and lack of surface water in the area, it is not surprising that only six frog species may occur in the area. Of these only those which are relatively independent of water such as the Karoo Toad *Vandijkophrynus gariepensis* and Tandy's Sand Frog *Tomopterna tandyi* are likely to occur within the site itself. Impacts on amphibians are likely to be low given the limited extent of the development as well as low likely density of amphibians in the area. Although there are some pans present in the area, these are not necessarily available to amphibians as many of the pans are saline and not suitable for amphibians.

3.7 DWARSRUG ACCESS ROAD SENSITIVITY ASSESSMENT

The sensitivity map for the Dwarsrug site and the access road corridors, is depicted below in Figure 9. The majority of the site consists of low open shrublands or arid grasslands on flat plains and gently sloping hills that are not considered highly sensitive. The overall diversity of the vegetation is low and the abundance of listed plant species is also low. The listed species that are present at the site occur at a very low density or in localised environments and would not be significantly affected by the development with the appropriate avoidance. The affected area does not have a lot of features and the only features of some significance at the site are some poorly developed drainage lines and some low gravelly hills. The low gravel hills are considered medium sensitivity as they have greater diversity and higher frequency of plant species of concern than the adjacent plains. Although there are a number of minor drainage lines along the road routes, these are not well-developed and a significant impact on these features is not likely. In terms of the two alternatives, Alternative 1 is identified as preferred alternative and would generate lower overall impact than Alternative 2.

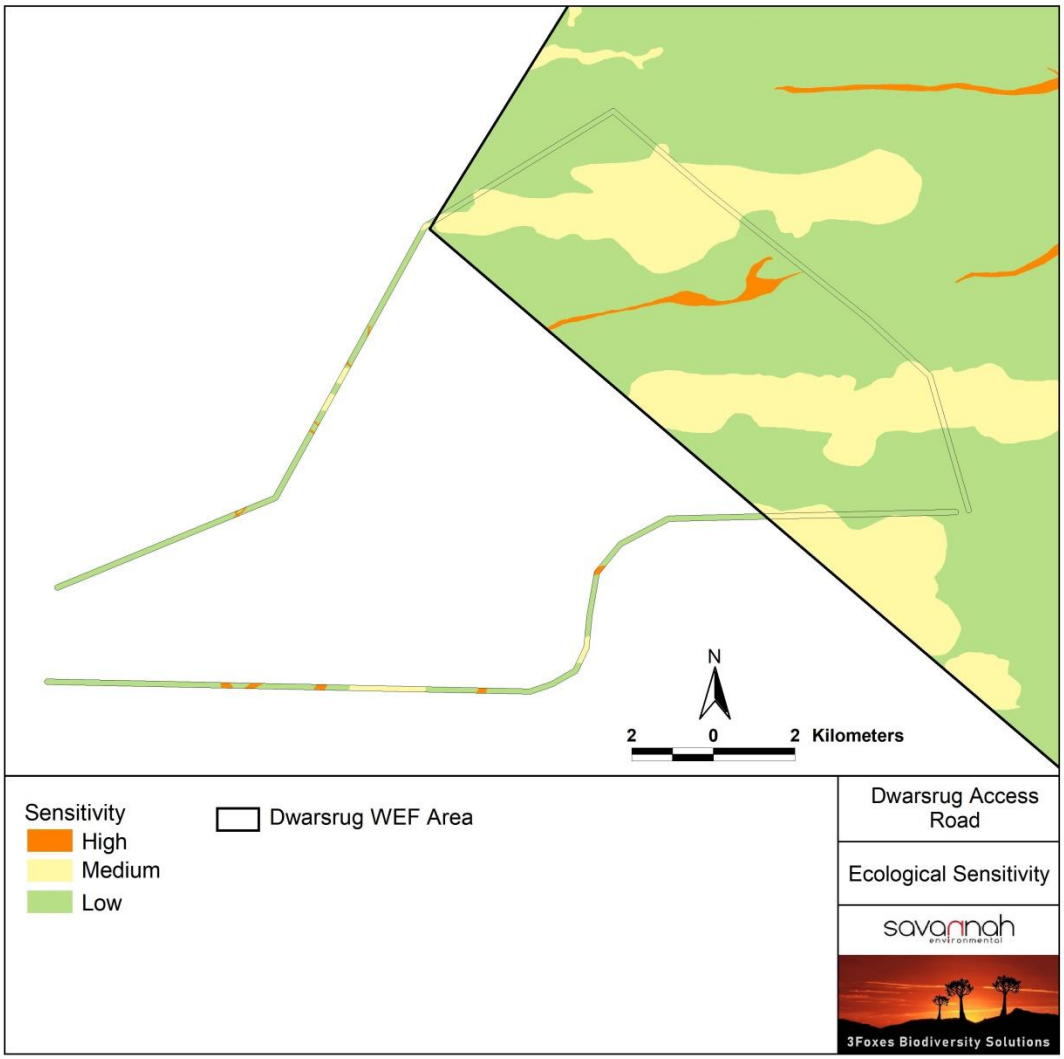

Figure 9. Ecological sensitivity map for the Dwarsrug site and the access road corridors.

4 IMPACT ASSESSMENT

5 *IMPACTS AND ISSUES IDENTIFICATION*

The development of the proposed Dwarsrug Access Road is likely to result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat due to road construction. The following impacts are identified as the major impacts that are likely to be associated with the development and which are assessed for the construction, operational and decommissioning phases of the development.

5.1 IDENTIFICATION OF POTENTIAL IMPACTS

The likely impacts on the terrestrial ecology of the site resulting from the development of the Dwarsrug Access Road are identified and discussed below with reference to the characteristics and features of the site. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarised below before the impacts are assessed.

Impact 1. Impacts on vegetation and listed or protected plant species

The development would require vegetation clearing for the road. Apart from the direct loss of vegetation within the development footprint, listed and protected species would potentially be impacted. These impacts are likely to occur during the construction phase of the development, with additional vegetation impacts during operation likely to be very low. This impact is therefore assessed for the construction phase only.

Impact 2. Direct Faunal Impacts

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 if proper management and monitoring is not in place. Traffic at the site during all phases of the project would pose a risk of collisions with fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible and the impact would be largely concentrated to the construction phase when vehicle activity is high. 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. During the operational phase, there will be some risk of mortality along the road due to collisions with vehicles. Faunal impacts are therefore assessed for the construction and operational phases of the development.

Impact 3. Increased Erosion Risk

The disturbance created during road construction would leave the affected areas vulnerable to wind and water erosion. Soil disturbance associated with the development will render the impacted areas vulnerable to erosion and measures to limit erosion will need to be implemented. As the construction phase will be of relatively short duration, this impact would manifest largely during the operational phase and decommissioning phases.

Impact 4. Alien Plant Invasion

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some alien plant invasion is inevitable and regular alien plant clearing activities would be required to limit the extent of this problem. Once the natural

vegetation has returned to the disturbed areas, these areas will be less vulnerable to alien plant invasion. This impact would manifest during the operational and decommissioning phases.

Cumulative Impact 1. Impacts on broad-scale ecological processes and cumulative habitat loss

The development will contribute to cumulative impacts in the area and potentially affect the ability to meet future conservation targets. However, the total footprint of the development would be less than 10ha and this is not considered to be a highly significant impact. It is however assessed as there are numerous other facilities in the area and the potential for cumulative impact is high.

6 ASSESSMENT OF IMPACTS

An assessment of the identified impacts above is made below for the different phases of the development, for the Dwarsrug Access Road. For each predicted impact, criteria are applied to establish the significance of the impact based on likelihood and consequence, both without mitigation being applied and with the most effective mitigation measure(s) in place. The criteria that contribute to the consequence of the impact are intensity (at the indicated spatial scale), which also includes the type of impact (being either a positive or negative impact); the duration (length of time that the impact will continue); and the extent (spatial scale) of the impact. The sensitivity of the receiving environment and/or sensitive receptors is incorporated into the consideration of consequence by appropriately adjusting the thresholds or scales of the intensity, duration and extent criteria, based on expert knowledge.

The further details of the assessment approach and the calculation of significance is detailed in the main EIA report and is not repeated in full here.

6.1 PLANNING & CONSTRUCTION PHASE IMPACTS

Construction Phase Impact 1: Impacts on vegetation due to construction activities

Impact Nature: Impacts on vegetation will occur due to disturbance and vegetation clearing associated with the construction of the access road. In addition, it is possible 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 (4)	Low (2)
Probability	Certain (5)	Likely (4)
Significance	Medium (45)	Low (28)

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, but the total extent would be low.	
Mitigation	• The final route 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.	
Cumulative Impacts	The development will contribute to cumulative impacts on habitat loss and transformation in the area, but the contribution would be low.	
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.	

Construction Phase Impact 2. Faunal impacts due to construction activities.

Impact Nature: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. This will however be transient and restricted to the construction phase.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (1)	Short-term (1)
Magnitude	Medium (4)	Low (3)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Low (24)	Low (20)
Status	Negative	Negative
Reversibility	High	High

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	• Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. • 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.	
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.	

Construction Phase Impact 3. Increased Soil Erosion Risk during Construction

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 (4)	Low (2)
Probability	Probable (3)	Unlikely (2)
Significance	Low (27)	Low (12)
Status	Negative	Negative
Reversibility	Moderate	High

Irreplaceable loss of resources	Low	Low
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	
Mitigation	• Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. • All roads 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	Erosion risk will persist for the life of the project due to increased runoff from the road, but this can be reduced to a low risk with regular maintenance.	

6.2 OPERATION PHASE IMPACTS

Operational Impact 1. Faunal impacts due to operation

Impact Nature: The road will generate some long-term impact on fauna due to habitat fragmentation as a result of the presence of the road and disturbance and mortality due to collisions with vehicles.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (3)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (21)
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No

Can impacts be mitigated?	To a large extent, but some low-level residual impact due to disturbance and road-related mortality of susceptible species is likely.
Mitigation	• All vehicles using the road 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	Some low-level residual impact due to disturbance and road-related mortality of susceptible species is likely.

Operational Impact 2. Increased Soil Erosion Risk during Operation

Impact Nature: Disturbance created during construction will leave the site vulnerable to erosion for several years into the operational phase.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (4)	Low (4)
Probability	Likely (4)	Likely (3)
Significance	Medium (32)	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	• Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. • The road 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.

Operational Impact 3. Increased Alien Plant Invasion Risk during Operation

Impact Nature: Disturbance created during construction will leave the site vulnerable to alien plant invasion for several years into the operational phase.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (4)	Low (4)
Probability	Likely (3)	Unlikely (2)
Significance	Low (27)	Low (16)
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	• Alien management at the site should take place according to the Alien Invasive Management Plan. • Regular monitoring for alien plant during operation to ensure that no erosion problems have developed as result of the disturbance, as per the Alien Management Plan for the project. • Woody aliens should be controlled on at least an annual basis using the appropriate alien control techniques as determined by the species present.	
Cumulative Impacts	Alien plant invasion would contribute to degradation in the area, but as this can be well-mitigated, the contribution can be minimised.	
Residual Risks	With mitigation there would be very little residual risk.	

6.3 DECOMMISSIONING PHASE IMPACTS

Decommissioning Impact 1. Faunal Impacts due to decommissioning

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	• 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. • 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	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.	

Decommissioning Impact 2. Soil Erosion Risk due to Decommissioning.

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 (4)	Minor (3)

Probability	Probable (4)	Improbable (3)
Significance	Medium (32)	Low (27)
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	• 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. • 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. However, this can be reduced to a low level and residual risks can be reduced to an acceptable level.	

Decommissioning Impact 3. Increased Alien Plant Invasion Risk

Impact Nature: Disturbance created during decommissioning will leave the site vulnerable to alien plant invasion for several years after site clearing and decommissioning.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (4)	Low (4)
Probability	Likely (3)	Unlikely (2)
Significance	Low (27)	Low (16)
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	• Alien management at the site should take place according to the Alien Invasive Management Plan. • Regular monitoring for alien plant invasion following decommissioning to ensure that no erosion problems have developed as result of the disturbance, as per the Alien Management Plan for the project. • Woody aliens should be controlled on at least an annual basis using the appropriate alien control techniques as determined by the species present. Follow-up monitoring should occur for at least 5 years after decommissioning.	
Cumulative Impacts	Alien plant invasion would contribute to degradation in the area, but as this can be well-mitigated, the contribution can be minimised.	
Residual Risks	With mitigation there would be very little residual risk.	

6.4 CUMULATIVE IMPACTS

Cumulative Impact on Habitat loss and ecological functioning

Nature: The development of the Dwarsrug Access road will potentially contribute to cumulative habitat loss and other cumulative impacts in the wider 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 (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (3)	Medium (4)
Probability	Improbable (2)	Probable (3)
Significance	Low (16)	Low (27)
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:

- Reduce the access road footprint as far as possible.
- Ensure that erosion and alien plant invasion along the road are controlled as much as possible to reduce the overall long-term impact of the road.

7 ASSESSMENT OF ALTERNATIVES

There are two site alternatives considered in the current assessment. Alternative 1 is considered the preferred alternative as it traverses the least extent of sensitive habitat. In addition, large sections of this route run adjacent to existing disturbance or next to existing power lines. As a result, this alternative would generate the lowest long-term impact and is the preferred alternative. Alternative 2 traverses more sensitive habitat and would generate higher impact than Alternative 1.

Alternative	Preference	Reasons (incl. potential issues)
ACCESS ROAD ALTERNATIVES		
Alternative 1	Preferred	This access road alternative traverses the least extent of sensitive habitat. In addition, the majority of the route is adjacent to existing disturbance or power lines. This is clearly the preferred alternative and would generate less impact than Alternative 2.
Alternative 2	Not Preferred	This alternative is less preferred because it has a higher associated footprint and traverses a greater extent of sensitive habitat such as drainage lines and low hills.

8 CONCLUSION & RECOMMENDATIONS

The majority of the Dwarsrug Access Road routes traverse low open shrubland or grassland on flat plains and gently sloping hills that are low or medium sensitivity and where the impact of the road on fauna and flora would be low or very low and of a local nature only. The overall diversity of the vegetation is low and the abundance of listed plant species is also very low. The listed species that are present at the site occur at a very low density or in localised environments and would not be significantly affected by the road with the appropriate preconstruction avoidance. Apart from the low ridges, the only other significant feature of the site are the poorly developed drainage lines of the area. These are considered sensitive on account of their vulnerability to disturbance as well as the ecological function that they perform in terms of hydrological regulation

and provision of habitat. As these are narrow, it is likely that the access road would be able to traverse these features with minimal impact.

In terms of the two alternatives, Alternative 1 is considered the preferred alternative as it traverses the least extent of sensitive habitat. In addition, large sections of this route run adjacent to existing disturbance or next to existing power lines. As a result, this alternative would generate the lowest long-term impact and is the preferred alternative. Alternative 2 is longer and traverses more sensitive habitat and would generate higher impact than Alternative 1.

Impact Statement

With the application of relatively simple mitigation and avoidance measures, the impact of the Dwarsrug Access Road can be reduced to a low overall level. There are no specific long-term impacts likely to be associated with the road that cannot be reduced to a low or very low level through mitigation and avoidance. As such, there are no fatal flaws associated with the development and from a terrestrial ecology perspective the development of the access Road is considered acceptable and is not opposed.

9 ACTIVITIES FOR INCLUSION THE DRAFT EMPR

An Environmental Management Programme (EMPr) provides a link between the predicted impacts and mitigation measures recommended within the EIA and the implementation and operational activities of a project. As the construction and operation of the Dwarsrug Access Road may impact the environment, activities which pose a threat should be managed and mitigated so that unnecessary or preventable environmental impacts do not result. The primary objective of the EMPr is to detail actions required to address the impacts identified in the EIA during the establishment, operation and rehabilitation of the proposed infrastructure. The EMPr provides an elaboration of how to implement the mitigation measures documented in the EIA. As such the purpose of the EMPr can be outlined as follows:

- To outline mitigation measures and environmental specifications which are required to be implemented for the planning, establishment, rehabilitation and operation/maintenance phases of the project in order to minimise and manage the extent of environmental impacts.
- To ensure that the establishment and operation phases of the wind farm do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- To propose mechanisms for monitoring compliance, and preventing long-term or permanent environmental degradation.
- To facilitate appropriate and proactive response to unforeseen events or changes in project implementation that were not considered in the EIA process

Below are the ecologically-orientated measures that should be implemented as part of the EMPr for the development to reduce the significance or extent of the above impacts. The measures below do not exactly match with the impacts that have been identified, as certain mitigation measures, such as limiting the loss of vegetation may be effective at combating several different impacts, such as erosion, faunal impact etc.

9.1 CONSTRUCTION PHASE ACTIVITIES

Objective: Limit disturbance of vegetation and loss of protected flora during construction			
Project component/s	All infrastructure and activities which result in vegetation loss or clearing including: » Clearing and excavation for establishment of infrastructure. » Construction camps & other temporary infrastructure. » Access road.		
Potential Impact	Loss of plant cover leading to erosion as well as loss of faunal habitat and loss of specimens of protected plants.		
Activity/risk source	Vegetation clearing for the following » Clearing for infrastructure establishment. » Access roads. » Laydown areas. » Construction Camps.		
Mitigation: Target/Objective	» Low footprint and low impact on terrestrial environment. » Low impact on protected plant species.		
Mitigation: Action/control		Responsibility	Timeframe
» Preconstruction walk-through of road footprint. » Obtain relevant permits from the Department of Agriculture, Forestry and Fisheries (DAFF) and the Northern Cape Department of Environment and Nature Conservation (DENC) prior to any construction activities at the site. » Affected individuals of protected species which cannot be avoided should be translocated to a safe area on the site prior to construction. This does not include trees which cannot be translocated and where these are protected by DAFF and permit for their destruction would be required. » Erosion control measures should be implemented in areas where slopes have been disturbed. » Revegetation of cleared areas or monitoring to ensure that recovery is taking place. » Alien plant clearing where necessary.		Management/ECO	Construction & Operation
Performance Indicator	» Vegetation loss restricted to infrastructure footprint. » Low impact on protected plant species. » Permit obtained to destroy or translocate affected individuals of protected species.		

Monitoring	ECO to monitor construction to ensure that: » Vegetation is cleared only within essential areas. » Erosion risk is maintained at an acceptable level through flow regulation structures where appropriate and the maintenance of plant cover wherever possible.

Objective: Limit direct and indirect terrestrial faunal impacts during construction			
Project component/s	Construction activities especially the following: » Vegetation clearing. » Human presence. » Operation of heavy machinery.		
Potential Impact	Disturbance of faunal communities due to construction as well as poaching and hunting risk from construction staff.		
Activity/risk source	» Habitat transformation during construction. » Presence of construction crews. » Operation of heavy vehicles.		
Mitigation: Target/Objective	Low faunal impact during construction.		
Mitigation: Action/control		Responsibility	Timeframe
» Environmental induction for all construction staff » ECO to monitor and enforce ban on hunting, collecting etc. of all plants and animals or their products. » Any fauna encountered during construction should be removed to safety by the ECO or other suitably qualified person, or allowed to passively vacate the area. » All vehicles to adhere to low speed limits (30km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust. » All night-lighting should use low-UV type lights (such as most LEDs), which do not attract insects. The lights should also be of types which are directed downward and do not result in large amounts of light pollution.		Management/ECO	Construction
Performance Indicator	» Low mortality of fauna due to construction machinery and activities. » No poaching etc of fauna by construction personnel during construction. » Removal to safety of fauna encountered during construction.		
Monitoring	Monitoring for compliance during the construction phase. All incidents to be noted.		

9.2 OPERATION PHASE ACTIVITIES

OBJECTIVE: Limit the ecological footprint of the road			
Project component/s	Presence and operation of the facility including » Movement of maintenance vehicles along the access road. » Vegetation & Erosion management along the road.		
Potential Impact	» Alien plant invasion » Erosion » Pollution		
Activity/risk source	» Alien plant invasion in and around the road. » Unregulated runoff from the access road. » Human presence during road maintenance activities » Pollution from maintenance vehicles due to oil or fuel leaks etc. » Maintenance activities which may lead to negative impacts such as pollution, herbicide drift etc.		
Mitigation: Target/Objective	Low ecological footprint of the road during operation.		
Mitigation: Action/control		Responsibility	Timeframe
Vegetation control should be by manual clearing and herbicides should not be used except to control alien plants in the prescribed manner.		Management/ Contractor	Operation
Annual monitoring for alien plant species - with follow up clearing as needed – or as per the frequency stated in the alien invasive management plan to be developed for the site.		Management/ Contractor	Operation
Annual site inspection for erosion or water flow regulation problems – with follow up remedial action where problems are identified.		Management/ Contractor	Operation
Performance Indicator	» No erosion problems along the access road. » Low abundance of alien plants.		
Monitoring	» Annual monitoring with records of alien species presence and clearing actions. » Annual monitoring with records of erosion problems and mitigation actions taken with photographs.		

10 REFERENCES

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11 ANNEX 1. LIST OF PLANTS

List of plant species known from the vicinity of the Dwarsrug Access Road Site, based on the SANBI SIBIS database, supplemented with additional species not on the list and showing which species were observed at the site. IUCN conservation status is from the South African Red Data List of Plants 2016.

Family	Species	IUCN	Obs.	Family	Species	IUCN	Obs.
ACANTHACEAE	*Acanthopsis disperma*	LC		ACANTHACEAE	*Blepharis furcata*	LC	
ACANTHACEAE	*Blepharis mitrata*	LC		ACANTHACEAE	*Monechma spartioides*	LC	
AIZOACEAE	*Aizoon canariense*	LC	1	AIZOACEAE	*Galenia africana*	LC	1
AIZOACEAE	*Galenia fruticosa*	LC	1	AIZOACEAE	*Galenia sarcophylla*	LC	1
AIZOACEAE	*Galenia squamulosa*	LC		AIZOACEAE	*Plinthus cryptocarpus*	LC	
AIZOACEAE	*Plinthus karooicus*	LC	1	AIZOACEAE	*Tetragonia arbuscula*	LC	
AIZOACEAE	*Tetragonia fruticosa*	LC	1	AIZOACEAE	*Tetragonia microptera*	LC	
AIZOACEAE	*Trianthema parvifolia*	LC	1	AMARANTHACEAE	*Amaranthus praetermissus*	LC	
AMARANTHACEAE	*Sericocoma avolans*	LC		AMARANTHACEAE	*Sericocoma pungens*	LC	
AMARYLLIDACEAE	*Brunsvigia comptonii*	LC		APIACCEAE	*Deverra denudata*	LC	1
APOCYNACEAE	*Fockea sinuata*	LC	1	APOCYNACEAE	*Gomphocarpus filiformis*	LC	1
APOCYNACEAE	*Hoodia gordonii*	DDD	1	APOCYNACEAE	*Microloma armatum var. armatum*	LC	
APOCYNACEAE	*Microloma incanum*	LC		APOCYNACEAE	*Microloma longitubum*	LC	
APOCYNACEAE	*Quaqua incarnata*	LC	1	APOCYNACEAE	*Sarcostemma viminale subsp. viminale*	LC	
ASPARAGACEAE	*Asparagus africanus*	LC		ASPARAGACEAE	*Asparagus capensis var. capensis*	LC	1
ASPHODELACEAE	*Aloe claviflora*	LC	1	ASPHODELACEAE	*Aloe falcata*	LC	1
ASPHODELACEAE	*Aloe variegata*	LC	1	ASTERACEAE	*Amellus microglossus*	LC	
ASTERACEAE	*Amellus strigosus subsp. pseudoscabridus*	LC		ASTERACEAE	*Arctotis fastuosa*	LC	1
ASTERACEAE	*Arctotis leiocarpa*	LC	1	ASTERACEAE	*Athanasia minuta subsp. minuta*	LC	
ASTERACEAE	*Berkheya annectens*	LC		ASTERACEAE	*Berkheya spinosissima subsp. namaensis var. namaensis*	LC	1
ASTERACEAE	*Cotula microglossa*	LC		ASTERACEAE	*Dicoma capensis*	LC	
ASTERACEAE	*Didelta carnosa var. carnosa*	LC		ASTERACEAE	*Didelta spinosa*	LC	
ASTERACEAE	*Dimorphotheca polyptera*	LC		ASTERACEAE	*Eriocephalus ericoides subsp. ericoides*	LC	
ASTERACEAE	*Eriocephalus microphyllus var. pubescens*	LC	1	ASTERACEAE	*Eriocephalus spinescens*	LC	1
ASTERACEAE	*Felicia clavipilosa subsp. clavipilosa*	LC	1	ASTERACEAE	*Felicia hyssopifolia subsp. hyssopifolia*	LC	
ASTERACEAE	*Foveolina dichotoma*	LC		ASTERACEAE	*Gazania jurineifolia*	LC	1
ASTERACEAE	*Gazania lichtensteinii*	LC	1	ASTERACEAE	*Helichrysum herniarioides*	LC	
ASTERACEAE	*Kleinia longiflora*	LC		ASTERACEAE	*Lasiopogon glomerulatus*	LC	

ASTERACEAE	*Osteospermum armatum*	LC	1	ASTERACEAE	*Osteospermum pinnatum var. pinnatum*	LC	1
ASTERACEAE	*Osteospermum spinescens*	LC	1	ASTERACEAE	*Pegolettia retrofracta*	LC	1
ASTERACEAE	*Pentzia globosa*	LC	1	ASTERACEAE	*Pentzia lanata*	LC	
ASTERACEAE	*Pentzia pinnatisecta*	LC		ASTERACEAE	*Pentzia spinescens*	LC	1
ASTERACEAE	*Pteronia adenocarpa*	LC		ASTERACEAE	*Pteronia glauca*	LC	
ASTERACEAE	*Pteronia glomerata*	LC	1	ASTERACEAE	*Pteronia inflexa*	LC	
ASTERACEAE	*Pteronia leucoclada*	LC	1	ASTERACEAE	*Pteronia mucronata*	LC	1
ASTERACEAE	*Pteronia oblanceolata*	LC		ASTERACEAE	*Pteronia sordida*	LC	
ASTERACEAE	*Rosenia humilis*	LC	1	ASTERACEAE	*Senecio abbreviatus*	LC	1
ASTERACEAE	*Senecio niveus*	LC	1	ASTERACEAE	*Tripteris sinuata var. linearis*	LC	
ASTERACEAE	*Tripteris sinuata var. sinuata*	LC	1	ASTERACEAE	*Ursinia nana subsp. nana*	LC	1
BIGNONIACEAE	*Rhigozum trichotomum*	LC	1	BRASSICACEAE	*Heliophila arenosa*	LC	1
BRASSICACEAE	*Heliophila trifurca*	LC		BRASSICACEAE	*Lepidium desertorum*	LC	1
BRASSICACEAE	*Sisymbrium burchellii var. burchellii*	LC		CAPPARACEAE	*Cleome angustifolia subsp. diandra*	LC	
CARYOPHYLLACEAE	*Dianthus namaensis var. dinteri*	LC		CHENOPODIACEAE	*Atriplex cinerea subsp. bolusii var. adamsonii*	LC	
CHENOPODIACEAE	*Atriplex lindleyi subsp inflata*	Alien	1	CHENOPODIACEAE	*Atriplex semibaccata*	Alien	1
CHENOPODIACEAE	*Atriplex vestita var. appendiculata*	LC	1	CHENOPODIACEAE	*Bassia salsoloides*	LC	1
CHENOPODIACEAE	*Exomis microphylla var. axyrioides*	LC	1	CHENOPODIACEAE	*Salsola aellenii*	LC	
CHENOPODIACEAE	*Salsola aphylla*	LC	1	CHENOPODIACEAE	*Salsola glabrescens*	LC	
CHENOPODIACEAE	*Salsola henriciae*	LC		CHENOPODIACEAE	*Salsola procera*	LC	
CHENOPODIACEAE	*Salsola rabieana*	LC		CHENOPODIACEAE	*Salsola tuberculata*	LC	1
CHENOPODIACEAE	*Sasola kali*	Alien	1	CHENOPODIACEAE	*Suaeda fruticosa*	LC	
CHENOPODIACEAE	*Suaeda merxmuelleri*	LC		COLCHICACEAE	*Ornithoglossum viride*	LC	
CRASSULACEAE	*Crassula corallina subsp. corallina*	LC	1	CUCURBITACEAE	*Cucumis africanus*	LC	
CUCURBITACEAE	*Cucumis myriocarpus subsp. leptodermis*	LC		CYPERACEAE	*Cyperus capensis*	LC	
EUPHORBIACEAE	*Euphorbia aequoris*	LC	1	EUPHORBIACEAE	*Euphorbia decussata*	LC	1
EUPHORBIACEAE	*Euphorbia inaequilatera var. inaequilatera*	LC		EUPHORBIACEAE	*Euphorbia multiceps*	LC	1
EUPHORBIACEAE	*Euphorbia rectirama*	LC		EUPHORBIACEAE	*Euphorbia rudis*	LC	
FABACEAE	*Indigastrum argyraeum*	LC		FABACEAE	*Indigofera hololeuca*	LC	
FABACEAE	*Lebeckia spinescens*	LC	1	FABACEAE	*Lessertia macrostachya var. macrostachya*	LC	
FABACEAE	*Lessertia pauciflora var. pauciflora*	LC		FABACEAE	*Lotononis leptoloba*	LC	
FABACEAE	*Melolobium candicans*	LC	1	FABACEAE	*Parkinsonia africana*	LC	1
FABACEAE	*Prosopis glandulosa*	Alien	1	FABACEAE	*Sutherlandia frutescens*	LC	
FABACEAE	*Tephrosia capensis var. acutifolia*	LC		FRANKENIACEAE	*Frankenia pulverulenta*	LC	
GERANIACEAE	*Monsonia umbellata*	LC		GERANIACEAE	*Pelargonium minimum*	LC	1

GERANIACEAE	*Sarcocaulon patersonii*	LC	1	GISEKIACEAE	*Gisekia pharnacioides var. pharnacioides*	LC	
HYACINTHACEAE	*Albuca concordiana*	LC	1	HYACINTHACEAE	*Albuca cooperi*	LC	1
HYACINTHACEAE	*Dipcadi gracillimum*	LC		HYACINTHACEAE	*Drimia elata*	LC	1
HYACINTHACEAE	*Drimia intricata*	LC		HYACINTHACEAE	*Drimia physodes*	LC	
HYACINTHACEAE	*Ledebouria undulata*	LC		IRIDACEAE	*Moraea pallida*	LC	
IRIDACEAE	*Moraea speciosa*	LC		IRIDACEAE	*Tritonia karooica*	LC	
LAMIACEAE	*Salvia disermas*	LC	1	LOPHIOCARPACEAE	*Lophiocarpus polystachyus*	LC	
LORANTHACEAE	*Septulina glauca*	LC		MALVACEAE	*Hermannia cueneifolia*	LC	1
MALVACEAE	*Hermannia erodioides*	LC		MALVACEAE	*Hermannia grandiflora*	LC	
MALVACEAE	*Hermannia johanssenii*	LC		MALVACEAE	*Hermannia paucifolia*	LC	
MALVACEAE	*Hermannia spinosa*	LC	1	MALVACEAE	*Hermannia vestita*	LC	
MALVACEAE	*Radyera urens*	LC	1	MELIANTHACEAE	*Melianthus comosus*	LC	1
MESEMBRYANTHEMACEAE	*Aloinopsis luckhoffii*	DDT	1	MESEMBRYANTHEMACEAE	*Antimima evoluta*	LC	
MESEMBRYANTHEMACEAE	*Aridaria noctiflora subsp. straminea*	LC	1	MESEMBRYANTHEMACEAE	*Brownanthus ciliatus*	LC	1
MESEMBRYANTHEMACEAE	*Cephalophyllum fulleri*	Rare		MESEMBRYANTHEMACEAE	*Cephalophyllum rigidum*	LC	1
MESEMBRYANTHEMACEAE	*Conophytum uviforme subsp. uviforme*	LC		MESEMBRYANTHEMACEAE	*Drosanthemum lique*	LC	1
MESEMBRYANTHEMACEAE	*Lampranthus haworthii*	LC		MESEMBRYANTHEMACEAE	*Lampranthus uniflorus*	LC	1
MESEMBRYANTHEMACEAE	*Lithops otzeniana*	VU		MESEMBRYANTHEMACEAE	*Mesembryanthemum crystallinum*	LC	1
MESEMBRYANTHEMACEAE	*Mesembryanthemum stenandrum*	LC	1	MESEMBRYANTHEMACEAE	*Prenia tetragonia*	LC	1
MESEMBRYANTHEMACEAE	*Psilocaulon articulatum*	LC		MESEMBRYANTHEMACEAE	*Psilocaulon coriarium*	LC	1
MESEMBRYANTHEMACEAE	*Psilocaulon junceum*	LC	1	MESEMBRYANTHEMACEAE	*Ruschia abbreviata*	LC	1
MESEMBRYANTHEMACEAE	*Ruschia robusta*	LC	1	MESEMBRYANTHEMACEAE	*Ruschia spinosa*	LC	1
MESEMBRYANTHEMACEAE	*Sceletium tortuosum*	LC	1	MESEMBRYANTHEMACEAE	*Stoeberia frutescens*	LC	
MESEMBRYANTHEMACEAE	*Stomatium mustellinum*	LC		MOLLUGINACEAE	*Hypertelis salsoloides var. salsoloides*	LC	1
MOLLUGINACEAE	*Limeum aethiopicum*	LC	1	MOLLUGINACEAE	*Limeum africanum*	LC	1
MOLLUGINACEAE	*Limeum argute-carinatum var. argute-carinatum*	LC		MOLLUGINACEAE	*Limeum rhombifolium*	LC	
MOLLUGINACEAE	*Mollugo cerviana var. cerviana*	LC		NEURADACEAE	*Grielum humifusum var. parviflorum*	LC	1
NYCTAGINACEAE	*Phaeoptilum spinosum*	LC	1	OXALIDACEAE	*Oxalis beneprotecta*	LC	
OXALIDACEAE	*Oxalis lawsonii*	LC		PEDALIACEAE	*Sesamum capense*	LC	1
PLUMBAGINACEAE	*Dyerophytum africanum*	LC	1	POACEAE	*Aristida adscensionis*	LC	1
POACEAE	*Aristida congesta subsp. barbicollis*	LC		POACEAE	*Ehrharta calycina*	LC	
POACEAE	*Enneapogon cenchroides*	LC		POACEAE	*Enneapogon desvauxii*	LC	1
POACEAE	*Enneapogon scaber*	LC	1	POACEAE	*Eragrostis annulata*	LC	
POACEAE	*Fingerhuthia africana*	LC	1	POACEAE	*Schismus barbatus*	LC	
POACEAE	*Stipagrostis anomala*	LC	1	POACEAE	*Stipagrostis brevifolia*	LC	1
POACEAE	*Stipagrostis ciliata var. capensis*	LC	1	POACEAE	*Stipagrostis namaquensis*	LC	1

POACEAE	*Stipagrostis obtusa*	LC	1	POACEAE	*Stipagrostis uniplumis var. neesii*	LC	
POACEAE	*Tragus berteronianus*	LC		POLYGALACEAE	*Polygala pungens*	LC	
POLYGALACEAE	*Polygala seminuda*	LC	1	PORTULACACEAE	*Talinum arnotii*	LC	
RUTACEAE	*Agathosma virgata*	LC		SANTALACEAE	*Thesium hystricoides*	LC	
SANTALACEAE	*Thesium hystrix*	LC	1	SANTALACEAE	*Thesium lineatum*	LC	1
SCROPHULARIACEAE	*Aptosimum elongatum*	LC		SCROPHULARIACEAE	*Aptosimum indivisum*	LC	1
SCROPHULARIACEAE	*Aptosimum marlothii*	LC		SCROPHULARIACEAE	*Aptosimum procumbens*	LC	1
SCROPHULARIACEAE	*Aptosimum spinescens*	LC	1	SCROPHULARIACEAE	*Jamesbrittenia atropurpurea subsp. atropurpurea*	LC	1
SCROPHULARIACEAE	*Nemesia calcarata*	LC		SCROPHULARIACEAE	*Peliostomum leucorrhizum*	LC	1
SCROPHULARIACEAE	*Polycarena filiformis*	Rare		SCROPHULARIACEAE	*Selago albida*	LC	
SCROPHULARIACEAE	*Selago pinguicula*	LC	1	SOLANACEAE	*Lycium cinereum*	LC	1
SOLANACEAE	*Lycium oxycarpum*	LC	1	SOLANACEAE	*Lycium pumilum*	LC	1
SOLANACEAE	*Solanum burchellii*	LC	1	SOLANACEAE	*Solanum capense*	LC	
URTICACEAE	*Forsskaolea candida*	LC		VERBENACEAE	*Chascanum incisum*	LC	
VERBENACEAE	*Chascanum pumilum*	LC		ZYGOPHYLLACEAE	*Augea capensis*	LC	1
ZYGOPHYLLACEAE	*Tribulus pterophorus*	LC		ZYGOPHYLLACEAE	*Tribulus terrestris*	LC	1
ZYGOPHYLLACEAE	*Tribulus zeyheri*	LC	1	ZYGOPHYLLACEAE	*Zygophyllum flexuosum*	LC	
ZYGOPHYLLACEAE	*Zygophyllum lichtensteinianum*	LC	1	ZYGOPHYLLACEAE	*Zygophyllum retrofractum*	LC	1
ZYGOPHYLLACEAE	*Zygophyllum simplex*	LC	1				

12 ANNEX 2. LIST OF MAMMALS

List of mammals which are likely to occur in the broad vicinity of the Dwarsrug Access Road study area. Habitat notes and distribution records are based on Skinner & Chimimba (2005). Species observed on the adjacent wind farm property are assumed present on the current site as well.

Scientific Name	Common Name	Status	Habitat	Likelihood
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	Confirmed
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Confirmed
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	Low
Lagomorpha (Hares and Rabbits):				
Pronolagus rupestris	Smith's Red Rock Rabbit	LC	Confined to areas of krantzes, rocky hillsides, boulder-strewn koppies and rocky ravines	Low
Lepus capensis	Cape Hare	LC	Dry, open regions, with palatable bush and grass	High
Lepus saxatilis	Scrub Hare	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Confirmed
Rodentia (Rodents):				
Cryptomys hottentotus	African Mole Rat	LC	Wide diversity of substrates, from sandy soils to heavier compact substrates such as decomposed schists and stony soils	High
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Confirmed
Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	Low
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	Confirmed
Mus minutoides	Pygmy Mouse	LC	Wide habitat tolerance	High
Aethomys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	High
Parotomys brantsii	Brants' Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High

Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	High
Otomys unisulcatus	Bush Vlei Rat	LC	Shrub and fynbos associations in areas with rocky outcrops Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	Confirmed
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Petromyscus collinus	Pygmy Rock Mouse	LC	Arid areas on rocky outcrops or koppies with a high rock cover	Low
Primates:				
Papio ursinus	Chacma Baboon	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Low
Eulipotyphla (Shrews):				
Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
Carnivora:				
Proteles cristata	Aardwolf	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	Confirmed
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
Genetta genetta	Small-spotted genet	LC	Occur in open arid associations	High
Suricata suricatta	Meerkat	LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	Confirmed
Cynictis penicillata	Yellow Mongoose	LC	Semi-arid country on a sandy substrate	Confirmed
Herpestes pulverulentus	Cape Grey Mongoose	LC	Wide habitat tolerance	High
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	Confirmed
Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	Confirmed
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	Confirmed

Ictonyx striatus	Striped Polecat	LC	Widely distributed throughout the sub-region	High
Mellivora capensis	Ratel/Honey Badger	IUCN LC/SA RDB EN	Catholic habitat requirements	Low
Rumanantia (Antelope):				
Sylvicapra grimmia	Common Duiker	LC	Presence of bushes is essential	Confirmed
Pelea capreolus	Grey Rhebok	LC	Associated with rocky hills, rocky mountainsides, mountain plateaux with good grass cover.	Low
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Confirmed
Raphicerus campestris	Steenbok	LC	Inhabits open country,	Confirmed
Oreotragus oreotragus	Klipspringer	LC	Closely confined to rocky habitat.	V.Low

13 ANNEX 3. LIST OF REPTILES

List of reptiles which are likely to occur in the broad vicinity of the Dwarsrug Access Road site, based on records from the SARCA database, conservation status is from Bates et al. 2013.

Type	Family	Genus	Species	Subspecies	Common name	Red list category
Chameleon	*Chamaeleonidae*	*Chamaeleo*	*namaquensis*		Namaqua Chameleon	Least Concern
Geckos	*Gekkonidae*	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern
Geckos	*Gekkonidae*	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern
Geckos	*Gekkonidae*	*Goggia*	*lineata*		Striped Pygmy Gecko	Least Concern
Geckos	*Gekkonidae*	*Pachydactylus*	*capensis*		Cape Gecko	Least Concern
Geckos	*Gekkonidae*	*Pachydactylus*	*labialis*		Western Cape Gecko	Least Concern
Geckos	*Gekkonidae*	*Pachydactylus*	*latirostris*		Quartz Gecko	Least Concern
Geckos	*Gekkonidae*	*Pachydactylus*	*weberi*		Weber's Gecko	Least Concern
Geckos	*Gekkonidae*	*Ptenopus*	*garrulus*	*maculatus*	Spotted Barking Gecko	Least Concern
Lizards	*Agamidae*	*Agama*	*aculeata*	*aculeata*	Common Ground Agama	Least Concern
Lizards	*Agamidae*	*Agama*	*atra*		Southern Rock Agama	Least Concern
Lizards	*Cordylidae*	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern
Lizards	*Cordylidae*	*Namazonurus*	*peersi*		Peers' Girdled Lizard	Least Concern
Lizards	*Gerrhosauridae*	*Cordylosaurus*	*subtessellatus*		Dwarf Plated Lizard	Least Concern
Lizards	*Lacertidae*	*Meroles*	*suborbitalis*		Spotted Desert Lizard	Least Concern
Lizards	*Lacertidae*	*Nucras*	*tessellata*		Western Sandveld Lizard	Least Concern
Lizards	*Lacertidae*	*Pedioplanis*	*laticeps*		Karoo Sand Lizard	Least Concern
Lizards	*Lacertidae*	*Pedioplanis*	*lineoocellata*	*lineoocellata*	Spotted Sand Lizard	Least Concern
Lizards	*Lacertidae*	*Pedioplanis*	*lineoocellata*	*pulchella*	Common Sand Lizard	Least Concern
Lizards	*Lacertidae*	*Pedioplanis*	*namaquensis*		Namaqua Sand Lizard	Least Concern
Lizards	*Scincidae*	*Acontias*	*lineatus*		Striped Dwarf Legless Skink	Least Concern
Lizards	*Scincidae*	*Trachylepis*	*occidentalis*		Western Three-striped Skink	Least Concern
Lizards	*Scincidae*	*Trachylepis*	*sulcata*	*sulcata*	Western Rock Skink	Least Concern
Lizards	*Scincidae*	*Trachylepis*	*variegata*		Variegated Skink	Least Concern
Snakes	*Colubridae*	*Boaedon*	*capensis*		Brown House Snake	Least Concern
Snakes	*Colubridae*	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern
Snakes	*Colubridae*	*Dipsina*	*multimaculata*		Dwarf Beaked Snake	Least Concern
Snakes	*Colubridae*	*Lamprophis*	*guttatus*		Spotted House Snake	Least Concern

Snakes	*Colubridae*	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Least Concern
Snakes	*Colubridae*	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern
Snakes	*Colubridae*	*Pseudaspis*	*cana*		Mole Snake	Least Concern
Snakes	*Colubridae*	*Telescopus*	*beetzii*		Beetz's Tiger Snake	Least Concern
Snakes	*Elapidae*	*Aspidelaps*	*lubricus*	*lubricus*	Coral Shield Cobra	Not listed
Snakes	*Elapidae*	*Naja*	*nivea*		Cape Cobra	Least Concern
Snakes	*Typhlopidae*	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern
Snakes	*Viperidae*	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern
Tortoises	*Testudinidae*	*Chersina*	*angulata*		Angulate Tortoise	Least Concern
Tortoises	*Testudinidae*	*Homopus*	*signatus*	*signatus*	Namaqua Speckled Padloper	Not listed
Tortoises	*Testudinidae*	*Psammobates*	*tentorius*	*subsp. ?*	Tent Tortoise (subsp. ?)	Least Concern
Tortoises	*Testudinidae*	*Psammobates*	*tentorius*	*tentorius*	Karoo Tent Tortoise	Not listed
Tortoises	*Testudinidae*	*Psammobates*	*tentorius*	*verroxii*	Verrox's Tent Tortoise	Not listed

14 ANNEX 4. LIST OF AMPHIBIANS

List of amphibians which are likely to occur in in the broad vicinity of the Dwarsrug Access Road site. Habitat notes and distribution records are based on Du Preez and Carruthers (2009), while conservation status is from the Minter et al. 2004.

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Vandijkophrynus gariepensis	Karoo Toad	Least Concern	Karoo Scrub	Widespread	High
Xenopus laevis	Common Platanna	Least Concern	Any more or less permanent water	Widespread	Very Low
Amietia fuscigula	Cape River Frog	Least Concern	Large still bodies of water or permanent streams and rivers.	Widespread	Very Low
Cacosternum namaquense	Namaqua Caco	Least Concern	Marshy areas, vleis and shallow pans	Widespread	Moderate
Cacosternum boettgeri	Common Caco	Least Concern	Marshy areas, vleis and shallow pans	Widespread	Moderate
Tomopterna tandyi	Tandy's Sand Frog	Least Concern	Nama karoo grassland and savanna	Widespread	High