

**TERRESTRIAL ANIMAL SPECIES SPECIALIST
ASSESSMENT:
KAROO DWARF TORTOISE *CHERSOBIUS BOULENGERI*
WITHIN THE KLIPKRAAL 3 WEF**



Picture credit: Bonnie Schuman EWT

PRODUCED FOR SiVEST



Simon.Todd@3foxes.co.za

First Draft – January 2023

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) – REPORTING REQUIREMENTS FOR SPECIALIST THEMES

GN 1150 of 30 October 2020: Terrestrial Animal Species Specialist Assessment Report (Very High or High Sensitivity)	Section of Report
3.1.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;	P5
3.1.2 a signed statement of independence by the specialist;	P7
3.1.3 a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
3.1.4 a description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant;	Section 2
3.1.5 a description of the mean density of observations/number of sample sites per unit area and the site inspection observations;	Section 2
3.1.6 a description of the assumptions made and any uncertainties or gaps in knowledge or data;	Section 2
3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;	Section 2
3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;	Section 3.3
3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant;	Section 3
3.1.10 a discussion on the cumulative impacts;	Section 3, Section 5
3.1.11 impact management actions and impact management outcomes proposed	Section 3, Section 5
3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and	Section 6
3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above [of GN 1150 of 30 October 2020] that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.	Section 2.4

TABLE OF CONTENTS

Table of Contents	3
List of Figures	4
Short CV/Summary of Expertise – Simon Todd	5
Specialist Declaration	7
1 Introduction	8
1.1 Scope of Study.....	8
1.2 Relevant Aspects of the Development.....	Error! Bookmark not defined.
2 Methodology.....	12
2.1 Habitat Delineation	12
2.2 Limitations & Assumptions	12
2.3 DFFE Site Verification.....	13
3 Karoo Dwarf Tortoise Species Assessment	13
3.1 Karoo Dwarf Tortoise Species Account.....	13
3.2 Habitat Suitability Assessment.....	14
3.3 Site Ecological Importance	16
3.4 Karoo Dwarf Tortoise Spatial Assessment	18
4 Impacts and Issues Identification.....	20
4.1 Identification of Potential Impacts	20
5 Assessment of Impacts on Karoo Dwarf Tortoise	20
5.1 Construction Phase Impacts on Karoo Dwarf Tortoise	21
5.2 Impacts on Karoo Dwarf Tortoises During Operation.....	22
5.3 Decommissioning Phase Impacts on Karoo Dwarf Tortoises.....	23
5.4 Cumulative Impacts on the Karoo Dwarf Tortoise.....	24
6 Conclusion & Recommendations	25
7 References	26

LIST OF FIGURES

Figure 1. Satellite image showing the location of the proposed Klipkraal 3 Wind Farm, southeast of Fraserburg.	11
Figure 2. Historical and recent distribution records for the Karoo Dwarf Tortoise according to the Virtual Museum records. The approximate location of the Klipkraal 3 WEF Site is indicated in red. ...	14
Figure 3. Dolerite ridge from within the Klipkraal 3 WEF Site considered to represent potential habitat for the Karoo Dwarf Tortoise.....	15
Figure 4. Mudstone slope from within the Klipkraal 3 WEF Site considered to represent potentially habitat for the Karoo Dwarf Tortoise.	15
Figure 5. Map of areas considered to represent potentially suitable Karoo Dwarf Tortoise habitat within the Klipkraal 3 WEF site based on ground-truthed mapping from satellite imagery.....	16

SHORT CV/SUMMARY OF EXPERTISE – SIMON TODD

 <p>3Foxes Biodiversity Solutions</p> <p>ECOLOGICAL SPECIALIST SERVICES</p> <p>Assessment/Management/Research</p>	<p>Simon Todd Pr.Sci.Nat Director & Principle Scientist C: 082 3326502 Simon.Todd@3foxes.co.za</p> <p>23 De Villiers Road Kommetjie 7975</p>	Ecological Solutions for People & the Environment
--	--	--

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).

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Nama Karoo, Succulent Karoo, Thicket, Arid Grassland, Fynbos and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 2009 – Present – Sole Proprietor of Simon Todd Consulting, providing specialist ecological services for development and research.
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.

- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town
- 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute

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.

Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent Specialist Ecological Studies of Relevance to the Current Project

- Nuweveld North, East and West WEFs. Fauna & Flora Specialist Study for EIA. Zutari 2021.
- Beaufort West PV Facility. Fauna & Flora Assessment. SiVest Environmental 2022.
- San Solar PV Facility, Kathu. Fauna & Flora Assessment. Savannah Environmental 2022.
- Soventix Phase 3 PV Facility, De Aar. Fauna & Flora Assessment. Ecologes Environmental Consultants, 2022.
- Sadawa PV Facilities, Tankwa Karoo. Fauna & Flora Assessment. Savannah Environmental 2021.
- Kotulo Tsatsi PV 1 Facility near Kenhardt. Fauna & Flora Assessment. Savannah Environmental 2021.
- Hyperion 2 PV Facility, Kathu. Fauna & Flora Assessment. Savannah Environmental 2021.

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: ____12 December 2022_____

1 INTRODUCTION

Aura Development Company (Pty) Ltd is proposing to develop the Klipkraal Wind Energy Facility 3 on a ca. 7600 ha site situated about 30km southeast of Fraserburg, within the Karoo Hoogland Local Municipality, Namakwa District Municipality, Northern Cape. The development would have a maximum output of 240MW and a maximum of 40 turbines. The proposed wind farm would make up part of a larger wind energy facility (WEF) (with associated BESS) which will be referred to as the Klipkraal WEF, consisting of up to seven (7) phases, with a combined generation capacity of up to approximately 1 400 MW.

3Foxes Biodiversity Solutions has been appointed by SiVest on behalf of Aura Development Company to undertake a terrestrial biodiversity assessment of the proposed project in terms of the Environmental Impact Assessment Regulations, 2014, as amended, including the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020). The DFFE Screening Tool indicates that the Klipkraal 3 WEF Site contains areas mapped as Medium Sensitivity for the Karoo Dwarf Tortoise *Chersobius boulengeri* (EN) and the site verification has confirmed the presence of potentially suitable habitat within the site and confirmed observations from the broader area. Consequently, in terms of the regulations, a Terrestrial Animal Species Assessment is required for the Karoo Dwarf Tortoise within the Klipkraal 3 WEF Site (also referred to as the site or study area). To these ends, this Karoo Dwarf Tortoise Species Assessment for the Klipkraal 3 WEF and associated infrastructure, addresses the potential impacts of the project on the Karoo Dwarf Tortoise and must be included in the EIA for the development and any mitigation and monitoring measures as identified, must be incorporated into the EMP for the development.

1.1 SCOPE OF STUDY

In terms of GN 320 (20 March 2020) and GN 1150 (30 October 2020) of the NEMA EIA Regulations of 2014 (as amended), prior to the commencement of a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project areas as identified by the Screening Tool. The results of the Site Verification are provided in another report, but of relevance to the current study is that the DFFE Screening Tool identified the site as having a Medium Sensitivity due to the possible presence of the Karoo Dwarf Tortoise. The site verification confirms the presence of suitable habitat for this species within the Klipkraal 3 site and hence also the medium sensitivity of the site for this species. In terms of the regulations, a Terrestrial Animal Species Impact Assessment is required when a site is confirmed as being of Medium sensitivity for a faunal species. In terms of the guidelines and minimum requirements, the Terrestrial Animal Species Impact Assessment should meet the following terms of reference:

2.1 The assessment must be undertaken by a suitably qualified taxon relevant SACNASP registered specialist aligned with the taxa identified in the report generated from the national

web based environmental screening tool on the site being submitted as the preferred development site.

2.2 The Terrestrial Animal Species Impact Assessment must include the results of a site assessment undertaken on the preferred development site.

2.3 The Terrestrial Animal Species Impact Assessment must be undertaken in accordance with the Species Environmental Assessment Best Practice Guidelines and must identify the following:

2.3.1 The species of conservation concern which were found on site;

2.3.2 The distribution, location, viability (ability to survive and reproduce in future) and detailed description of population size of the species of conservation concern identified on the preferred development site;

2.3.3 The nature and the extent of the potential impact of the proposed development on the species of conservation concern on the proposed development site;

2.3.4 The importance of the conservation of the population of the species of special concern identified on the proposed development site based on information available in national and international databases including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases;

2.3.5 The potential impact of the proposed development on the habitat of the species of conservation concern;

2.3.6 Any dynamic ecological processes occurring within the site and its surrounds that might be disrupted by the proposed development and resulting impact on the identified species of conservation concern; for example, fires in fire-prone systems;

2.3.7 Any potential impact of ecological connectivity (on site, and in relation to the broader landscape) and resulting impact on the identified species of conservation concern;

2.3.8 Buffer distances as per the Species Environmental Assessment Best Practice Guidelines used for the population of each species of conservation concern;

2.3.9 The likelihood of other threatened species, undescribed species or highly localised endemics, migratory species, or species of conservation concern, occurring in the vicinity; and

2.3.10 Identify any alternative development footprints within the preferred development site which would be of “low” sensitivity as identified by the national web based

environmental screening tool and verified through the initial site sensitivity verification.

3. The findings of the Terrestrial Animal Species Impact Assessment must be written up in a Terrestrial Animal Species Impact Assessment Report.

This report must include as a minimum the following information:

- 3.1. Contact details and curriculum vitae of the specialist including SACNASP registration number and fields of expertise;
- 3.2. A signed statement of independence by the specialist;
- 3.3. Duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;
- 3.4. A description of the methodology used to undertake the impact assessment and site inspection, including equipment and modelling used where relevant;
- 3.5. A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;
- 3.6. Areas not suitable for development, to be avoided during construction and operation where relevant;
- 3.7. Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts; and
- 3.8. Impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);
- 3.9. A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not, and any conditions to which the opinion is subjected;
- 3.10. A motivation must be provided if there were development footprints identified as per paragraph 2.3.10 above that were identified as having a “low” terrestrial animal species sensitivity and were not considered appropriate.
4. The findings of the Terrestrial Animal Impact Assessment must be incorporated into the Basic Assessment Report (BAR) or the Environmental Impact Assessment Report (EIAR), including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the assessment must be appended to the BAR or EIAR.

These Terms of Reference and reporting requirements are achieved in this study and report.

1.2 PROJECT LOCATION

The Klipkraal Wind Energy Facility 2 is part of the Klipkraal Cluster and is located approximately 30 km southeast of Fraserburg in the Northern Cape. The layout and location of the Klipkraal Wind Energy Facility 2 is illustrated below in Figure 1 and includes up to 50 potential turbine locations with a maximum output of 240 MW.



Figure 1. Satellite image showing the location of the proposed Klipkraal 3 Wind Farm, southeast of Fraserburg.

1.3 PROJECT DESCRIPTION

The Klipkraal Wind Energy Facility 3 is part of the Klipkraal Cluster and is located approximately 30 km southeast of Fraserburg in the Northern Cape. The layout and location of the Klipkraal Wind Energy Facility 3 is illustrated below in Figure 1 and includes up to 40 potential turbine locations with a maximum output of 240 MW. The estimated total permanent footprint of the Klipkraal Wind Energy Facility 3 is estimated at 120ha. The electricity generated by the proposed WEF development will be fed into the national grid via a 132kV/400kV overhead power line. A Battery Energy Storage System (BESS) will be located next to the onsite 33/132kV substation.

2 METHODOLOGY

2.1 HABITAT DELINEATION

Habitat distribution and suitability was assessed firstly in the field based on the nature and extent of potentially suitable habitat present within the site. This confirmed that there is suitable habitat present within the site and that this is of sufficient extent to support a viable local population of Karoo Dwarf Tortoises. Additional desktop mapping from satellite imagery was then used to assess the availability, distribution and extent of potential Karoo Dwarf Tortoise habitat within the Klipkraal 3 WEF Site. Such areas can be reasonably easily delineated from satellite imagery due to the specific habitat requirements of the Karoo Dwarf Tortoise. According to the IUCN 2018 Red List Assessment for this species (Hofmeyr et al. 2018), *Chersobius boulengeri* is habitat specialist that occurs in association with dolerite ridges and rocky outcrops of the Nama and Succulent Karoo. The tortoises usually take shelter under rocks in vegetated areas or in rock crevices (Boycott and Bourquin 2000), but few rocky sites over the range offer suitable retreats for the species. Populations are considered to be relatively isolated within areas of suitable habitat and movement between such patches is expected to be low. As such, suitable areas of habitat can be relatively easily recognised and mapped from satellite imagery. In addition, it is also possible to at least some degree differentiate between high-quality habitat associated with dolerite outcrops and ridges from lower-quality shale and mudstone slopes that appear to be less-favoured. The areas of suitable habitat were also investigated and noted in the field where present in order to verify the mapping results.

2.2 LIMITATIONS & ASSUMPTIONS

A number of limitations and assumptions are inherent in the study including the following:

- The presence of the Karoo Dwarf Tortoise within the areas of suitable habitat present within the site could not be directly confirmed for the current study. This species has a low detectability and may be active for as little as 10 minutes a day, making it very difficult to confirm presence and density.
- In order to ensure a conservative approach, all areas with suitable habitat are assumed or treated as if they have Karoo Dwarf Tortoises present. Clearly this is not the case as not all areas of suitable habitat would be occupied. As such, the assessment is designed to assess the worst-case scenario with regards to the distribution of the tortoise within the site.
- It is assumed that there are no Karoo Dwarf Tortoises resident in areas outside of the rocky hills habitat typically associated with this species. This is considered to be a reasonable assumption as this species is known to be strongly associated with rocky hills and does not occur within areas without sufficient shelter.

2.3 DFFE SITE VERIFICATION

Government Notice No. 320, dated 20 March 2020, includes the requirement that an Initial Site Sensitivity Verification Report must be produced for a development footprint. The outcomes of the Site Verification Report determine the level of assessment required for the site (including that a Karoo Dwarf Tortoise species assessment be undertaken). The Site Sensitivity Verification Report for the Klipkraal 3 site for Terrestrial Ecology is included as a separate study and confirms that the Klipkraal site has suitable Karoo Dwarf Tortoise habitat and that a full assessment is required.

3 KAROO DWARF TORTOISE SPECIES ASSESSMENT

3.1 KAROO DWARF TORTOISE SPECIES ACCOUNT

The majority of the following species account is taken from the SANBI species account for *Chersobius boulengeri* as well as various scientific publications on this species including Loehr and Keswick (2022), Loehr et al. (2021), the IUCN Red List assessment for this species (Hofmeyr et al. 2018).

Chersobius boulengeri occurs in association with dolerite ridges and rocky outcrops of the southern Succulent and Nama Karoo biomes, and peripherally in the Albany Thicket biome in the southeast, at altitudes of approximately 800 to 1,500 m. The vegetation usually consists of dwarf shrubland that often contains succulent and grassy elements. The tortoises usually take shelter under rocks in vegetated areas or in rock crevices. However, these are quite specific in terms of their requirements with the result that suitable retreats for the species are not common. Females nest in summer and have single-egg clutches. No information exists on age at maturity and longevity, but based on the life history of *Chersobius signatus* (Loehr et al. 2007), female *C. boulengeri* are expected to mature at 10-12 years of age.

Due to their strong habitat association, populations are isolated on rocky outcrops with specialized vegetation. Recent surveys for this species indicate that many populations have disappeared and that population numbers have declined significantly (Hofmeyr et al. 2018). The reasons for the current population decline are not well known. However presumed threats to this species include habitat degradation, drought and agricultural overgrazing as well as climate change and increased levels of predation by crows in particular.

The motivation for the red-listing of *Cherobius boulengeri* as Endangered under criterion A4ace, based on an estimate of a reduction in population size of approximately 30% over the past 25 years (one generation), and a projected reduction of at least another 30% over the next 50 years (two generations), for a total reduction over three generations of approximately 60%.

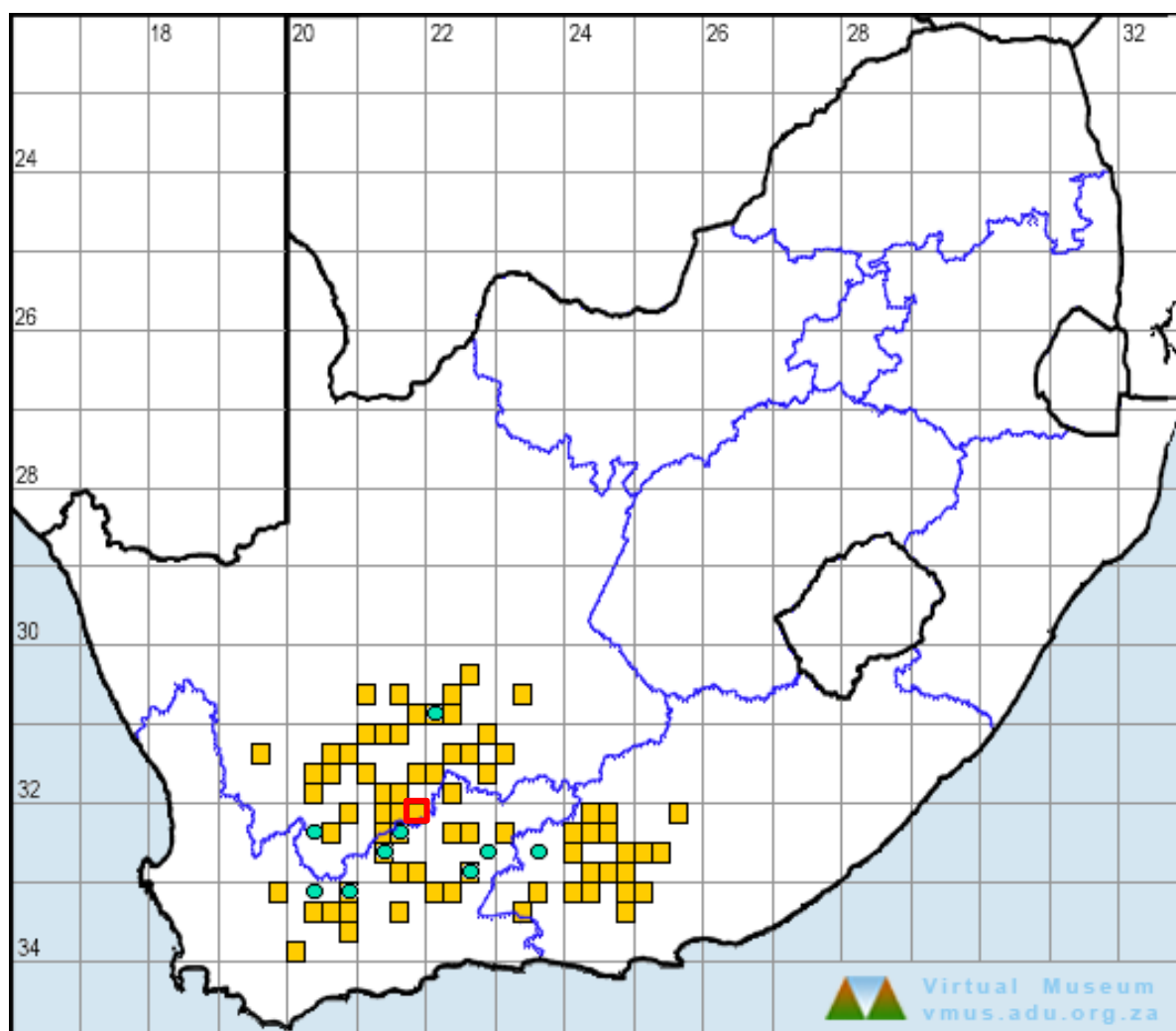


Figure 2. Historical and recent distribution records for the Karoo Dwarf Tortoise according to the Virtual Museum records. The approximate location of the Klipkraal 3 WEF Site is indicated in red.

3.2 HABITAT SUITABILITY ASSESSMENT

There are not any extensive tracts of potentially suitable habitat for the Karoo Dwarf Tortoise within the Klipkraal 3 WEF site, although there are some mudstone slopes and localised dolerite outcrops present that are considered moderately suitable (Figure 3, **Error! Reference source not found.**). The areas of habitat have been split into areas of dolerite hills considered to represent favourable habitat (Figure 3) and areas of shale and mudstone hills with less rock cover considered to be less favourable/sub-optimal (**Error! Reference source not found.**) and hence less likely to harbour Karoo Dwarf Tortoise. The total extent of highly favourable habitat within the site is estimated at 89 ha, while the areas of suboptimal habitat is estimated at 240 ha (see Figure 5). Under the layout provided for the assessment, there are no turbines within the highly favourable areas and it would only be a few roads and underground cabling routes that would impact some of the less favourable areas of potential habitat.



Figure 3. Dolerite ridge from within the Klipkraal 3 WEF Site considered to represent potential habitat for the Karoo Dwarf Tortoise.



Figure 4. Mudstone slope from within the Klipkraal 3 WEF Site considered to represent potentially habitat for the Karoo Dwarf Tortoise.

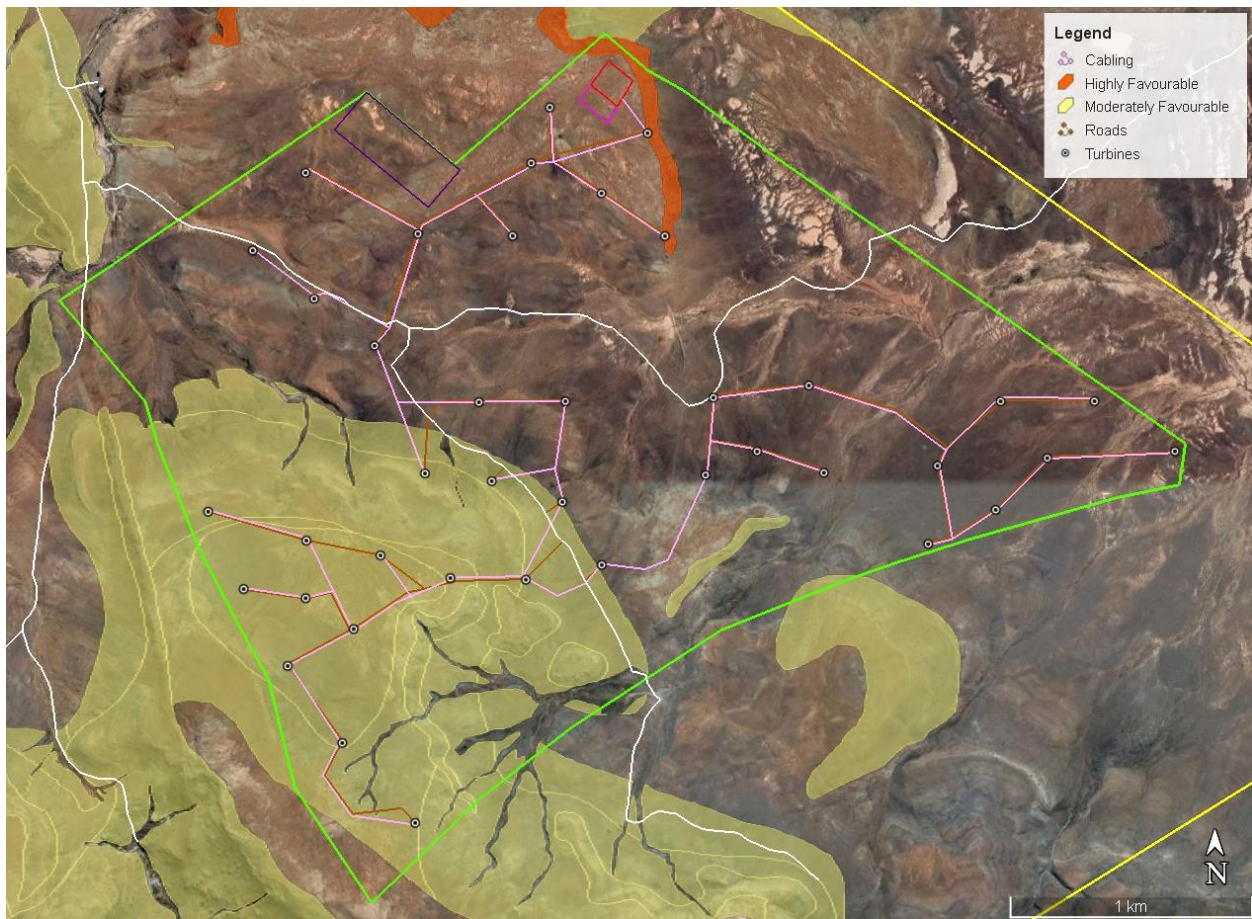


Figure 5. Map of areas considered to represent potentially suitable Karoo Dwarf Tortoise habitat within the Klipkraal 3 WEF site based on ground-truthed mapping from satellite imagery.

3.3 SITE ECOLOGICAL IMPORTANCE

The Terrestrial Animal/Plant Species Protocols require specialists to identify:

- the nature and the extent of the potential impact of the proposed development on species of conservation concern occurring on the proposed development site;
- the potential impact of the proposed development on the habitat of the species of conservation concern; and
- any alternative development footprints within the preferred development site which would be of 'low' sensitivity as identified by the screening tool and verified through the site sensitivity verification.

In order to spatially identify the different areas of importance for a species for a proposed development site and to facilitate transparent and comparable reporting of the potential impacts of development, a standardised metric for identifying site-based ecological importance for species, in relation to a proposed project with a specific footprint/ project areas of influence (PAOI) and suite of anticipated activities. It allows for rapid spatial inspection and evaluation of impacts

of proposed developments within the context of on-site habitats and Species of Conservation Concern (SCC), and also facilitates integration of inputs from different specialist studies. This process is necessary because the screening tool evaluates 'environmental sensitivity' at a larger scale than that of a proposed development site and frequently includes modelled data that require field verification. This assessment relies on the data collected during the necessary specialist surveys to provide a current evaluation of the on-site habitat conditions. This assessment does not replace the output of the screening tool but is more specific to the proposed development footprint/PAOI and proposed project activities. Where the site-specific assessment produces lower or higher Site ecological Importance (SEI) classification than the 'environmental sensitivity' output of the screening tool for that particular site, it is the responsibility of the specialist to provide a clear and defensible justification for the difference.

The SEI is considered to be a function of the biodiversity importance (BI) of the receptor (e.g., species of conservation concern, the vegetation/fauna community or habitat type present on the site) and its resilience to impacts (receptor resilience [RR]) as follows:

- $SEI = BI + RR$

BI in turn is a function of conservation importance (CI) and the functional integrity (FI) of the receptor as follows:

- $BI = CI + FI$

Given the IUCN status of the Karoo Dwarf Tortoise is Endangered under criterion A4ace and, the **Conservation Importance** of the site is considered to be **High**. As the important rocky hills habitat has experienced very little direct transformation to date, it is considered to have **High Functional Integrity**. As the CI and FI are both High, the BI of the site is considered to be High as well. The habitat within the site is considered to have a Medium resilience. Thus, the overall **SEI** of suitable habitat for the Karoo Dwarf Tortoise within the site **is considered to be High** (Figure). In terms of the species assessment guidelines, the implications for the High SEI rating for suitable Karoo Dwarf Tortoise habitat at the site indicates that the following general measures are considered appropriate for these areas - *“Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.”*

It is not possible to provide a reliable estimate of the population size within the Klipkraal 3 WEF site. Firstly, there are no reliable estimates of population density for this species that can be extrapolated across the range and secondly, the reported population declines appear to be widespread with the result that it is not possible to ascertain what proportion of the suitable habitat within the site would actually be occupied. However, in order to assess the relative importance of the area impacted by the Klipkraal 3 WEF, the whole of the Klipkraal 3 site has an area of 798

ha (7.98 km²) which compares to the Area of Occurrence of this species of 13 5090 km². The Klipkraal 3 WEF site therefore occupies less than 0.01% of the Area of Occurrence of this species and assuming a similar level of occupancy across the range, this would amount to less than 0.01% of the population. Assuming that the roads and underground cabling result in a permanent footprint of 10m wide the maximum footprint (habitat loss) within areas mapped as potentially suitable for the Karoo Dwarf Tortoise would be less than 7ha located largely within areas deemed to be of low suitability for this species. Direct habitat loss within the Klipkraal 3 site would thus amount to about 3% of the mapped suitable habitat present within the site (232 ha), with the result that direct habitat loss would be minimal and is not considered a significant threat resulting from the development.

3.4 KAROO DWARF TORTOISE SPATIAL ASSESSMENT

The overall direct (primary) extent of habitat loss within the areas identified as being important to the Karoo Dwarf Tortoise is conservatively estimated at approximately 7 ha, which is a small proportion of the available habitat within the site and the wider area. There are however two turbines located marginally into an area mapped as high sensitivity for this species (Turbine 4 & Turbine 17) and which should be moved slightly to avoid impact on the sensitive area. An indirect/secondary influence from the proposed wind farm could result from the use of any overhead cabling and associated pylons by crows for nesting purposes. This represents a potential secondary impact because crows frequently prey on tortoises, especially when breeding (Joseph *et al.* 2017). Given the low reproductive rate of the Karoo Dwarf Tortoise, even relatively low levels of predation would be likely to have significant negative impacts on local tortoise populations. It is therefore recommended that underground cabling is used whenever possible and secondly where this is not possible that any pylons present are designed in a manner which discourages the use of the pylons by crows for nesting. The Project Area of Influence (PAOI) is therefore considered to extend no more than 1-2km from the roads and cabling routes within suitable habitat for the Karoo Dwarf Tortoise.

In terms of the noise and movement generated by the turbines, this does not appear to be a significant issue for tortoises generally as tortoises are one of the few groups of reptiles that have been specifically studied with regards to their responses to wind energy development and no significant negative impacts have been detected within population's resident on wind farms (Agha *et al.* 2015, Lovich *et al.* 2011). Consequently, some minor habitat loss for the Karoo Dwarf Tortoise and potentially increased levels of predation where overhead cabling is used are likely to be the only likely avenues of potential impact resulting from the wind farm development. Specific attention to potential habitat loss for this species was paid during the sensitivity mapping and all areas which represent highly favourable habitat for this species have been mapped as no-go areas for turbines and have been entirely avoided by turbines, with minimal impact by access roads and cabling.

In order to mitigate potential negative impacts of the wind farm development on the Karoo Dwarf Tortoise through avoidance and changes to the layout of the development, the following avoidance and mitigation should be implemented:

- Areas of suitable Dwarf Tortoise habitat that have been mapped as having a High SEI should be avoided by the wind farm wherever possible. Under the layout assessed, there are no turbines in any areas considered to be highly favourable for the Karoo Dwarf Tortoise.
- Any overhead cabling with associated pylons within and near (within 1km) areas of suitable habitat should be designed so as to discourage crows from nesting on the structures.
- Crow nests should be removed from the pylons within and near (within 1 km) mapped areas of suitable habitat regularly.

As a result of the implementation of the above avoidance mitigation, the overall development footprint of the wind farm within Karoo Dwarf Tortoise habitat has been reduced to a minimal amount considered to represent a low direct impact potential.



Figure 6. SEI for the Karoo Dwarf Tortoise within the Klipkraal 3 WEF Site.

4 IMPACTS AND ISSUES IDENTIFICATION

4.1 IDENTIFICATION OF POTENTIAL IMPACTS

The development of the Klipkraal 3 WEF would result in a number of potential impacts on the Karoo Dwarf Tortoise during the construction and operational phases of the development. During construction, the major impact would likely be habitat loss and disturbance while during the operational phase, direct disturbance would be reduced but there would still be some potential indirect impact due to increased crow predation. The following impacts are identified as the major impacts that are likely to be associated with the development of the Klipkraal 3 WEF on the Karoo Dwarf Tortoise and their associated habitat.

Impact 1. Construction-Phase Impact on the Karoo Dwarf Tortoise

During construction, the increased levels of traffic within as well as to and from the site would likely increase collision risk with tortoises. Furthermore, the construction activities would result in some habitat loss and degradation within areas of suitable habitat.

Impact 2. Operational-Phase Impact on the Karoo Dwarf Tortoise

During operation, impacts would likely be reduced, but occasional anthropogenic disturbance associated with maintenance activities within the wind farm would potentially impact the Karoo Dwarf Tortoise. In addition, any overhead power lines within the facility could increase the abundance of corvids within the site, resulting in increased Karoo Dwarf Tortoise predation.

Impact 3. Cumulative Impact on Karoo Dwarf Tortoise

The development would contribute to cumulative impacts on the Karoo Dwarf Tortoise due to habitat loss and habitat degradation. The additional contribution of the wind farm to habitat loss would however be low as there would be significant avoidance of all potential Karoo Dwarf Tortoise habitat present within the site. It is possible that there would be some habitat degradation within Karoo Dwarf Tortoise habitat due to the presence of the turbine access roads, but a more likely source of habitat degradation would be from increased levels of crow predation in areas in proximity to any overhead power lines within the site. The extent over which this latter effect would take place is considered to be relatively limited as it is likely that the majority of cabling within the facility would be underground.

5 ASSESSMENT OF IMPACTS ON KAROO DWARF TORTOISE

An assessment of the likely significance of the impacts identified above is made below for the Klipkraal 3 WEF on the Karoo Dwarf Tortoise.

5.1 CONSTRUCTION PHASE IMPACTS ON KAROO DWARF TORTOISE

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL BEFORE MITIGATION							SIGNIFICANCE			RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL AFTER MITIGATION							SIGNIFICANCE		
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S	E		P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S		
Construction Phase																						
Construction Phase impact on the Karoo Dwarf Tortoise	Impacts on Karoo Dwarf Tortoise as a result of construction phase activities, including vehicle collisions, disturbance and habitat loss.	2	2	2	2	2	2	20	-	Low	See Below.	2	2	2	2	2	2	10	-	Low		
Recommended Mitigation Measures	1) No turbines to be placed in areas mapped as being of high SEI for the Karoo Dwarf Tortoise. 2) Any overhead grid lines with associated pylons required within the facility should be of a design that discourages the use of the pylons for nesting by crows. 3) All vehicles should adhere to a low-speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h. 4) Construction staff should remain within the construction footprint and access routes and should not be allowed to wander into the veld. 5) No fauna including tortoises should be disturbed or removed from the veld. 6) No holes or trenches should be left open for extended periods as tortoises may fall in and become trapped. Trenches should have soils ramps present that allow for tortoises and other fauna to escape. Holes should also be checked regularly for tortoises and other fauna that may have fallen in. 7) Search and Rescue before construction clearing of areas of high-quality habitat withing the development footprint as identified and mapped during a preconstruction walk-through of the development footprint.																					

5.2 IMPACTS ON KAROO DWARF TORTOISES DURING OPERATION

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL BEFORE MITIGATION							SIGNIFICANCE		RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL AFTER MITIGATION							SIGNIFICANCE	
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S
Operational Phase																				
Operational Phase impact on the Karoo Dwarf Tortoise	There would potentially be impact on Karoo Dwarf Tortoises at the site during operation due to operational activities (vehicles/disturbance) as well as predation by crows.	2	2	2	2	3	2	22	-	Low	See Below.	2	2	2	2	3	1	11	-	Low
Recommended Mitigation Measures	1) Crow nests along any overhead lines within the site, identified during annual surveys and located within 1km of suitable Karoo Dwarf Tortoise habitat should be removed. 2) Apply additional mitigation in consultation with a terrestrial ecologist to prevent roadkill mortalities and / or discourage predation of Karoo Dwarf Tortoise by crows if monitoring demonstrates these aspects to be the cause of persistent impacts on this species. 3) Conduct annual surveys along any overhead lines within the site to census crow nesting sites, and log tortoise carcasses observed along the powerline and especially under any crow nests if present. 4) If any Dwarf Tortoise mortalities within the site are confirmed it is recommended that structured monitoring of the local Dwarf Tortoise population within the site is initiated using mark-recapture and similar techniques to monitor population stability and structure. Should further declines become evident, then the wind farm should contribute towards active conservation of this species within the site and in the broader area.																			

5.3 DECOMMISSIONING PHASE IMPACTS ON KAROO DWARF TORTOISES

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL BEFORE MITIGATION							SIGNIFICANCE		RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL AFTER MITIGATION							SIGNIFICANCE	
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S
Decommissioning Phase																				
Decommissioning Phase impact on the Karoo Dwarf Tortoise	Impacts on Karoo Dwarf Tortoise as a result of decommissioning phase activities, including vehicle collisions, disturbance.	2	2	2	2	2	2	20	-	Low	See Below.	2	2	2	2	2	1	10	-	Low
Recommended Mitigation Measures	1) All vehicles should adhere to a low-speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h. 2) Decommissioning staff should remain within the power line footprint areas and access routes and should not be allowed to wander into the veld. 3) No fauna including tortoises should be disturbed or removed from the veld. 4) No holes or trenches should be left open for extended periods as tortoises may fall in and become trapped. Trenches should have soils ramps present that allow for tortoises and other fauna to escape. Holes should also be checked regularly for tortoises and other fauna that may have fallen in. 5) No litter or other material from the power line or decommissioning activity should be left lying around as tortoises and other fauna may become trapped in fibres, plastic and other waste material.																			

5.4 CUMULATIVE IMPACTS ON THE KAROO DWARF TORTOISE

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL BEFORE MITIGATION							SIGNIFICANCE		RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL AFTER MITIGATION							SIGNIFICANCE	
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S
Decommissioning Phase																				
Cumulative impact on the Karoo Dwarf Tortoise	Cumulative impacts on the Karoo Dwarf Tortoise as a result of habitat loss, disturbance and increased predation and poaching.	2	2	2	2	3	2	22	-	Low	See Below.	2	2	2	2	3	1	11	-	Low
Recommended Mitigation Measures	1) Rehabilitation of disturbed areas and annual monitoring and management of erosion and alien vegetation along the site access roads and turbine hard stands. 2) Annual monitoring and action to ensure that crow nests are removed from any overhead power lines where present.																			

6 CONCLUSION & RECOMMENDATIONS

The Klipkraal 3 WEF Site has very little habitat present considered to be highly favourable for the Karoo Dwarf Tortoise. There are however some low mudstone hills present, parts of which offer potential habitat for the Karoo Dwarf Tortoise. As these hills are quite extensive within the site, it would not be possible to avoid these areas under the assessed layout. Consequently, some direct habitat loss for the Karoo Dwarf Tortoise within these areas is inevitable but has been estimated at no more than 7ha. This is insignificant when considered in context of the range of this species. Direct habitat loss is therefore not considered to represent a significant source of potential impact associated with the Klipkraal 3 WEF Site on the Karoo Dwarf Tortoise.

During operation, there is a risk that any pylons associated with overhead lines would attract crows and increase the local density of crows, thereby increasing predation levels on the Karoo Dwarf Tortoise. Given the low reproductive rate of the Karoo Dwarf Tortoise, even relatively low levels of predation would be likely to have significant long-term negative impacts on local tortoise populations. It is therefore recommended that the pylons are designed in a manner which discourages the use of the pylons by crows for nesting, and that crow nests are removed regularly from pylons within and near (1km) suitable Karoo Dwarf Tortoise habitat as mapped in this assessment.

Provided that the various mitigation and avoidance measures as suggested are implemented, the overall long-term impact of the grid connection development on Karoo Dwarf Tortoises and associated habitat is likely to be low and hence considered acceptable.

Impact Statement

The direct impact of the Klipkraal 3 WEF Site on the Karoo Dwarf Tortoise habitat would be low and is considered acceptable. Indirect impacts, particularly predation by crows would potentially represent a more persistent, long-term threat to the Karoo Dwarf Tortoise population within the site. However, with the implementation of the suggested mitigation and avoidance measures, it is likely that this impact can be reduced to an acceptable, low level. Consequently, the development of the Klipkraal 3 WEF Site is considered acceptable with the implementation of the suggested avoidance and monitoring as indicated and should be allowed to proceed with regards to potential impacts on the Karoo Dwarf Tortoise.

7 REFERENCES

- Dean, W.R.J., Seymour, C.L. & Joseph, G.S. 2018. Linear structures in the Karoo, South Africa, and their impacts on biota. *African Journal of Range & Forage Science* 35: 223-232.
- Joseph, G.S., Seymour, C.L. & Foord, S.H. 2017. The effect of infrastructure on the invasion of a generalist predator: Pied Crows in southern Africa as a case-study. *Biological Conservation* 205: 11-15.
- Hofmeyr, M.D., Loehr, V.J.T., Baard, E.H.W. and Juvik, J.O. 2018. *Chersobius boulengeri*. The IUCN Red List of Threatened Species 2018: e.T170521A115656360. <https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T170521A115656360.en>. Downloaded on 20 July 2022.
- Loehr, V.J.T and Keswick, T. 2022. Structure and projected decline of a Karoo dwarf tortoise population. *Journal of Wildlife Management* 2022: 1–13.
- Loehr, V.J.T, Keswick, T., Reijnders, M.A.D.E. and Zweers, I.M. 2021. High-Level Inactivity Despite Favorable Environmental Conditions in the Rock-Dwelling Dwarf Tortoise *Chersobius boulengeri*. *Herpetologica* 77(3): 232–238.
- South African National Biodiversity Institute (SANBI). 2020. *Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa*. South African National Biodiversity Institute, Pretoria. Version 1.2020.