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Terrestrial Faunal Impact Assessment –Hartenbos Hills Garden Estate, Erf 3122, Mossel Bay

Compiled for: Cape Environmental Assessment Practitioners (Pty) Ltd (Cape EAPrac)

Project name: Hartenbos Hills Garden Estate, Erf 3122, Mossel Bay, Western Cape Province

Applicant: ATKV Sake (Pty) Ltd

31 October 2022

DECLARATION OF INDEPENDENCE

In terms of Chapter 5 of the National Environmental Management Act of 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2014, specialists involved in Environment Assessment Processes must declare their independence and provide their contact details, relevant experience, and a curriculum vitae.

I, Jonathan F. Colville, as the appointed independent specialists, do hereby declare that I am financially and otherwise independent of the client and their EAP, and that all opinions expressed in this document are my own and based on my scientific and professional knowledge, and available information.

Jonathan F. Colville

ABRIDGED CURRICULUM VITAE

Jonathan Colville
Qualifications: **PhD (Zoology):** University of Cape Town, 2009; **Postdoctoral Research Fellowship:** South African National Biodiversity Institute, 2009-2013.

SACNASP Registration No: 134759 (Ecological Science (Professional Natural Scientist)).

Experience: I have over fourteen years post-PhD experience in the fields of terrestrial ecology, including investigating the spatial patterns of South Africa's animal and plant diversity, with a particular focus on invertebrates. Between 2009 and 2019, I was involved with the South African National Biodiversity Institute's (SANBI) Biodiversity, Research, Assessment and Monitoring Division (BRAM) undertaking ecological research on South Africa's insect and plant diversity. Since 2020 I have been working as a specialist faunal consultant for EIAs and conservation projects. *See copy of my CV attached as Appendix-1 to this report.

CONDITIONS PERTAINING TO THIS REPORT

The content of this report is based on my best scientific and professional knowledge, and available information. I reserve the right to modify the report in any way deemed fit should new, relevant, or previously unavailable or undisclosed information become known to me from on-going research or further work in this field, or pertaining to this investigation, and will inform Cape EAPrac accordingly. This report must not be altered or added to without the prior written consent of myself. This also refers to electronic copies of the report, which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based

on this report must refer to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

TABLE OF CONTENTS

1. INTRODUCTION

Cape EAPrac has been engaged by ATKV Sake (Pty) Ltd to undertake an Environmental Impact Assessment for a residential development on Erf 3122 (Mossel Bay). Part of this assessment includes a specialist impact assessment for terrestrial animal species that were identified by the screening tool (18/08/2022) as of high Sensitivity.

In the past nine years, four faunal assessments have been undertaken for Erf 3122.

- An early faunal assessment by Karin van der Walt of Strategic Environmental Focus (van der Walt, 2013) provided the first detailed faunal assessment for Erf 3122. This report both confirmed and concluded a high probability of several faunal species of conservation concern occurring at Erf 3122. However, it felt that after mitigation the proposed development would not have a '*significant impact on the fauna within the area*'.
- Five years after this, Simon Todd of 3Foxes Biodiversity Solutions (Todd, 2018) provided a second comprehensive faunal scoping and site sensitivity assessment for Erf 3122. This report concluded that from a faunal perspective, the project site was of '*generally poor condition*', the surrounding area was mostly '*transformed*', and that impact on the fauna would be '*low to moderate after mitigation*'.
- Both van der Walt (2013) and Todd's (2018) assessment involved field site surveys and a desktop study.
- More recently, the lepidopterist Dave Edge of Dave Edge & Associates undertook a single taxon assessment for the butterfly *Aloeides trimeni southeyae* (Edge, 2021). After two site surveys and several reports, Dave Edge proposed that a butterfly reserve be created on the far northern area of Erf 3122 as a conservation priority for local populations of *A. t. southeyae*.
- In 2021, Marius van der Vyver of Chepri (Pty) Ltd, undertook a faunal assessment through a desktop study that primarily focussed on the four bird and one invertebrate species of conservation concern (SCC) flagged by the online screening tool (van der Vyver, 2021). This desktop assessment concluded that the development impact would be '*high*' and that the habitat of Erf 3122 is '*optimal*' for the five faunal SCC flagged and recommended that a faunal impact assessment be undertaken.
- The impact and significance findings of van der Vyver (2021) contrasts with the findings of the earlier faunal assessments by van der Walt (3013) and Todd (2018) listed above, and with the findings of the botanical and terrestrial biodiversity assessment reports (Helme, 2016; McDonald, 2022).

The following faunal SCC were flagged by the screening tool and considered in this impact assessment:

Invertebrates:

- **Orthoptera**:
  - Medium Sensitivity: *Aneuryphymus montanus* (Yellow-winged Agile Grasshopper)

Avifauna:

  - High Sensitivity: *Circus ranivorus* (African Marsh Harrier)
  - High Sensitivity: *Neotis denhami* (Denham's Bustard)
  - Medium Sensitivity: *Afrotis afra* (Southern Black Korhaan)

- High/Medium Sensitivity: *Bradypterus sylvaticus* (Knysna Warbler)
- High Sensitivity: *Polemaetus bellicosus* (Martial Eagle)

Mammals:

- Medium Sensitivity: *Sensitive species 5*
- Medium Sensitivity: *Sensitive species 8*

2. TERMS OF REFERENCE

I was appointed by Cape EAPrac on 26 September 2022 to conduct an impact assessment, including a desktop study and site visit to assess the possibility of the occurrence of the seven faunal SCC and the availability of suitable habitat for these at the project site. Based on the information obtained from these two phases, an assessment of the nature and the extent of the potential impacts of the proposed development on the populations of the faunal SCC located within the project area would be undertaken as stipulated in the Government Gazette, No. 43855 (Published in Government Notice No. 1150) of 30 October 2020: '*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species*' and following SANBI's (2020) '*Guidelines for the Implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for Environmental Impact Assessments In South Africa*'.

1. Carry out a desktop study to determine if any of the faunal SCC have been recorded at or near the project area and to ascertain their habitat requirements.
2. Conduct a site visit of the project area to assess the physical and biological characteristics of the site with regards to habitat suitability and sensitivity for the faunal SCC.
3. Estimate of the nature and the extent of the potential impacts of the proposed development on the populations of the faunal SCC located within the project area, including project (preferred) alternative (as defined in Figure 1) and a 'No-go' option.
4. Place these findings within the context of the previous faunal assessments for Erf 3122.
5. Provide potential mitigation measures to reduce the impacts of the development on the faunal SCC.
6. Provide a terrestrial animal species impact assessment report detailing the findings of the desktop study and site inspection and including a reasoned opinion, based on the findings of the specialist assessment process, regarding the acceptability or not of the development and if the development should receive approval or not.

3. METHODOLOGY

3.1 DESKTOP STUDY

- Distributional records for invertebrate SCC were extracted from digitized databases of several South African museums (e.g., Iziko Museum of South Africa, Ditsong National Museum of Natural History, South African National Collections of Insects). Online resources, such as the IUCN Red List of Threatened Species (https://www.iucnredlist.org/), the Orthoptera Species File Online (http://orthoptera.speciesfile.org/HomePage/Orthoptera/HomePage.aspx), LepiMAP

(https://vmus.adu.org.za/), and iNaturalist (https://www.inaturalist.org/) were also consulted for information on SCC's geographic distributions and habitat requirements.

- The Virtual Mueum of African Mammlas (MammalMap; https://vmus.adu.org.za/) was consulted for distributional records for South Africa's mammals.
- Distributional records from the Southern African Bird Atlas Project (SABAP2 data (http://sabap2.birdmap.africa/)) for the bird SCC were examined. Online resources, such as the IUCN Red List of Threatened Species (https://www.iucnredlist.org/) were also consulted for information on the bird SCC's geographic distributions and habitat requirements. Furthermore, collaboration during the site visit and compiling this report was undertaken with avifaunal specialists at Birding Africa (Callan Cohen). Callan Cohen (Director of Birding Africa) has extensive knowledge of Cape birds and is a recognised international expert on African birds. He has a PhD in Ornithology from the University of Cape Town where he is a Research Associate of the FitzPatrick Institute of African Ornithology. He has co-authored two books on South African birds and contributed to five others, including the Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.*, 2015). He has over 30 years of experience of bird field surveys.
- Distributional records from FrogMap (http://frogmap.adu.org.za/), an atlas of African frogs, was also examined.
- Published information on all faunal SCC were also investigated to further assess their distribution range, ecology, habitat, and any life history requirements.
- Methodology used to assess possible impacts from the proposed development activities follows Appendix-1.
- No modelling was required.

3.2 FIELD SITE VISIT

- The project area (Figure 1) was surveyed on foot on the 29 September 2022 to assess faunal habitat sensitivity and quality, in terms of the type and amount of natural vegetation remaining. The extent of disturbance that the project area has experienced, in terms of changes to its vegetation and physical properties (e.g. soil) was also considered.
- Andrew Morton (Chairman of the Lepidopterists Society of the Western Cape) participated in the site inspection and in searching and assessing habitat for butterfly SCC.
- Season: Spring.
- Duration: ~ 6 hrs.
- Areas at and around selected points were investigated across the project area and photographed (Figures 4 - 22).
- At, or near each photograph site the surrounding habitat was characterised, photographs were taken of the surrounding area, and the likelihood of any of the SCC being present was assessed.
- In additional to visual searching, sweep netting (SANBI, 2020) using an insect net was undertaken at selected points for the Orthoptera SCC.
- Seasonal Relevance:
    - For the invertebrate SCC spring to summer is an ideal time for detection of these species (Brown, 1960a; Hochkirch *et al.*, 2018; Mecenero *et al.*, 2013; South African National Biodiversity Institute (SANBI), 2020)

- Late September is an appropriate time for field detection of the avifaunal SCC, as it overlaps with the breeding season of the fynbos breeding species. Surveys for breeding pairs of Black Harrier are best undertaken in spring (September – October). Although Black Harriers are not migratory, they can show seasonal movements.

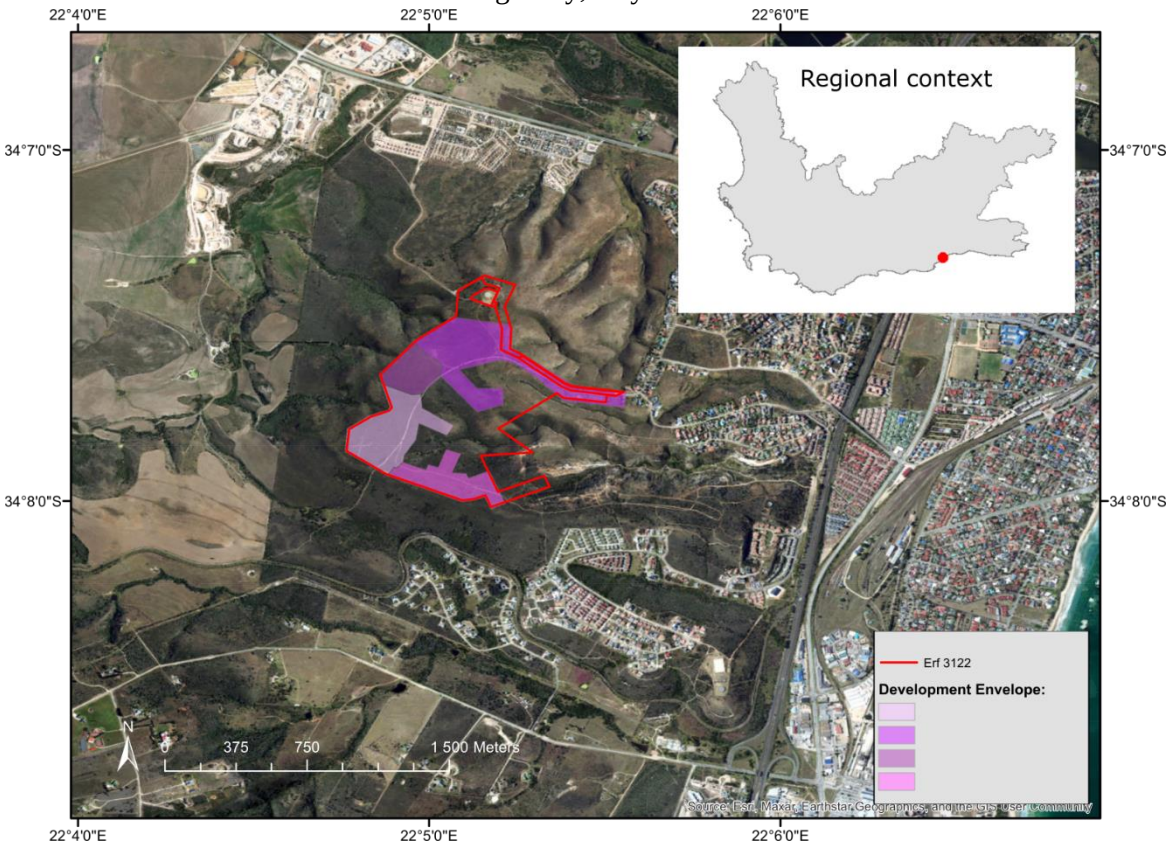

Figure 1: The proposed project development envelope within Erf 3122, Mossel Bay, Western Cape Province. Several sides of the project area abut areas of natural vegetation and are connected through natural drain lines and watercourses.

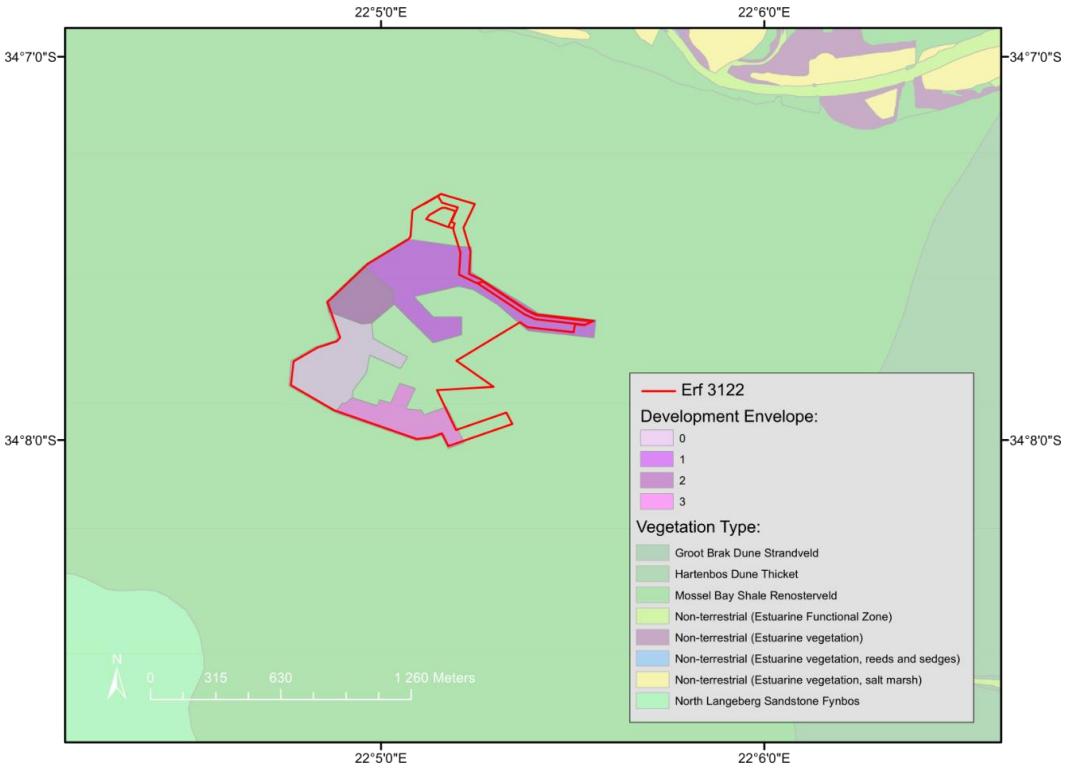

Figure 2: The proposed development envelope in relation to vegetation types (SANBI, 2018; Skowno *et al.*, 2019).

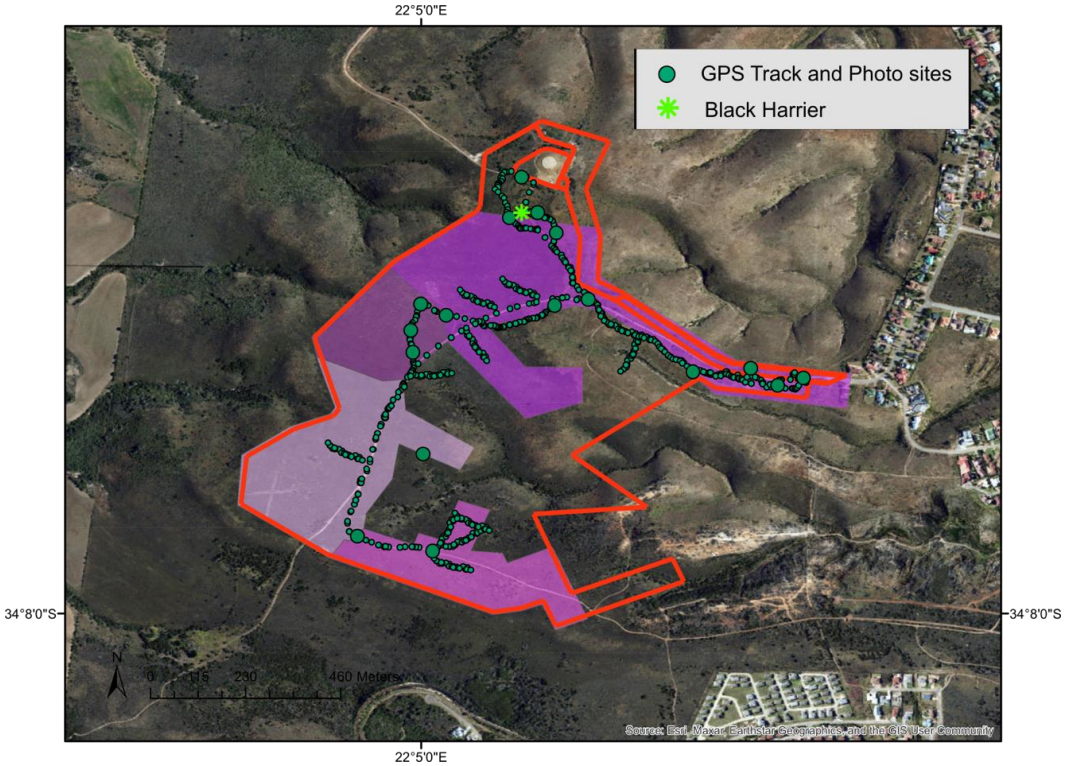

Figure 3: The GPS track walked by specialists on 29 September 2022, showing photo sites and Black Harrier siting.

4. RESULTS

4.1 ASSUMPTIONS AND LIMITATIONS

- It is assumed that all third-party information used (e.g. GIS data and species historical records) was correct at the time of generating this report.
- A site visit was undertaken during spring (late September) on a warm and sunny day. Undertaking a site visit in spring is an ideal time to detect most of the listed faunal SCC at the project site.

4.2. DESKTOP STUDY

The main vegetation type of the project area following SANBI (2018) and Skowno *et al.* (2019) is:

- Mossel Bay Shale Renosterveld (Critically Endangered (CR)).
- See botanical impact assessment by Dave McDonald for details on vegetation type and structure found at the project site (McDonald, 2022).

4.2.1 INVERTEBRATE SPECIES OF CONSERVATION CONCERN (SCC)

Orthoptera:

Aneuryphymus montanus (Brown 1960) Yellow-winged Agile Grasshopper

- This species of grasshopper is endemic to South Africa and has an IUCN Red List Category and Criteria of **Vulnerable** B2ab (iii,v) (Hochkirch *et al.*, 2018).
- Within South Africa, the species has a broad distribution occurring across mountainous habitats of the "Cape Region" from the north-western winter-rainfall areas near Clanwilliam, eastwards until just before East London (Brown, 1960b). The species appears to be associated with several fynbos vegetation types (e.g., Leipoldtville Sand Fynbos, Kogelberg Sandstone Fynbos) and "south-facing cool slopes" (Kinvig, 2005).
- It has a large estimated extent of occurrence of 172463km^2 and its estimated geographic range overlaps the project area (Bazelet and Naskrecki, 2014).
- The species has not been historically recorded from near the project area; the closest known record is approximately 86kms northwards for a collection record from South Swartberg Sandstone Fynbos.

4.2.2 AVIFAUNAL SPECIES OF CONSERVATION CONCERN (SCC)

Avifauna:

Circus ranivorus (Daudin, 1800) African Marsh Harrier

- This species of harrier is endemic to Africa and has an Regional Red List Status of **Endangered** and in the global context an IUCN Red List Category and Criteria of **Least Concern** (BirdLife International, 2016; Taylor et al., 2015).
- This species is associated with aquatic habitats and often nests in extensive marshes (Taylor et al. 2015). Prey included rodents, as well as birds and amphibians.
- This species has been recorded from the general area of the site, but the site lacks the extensive marshes needed for nesting and prolonged foraging of this species. It is possible that the species occasionally visits but the site is considered of low importance for this species.

Neotis denhami (Children & Vigors, 1826) Denham's bustard

- This species of bustard is endemic to Africa and has an Regional Red List Status of **Vulnerable** however in the global context an IUCN Red List Category and Criteria of **Near-Threatened** (BirdLife International, 2022a; Taylor *et al.*, 2015).
- This species inhabits and breeds in open vegetation types in this area of the South Coast (Taylor et al., 2015). It can also occur in recovering vegetation that has been previously disturbed. Denham's Bustard show local movements and are more common as breeders after fires have made the vegetation more open.
- The two earlier reports by van der Walt and Simon Todd's report say that they recorded this SCC on site. Further, the "Ludwig's Bustard" recorded by van der Walt (2013) is highly likely to refer to this species, as Ludwig's Bustard is an arid species largely restricted to the Karoo and Kalahari.
- Denham's Bustard is thus confirmed to visit the site, on the flatter, more open areas, and would likely breed there when conditions are suitable. The site is of high significance for the species. Development of the site would result in the loss of this shy species from the site. However, this species is still reasonably common in similar habitats across the broader region.

Afrotis afra (Linnaeus, 1758) Southern Black Korhaan

- This species of bustard is endemic to South Africa and has an Regional Red List Status of **Vulnerable** however in the global context an IUCN Red List Category and Criteria of **Least Concern** (BirdLife International, 2022b; Taylor *et al.*, 2015).
- It is broadly found in similar habitats in the area, but seems absent (it has not been confirmed to occur there) or very rare at the site and the site is thus of low importance for this species.

Bradypterus sylvaticus (Sundevall, 1860) Knysna Warbler

- This species of warbler is endemic to South Africa and has an Regional Red List Status of **Vulnerable** however in the global context an IUCN Red List Category and Criteria of **Vulnerable** (BirdLife International, 2022c; Taylor *et al.*, 2015).
- The van der Walk report indicates a Low chance it would occur on the site. We estimate there is a Medium-High chance it would occur in the dense thickets along the river valleys. However, as these sites are excluded from the development, the development is thus of low importance to this species.

Polemaetus bellicosus (Heine, 1890) Martial Eagle

- This species of eagle is endemic to Africa and has an Regional Red List Status of **Vulnerable** however in the global context an IUCN Red List Category and Criteria of **Endangered** (BirdLife International, 2022d; Taylor *et al.*, 2015).
- The species is wide-ranging and likely hunts over the site from time to time, but the site does not contain suitable nesting sites.

Circus maurus (Temminck 1828) Black Harrier

- This species of harrier is endemic to southern Africa and has an IUCN Red List Category and Criteria of Endangered C2a(ii) (BirdLife International, 2017; Taylor *et al.*, 2015).

- This species occurs widely in South Africa, but fewer than 1000 birds are thought to occur, and habitat transformation is a major threat (Taylor *et al*. 2015).
- This species breeds on the ground in low, shrubby vegetation in spring, mainly in the Western Cape, before undertaking complex and variable post breeding movements that can take birds to the Drakensberg (Taylor *et al.* 2015).
- Prey is mainly rodents and birds.
- Although not flagged by the Screening Tool, the habitat is of high significance for this species and it was observed during the field survey, showing behaviour that was indicative of possible breeding on the site.

4.2.3 VERTEBRATE SPECIES OF CONSERVATION CONCERN (SCC)

Mammals:

Sensitive Species 5

- This species of mammal has an IUCN Red List Category and Criteria of **Vulnerable** A4b; C1 and a South African regional red list of **Vulnerable** C2a(i) + D1. [**Please Note: Citations for published literature related to this sensitive species have been withheld to protect its identity and can be requested from the author of this report if needed].
- Of the estimated 3,500 mature individuals in southern Africa, over 9%% are associated with large transboundary landscapes spanning southern Botswana, Namibia, southern Angola, northern South Africa, and south-western Mozambique.
- High urban and agricultural development across many areas of South Africa have resulted in a drastic reduction in free-roaming populations of this SCC.
- Their presence in the Western Cape Province is confined to fenced protected areas.

Sensitive Species 8

- This species of mammal is endemic to Africa and has an IUCN Red List Category and Criteria of **Least Concern** South African regional red list of **Vulnerable** B2ab(ii, ii, v) + C1a(i). [**Please Note: Citations for published literature related to this sensitive species have been withheld to protect its identity and can be requested from the author of this report if needed].
- Within South Africa, the species appears to be declining due to forest habitat loss from urban development, mining and increasing poaching and hunting with domestic dogs.
- The estimated area of occupancy (AOO) ranges from 1,415–2,858 km^2, but this SCC has very short dispersal distances (< 1km) between forest patches; habitat fragmentation is therefore a key consideration for this SCC.
- Within South Africa, they occur predominantly within scarp and coastal forests, thickets and dense coastal bush, but can occupy modified habitats and mixed land use areas. They forage in forest glades and open areas but require dense underbrush to rest or take cover.
- Historical records extracted from virtual museums, and more recent records from citizen science online platforms, are known for this SCC from close to the project site (e.g. a 2019 camera trap record from approximately 14kms north-east of the project site).

4.3 FIELD SITE VISIT

- Although partly overcast, the weather was warm, and conducive to faunal activity.
- All areas across the project development were investigated and chosen to provide representative photographs (Figures 4 - 22).

- Sweep netting (SANBI, 2020) was undertaken at selected points for the Orthoptera SCC.
- Within the project area, visual searching using binoculars and sound recordings of bird calls were used to detect bird SCC.
- Habitat characteristics and likelihood of faunal SCC being found around each picture site is provided below.
- Overview of locations of these photographs. Note that photos towards the edge of the project area are taken looking into the project area, and thus the areas represented are far more than simply the footprint of the photographer.

Figure 4: The area of the planned security entrance. The area is densely infested with alien trees, particularly the area on the right-hand side of the existing dirt road. [GPS: S34.12822 E22.09165].

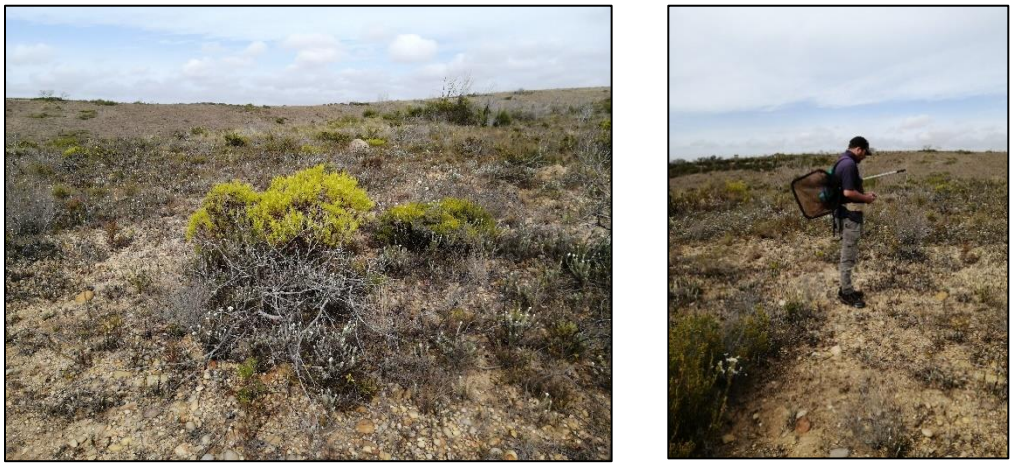

Figure 5: The area on the left-hand side of the planned security entrance is classed as botanically sensitive (Oval 1 on the Environmental Constraints map of 02-Oct-2022). From a faunal perspective, this area is also considered as high sensitivity: It offers suitable habitat for *Aloeides trimeni southeyae* with patches of *Hermannia lavandulifolia* and open patches of stony and rocky ground suitable for its larval ant host's nests; the watercourse running alongside this area is also considered an important faunal corridor connecting Erf 3122 south-eastwards with natural vegetation next to the Heuwelsrust Retirement Village. This corridor could be important for several faunal elements, such as small antelope. [GPS: S34.12838 E22.09109].

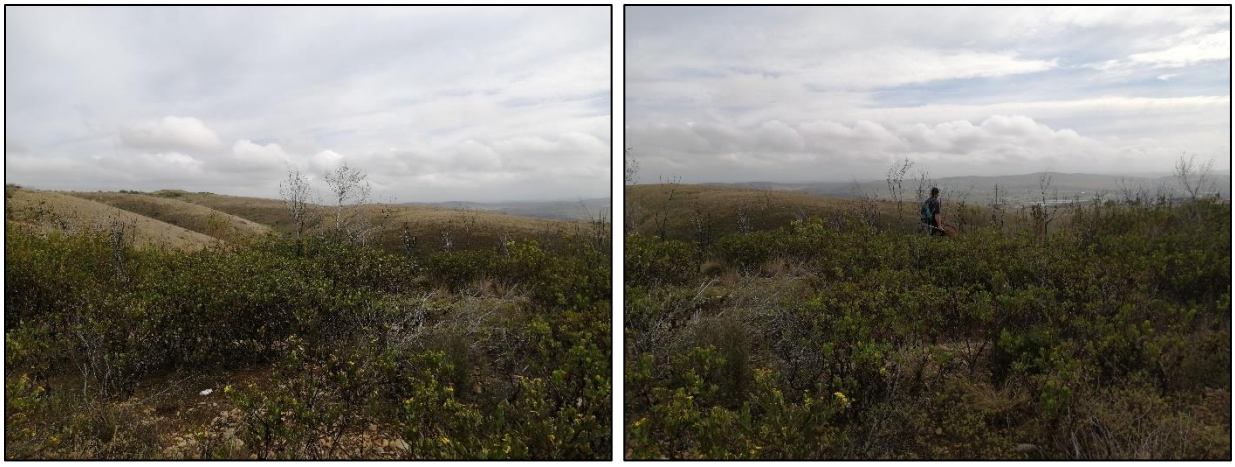

Figure 6: The area north-west of the planned security entrance and on the right-hand side of the current dirt road (Oval 1 on the Environmental Constraints map of 02-Oct-2017) is an area of faunal sensitivity, offering habitat for the butterflies *Aloeides trimeni southeyae* and possibly *Chrysoritis thysbe mithras* (Critically Endangered (Mecenero *et al.*, 2020)), as evidenced by the presence of its larval host plant (*Osteospermum moniliferum*) and ant host (*Crematogaster peringueyi*). The butterfly *Pseudonympha magus* (Least Concern) was collected in this area and was abundant at several parts of the project site. This area could also potentially act as a faunal corridor linking the project site to a relatively large area of natural habitat to the north of Erf 3122. [GPS: S34.12801 E22.0905].

Figure 7: Sensitive watercourse habitat falling within Oval 1 on the Environmental Constraints map of 02-Oct-2017. Such areas would be of high importance from a faunal perspective. [GPS: S34.12808 E22.08925].

Figure 8: Northern areas of moderate and high sensitivity (foreground) transition into low sensitive areas (darker background) on the plateau of Erf 3122 where development activities will be primarily focussed [GPS: S34.12651 E22.08697].

Figure 9: Areas close to the reservoir (Oval 2 on the Environmental Constraints map of 02-Oct-2017) offer suitable habitat for the butterfly *Aloeides trimeni southeyae* with open stony ground, and large patches of their potential host plant *Hermannia lavandulifolia* (foreground) found here. This habitat is currently classed as Moderate sensitivity for environmental constraints. [GPS: S34.12507 E22.08628]. The small hills of natural vegetation in the background fall outside of Erf 3122.

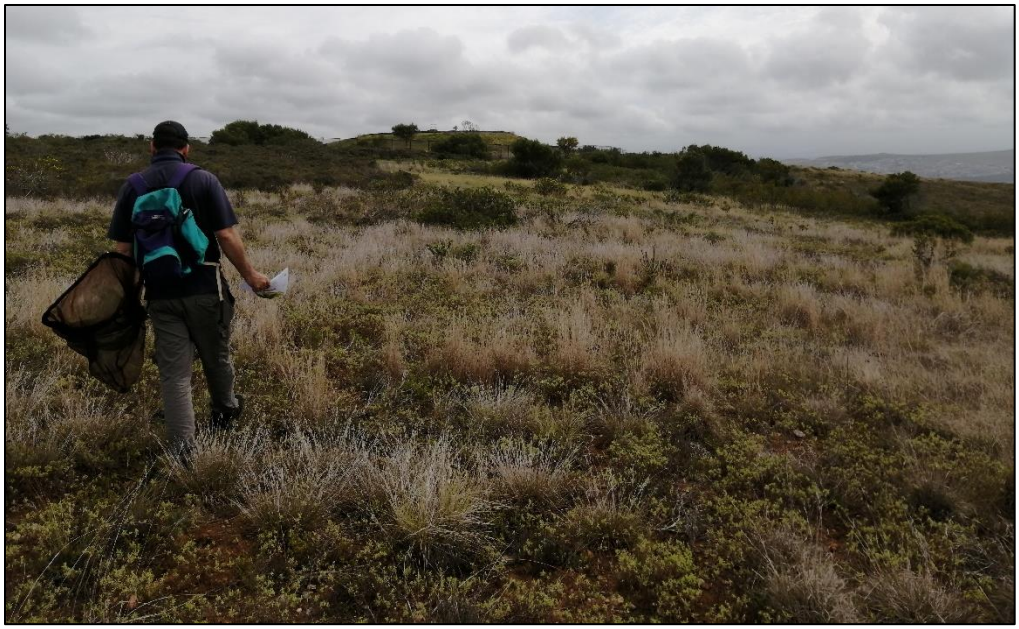

Figure 10: Specialist walking through suitable habitat for butterfly SCC, approaching the reservoir in the background. Parts of this area fall within the proposed butterfly reserve (Edge, 2021) and connect to natural vegetation outside of Erf 3122. A large number of *Hermannia lavandulifolia* plants are found here (foreground). [GPS: S34.12507 E22.08628].

Figure 11: Specialist looking for faunal SCC within the habitat close to the reservoir earmarked for a butterfly reserve. This area offers high-quality habitat for the butterfly SCC, and several other faunal elements (see Figure 13 below). Black Harrier (*Circus maurus*), a bird species of high conservation concern, although not flagged by the screening tool for this project, was also recorded from this area and its behaviour suggested that it could be breeding at this site (SABAP2 Card Number: 3405_2205a022118a20221028) [GPS: 34.12462 E22.08552].

Figure 12: The area adjacent to the municipal reservoir, with its fence on the left. This fence would act as a barrier to faunal movement. [GPS: S34.12386 E22.08552].

Figure 12: The area adjacent to the municipal reservoir offers a diverse habitat for faunal SCC. [GPS: S34.12386 E22.08552].

Figure 13: Reptile and amphibian species found in the area below the reservoir earmarked for a butterfly reserve: Robertson Dwarf Chameleon (*Bradypodion gutturale*) (Least Concern) [https://www.inaturalist.org/observations/137308102]; Painted Reed Frog (*Hyperolius marmoratus*) (Least Concern) [https://www.inaturalist.org/observations/137308038].

Figure 14: Habitat of the plateau looking south-eastwards. This habitat was previously disturbed trough ploughing and is dominated by renosterbos and it makes up the bulk of the development footprint. [GPS: S34.12474 E22.08526].

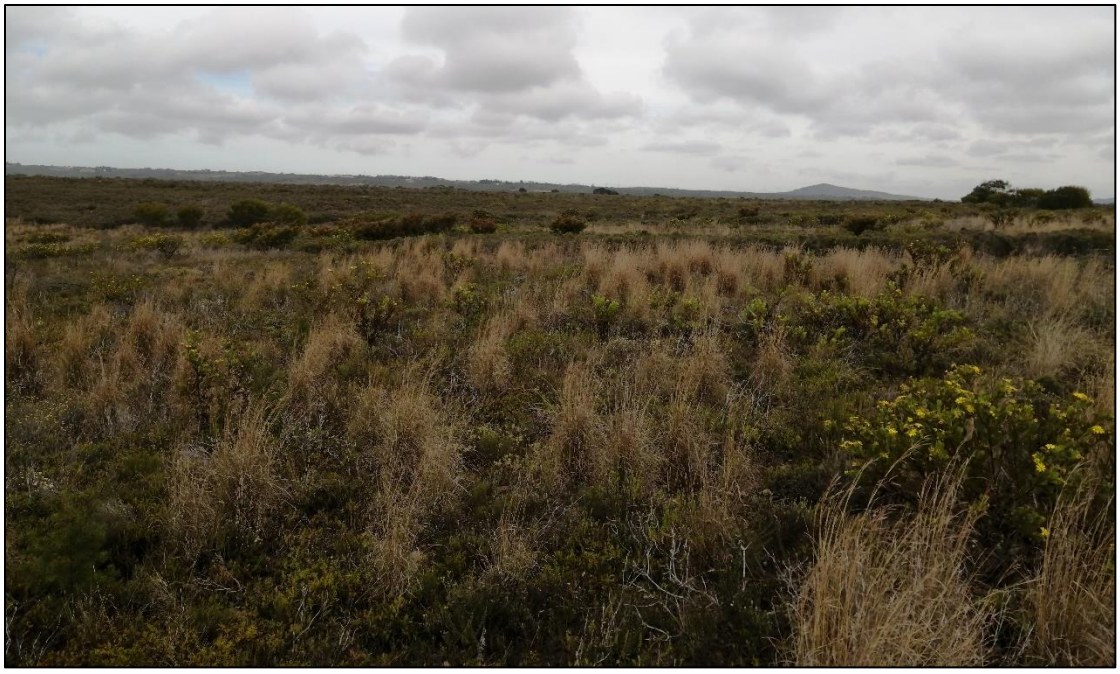

Figure 15: Looking north-westwards into the development footprint. Although some areas offer suitable habitat for butterfly SCC, this area is considered of medium sensitivity and is suitable habitat for Denham's bustard. [GPS: 34.12664 E22.08644].

Figure 16: Evidence of alien plants (*Hakea sericea*) were seen on the plateau.

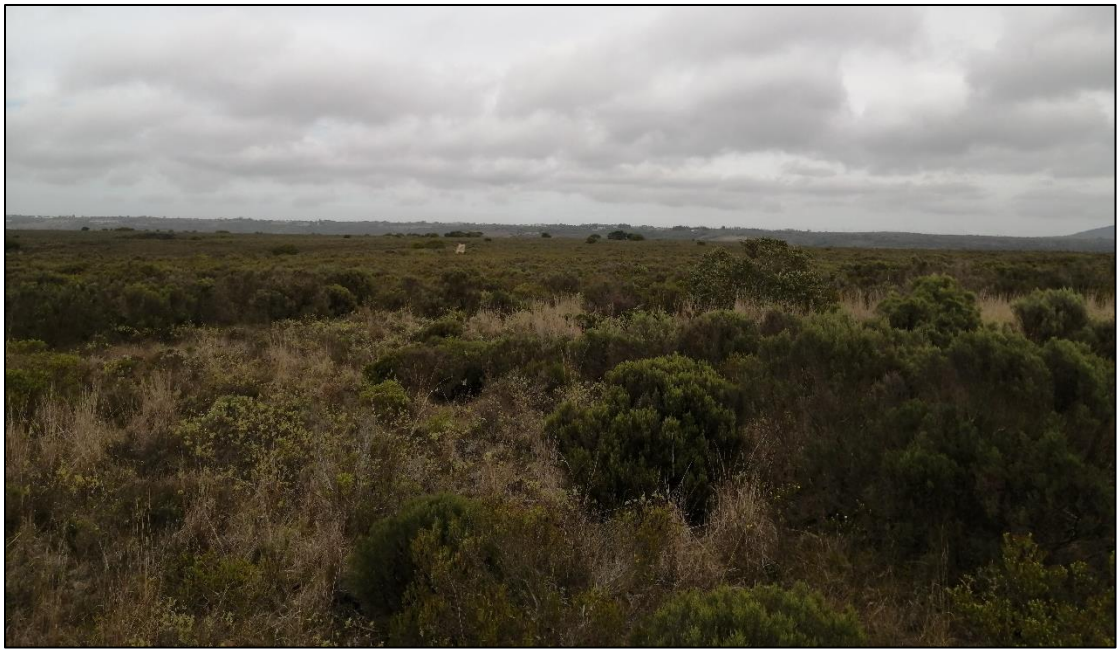

Figure 17: Looking westwards into the development footprint across the homogenous renosterveld habitat. [GPS: S34.12686 E22.08388].

Figure 18: Specialist walking along dirt road running south-westwards. The highsensitive environmental constraints area is to the left of the road.

Figure 19: *Crematogaster peringueyi* arboreal ant nest were encountered in several places in the renosterveld plateau habitat of the project envelope. [GPS: S34.12661 E22.08333].

Figure 20: Looking westwards into the development envelope showing homogenous and previously disturbed renosterveld vegetation that is suitable for Denham's bustard. Numerous *Boophone disticha* plants were seen in this area. [GPS: 34.12719 E08312].

Figure 21: Looking east along the small arm of development envelope that extends towards high sensitive environmental constraint areas (oval 4 in environmental constraints map of 02-Oct-2017). The stand of trees in the mid-ground are black wattle (*Acacia mearnsii*) growing in a watercourse. [GPS: 34.13198 E22.08359].

Figure 22: The southern area of the project envelope is mostly homogenous renosterveld habitat, which would be suitable for Denham's bustard.

4.3.1 SCC Located at the Project Area

- The invertebrate SCC flagged by the screening tool for this project was not located on site.
    - Several areas of natural habitat within and outside the development envelope appear to be ideal for the grasshopper SCC, and therefore it is assumed that there is a high likelihood of this SCC occurring within the project area.

- For the bird SCC flagged by the screening tool for this project, none were recorded at the study site. However, Black Harrier was recorded, possibly showing breeding behaviour, and Denham's Bustard was recorded in past surveys.
- For the mammal SCC flagged by the screening tool for this project, none were recorded at the study site.
    - Sensitive species 5 would not be found on Erf 3122.
    - There is a low likelihood that Sensitive species 8 would be found on Erf 3122. This species requires dense undergrowth; some sections of such habitat were seen along parts of the watercourses and drainage lines; however, the area seems marginal for this SCC particularly considering its short inter-patch dispersal distance. Todd (2018) recorded related mammal species that also require dense undergrowth habitat, but these species have far greater inter-patch dispersal distances.

4.4 FINDINGS OF PREVIOUS AND CURRENT FAUNAL ASSESSMENTS

The earlier faunal assessments by van der Walt (2013) and (Todd, 2018) were detailed and comprehensive and included both a field survey and desktop study. Both reports concluded, based on historical records from the broader area and the presence of large areas of natural vegetation, that Erf 3122 could possibly provide habitat for several different faunal elements of conservation concern. Several of these were confirmed during field surveys, such as large mammals (e.g. Bushbuck, Caracal, Aardwolf), birds (e.g. Black Harrier, Denhams's Bustard, Lanner Falcon), and reptiles (e.g. Karoo Dwarf Chameleon).

Based on the different types of faunal habitat, both reports generally agreed in their classification of sensitivity. van der Walt (2013) classed most of the project area as medium to high faunal sensitivity, whereas Todd (2018) considered the plateau areas as low sensitivity, owing to previous landuse impacts, and the lower-lying and sloping grassy-fynbos areas as medium. Both reports recognise the watercourses and drainage line areas as high sensitivity and of high importance as faunal corridors. The 2016 botanical specialist report by Nick Helme (Helme, 2016) considered the plateau areas as medium sensitivity and the lower lying slopes as high sensitivity. The recently completed botanical and terrestrial biodiversity impact assessment report by Dave McDonald further reinforces these findings and considered the upper renosterveld plateau as low botanical diversity and low sensitivity, and the lower-lying grassy-fynbos incorporating the watercourses and drainage lines as high sensitivity from both a botanical and terrestrial biodiversity perspective (McDonald, 2022).

Both faunal reports also recognised that a key disturbance and current threat to the faunal habitats of Erf 3122 are alien plant infestations, including the highly sensitive watercourses and drainage lines. This latter concern was also highlighted by the freshwater scoping assessment (Ewart-Smith, 2021) and botanical and terrestrial biodiversity impact assessment reports (Helme, 2016; McDonald, 2022).

van der Walt (2013) and Todd (2018) came to similar conclusions in their faunal reports that after mitigation the impacts of the development on the different faunal elements of Erf 1322 would be low to moderate and that it should not have a significant impact on the fauna within the area. Dave McDonald's botanical impact assessment report also concluded that the development would have a low impact. However, one concern expressed by van der Walt (2013) was the potential for several butterfly species of high conservation concern to be found on Erf 1322 and recommended that a specialists butterfly assessment should be undertaken as a priority. In earlier botanical scoping assessments by Dave McDonald (see McDonald, 2021) a key foodplant for the Endangered butterfly *Aloeides trimeni southeyae* was identified to occur on Erf 3122. A local lepidopterist Dave Edge was subsequently appointed in 2018 to undertake a butterfly assessment for Erf 3122 (Edge, 2021). Through a series of site visits and reports between 2018 -2021 by Dave Edge, and consultation with Cape EAPrac, ATKV, and DAE, a 'butterfly reserve' has now been earmarked incorporating northern areas of Erf 3122 and the area around the municipal reservoir.

It must be noted that van der Walt (2013), Todd (2018), and Edge's (2021) assessments were essentially undertaken before the National Web-based Environmental Screening Tool became operational. The screening tool was applied to Erf 3122 in 2021 and several animal species of conservation concern (SCC) were flagged, including four bird and one grasshopper SCC. Marius van der Vyfer was subsequently appointed to undertake, utilising a desktop study, a faunal protocol update report for Erf 3122, with a focus on the five faunal SCC flagged by the screening tool (van der Vyver, 2021). van der Walt (2013) and Todd (2018) had considered in detail the four bird SCC flagged by the screening tool. They did not consider the grasshopper SCC, as this widespread grasshopper species was only red listed in 2018 (Hochkirch *et al.*, 2018). The screening tool did not flag any butterfly SCC; however, this was due to the screening tool using inaccurate data (Edge, 2021).

Although broadly agreeing with the findings of Todd (2018), van der Vyver (2021) considered the habiatat of Erf 3122 to be "optimal" for the SCC flagged and several other faunal species and that there was a medium to medium-high likelihood of the SCC occuring on Erf 3122. van der Vyver (2021) also consdered that the development impact would be 'high' for a range of fauna including the flagged SCC and that Erf 3122 shows 'little disturbance from agricultural activities'and is a 'haven for the remaining rich faunal and floral biodiversity'. These findings are generally in contrast with those of earlier faunal and botanical reports, and the recent botanical and terrestrial biodiversity impact report of Dave McDonald. van der Vyver (2021) not make reference to the early faunal report of van der Walt (2013), or the pre-2020 botanical reports of Nick Helme and Dave McDonald. van der Vyver (2021) considered a possible but irregular occurrence for Leopard (Panthera pardus) occuring at Erf 3122. Todd's (2018) assessment was an 'extremely unlikely' occurrence and van der Walt's (2013) assessment indicated a 'low' occurrence for this large carnivore. A 2016 conservation assessment for Leopards in South Africa suggests a low likelihood of Leopard occurring on Erf 3122, with only pre-2000 observational records known for the general area (Swanepoel et al., 2016).

The findings of the current faunal assessment, based on the desktop study and site visit (see result sections above), align mostly with those of van der Walt (2013), Todd (2018), and Edge (2021), with the exception that we increase the sensitivity of the upper flat areas of renosterveld to Medium to account for Denham's Bustard, and the area where the harrier was seen to High. These higher sensitivity scores align more with van der Vyver (2021). Our findings also align mostly in terms of habitat sensitivity with the botanical reports of Helme (2016) and McDonald (2022), and the freshwater report of Ewart-Smith (2021).

From a faunal perspective, key aspects of the current faunal report include high sensitive lower lying grassy-fynbos areas, drainage lines and watercourses as important faunal corridors connecting Erf 3122 to surrounding areas of natural vegetation, and the establishment of the butterfly reserve. With regards to the butterfly reserve, parts of the areas on the eastern and north-eastern extent of the development envelope (moderate sensitivity in ovals 1 & 2 in the environmental constraints map) should potentially be classed as high sensitivity, as this area would connect suitable butterfly habitat within the eastern and north-eastern areas of Erf 3122 with areas of natural vegetation on adjacent municipal land. Additionally, these areas also appear of high importance for the Black Harrier.

Overall, the two main faunal concerns of this assessment are associated with the occurrence of Denham's Bustard in the upper renosterveld plateau area, where this species is known to occur and almost certainly uses this area for breeding when conditions are suitable. Development of the site would result in the loss of this shy species from the site. However, this species is still reasonably common in similar habitats across the broader region. This elevates the sensitivity of this renosterveld area to Medium. The occurrence of Black Harrier, with a potential breeding site on the northern extent of the development envelope, together with the butterfly SCC, elevates the sensitivity of this area to high.

4.5 ASSESSMENT OF IMPACTS

The development envelope covers ~ 50% of Erf 3122 and will be concentrated on previously disturbed renosterveld habitat on the higher lying plateau areas. The remaining area of Erf 3122 falls outside of the development envelope and is generally classed as highly sensitive from a botanical, faunal and freshwater perspective. From a faunal perspective, the overall impact of the proposed development is considered medium significance once mitigation (including the establishment of the butterfly reserve) is considered. Of high concern for the faunal SCC is the presence of alien plant encroachment into the lower lying grassy fynbos and watercourse and drainage habitats. Removal of these plants would have a positive impact on local faunal SCC populations.

4.5.1 CONSTRUCTION PHASE IMPACTS

Relatively large areas of habitat (mostly natural vegetation) will be directly and negatively affected during the construction phase. It should mostly have a localised impact on populations of the SCC and their long-term viability and persistence in the area. The 'No-Go' or 'leave as is' option would potentially see the highly sensitive grassy-fynbos and drainage line/watercourse habitats of the project area becoming overgrown if no alien plant management plan is earmarked for future implementation. The encroachment of alien plants could have significant long-term negative impacts and implications for faunal SCC. The mitigation measure of removal and future monitoring of these alien plants would help solve this issue.

CONSTRUCTION PHASE		
	PREFERRED ACTIVITY & LAYOUT ALTERNATIVE (Proposed development activities within development envelope)	**NO-GO ALTERNATIVE** (No development, *status quo*)
Potential impact and risk:	**FAUNAL IMPACTS:** Disturbance and habitat destruction associated with removal of natural vegetation, soil disturbance and compaction.	
Nature of impact:	Loss of local populations of faunal SCC.	Loss of local populations of faunal SCC through continued alien plant infestations.
Extent and duration of impact:	Local and Short term.	Local and Long term.
Consequence of impact or risk:	Loss of populations of faunal SCC; Restrict movement of fauna through ecological corridors; Fragmentation of sub-populations of butterfly SCC across southern Cape habitats.	Loss of sub-populations of faunal SCC; Further fragmentation of sub-populations of butterfly SCC across southern Cape habitats habitats.
Probability of occurrence:	Medium probability	High probability
Degree to which the impact may cause irreplaceable loss of resources:	Medium-High	High

CONSTRUCTION PHASE		
	PREFERRED ACTIVITY & LAYOUT ALTERNATIVE (Proposed development activities within development envelope)	**NO-GO ALTERNATIVE** (No development, *status quo*)
Degree to which the impact can be reversed:	Low	High
Indirect impacts:	None identified	None identified
Cumulative impact prior to mitigation:	Medium (-)	High (-)
Significance rating of impact prior to mitigation (e.g., Low, Medium, Medium-High, High, or Very-High)	**Medium (-)**	**High (-)**
Degree to which the impact can be avoided:	Medium	High
Degree to which the impact can be managed:	Medium	High
Degree to which the impact can be mitigated:	Medium	High
Proposed mitigation:	• Mitigation measures outlined in van der Walt (2013) and Todd (2018) should also be considered. • Creation of butterfly reserve which should be clearly demarcated and considered a no-go area. • Clearing of natural vegetation should be prevented or to be kept to a minimum where necessary. • The smallest possible working corridor, particularly along sensitive habitats, must be used. • No off-road driving should be allowed by construction vehicles. • All temporary/permanent fences to be erected will need to be of sufficient low height and mesh size to allow fauna (small rodents, antelope, etc.) to move freely through and to not act as a barrier to dispersal. • Any drainage/water run-off trenches required to be built alongside roads should be shallow	• Clearance of alien vegetation across the project area.

CONSTRUCTION PHASE		
	PREFERRED ACTIVITY & LAYOUT ALTERNATIVE (Proposed development activities within development envelope)	**NO-GO ALTERNATIVE** (No development, *status quo*)
	and broad with low-angle sides (<30 degrees) so as not to trap fossorial invertebrates (e.g. dung beetles) and small vertebrates (e.g. snakes, tortoises). • Alien vegetation found on the project area should be removed by an alien plant clearing team during the construction phase; invasive alien plants are seen as a significant threat to faunal SCC (e.g. butterflies (Mecenero et al., 2013)). • Buffer zones of ~ 50m should be used around drainage and watercourses. • A ~5m buffer zone should also be considered for any development close to the proposed butterfly reserve (e.g. frail care centre and 'dwelling house' on the north-eastern extent of the envelope.	
Residual impacts:	Medium (-)	Low (-)
Cumulative impact post mitigation:	Medium (-)	High (+)
Significance rating of impact after mitigation (e.g., Low, Medium, Medium-High, High, or Very-High)	**Medium (-)**	**High (+)**

4.5.2 Operation Phase Impacts

The impact significance during the operational phase of the proposed development is considered low. Continued monitoring and removal of alien plants would, however, be a key mitigation measure to be continued after the construction phase.

One other important aspect to consider is the effect of Artificial light at night (ALAN), which can potentially have long-term negative impacts on local insect fauna (Deichmann *et al.*, 2021; Owens *et al.*, 2020; Stewart, 2021). The impact of ALAN during the operational phase of the project should be considered, particularly as the development envelope abuts areas of natural vegetation which currently appear to have little to no artificial lightening. Outside lights for the planned houses, frail care centre, restaurant, clubhouse, sport facilities, etc., and any additional road lights that may be

added, could also add to an overall negative impact on local insect faunas. There are several mitigation options to reduce the impact and attraction of artificial lights on insects (see Table below).

Bird flappers on high altitude Eskom lines for Denham's bustard and raptors should be implemented (see van der Walt (2013)).

Overall, the impact significance during the operational phase of the proposed development is considered low, particularly when mitigation is considered. It should mostly have a small and localised impact on populations of the faunal SCC and their long-term viability and persistence in the area. The use of artificial lights may extend the area of influence of the project site and mitigation measures should therefore be considered in this regard.

OPERATIONAL PHASE		
	PREFERRED ACTIVITY & LAYOUT ALTERNATIVE (Proposed development activities within development envelope)	**NO-GO ALTERNATIVE** (No development, *status quo*)
Potential impact and risk:	**FAUNAL IMPACTS:** Human disturbance and habitat loss associated with alien plants.	
Nature of impact:	Loss of local populations of faunal SCC; Disturbance and possible road deaths associated with vehicle movements.	Loss of local populations of faunal SCC through land cultivation and continued alien plant infestations.
Extent and duration of impact:	Local and Short term.	Local and Long term.
Consequence of impact or risk:	Loss of sub-populations of faunal SCC; Further fragmentation of sub-populations of faunal SCC across renosterveld habitats.	Loss of sub-populations of faunal SCC; Further fragmentation of sub-populations of faunal SCC across renosterveld habitats.
Probability of occurrence:	Low probability	High probability
Degree to which the impact may cause irreplaceable loss of resources:	Low	High
Degree to which the impact can be reversed:	High	High
Indirect impacts:	None identified	None identified
Cumulative impact prior to mitigation:	Medium (-)	High (-)
Significance rating of impact prior to mitigation (e.g., Low, Medium,	**Low-Medium (-)**	**High (-)**

OPERATIONAL PHASE		
	PREFERRED ACTIVITY & LAYOUT ALTERNATIVE (Proposed development activities within development envelope)	**NO-GO ALTERNATIVE** (No development, *status quo*)
Medium-High, High, or Very-High)		
Degree to which the impact can be avoided:	Medium	High
Degree to which the impact can be managed:	High	High
Degree to which the impact can be mitigated:	High	High
Proposed mitigation:	• Mitigation measures outlined in van der Walt (2013) and Todd (2018) should also be considered. • Ongoing clearance of alien vegetation across the project area and rehabilitation to encourage natural vegetation to regenerate on the areas disturbed during construction and to restore and increase natural habitat for faunal SCC. • Possible options to mitigate the negative impacts of artificial lights could include: • Fixtures on lights to cover the light bulb and direct the light to where it is needed. • Use timers and sensors to control when lights are on and to make lights motion activated. • Use coloured lights, such as long wavelength amber and red lights. Yellow illumination lights have also been shown to attract less moth specimens (Verovnik et al., 2015). Deichmann et al. (2021) recommend filtered amber LED lamps with no blue and minimal green light content to be used for outdoor lighted areas. • An outdoor lighting plan should be developed that includes an overall reduction of nocturnal lighting. • Speed bumps should be installed on internal roads and speed limits and animal crossing warning signs should be erected.	• Clearance of alien vegetation across the project area and monitoring of new infestations.

OPERATIONAL PHASE		
	PREFERRED ACTIVITY & LAYOUT ALTERNATIVE (Proposed development activities within development envelope)	**NO-GO ALTERNATIVE** (No development, *status quo*)
	• Bird flappers for Denham's Bustard	
Residual impacts:	Low (-)	Low (-)
Cumulative impact post mitigation:	Low (-)	High (+)
Significance rating of impact after mitigation (e.g., Low, Medium, Medium-High, High, or Very-High)	**Low (-)**	**High (+)**

4.5.3 CUMULATIVE IMPACTS

Although the development is considered of medium significance for the faunal SCC, it may become more significant if added to existing or future impacts from other activities in the area. Loss of renosterveld habitat is considered of high conservation concern, with losses to agriculture and urban development (Skowno *et al.* 2019). The proposed development will therefore occur in a broader area within a mosaic of vegetation and habitat that is highly fragmented and disturbed.

Currently, it seems unlikely that the addition of the proposed developments will contribute to a high cumulative negative impact on the long-term viability of any of the populations of the SCC and their persistence: except possibly for the butterfly SCC, although creation of the butterfly reserve should mitigate against this. The creation of the butterfly reserve should also be beneficial for the Black Harrier. Mitigation measures would help to further reduced any cumulative negative impacts, particularly in terms of alien plant removal and monitoring. Removal and the long-term monitoring of alien plants could potentially have a long-term positive impact offsetting any shorter-term negative impacts from the proposed development for certain faunal SCC. Restoring and retaining parts of the Erf 3122 as natural vegetation and retaining ecological corridors to natural vegetation that are currently connected to several sides of Erf 3122 would also have a positive conservation impact. In this regard, a compromise between the loss of Denham's Bustard habitat with the creation of a sizeable butterfly reserve incorporating a potential Black Harrier breeding site should be considered for this development.

The current and future development of natural areas in and around Hartenbos would need to be considered in the broader context of conservation strategies around the identification and establishment of a network of protected areas to help offset the cumulative negative impacts of development on faunal SCC, such as Denham's Bustard and the butterfly *Aloeides trimeni southeyae*.

5. IMPACT STATEMENT

The proposed development on Erf 3122 is likely to generate low to medium negative impacts on the faunal SCC flagged for this project once mitigation is followed. It is the specialists' opinion that the proposed development will have an overall medium to low significance on the faunal SCC flagged and therefore the proposed development can be approved in terms of the specific theme of this terrestrial animal species assessment, based on the condition of the creation of a butterfly reserve, setting aside, and incorporating the adjacent harrier area in the butterfly reserve, and that all alien vegetation is removed from the site and that an ongoing annual programme of follow-up is undertaken.

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APPENDIX – 1

Impact Assessment Methodology:

A **Basic Assessment** process is being undertaken for this project. Potential impacts must be assessed and rated based on the methodology and rating criteria outlined below, which correspond with the methodology that is required for Basic Assessment processes.

A comparative analysis of the **alternatives** (Preferred and No-go) should be conducted using a significance rating scale (equally weighted) based on the following definitions:

EXTENT (or spatial scale/influence of impact)

- **International:** Beyond National boundaries.
- **National:** Beyond Provincial boundaries and within National boundaries.
- **Regional:** Beyond 5 km of the proposed development and within Provincial boundaries.
- **Local:** Within 5 km of the proposed development.
- **Site-specific:** On site or within 100 m of the site boundary.
- **None**

DURATION

- **Permanent**
- **Long term:** Impact ceases after operational phase/life of the activity (> 20 years).
- **Medium term:** Impact might occur during the operational phase/life of the activity (2 to 20 years).
- **Short term:** Impact might occur during the construction phase (< 2 years).
- **Immediate**

PROBABILITY (of occurrence)

- **Definite:** >95% chance of the potential impact occurring.
- **High probability:** 75% - 95% chance of the potential impact occurring.
- **Medium probability:** 25% - 75% chance of the potential impact occurring.
- **Low probability:** 5% - 25% chance of the potential impact occurring.
- **Improbable:** <5% chance of the potential impact occurring.

IRREPLACEABLE loss of resources

- **Definite:** Definite loss of irreplaceable resources.
- **High:** High potential for loss of irreplaceable resources.
- **Moderate:** Moderate potential for loss of irreplaceable resources.
- **Low:** Low potential for loss of irreplaceable resources.
- **Very low:** Very low potential for loss of irreplaceable resources.
- **None**

REVERSIBILITY of impact

- **Not reversible:** Impact cannot be reversed.
- **Low:** Low potential that impact might be reversed.
- **Moderate:** Moderate potential that impact might be reversed.
- **High:** High potential that impact might be reversed.
- **Reversible:** Impact will be reversible.
- **None:** No impact.

CUMULATIVE impacts

- **High:** The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
- **Medium:** The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of medium significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
- **Low:** The activity is localised and might have a negligible cumulative impact.
- **None:** No cumulative impact on the environment.

The **significance** of an impact is defined as a combination of the consequence of the impact occurring and the probability that the impact will occur. The criteria used to determine impact consequence are presented below.

- **High significance**: refers to potentially adverse impacts of high, harmful or destructive intensity and / or has long term (i.e., 5 to 10 years) or permanent duration on the immediate or surrounding environment.
- **Medium significance**: refers to potentially adverse impacts of moderate intensity and / or has medium term duration (i.e., 2 to 5 years) that could have an effect on the immediate or surrounding environment
- **Low significance**: Potentially adverse impacts of a low intensity and / or has short term duration (i.e., less than 2 years) that could have an effect over the immediate or surrounding environment.

Example of an assessment table to be used for impact assessment:

CONSTRUCTION PHASE (PLANNING, DESIGN AND DEVELOPMENT)		
	PREFERRED ACTIVITY & LAYOUT ALTERNATIVE (Proposed agricultural activities on the farm)	**NO-GO ALTERNATIVE** (Current cultivation on the farm not expanded)
Potential impact and risk:	**SOCIO-ECONOMIC IMPACTS:** Construction phase employment opportunities created	
Nature of impact:	Creation of 20 temporary jobs during the construction phase.	Loss of the opportunity to create 20 temporary jobs during the construction phase.
Extent and duration of impact:	Regional and Short term	Regional and Short term
Consequence of impact or risk:	The creation of temporary jobs during the construction phase in a local area where unemployment is high.	No new temporary jobs created.
Probability of occurrence:	Probable	Probable
Degree to which the impact may cause irreplaceable loss of resources:	None	None
Degree to which the impact can be reversed:	High	High
Indirect impacts:	• More spending by labourers within their communities could lead to local economic growth. • Opportunity to develop new skills for the benefit of possible future employment.	None expected
Cumulative impact prior to mitigation:	Low (+) Minor temporary alleviation in high unemployment in the area.	Low (-) No contribution to alleviation in unemployment in the local area.
Significance rating of impact prior to mitigation (e.g., Low, Medium, Medium-High, High, or Very-High)	**Low (+)**	**Very Low (-)**
Degree to which the impact can be avoided:	Positive impact, no need to avoid.	Medium
Degree to which the impact can be managed:	Medium	Medium
Degree to which the impact can be mitigated:	High	Medium
Proposed mitigation:	• Provide temporary construction phase jobs to local people from previously disadvantaged backgrounds, wherever possible	Non mitigatable

CONSTRUCTION PHASE (PLANNING, DESIGN AND DEVELOPMENT)		
	PREFERRED ACTIVITY & LAYOUT ALTERNATIVE (Proposed agricultural activities on the farm)	**NO-GO ALTERNATIVE** (Current cultivation on the farm not expanded)
	/ feasible.	
Residual impacts:	Low (-)	Low(-)
Cumulative impact post mitigation:	Temporary alleviation in high unemployment in the area.	No contribution to alleviation in unemployment in the area.
Significance rating of impact after mitigation (e.g., Low, Medium, Medium-High, High, or Very-High)	**Low (-)**	**High (+)**

APPENDIX – 2

CURRICULUM VITAE – JONATHAN F. COLVILLE

EDUCATION

PhD (Zoology): University of Cape Town, 2009. Thesis title: "*Understanding the evolutionary radiation of the megadiverse monkey beetle fauna (Scarabaeidae: Hopliini) of South Africa*".

Postdoctoral research fellowship: South African National Biodiversity Institute, 2009-2010.

PRIOR EMPLOYMENT

National Research Foundation Research Career Advancement Fellow: South African National Biodiversity Institute (2014-2019).

Researcher, South African National Biodiversity Institute, GEF/UNEP/FAO Global Pollination Project – South Africa (2010-2014).

PUBLICATIONS

Books edited:

- Allsopp, N., **Colville, J.F.**, Verboom, G.T. (2014). *Fynbos: Ecology, Evolution, and Conservation of a Megadiverse Region* (16 chapters; pp 1-377). Oxford University Press.

Book chapters:

- Forest F., **Colville J.F.**, Cowling R.M. (2018). Evolutionary diversity patterns in the Cape Flora of South Africa. In: *Phylogenetic Diversity: Applications and challenges in biodiversity science*. R. Scherson, D. Faith (Eds), Springer International Publishing.
- Lebuhn, G., Connor, E.F., Brand, M., **Colville, J.F.**, Keday, D., Resham, B.T., Muo, K., Ravindra, K.J. (2015). Monitoring pollinators around the world. In: *Pollination services to agriculture*. B. Gemmill-Herren (Ed), Routledge.
- **Colville, J.F.**, Potts, A.J., Bradshaw, P.L., Measey, G.J., Snijman, D., Picker, M.D., Procheș, Ș., Bowie, R.C.K., Manning, J.C. (2014). Floristic and faunal Cape biochoria: do they exist? In: *Fynbos: Ecology, Evolution, and Conservation of a Megadiverse Region*. N. Allsopp, J.F. Colville, G.A. Verboom (Eds), Oxford University Press.
- Lach, L., Picker, M.D., **Colville, J.F.**, Allsopp, M.H., and Griffiths, C.L. (2002). Alien invertebrate animals in South Africa. In: *Biological invasions: Economic and environmental costs of alien plant, animal, and microbe species*. D. Pimentel (Ed), CRC Press, London.

Journal articles:

- Barraclough, D.A., and **Colville, J.F**. (2022). The first species of Nemestrinidae (Diptera) endemic to Madagascar: A remarkable new species of *Atriadops* Wandolleck, 1897. *Zootaxa*. 5196 (1): 145–150.
- Dombrow, H., **Colville, J.F**., Bowie, R.C.K. (2022). Review of the genus *Amblymelanoplia* Dombrow, 2002 (Coleoptera: Scarabaeidae: Melolonthinae: Hopliini) with the description of ninety-three new species from South Africa and observations on its biogeography and phylogeny. *Zootaxa*. 5163 (1): 1-278.
- Melin, A., and **Colville, J.F**. (2022). Description of the male of *Rediviva steineri* Kuhlmann 2012 (Hymenoptera: Melittidae), an endemic oil-collecting bee species from South Africa. *African Entomology*. 30: e11178.

- Allen-Perkins, A., Magrach, A., Dainese, M., Garibaldi, L., … **Colville, J.F**., et al. (2022). CropPol: A dynamic, open, and global database on crop pollination. *Ecology*. 103, 3, e3614.
- Dorchin, N.; van Munster, S.; Klak, C.; Bowie, R.C.K.; **Colville, J.F**. (2022). Hidden diversity – A new speciose gall midge genus (Diptera: Cecidomyiidae) associated with succulent Aizoaceae in South Africa. *Insects*. 13, 75. https://doi.org/10.3390/insects13010075
- Cohen, C., Liltved, W.R., **Colville, J.F**., Shuttleworth, A., Weissflog, J., Svatos, A., Bytebier, B., Johnson, S.D. (2021). Sexual deception of a beetle pollinator through floral mimicry. *Current Biology*. 31: 1–8.
- Krenn, H.W., Karolyi, F., Lampert, P., Melin, A., **Colville, J.F**. (2021). Nectar uptake of a long-proboscid *Prosoeca* fly (Nemestrinidae) – Proboscis morphology and flower shape. *Insects*. 12(371): 1–13.
- McLeod, L., and **Colville, J.F.** (2021). Observations on unusual feeding and mating behaviour of a monkey beetle genus *Amblymelanoplia* Dombrow (Coleoptera: Scarabaeidae: Hopliini). *African Entomology*. 29(1): 301–306.
- **Colville, J.F**., Beale, C.M., Forest, F., Altwegg, R., Huntley, B., Cowling, R.M. (2020). Plant species richness, turnover and evolutionary diversity track gradients of stability and ecological opportunity in a megadiversity centre. *Proceedings of the National Academy of Sciences* (*PNAS)*. 117 (33): 20027–20037.
- Dombrow, H. & **Colville, J.F.** (2020). Review of the genus *Beckhoplia* Dombrow with the description of fifteen new species from South Africa and observations on its biogeography (Coleoptera: Scarabaeidae: Melolonthinae: Hopliini). *Zootaxa*. 4823(1): 1-64.
- Melin, A., Altwegg, R., Manning, J.C., and **Colville, J.F.** (2020). Allometric relationships shape foreleg evolution of long-legged oil bees (Melittidae: *Rediviva*). *Evolution*. https://doi.org/10.1111/evo.14144.
- Melin, A. & **Colville, J.F**. (2020). A nesting aggregation of *Rediviva intermixta* (Melittinae: Melittidae) with males sleeping together in nests (Namaqualand, South Africa). *The Journal of the Kansas Entomological Society*. 92 (3): 561–568.
- Melin, A., **Colville, J.F**., Duckworth, G.D.; Altwegg, R.; Slabbert, R.; Midgley, J.J.; Rouget, M.; Donaldson, J.S. (2020). Diversity of pollen sources used by managed honeybees in variegated landscapes. *Journal of Apicultural Research*. Doi10.1080\00218839.2020.1750757.
- Melin, A., Krenn, H.W., Manning, J.C., **Colville, J.F.** (2019). The allometry of proboscis length in Melittidae (Hymenoptera: Apoidae) and an estimate of their foraging distance using museum collections. *PLoS ONE*. 14(6): e0217839.
- Melin, A. & **Colville, J.F.** (2019). A review of 250 years of Southern African bee taxonomy and exploration (Hymenoptera: Apoidea: Anthophila). *Transactions of the Royal Society of South Africa*. 74:1, 86-96. [**Featured on Cover Page**]
- Rink, A.R., Altwegg, R., Edwards, S., Bowie, R.C.K., **Colville, J.F.** (2019). Contest dynamics and assessment strategies in combatant monkey beetles (Scarabaeidae: Hopliini). *Behavioural Ecology*. 40: 713–723.
- Barraclough, D., **Colville, J.F.**, Karolyi, F., Krenn, H.W. (2018). A striking new species of *Prosoeca* Schiner, 1867 (Diptera: Nemestrinidae): An important pollinator from the Bokkeveld Plateau, Northern Cape Province, South Africa. *Zootaxa* 4497: 411–421.
- **Colville, J.F.**, Picker, M.D., Cowling, R.M. (2018). Feeding ecology and sexual dimorphism in a speciose flower beetle clade (Hopliini: Scarabaeidae). *PeerJ*: 6:e4632.
- Melin, A., Mathieu, R., **Colville, J.F**., Midgley, J.J., Donaldson, J.S. (2018). Quantifying and evaluating distributed floral resources for managed honeybee pollination using an expanded concept of supporting ecosystem services. *PeerJ*: e5654.
- Cowling, R.M, Bradshaw, P.L., **Colville, J.F.**, Forest, F. (2017). Levyns' Law: Explaining the evolution of a remarkable longitudinal gradient in Cape plant diversity. *Transactions of the Royal Society of South Africa*. 72: 184-201.
- Treurnicht M., **Colville J.F.**, Joppa L.N., Huyser O., Manning J.C. (2017) Counting complete? Finalising the plant inventory of a global biodiversity hotspot. *PeerJ:* 5:e2984.
- Janion-Scheepers, C., Measey, G.J., Braschler, B., Chown, S.L., Coetzee, L., **Colville, J.F.**, Dames, J., Davies, A.B., *et al*. (2016). Soil biota in a megadiverse country: Current knowledge and future research directions in South Africa. *Pedobiologia*. 59: 129-174.
- Karolyi F., Hansal T., Krenn H.W., **Colville J.F.** (2016). Comparative morphology of the mouthparts of the megadiverse South African monkey beetles (Scarabaeidae: Hopliini): Feeding adaptations and guild structure. *PeerJ*: 4:e1597.

- Bradshaw, P.L., **Colville, J.F.**, Linder, H.P. (2015). Optimising regionalisation techniques: Identifying centres of endemism in the extraordinarily endemic-rich Cape Floristic Region. *PLoS ONE*. 10: e0132538.
- Cowling, R.M., Potts, A.J., Bradshaw, P.L., **Colville, J.F.**, Arianoutsou, M., Ferrier, S., Forest, F., Fyllas, N.M., Hopper, S.D., Ojeda, F., Procheș, Ș., Smith, R.J., Rundel, P.W., Vassilakis, E., Zutta, B.R. (2015). Variation in plant diversity in Mediterranean-climate ecosystems: The role of climatic and topographical stability. *Journal of Biogeography*. 42: 552-564.
- Kleijn, D., Winfree, R., Bartomeus, I., Carvalheiro, L.G., Henry, M., Isaacs, R., Klein, A-M., Kremen, C., M'Gonigle, L.K., Rader, R., Ricketts, T., Williams, N.M, Adamson, N-L., Ascher, J.S., Baldi, A., Batary, P., Benjamin, F., Biesmeijer, J.C., Blitzer, E.J., Bommarco, R., Brand, M.R., Bretagnolle, V., Button, L., Cariveau, D.P., Chifflet, R., **Colville, J.F.**, Danforth, B.N., Elle, E., Garratt, M.P.D., Herzog, F., Holzschuh, A., Howlett, B.G., Jauker, F., Jha, S., Knop, E., Krewenka, K.M., Le Feon, V., Mandelik, Y., May, E.M., Park, M.G., Pisanty, G., Reemer, M., Riedinger, V., Rollin, O., Rundlof, M., Sardinas, H.S., Scheper, J., Sciligo, A.R., Smith, H.G., Steffan-Dewenter, I., Thorp, R., Tscharntke, T., Verhulst, J., Viana, B.F., Vaissiere, B.E., Veldtman, R., Westphal, C., Potts, S.G. (2015). Delivery of crop pollination services is an insufficient argument for wild pollinator conservation. *Nature Communications*. 6: 7414**.**
- Manning, J.C., Goldblatt, P., **Colville, J.F.**, Cupidoa, C.N. (2015). Hopliine beetle pollination in annual *Wahlenbergia* species (Campanulaceae) from western South Africa, and the new species *W. melanops*. *South African Journal of Botany*. 100: 58-62.
- Mecenero, S., Altwegg, R., **Colville, J.F.**, Beale, C.M. (2015). Roles of spatial scale and rarity on the relationship between butterfly species richness and human density in South Africa. *PLoS ONE*. 10: e0124327.
- Forest, F., Goldblatt, P., Manning, J.C., Baker, D., **Colville, J.F.**, Devey, D.S., Jose, S., Kaye, M., Buerki, S. (2014). Pollinator shifts as trigger of speciation in painted petal irises (*Lapeirousia*: Iridaceae). *Annals of Botany*. 113: 357-71.
- Karolyi, F., **Colville, J.F.**, Handschuh, S., Metscher, B.D., Krenn, H.W. (2014). One proboscis, two tasks: Adaptations to blood-feeding and nectar-extracting in long-proboscid horse flies (Tabanidae, *Philoliche*). *Arthropod Structure & Development*. 43: 403-413.
- Karolyi, F., Morawetz, L., **Colville, J.F.**, Handschuh, S., Metscher, B.D., Krenn, H.D. (2013). Time management and nectar flow: Flower handling and suction feeding in long-proboscid flies (Nemestrinidae: *Prosoeca*). *Naturwissenschaften*. 100: 1083-1093. [**Featured on Cover Page**]
- Ryan, P.G., **Colville, J.F.**, Picker, M.D. (2013). Juvenile African Pipit feeding on monkey beetles. *Ornithological Observations*. 4: 6-8.
- Karolyi, F., Szucsich, N.U., **Colville, J.F.**, Krenn, H.W. (2012). Adaptations for nectar-feeding in the mouthparts of long-proboscid flies (Nemestrinidae: *Prosoeca*). *Biological Journal of the Linnean Society*. 107: 414-424.
- Picker, M.D., **Colville, J.F.**, Burrows, M. (2012). A cockroach that jumps. *Biology Letters*. 8: 390-392.
- **Colville, J.F.** (2009). Understanding the evolutionary radiation of the mega-diverse monkey beetle fauna (Scarabaeidae: Hopliini) of South Africa. *Frontiers in Biogeography*. 1: 24-29.
- Bohn, H., Picker, M.D., Klaus-Dieter, K. & **Colville, J.F.** (2010). A jumping cockroach from South Africa, *Saltoblattella montistabularis*, gen. nov., spec. nov. (Blattodea: Blattellidae). *Arthropod Systematics & Phylogeny*. 68: 53-69. **[Featured as a "Top 10 New Species discovery" by the International Institute for Species Exploration**].
- **Colville, J.F.**, Picker, M.D., Cowling, R.M. (2002). Species turnover of monkey-beetles (Scarabaeidae: Hopliini) along environmental and disturbance gradients in the Namaqualand region of the Succulent Karoo, South Africa. *Biodiversity and Conservation*. 11: 243–264.
- Picker, M.D., **Colville, J.F.**, van Noort, S. (2002). Mantophasmatodea now in South Africa. *Science*. 297: 1475.

Technical reports:

- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Biodiversity Specialist Assessment. Duyker Eiland Prospecting Rights. Prepared for Elemental Sustainability (Pty) Ltd.
- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Animal Species Specialist Assessment. Proposed mixed use housing development. Prepared for EcoSense CC.

- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Animal Species Specialist Assessment. Proposed agricultural development. Prepared for McGregor Environmental Services.
- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Animal Species Specialist Assessment. Blue Sky's Project Prepared for Doug Jeffery – Environmental Consultants.
- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Animal Species Specialist Assessment. Proposed Expansion of Nature's View Dam near Citrusdal. Prepared for Earth Grace Environmental Consultancy.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Proposed enlargement of existing Kleigat Dam. Prepared for Earth Grace Environmental Consultancy.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Moorreesburg Wastewater Treatment Works Upgrade Project. Prepared for Zutari (Pty) Ltd.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Maxnau Citrus Development. Prepared for Charl de Villiers Environmental Consulting.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Gletwyn Estate Mixed Use Development. Prepared for Johan Neethling Environmental Services cc.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Moorreesburg Wastewater Treatment Works Upgrade Project. Prepared for Zutari (Pty) Ltd.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Proposed Development of Solar Photo-Voltaic Renewable Energy Power Station. Prepared for Resource Management Services (RMS).
- **Colville, J.F.** & Picker, M.D. (2009-2010). *Invertebrate impact assessment – Oudekraal, Table Mountain*. Prepared for Doug Jeffery Environmental Consultants.
- Picker, M.D. & **Colville, J.F.** (2007). *Invertebrate impact assessment: Worcester Island Development*. SRK Environmental impact report for Consulting Engineers and Scientists, Cape Town.
- Picker, M.D. & **Colville, J.F.** (2006). *Baseline faunal investigation for proposed development at Altona, Worcester, Western Cape Province*. Environmental impact report for SRK Consulting Engineers and Scientists, Cape Town.
- **Colville, J.F.** & Picker, M.D. (2005). *Scoping Phase II: The impact of development of Worcester on the insect and scorpion fauna*. Environmental impact report for Chand Environmental Consultants, Cape Town.
- **Colville, J.F.** (2001) *Scoping and faunal assessment for proposed housing development, Skapenberg, Somerset West*. Prepared for Design consultants CNdV Africa

MEMBERSHIPS/RESEARCH ASSOCIATE

- Membership of Entomological Society of Southern Africa (2007-current).
- Membership of Lepidopterists Society of Southern Africa (2014-current).
- Honorary Research Associate (HRA), Statistics in Ecology, Environment and Conservation (SEEC), Department of Statistical Sciences, UCT (2014-current).
- SACNASP registration for Ecological Science (Professional Natural Scientist) (member#: 134759).

PROFESSIONAL SERVICES

- Editorial board *African Entomology* (2010-current).
- Editorial board *Metamorphosis* (2017-current).
- Editorial board *PeerJ* (2019-current).
- CAPE Invasive Alien Animal (IAA) Working Group (2016-2018).