TERRESTRIAL FAUNAL AND AVIFAUNAL SPECIES IMPACT ASSESSMENT REPORT FOR PORTION 3 OF FARM 781, THEEWATERSKLOOF LOCAL MUNICIPALITY

December 2023

Prepared for:

PHS Consulting

Prepared by:

Blue Skies Research

Dr Jacobus H. Visser

(PhD Zoology; Pr. Sci. Nat.)

Faunal Biodiversity Specialist

Cell: (083) 453 7916

e-mail: BlueSkiesResearch01@gmail.com

Table of contents

List of figures

List of tables

Specialist details and expertise

Full Name: Jacobus Hendrik Visser

Professional registration: South African Council for Natural Scientific Professions**,** Professional Natural Scientist (Zoological Science) – Registration number: 128018

Address: 13 Dennelaan
Stilbaai
6674

Cell: (083) 453 7916

E-mail: BlueSkiesResearch01@gmail.com

Website: https://blueskiesresearch0.wixsite.com/blue-skies-research

Qualifications

- PhD (Zoology), University of Johannesburg (2015 - 2017)
- MSc (Zoology), Stellenbosch University (2011 - 2013)
- BSc Honours (Zoology) cum laude, Stellenbosch University (2010)
- BSc (Biodiversity and Ecology) cum laude, Stellenbosch University (2007 - 2009)

Expertise

- 27 years of in-the-field naturalist experience involving all faunal groups
- Zoologist with 16 years of professional experience
- 14 Peer-reviewed publications in high impact national and international scientific journals on the patterns and processes which drive and maintain faunal biodiversity, as well as on aspects of faunal biology and ecology
- Five IUCN Red List assessments

- Involved in the Southern African Bird Atlas Project 2 (SABAP2)
- Contributor on the National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria.

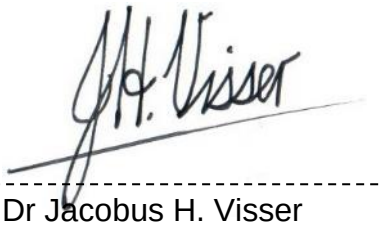
CELL: (083) 453 7916 E-MAIL: BlueSkiesResearch01@gmail.com
13 Dennelaan, Stilbaai, 6674

Declaration of independence by the independent person who compiled a specialist report or undertook a specialist process

I, Dr Jacobus Hendrik Visser, as the appointed independent specialist hereby declare that I:

• act/ed as the independent specialist in this application;
• 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 and any specific environmental management Act;
• have no and will not have any vested interest in the proposed activity proceeding;
• have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations and any specific environmental management Act;
• am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
• 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;
• 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;

• have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
• have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
• am aware that a false declaration is an offence.



11 December 2023

Dr Jacobus H. Visser
(PhD Zoology; Pr. Sci. Nat.)
SACNASP Registration Number: 128018

Date

Blue Skies Research

Dr Jacobus H. Visser
(PhD Zoology; Pr. Sci. Nat.)
Faunal Biodiversity Specialist

13 Dennelaan
Stilbaai
6674

11 December 2023

TERRESTRIAL FAUNAL AND AVIFAUNAL SPECIES IMPACT ASSESSMENT REPORT FOR PORTION 3 OF FARM 781, THEEWATERSKLOOF LOCAL MUNICIPALITY

Executive summary

Background

Erin de Vigne (Pty) Ltd is proposing to expand existing dams and cultivation areas on Portion 3 of Farm 781, Theewaterskloof Local Municipality. The study area is approximately 68.9 hectares in size and is located roughly 3km south of Bot River in the Western Cape. The farm portion is bordered by the Karwyderskraal and R43 roads to the east and the Bot River along the south-eastern margin. Blue Skies Research was appointed by PHS Consulting on behalf of Erin de Vigne (Pty) Ltd to perform the required terrestrial faunal and avifaunal assessment of the study area. The current report forms part of the Environmental Impact Assessment (EIA) for the proposed development.

The study area has been identified as being of and overall “High Sensitivity” under the “Relative Animal Species Sensitivity Theme” in the DFFE Screening Tool. In this regard, the larger western and north-central part of the site is identified as having a “High sensitivity” for the possible occurrence of four avifaunal Species of Conservation Concern (SCC). Parts in the south, east and north-east of the site are identified as having a “Medium sensitivity” for the possible occurrence of one avifaunal SCC and three invertebrate SCC. The current report therefore assesses the presence or likely presence of these avifaunal and invertebrate SCC (as well as other possible SCC) within the study area in accordance with the protocols outlined

in the Species Environmental Assessment Guideline (SANBI, 2020). Furthermore, this study represents an assessment of the terrestrial faunal and avifaunal diversity and abundances, -habitat composition and ecosystem dynamics within the study area. As such, the aims of this investigation were to:

1.) Assess, define and create a spatial rendering of available faunal habitats across the study area based on information gathered during the field survey as well as through a desktop assessment using the latest satellite imagery,

2.) compile a complete faunal desktop species list (including avifauna and butterflies) for the study area based on a thorough desktop assessment so as to assess the presence of any of the listed SCC as well as any additional SCC,

3.) compile a faunal species list (including mammals, reptiles, amphibians, avifauna, butterflies and grasshoppers) within the study area through field surveying so as to assess the possibility of occurrence of the SCC retrieved in the desktop assessment (based on appropriate sampling methods, as well as the presence of suitable habitat for these species), or any additional SCC which are present on the site, and

4.) generate spatial occurrence maps for the recovered faunal species within the study area to assess the spatial extent of areas supporting higher levels of diversity, and SCC sub-populations and habitats which need consideration during the impact assessment.

Study methodology

To assess the possible occurrence of the listed (as well as any additional) avifaunal and butterfly SCC, a desktop assessment was performed to create a representative desktop species list for these faunal groups. The desktop avifaunal species list for the study area was generated by referring to the species records of the South African Bird Atlas Project 2 (SABAP2), with the desktop species list for butterflies constructed with reference to the distributional records available on the “LepiMAP” platform of the Virtual Museum of the Animal Demographic Unit (vmus.adu.org).

During the field survey, the study area was surveyed on foot over three consecutive days, from the 8th to the 10th of November 2022, during the Spring season. Surveying included unconstrained point sampling through search meanders, as well as acoustic surveys at Dam 1. All tracks surveyed were recorded by GPS (Garmin eTrex® 10, Garmin International Inc, USA). Terrestrial faunal species (mammals and reptiles) were identified by direct visual observation, or by their tracks, burrows, remains or scat. Amphibian species were further identified by direct visual observation or by auditory means, supplemented by both diurnal and nocturnal sound recordings. Avifaunal species were identified by visual observation, using a 180x zoom lens, or by auditory means. Butterfly species were identified and photographed from less than one meter away. Finally, grasshopper species were collected and identified through sweepnetting procedures. During surveying, faunal habitats were broadly identified in the field, and thereafter delineated through a desktop assessment of the study area using satellite imagery.

Habitat types

The study area is comprised of seven broadly identified habitat types. The most intact habitats on the site are characterised by either dense, medium-high or low shrubland habitats, and encompass the southern margin and central to northern parts of the study area. The more degraded parts of the site have been either cleared (through soil preparation or the planting of vineyards) in the western and central parts, or consist of degraded areas where incidences of heavy alien tree infestations have been felled with little remaining natural vegetation (in the southern section). The eastern, north-eastern and north-western sections of the site harbour dense and impenetrable stands of alien invasive trees with little remaining natural vegetation within these thick stands. Finally, three artificial dams are located on the site (in the western, northern and eastern parts respectively), with only Dam 1 showing evidence of vegetation which was planted by the applicant.

Faunal and avifaunal components

From the available distributional data and observational records (i.e., the desktop species list), the study area potentially harbours 193 avifaunal and 18 butterfly

species. Among these, 11 avifaunal species constitute SCC which include the following:

1. Forest Buzzard (*Buteo trizonatus*) classified as “Near-Threatened”,
2. Black Harrier (*Circus maurus*) classified as “Endangered”,
3. African Marsh Harrier (*Circus ranivorus*) classified as “Least Concern”,
4. Martial Eagle (*Polemaetus bellicosus*) classified as “Endangered”,
5. Secretarybird (*Sagittarius serpentarius*) classified as “Endangered”,
6. Maccoa Duck (*Oxyura maccoa*) classified as “Endangered”,
7. Blue Crane (*Anthropoides paradiseus*) classified as “Vulnerable”,
8. Southern Black Korhaan (*Afrotis afra*) classified as “Vulnerable”, and
9. Denham's Bustard (*Neotis denhami*) classified as “Near-Threatened”
10. Ground Woodpecker (*Geocolaptes olivaceus*) classified as “Near-Threatened”
11. Cape Cormorant (*Phalacrocorax capensis*) classified as “Endangered” by the IUCN.

During the field survey, 11 mammal, five reptile, five amphibian, 55 avifaunal, six butterfly and four grasshopper species were recorded within the study area. While the majority of species are currently classified as “Least Concern” by the IUCN, the study area harbours confirmed subpopulations of the following five SCC:

1. The Montane Marsh Frog (*Poyntonia paludicola*) classified as “Near-Threatened”,
2. Cape Flats Frog (*Microbatrachella capensis*) classified as “Critically Endangered”,
3. Black Harrier (*Circus maurus*) classified as “Endangered”,
4. Blue Crane (*Anthropoides paradiseus*) classified as “Vulnerable”, and
5. Yellow-winged Agile Grasshopper (*Aneuryphymus montanus*) classified as “Endangered” by the IUCN (IUCN, 2021).

Species of Conservation Concern (SCC)

Along with the eight (five avifaunal and three invertebrate) SCC listed in the DFFE Screening Tool, the potential occurrence of nine other (two amphibian and seven

avifaunal) SCC within the study area was therefore assessed, given their confirmed presence on the site, or through their presence in the desktop species lists. The presence of five SCC (two amphibians, two birds and one invertebrate) was confirmed one the site, with three avifaunal SCC further likely also utilizing the site as foraging habitat. All remaining SCC which have a “Low” or “Medium” probability of occurrence are not further considered, given their low likelihood of being present on the site.

Suitable habitats for the avifaunal and invertebrate SCC encompasses all shrubland habitats (Dense, Medium-high and Low shrubland) on the site, with Dam 1 currently harbouring subpopulations of the two amphibian SCC. Furthermore, Dam 2 and surrounds are a confirmed breeding and foraging habitat for the resident pair of Blue Cranes.

Site Ecological Importance (SEI)

Based on the Conservation Importance (CI) of these SCC, along with the Functional Integrity (FI) and Receptor Resilience (RR) of their preferred habitats, all shrubland habitats (Dense, Medium-high and low shrubland) on the site are retrieved as having a “Very high” Site Ecological Importance (SEI), and should be excluded from any planned development. Although two amphibian SCC are confirmed in Dam 1, this habitat is retrieved as having a “Medium” SEI because of its high receptor resilience. Finally, all other habitats on the site exist in a degraded state with no suitable habitat for any of the faunal SCC. These habitats have a “Very low” SEI, allowing for development activities of medium to high impact without restoration being required.

Current impacts

Current impacts on the site include alien invasive trees such as Pine, Port Jackson and Bluegum, which have infested all habitats to various degrees. Significant tracts of this vegetation remain in the eastern and north-eastern parts of the site, with these trees being so impenetrable that very little natural vegetation or suitable faunal habitat remains. In the south-central part of the site, these trees have been cut down and very little natural vegetation remains among these felled trees. The shrubland

habitats of the site have also contained a proportion of these trees, but these have been similarly cleared, allowing for an increase in the quality of these habitats. Finally, the western and central parts of the site have been cleared through soil preparation or the planting of vineyards, and no natural vegetation remains here. Agricultural activities, and noise and vibration through machinery and people are also part of the daily operations on the farm portion.

Project-related impacts

Impacts from planned development activities will include enlargement of Dams (through constructing earthfill embankments, new cores and cut-off trenches, and excavation of a new open channel spillways on the embankments) as well as clearing of the vegetation, soil preparation, and the planting of vineyards in the proposed agricultural areas. Impacts from these activities will include the destruction of habitat and direct mortality of fauna during the construction phase, and vibration and noise and possible pollution of the surrounding area (through run-off) during the construction and operational phases. Other possible project-related impacts (which are listed as specific threats to the SCC confirmed or possibly occurring on the site) may include habitat degradation through afforestation and agricultural expansion, uncontrolled burning of vegetation and illegal hunting during the construction and operational phases, and accidental poisoning of avifaunal SCC during the operational phase.

Mitigation measures and impact management actions

Taking into account these possible impacts, as well as the “Very high” SEI for SCC habitats, it is advocated that any development should exclude all shrubland habitats (Dense, Medium-high and Low shrubland i.e., avoidance mitigation). Because amphibian SCC are present within Dam 1, the enlargement of this dam is not desirable and an alternative placement for a new dam should be considered in the less sensitive areas retrieved as having a “Very low” SEI (i.e., avoidance mitigation). It is also possible that project-related impacts may impinge on SCC subpopulations and -habitats outside of the development footprints. To this end, species-specific buffer distances are recommended around core SCC habitats / colonies where no

development should take place (i.e., avoidance mitigation), excluding the clearing of alien invasive vegetation. Collectively, this renders an area of 27.5 hectares as potentially developable, and an area of 43.7 hectares which may need to be excluded from development planning. Should development proceed on the site, several general impact management actions are suggested which are aimed at limiting impacts on the resident fauna, also taking into account specific threats to the persistence of SCC subpopulations on the site.

Impact assessment

During the impact assessment (considering both the construction and operational phases of the project), two development alternatives were considered with Alternative 1 constituting the initial development layout which was assessed during the scoping phase of the current assessment, and Alternative 2 (the preferred alternative) representing a development layout which was selected subsequent to the scoping phase, and following the inputs from this report, as well as those from the botanical and freshwater specialists.

Under Alternative 1 the majority of the agricultural node (as well as the proposed outlet pipe and pump station at Dam 1) intersects an area of "Very low" SEI and is located outside of the SCC core habitats and -buffers, but part of the footprint intersects an area of "Very high" SEI, and is located within the core habitat area for the avifaunal and invertebrate SCC. Placement of this part of the agricultural will possibly lead to the destruction of SCC habitat, especially during the construction phase when vegetation clearing and soil preparation will be performed. Furthermore, enlargement of Dam 1 will include opening of the existing dam which currently comprises a "Medium" SEI habitat and a core habitat for the amphibian SCC. Although this dam is artificial, the resident amphibian SCC are sensitive to direct environmental disturbance, and may be impacted if this habitat is modified. Taken together, development under Alternative 1 will have a number of negative impacts on the receiving environment during the construction phase, but impacts during the operational phase will likely be limited.

Under Alternative 2 the majority and larger part of the agricultural nodes intersect with areas of “Very low” SEI and are located outside of core SCC habitats and -buffers, with only a small and extralimital part of the south-central agricultural node intersecting with a habitat buffering as “Very high” SEI and located with the buffer zone for the invertebrate SCC. Given the small and extralimital nature of these intersected habitat areas, development here should not drastically affect ecosystem processes in adjacent habitats. Furthermore, the new dam footprint at Dam 1 is spatially separated and buffered (by 30m) from the existing dam, and construction of the new dam embankment intersect with an area of “Very low” SEI. The placement of the new dam footprint is unlikely to impact on the resident amphibian SCC subpopulations and will further increase suitable habitat for these species.

The Dam 2 footprint is restricted to the existing dam, and intersects an area of “Very low” SEI, but overlaps with the core habitat for the resident pair of Blue Cranes. This pair does not appear to be disturbed by current levels of daily activity, noise and vibration by machinery and people in the adjacent vineyard. Should Dam 2 be enlarged (deepened and the dam walls raised), it is likely that the resident pair will temporarily vacate the direct area surrounding the dam, but should remain within the study area and return to this part of the site once disturbance has ceased. Even so, any enlargement of this dam should consider a monitoring program to track the activity and movement of these birds (this may be performed by an Environmental Control Officer without requiring specialist input), and should be performed out of the breeding season (August of the year which construction is started to April of the following year).

Conclusions

Taken together, development under Alternative 2 is likely to have fewer impacts on the receiving environment and will have a more acceptable outcome from a faunal biodiversity perspective. There is no reason why the development in the study area should not proceed under Alternative 2, given that the results from this report are considered.

1. Introduction

Erin de Vigne (Pty) Ltd is proposing to expand existing dams and cultivation areas on Portion 3 of Farm 781, Theewaterskloof Local Municipality (hereafter referred to as the “study area” or “site”). Blue Skies Research was appointed by PHS Consulting on behalf of Erin de Vigne (Pty) Ltd to perform the required terrestrial faunal and avifaunal assessment of the study area (see Sections 2 and 3).The current report forms part of the Environmental Impact Assessment (EIA) for the proposed development, representing a terrestrial faunal and avifaunal assessment in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment (EIA) Regulations 2014 (Government Notice (GN) 984), as amended.

Within the study area two development alternatives have been identified. Alternative 1 constitutes the initial development layout which was assessed during the scoping phase of the current assessment and is therefore represented throughout the initial sections of this report (Sections 3 to 10). Alternative 2 (the preferred alternative) represents a development layout which was selected subsequent to the scoping phase, and following the inputs from this report, as well as those from the botanical and freshwater specialists. This alternative is considered in during the impact assessment section of this report (Section 11).

1.1 Alternative 1

Under Alternative 1, the project is proposed to include the following developments (see Figure 1):

- Construction of the enlarged 35 000 m^3 storage capacity Dam 1 with a new core and cut-off trench.
- The dam will have a 12.5 m wall height and a total footprint area of 1.5 ha.
- Proposed 250 mm diameter HDPE outlet pipe Class PE100 PN10 and 160 mm diameter PVC pipeline to downstream irrigation areas.

- Excavation of a new open channel spillway on the embankment left flank.
- Pump station below dam (4 m x 4 m).
- New irrigation areas of 7 ha below Dam 1.

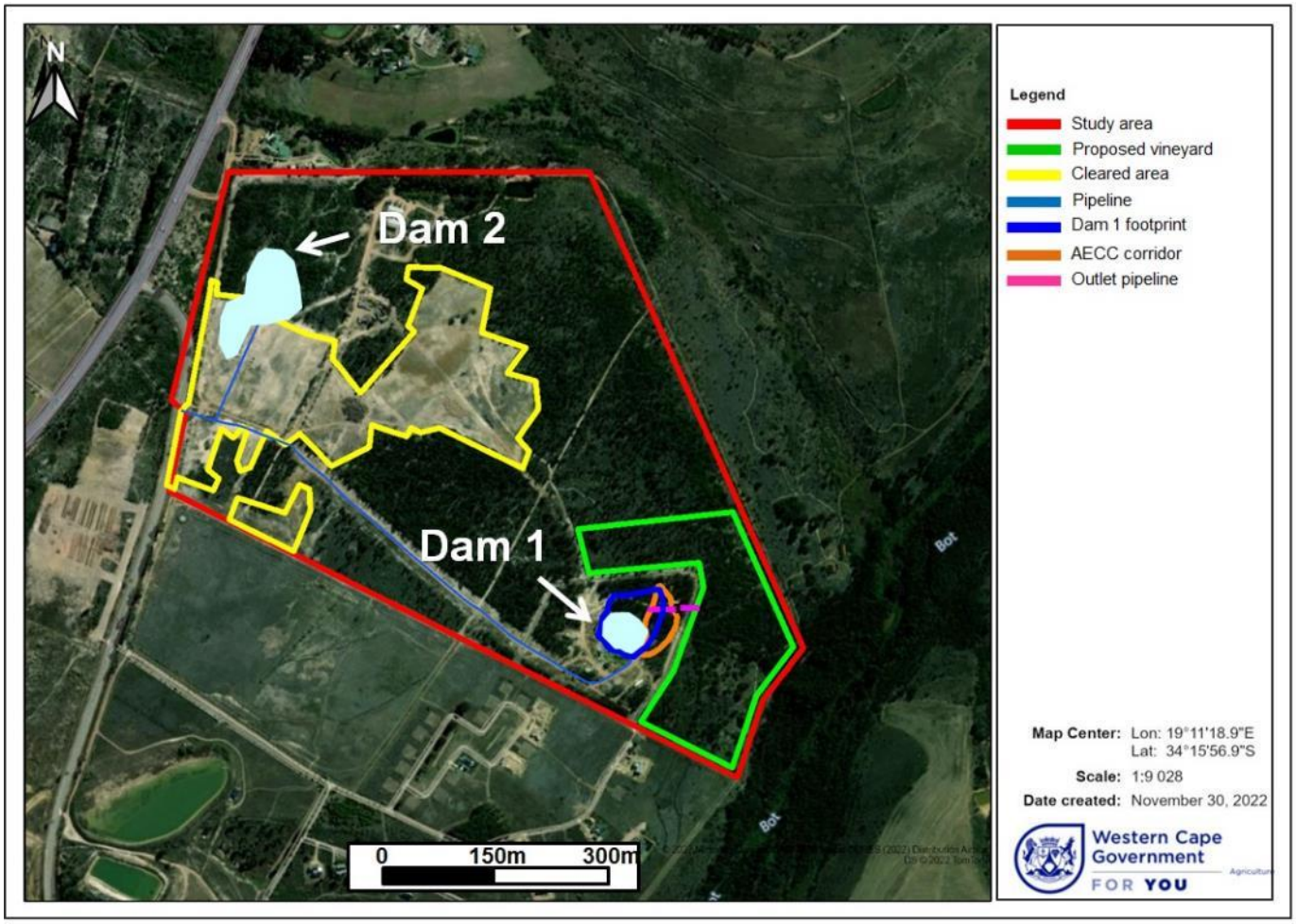


Figure 1 Spatial locations of the potential development nodes under Alternative 1 (map generated in Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

1.2 Alternative 2 (Preferred Alternative)

Under Alternative 2, the project is proposed to include the following developments (see Figure 2):

- New irrigation area of approximately 10ha.

Dam 1

- Construction of a new dam located directly downstream of existing dam 1 with a storage capacity of 2 000 m^3.
- The dam will have a 4.9 m wall height and a total footprint area of 0.15 ha.
- Excavation of a new open channel spillway on the embankment left flank.

Dam 2

- Construction of the enlarged 67 000 m^3 storage capacity Dam 2 with a new core and cut-off trench.
- The dam will have a 4.2 m wall height and a total footprint area of 2.5 ha.
- Proposed 250 mm diameter HDPE outlet pipe Class PE100 PN10.
- Proposed 315 mm diameter HDPE overflow spillway pipe.

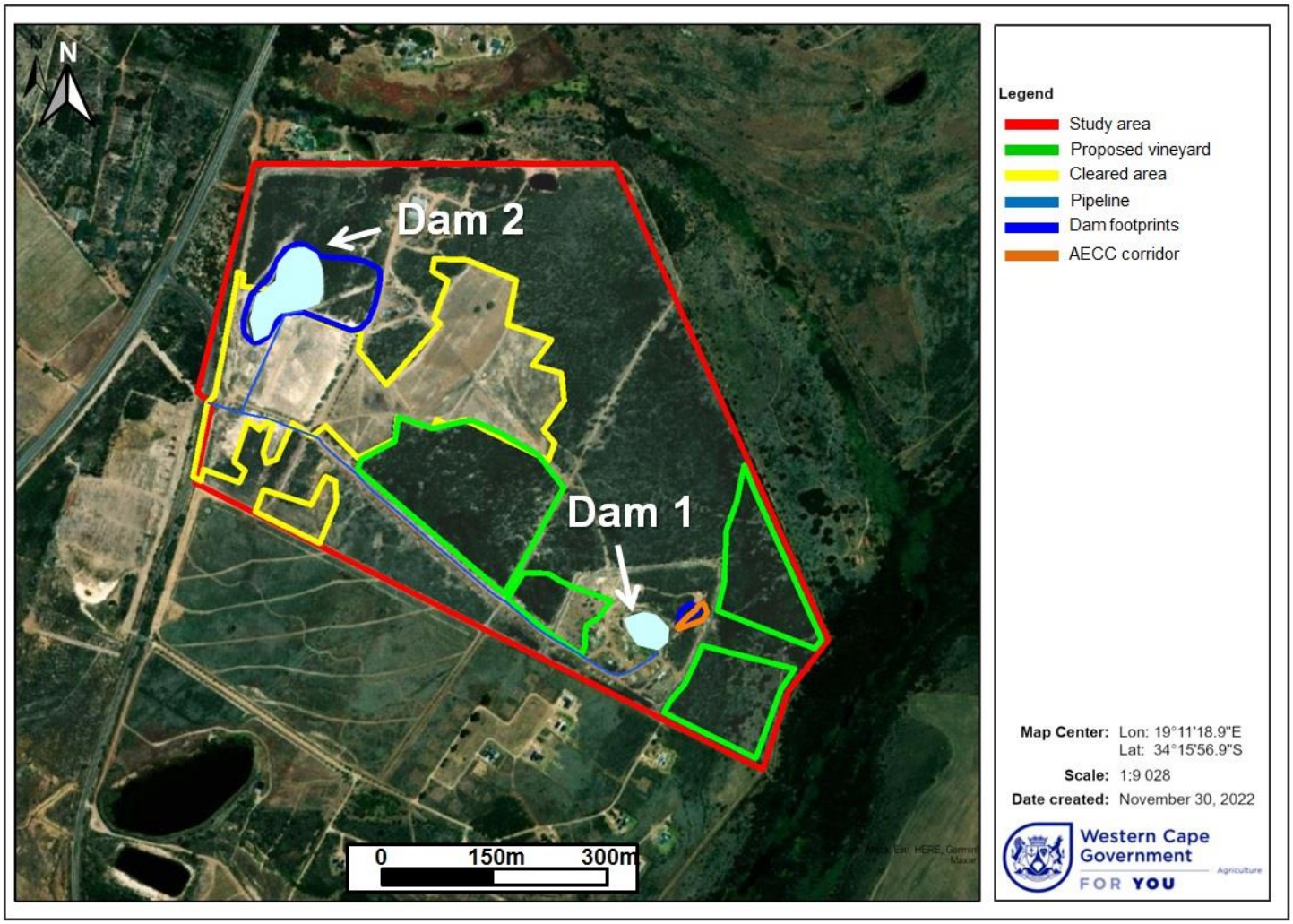


Figure 2 Spatial locations of the potential development areas under Alternative 2 (map generated in Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

2. Terms of Reference

2.1. General legislature pertaining to this report

This terrestrial faunal and avifaunal assessment report is compiled in accordance with the following guidelines:

- *Department of Environmental Affairs and Development Planning (DEA&DP) Guidelines for Involving Biodiversity Specialists in the EIA Process* (Brownlie, 2005).
- *Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes, Government Notice No. 320* (Gazetted 20 March 2020).
- *Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species*, *Government Notice No. 1150* (Gazetted 30 October 2020).
- 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 2.1 2021.

2.2 Other sources consulted

Other sources pertaining to this report are as follows:

- IUCN. 2021. The IUCN Red List of Threatened Species. Version 2021-3. https://www.iucnlist.org. Accessed on 03 November 2022.
- *National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of critically endangered, endangered, vulnerable and protected species, Government Notice No. 2007* (Gazetted 14 December 2007).

3. Reporting protocol

The study area has been identified as being of and overall “High Sensitivity” under the “Relative Animal Species Sensitivity Theme” in the Department of Forestry Fisheries and the Environment (DFFE) Screening Tool (https://screening.environment.gov.za/screeningtool/). In this regard, the larger western and north-central part of the site is identified as having a “High sensitivity” for the possible occurrence of four avifaunal Species of Conservation Concern (SCC) (Figure 3, Table 1). Parts in the south, east and north-east of the site are identified as having a “Medium sensitivity” for the possible occurrence of one avifaunal SCC and three invertebrate SCC (Table 1). The current report therefore assesses the presence or likely presence of these avifaunal and invertebrate SCC (as well as other possible SCC, see Section 9) within the study area in accordance with the protocols outlined in the Species Environmental Assessment Guideline (SANBI, 2020).

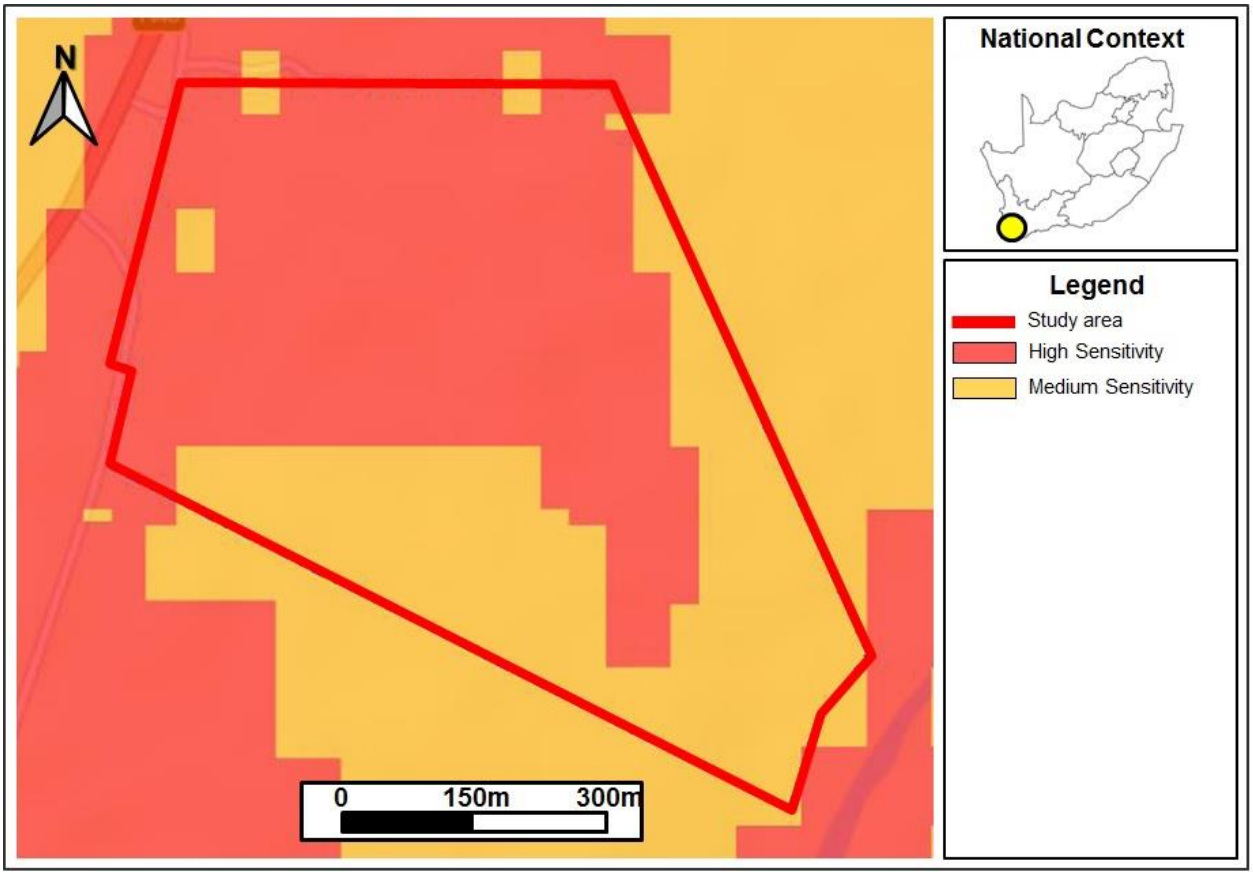


Figure 3 Relative Animal Species Sensitivity Map retrieved for the study area by the DFFE Screening Tool (https://screening.environment.gov.za/screeningtool/).

Table 1 List of Species of Conservation Concern (SCC) identified in the DFFE Screening Tool Report. For each, the listed sensitivity (possibility of occurrence within the study area), species' scientific name and common name is shown, along with its current classification under the IUCN Red List of Threatened Species (IUCN, 2021).

Sensitivity	Species	Common name	IUCN status
High	*Circus ranivorus*	African Marsh-harrier	Least Concern
High	*Neotis denhami*	Denham's Bustard	Near-Threatened
High	*Circus maurus*	Black Harrier	Endangered
High	*Afrotis afra*	Southern Black Korhaan	Vulnerable
Medium	*Turnix hottentottus*	Fynbos Buttonquail	Endangered
Medium	*Aloeides egerides*	Red Hill Copper	Vulnerable
Medium	*Brinckiella aptera*	Mute Winter Katydid	Vulnerable
Medium	*Aneuryphymus montanus*	Yellow-winged Agile Grasshopper	Vulnerable

4. Overview of the study area

4.1 Geographic location

Portion 3 of Farm 781 is approximately 68.9 hectares in size and is located roughly 3km south of Bot River in the Western Cape (Figure 4). The farm portion is bordered by the Karwyderskraal and R43 roads to the east and the Bot River along the south-eastern margin.

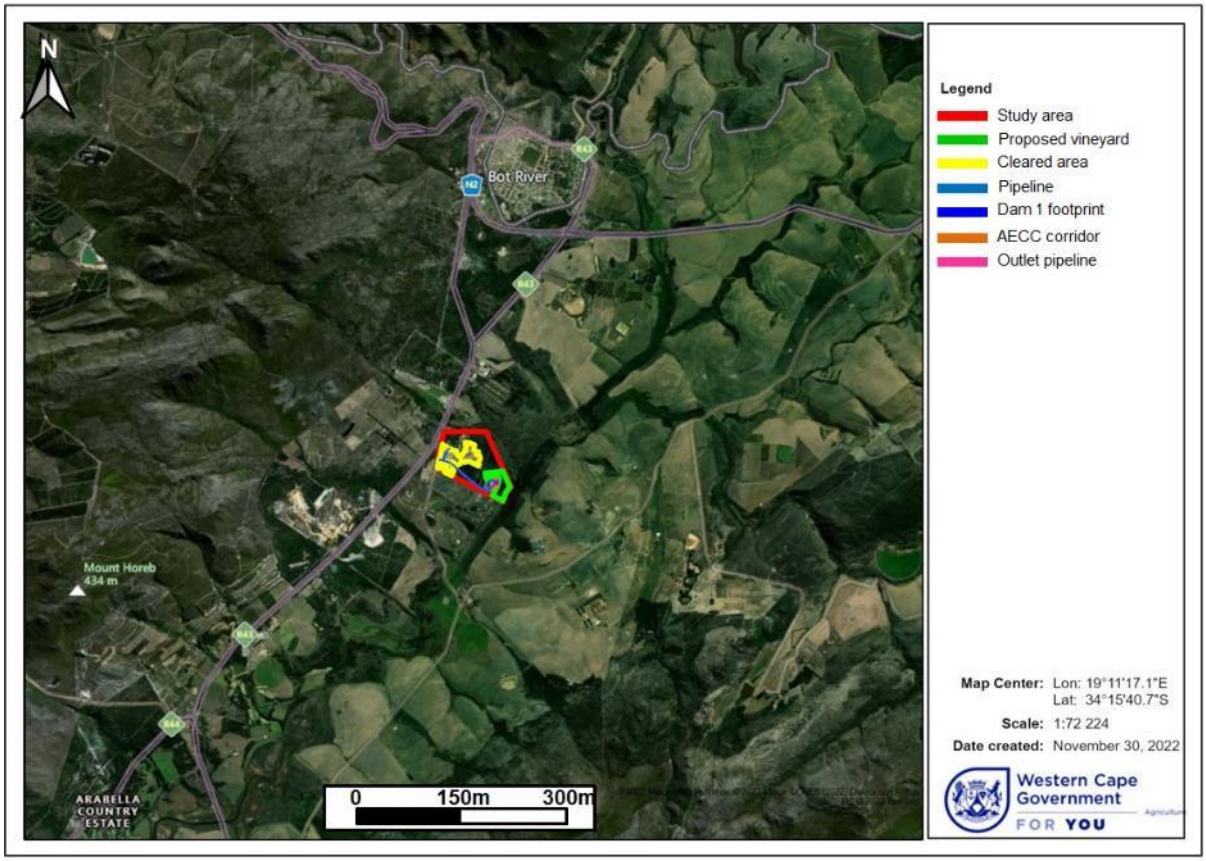


Figure 4 Spatial location of the study area relative to surrounding settlements and main roads (map generated in Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

4.2 Topography, geology and vegetation

The topography of the study area is mostly flat in the eastern section, and gently slopes south-eastward toward the Bot River (Figure 5). The geology of the site consists of the Ceres Subgroup comprising siltstone, mudstone and shale of the Bokkeveld Group, with alluvial sand in the valley bottoms. Vegetation in the study area comprises Rûens Silcrete Renosterveld in the western and south-central sections, Elim Ferricrete Fynbos in the north-western section and Western Rûens Shale Renosterveld along the eastern and north-eastern sections, with the latter corresponding to the placement of the proposed development areas under Alternative 1 (Figure 6). This Western Rûens Shale Renosterveld is classified as "Critically Endangered" by *The National List of Ecosystems that are Threatened and Need of Protection* (Government Gazette, 2011).

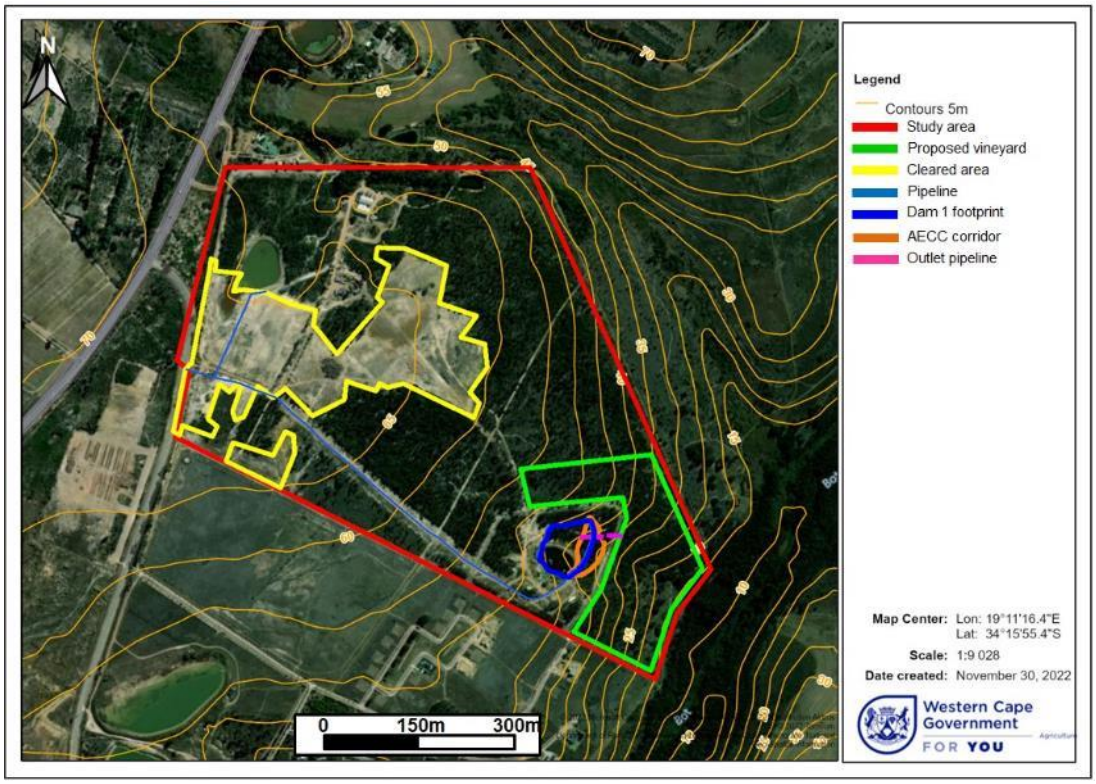


Figure 5 Topology of the study area showing 5 meter contour lines (map generated in Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

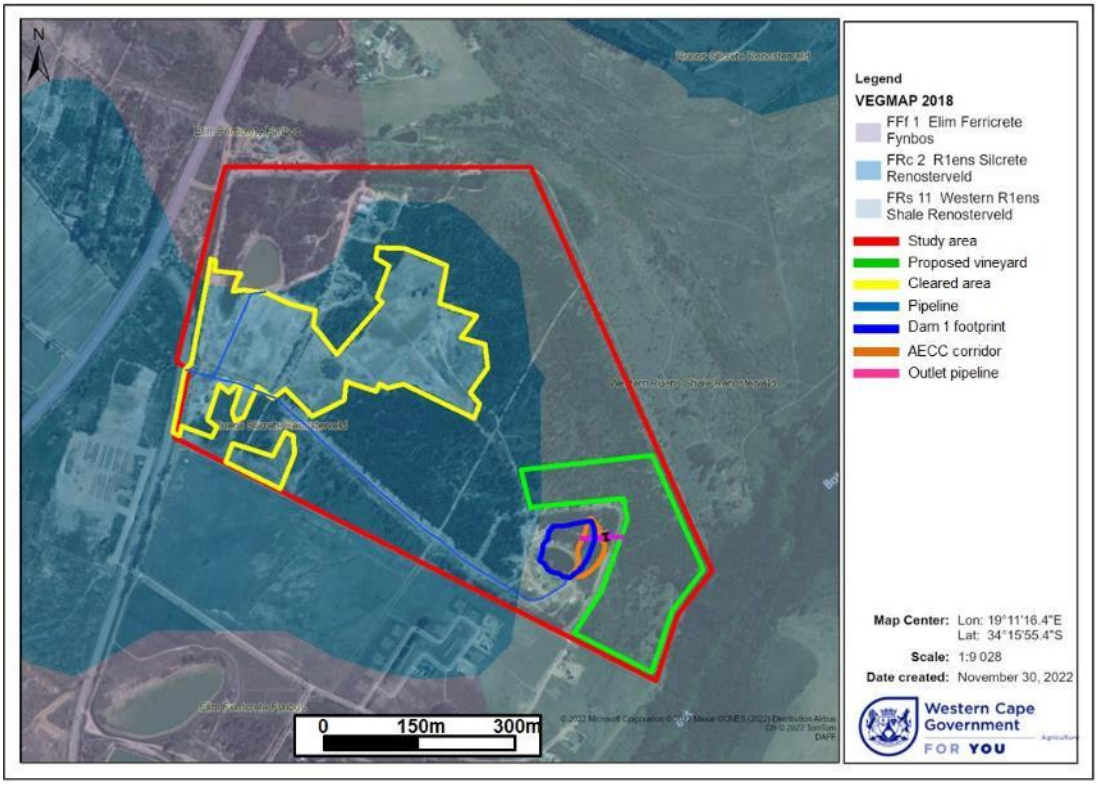


Figure 6 Vegetation types within the study area (VEGMAP, SANBI 2018; map generated in Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

4.3 Land cover

Classification of land cover within the study area (Land Cover 73-class, Department of Environmental Affairs, 2020) indicates the presence of barren areas (in the central and western parts), fallow lands and old fields consisting of trees or shrubs (in the south, east and north-east where Dam 1 and part of the proposed cultivation area is located) and low fynbos shrubland across the larger northern and central parts (partly overlapping with the proposed agricultural area under Alternative 1, Figure 7). Three artificial dams are also located on the site (in the west (Dam 2), north and south-east (Dam 1) respectively). These designations of land cover were found to be broadly accurate, and are further discussed in Section 7.

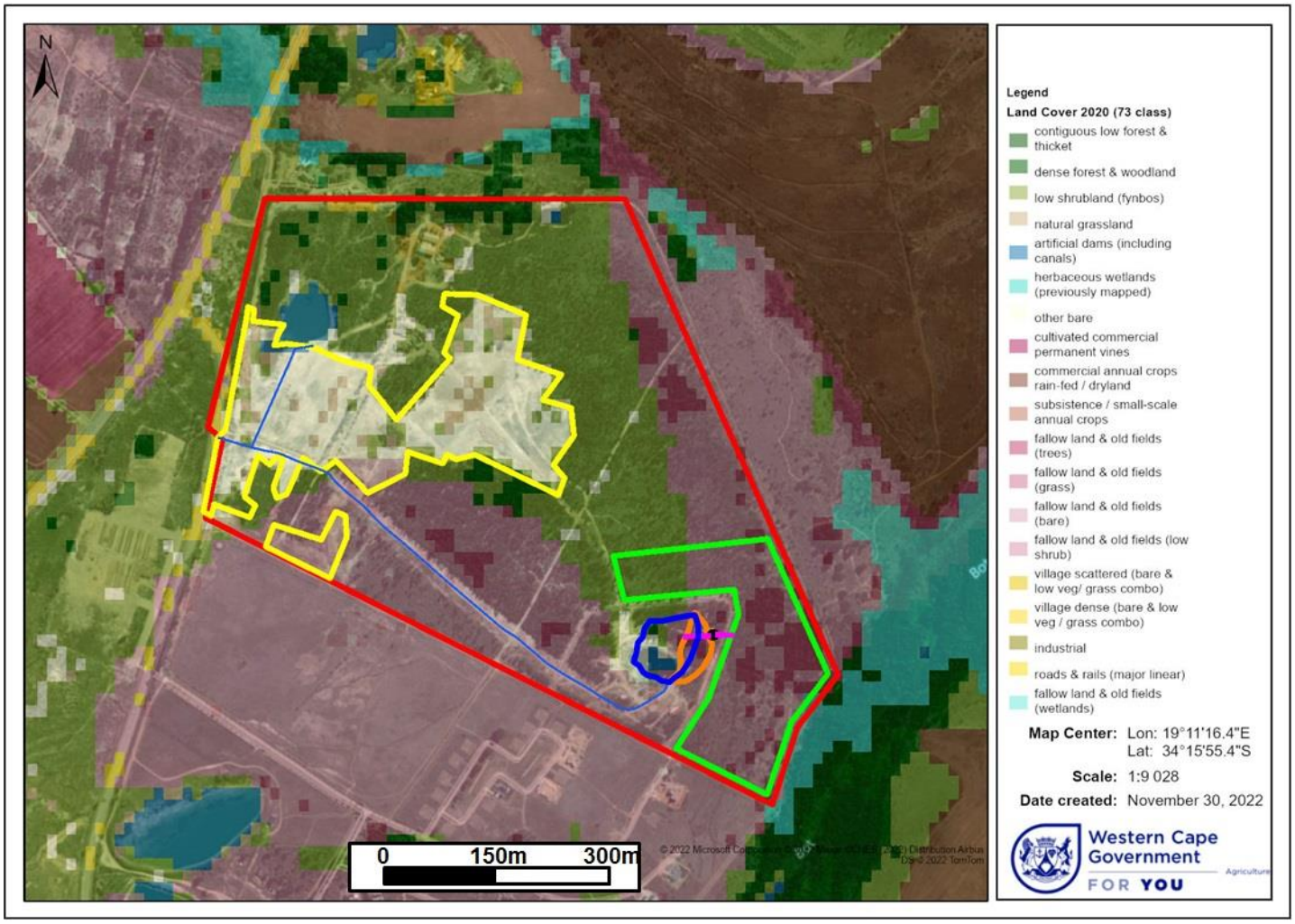


Figure 7 Land cover (Land Cover 73-class, Department of Environmental Affairs, 2020) within the study area (information sourced from Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

4.4 Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)

Critical Biodiversity Areas (CBAs) are areas required to meet biodiversity targets for ecosystems, species and ecological processes, as identified in a systematic biodiversity plan (Purves and Holmes, 2015). Ecological Support Areas (ESAs) are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of CBAs and/or in delivering ecosystem services. A small area in the south-east of the site is classified as a Terrestrial CBA (overlapping with part of the proposed agricultural area), with small sections on the Bot River floodplain and at Dam 2 constituting Aquatic CBA (Figure 8). The remainder of the site (and proposed development areas) is retrieved as a CBA2, which exists in a degraded state (Table 2). The site furthermore overlaps with two small ESA2 (small portions in the east, and at Dam 2, Figure 9), which similarly exist in a degraded state (Table 2). The presence and integrity of these CBA and ESA are discussed in Section 12.

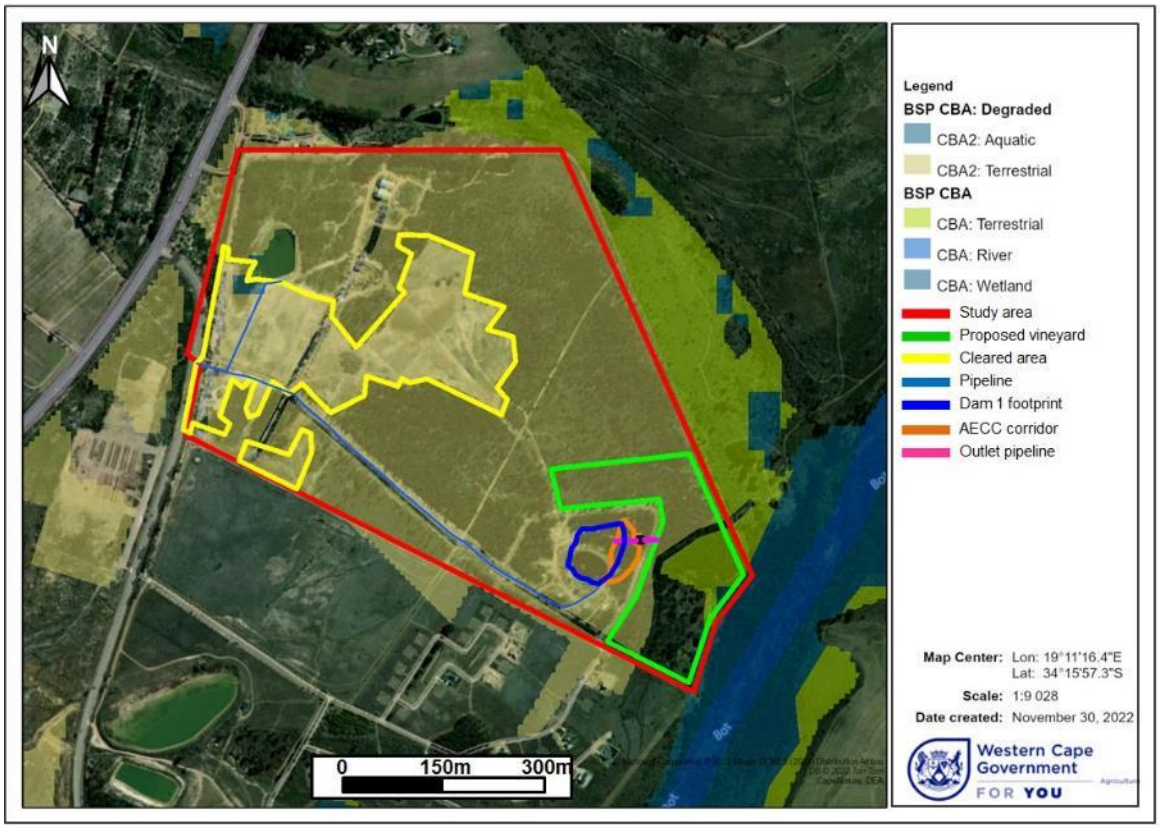


Figure 8 Spatial locations of Critical Biodiversity Areas (CBAs) overlapping with the study area (information sourced from Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

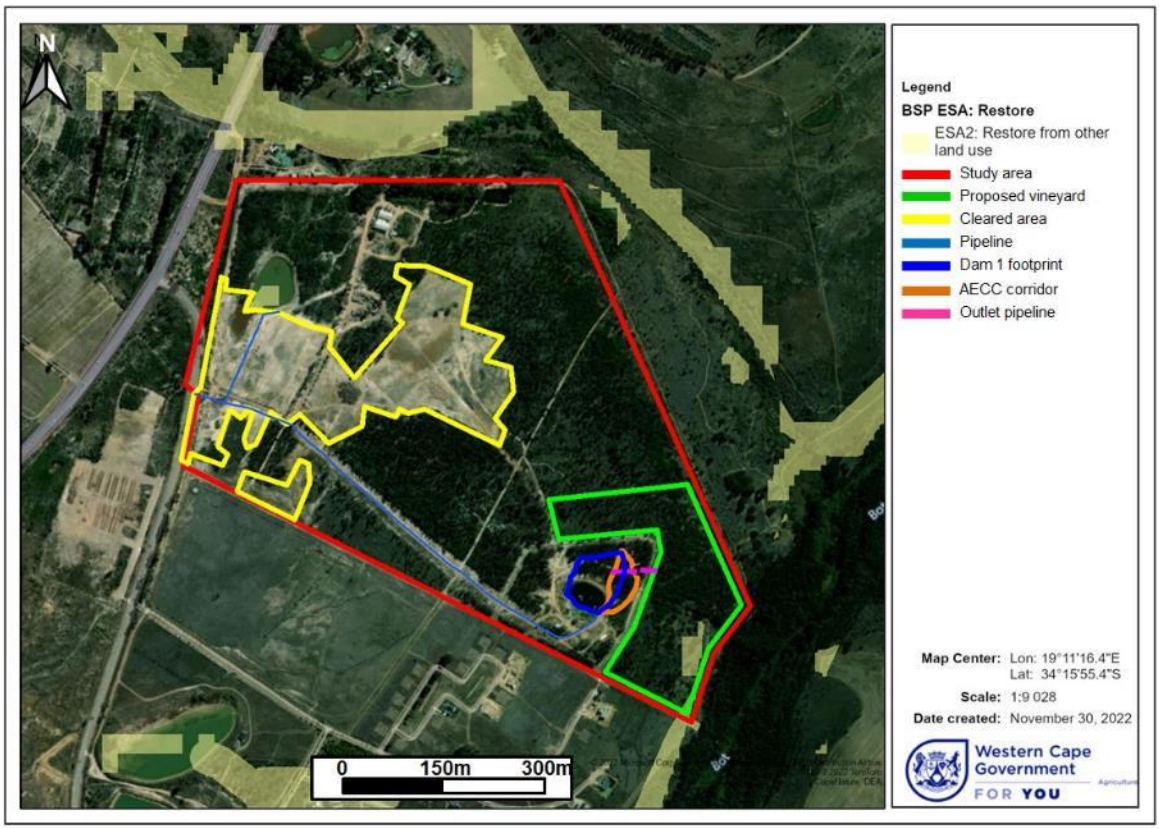


Figure 9 Spatial location of Ecological Support Areas (ESAs) overlapping with the study area (information sourced from Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

Table 2 A brief description of the Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) categories which intersect with the study area (information sourced from Cape Farm Mapper version 2.6.10, Western Cape Department of Agriculture).

Category 1	Category 2	Definition	Objective
CBA: Terrestrial	CBA: Terrestrial	Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.	Maintain in a natural or near-natural state, with no further loss of natural habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.
CBA: Aquatic	CBA: Wetland	Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.	Maintain in a natural or near-natural state, with no further loss of natural habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.
CBA2: Terrestrial	CBA2: Terrestrial	Areas in a degraded or secondary condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.	Maintain in a natural or near-natural state, with no further loss of habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land-uses are appropriate.
ESA2: Restore from other land use	-	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services.	Restore and/or manage to minimize impact on ecological processes and ecological infrastructure functioning, especially soil and water-related services, and to allow for faunal movement.

5. Study methodology

5.1 Study aims

This study represents an assessment of the terrestrial faunal and avifaunal diversity and abundances, -habitat composition, ecosystem dynamics and potential occurrence of avifaunal and invertebrate (and other) SCC within the study area. As such, the aims of this investigation were to:

1.) Assess, define and create a spatial rendering of available faunal habitats across the study area based on information gathered during the field survey as well as through a desktop assessment using the latest satellite imagery,

2.) compile a complete faunal desktop species list (including avifauna and butterflies) for the study area based on a thorough desktop assessment so as to assess the presence of any of the listed SCC (Table 1) as well as any additional SCC,

3.) compile a faunal species list (including mammals, reptiles, amphibians, avifauna, butterflies and grasshoppers) within the study area through field surveying so as to assess the possibility of occurrence of the SCC retrieved in the desktop assessment (based on appropriate sampling methods, as well as the presence of suitable habitat for these species), or any additional SCC which are present on the site, and

4.) generate spatial occurrence maps for the recovered faunal species within the study area to assess the spatial extent of areas supporting higher levels of diversity, and SCC sub-populations and habitats which need consideration during the impact assessment.

5.2 Desktop assessment

To assess the possible occurrence of the listed (Table 1) as well as any additional avifaunal and butterfly SCC, a desktop assessment was performed to create a representative desktop species list for these faunal groups. Because distributional

data on grasshopper and katydid species is scarce, the presence of these SCC were could only be assessed during the field survey (see Subsection 5.3).

5.2.1 Avifauna

The desktop avifaunal species list for the study area was generated by referring to the species records of the South African Bird Atlas Project 2 (SABAP2, https://sabap2.birdmap.africa/) (Appendix A). The study area overlaps with one pentad (see below) which is well-represented in the atlassing cards:

Pentad: 3415_1910

Full protocol cards: 123
Ad-hoc protocol cards: 68
Total cards: 191

To create the desktop avifaunal species list for the study area, all species observed in this pentad were included, noting the total number of observations (including both full and ad-hoc protocols), and the latest date that the species was recorded.

5.2.2 Invertebrates

The desktop species list for butterflies was constructed with reference to the distributional records available on the “LepiMAP” platform of the Virtual Museum of the Animal Demographic Unit (vmus.adu.org), noting species recorded within the Quarter Degree Grid Square (QDGS) where the study area is located (3419AC).

5.3 Field survey

The study area was surveyed on foot over three consecutive days, from the 8th to the 10th of November 2022, during the Spring season. Weather conditions during the surveying period were characterised by relatively warm (20°C and higher) days, with cloud cover on the first two days and with a moderate breeze in the afternoon of the first day, and during the second and third days (Figure 10).

Surveying included unconstrained point sampling through search meanders, as well as acoustic surveys at Dam 1. All tracks surveyed were recorded by GPS (Garmin eTrex® 10, Garmin International Inc, USA) and are represented in Figure 11. Terrestrial faunal species (mammals and reptiles) were identified by direct visual observation, or by their tracks, burrows, remains or scat. Amphibian species were further identified by direct visual observation or by auditory means, supplemented by both diurnal and nocturnal sound recordings. Avifaunal species were identified by visual observation, using a 180x zoom lens, or by auditory means. Butterfly species were identified and photographed from less than one meter away. Finally, grasshopper species were collected and identified through sweepnetting procedures. All observations were recorded by GPS and the species or evidence of species' presence or activity were photographed using a digital camera (Canon PowerShot SX430 IS, Canon Inc, USA). A species list for all fauna recorded within the study area is given in Appendix C.

Given the warmer daily temperatures, faunal and avifaunal species' activity was observed to be high over the surveying period, thereby resulting in 163 recorded observations across the study area (Figure 12, Appendix C), relating to one observation per every 0.4 hectares of study area (the total study area is 68.9 hectares in extent). During surveying, faunal habitats were broadly identified in the field, and thereafter delineated through a desktop assessment of the study area using satellite imagery (CapeFarmMapper Version 2.6.4, Western Cape Department of Agriculture).

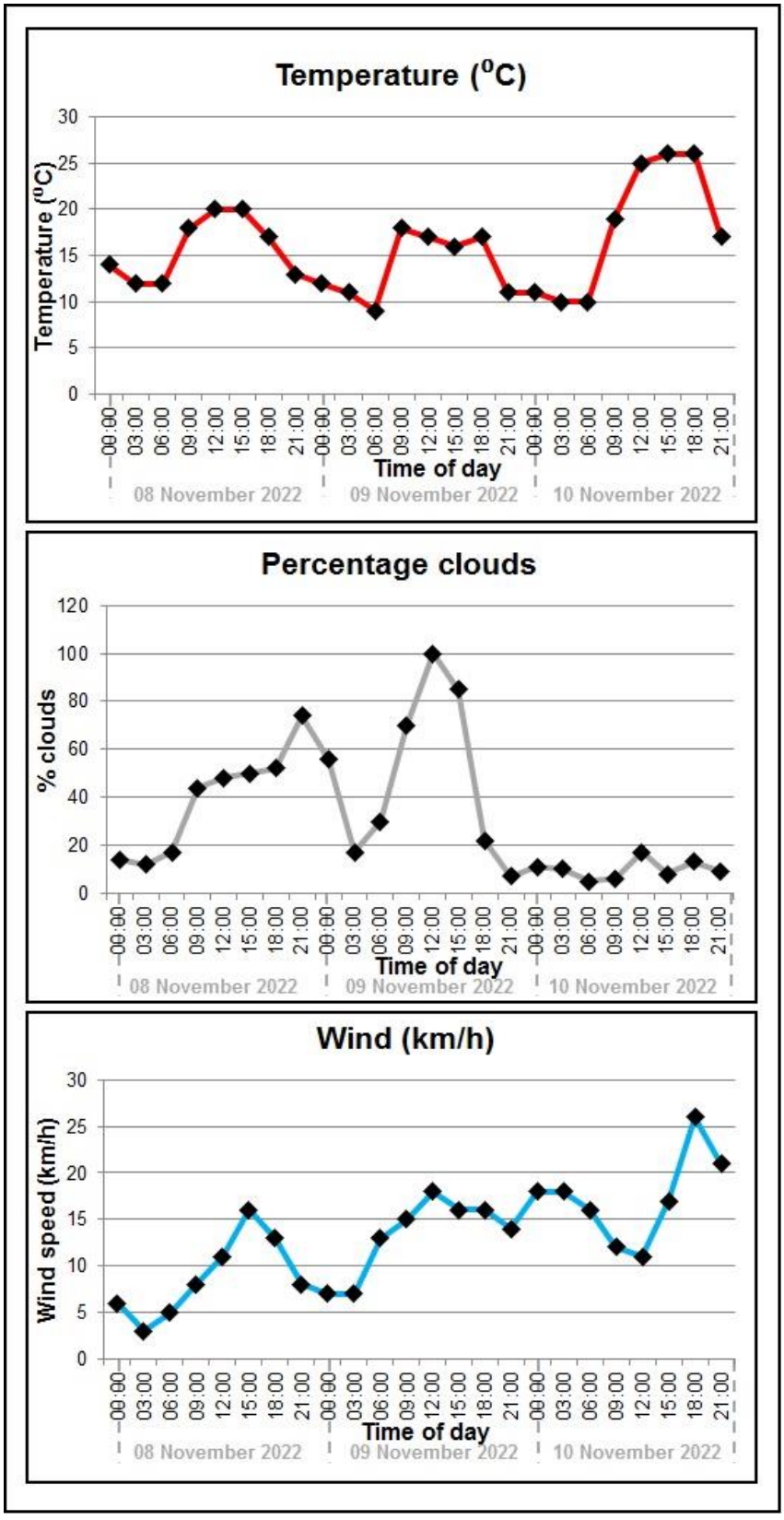


Figure 10 Weather conditions in the study area over the surveying period (8 to 10 November 2022). The time of day is indicated, along with the temperature (in °C), percentage cloud cover and wind speed (in km/h) (weather data sourced from https://www.worldweatheronline.com).

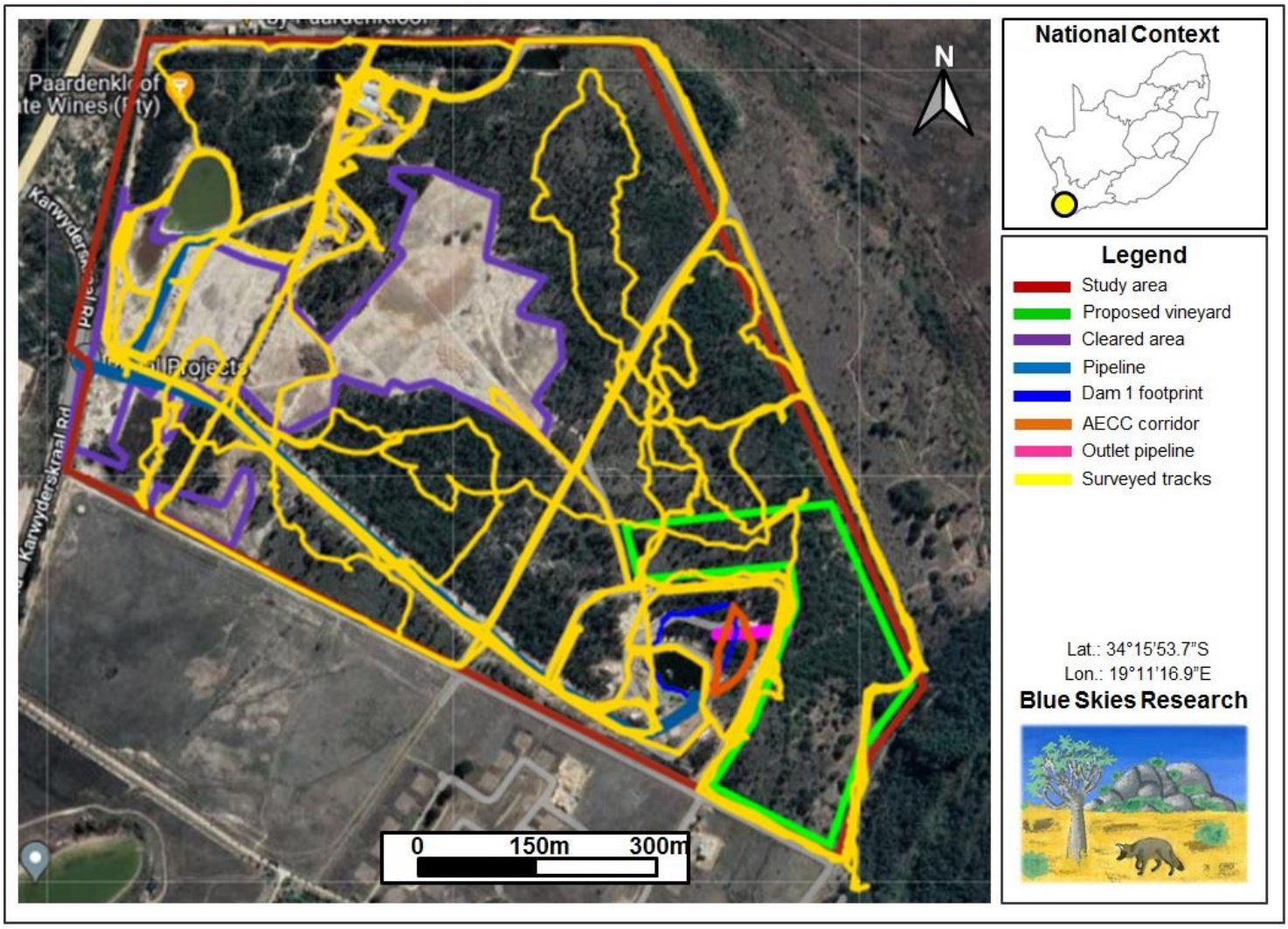


Figure 11 Spatial tracks recorded by GPS for all the search meanders across the study area over the surveying period.

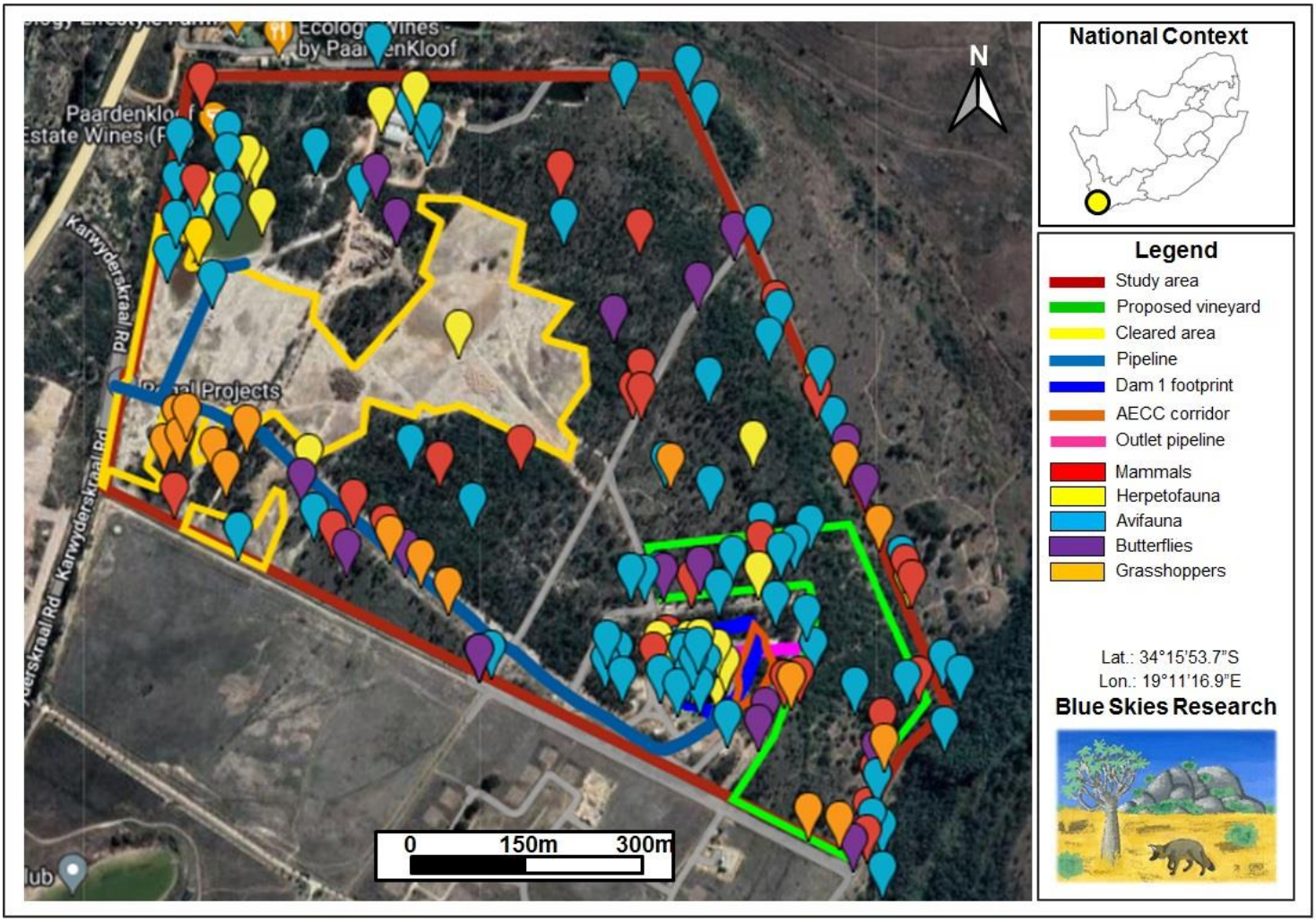


Figure 12 Spatial locations of all the faunal observations across the study area over the surveying period.

6. Assumptions and limitations

The desktop species lists for the study area (Appendices A and B) utilized the most up-to-date observational records available, and therefore the SCC considered in the current investigation (see Section 9) all occur, or are likely to occur (given habitat characteristics) on the site. Even so, it is possible that the species list may not be complete given the cryptic nature of many small species (especially invertebrate species). Conversely, it is possible that not all avifaunal SCC considered (but are unconfirmed in the study area) occur on the site, or may only be ephemerally associated to the site.

It is further possible that the surveying period did not correspond to the activity period of some species. Coupled to this, the impenetrable nature of the alien and invasive vegetation (trees) affected sampling efforts as not all areas within this habitat could be surveyed. Taken together therefore, the current rendering of the faunal composition within the study area only partly reflects the true faunal species richness of, and faunal abundances on the site.

7. Faunal habitat types within the study area

The study area is comprised of seven broadly identified habitat types (Figure 13, Table 3). The most intact habitats on the site are characterised by either dense, medium-high or low shrubland habitats, and encompass the southern margin and central to northern parts of the study area. Although these habitats bear evidence of either light or medium infestations by alien invasive trees such as Pine, Port Jackson and Bluegum, these trees have been mostly felled, allowing for a more open landscape and improvement of habitat quality.

The more degraded parts of the site have been either cleared (through soil preparation or the planting of vineyards) in the western and central parts, or consist of degraded areas where incidences of heavy alien tree infestations have been felled with little remaining natural vegetation (in the southern section). The eastern, north-eastern and north-western sections of the site harbour dense and impenetrable stands of alien invasive trees (designated as trees/woodland/thicket habitat) with little remaining natural vegetation within these thick stands.

Finally, three artificial dams are located on the site (in the western, northern and eastern parts respectively), with only Dam 1 showing evidence of vegetation which was planted by the applicant. Overall, these habitat conditions align well with the land cover designations on the site (see Subsection 4.3).

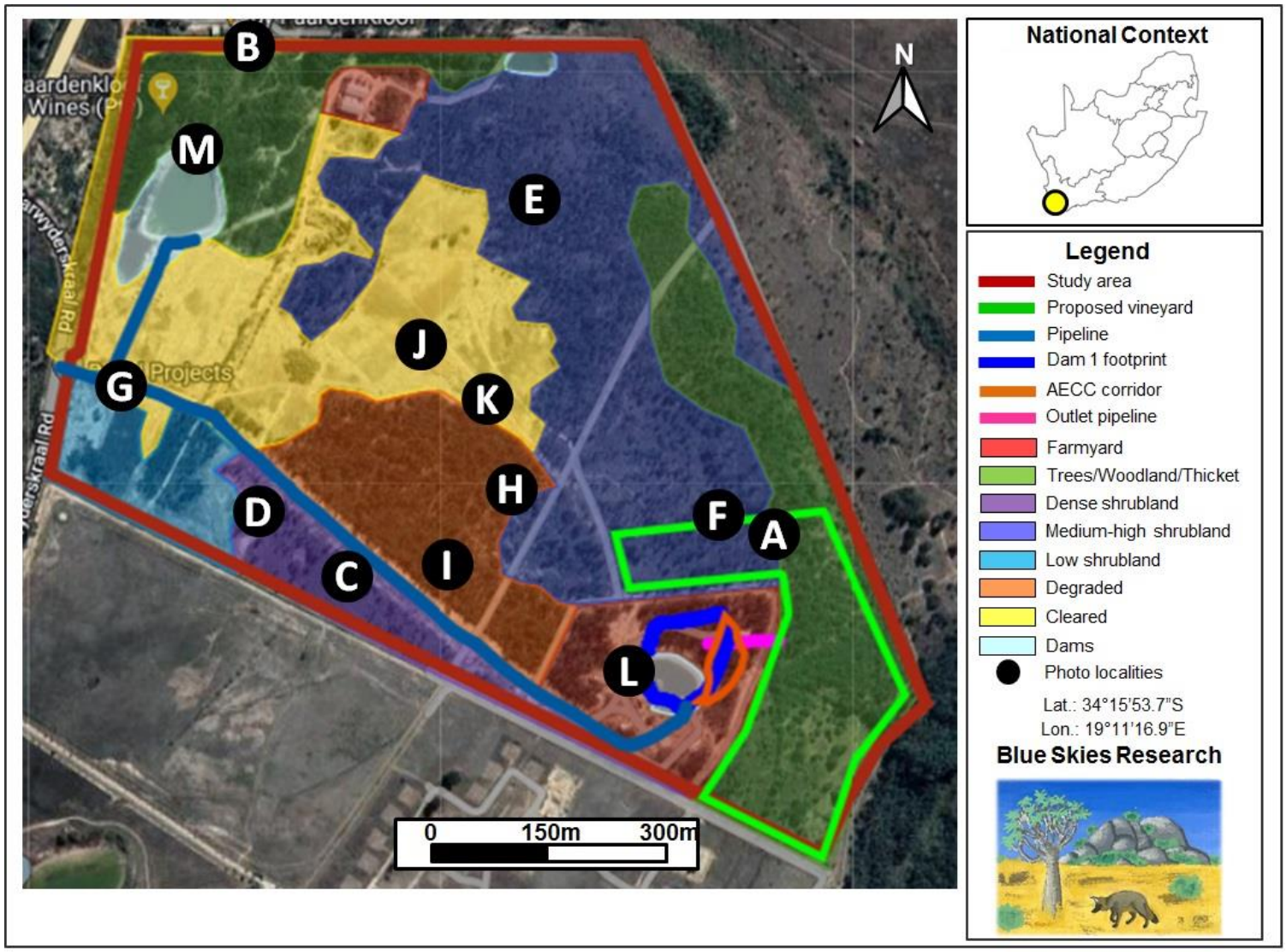


Figure 13 A broad indication of the spatial extent of habitat types within the study area. Photo localities (A to M) correspond to the habitat photos in Table 3.

Table 3 Habitat locations, habitat descriptions and visual representations of the different habitat types within the study area. Location designations (A to M) correspond to the photo locations in Figure 12.

Location	Habitat description	Photo 1	Photo 2
A 34°16'00.6"S 19^{0}11'31.5"E **B** 34^{0}15'41.3"S 19^{0}11'06.2"E	**Trees/Woodland/Thicket** Consists of dense (mostly impenetrable) stands of alien invasive trees such as Pine, Port Jackson and Bluegum. Very little natural vegetation remains among these trees.		

C 34^{0}16’02.3”S 19^{0}11’11.0”E **D** 34^{0}15’59.8”S 19^{0}11’06.7”E	**Dense shrubland** Consists of dense and high (>1m) shrub vegetation with a low incidence of current or cleared alien invasive vegetation.	 
E 34^{0}15’47.3”S 19^{0}11’19.9”E **F** 34^{0}15’59.9”S 19^{0}11’28.7”E	**Medium-high shrubland** Consists of more open and lower (<1m) shrub vegetation with fynbos and renosterveld elements. A medium incidence of current or cleared alien invasive vegetation is evident within this habitat.	 

G 34^{0}20’12.5”S 19^{0}06’01.6”E	**Low shrubland** Consists of more open and low shrub vegetation.	
H 34^{0}15’58.9”S 19^{0}11’18.9”E **I** 34^{0}16’01.8”S 19^{0}11’15.8”E	**Degraded** Consists of cleared dense stands of alien invasive vegetation. Almost none of the natural vegetation remains here.	 

J 34^{0}15’53.2”S 19^{0}11’14.5”E **K** 34^{0}15’55.3”S 19^{0}11’17.7”E	**Cleared** Consists of cleared (through soil preparation) or cultivated (vineyards) areas.		
L 34^{0}16’06.1”S 19^{0}11’24.4”E **M** 34^{0}15’45.5”S 19^{0}11’03.7”E	**Dams** Consists of artificial dams, with only Dam 1 (photo L) harbouring vegetation which was planted by the applicant.		

8. Faunal and avifaunal composition within the study area

8.1 Mammals

Eleven mammal species were recovered within the study area (Figures 14 and 15), all of which are currently classified as “Least concern” by the IUCN Red List of Threatened Species (Appendix C). Larger mammal species on the site include the Common Duiker (*Sylvicapra grimmia*), Cape Grysbok (*Raphicerus melanotis*), Cape Scrub Hare (*Lepus saxatilis*) and Cape Porcupine (*Hystrix africaeaustralis*). Common prey species such as the Cape Golden Mole (*Chrysochloris asiatica*), and rodents such as the Four-striped Grass Mouse (*Rhabdomys pumilio*), Cape Gerbil (*Gerbilliscus afra*) and African Mole-rat (*Cryptomys hottentotus*) are also present on the site. Given the presence of these prey species, small carnivores are present including the Caracal (*Caracal caracal*), Yellow Mongoose (*Cynictis penicillata*) and Cape Grey Mongoose (*Herpestes pulverulentus*).

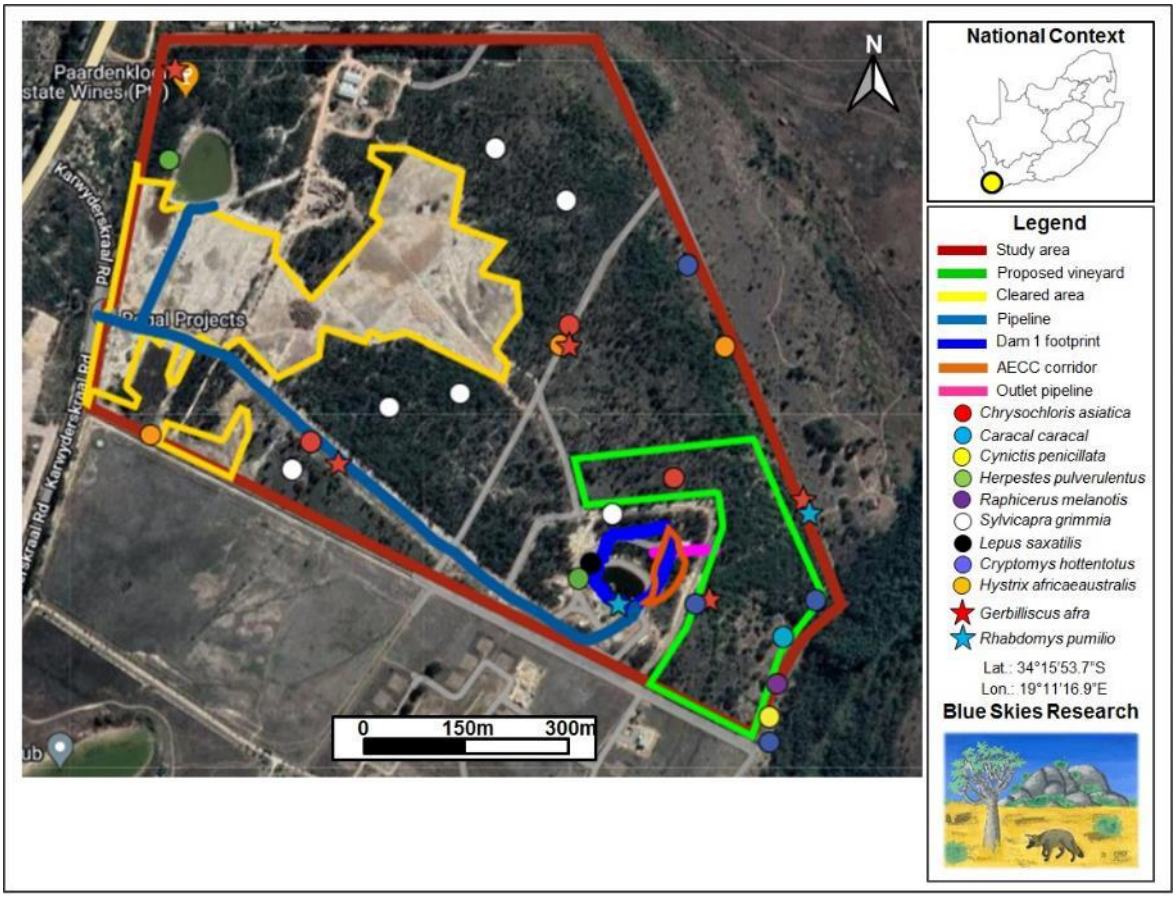


Figure 14 Spatial locations of the different mammal species recorded within the study area.

Figure 15 Photographic evidence of the different mammal species recorded in the study area. A) Tunnel system (arrowed) of the Cape Golden Mole (*Chrysochloris asiatica*). B) Scat of a Caracal (*Caracal caracal*). C) Burrow (arrowed) of a Yellow Mongoose (*Cynictis penicillata*). D) Tracks of a Cape Grey Mongoose (*Herpestes pulverulentus*). E) Tracks of a Cape Grysbok (*Raphicerus melanotis*) ewe and lamb. F) Common Duiker (*Sylvicapra grimmia*). G) Scrub Hare (*Lepus saxatilis*). H) Mounds of the African Mole-rat (*Cryptomys hottentotus*). I) Feeding hole of the Cape Porcupine (*Hystrix africaeaustralis*). J) Burrow of the Cape Gerbil (*Gerbilliscus afra*). K) Run (arrowed) of the Four-striped Grass Mouse (*Rhabdomys pumilio*).

8.2 Herpetofauna

8.2.1 Reptiles

Five reptile species were recorded from the site (Figures 16 and 17), all of which are currently classified as “Least concern” by the IUCN (IUCN, 2021; Appendix C). The most abundant reptile species include the Angulate Tortoise (*Chersina angulata*) and South African Helmeted Terrapin (*Pelomedusa galeata*), with a large subpopulation of the latter found within Dam 2. One common lizard species, the Cape Skink (*Trachylepis capensis*) was also noted, with two large predatory snake species, the Cape Cobra (*Naja nivea*) and Puff Adder (*Bitis arietans*) also recorded on the site.

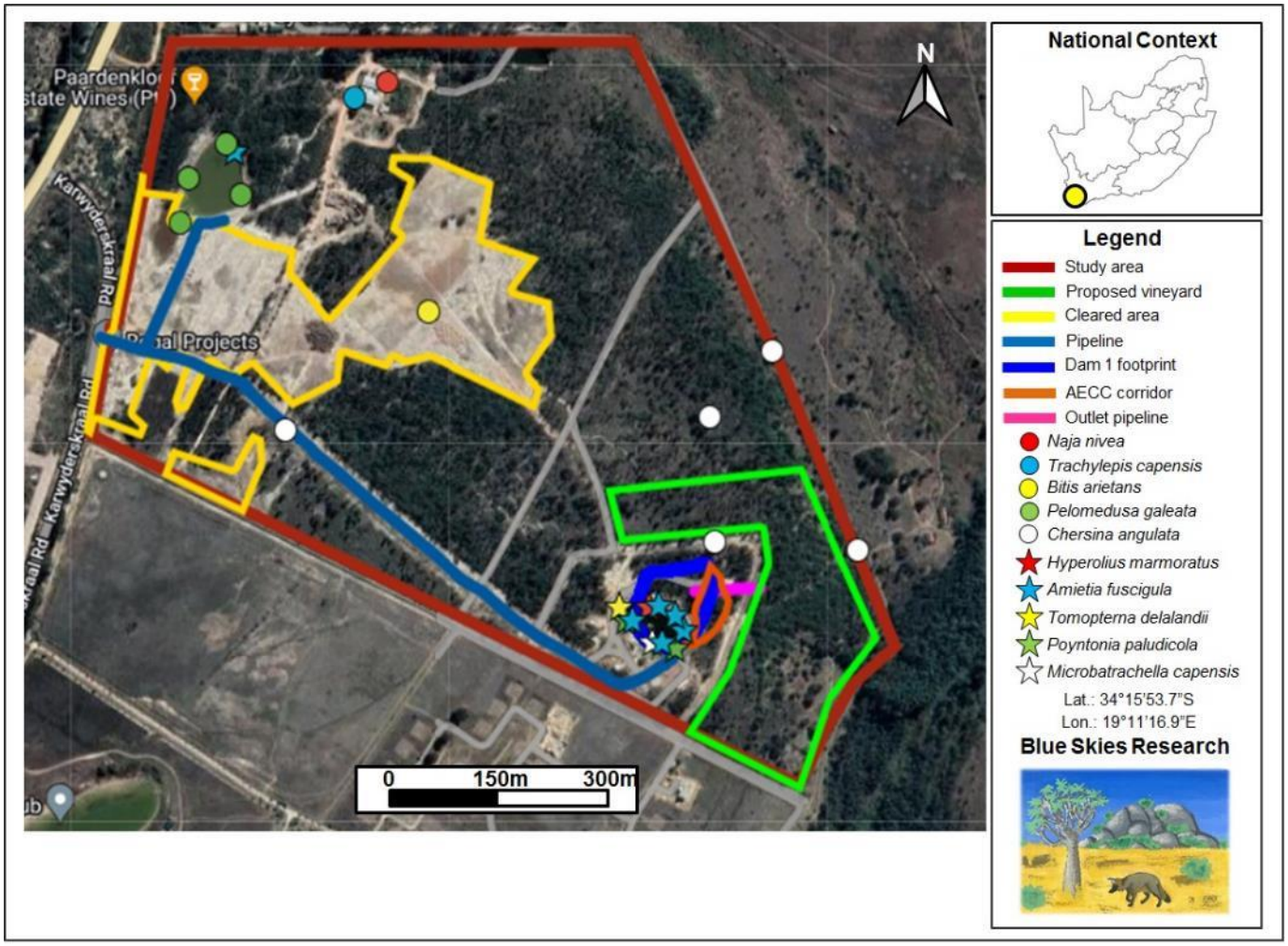


Figure 16 Spatial locations of the different herpetofaunal species recorded within the study area.

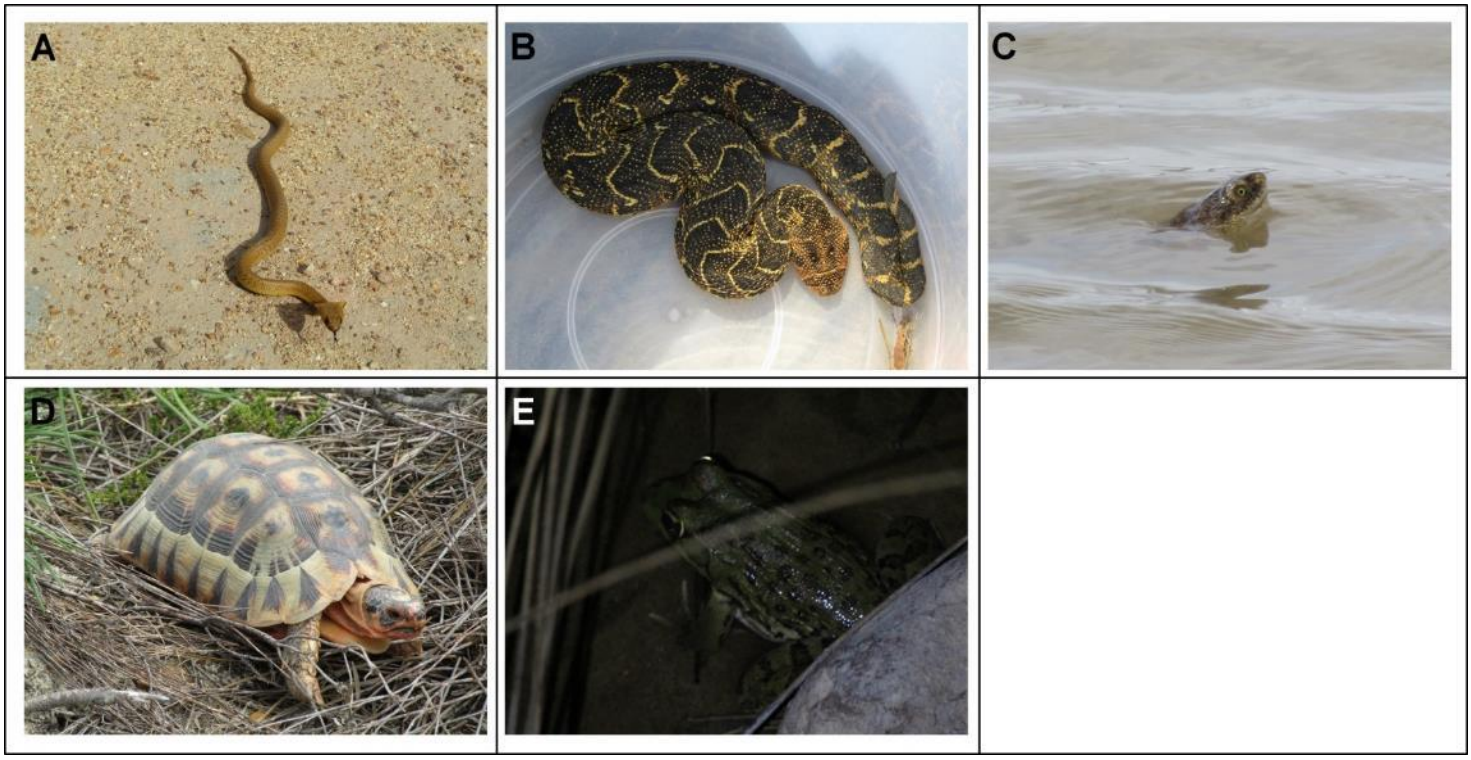


Figure 17 Photographic evidence of the different herpetofaunal species recorded in the study area. A) Cape Cobra (*Naja nivea*). B) Puff Adder (*Bitis arietans*). C) Helmeted Terrapin (*Pelomedusa galeata*). D) Angulate Tortoise (*Chersina angulata*). E) Dark-throated River Frog (*Amietia fuscigula*).

8.2.2 Amphibians

Five frog species were recorded in the study area (Figures 16 and 17), three of which are currently classified as “Least Concern” by the IUCN (IUCN, 2021; Appendix C), and two which represent amphibian SCC. These two amphibian SCC include the:

1. Montane Marsh Frog (*Poyntonia paludicola*) classified as “Near-Threatened”, and
2. Cape Flats Frog (*Microbatrachella capensis*) classified as “Critically Endangered” by the IUCN (Appendix C, the observational record for these species have been added to the iNaturalist database).

All frog species occur within or around Dam 1 (Figure 15), including the Painted Reed Frog (*Hyperolius marmoratus*), Dark-throated River Frog (*Amietia fuscigula*),

Cape Sand Frog (*Tomopterna delalandii*), Montane Marsh Frog (*Poyntonia paludicola*) and Cape Flats Frog (*Microbatrachella capensis*). Only the Dark-throated River Frog was recorded in Dam 2 (Figure 15).

8.3 Avifauna

8.3.1 Desktop assessment

According to the SABAP2 records, 193 bird species have been recorded from the pentad overlapping the study area with 182 species classified as “Least Concern” by the IUCN (IUCN, 2021), and 11 species which constitute avifaunal SCC (Appendix A). These avifaunal SCC includes the:

1. Forest Buzzard (*Buteo trizonatus*) classified as “Near-Threatened”,
2. Black Harrier (*Circus maurus*) classified as “Endangered”,
3. African Marsh Harrier (*Circus ranivorus*) classified as “Least Concern”,
4. Martial Eagle (*Polemaetus bellicosus*) classified as “Endangered”,
5. Secretarybird (*Sagittarius serpentarius*) classified as “Endangered”,
6. Maccoa Duck (*Oxyura maccoa*) classified as “Endangered”,
7. Blue Crane (*Anthropoides paradiseus*) classified as “Vulnerable”,
8. Southern Black Korhaan (*Afrotis afra*) classified as “Vulnerable”, and
9. Denham's Bustard (*Neotis denhami*) classified as “Near-Threatened”
10. Ground Woodpecker (*Geocolaptes olivaceus*) classified as “Near-Threatened”
11. Cape Cormorant (*Phalacrocorax capensis*) classified as “Endangered” by the IUCN.

8.3.2 Field survey

In total, 55 bird species were recorded within the study area, 53 of which are currently classified as “Least concern” by the IUCN (IUCN, 2021), and two species, the Black Harrier (*Circus maurus*) and Blue Crane (*Anthropoides paradiseus*),

representing avifaunal SCC (Figures 18 and 19, Appendix C, the observational records for these avifaunal SCC have been submitted to the SABAP2 database).

The majority of avifauna on the site constitute common freshwater- or vegetation associated species, and avifaunal diversity appears spatially clustered around the artificial dams on the site, as well as within the Medium-high shrubland habitat and along the site margins (Figure 18). Most notable is the high diversity of raptor species in the study area, including the Common Buzzard (*Buteo buteo*), Jackal Buzzard (*Buteo rufofuscus*), Black Harrier (*Circus maurus*), Black-winged Kite (*Elanus caeruleus*), African Fish Eagle (*Haliaeetus vocifer*), Yellow-billed Kite (*Milvus aegyptius*) and Spotted Eagle-Owl (*Bubo africanus*).

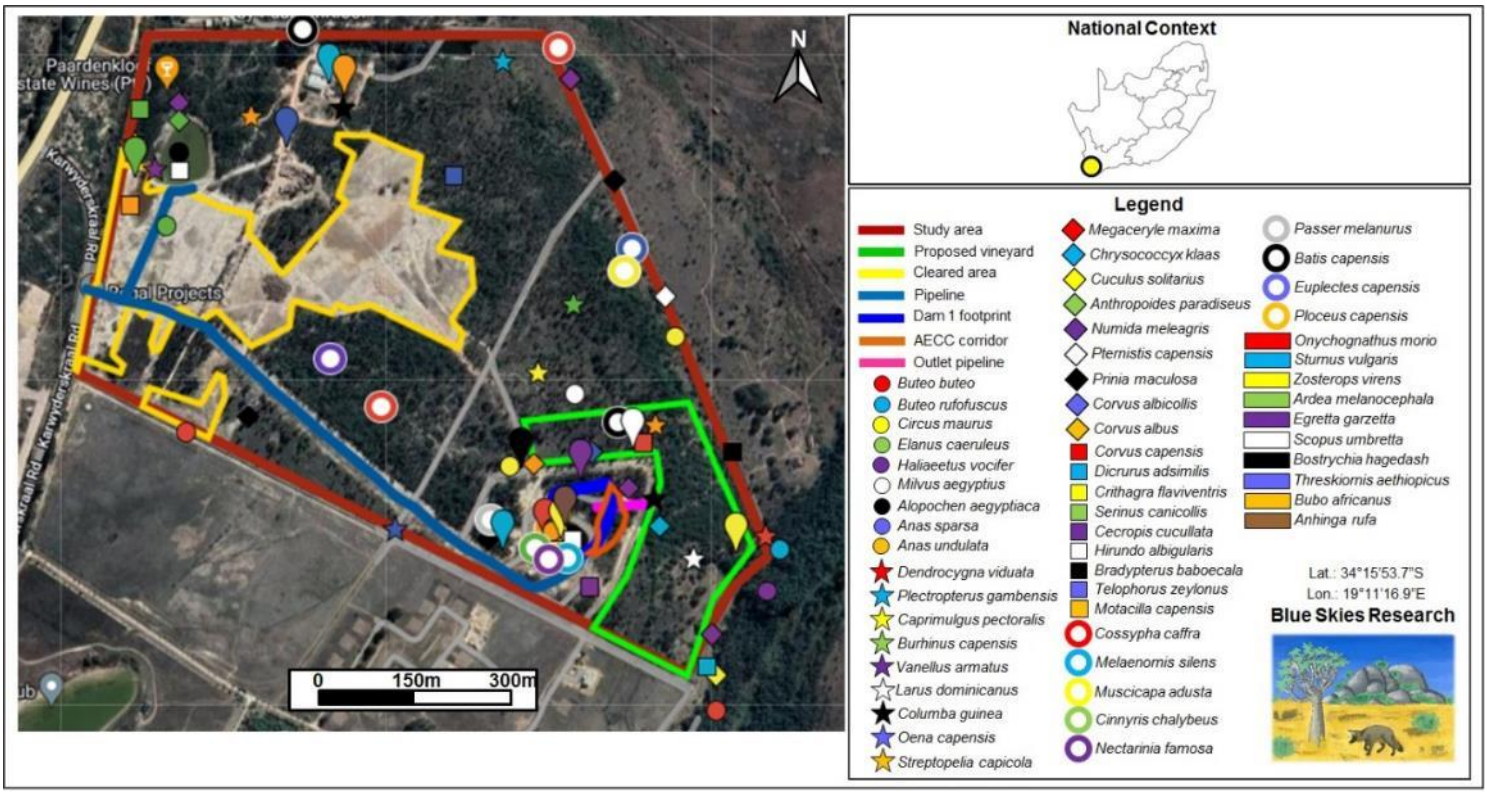
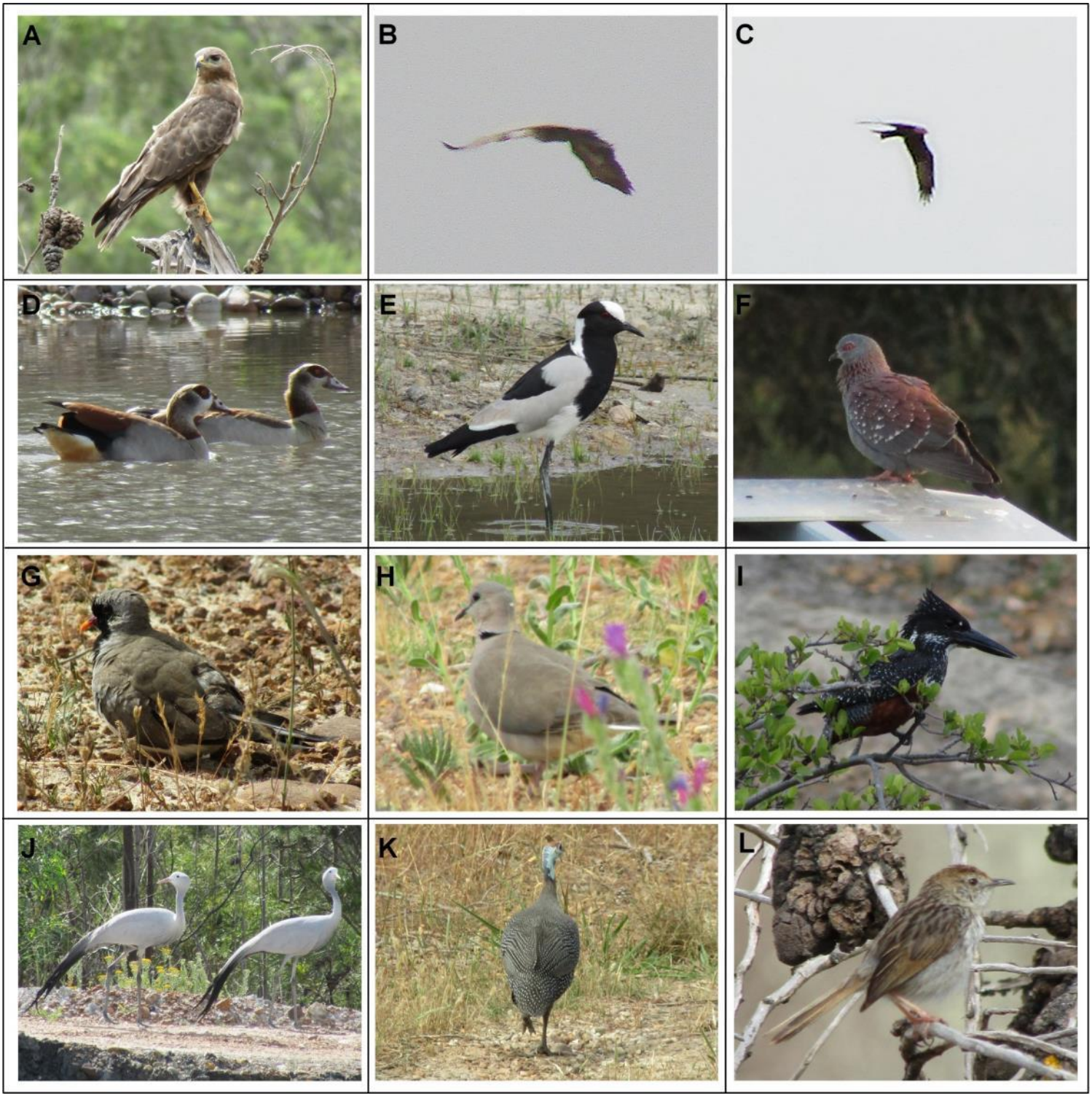


Figure 18 Spatial locations of the different avifaunal species recorded within the study area.



CELL: (083) 453 7916 E-MAIL: BlueSkiesResearch01@gmail.com
13 Dennelaan, Stilbaai, 6674

CELL: (083) 453 7916 E-MAIL: BlueSkiesResearch01@gmail.com
13 Dennelaan, Stilbaai, 6674

Figure 19 Photographic evidence of different avifaunal species recorded in the study area. A) Common Buzzard (*Buteo buteo*). B) Jackal Buzzard (*Buteo rufofuscus*). C) Yellow-billed Kite (*Milvus aegyptius*). D) Egyptian Goose (*Alopochen aegyptiaca*). E) Blacksmith Lapwing (*Vanellus armatus*). F) Speckled Pigeon (*Columba guinea*). G) Namaqua Dove (*Oena capensis*). H) Cape Turtle Dove (*Streptopelia capicola*). I) Giant Kingfisher (*Megaceryle maxima*). J) Blue Crane (*Anthropoides paradiseus*). K) Helmeted Guineafowl (*Numida meleagris*). L) Karoo Prinia (*Prinia maculosa*).

M) White-necked Raven (*Corvus albicollis*). N) Pied Crow (*Corvus albus*). O) Fork-tailed Drongo (*Dicrurus adsimilis*). P) Yellow Canary (*Crithagra flaviventris*). Q) Cape Canary (*Serinus canicollis*). R) Greater Striped Swallow (*Cecropis cucullata*). S) White-throated Swallow (*Hirundo albigularis*). T) Cape Wagtail (*Motacilla capensis*). U) Cape Robin-Chat (*Cossypha caffra*). V) Fiscal Flycatcher (*Melaenornis silens*). W) African Dusky Flycatcher (*Muscicapa adusta*). X) Malachite Sunbird (*Nectarinia famosa*).

Y) Cape Sparrow (*Passer melanurus*). Z) Yellow Bishop (*Euplectes capensis*). 1) Cape Weaver (*Ploceus capensis*). 2) Red-winged Starling (*Onychognathus morio*). 3) Common Starling (*Sturnus vulgaris*). 4) Black-headed Heron (*Ardea melanocephala*). 5) Little Egret (*Egretta garzetta*). 6) Hamerkop (*Scopus umbretta*). 7) Hadada Ibis (*Bostrychia hagedash*). 8) African Sacred Ibis (*Threskiornis aethiopicus*). 9) Spotted Eagle-Owl (*Bubo africanus*). 10) African Darter (*Anhinga rufa*).

8.4 Butterflies

8.4.1 Desktop assessment

Based on the species records available on “LepiMAP” (vmus.adu.org), 18 butterfly species have been recorded from the specific Quarter Degree Grid Square overlapping the study area. Among these species, 15 species are classified as “Least Concern”, and three are currently not assessed by the IUCN (IUCN, 2021; Appendix B).

8.4.2 Field survey

Six butterfly species were located in the study area, all of which are currently classified as “Least concern” by the IUCN (IUCN, 2021; Figures 20 and 21, Appendix C). These species include the highly abundant Painted Lady (*Vanessa cardui*), as well as the Dull Copper (*Aloeides pierus*), Vivid Dotted Blue (*Tarucus thespis*), African Grass Blue (*Zizeeria knysna*), African Clouded Yellow (*Colias electo*) and Southern Meadow White (*Pontia helice*).

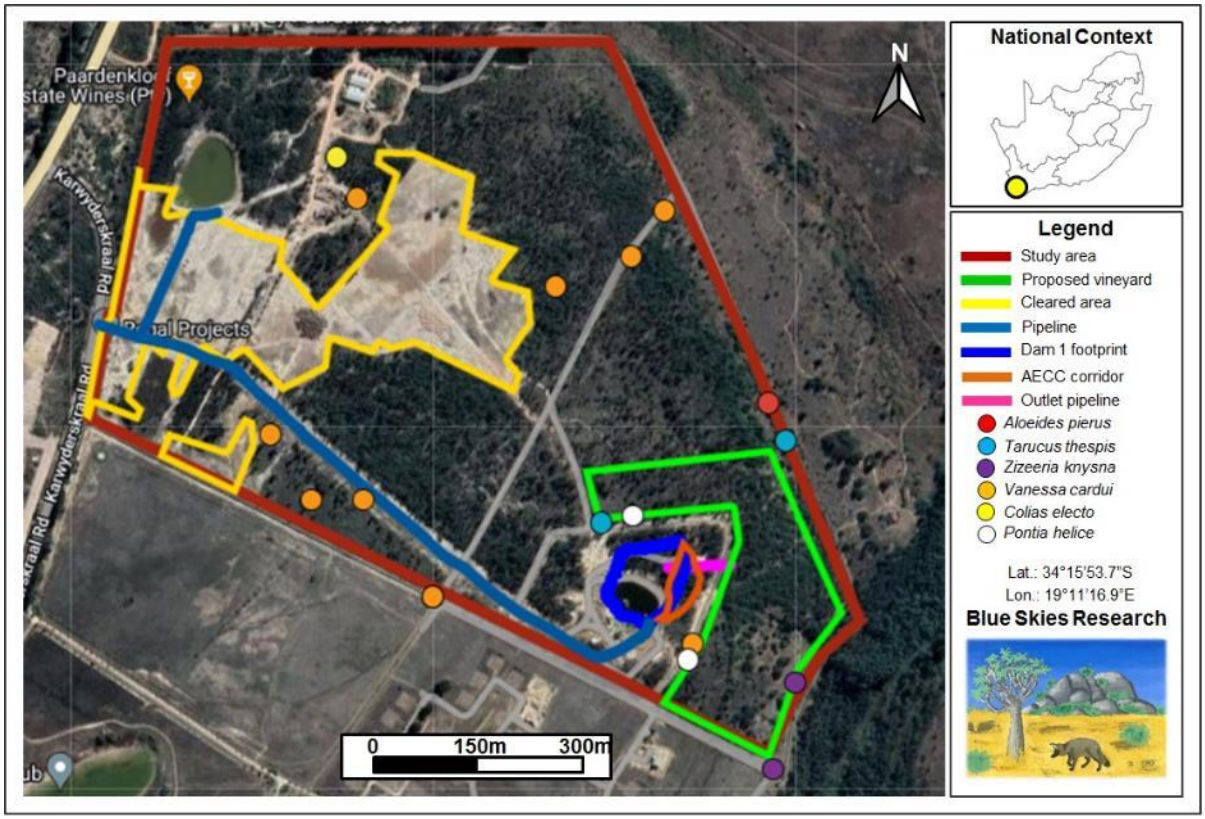


Figure 20 Spatial locations of the different butterfly species recorded within the study area.

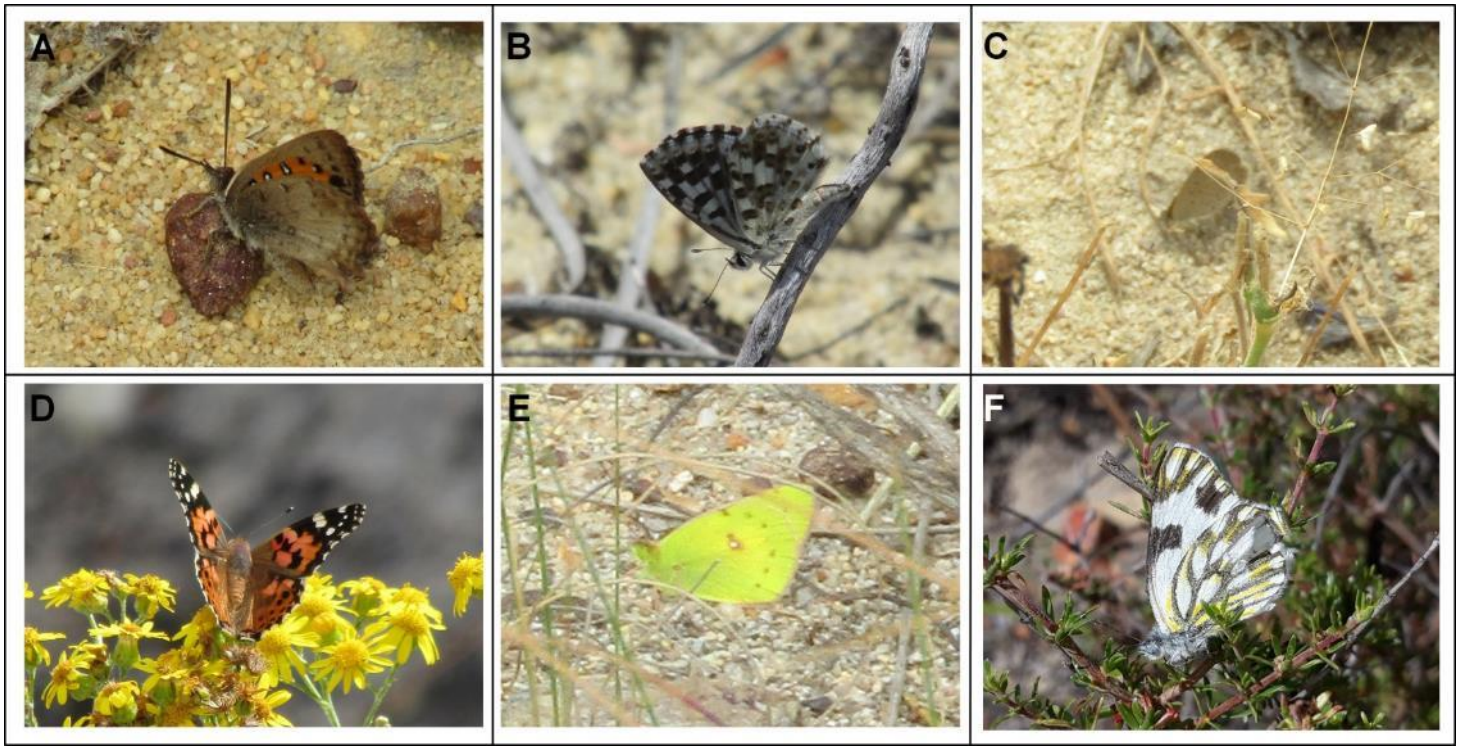


Figure 21 Photographic evidence of different butterfly species recorded in the study area. A) Dull Copper (*Aloeides pierus*). B) Vivid Dotted Blue (*Tarucus thespis*). C) African Grass Blue

(*Zizeeria knysna*). D) Painted Lady (*Vanessa cardui*). E) African Clouded Yellow (*Colias electo*). F) Southern Meadow White (*Pontia helice*).

8.5 Grasshoppers

Four grasshopper species were recorded from the study area, with one classified as "Least Concern", two not assessed, and one, the Yellow-winged Agile Grasshopper (*Aneuryphymus montanus*) classified as "Endangered" by the IUCN (IUCN, 2021; Figures 22 and 23, Appendix C, the observational record for this species have been added to the iNaturalist database). The Slender Green-winged Grasshopper (*Aiolopus thalassinus*) is the most abundant grasshopper species on the site, with the Garden Locust (*Acanthacris ruficornis*) and Spur-throated Grasshopper (*Catantops humeralis*) also noted.

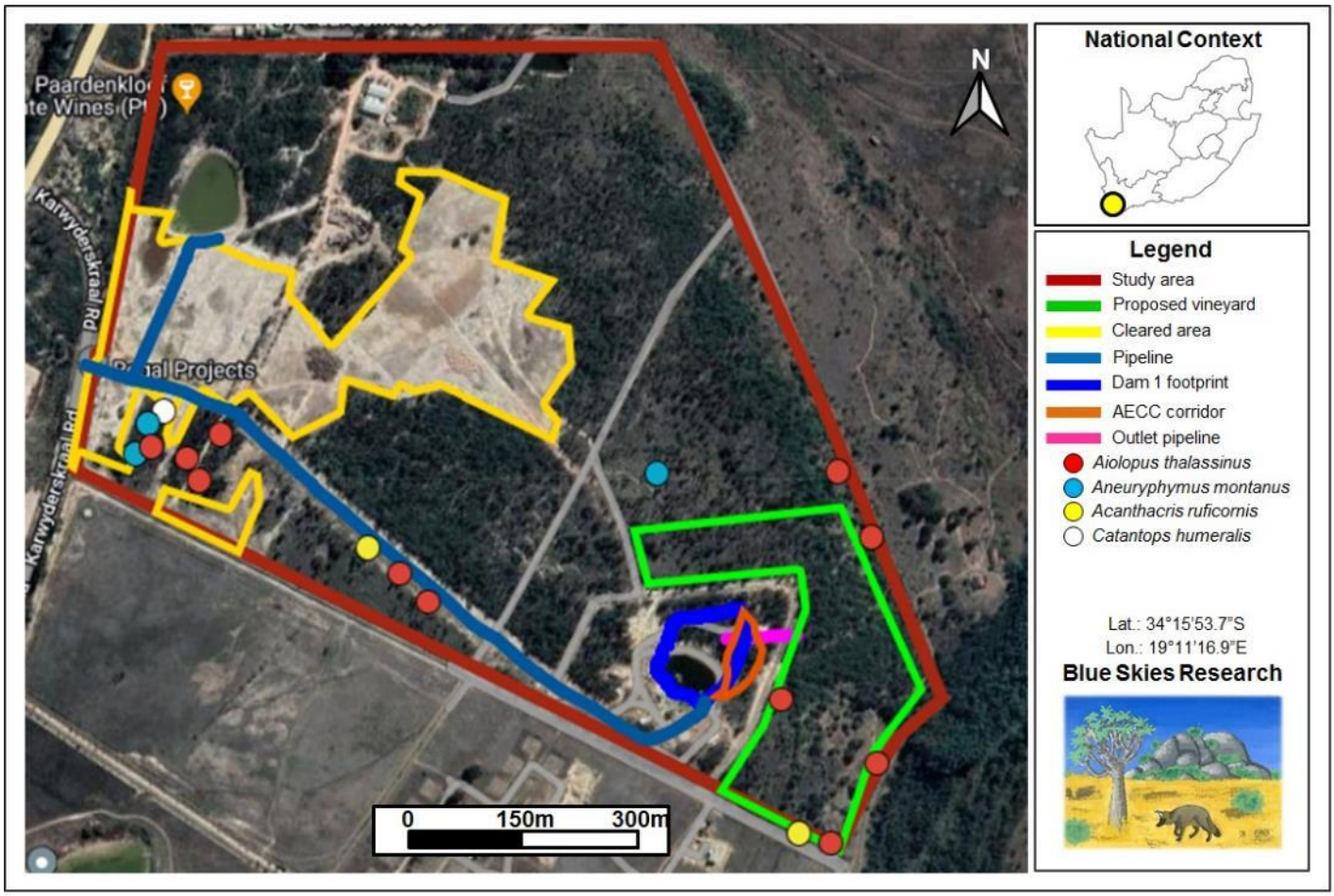


Figure 22 Spatial locations of the different grasshopper species recorded within the study area.

Figure 23 Photographic evidence of different grasshopper species recorded in the study area. A) Slender Green-winged Grasshopper (*Aiolopus thalassinus*). B) Yellow-winged Agile Grasshopper (*Aneuryphymus montanus*). C) Spur-throated Grasshopper (*Catantops humeralis*).

8.6 Faunal and avifaunal diversity and distributions within the study area

The study area supports a high faunal and avifaunal diversity with a functional ecosystem and intact predator-prey dynamics (evident from the high number of predatory species among mammals, reptiles and avifauna). Faunal diversity appears spatially associated to the shrubland habitats and site margins, as well as the artificial dams on the site. Through systematically clearing the alien vegetation, it appears that the applicant has effectively increased habitat quality in the shrubland habitats, concomitantly prompting the return of faunal and avifaunal species diversity. Furthermore, construction of dams on the site has placed aquatic habitats within this landscape which has also contributed to an increased biodiversity in the area, especially in amphibian species. In contrast, terrestrial biodiversity and trophic patterns appear compromised in the degraded parts of the site, including the dense stands of alien invasive trees and open / cleared habitats. These degraded areas are therefore less sensitive from a faunal biodiversity perspective (see Sections 10 to 12).

9. Species of Conservation Concern

Along with the eight (five avifaunal and three invertebrate) SCC listed in the DFFE Screening Tool (Table 1), the potential occurrence of nine other (two amphibian and seven avifaunal) SCC within the study area was assessed (Table 4). The probability of occurrence of the specific SCC within the study area was assessed based on the following criteria:

Confirmed - The species was confirmed as present within the study area during the field survey.

High - The species was not confirmed as present within the study area during the field survey but has been recorded in the overlapped pentad / QDGS recently (less than 2 years ago) and in high number (>10 times) and is therefore likely to also occur on the site, given suitable habitat characteristics.

Medium - The species was not confirmed as present within the study area during the field survey, but has been recorded a number of times (>2 but <10 times) in the overlapped pentad / QDGS recently (less than 2 years ago). Suitable habitat for the species is also present on the site.

Low - No suitable habitat for the species is present on the site, or the species has been recorded a low number of times (only once) or more than five years ago in the overlapped pentad / QDGS.

The presence of five SCC (two amphibians, two birds and one invertebrate) was confirmed one the site, with three further avifaunal SCC likely also utilizing the site as foraging habitat (Table 4). All remaining SCC which have a “Low” or “Medium” probability of occurrence are not further considered, given their low likelihood of being present on the site.

Table 4 Probability of occurrence of specific SCC in the study area. For each species, the taxonomic Family, scientific name and common name is shown, along with its current classification under the IUCN Red List of Threatened Species (IUCN, 2021). In addition, the species' preferred habitat and the probability that the species occurs within the study area is given, along with a justification for listing this probability.

Family	Species	Common name	IUCN status	Habitat	Probability of occurrence in the study area	Justification of probability
Pyxicephalidae	*Poyntonia paludicola*	Montane Marsh Frog	Near-Threatened	This species inhabits mountain fynbos heathland, and is restricted to areas with high rainfall (2,000–3,000 mm of rain per year). It breeds in shallow streams, seepages and marshy areas on mountain slopes.	Confirmed	Two individuals of this species were recorded vocalising nocturnally in the vegetation surrounding Dam 1. This habitat corresponds to the marshy freshwater habitat required by this species for breeding. Notably, however, this is an artificial habitat created by the applicant, and the species would not have been present if not for this situation.
Pyxicephalidae	*Microbatrachella capensis*	Cape Flats Frog	Critically Endangered	This species occurs in undisturbed coastal lowland fynbos pools and vleis, and it is not generally found in anthropogenic habitats. It depends on black, acidic waters for breeding.	Confirmed	A single individual of this species was recorded vocalising diurnally in the vegetation surrounding Dam 1. This anthropogenic habitat is in contrast to what is known about the habitat requirements for the species, but its presence here is likely linked to suitable water conditions and adequate vegetation cover. Notably, however, this is an artificial habitat created by the applicant, and the species would not have been present if not for this situation.
Accipitridae	*Buteo trizonatus*	Forest Buzzard	Near-Threatened	This species inhabits native temperate forests from sea level up to 1,000 m, and rarely to 1,500 m (Ferguson-Lees and Christie 2001). It can also be found in plantations, though usually near to areas of native forest (Ferguson-Lees and Christie 2001).	Medium	No individuals of this species were recorded in the study area, but the species has been recorded a number of four times in the study area landscape, with the last observation in December 2021 (Appendix A). As such, it is possible that the Forest Buzzard may occur in the dense plantations of Bluegum adjacent (east) to the site on the Bot River floodplain, but its presence on the site itself may only be ephemeral.

Accipitridae	*Circus maurus*	Black Harrier	Endangered	The species occurs in coastal and montane Fynbos, highland grasslands, Karoo subdesert scrub, open plains with low shrubs and croplands (Curtis *et al*. 2004). In the Western Cape of South Africa it is most abundant in coastal and montane fynbos (Curtis *et al*. 2004), and loose colonies may aggregate around wetland areas. The Black Harrier prefers open ground with low vegetation for hunting, where it feeds mainly on small mammals, especially *Otomys* and *Rhabdomys* species, although its diet may also include birds and reptiles (Garcia-Heras *et al*. 2017). The species breeds close to coastal and upland marshes (damp sites, near vleis, marshes or streams), but may also nest in montane habitats, preferring south-facing slopes (Brown *et al*. 1982; Curtis *et al*. 2004). Nests are built on the ground in tall vegetation such as shrubs or reeds (Brown *et al*. 1982, Curtis *et al*. 2004). The species does not breed in transformed and cultivated lands, although it may forage in these environments (Curtis *et al*. 2004).	Confirmed	Two individuals of this species (it is possible that this was the same individual, as observations were a day apart) were recorded foraging over the Medium-high shrubland habitat of the study area. Shrubland habitats on the site likely allow for adequate foraging opportunities among the resident rodent species on the site, however it is not likely that the Black Harrier will breed here, given a lack of adequate marsh / wetland environments.
Accipitridae	*Circus ranivorus*	African Marsh Harrier	Least Concern	The species breeds in wetlands, foraging primarily over reeds and lake margins (Harrison *et al*. 1997). Its diet consists largely of small mammals, particularly striped mouse *Rhabdomys pumilio* (Kemp and Dean, 1988).	High	No individuals of this species were recorded in the study area, but the species has been recorded a high number of times (29 times) in the study area landscape, with the last observation in March 2022 (Appendix A). Like with the Black Harrier, the shrubland habitats on the site likely represents foraging habitat for the African Marsh Harrier, although it is unlikely that this species will breed here, given a lack of reeds and wetland habitats.
Accipitridae	*Polemaetus bellicosus*	Martial Eagle	Endangered	The species inhabits open woodland, wooded savanna, bushy grassland, thornbush and, in southern Africa, more open country and even subdesert, from sea level to 3,000 m but mainly below 1,500 m (Ferguson-Lees and Christie, 2001). The main prey is sizeable mammals, birds and reptiles (Ferguson-Lees and Christie, 2001).	Medium	No individuals of this species were recorded in the study area, but the species has been recorded a number of four times in the study area landscape, with the last observation in December 2019 (Appendix A). It is therefore possible that this species may forage over the shrubland habitats on the site, but its presence may only be ephemeral.
Sagittariidae	*Sagittarius serpentarius*	Secretarybird	Endangered	The species inhabits open landscapes, ranging from open plains and grasslands, to lightly wooded savanna, but is also found in agricultural areas and sub-desert (Ferguson-Lees and Christie, 2001), with up to 50% of recorded individuals in the Fynbos biome in winter being found in transformed environments (Hofmeyr *et al*. 2014). The species avoids areas of >20% wood cover (Loftie-Eaton, 2017). Although the species is nomadic, individuals which inhabit moist grassland tend to be less nomadic but may travel 20-30 km per day while foraging (Kemp and Kemp, 1977; Whitecross *et al*. 2019). The species preys on a variety of invertebrates (insects form 86% of the diet, Whitecross *et al*. 2019) and vertebrates (rodents, other mammals, lizards, snakes, eggs, young birds and amphibians, Kemp and Kemp, 1977; Ferguson-Lees and Christie, 2001). Breeding occurs throughout the year and the species typically nests in a flat-topped Acacia or other thorny tree (Ferguson-Lees and Christie, 2001).	High	No individuals of this species were recorded in the study area, but the species has been recorded a high number of times (21 times) in the study area landscape, with the last observation in July 2020 (Appendix A). The shrubland habitats on the site likely represents foraging habitat for this species, although it is unlikely that the species will breed here (no resident breeding pairs were observed during the field survey).

Anatidae	*Oxyura maccoa*	Maccoa Duck	Endangered	The species inhabits small temporary and permanent inland freshwater lakes (Berruti *et al*. 2005, 2007), preferring those that are shallow and nutrient-rich (Johnsgard,1978, Johnsgard and Carbonell, 1996) with extensive emergent vegetation such as reeds (*Phragmites* spp.) and cattails (*Typha* spp.) (Johnsgard and Carbonell, 1996) on which it relies for nesting. It prefers areas with a bottom of mud or silt and minimal amounts of floating vegetation, since this provides the best foraging conditions (Johnsgard and Carbonell, 1996). It also breeds on man-made habitats, such as small farm wetlands, and sewage-farm basins (Johnsgard, 1978, Johnsgard and Carbonell, 1996). Outside the breeding season it will wander over larger, deeper lakes and brackish lagoons (del Hoyo *et al*. 1992, Berruti *et al*. 2005, 2007). It is thought to find refuge on the larger lakes while moulting (Berruti *et al*. 2005, 2007). This species feeds primarily on benthic invertebrates (Johnsgard, 1978, Johnsgard and Carbonell, 1996), as well as algae, the seeds of *Persicaria* and *Polygonum* (Johnsgard, 1978, Berruti *et al*. 2005, 2007), and the seeds and roots of other aquatic plants (Johnsgard and Carbonell, 1996). The species tends to nest over deeper water among emergent vegetation (Berruti *et al*. 2005, 2007).	Low	No individuals of this species were recorded in the study area, and the species has been observed only once in the study area landscape, with this observation in November 2015 (Appendix A). As such, it is highly unlikely that this species will occur on the site.
Turnicidae	*Turnix hottentottus*	Fynbos Buttonquail	Least Concern	This species is usually solitary, but can be found in pairs during the breeding season (Lee, 2013). It is considered restricted to the fynbos biome of South Africa, a heath-like, fire-driven ecosystem, dominated by Proteaceae, Ericaceae and Restionaceae plant families. Surveys suggest that this species may prefer areas of low gradient terrain, and fynbos that has experienced a fire cycle 2-5 years previously. Individuals may avoid older vegetation that has not experienced a fire cycle in more than 10 years (Lee et al. 2018b). This may be because older vegetation becomes more dense and difficult for terrestrial birds to navigate (Madge and McGowan 2002). The species is also found in coastal strandveld, in similarly structured habitat (Barnes 2000, Madge and McGowan 2002).	Low	This species has not been observed in the study area landscape, and is therefore unlikely to occur on the site.

Gruidae	*Anthropoides paradiseus*	Blue Crane	Vulnerable	This species breeds in natural grass- and sedge-dominated habitats, preferring secluded grasslands at high elevations where the vegetation is thick and short (Barnes, 2000). Occasionally it will breed in or near wetland areas (Barnes, 2000), in pans or on islands in dams (Hockey *et al*. 2005). Particularly in the Western Cape of South Africa, it also uses lowland agricultural areas, particularly pasture, fallow fields and cereal crop fields as stubble becomes available after harvest (Barnes, 2000, Hockey *et al*. 2005). During the non-breeding season the species inhabits short, dry, natural grasslands, as well as the Karoo and fynbos biomes (Barnes, 2000). In fynbos it occurs almost exclusively in cultivated habitats, largely avoiding the natural vegetation (Barnes, 2000), although this habitat may provide important cover for juveniles (Bidwell *et al*. 2006). The agricultural habitats that it uses include pastures; croplands, particularly where cereal crops are grown (Barnes, 2000), and fallow fields. It is intolerant of intensively grazed and burnt grassland (Hockey *et al*. 2005). It roosts in shallow wetlands (Barnes, 2000, Hockey *et al*. 2005). This species feeds primarily on plant material including the seeds of sedges and grasses, roots, tubers and small bulbs (del Hoyo *et al*. 1996, Hockey *et al*. 2005). It also takes a variety of animals including insects such as locusts and their eggs, grasshoppers, termites and caterpillars, worms, crabs, fish, frogs, reptiles and small mammals (del Hoyo *et al*. 1996, Hockey *et al*. 2005). In agricultural areas it feeds on cereal grains such as wheat and maize, and also eats invertebrate crop pests (del Hoyo *et al*. 1996, Hockey *et al*. 2005).	Confirmed	A permanently resident breeding pair of this species was observed in the vicinity of Dam 2. This pair breeds and forages in the low grass and sedge-dominated vegetation surrounding this artificial dam - in line with the species' habitat requirements. It is also possible that this species may forage in the shrubland habitats of the site.
Otididae	*Afrotis afra*	Southern Black Korhaan	Vulnerable	The species is restricted to the non-grassy, winter rainfall or mixed winter-summer rainfall fynbos and succulent Karoo biomes, and the extreme south of the Nama-Karoo biome, in a narrow strip along the southern and western coastlines of South Africa (Hofmeyr 2012). It also occurs in semi-arid scrub and dunes with succulent vegetation, and extends into renosterveld scrub and semi-arid karoo (del Hoyo et al. 1996, Hockey et al. 2005). It occurs occasionally in cultivated fields with nearby cover (Hockey et al. 2005). The diet consists of insects, small reptiles and plant material, including seeds and green shoots (Hockey et al. 2005).	Low	No individuals of this species were recorded in the study area, and the species has been observed only once in the study area landscape, with this observation in July 2021 (Appendix A). As such, it is highly unlikely that this species will occur on the site.
Otididae	*Neotis denhami*	Denham's Bustard	Near-Threatened	The species inhabits grasslands, grassy *Acacia*-studded dunes, fairly dense shrubland, light woodland, farmland, crops, dried marsh and arid scrub plains, also grass-covered ironstone pans and burnt savanna woodland in Sierra Leone and high rainfall sour grassveld, planted pastures and cereal croplands in fynbos in South Africa (del Hoyo et al. 1996). It feeds on insects, small vertebrates and plant material (Collar 1996).	High	No individuals of this species were recorded in the study area, but the species has been recorded a high number of times (56 times) in the study area landscape, with the last observation in October 2022 (Appendix A). The shrubland habitats on the site likely represents foraging habitat for this species.

Picidae	*Geocolaptes olivaceus*	Ground Woodpecker	Near-Threatened	The species occurs on rocky slopes, mostly in areas dominated by grass and shrubs; including road cuttings or derelict buildings (Hockey et al. 2005). It is mainly sedentary but there is some suggestion that it could be an altitudinal migrant, and individuals may wander away from mountainous areas in the non-breeding season (Hockey et al. 2005).	Low	No individuals of this species were recorded in the study area, and the species has been observed only once in the study area landscape, with this observation in December 2010 (Appendix A).In addition, the site does not contain any of the rocky slope habitats preferred by this species. As such, it is highly unlikely that this species will occur on the site.
Phalacrocoracidae	*Phalacrocorax capensis*	Cape Cormorant	Endangered	This species is usually found in the Benguela Current less than 10 km from the coast (del Hoyo *et al*. 1992), although it does occasionally range as far as 70km offshore. During both the breeding and the non-breeding seasons it inhabits cliffs and ledges on the mainland and on offshore islands (Nelson, 2005). It is occasionally found in the brackish waters of coastal lagoons, estuaries and harbours (del Hoyo *et al*. 1992), but does not use these habitats for breeding. It occurs in highest densities in areas of suitable habitat near the recruitment grounds for pilchards (Clupeidae) and anchovies (Engraulidae.) (Crawford and Shelton, 1978).	Low	No individuals of this species were recorded in the study area, and the species has been observed only once in the study area landscape, with this observation in March 2022 (Appendix A). In addition, the site does not contain any of the marine habitats preferred by this species. As such, it is highly unlikely that this species will occur on the site.
Lycaenidae	*Aloeides egerides*	Red Hill Copper	Vulnerable	The species occurs on flat, sandy, open ground among low-growing fynbos, from just above sea level to about 300 m in altitude (Selb, 2020).	Low	The closest record for this species is around 9km south of the study area in Overberg Sandstone Fynbos, with a further record 55km north-east in Breede Sand Fynbos and 72km west in Hangklip Sandstone Fynbos and Peninsula Sandstone Fynbos (IUCN, 2022). Given a distinct lack of sandstone fynbos on the site, it is unlikely that the species will occur here.
Acrididae	*Aneuryphymus montanus*	Yellow-winged Agile Grasshopper	Vulnerable	The species is associated with fynbos vegetation, where it has been collected "amongst partly burnt stands of evergreen Sclerophyll in rocky foothills" (Brown, 1960). It prefers south-facing cool slopes (Kinvig, 2005).	Confirmed	Three individuals of this species were collected from the Medium-high and Low shrubland habitats of the site, representing two resident colonies. These habitats have not been recently burnt, and therefore represent atypical habitat for the species.
Tettigoniidae	*Brinckiella aptera*	Mute Winter Katydid	Vulnerable	This species is endemic to the Fynbos and Succulent Karoo biomes, and feeds on flowers and leaves of a very narrow range of host plants consisting of low herbaceous shrubs (Bazelet and Naskrecki, 2014).	Medium	The study area forms part of the projected distribution of this species (IUCN, 2022), however very little is known about the habitat preferences of this species. By applying the Precautionary Principle therefore, it is possible that all shrubland habitats on the site may constitute suitable habitat for this species (similar to the Yellow-winged Agile Grasshopper).

9.1 SCC conservation status, on-site habitat size and listed threats

Table 5 provides a breakdown of the conservation importance of each SCC confirmed or possibly occurring in the study area. The on-site suitable habitat for each species and its spatial extent is also compared to the species' Area Of Occupancy (AOO) and Extent Of Occurrence (EOO), as listed by the IUCN (IUCN, 2021). A reference map showing the spatial location and extent of suitable habitats for the SCC is provided in Figure 24.

Among the SCC confirmed or possibly occurring on the site, the Cape Flats Frog (*Microbatrachella capensis*), Black Harrier (*Circus maurus*) and Secretarybird (*Sagittarius serpentarius*) is currently of the greatest conservation concern, with the remainder of species listed either as "Near-Threatened or "Vulnerable" (Table 5). The conservation status of each SCC relates directly to the conservation importance of its habitat on the site, and is therefore considered during the calculation of Site Ecological Importance (SEI) of habitats (Section 10).

Suitable habitats for SCC on the site currently constitute a very small proportion of the AOO and EOO of each species, with the exception *M. capensis*. The presence of this species, along with the Montane Marsh Frog (*Poyntonia paludicola*), represents novel distributional records (both species are currently known from only four locations, IUCN, 2021) and likely follows habitat expansion into an artificial dam on the site. Although artificial, it is important that this habitat not be altered or degraded, as both amphibian SCC are highly sensitive to changes in habitat quality (IUCN, 2021).

Similarly, the presence of two colonies of the Yellow-winged Agile Grasshopper (*Aneuryphymus montanus*) represents a novel subpopulation of this species. The number of populations of this species is currently assessed to be between six and ten (IUCN, 2021), with the species rarely collected, even after extensive searches across its known distribution. Given its scarcity, it is possible that its future IUCN extinction risk category may change if this subpopulation is destroyed.

In order to conserve the subpopulations of SCC on the site, the major threats to these species need to be taken into account during development planning. These major

include habitat loss, degradation or alteration through agriculture, uncontrolled burning of vegetation, the presence of alien vegetation, inappropriate management of freshwater habitats, hunting and poisoning on agricultural land (Table 5). These threats are therefore considered during the recommendations of impact management actions for the proposed development (Subsection 11.3).

Table 5 Table showing the SCC confirmed or possibly occurring in the study area along with the full conservation status classification by the IUCN, listed Area Of Occupancy (AOO) and Extent Of Occurrence (EOO), the specific habitat for this SCC and its extent on the site, and the proportion of the AOO and EOO which this habitat represents. In addition, major threats each species is shown, as listed by the IUCN (IUCN, 2021).

Species	IUCN status	AOO (km^2)	EOO (km^2)	Habitat on site	Extent of habitat on site (km^2)	%AOO / %EOO	Threats
Montane Marsh Frog (*Poyntonia paludicola*)	Near-Threatened	695	1 845	Dam 1	0.005	0.0007/0.0003	Alien vegetation (particularly pines), afforestation and the construction of dams.
Cape Flats Frog (*Microbatrachella capensis*)	Critically Endangered B2ab(ii,iii)	7	1 559	Dam 1	0.005	0.07/0.0003	Habitat degradation caused by urbanization, agricultural expansion, and the spread of alien vegetation leading to an alteration in water quality and the drying out of breeding pools.
Black Harrier (*Circus maurus*)	Endangered C2a(ii)	18 610	1 340 000	All shrubland habitats (Dense, Medium-high and Low shrubland) are foraging habitats.	0.26	0.001/0.00002	Habitat loss due to agriculture, alien vegetation and urbanisation, compounded by the uncontrolled burning of fynbos and grassland. Low hatching rates, possibly as a result of high pesticide residues in agricultural areas. Drainage impoundment and inappropriate management of vleis, marshes or streams near breeding grounds.
African Marsh Harrier (*Circus ranivorus*)	Least Concern	12 615	9 470 000	All shrubland habitats (Dense, Medium-high and Low shrubland) are potential foraging habitats.	0.26	0.002/0.000003	The drainage and damming of wetland habitats, loss of habitat through burning, over-grazing and human disturbance, and possibly poisoning owing to the over-use of pesticides.
Secretarybird (*Sagittarius serpentarius*)	Endangered A2acde+3cde+4acde	27 548	23 200 000	All shrubland habitats (Dense, Medium-high and Low shrubland) are potential foraging habitats.	0.26	0.0009/0.000001	Habitat degradation (excessive burning of grasslands and the intensive grazing of livestock), disturbance, hunting and capture for trade. Exposure to secondary pesticide poisoning.
Blue Crane (*Anthropoides paradiseus*)	Vulnerable A3cde+4cde	-	1 890 000	Dam 2 and surrounds are a confirmed breeding and foraging habitat. All shrubland habitats (Dense, Medium-high and Low shrubland) are potential foraging habitats.	0.28	-/0.00001	Poisoning on agricultural land (both intentional and accidental) and the commercial afforestation of large tracts of its grassland nesting habitat.
Denham's Bustard (*Neotis denhami*)	Near-Threatened A2bcd+3bcd+4bcd	13 633	20 700 000	All shrubland habitats (Dense, Medium-high and Low shrubland) are potential foraging habitats.	0.26	0.002/0.000001	Hunting and conversion of grassland habitat for agriculture. Accidental poisoning by agricultural pesticides.
Yellow-winged Agile Grasshopper (*Aneuryphymus montanus*)	Vulnerable B2ab(iii,v)	55 010	172 463	All shrubland habitats (Dense, Medium-high and Low shrubland).	0.26	0.0005/0.0002	Conversion of its habitat into farmland and invasions of alien plant species.

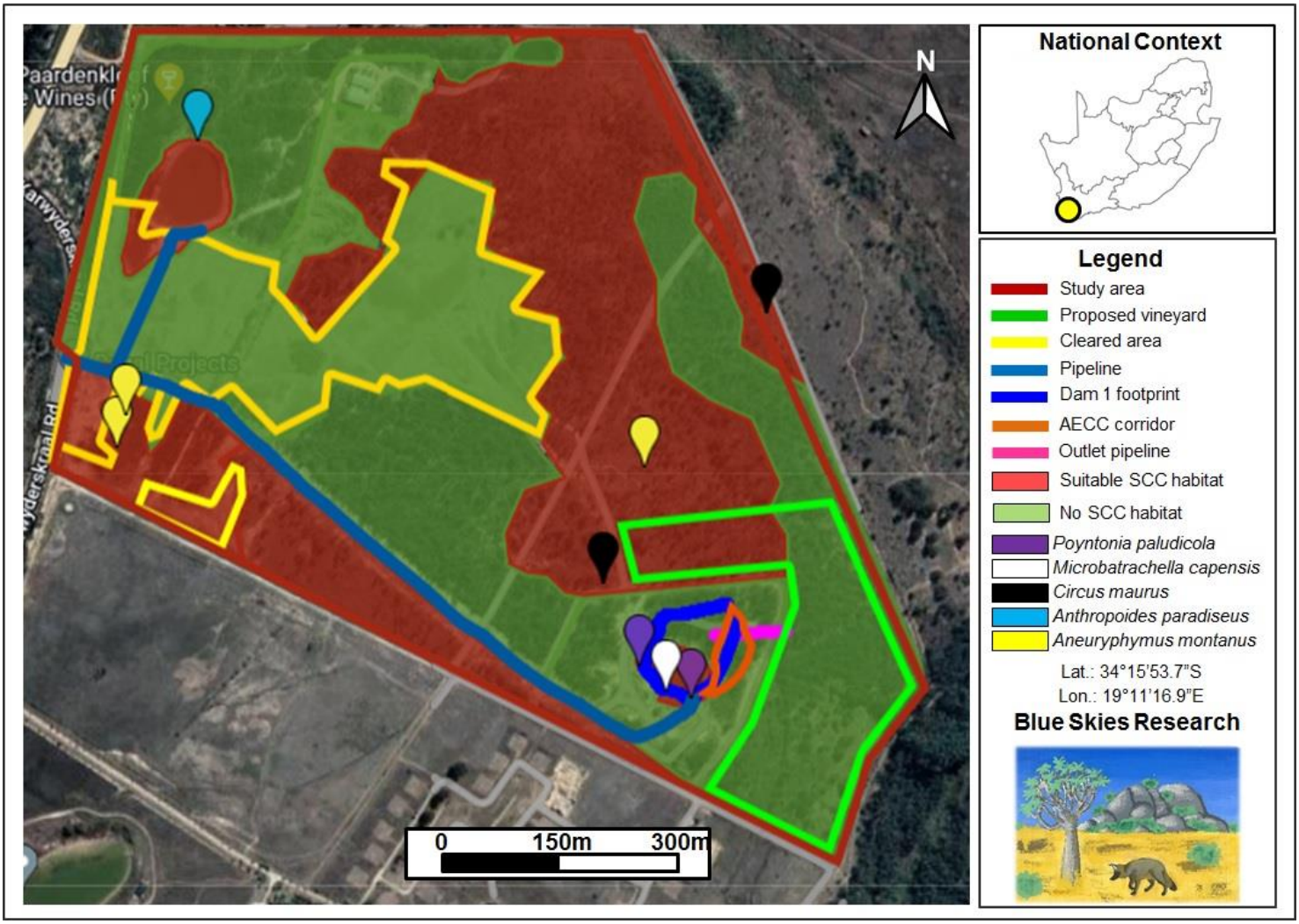


Figure 24 Spatial location and extent of suitable habitat for the Species of Conservation Concern (SCC) confirmed or possibly occurring within the study area. The spatial location of all SCC recovered during the field survey is also shown.

10. Evaluation of Site Ecological Importance (SEI)

10.1 Evaluating SEI for habitats in the study area

Evaluation of the Site Ecological Importance (SEI) for each SCC faunal group in the current assessment (i.e., amphibians, avifauna and invertebrates) was performed following the methods and criteria outlined in the Species Environmental Assessment Guideline (SANBI, 2020). In short, SEI is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/faunal community or habitat type present on the site) and its resilience to impacts (Receptor Resilience, RR) as follows: SEI = BI + RR. Biodiversity Importance (BI) is in turn a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows: BI = CI + FI.

Following these methods, SEI for the study area was evaluated based on the suitable habitat for each SCC (Section 9), as well as the spatial distribution of habitats within the study area (Section 7). To calculate the Conservation Importance (CI) and Functional Integrity (FI) of each habitat within the study area, the criteria outlined in Table 6 and Table 7 were respectively used.

According to the Species Environmental Assessment Guideline, Conservation Importance (CI) may defined as follows:

Conservation Importance (CI): "*The importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.*"

Table 6 Conservation importance (CI) criteria (table adapted from the Species Environmental Assessment Guideline, SANBI, 2020).

Conservation Importance (CI)	Fulfilling Criteria
Very high	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10 km^2. Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type. Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU. Presence of range-restricted species. > 50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC.
Very low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

According to the guideline, Functional Integrity (FI) is defined as:

Functional integrity (FI): "*The receptors' current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions. Simply stated, FI is: 'A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts.*"

Table 7 Functional integrity (FI) criteria (table adapted from the Species Environmental Assessment Guideline, SANBI, 2020).

Functional Integrity (FI)	Fulfilling Criteria
Very high	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing).
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

Based on assessments of CI and FI for habitats within the study area, the Biodiversity Importance (BI) of each habitat was calculated using the matrix in Table 8 (based on the formula: BI = CI + FI). As Biodiversity Importance (BI) is a function of Conservation Importance (CI) and the Functional Integrity (FI) of a receptor, BI can be derived from a simple matrix of CI and FI as follows:

Table 8 Matrix for calculating Biodiversity Importance (BI) (table adapted from the Species Environmental Assessment Guideline, SANBI, 2020).

Biodiversity Importance (BI)		**Conservation Importance (CI)**				
		Very high	High	Medium	Low	Very low
Functional Integrity (FI)	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

Finally, the Receptor Resilience for each habitat was evaluated following the criteria listed in Table 9. According to the Species Assessment Guidelines, Receptor resilience (RR) may defined as follows:

Receptor resilience (RR): "*The intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention.*"

Table 9 Receptor Resilience (RR) criteria (table adapted from the Species Environmental Assessment Guideline, SANBI, 2020).

Receptor Resilience (RR)	**Fulfilling Criteria**
Very high	Habitat that can recover rapidly (~ less than 5 years) to restore > 75%28 of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

Taken together, the Site Ecological Importance (SEI) was calculated for each habitat within the study area using the formula: SEI = BI + RR, and following the matrix outlined in Table 10. The interpretation of the development actions allowed for each SEI category are outlined in Table 11.

Table 10 Matrix for calculating Site Ecological Importance (SEI) (table adapted from the Species Environmental Assessment Guideline, SANBI, 2020).

Site Ecological Importance (SEI)		**Biodiversity Importance (BI)**				
		Very high	High	Medium	Low	Very low
Receptor Resilience (RR)	Very high	Very high	Very high	High	Medium	Low
	High	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	Low	High	Medium	Low	Very low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

Table 11 Guidelines for interpreting SEI in the context of the proposed development activities (table adapted from the Species Environmental Assessment Guideline, SANBI, 2020).

Site Ecological Importance (SEI)	**Interpretation in relation to proposed development activities**
Very high	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	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.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

10.2 SEI for amphibian SCC habitats in the study area

The SEI results for amphibian SCC habitats within the study area are given in Table 12 with the spatial representation for each habitat and its concomitant SEI category portrayed in Figure 25. Amphibian SCC were only detected at Dam 1, with one of these species (*M. capensis*) classified as "Critically Endangered". Even though Dam 1 is of a high conservation importance, the SEI for this habitat is only retrieved as "Medium", given a very high receptor resilience (this dam is an artificial habitat which may readily be recreated). Conversely, although the shrubland habitats on the site do not constitute habitat for amphibian SCC, these habitats have a high functional integrity and very low receptor resilience, similarly rendering them with a "Medium" SEI. Although it is recommended that neither the shrubland habitats (including a portion of the proposed agricultural area under Alternative 1) or Dam 1 be altered (see below; also see Sections 11 and 12), the "Medium" SEI retrieved for these habitats from an amphibian SCC perspective allows for minimisation and restoration mitigation, entailing development activities of medium impact followed by appropriate restoration activities (Table 11).

All remaining habitats on the site exist in a transformed or degraded state, and are therefore retrieved as having a "Very low" SEI (including the larger portion of the proposed agricultural area). Minimisation mitigation is acceptable for these habitats, allowing for development activities of medium to high impact without restoration activities being required (Table 11).

Table 12 Evaluation of SEI for amphibian SCC habitats within the study area. BI = Biodiversity Importance, RR = Receptor Resilience.

Habitat type	Conservation Importance	Functional Integrity	Receptor Resilience	Site Ecological Importance
Trees/Woodland/Thicket	Very low - No suitable habitat for amphibian SCC.	Very low - Several major current negative ecological impacts (dense stands of alien and invasive trees).	Very high - This habitat consists of thick stands of alien and invasive vegetation with little remaining natural vegetation. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Dense shrubland	Very low - No suitable habitat for amphibian SCC.	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Medium - BI = Low; RR = Very low
Medium-high shrubland	Very low - No suitable habitat for amphibian SCC.	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Medium - BI = Low; RR = Very low
Low shrubland	Very low - No suitable habitat for amphibian SCC.	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Medium - BI = Low; RR = Very low
Degraded	Very low - No suitable habitat for amphibian SCC.	Very low - Several major current negative ecological impacts (consists of cleared alien and invasive pines with little remaining natural vegetation).	Very high - This habitat consists of cleared alien and invasive pines with little remaining natural vegetation. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Cleared	Very low - No suitable habitat for amphibian SCC.	Very low - Several major current negative ecological impacts (consists of cleared areas and planted vineyards).	Very high - This habitat consists of cleared areas and planted vineyards. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Dam 1	High - Confirmed presence of *Microbatrachella capensis* (listed as Critically Endangered under Criterion B) and *Poyntonia paludicola* (listed as Near Threatened) at Dam 1.	Very high - No current negative ecological impacts or signs of past disturbance.	Very high - Because all dams on the site are artificial, this habitat can easily be recreated using similar dam construction methods.	Medium - BI = Very high; RR = Very high
Dams 2 and 3	Very low - No suitable habitat for amphibian SCC.	Low - Several major and minor current negative ecological impacts (e.g, the presence of alien and invasive trees, and recent desiltation of Dam 2.	Very high - Because all dams on the site are artificial, this habitat can easily be recreated using similar dam construction methods.	Very low - BI = Very low; RR = Very high

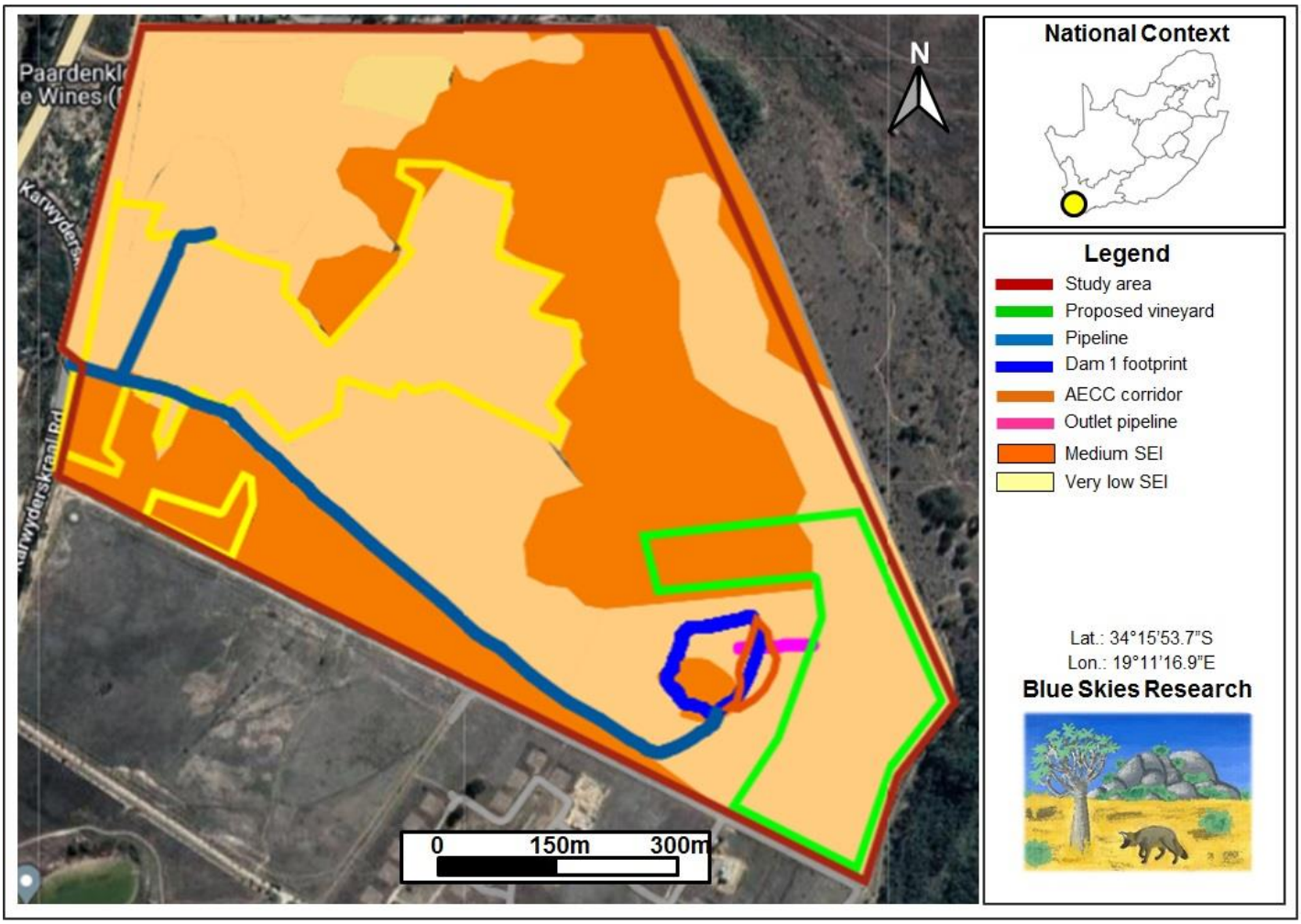


Figure 25 Spatial representation of the SEI of habitat types within the study area considering amphibian SCC.

10.3 SEI for avifaunal SCC habitats in the study area

Considering that all shrubland habitats on the site represent foraging habitat for two confirmed and three possibly occurring avifaunal SCC, these habitats are retrieved as having a "Very high" SEI (Table 13, Figure 26), and avoidance advocated for these habitats (including a portion of the proposed agricultural area under Alternative 1) where no destructive development activities should be considered (Table 11). Although Dam 2 offers suitable breeding and foraging habitat for one avifaunal SCC (the *A. paradiseus* breeding pair), this habitat, along with all other habitats on the site (including the Dam 1 footprint and larger portion of the proposed agricultural area), is retrieved as having a "Very low" SEI where minimisation mitigation is acceptable, allowing for development activities of medium to high impact without restoration being required.

Table 13 Evaluation of SEI for avifaunal SCC habitats within the study area. BI = Biodiversity Importance, RR = Receptor Resilience.

Habitat type	Conservation Importance	Functional Integrity	Receptor Resilience	Site Ecological Importance
Trees/Woodland/Thicket	Very low - No suitable habitat for avifaunal SCC.	Very low - Several major current negative ecological impacts (dense stands of alien and invasive trees).	Very high - This habitat consists of thick stands of alien and invasive vegetation with little remaining natural vegetation. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Dense shrubland	High - Highly likely foraging habitat for *Circus maurus* (listed as Endangered under Criterion C) and *Circus ranivorus* (listed as Least Concern).	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Very high - BI = High; RR = Very low
Medium-high shrubland	High - Confirmed foraging habitat for *Circus maurus* (listed as Endangered under Criterion C). Highly likely foraging habitat for *Circus ranivorus* (listed as Least Concern), *Sagittarius serpentarius* (listed as Endangered under Criterion A), *Neotis denhami* (listed as Near Threatened under Criterion A) and *Anthropoides paradiseus* (listed as Vulnerable under Criterion A).	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Very high - BI = High; RR = Very low
Low shrubland	High - Highly likely foraging habitat for *Circus maurus* (listed as Endangered under Criterion C), *Circus ranivorus* (listed as Least Concern), *Sagittarius serpentarius* (listed as Endangered under Criterion A), *Neotis denhami* (listed as Near Threatened under Criterion A) and *Anthropoides paradiseus* (listed as Vulnerable under Criterion A).	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Very high - BI = High; RR = Very low
Degraded	Very low - No suitable habitat for avifaunal SCC.	Very low - Several major current negative ecological impacts (consists of cleared alien and invasive pines with little remaining natural vegetation).	Very high - This habitat consists of cleared alien and invasive pines with little remaining natural vegetation. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Cleared	Very low - No suitable habitat for avifaunal SCC.	Very low - Several major current negative ecological impacts (consists of cleared areas and planted vineyards).	Very high - This habitat consists of cleared areas and planted vineyards. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Dams 1 and 3	Very low - No suitable habitat for avifaunal SCC.	Very high - No current negative ecological impacts or signs of past disturbance.	Very high - Because all dams on the site are artificial, this habitat can easily be recreated using similar dam construction methods.	Very low - BI = Low; RR = Very high
Dam 2	Medium - Confirmed foraging and breeding habitat for *Anthropoides paradiseus* (listed as Vulnerable under Criterion A).	Low - Several major and minor current negative ecological impacts (e.g., the presence of alien and invasive trees, and recent desiltation of Dam 2.	Very high - Because all dams on the site are artificial, this habitat can easily be recreated using similar dam construction methods.	Very low - BI = Low; RR = Very high

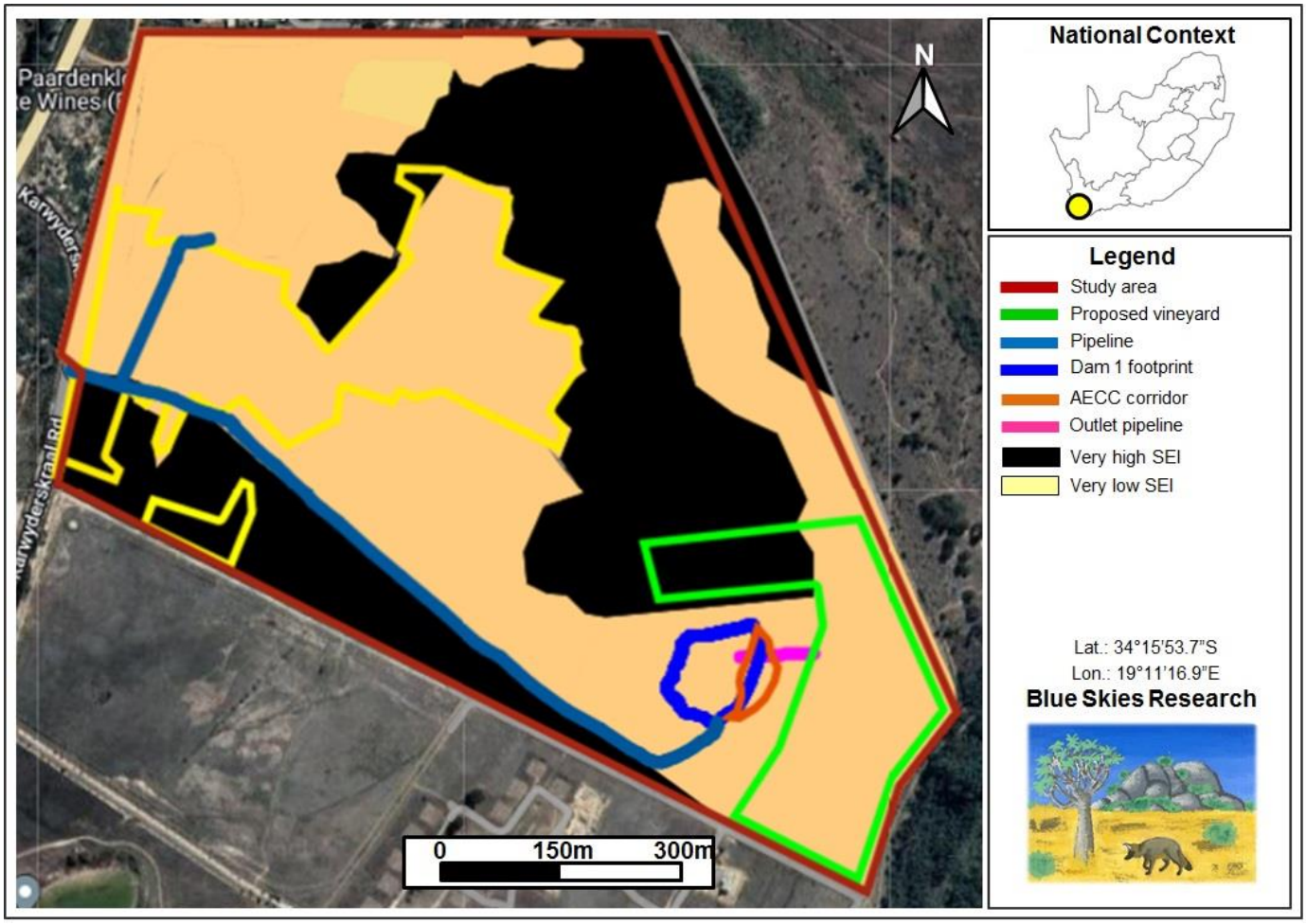


Figure 26 Spatial representation of the SEI of habitat types within the study area considering avifaunal SCC.

10.4 SEI for invertebrate SCC habitats in the study area

Similar to the SEI results for avifauna, all shrubland habitats on the site represent suitable habitat for a confirmed subpopulation of and invertebrate SCC (*A. montanus*), and these habitats are also retrieved as having a "Very high" SEI (Table 14, Figure 27). From an invertebrate SCC perspective therefore, avoidance mitigation is similarly advocated for these habitats (including a portion of the proposed agricultural area under Alternative 1), where no destructive development activities should be considered (Table 11). All other habitats on the site (including a portion of the Dam 1 footprint and a large portion of the proposed agricultural area) are retrieved as having a "Very low" SEI where minimisation mitigation is acceptable, allowing for development activities of medium to high impact without restoration being required.

Table 14 Evaluation of SEI for invertebrate SCC habitats within the study area. BI = Biodiversity Importance, RR = Receptor Resilience.

Habitat type	Conservation Importance	Functional Integrity	Receptor Resilience	Site Ecological Importance
Trees/Woodland/Thicket	Very low - No suitable habitat for invertebrate SCC.	Very low - Several major current negative ecological impacts (dense stands of alien and invasive trees).	Very high - This habitat consists of thick stands of alien and invasive vegetation with little remaining natural vegetation. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Dense shrubland	High - Possible suitable habitat for *Aneuryphymus montanus* (listed as Vulberable under Criterion B).	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Very high - BI = High; RR = Very low
Medium-high shrubland	High - Confirmed presence of *Aneuryphymus montanus* (listed as Vulberable under Criterion B).	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Very high - BI = High; RR = Very low
Low shrubland	High - Confirmed presence of *Aneuryphymus montanus* (listed as Vulberable under Criterion B).	High - Only minor current ecological impacts (alien and invasive vegetation has been removed) with no signs of past disturbance.	Very low - It is unlikely that the vegetation here will be able to recover after major disturbance or habitat alteration, with a concomitantly low likelihood that the resident faunal species will return after removal of the disturbance.	Very high - BI = High; RR = Very low
Degraded	Very low - No suitable habitat for invertebrate SCC.	Very low - Several major current negative ecological impacts (consists of cleared alien and invasive pines with little remaining natural vegetation).	Very high - This habitat consists of cleared alien and invasive pines with little remaining natural vegetation. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Cleared	Very low - No suitable habitat for invertebrate SCC.	Very low - Several major current negative ecological impacts (consists of cleared areas and planted vineyards).	Very high - This habitat consists of cleared areas and planted vineyards. As such, it can only recover to this degraded state.	Very low - BI = Very low; RR = Very high
Dam 1	Very low - No suitable habitat for invertebrate SCC.	Very high - No current negative ecological impacts or signs of past disturbance.	Very high - Because all dams on the site are artificial, this habitat can easily be recreated using similar dam construction methods.	Very low - BI = Low; RR = Very high
Dams 2 and 3	Very low - No suitable habitat for invertebrate SCC.	Low - Several major and minor current negative ecological impacts (e.g., the presence of alien and invasive trees, and recent desiltation of Dam 2.	Very high - Because all dams on the site are artificial, this habitat can easily be recreated using similar dam construction methods.	Very low - BI = Very low; RR = Very high

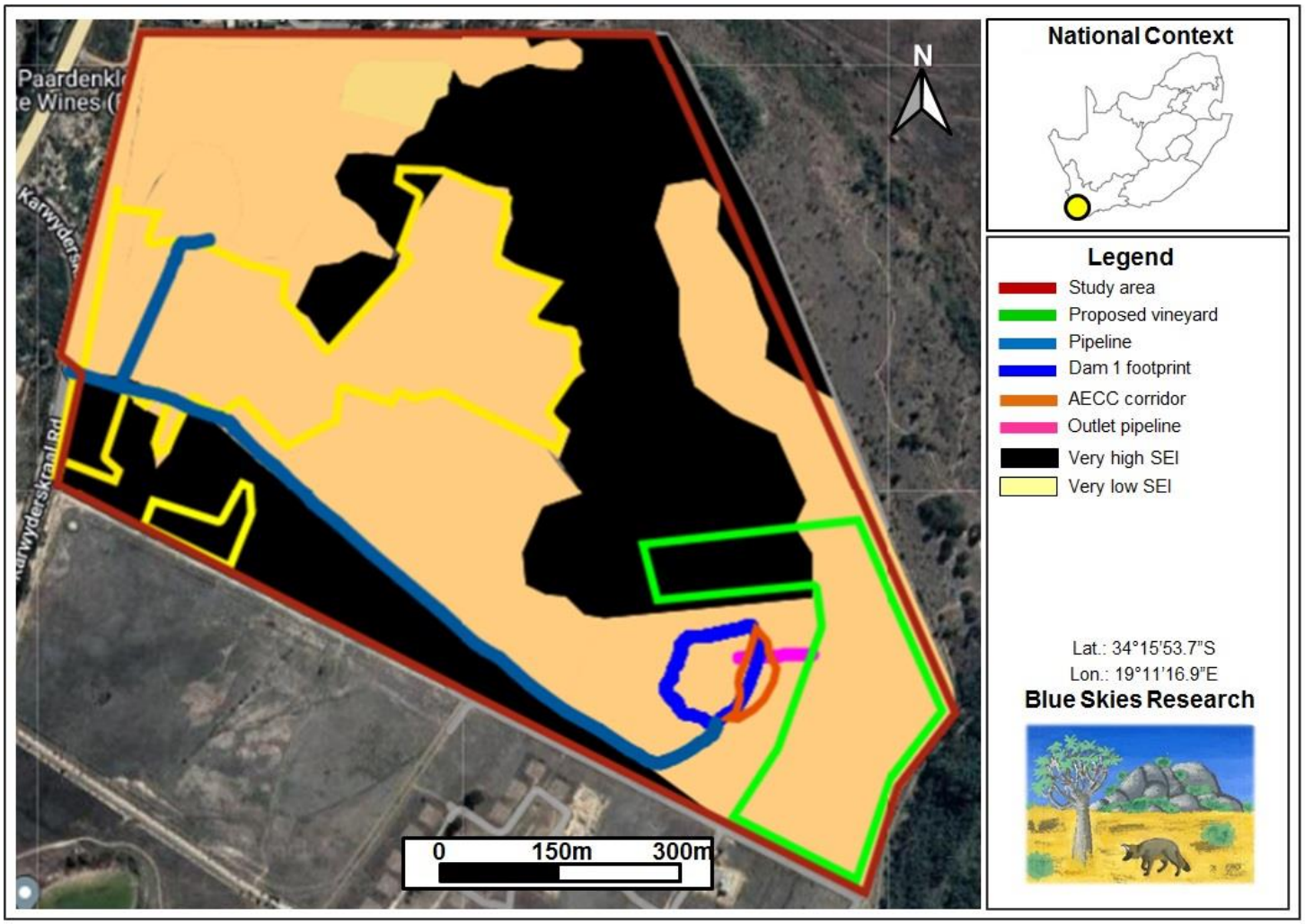


Figure 27 Spatial representation of the SEI of habitat types within the study area considering invertebrate SCC.

10.5 Combined SEI for habitats in the study area

Taking into account the combined SEI for all faunal groups (amphibians, avifauna and invertebrates), all shrubland habitats (Dense, Medium-high and low shrubland) on the site are retrieved as having a "Very high" SEI (Table 16, Figure 28), and should be excluded from any planned development. Currently, this includes a part of the proposed agricultural area under Alternative 1, and therefore the placement of this part of the development node would need to be reconsidered.

Although two amphibian SCC are confirmed in Dam 1, this habitat is retrieved as having a "Medium" SEI because of its high receptor resilience. Taking into account the conservation importance of these amphibian SCC (Subsection 9.1) it is however

recommended that the enlargement of this dam be avoided and that a new dam be constructed in adjacent parts of the site which has a “Very low” SEI (see Sections 11 and 12).

Finally, all other habitats on the site (including a large portion of the proposed agricultural area) exist in a degraded state with no suitable habitat for any of the faunal SCC. These habitats have a “Very low” SEI, allowing for development activities of medium to high impact without restoration being required. Development within these areas should therefore be of a lower consequence to fauna within the study area landscape, and development planning should rather focus on these already disturbed areas (also see Sections 11 and 12).

Table 15 Combined SEI for habitats within the study area.

Habitat type	Amphibian SEI	Avifaunal SEI	Invertebrate SEI	Combined SEI	Explanation
Trees/Woodland/Thicket	Very low	Very low	Very low	Very low	
Dense shrubland	Medium	Very high	Very high	Very high	Avifaunal and Invertebrate SEI designated as Very high
Medium-high shrubland	Medium	Very high	Very high	Very high	Avifaunal and Invertebrate SEI designated as Very high
Low shrubland	Medium	Very high	Very high	Very high	Avifaunal and Invertebrate SEI designated as Very high
Degraded	Very low	Very low	Very low	Very low	
Cleared	Very low	Very low	Very low	Very low	
Dam 1	Medium	Very low	Very low	Medium	Amphibian SEI designated as Medium
Dams 2 and 3	Very low	Very low	Very low	Very low	

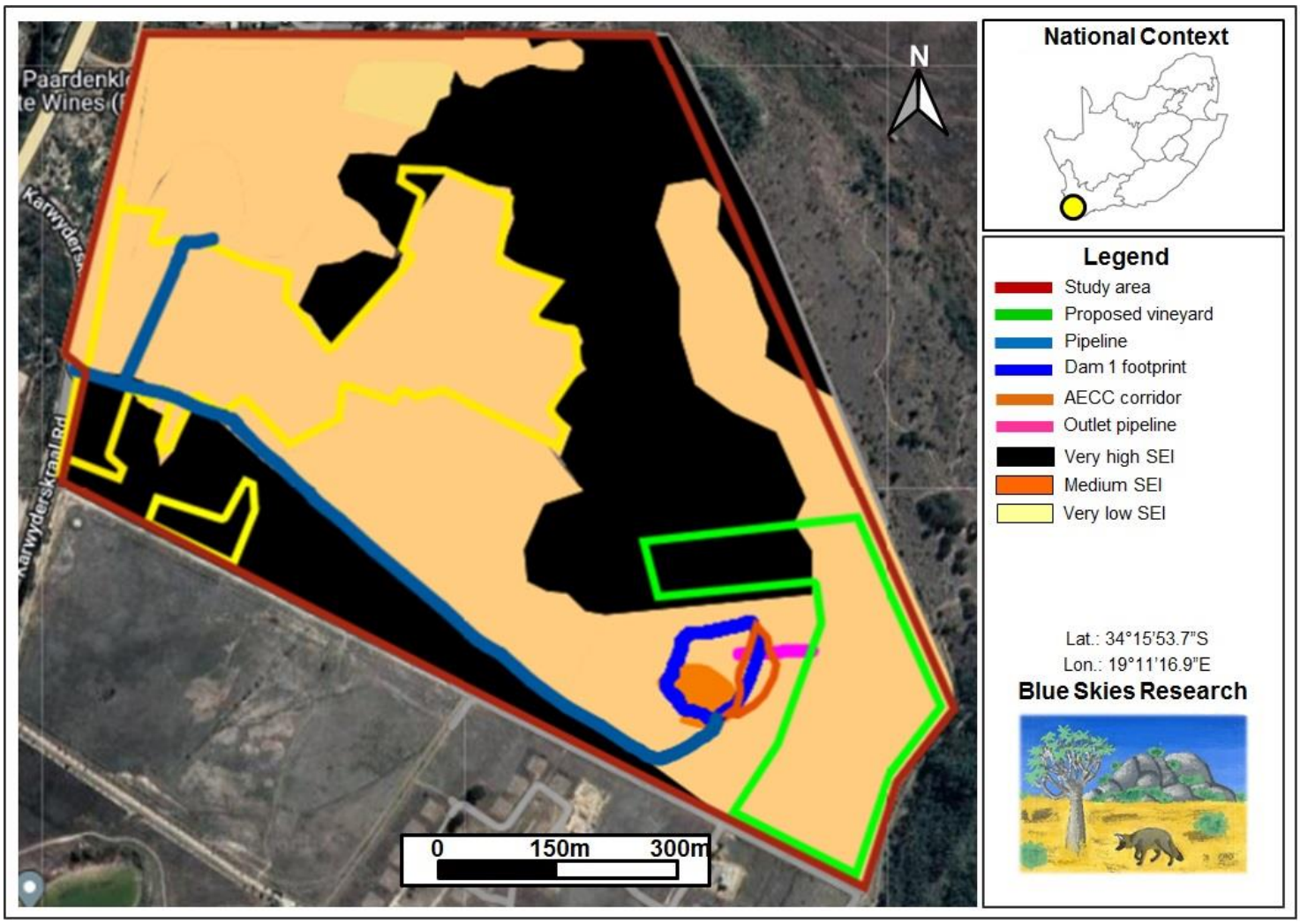


Figure 28 Spatial representation of the combined SEI categories of habitat types within the study area considering all faunal SCC.

11. Current impacts, project impacts and mitigation measures, and impact assessment

11.1 Current impacts

The site harbours alien invasive trees such as Pine, Port Jackson and Bluegum, which have infested all habitats to various degrees. Significant tracts of this vegetation remain in the eastern and north-eastern parts of the site, with these trees being so impenetrable that very little natural vegetation or suitable faunal habitat remains. In the south-central part of the site, these trees have been cut down and very little natural vegetation remains among these felled trees. The shrubland

habitats of the site have also contained a proportion of these trees, but these have been similarly cleared, allowing for an increase in the quality of these habitats. Finally, the western and central parts of the site have been cleared through soil preparation or the planting of vineyards, and no natural vegetation remains here. Agricultural activities, and noise and vibration through machinery and people are also part of the daily operations on the farm portion. Collectively, these encompass the current impacts on the site.

11.2 Anticipated project impacts

Planned development activities will include enlargement of Dams (through constructing earthfill embankments, new cores and cut-off trenches, and excavation of a new open channel spillways on the embankments) as well as clearing of the vegetation, soil preparation, and the planting of vineyards in the proposed agricultural areas. Impacts from these activities will include the destruction of habitat and direct mortality of fauna during the construction phase, and vibration and noise and possible pollution of the surrounding area (through run-off) during the construction and operational phases. Other possible project-related impacts (which are listed as specific threats to the SCC confirmed or possibly occurring on the site, Table 5 in Subsection 9.1) may include habitat degradation through afforestation and agricultural expansion, uncontrolled burning of vegetation and illegal hunting during the construction and operational phases, and accidental poisoning of avifaunal SCC during the operational phase.

11.3 Mitigation measures and impact management actions

Given the conservation importance of the faunal SCC confirmed or possibly occurring on the site (Section 9), along with the “Very high” SEI retrieved for the habitats of these SCC (Section 10), it is advocated that any development should exclude all shrubland habitats (Dense, Medium-high and Low shrubland) as these are highly sensitive from a faunal perspective (i.e., avoidance mitigation). Because amphibian SCC are present within Dam 1, the enlargement of this dam is not desirable and an alternative placement for a new dam should be considered in the

less sensitive areas retrieved as having a “Very low” SEI (i.e., avoidance mitigation, Section 10).

Taking into account the nature of the development, it is also possible that project-related impacts may impinge on SCC subpopulations and -habitats outside of the development footprints. To this end, species-specific buffer distances are recommended around core SCC habitats / colonies where no development should take place (i.e., avoidance mitigation, Table 16, Figure 29), excluding the clearing of alien invasive vegetation.

Collectively, this renders an area of 27.5 hectares as potentially developable, and an area of 43.7 hectares which may need to be excluded from development planning (avoidance mitigation). Should development proceed on the site, several general impact management actions are suggested which are aimed at limiting impacts on the resident fauna, also taking into account specific threats to the persistence of SCC subpopulations on the site (Table 17).

Table 16 Recommended buffer distances around core SCC habitats or colonies within the study area.

Species	Recommended buffer distances around core SCC habitats / colonies
Montane Marsh Frog *(Poyntonia paludicola*) and Cape Flats Frog *(Microbatrachella capensis)*	Because Dam 1 represents an artificial habitat created by the applicant, neither of the amphibian SCC would have been present on the site if not for this situation. MacFarlane and Bredin (2017) recommend a buffer distance of 15m from the edge of freshwater habitats, although a buffer distance of at least **30m** (twice the buffer distance of MacFarlane and Bredin, 2017) was applied around Dam 1 in the context of the current development (i.e., avoidance mitigation). Even so, given the artificial nature of Dam 1, this buffer distance may be relaxed if this dam remains unaltered (see subsection 11.6.2).
Black Harrier *(Circus maurus),* African Marsh Harrier (*Circus ranivorus),* Secretarybird *(Sagittarius serpentarius),* Denham's Bustard *(Neotis denhami)* and Blue Crane *(Anthropoides paradiseus)*	Foraging habitat for these species is encompassed by all shrubland habitats (Dense, Medium-high and low shrubland) on the site. It is therefore recommended that these habitats be excluded from any planned development (i.e., avoidance mitigation). No buffering of these habitats will be necessary from an avifaunal perspective, partly because these do not constitute typical breeding habitats of these avifaunal SCC, and partly because large tracts of these habitats are already largely buffered due to the presence of *A. montanus* (see below).
Blue Crane *(Anthropoides paradiseus)*	Dam 2 and the already cleared areas surrounding this dam represent a breeding and foraging site for this species. According to the Species Environmental Assessment Guideline (SANBI, 2021), buffer distances for large breeding avifauna such as Cranes may be reduced for low intensity developments, and when taking into account the nature of the impact and species affected. A buffer distance of **100m** was therefore applied around Dam 2 (as is recommended for nesting passerine birds) where low intensity development may be considered (i.e., avoidance mitigation). Notwithstanding this buffer distance, enlargement of Dam 2 is proposed under Alternative 2 (see subsection 11.4.2). Under this alternative, the new Dam 2 footprint intersects an area of "Very low" SEI. The pair of Blue Cranes does not appear to be disturbed by current levels of daily activity, noise and vibration by machinery and people in the adjacent vineyard, and modification of Dam 2 is therefore allowable. Even so, it is likely that the Blue Cranes will temporarily vacate the direct area surrounding the dam, but should remain within the study area and return once the disturbance from development has ceased (see subsection 11.6.2). A monitoring program to track the activity and movement of these birds should however be considered, and development should be performed out of the breeding season (August of the year which construction is started to April of the following year).
Yellow-winged Agile Grasshopper *(Aneuryphymus montanus)*	The known distributions of the Yellow-winged Agile Grasshopper currently overlaps with two (Western Cape and Eastern Cape) Provinces (IUCN, 2021), rendering it with an priority grouping of A2, with associated buffer distances of 500m (Species Environmental Assessment Guideline, SANBI, 2021). Even so, the colonies of this species on the site exist as little as 12m from disturbed where similar impacts occur as those for the planned development (see Figure 23). As such, a 500m buffer distance may likely be too large in the context of the current development, given a low frequency of re-occurrence of impacts and a limited spatial extent of these impacts (likely limited to 50m to 100m from the edge of the development). The minimum buffer distance required from the edge of a butterfly SCC subpopulation (in urban and highly developed areas) is currently listed as **200m**. Realistically, this buffer distance from the edge of the two Yellow-winged Agile Grasshopper colonies should eliminate any edge effects during the construction and operational phases of the current development (i.e., avoidance mitigation) and will act to include and conserve the majority of this species' habitat on the site.

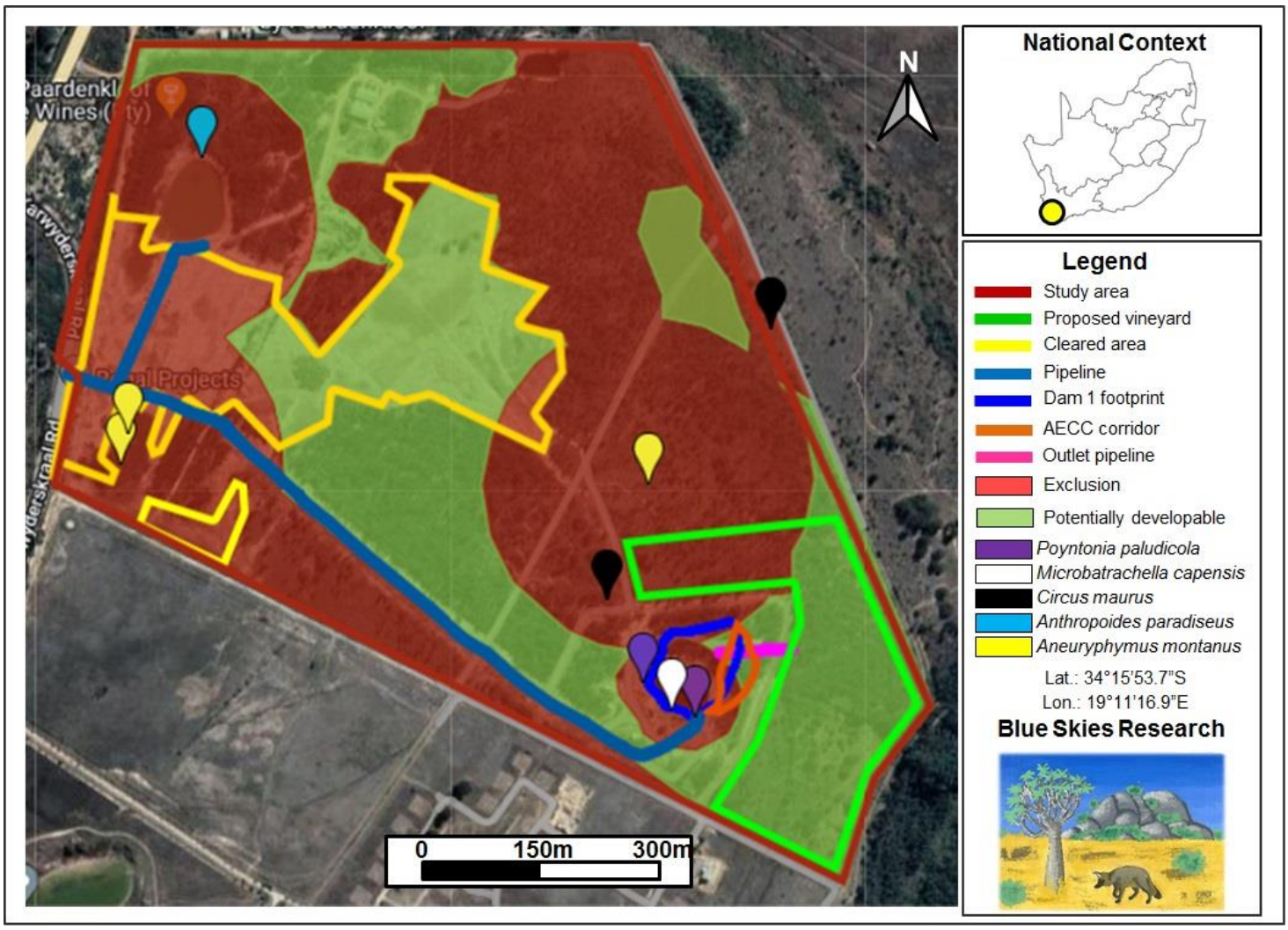


Figure 29 "Constraints and Opportunities" map of the study area showing areas where avoidance mitigation is advocated (based on the presence of suitable habitat for the amphibian, avifaunal and invertebrate SCC) inclusive of buffer distances (Table 16), and areas which are of a lower sensitivity and are therefore suitable for potential development.

Table 17 Possible project impacts along with associated impact management actions.

Impact	Impact management action(s)
Destruction of habitats (construction phase)	It is recommended that development footprints be kept at a minimum, inclusive of exclusion buffers (see Table 16), and avoid the degradation or disturbance of surrounding natural habitats on the site.
Direct mortality of fauna (construction phase)	Every effort should be made to save and relocate any mammal, reptile, amphibian, bird, or invertebrate that cannot flee of its own accord, encountered during site preparation (i.e., to avoid and minimise the direct mortality of faunal species). These animals should be relocated to a suitable habitat area immediately outside the project footprint (in the adjoining natural habitats of the site), but under no circumstance to an area further away.
Vibration and noise (construction phase)	Vibration and noise through machinery and people is unavoidable during the construction phase. As such, no mitigation measures are suggested to reduce this impact during the construction phase.
Vibration and noise (operational phase)	Like with the construction phase, vibration and noise through machinery and people is unavoidable during the operational phase. Even so, faunal diversity and abundances in the already developed parts of the site appears high, and multiple species assemblages occur directly adjacent to these areas which appear unperturbed by the current levels of disturbance. As such, no mitigation measures are suggested to reduce noise and vibration during the operational phase.
Pollution of the surrounding area (construction and operational phases)	It is recommended that pollution of the development footprints, as well as any areas adjacent to these footprints, be monitored and avoided during the construction phase. During the operational phase of the development, herbicides, fungicides or fertilizers should be applied in such a manner as to produce minimal risk of wind drift. If pest management is to proceed, this should be done under an integrated pest management programme where the use of chemicals is considered as a last option, similarly taking cognisance of potential wind drift.
Habitat degradation through afforestation and agricultural expansion (construction and operational phases)	As with the destruction of habitat (see above) it is recommended that the development footprints be kept at a minimum, and avoid the degradation or disturbance of surrounding natural habitats on the site. In addition, no livestock should be kept on the property as this may cause degradation of the remaining natural vegetation.
Uncontrolled burning of vegetation (construction and operational phases)	All burning of vegetation on the site should be done under a controlled and integrated fire management scheme. No open fires should be allowed near the natural vegetation on the site, and a fire management scheme should be put in place to contain any uncontrolled veldfires.
Alien vegetation (construction and operational phases)	Alien vegetation has already been cleared to a large extent within the study area, thereby greatly improving habitat quality. A large amount of alien invasive trees still remain, which will similarly need to be cleared. In addition, any recruitment from alien vegetation seedbanks would need to be addressed, and these newly growing trees should be removed.
Drainage impoundment and inappropriate management freshwater habitats (construction and operational phases)	All waterflow to the existing three artificial dams is facilitated through an underground HDPE pipeline, and drainage impoundment is not considered as an impact for the current development. The most notable potential aquatic feature on the site pertains to Dam 1 where two amphibian SCC were recorded. It is therefore recommended that water usage from this dam be carefully managed to not cause excessive drying of this habitat.
Hunting (construction and operational phases)	No illegal hunting (either through illegal methods or of rare or threatened species) should be allowed on the site.
Poisoning of avifaunal SCC on agricultural land (operational phase)	If pest management is to proceed, this should be done under an integrated pest management programme where the use of chemicals is considered as a last option, and where these chemicals are placed in such a way where it does not lead to the accidental poisoning of non-target species.

11.4 Development alternatives

11.4.1 Alternative 1

Under Alternative 1, the project is proposed to include the following developments:

- Construction of the enlarged 35 000 m^3 storage capacity Dam 1 with a new core and cut-off trench.
- The dam will have a 12.5 m wall height and a total footprint area of 1.5 ha.
- Proposed 250 mm diameter HDPE outlet pipe Class PE100 PN10 and 160 mm diameter PVC pipeline to downstream irrigation areas.
- Excavation of a new open channel spillway on the embankment left flank.
- Pump station below dam (4 m x 4 m).
- New irrigation areas of 7 ha below Dam 1.

11.4.2 Alternative 2 (Preferred Alternative)

Under Alternative 2, the project is proposed to include the following developments:

- New irrigation area of approximately 10ha.

Dam 1

- Construction of a new dam located directly downstream of existing dam 1 with a storage capacity of 2 000 m^3.
- The dam will have a 4.9 m wall height and a total footprint area of 0.15 ha.
- Excavation of a new open channel spillway on the embankment left flank.

Dam 2

- Construction of the enlarged 67 000 m^3 storage capacity Dam 2 with a new core and cut-off trench.
- The dam will have a 4.2 m wall height and a total footprint area of 2.5 ha.
- Proposed 250 mm diameter HDPE outlet pipe Class PE100 PN10.
- Proposed 315 mm diameter HDPE overflow spillway pipe.

11.5 Alignment of development alternatives relative to habitat SEI and SCC core habitats and -buffers

11.5.1 Alternative 1

Agricultural node

- The majority (5.52 hectares) of the agricultural node intersects an area of "Very low" SEI and is located outside of the SCC core habitats and -buffers (see subsections 10.5 and 11.3).

- Part of the agricultural node footprint (1.48 hectares) intersect with areas of "Very high" SEI, and is located within the core habitat area for the avifaunal and invertebrate SCC.

Dam 1

- The new footprint of Dam 1 will include opening of the existing dam which has a "Medium" SEI. As such, this footprint (along with part of the embankment) includes core habitat for the amphibian SCC (see subsections 10.5 and 11.3).

- The proposed outlet pipe and pump station are located in an area of “Very low” SEI, and outside of core suitable SCC habitats and -buffers.

11.5.2 Alternative 2 (Preferred Alternative)

Agricultural nodes

- Among the four identified agricultural nodes, the majority (9.74 hectares) intersect with areas of “Very low” SEI (Figure 30) and are located outside of core SCC habitats and -buffers (Figure 31).

- A small part (0.26 hectares) of the south-central agricultural node intersects with a habitat buffering as “Very high” SEI (Figure 30), with a small and extra-limital part of this node (1.12 hectares) located with the buffer zone for the invertebrate SCC (Figure 31).

Dam 1

- The new dam footprint is spatially separated (i.e., buffered by the recommended 30m) from Dam 1, and Dam 1 will therefore remain unaltered (Figures 30 and 31). The new dam embankment and dam footprint intersects an area of “Very low” SEI.

Dam 2

- The Dam 2 footprint intersects an area of “Very low” SEI (Figure 30). Even so, this footprint overlaps with the core habitat for an avifaunal SCC (the resident pair of Blue Cranes, Figure 31).

11.5.3 “No-Go” alternative

This alternative considers that no development will take place. Under this alternative, all current impacts will persist (Subsection 11.1).

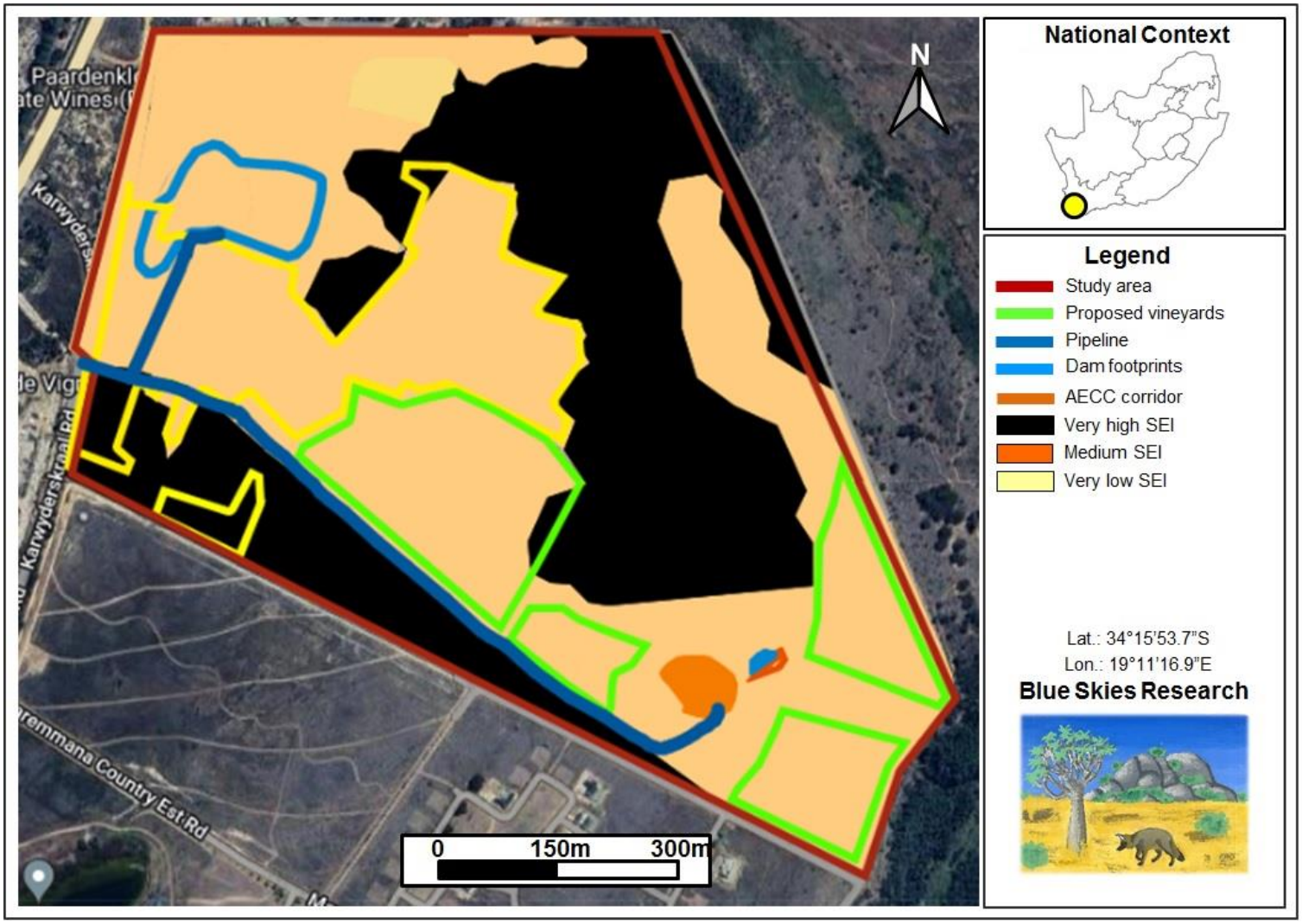


Figure 30 Spatial representation of the combined SEI categories of habitat types within the study area considering all faunal SCC, and showing development nodes under Alternative 2.

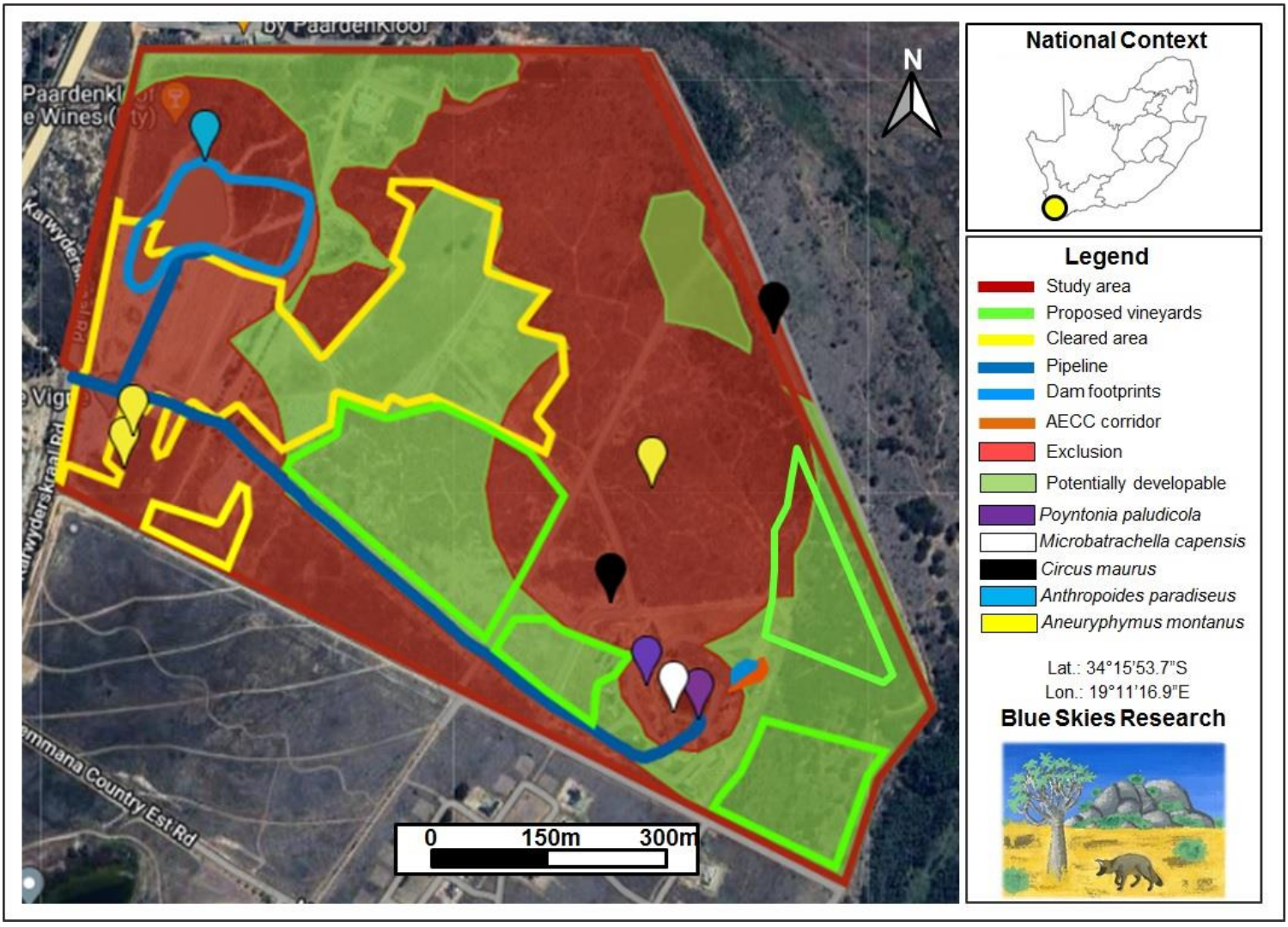


Figure 31 "Constraints and Opportunities" map of the study area showing the intersection of development nodes under Alternative 2 with areas where avoidance mitigation is advocated (based on the presence of suitable habitat for the amphibian, avifaunal and invertebrate SCC) inclusive of buffer distances (Table 16), and areas which are of a lower sensitivity and are therefore suitable for potential development.

11.6 Impact assessment

11.6.1 Methodology

The following impact assessment methodology was used to investigate the impacts of the different development alternatives on the receiving environment. Firstly, the intensity, duration and extent of impacts on the receiving environment was evaluated based on the defining criteria outlined in Table 18 (Part A). Collectively, these criteria are considered a function of the consequence of impacts on the receiving environment (Table 19, Part B). This consequence of the impacts, together with the probability that the impact will occur, is then used to determine the significance of the impacts on the receiving environment (Table 20, Part C), which may in turn be used to inform the appropriate decisions during the EA process (Table 21, Part D).

Table 18 Definitions and criteria for defining the intensity, duration and extent of impacts on the receiving environment. VH = Very high, H = High, M= Medium, L= Low and VL= Very low and + denotes a positive impact.

PART A: DEFINITIONS AND CRITERIA		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilisation against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.

	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 20 years.
	H	Long term, between 20 and 35 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

Table 19 Matrices for determining the consequence of environmental impacts on the receiving environment. VH = Very high, H = High, M= Medium, L= Low and VL= Very low.

PART B: DETERMINING CONSEQUENCE							
			EXTENT				
			A part of the site/property	Whole site	Beyond the site, affecting neighbours	Local area, extending far beyond site.	Regional/ National
			VL	**L**	**M**	**H**	**VH**
INTENSITY = VL							
DURATION	Very long	**VH**	**Low**	**Low**	**Medium**	**Medium**	**High**
	Long term	**H**	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Medium term	**M**	**Very Low**	**Low**	**Low**	**Low**	**Medium**

	Short term	L	Very low	Very Low	Low	Low	Low
	Very short	VL	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	VH	Medium	Medium	Medium	High	High
	Long term	H	Low	Medium	Medium	Medium	High
	Medium term	M	Low	Low	Medium	Medium	Medium
	Short term	L	Low	Low	Low	Medium	Medium
	Very short	VL	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	VH	Medium	High	High	High	Very High
	Long term	H	Medium	Medium	Medium	High	High
	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short	VL	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short	VL	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short	VL	Low	Medium	Medium	High	High
			VL	**L**	**M**	**H**	**VH**
			A part of the site/property	Whole site	Beyond the site, affecting neighbours	Local area, extending far beyond site.	Regional/ National
			EXTENT				

Table 20 Matrix for determining the significance of environmental impacts on the receiving environment. VH = Very high, H = High, M= Medium, L= Low and VL= Very low.

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**VH**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**H**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible/ frequent	**M**	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**L**	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely/ improbable	**VL**	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
			VL	**L**	**M**	**H**	**VH**
			CONSEQUENCE				

Table 21 Interpretation of the significance of environmental impacts on the receiving environment.

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely to be required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

11.6.2 Impact assessment for the development alternatives

The impact assessment for the receiving environment in the current study was performed for the two development alternatives considering both the construction and operational phases of the project (Table 22).

Under Alternative 1 the majority of the agricultural node (as well as the proposed outlet pipe and pump station at Dam 1) intersects an area of "Very low" SEI and is located outside of the SCC core habitats and -buffers, but part of the footprint intersects an area of "Very high" SEI, and is located within the core habitat area for the avifaunal and invertebrate SCC. Placement of this part of the agricultural will lead to the destruction of SCC habitat, especially during the construction phase when vegetation clearing and soil preparation will be performed. Furthermore, enlargement of Dam 1 will include opening of the existing dam which currently comprises a "Medium" SEI habitat and a core habitat for the amphibian SCC. Although this dam is artificial, the resident amphibian SCC are sensitive to direct environmental disturbance, and may be impacted if this habitat is modified. Taken together, development under Alternative 1 will have a number of short to medium term negative impacts on the receiving environment during the construction phase, but impacts during the operational phase will likely be limited (Table 22).

Under Alternative 2 the larger part of the agricultural nodes intersect with areas of “Very low” SEI and are located outside of core SCC habitats and -buffers, with only a small and extralimital part of the south-central agricultural node intersecting with a habitat buffering as “Very high” SEI and located with the buffer zone for the invertebrate SCC. Given the small and extralimital nature of these intersected habitat areas, development here should not drastically affect ecosystem processes in adjacent habitats.

Furthermore, the new dam footprint at Dam 1 is spatially separated from the existing dam by the recommended buffer distance of 30m, and construction of the new dam embankment intersects with an area of “Very low” SEI. The placement of the new

dam footprint is unlikely to impact on the resident amphibian SCC subpopulations and will further increase suitable habitat for these species.

The new Dam 2 footprint intersects an area of “Very low” SEI, but overlaps with the core habitat for the resident pair of Blue Cranes. This pair does not appear to be disturbed by current levels of daily activity, noise and vibration by machinery and people in the adjacent vineyard. Should Dam 2 be enlarged (deepened and the dam walls to be raised), it is likely that the resident pair will temporarily vacate the direct area surrounding the dam, but should remain within the study area and return to this part of the site once disturbance has ceased. Even so, any enlargement of this dam should consider a monitoring program to track the activity and movement of these birds (this may be performed by an Environmental Control Officer without requiring specialist input), and should be performed out of the breeding season (August of the year which construction is started to April of the following year).

Taken together, development under Alternative 2 is likely to have fewer impacts on the receiving environment and will have an acceptable outcome from a faunal biodiversity perspective (especially through creating further habitat for amphibian SCC). To this end, the “No-Go” alternative was not considered, given that the environmental outcomes under Alternative 2 are in line with sustainable development and will possibly aid in propagating further subpopulations of threatened species.

Table 22 Impact assessment of two development alternatives identified for the study area, considering both the construction and operational phases of the project.

	Alternative 1		Alternative 2 (Preferred alternative)	
	Construction phase	**Operational phase**	**Construction phase**	**Operational phase**
Extent	**Low** - The majority of the agricultural node intersects an area of "Very low" SEI and is located outside of the SCC core habitats and -buffers. Part of the agricultural node footprint however, intersect with and area of "Very high" SEI, and is located within a SCC core habitat. Enlargement of Dam 1 would result in the modification of the existing dam footprint, intersecting with an area of "Medium" SEI, and a SCC core habitat. Taken together, although these impacts are restricted to parts of the site, this may influence faunal biodiversity in the entire site through impacting on resident SCC subpopulations.	**Very low** - Impacts are likely to be restricted to the development footprints and directly adjacent areas.	**Very low** - The agricultural nodes and Dam 1 footprint intersect areas of "Very low" SEI and is largely located outside of, or extralimital within the SCC core habitats and -buffers. While the footprint of Dam 2 is also located in an area of "Very low" SEI, this footprint currently forms part of the core habitat for an avifaunal SCC. Even so, it is likely that this species will remain on the site when the disturbance is occurring. Taken together, development under this alternative should not significantly influence faunal biodiversity on the site.	**Very low** - Impacts under this alternative will likely be restricted to the developed footprints, and should not impinge on core SCC habitats on the site
Duration	**Medium** - The agricultural node largely follows degraded habitat which should be able to quickly recover to a similarly degraded state. Part of the Agricultural node, however, intersects with natural vegetation, which would take a medium term to recover. Enlargement of Dam 1 is restricted to an artificial area and will therefore quickly recover to this state.	**Very low** - All habitats within the development footprints will already be modified at the onset of this phase, and impacts such as irrigation, weed / pest control, planting and harvesting will be of a short duration (less than a year).	**Very low** - Because development footprints under this alternative are restricted to areas of "Very low" SEI and largely outside of SCC core habitats and -buffers (with exception of the Dam 2 footprint, but see above), impacts from development are expected to be of a very short term of less than a year.	**Very low** - All habitats within the development footprints will already be modified at the onset of this phase, and impacts such as irrigation, weed / pest control, planting and harvesting will be of a short duration (less than a year).

Intensity	**High** - The majority of the agricultural node intersects an area of "Very low" SEI and is located outside of the SCC core habitats and -buffers. However, part of the agricultural node footprint intersect with areas of "Very high" SEI, and is located within an SCC core habitat. Enlargement of Dam 1 would result in the modification of the existing dam footprint, intersecting with an area of "Medium" SEI, and an SCC core habitat. As such, these activities may directly affect resident subpopulations of SCC, and prominent change, disturbance and degradation of SCC habitats are expected during construction.	**Low** - Because impacts such as irrigation, weed / pest control, planting and harvesting will be largely restricted to the developed footprints, this will be associated with only minor change, disturbance or nuisance to the surrounding habitats.	**Medium** - Development footprints under this alternative are largely restricted to areas of "Very low" SEI, albeit enlargement of Dam 2 would likely temporarily influence the resident pair of Blue Cranes. As such, only moderate change, disturbance or discomfort are expected, associated with real but not substantial consequences.	**Very low** - All project footprints will already be modified at the onset of this phase, and impacts such as irrigation, weed / pest control, planting and harvesting will be restricted to areas outside of core SCC habitats. Enlargement of Dam 1 would furthermore likely result in a positive change to the receiving environment through offering further suitable habitat for the resident populations of amphibian SCC. Negligible change, disturbance or nuisance is expected, associated with very minor consequences or deterioration.
Consequence	**Medium**	**Very low**	**Low**	**Very low**
Probability	**High** - Probable impacts on SCC subpopulations on the site, as well as habitats outside of the development footprints.	**Low** - Impacts on SCC subpopulations outside of the development footprints are conceivable, albeit this exposure will be infrequent.	**Medium** - Although the majority of the development footprint should not influence SCC sub-populations or habitats, impacts on the resident pair of Blue Cranes is possible.	**Very low** - Impacts on SCC subpopulations and habitats are unlikely.
Significance	**Medium**	**Insignificant**	**Very low**	**Insignificant**
Interpretation of significance	It should have an influence on the decision. Mitigation will be required.	Inconsequential, not requiring any consideration.	It will not have an influence on the decision. Does not require any mitigation.	Inconsequential, not requiring any consideration.

12. Conclusion

This report provides a representative faunal assessment of the study area considering facets of:

- Terrestrial faunal and avifaunal habitat composition (Section 7),
- terrestrial faunal and avifaunal components (Section 8),
- the presence or likely presence of the SCC listed in the DFFE Screening Tool Report (Table 1) as well as additional SCC (Section 9),
- the conservation status and on-site habitats of, and threats to these SCC (Section 9),
- the SEI of habitats within the study area, with associated acceptable development activities (Section 10),
- mitigation measures and impact management actions to be implemented during the construction and operational phases of the project along with a “Constraints and opportunities” map of the site (Section 11), and
- an impact assessment for two development alternatives considering both the construction and operational phases of the project (Section 11).

12.1 Exclusion and buffering of sensitive habitats

The two amphibian SCC were recorded digitally through nocturnal sound recordings around Dam 1. Both species were thereafter identified through referencing these recordings to the standard call signatures available from du Preez & Carruthers (2009) as well as recorded vocalisations on the iNaturalist database. These sound recordings were submitted to the iNaturalist database on the 9th of November 2022, but are still both listed as “Need ID”, which is likely the reason the records do not currently reflect on the database.

Dam 1 is fed by a pipeline which feeds water from a weir higher up in the catchment. To this end, water quality in this dam is similar to that of this mountainous area, and does appear more acidic in nature. Notably, the applicant has opted to further keep

this dam close to a natural profile through providing riparian vegetation and suitable rocky substrate (in contrast to what would be classified as a farm dam).

Given these characteristics, Dam 1 harbours a rich amphibian assemblage, supporting five confirmed species (possibly even more), some of which are highly abundant. This high amphibian diversity gives testament to the near-natural and near-pristine habitat conditions of this artificial dam, also pointing towards this habitat being highly sensitive from an aquatic perspective. It is not precisely known how these amphibians have colonized this dam, although it is highly likely that their eggs have been transported here via the pipeline from the weir.

Given these considerations, exclusion of this sensitive aquatic habitat from development planning is therefore warranted from a conservation perspective. Exclusion of Dam 1 is further supported by the “Precautionary Principle”, given that this habitat may harbour even more sensitive aquatic species. Furthermore, the recommended buffer distance around this habitat will be sufficient to significantly reduce any negative ecological impacts on this dam over the short and long term.

Considering the breeding site preferences of the Black Harrier, this species prefers a dense habitat structure for nesting, such as is found in the Rooisand Nature Reserve to the south. Currently, the habitat profile of the site is characterised by an open-structured medium-high shrubland which is vastly different to the preferred nesting preferences of the Black Harrier. The presence of this species is likely linked to a suitable rodent prey base, making its presence highly ephemeral.

Considering the breeding pair of Blue Cranes on the site, this pair has been resident here for a number of years, nesting every year but with a low breeding success. Blue Cranes are highly resilient to daily disturbances (as are this pair), and it is highly likely that they will remain on the site when enlargement of the western dam is occurring. Should enlargement of Dam 2 be performed out of the breeding season, it is also likely that this pair will remain and breed here in the subsequent breeding season (as is the case with nearly all breeding pairs which breed on cultivated land in the Western Cape). To this end, a buffer distance around Dam 2 is not realistically

functionally significant in the context of the current development per se, but was applied following the “Precautionary Principle” as recommended in the Species Environmental Assessment Guideline (SANBI, 2020).

Taken together, the exclusion of sensitive habitats and associated sensitive species on the site as are considered under Alternative 2 are appropriate for ensuring their persistence. To this end, Alternative 2 offers a sustainable development option which should not impinge on patterns and processes which drive biodiversity in the broader study area landscape.

12.2 Conclusion

The results from this report represent a more site-specific and finer-grained rendering of the site sensitivity than is represented in the DFFE Screening Tool Report (Figure 2, Section 3). Most notable is the ecosystem integrity of the shrubland habitats on the site (Sections 7, 10 and 11) which spatially align with the projected “high sensitivity” area listed in the screening tool report to some extent, but is in contrast to these areas being considered as degraded terrestrial CBA2. By removing the alien invasive vegetation from these habitats, the applicant has essentially improved habitat quality to such a degree that faunal species diversity is high and ecosystem dynamics are intact, with multiple faunal SCC also being present. Shrubland habitats on the site therefore represent a terrestrial CBA, defined by Purves and Holmes (2015) as “*Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure*”. No development should be considered within the shrubland habitats, as this may compromise this sensitive faunal link in the study area landscape.

Conversely, large tracts in the eastern (where a terrestrial CBA is located) and north-eastern parts of the site, and western and central parts of the site either respectively harbour thick infestations of alien invasive trees, or have been cleared from this type of vegetation. No natural vegetation remains here and these areas exist in a degraded state. Any development within these compromised portions of the site should not have adverse effects on ecosystem functioning in the landscape.

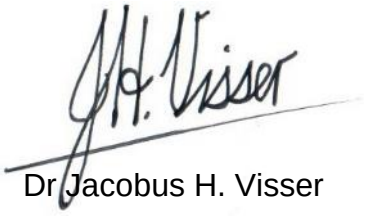
Although Dam 1 harbours two amphibian SCC and Dam 2 represents a core habitat for the resident pair of Blue Cranes (avifaunal SC), these artificial habitats were created by the applicant in its current form, allowing for these species to be present - a situation that would not have been naturally possible. Any construction of a new, or enlargement of a current dam should therefore attempt to establish adequate vegetation cover around the footprint to create further novel habitat for these (and other) SCC, allowing for the establishment of larger subpopulations and adding to the conservation of these species.

Finally, among the two development alternatives considered, Alternative 2 will have fewer negative impacts on the receiving environment, and may even add novel aquatic habitats on the site (the “No-Go” alternative was not considered, given that the environmental outcomes under Alternative 2 are in line with sustainable development). From a faunal perspective therefore, there is no reason why the development in the study area should not proceed under Alternative 2, given that the results from this report are considered.

13. Conditions to which this statement is subjected

The content of this report is based on the author’s best scientific and professional knowledge as well as available information. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage which is not listed in this report. As such, the conclusions and recommendations made in this report are done in good faith based on information gathered at the time of the investigation.

This report must not be altered or added to without the prior written consent of the author. 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 make reference 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.



Dr Jacobus H. Visser
(PhD Zoology; Pr. Sci. Nat.)
SACNASP Registration Number: 128018

14. References

Baker, N., Brouwer, J., Baker, L., Sinclair, T., Harebottle, D., Buij, R. 2011. The status of the Secretarybird *Sagittarius serpentarius* with special reference to Tanzania and declines across the continent. A preliminary report to the UK CITES Scientific Authority (Fauna).

Bazelet, C., Naskrecki, P. 2014. *Brinckiella aptera*. The IUCN Red List of Threatened Species 2014: e.T20644119A56180304. https://dx.doi.org/10.2305/IUCN.UK.2014-3.RLTS.T20644119A56180304.en. Accessed on 10 December 2022.

Barnes, K.N. 2000. *The Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg.

Berruti, A., Baker, N., Buijs, D., Colahan, B.D., Davies, C., Dellegn, Y., Eksteen, J., Kolberg, H., Marchant, A.H., Mpofu, Z., Nantongo-Kalundu, P., Nnyiti, P., Pienaar, K., Shaw, K., Tyali, T., van Niekerk, J., Wheeler, M. J. 2005. International Maccoa Duck *Oxyura maccoa* Action Plan.

Berruti, A., Baker, N.; Buijs, D., Colahan, B.D., Davies, C., Dellegn, Y., Eksteen, J., Kolberg, H., Marchant, A., Mpofu, Z., Nantongo-Kalundu, P., Nnyiti, P., Pienaar, K., Shaw, K., Tyali, T., van Niekerk, J., Wheeler, M.J., Evans, S.W. 2007. International Single Species Action Plan for the conservation of the Maccoa Duck *Oxyura maccoa*. AEWA, Bonn.

BirdLife International. 2021. *Anthropoides paradiseus*. The IUCN Red List of Threatened Species 2021: e.T22692109A177514877. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22692109A177514877.en. Accessed on 28 August 2022.

BirdLife International. 2021. *Buteo trizonatus*. The IUCN Red List of Threatened Species 2021: e.T22735392A206649395. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22735392A206649395.en. Accessed on 28 August 2022.

BirdLife International. 2021. *Circus maurus*. The IUCN Red List of Threatened Species 2021: e.T22695379A173521089. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22695379A173521089.en. Accessed on 28 August 2022.

BirdLife International. 2016. *Circus ranivorus*. The IUCN Red List of Threatened Species 2016: e.T22695352A93504602. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22695352A93504602.en. Accessed on 28 August 2022.

BirdLife International. 2016. *Neotis denhami*. The IUCN Red List of Threatened Species 2016: e.T22691905A93327715. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22691905A93327715.en. Accessed on 28 August 2022.

BirdLife International. 2021. *Oxyura maccoa*. The IUCN Red List of Threatened Species 2021: e.T22679820A181759055. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22679820A181759055.en. Accessed on 28 August 2022.

BirdLife International. 2018. *Phalacrocorax capensis*. The IUCN Red List of Threatened Species 2018: e.T22696806A132594943. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22696806A132594943.en. Accessed on 10 December 2022.

BirdLife International. 2020. *Polemaetus bellicosus*. The IUCN Red List of Threatened Species 2020: e.T22696116A172287822. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22696116A172287822.en. Accessed on 28 August 2022.

BirdLife International. 2020. *Sagittarius serpentarius*. The IUCN Red List of Threatened Species 2020: e.T22696221A173647556. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22696221A173647556.en. Accessed on 28 August 2022.

BirdLife International. 2022. *Turnix hottentottus*. The IUCN Red List of Threatened Species 2022: e.T22725519A173983646. https://dx.doi.org/10.2305/IUCN.UK.2022-1.RLTS.T22725519A173983646.en. Accessed on 28 August 2022.

Brown, H.D. 1960. New Grasshoppers (Acridoidea) from the Great Karroo and the South Eastern . Journal of the Entomological Society of South Africa 23: 126-143.

Brownlie, S. 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No. ENV-S-C 2005-053 C. Provincial Government of

the Western Cape: Department of Environmental Affairs and Development Planning.

Collar, N.J. 1996. Otididae (Bustards). In: del Hoyo, J.; Elliott, A.; Sargatal, J. (ed.), *Handbook of the birds of the world*, pp. 240-273. Lynx Edicions, Barcelona, Spain.

Crawford, R.J.M. and Shelton, P.A. 1978. Pelagic fish and seabird interrelationships off the coast of south west and south Africa. Biological Conservation 14: 85-109.

Curtis, O., Simmons, R.E., Jenkins, A.R. 2004. Black Harrier *Circus maurus* of the Fynbos biome, South Africa: a threatened specialist or an adaptable survivor? Bird Conservation International 14: 233-245.

Ferguson-Lees, J., Christie, D.A. 2001. *Raptors of the world*. Christopher Helm, London.

del Hoyo, J., Elliot, A., Sargatal, J. 1992. *Handbook of the Birds of the World, Vol. 1: Ostrich to Ducks*. Lynx Edicions, Barcelona, Spain.

del Hoyo, J., Elliott, A., Sargatal, J. 1996. *Handbook of the Birds of the World, vol. 3: Hoatzin to Auks*. Lynx Edicions, Barcelona, Spain.

du Preez, L., Carruthers, V. 2017. *Frogs of southern Africa: A complete guide*. Struik Nature, Cape Town, South Africa.

Government Gazette No 34809, 9 December 2011. Department of Environmental Affairs, No. 1002 of 2011. List of Ecosystems that are Threatened and in Need of Protection.

Government Gazette No. 43110, 20 March 2020. Procedures for the assessment and minimum criteria for reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation.

Government Gazette No. 43855, 30 October 2020. Procedures for the assessment and minimum criteria for reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation.

Hochkirch, A., Bazelet, C., Danielczak, A. 2018. *Aneuryphymus montanus*. The IUCN Red List of Threatened Species 2018: e.T116114515A116116590.

https://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T116114515A116116590.en. Accessed on 10 December 2022.

Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. 2005. *Roberts birds of southern Africa*. Trustees of the John Voelcker Bird Book Fund, Cape Town, South Africa.

Hofmeyr, S.D., Symes, C.T., Underhill, L.G. 2014. Secretarybird *Sagittarius serpentarius* population trends and ecology: insights from South African citizen science data. PLoS ONE 9: e96772

IUCN SSC Amphibian Specialist Group & South African Frog Re-assessment Group (SA-FRoG). 2017. *Microbatrachella capensis*. The IUCN Red List of Threatened Species 2017: e.T13318A77158116. https://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T13318A77158116.en. Accessed on 28 August 2022.

IUCN SSC Amphibian Specialist Group & South African Frog Re-assessment Group (SA-FRoG). 2017. *Poyntonia paludicola*. The IUCN Red List of Threatened Species 2017: e.T58153A77161825. https://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T58153A77161825.en. Accessed on 28 August 2022.

IUCN SSC Amphibian Specialist Group & South African Frog Re-assessment Group (SA-FRoG). 2017. *Xenopus gilli*. The IUCN Red List of Threatened Species 2017: e.T23124A77164368. https://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T23124A77164368.en. Accessed on 28 August 2022.

Johnsgard, P.A. 1978. *Ducks, geese and swans of the World*. University of Nebraska Press, Lincoln and London.

Johnsgard, P.A. and Carbonell, M. 1996. University of Oklahoma Press, Norman, USA.

Kemp, A., Dean, R. 1988. Diet of African Marsh Harriers from pellets. Gabar 3: 54-55.

Kemp, M.I., Kemp, A.C. 1977. *Bucorvus* and *Sagittarius*: two modes of terrestrial predation. In: Kemp, A.C (ed.), Proceedings of the Symposium on African Predatory Birds, Transvaal Museum, Pretoria, 29 August - 1 September 1977, pp. 13-16. Nothern Transvaal Ornithological Society, Pretoria.

Kinvig, R.G. 2005. Biotic indicators of grassland condition in Kwazulu-Natal, with management recommendations. School of Biological and Conservation Sciences, University of KwaZulu-Natal.

Lee, A.T. 2013. Fynbos Enigma: Hottentot Buttonquail in the Kouga Mountains. African Birdlife Sept/Oct 2013 pp.20-22.

Lee, A.T., Wright, D.R., Reeves, D. 2018. Habitat variables associated with encounters of Hottentot Buttonquail *Turnix hottentottus* during flush surveys across the Fynbos biome . Ostrich 89(1): 13-18.

Loftie-Eaton, M. 2017. *The impacts of bush encroachment on bird distributions in the Savanna biome of South Africa*. University of Cape Town, South Africa.

Madge, S., McGowan, P. 2002. *Pheasants, partridges and grouse: including buttonquails, sandgrouse and allies*. Christopher Helm, London.

McCann, K., Theron, L-J., Morrison, K. 2007. Conservation priorities for the Blue Crane (*Anthropoides paradiseus*) in South Africa - the effects of habitat changes on distribution and numbers. Ostrich 78(2): 205-211.

Macfarlane, D., Bredin, I. 2017. Buffer Zone Guidelines for Rivers, Wetlands and Estuaries Part 1: Technical Manual. WRC Report No. TT/715/1/17. Water Research Commission: Pretoria, South Africa.

Minter, L.R., M. Burger, J.A. Harrison, H.H. Braack, P.J. Bishop, D. Kloepfer, 2004. *Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland*. SI/MAB Series #9. Smithsonian Institution, Washington, DC.

Nelson, J. B. 2005. Pelicans, cormorants and their relatives. Pelecanidae, Sulidae, Phalacrocoracidae, Anhingidae, Fregatidae, Phaethontidae. Oxford University Press, Oxford, U.K.

Selb, H.E.T. 2020. *Aloeides egerides*. The IUCN Red List of Threatened Species 2020: e.T884A168303111. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T884A168303111.en. Accessed on 10 December 2022.

Taylor, M.R. 2015. Black Harrier *Circus maurus*. In: Taylor, M. R.; Peacock, F.; Wanless, R. M. (ed.), The 2015 *Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*, pp. 125-127. BirdLife South Africa, Johannesburg, South Africa.

Taylor, B., van Perlo, B. 1998. *Rails: a guide to the rails, crakes, gallinules and coots of the world*. Pica Press, Robertsbridge, UK.

Urban, E.K., Fry, C.H., Keith, S. 1997. *The birds of Africa vol. V*. Academic Press, London.

van Velden, J.L., Altwegg, R., Shaw, K., Ryan, P. G. 2017. Movement patterns and survival estimates of Blue Cranes in the Western Cape. Ostrich 88: 33-43.

Whitecross, M.A., Retief, E.F. and Smit-Robinson, H.A. 2019. Dispersal dynamics of juvenile Secretarybirds *Sagittarius serpentarius* in southern Africa. Ostrich 90(2): 97-110.

Appendix A

Appendix A Desktop species list of the avifaunal species which have been recorded in the pentad (3415_1910) which overlaps the study area (South African Bird Atlas Project 2, https://sabap2.birdmap.africa/), noting the total number of observations, and also the latest date the species was recorded. Furthermore, for each species, the taxonomic Order, Family, species binomial name and common name is shown, along with the current IUCN Red List classification of the species. Species in bold represent avifaunal species of conservation concern (SCC).

Order	Family	Species	Common name	IUCN status	Number of observations	Latest record
Accipitriformes	Accipitridae	*Accipiter melanoleucus*	Black Sparrowhawk	Least Concern	4	2021/06/14
		Accipiter rufiventris	Rufous-breasted Sparrowhawk	Least Concern	3	2021/06/14
		Accipiter tachiro	African Goshawk	Least Concern	6	2020/09/08
		Aquila verreauxii	Verreaux's Eagle	Least Concern	5	2021/12/11
		Buteo buteo	Common Buzzard	Least Concern	69	2022/03/21
		Buteo rufofuscus	Jackal Buzzard	Least Concern	87	2022/07/09
		Buteo trizonatus	**Forest Buzzard**	**Near-Threatened**	**4**	**2021/12/20**
		Circus maurus	**Black Harrier**	**Endangered**	**21**	**2021/12/11**
		Circus ranivorus	**African Marsh Harrier**	**Least Concern**	**29**	**2022/03/21**
		Elanus caeruleus	Black-winged Kite	Least Concern	65	2022/09/01
		Haliaeetus vocifer	African Fish Eagle	Least Concern	44	2022/07/09
		Hieraaetus pennatus	Booted Eagle	Least Concern	7	2020/01/10
		Melierax canorus	Pale Chanting Goshawk	Least Concern	2	2020/12/30
		Milvus aegyptius	Yellow-billed Kite	Least Concern	66	2022/10/21
		Polemaetus bellicosus	**Martial Eagle**	**Endangered**	**4**	**2019/12/03**
		Polyboroides typus	African Harrier-Hawk	Least Concern	9	2017/12/20
	Sagittariidae	***Sagittarius serpentarius***	**Secretarybird**	**Endangered**	**21**	**2020/07/12**
Anseriformes	Anatidae	*Alopochen aegyptiaca*	Egyptian Goose	Least Concern	155	2022/09/01
		Anas capensis	Cape Teal	Least Concern	24	2022/04/13

		Anas erythrorhyncha	Red-billed Teal	Least Concern	56	2022/09/01
		Anas platyrhynchos	Mallard	Least Concern	4	2017/09/21
		Anas sparsa	African Black Duck	Least Concern	7	2020/07/08
		Anas undulata	Yellow-billed Duck	Least Concern	106	2022/04/13
		Dendrocygna viduata	White-faced Whistling Duck	Least Concern	58	2022/07/09
		Netta erythrophthalma	Southern Pochard	Least Concern	1	2015/12/29
		Oxyura maccoa	**Maccoa Duck**	**Endangered**	**1**	**2015/11/28**
		Plectropterus gambensis	Spur-winged Goose	Least Concern	129	2022/07/09
		Spatula hottentota	Blue-billed Teal	Least Concern	2	2012/10/07
		Spatula smithii	Cape Shoveler	Least Concern	30	2022/09/01
		Tadorna cana	South African Shelduck	Least Concern	23	2022/03/21
Bucerotiformes	Upupidae	*Upupa africana*	African Hoopoe	Least Concern	22	2020/12/30
Caprimulgiformes	Apodidae	*Apus affinis*	Little Swift	Least Concern	4	2017/12/22
		Apus barbatus	African Black Swift	Least Concern	8	2017/12/22
		Apus caffer	White-rumped Swift	Least Concern	37	2022/03/21
		Tachymarptis melba	Alpine Swift	Least Concern	22	2022/09/01
	Caprimulgidae	*Caprimulgus pectoralis*	Fiery-necked Nightjar	Least Concern	5	2009/07/03
Charadriiformes	Burhinidae	*Burhinus capensis*	Spotted Thick-knee	Least Concern	19	2021/12/11
		Burhinus vermiculatus	Water Thick-knee	Least Concern	5	2009/07/03
	Charadriidae	*Charadrius pecuarius*	Kittlitz's Plover	Least Concern	12	2021/12/11
		Charadrius tricollaris	Three-banded Plover	Least Concern	51	2022/07/09
		Vanellus armatus	Blacksmith Lapwing	Least Concern	130	2022/09/01
		Vanellus coronatus	Crowned Lapwing	Least Concern	56	2022/04/13
	Haematopodidae	*Haematopus moquini*	African Oystercatcher	Least Concern	1	2015/11/28
	Laridae	*Larus dominicanus*	Kelp Gull	Least Concern	25	2021/07/16
		Sterna hirundo	Common Tern	Least Concern	1	2015/11/28
		Thalasseus sandvicensis	Sandwich Tern	Least Concern	1	2015/11/28
	Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	Least Concern	6	2020/10/06
		Recurvirostra avosetta	Pied Avocet	Least Concern	1	2019/03/05

	Scolopacidae	*Gallinago nigripennis*	African Snipe	Least Concern	5	2020/07/24
		Tringa nebularia	Common Greenshank	Least Concern	2	2020/01/26
Ciconiiformes	Ciconiidae	*Ciconia ciconia*	White Stork	Least Concern	11	2017/01/05
Coliiformes	Coliidae	*Colius striatus*	Speckled Mousebird	Least Concern	41	2021/12/11
		Urocolius indicus	Red-faced Mousebird	Least Concern	1	2020/12/30
Columbiformes	Columbidae	*Columba guinea*	Speckled Pigeon	Least Concern	99	2022/09/01
		Columba livia	Rock Dove	Least Concern	6	2022/07/09
		Oena capensis	Namaqua Dove	Least Concern	17	2022/03/21
		Spilopelia senegalensis	Laughing Dove	Least Concern	20	2022/03/21
		Streptopelia capicola	Cape Turtle Dove	Least Concern	114	2022/07/09
		Streptopelia semitorquata	Red-eyed Dove	Least Concern	94	2022/07/09
		Turtur tympanistria	Tambourine Dove	Least Concern	1	2009/06/20
Coraciiformes	Alcedinidae	*Ceryle rudis*	Pied Kingfisher	Least Concern	6	2020/01/28
		Corythornis cristatus	Malachite Kingfisher	Least Concern	14	2021/06/14
		Halcyon albiventris	Brown-hooded Kingfisher	Least Concern	1	2013/07/28
		Megaceryle maxima	Giant Kingfisher	Least Concern	12	2020/12/30
	Coraciidae	*Coracias garrulus*	European Roller	Least Concern	1	2008/02/07
Cuculiformes	Cuculidae	*Centropus burchellii*	Burchell's Coucal	Least Concern	15	2021/06/20
		Chrysococcyx caprius	Diederik Cuckoo	Least Concern	5	2017/12/22
		Chrysococcyx klaas	Klaas's Cuckoo	Least Concern	11	2020/11/18
		Cuculus canorus	Common Cuckoo	Least Concern	1	2014/01/14
		Cuculus solitarius	Red-chested Cuckoo	Least Concern	3	2020/11/18
Falconiformes	Falconidae	*Falco amurensis*	Amur Falcon	Least Concern	1	2022/01/14
		Falco biarmicus	Lanner Falcon	Least Concern	9	2022/07/09
		Falco peregrinus	Peregrine Falcon	Least Concern	5	2021/06/14
		Falco rupicolus	Rock Kestrel	Least Concern	38	2022/03/21
Galliformes	Gruidae	***Anthropoides paradiseus***	**Blue Crane**	**Vulnerable**	**149**	**2022/10/21**
	Numididae	*Numida meleagris*	Helmeted Guineafowl	Least Concern	143	2022/10/21
	Phasianidae	*Coturnix coturnix*	Common Quail	Least Concern	16	2020/11/21

		Pavo cristatus	Indian Peafowl	Least Concern	8	2020/12/30
		Pternistis capensis	Cape Spurfowl	Least Concern	69	2022/04/13
		Scleroptila afra	Grey-winged Francolin	Least Concern	3	2013/06/30
	Rallidae	*Fulica cristata*	Red-knobbed Coot	Least Concern	49	2022/04/13
		Gallinula chloropus	Common Moorhen	Least Concern	74	2022/09/01
		Porphyrio madagascariensis	African Swamphen	Least Concern	1	2015/11/28
		Rallus caerulescens	African Rail	Least Concern	1	2020/07/08
		Zapornia flavirostra	Black Crake	Least Concern	28	2022/04/13
Otidiformes	Otididae	***Afrotis afra***	**Southern Black Korhaan**	**Vulnerable**	**1**	**2021/07/16**
		Neotis denhami	**Denham's Bustard**	**Near-Threatened**	**56**	**2022/10/21**
Passeriformes	Acrocephalidae	*Acrocephalus baeticatus*	African Reed Warbler	Least Concern	15	2020/12/30
		Acrocephalus gracilirostris	Lesser Swamp Warbler	Least Concern	66	2022/07/09
	Alaudidae	*Calandrella cinerea*	Red-capped Lark	Least Concern	119	2022/09/01
		Certhilauda brevirostris	Agulhas Long-billed Lark	Least Concern	4	2010/12/18
		Galerida magnirostris	Large-billed Lark	Least Concern	123	2022/09/01
		Mirafra apiata	Cape Clapper Lark	Least Concern	14	2021/12/11
	Cisticolidae	*Apalis thoracica*	Bar-throated Apalis	Least Concern	21	2022/04/13
		Cisticola fulvicapilla	Neddicky	Least Concern	7	2022/04/13
		Cisticola juncidis	Zitting Cisticola	Least Concern	81	2022/09/01
		Cisticola subruficapilla	Grey-backed Cisticola	Least Concern	75	2022/09/01
		Cisticola textrix	Cloud Cisticola	Least Concern	34	2021/12/20
		Cisticola tinniens	Levaillant's Cisticola	Least Concern	103	2022/07/09
		Prinia maculosa	Karoo Prinia	Least Concern	108	2022/04/13
	Corvidae	*Corvus albicollis*	White-necked Raven	Least Concern	69	2021/06/20
		Corvus albus	Pied Crow	Least Concern	96	2022/10/21
		Corvus capensis	Cape Crow	Least Concern	113	2022/10/21
	Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo	Least Concern	77	2022/07/09
	Emberizidae	*Emberiza capensis*	Cape Bunting	Least Concern	5	2016/09/29
	Estrildidae	*Coccopygia melanotis*	Swee Waxbill	Least Concern	1	2007/07/06

Fringillidae	*Crithagra albogularis*	White-throated Canary	Least Concern	1	2012/04/14
	Crithagra flaviventris	Yellow Canary	Least Concern	63	2022/04/13
	Crithagra gularis	Streaky-headed Seedeater	Least Concern	15	2022/04/13
	Crithagra sulphurata	Brimstone Canary	Least Concern	30	2021/07/16
	Crithagra totta	Cape Siskin	Least Concern	2	2021/07/16
	Serinus canicollis	Cape Canary	Least Concern	131	2022/10/21
Hirundinidae	*Cecropis cucullata*	Greater Striped Swallow	Least Concern	71	2022/04/13
	Hirundo albigularis	White-throated Swallow	Least Concern	73	2022/03/21
	Hirundo dimidiata	Pearl-breasted Swallow	Least Concern	14	2021/12/11
	Hirundo rustica	Barn Swallow	Least Concern	76	2022/10/21
	Psalidoprocne pristoptera	Black Saw-wing	Least Concern	18	2020/12/30
	Ptyonoprogne fuligula	Rock Martin	Least Concern	30	2022/07/09
	Riparia cincta	Banded Martin	Least Concern	8	2019/11/30
	Riparia paludicola	Brown-throated Martin	Least Concern	57	2022/07/09
Laniidae	*Lanius collaris*	Southern Fiscal	Least Concern	142	2022/10/21
	Lanius minor	Lesser Grey Shrike	Least Concern	2	2015/12/29
Locustellidae	*Bradypterus baboecala*	Little Rush Warbler	Least Concern	35	2021/07/16
Macrosphenidae	*Sphenoeacus afer*	Cape Grassbird	Least Concern	20	2021/07/16
Malaconotidae	*Laniarius ferrugineus*	Southern Boubou	Least Concern	21	2020/12/30
	Telophorus zeylonus	Bokmakierie	Least Concern	95	2022/09/01
Monarchidae	*Terpsiphone viridis*	African Paradise Flycatcher	Least Concern	9	2022/03/21
Motacillidae	*Anthus cinnamomeus*	African Pipit	Least Concern	123	2022/04/13
	Anthus leucophrys	Plain-backed Pipit	Least Concern	27	2022/07/09
	Anthus nicholsoni	Nicholson's Pipit	Least Concern	4	2012/12/02
	Anthus similis	Long-billed Pipit	Least Concern	2	2021/04/13
	Macronyx capensis	Cape Longclaw	Least Concern	25	2022/07/09
	Motacilla capensis	Cape Wagtail	Least Concern	129	2022/10/21
Muscicapidae	*Cossypha caffra*	Cape Robin-Chat	Least Concern	69	2022/07/09
	Melaenornis silens	Fiscal Flycatcher	Least Concern	110	2022/07/09

	Monticola rupestris	Cape Rock Thrush	Least Concern	2	2014/04/25
	Muscicapa adusta	African Dusky Flycatcher	Least Concern	4	2016/05/05
	Oenanthe familiaris	Familiar Chat	Least Concern	7	2022/07/09
	Oenanthe pileata	Capped Wheatear	Least Concern	107	2022/10/21
	Saxicola torquatus	African Stonechat	Least Concern	155	2022/10/21
	Turdus olivaceus	Olive Thrush	Least Concern	17	2017/07/29
	Tychaedon coryphoeus	Karoo Scrub Robin	Least Concern	10	2021/06/20
Nectariniidae	*Anthobaphes violacea*	Orange-breasted Sunbird	Least Concern	7	2022/03/21
	Chalcomitra amethystina	Amethyst Sunbird	Least Concern	2	2020/09/08
	Cinnyris chalybeus	Southern Double-collared Sunbird	Least Concern	63	2022/07/09
	Nectarinia famosa	Malachite Sunbird	Least Concern	76	2022/03/21
Passeridae	*Passer diffusus*	Southern Grey-headed Sparrow	Least Concern	30	2022/07/09
	Passer domesticus	House Sparrow	Least Concern	84	2022/07/09
	Passer melanurus	Cape Sparrow	Least Concern	97	2022/07/09
Platysteiridae	*Batis capensis*	Cape Batis	Least Concern	7	2022/04/13
Ploceidae	*Euplectes capensis*	Yellow Bishop	Least Concern	57	2021/07/16
	Euplectes orix	Southern Red Bishop	Least Concern	129	2022/07/09
	Ploceus capensis	Cape Weaver	Least Concern	110	2022/10/21
	Quelea quelea	Red-billed Quelea	Least Concern	1	2021/05/01
	Ploceus velatus	Southern Masked Weaver	Least Concern	45	2022/09/01
Promeropidae	*Promerops cafer*	Cape Sugarbird	Least Concern	23	2022/03/21
Pycnonotidae	*Andropadus importunus*	Sombre Greenbul	Least Concern	9	2022/04/13
	Pycnonotus capensis	Cape Bulbul	Least Concern	84	2022/09/01
Sturnidae	*Creatophora cinerea*	Wattled Starling	Least Concern	2	2007/10/16
	Lamprotornis bicolor	Pied Starling	Least Concern	50	2021/12/11
	Onychognathus morio	Red-winged Starling	Least Concern	10	2021/05/01
	Sturnus vulgaris	Common Starling	Least Concern	111	2022/10/21
Sylviidae	*Curruca subcoerulea*	Chestnut-vented Warbler	Least Concern	1	2007/07/06
Viduidae	*Vidua macroura*	Pin-tailed Whydah	Least Concern	23	2022/07/09

	Zosteropidae	*Zosterops virens*	Cape White-eye	Least Concern	40	2022/07/09
Pelecaniformes	Ardeidae	*Ardea cinerea*	Grey Heron	Least Concern	47	2022/04/13
		Ardea intermedia	Intermediate Egret	Least Concern	4	2022/04/13
		Ardea melanocephala	Black-headed Heron	Least Concern	96	2022/04/13
		Ardea purpurea	Purple Heron	Least Concern	14	2022/04/13
		Bubulcus ibis	Western Cattle Egret	Least Concern	130	2022/10/21
		Egretta garzetta	Little Egret	Least Concern	5	2016/04/24
		Nycticorax nycticorax	Black-crowned Night Heron	Least Concern	3	2017/04/16
	Pelecanidae	*Pelecanus onocrotalus*	Great White Pelican	Least Concern	4	2015/11/29
	Scopidae	*Scopus umbretta*	Hamerkop	Least Concern	18	2021/07/16
	Threskiornithidae	*Bostrychia hagedash*	Hadada Ibis	Least Concern	138	2022/09/01
		Platalea alba	African Spoonbill	Least Concern	27	2022/09/01
		Plegadis falcinellus	Glossy Ibis	Least Concern	6	2020/11/18
		Threskiornis aethiopicus	African Sacred Ibis	Least Concern	120	2022/09/01
Phoenicopteriformes	Phoenicopteridae	*Phoenicopterus roseus*	Greater Flamingo	Least Concern	1	2013/03/05
Piciformes	Indicatoridae	*Indicator indicator*	Greater Honeyguide	Least Concern	1	2007/07/06
		Indicator minor	Lesser Honeyguide	Least Concern	1	2015/11/28
	Lybiidae	*Tricholaema leucomelas*	Acacia Pied Barbet	Least Concern	1	2020/01/28
	Picidae	*Dendropicos fuscescens*	Cardinal Woodpecker	Least Concern	2	2021/06/14
		Dendropicos griseocephalus	Olive Woodpecker	Least Concern	1	2017/01/05
		Geocolaptes olivaceus	**Ground Woodpecker**	**Near-Threatened**	**1**	**2010/12/18**
Podicipediformes	Podicipedidae	*Tachybaptus ruficollis*	Little Grebe	Least Concern	56	2022/04/13
Strigiformes	Strigidae	*Bubo africanus*	Spotted Eagle-Owl	Least Concern	6	2020/01/28
	Tytonidae	*Tyto alba*	Western Barn Owl	Least Concern	4	2009/07/03
Struthioniformes	Struthionidae	*Struthio camelus*	Common Ostrich	Least Concern	25	2022/04/13
Suliformes	Anhingidae	*Anhinga rufa*	African Darter	Least Concern	46	2022/07/09
	Phalacrocoracidae	*Microcarbo africanus*	Reed Cormorant	Least Concern	87	2022/09/01
		Phalacrocorax capensis	**Cape Cormorant**	**Endangered**	**1**	**2022/03/21**
		Phalacrocorax lucidus	White-breasted Cormorant	Least Concern	45	2022/04/13

Appendix B

Appendix B Desktop species list of the butterfly species which have been recorded in Quarter Degree Grid Square (QDGS 3419AC) which overlap the study area ("LepiMAP", https://vmus.adu.org.za/). For each species, the taxonomic Order, Family, species binomial name and common name is shown, along with the current IUCN Red List classification of the species.

Order	Family	Species	Common name	IUCN status
Lepidoptera	Hesperiidae	*Spialia ferax*	Striped Sandman	Least Concern
	Lycaenidae	*Aloeides pierus*	Dull Copper	Least Concern
		Anthene definita	Common Hairtail	Least Concern
		Cacyreus fracta	Water Bronze	Least Concern
		Cacyreus lingeus	Bush Bronze	Least Concern
		Cacyreus marshalli	Common Geranium Bronze	Least Concern
		Eicochrysops messapus	Cupreous Blue	Least Concern
		Lampides boeticus	Pea Blue	Least Concern
		Lepidochrysops robertsoni	Robertson's Blue	Least Concern
		Tarucus thespis	Vivid Dotted Blue	Least Concern
		Zizeeria knysna	African Grass Blue	Least Concern
	Nymphalidae	*Charaxes brutus*	White-barred Charaxes	Least Concern
		Dira clytus	Cape Autumn Widow	Not Assessed
		Pseudonympha magus	Silver-bottom Brown	Least Concern
		Vanessa cardui	Painted Lady	Least Concern
	Papilionidae	*Papilio demodocus*	Citrus Swallowtail	Not Assessed
	Pieridae	*Mylothris agathina*	Eastern Dotted Border	Least Concern
		Pieris brassicae	Cabbage White	Not Assessed

Appendix C

Appendix C Species list of the faunal species recovered within the study area during the field survey. For each, the taxonomic Order, Family, species binomial name and species common name are shown, along with the current IUCN Red List classification of the species, and the number of records of the species during the surveying period. Species in bold represent species of conservation concern (SCC).

Mammals					
Order	**Family**	**Species**	**Common name**	**IUCN status**	**Number of observations**
Afrosoricida	Chrysochloridae	*Chrysochloris asiatica*	Cape Golden Mole	Least Concern	3
Carnivora	Felidae	*Caracal caracal*	Caracal	Least Concern	1
	Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern	1
		Herpestes pulverulentus	Cape Grey Mongoose	Least Concern	2
Cetartiodactyla	Bovidae	*Raphicerus melanotis*	Cape Grysbok	Least Concern	1
		Sylvicapra grimmia	Common Duiker	Least Concern	6
Lagomorpha	Leporidae	*Lepus saxatilis*	Cape Scrub Hare	Least Concern	1
Rodentia	Bathyergidae	*Cryptomys hottentotus*	African Mole-rat	Least Concern	4
	Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern	3
	Muridae	*Gerbilliscus afra*	Cape Gerbil	Least Concern	5
		Rhabdomys pumilio	Four-striped Grass Mouse	Least Concern	2
Reptiles					
Order	**Family**	**Species**	**Common name**	**IUCN status**	**Number of observations**
Squamata	Elapidae	*Naja nivea*	Cape Cobra	Least Concern	1
	Scincidae	*Trachylepis capensis*	Cape Skink	Least Concern	1
	Viperidae	*Bitis arietans*	Puff Adder	Least Concern	1
Testudines	Pelomedusidae	*Pelomedusa galeata*	South African Helmeted Terrapin	Least Concern	4
	Testudinidae	*Chersina angulata*	Angulate Tortoise	Least Concern	5

Amphibians					
Order	**Family**	**Species**	**Common name**	**IUCN status**	**Number of observations**
Anura	Hyperoliidae	*Hyperolius marmoratus*	Painted Reed Frog	Least Concern	1
	Pyxicephalidae	*Amietia fuscigula*	Dark-throated River Frog	Least Concern	6
		Tomopterna delalandii	Cape Sand Frog	Least Concern	1
		Poyntonia paludicola	**Montane Marsh Frog**	**Near-Threatened**	**2**
		Microbatrachella capensis	**Cape Flats Frog**	**Critically Endangered**	**1**
Avifauna					
Order	**Family**	**Species**	**Common name**	**IUCN status**	**Number of observations**
Accipitriformes	Accipitridae	*Buteo buteo*	Common Buzzard	Least Concern	2
		Buteo rufofuscus	Jackal Buzzard	Least Concern	1
		Circus maurus	**Black Harrier**	**Endangered**	**2**
		Elanus caeruleus	Black-winged Kite	Least Concern	1
		Haliaeetus vocifer	African Fish Eagle	Least Concern	1
		Milvus aegyptius	Yellow-billed Kite	Least Concern	1
Anseriformes	Anatidae	*Alopochen aegyptiaca*	Egyptian Goose	Least Concern	2
		Anas sparsa	African Black Duck	Least Concern	1
		Anas undulata	Yellow-billed Duck	Least Concern	1
		Dendrocygna viduata	White-faced Whistling Duck	Least Concern	1
		Plectropterus gambensis	Spur-winged Goose	Least Concern	1
	Caprimulgidae	*Caprimulgus pectoralis*	Fiery-necked Nightjar	Least Concern	1
Charadriiformes	Burhinidae	*Burhinus capensis*	Spotted Thick-knee	Least Concern	1
	Charadriidae	*Vanellus armatus*	Blacksmith Lapwing	Least Concern	1
	Laridae	*Larus dominicanus*	Kelp Gull	Least Concern	2
Columbiformes	Columbidae	*Columba guinea*	Speckled Pigeon	Least Concern	2
		Oena capensis	Namaqua Dove	Least Concern	2
		Streptopelia capicola	Cape Turtle Dove	Least Concern	3
Coraciiformes	Alcedinidae	*Megaceryle maxima*	Giant Kingfisher	Least Concern	1

Cuculiformes	Cuculidae	*Chrysococcyx klaas*	Klaas's Cuckoo	Least Concern	1
		Cuculus solitarius	Red-chested Cuckoo	Least Concern	1
Galliformes	Gruidae	***Anthropoides paradiseus***	**Blue Crane**	**Vulnerable**	**1**
	Numididae	*Numida meleagris*	Helmeted Guineafowl	Least Concern	4
	Phasianidae	*Pternistis capensis*	Cape Spurfowl	Least Concern	1
	Cisticolidae	*Prinia maculosa*	Karoo Prinia	Least Concern	3
	Corvidae	*Corvus albicollis*	White-necked Raven	Least Concern	1
		Corvus albus	Pied Crow	Least Concern	1
		Corvus capensis	Cape Crow	Least Concern	1
	Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo	Least Concern	1
	Fringillidae	*Crithagra flaviventris*	Yellow Canary	Least Concern	1
		Serinus canicollis	Cape Canary	Least Concern	2
	Hirundinidae	*Cecropis cucullata*	Greater Striped Swallow	Least Concern	1
		Hirundo albigularis	White-throated Swallow	Least Concern	2
	Locustellidae	*Bradypterus baboecala*	Little Rush Warbler	Least Concern	1
	Malaconotidae	*Telophorus zeylonus*	Bokmakierie	Least Concern	1
	Motacillidae	*Motacilla capensis*	Cape Wagtail	Least Concern	2
	Muscicapidae	*Cossypha caffra*	Cape Robin-Chat	Least Concern	2
		Melaenornis silens	Fiscal Flycatcher	Least Concern	1
		Muscicapa adusta	African Dusky Flycatcher	Least Concern	1
	Nectariniidae	*Cinnyris chalybeus*	Southern Double-collared Sunbird	Least Concern	1
		Nectarinia famosa	Malachite Sunbird	Least Concern	2
	Passeridae	*Passer melanurus*	Cape Sparrow	Least Concern	1
	Platysteiridae	*Batis capensis*	Cape Batis	Least Concern	2
	Ploceidae	*Euplectes capensis*	Yellow Bishop	Least Concern	1
		Ploceus capensis	Cape Weaver	Least Concern	1
	Sturnidae	*Onychognathus morio*	Red-winged Starling	Least Concern	1
		Sturnus vulgaris	Common Starling	Least Concern	2
	Zosteropidae	*Zosterops virens*	Cape White-eye	Least Concern	2

Pelecaniformes	Ardeidae	*Ardea melanocephala*	Black-headed Heron	Least Concern	1
		Egretta garzetta	Little Egret	Least Concern	1
	Scopidae	*Scopus umbretta*	Hamerkop	Least Concern	1
	Threskiornithidae	*Bostrychia hagedash*	Hadada Ibis	Least Concern	1
		Threskiornis aethiopicus	African Sacred Ibis	Least Concern	1
Strigiformes	Strigidae	*Bubo africanus*	Spotted Eagle-Owl	Least Concern	1
Suliformes	Anhingidae	*Anhinga rufa*	African Darter	Least Concern	1
Butterflies					
Order	**Family**	**Species**	**Common name**	**IUCN status**	**Number of observations**
Lepidoptera	Lycaenidae	*Aloeides pierus*	Dull Copper	Least Concern	1
		Tarucus thespis	Vivid Dotted Blue	Least Concern	2
		Zizeeria knysna	African Grass Blue	Least Concern	2
	Nymphalidae	*Vanessa cardui*	Painted Lady	Least Concern	10
	Pieridae	*Colias electo*	African Clouded Yellow	Least Concern	1
		Pontia helice	Southern Meadow White	Least Concern	2
Grasshoppers					
Order	**Family**	**Species**	**Common name**	**IUCN status**	**Number of observations**
Orthoptera	Acrididae	*Aiolopus thalassinus*	Slender Green-winged Grasshopper	Least Concern	11
		Aneuryphymus montanus	**Yellow-winged Agile Grasshopper**	**Vulnerable**	**3**
		Acanthacris ruficornis	Garden Locust	Not Assessed	2
		Catantops humeralis	Spur-throated Grasshopper	Not Assessed	1

Appendix D

Curriculum Vitae of Jacobus Hendrik Visser

Full Name: Jacobus Hendrik Visser

SACNASP Registration: Professional Natural Scientist (Zoological Science) – Registration number: 128018

Address: 13 Dennelaan
Stilbaai
6674

Cell: (083) 453 7916

E-mail: BlueSkiesResearch01@gmail.com

Website: https://blueskiesresearch0.wixsite.com/blue-skies-research

Qualifications

- PhD (Zoology), University of Johannesburg (2015 - 2017)
- MSc (Zoology), Stellenbosch University (2011 - 2013)
- BSc Honours (Zoology) cum laude, Stellenbosch University (2010)
- BSc (Biodiversity and Ecology) cum laude, Stellenbosch University (2007 - 2009)

Scientific publications

- **Visser J.H.** (2013). Gene-flow in the rock hyrax (*Procavia capensis*) at different spatial scales. MSc thesis, Stellenbosch University, Stellenbosch, South Africa. https://core.ac.uk/download/pdf/37420485.pdf
- **Visser J.H.** (2017). Evolution of the South African Bathyergidae: patterns and processes. PhD dissertation, University of Johannesburg, Johannesburg, South Africa.

- **Visser J.H.**, Bennett N.C., Jansen van Vuuren B. (2014). Local and regional scale genetic variation in the Cape dune mole-rat, *Bathyergus suillus*. PLos ONE 9(9):e107226. https://doi.org/10.1371/journal.pone.0107226
- **Visser J.H.**, Bennett N.C., Jansen van Vuuren B. (2017). Distributional range, ecology and mating system of the Cape mole-rat, *Georychus capensis* family Bathyergidae. Canadian Journal of Zoology 95 (10): 713-726. https://doi.org/10.1139/cjz-2017-0016
- **Visser J.H.**, Bennett N.C., Jansen van Vuuren B. (2018). Spatial genetic diversity in the Cape mole-rat, *Georychus capensis*: Extreme isolation of populations in a subterranean environment. PLoS ONE 13(3): e0194165. https://doi.org/10.1371/journal.pone.0194165
- **Visser J.H.**, Bennett N.C., Jansen van Vuuren B. (2019). Evolutionary and ecological patterns within the South African Bathyergidae: Implications for taxonomy. Molecular Phylogenetics and Evolution 130, 181-197. https://doi.org/10.1016/j.ympev.2018.10.017
- **Visser J.H.**, Bennett N.C., Jansen van Vuuren B. (2019). Phylogeny and biogeography of the African Bathyergidae: a review of patterns and processes. Journal of Biogeography PeerJ 7:e7730. https://doi.org/10.7717/peerj.7730
- **Visser J.H.**, Geerts S. (2020). Describing sexual dimorphism and fine scale spatial distributions in the Drab Thick-tail Scorpion, *Parabuthus planicauda*. African Zoology 55 (3): 250-256. https://doi.org/10.1080/15627020.2020.1796525
- **Visser J.H.**, Geerts S. (2021). Static allometry and sexual dimorphism in the Striped Lesser-thicktail Scorpion, *Uroplectes lineatus*. Arachnology 18 (7), 700–707. https://doi.org/10.13156/arac.2020.18.7.700
- **Visser J.H.**, Geerts S. (in review). Sexual dimorphism and static allometry in the burrowing scorpion, *Opistophthalmus pallipes*. African Zoology.
- **Visser J.H.**, Geerts S. (2021). Sexual dimorphism and static allometry in the South African scorpion *Opistophthalmus karrooensis*. Arachnology 18 (9), 1057-1063.
- **Visser J.H.**, Geerts S., Jansen van Vuuren B. (2021). Phylogeographic patterns in a semi-lithophilous burrowing scorpion from South Africa, *Opistophthalmus pallipes*. Zoological Science 38 (1): 36-44. https://doi.org/10.2108/zs200094

- **Visser J.H.**, Robinson T.J., Jansen van Vuuren B. (2020). Spatial genetic structure in the rock hyrax (*Procavia capensis*) across the Namaqualand and western Fynbos areas of South Africa - a mitochondrial and microsatellite perspective. Canadian Journal of Zoology 98 (8): 557-571. https://doi.org/10.1139/cjz-2019-0154
- Uhrová M., Mikula O., Bennett N.C., Van Daele P., Piálek L., Bryja J., **Visser J.H.**, Jansen van Vuuren B., Šumbera R. (2022). Species limits and phylogeographic structure in two genera of solitary African mole-rats *Georychus* and *Heliophobius*. Molecular Phylogenetics and Evolution 167 (2022) 107337

IUCN Red List Assessments

- Bennett N.C, Jarvis J.U.M., **Visser J.H.**, Maree, S. (2016). A conservation assessment of *Georychus capensis*. In: Child M.F., Roxburgh L., Do Linh San E., Raimondo D., Davies-Mostert H.T. (Eds). The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa. https://www.ewt.org.za/wp-content/uploads/2019/02/16.-Cape-Mole-rat-Georychus-capensis_LC.pdf
- Bennett N.C., **Visser J.H.**, Maree S., Jarvis J.U.M. (2016). A conservation assessment of *Bathyergus suillus*. In: Child M.F., Roxburgh L., Do Linh San E., Raimondo D., Davies-Mostert H.T. (Eds). The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa. https://www.ewt.org.za/wp-content/uploads/2019/02/6.-Cape-Dune-Mole-rat-Bathyergus-suillus__LC.pdf
- Maree S., Jarvis J.U.M., Bennett N.C., **Visser J.H.** (2017). *Bathyergus suillus*. The IUCN Red List of Threatened Species 2017:e.T2620A110017759. http://dx.doi.org/10.2305/IUCN.Uk.2017-2.RLTS.T2620A110017759.en.
- Maree S., **Visser J.H.**, Bennett N.C., Jarvis J.U.M. (2017). *Georychus capensis*. The IUCN Red List of Threatened Species 2017:e.T9077A110019425. http://dx.doi.org/10.2305/IUCN.Uk.2017-2.RLTS.T9077A110019425.en.
- **Visser J.H.**, Wimberger K. (2016). A conservation assessment of *Procavia capensis*. In: Child M.F., Roxburgh L., Do Linh San E., Raimondo D., Davies-Mostert H.T. (Eds). The Red List of Mammals of South Africa, Swaziland and

Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa. https://www.ewt.org.za/wp-content/uploads/2019/02/3.-Rock-Hyrax-Procavia-capensis_LC.pdf

Other projects

- Southern African Bird Atlas Project 2 (SABAP2)
- Endemism, genetic variance and conservation priorities in the highlands of south-western Africa.
- Biodiversity and ecology of scorpions in the Cape Floristic Region.
- National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria.

Conferences

- Presenter at the 2017 conference of the South African Wildlife Management Association (Presentation title: The influence of commercial game farming on maintaining genetic diversity in the sable antelope (*Hippotragus niger*) and roan antelope (*Hippotragus equinus*)
- Presenter at the 2017 conference of the Zoological Society of Southern Africa (Presentation title: Evolution of the South African Bathyergidae: Patterns and processes)
- Presenter at the 2010 conference of the Zoological Society of Southern Africa (Presentation title: Local and regional scale genetic variation in the Cape dune mole-rat, *Bathyergus suillus*)