



# **The Terrestrial Biodiversity Compliance Statement for the proposed Valley Tailings Storage Facility (TSF) Project**

## **Welkom, Free State Province, South Africa**

Report Date: August 2023 (Updated September 2023)

### **CLIENT**



### **Prepared by:**

**The Biodiversity Company**





Cell: +27 81 319 1225

Fax: +27 86 527 1965

[info@thebiodiversitycompany.com](mailto:info@thebiodiversitycompany.com)

[www.thebiodiversitycompany.com](http://www.thebiodiversitycompany.com)



Report Name	<b>The Terrestrial Biodiversity Compliance Statement for the proposed Valley Tailings Storage Facility (TSF) Project</b>	
Reference	<b>Valley TSF Expansion Project</b>	
Submitted to		
Report Writer	<b>Sarah Newman</b> 	
	Sarah Newman is a terrestrial environmental consultant (Cand. Sci. Nat. 158474) with experience working in the fields of ecology, conservation and biodiversity. Sarah obtained her Master of Science degree in Entomology from the University of Pretoria in 2018.	
Field Work & Report Reviewer	<b>Carami Burger</b> 	
	Carami Burger has completed her Bachelor of Science Honours degree in Ecological Interactions and Ecosystem Resilience. Carami is Pr Sci Nat registered (121757) as an ecologist and has completed various studies as part of Basic Assessments and Environmental Impact Assessments.	
Report Writer / Reviewer	<b>Andrew Husted</b> 	
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 13 years' experience in the environmental consulting field.	
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.	

## Table of Contents

1	Introduction.....	1
1.1	Background .....	1
1.2	Design Description .....	1
1.3	Report Legislative Framework .....	7
1.4	Assumptions and Limitations .....	8
2	Methods.....	9
2.1	Desktop Assessments.....	9
2.2	Biodiversity Field Survey .....	9
2.3	Terrestrial Site Ecological Importance .....	9
3	Results & Discussion .....	13
3.1	Desktop Assessments.....	13
3.1.1	Ecologically Important Landscape Features .....	13
3.1.2	Avifauna .....	13
3.1.3	Bats .....	14
3.2	Biodiversity Field Survey.....	15
3.2.1	Avifauna and Bat Assessment .....	18
3.2.2	Screening Tool Comparison.....	19
4	Biodiversity Risk Assessment .....	21
4.1	Present Impacts to Biodiversity.....	21
4.2	Loss of Irreplaceable Resources.....	21
5	Impact Management and Mitigation Plan.....	22
6	Conclusion and Impact Statement .....	30
6.1	Impact Statement .....	30
6.2	Specialist Recommendations .....	30
7	References .....	31
8	Appendix Items.....	33
8.1	Appendix A: Specialist Declarations .....	33
8.2	Appendix B: Specialist CVs.....	36

## List of Tables

Table 1-1	Terrestrial Biodiversity Compliance Statement information requirements as per the relevant protocol, including the location of the information within this report .....	7
Table 2-1	Summary of Conservation Importance (CI) criteria .....	10
Table 2-2	Summary of Functional Integrity (FI) criteria .....	10
Table 2-3	Matrix used to derive Biodiversity Importance (BI) from Functional Integrity (FI) and Conservation Importance (CI) .....	11
Table 2-4	Summary of Receptor Resilience (RR) criteria .....	11
Table 2-5	Matrix used to derive Site Ecological Importance from Receptor Resilience (RR) and Biodiversity Importance (BI) .....	11
Table 2-6	Guideline for interpreting Site Ecological Importance in the context of proposed activities	12
Table 3-1	Summary of the spatial relevance of the project area to local ecologically important landscape features .....	13
Table 3-2	List of bird species of regional or global conservation importance that are expected to occur in close vicinity to the project area. ....	13
Table 3-3	List of bat species of conservation concern that may occur in the project area as well as their global and regional conservation statuses. ....	15
Table 3-4	Sensitivity summary of the habitat types delineated within the Project Area .....	16
Table 3-5	A list of avifaunal species recorded for the project area .....	18
Table 3-6	Summary of the screening tool vs. specialist assigned sensitivities .....	19
Table 5-1	Project specific mitigation measures including requirements for timeframes, roles and responsibilities .....	23

## List of Figures

Figure 1-1	Map illustrating the regional locality of the Project Area .....	5
Figure 1-2	Map illustrating the Project Area .....	6
Figure 3-1	Terrestrial Biodiversity Theme Sensitivity for the Project Area (National Environmental Screening Tool, 2023) .....	20
Figure 4-1	Photograph illustrating current negative impacts associated with the PAOI: A) Alien and Invasive Plant infestation; B) Livestock grazing and C Mining Activities. ....	21

## 1 Introduction

### 1.1 Background

The Biodiversity Company (TBC) was appointed to undertake a terrestrial biodiversity (fauna and flora) baseline assessment for the proposed Valley TSF Expansion Project, Harmony Gold Mining Company Limited (Harmony). Harmony owns and operate a number of gold mines and plants located in Welkom, Free State province (Figure 1-1). Harmony currently deposit tailings onto the Free State South (FSS) 2 Tailings Storage Facility (TSF), St. Helena 4 TSF, St. Helena 123 TSF, Dam 23 TSF, Brand D TSF and Target 1&2 TSF. The current planned Life of Mine (LOM) of the Free State Operations exceed the available deposition capacity of these TSFs and Harmony is undertaking a feasibility assessment to construct the new Valley TSF. The project components were given a 50 m buffer to form the Project Area ( Figure 1-2).

To determine the baseline ecological state of the area and to present a detailed description of the receiving environment, both a desktop assessment as well as a field survey were conducted on the 11<sup>th</sup> of April 2023. Furthermore, the desktop assessment and field survey both involved the detection, identification and description of any locally relevant sensitive receptors and habitats, and the manner in which these sensitive features may be affected by the proposed development was also investigated.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations, 2014 (No. 326, 7 April 2017) of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998). The approach has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020 as well as the Government Notice 1150 in terms of NEMA dated 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". The National Web based Environmental Screening Tool has characterised the terrestrial biodiversity theme for the area as 'Very High' sensitivity (National Environmental Screening Tool, 2023).

The purpose of conducting the specialist study is to provide relevant input into the Environmental Authorisation application process, with a focus on the proposed activities and their impacts associated with the project. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Registered Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making as to the ecological viability of the proposed project.

### 1.2 Design Description

The following is the executive summary as provided by Geotheta in the Design Report (2023):

Geotheta was appointed by Harmony Gold to complete the design of the proposed new Valley Tailings Storage Facility (TSF) in Welkom, South Africa.

Geotheta was appointed by Harmony Gold to complete the design of the proposed new Valley Tailings Storage Facility (TSF) in Welkom, South Africa.

Key Parameters of the Valley TSF design are:

- |                                                |                   |
|------------------------------------------------|-------------------|
| • Maximum final height:                        | 36m               |
| • Footprint area:                              | 163.5 Ha          |
| • Total capacity:                              | 56.8 million tons |
| • Deposition period at 600 000 tons per month: | 8 years           |

- Maximum rate of rise (Basin): 4.12m/year
- Maximum rate of rise (Embankment): 3.99m/year
- Deposition method: Cyclone

The Valley TSF provides a storage capacity of 56.8 million tons over a deposition period of 8.0 years at the target deposition rate of 600 000tpm with a maximum rate of rise of 4.12m/year (basin) and 3.99m/year (embankment). This rate of rise will be achieved by cyclone deposition.

Valley TSF will be developed with an intermediate outer slope of 1V:3H between benches. The overall slope with benches is 1V:4H. The inter-bench height is 8.0m and the benches are 8.0m wide.

The maximum toe wall embankment height is 3m with a 3m wide crest, outer slope of 1V:1.5H and 1V:2H inner slope. The toe wall embankment will be constructed in 150mm layers to 95% Proctor density at 0% to +2% Optimum Moisture Content (OMC). The toe wall material will be obtained from the basin of the facility.

The cyclone walls will be constructed 50m away from the toe wall on the northwest, eastern and southern flanks of the Valley TSF. The other flanks butt up against the dormant FSN1 and FSN2 facilities and no cyclone deposition will occur from these flanks. Spigotting or open-end deposition will be done for pool control only when required.

These cyclone walls will provide an elevated platform to allow for overflow tailings deposition. The cyclone wall is 3m high with a 3m wide crest, outer slope of 1V:2H and 1V:2H inner slope.

According to GISTM, the Valley TSF has a Very High Consequence Classification rating.

Based on SANS 10286, the Valley TSF has a High Hazard classification rating.

The minimum Factor of Safety against failure, based on the Limit Equilibrium method of stability analysis, is 2.0 under drained conditions, 1.6 under undrained conditions, 1.2 under post seismic, post liquefaction or residual conditions and 1.3 under pseudo static conditions. These Factors of Safety comply with the local legislation and international slope stability standards.

Most dormant up-stream deposited facilities, including FSN1 and FSN2, do not meet new legislated Factor of Safety requirements. To ensure the entire complex complies at closure, remedial works for FSN1 and FSN2 may be incorporated into the Valley TSF closure plan. Conceptual-level work has been carried out to assess the required remedial work based on the limit equilibrium method for stability calculations. This work will be updated once the proposed stability assessments using finite element analyses are conducted on Harmony's dams.

The gold tailings material classified as a Type 3 waste according to the waste classification report by Jones and Wagner. This necessitates a Class C barrier system. However, as per an independent review by Legge and Associates, an 'inverted barrier' system can be used. The inverted barrier reduces seepage by changing the flow through the liner from Bernoulli flow at discontinuities to D'Arcian flow controlled by the tailings permeability at these points. The stability of the TSF is also improved by omitting lower strength compacted clay layers and the geomembrane cushion layer (replaced by tailings). The inverted barrier system is used in the design of the Valley TSF barrier system.

The Valley TSF barrier system has two different areas. Liner area 1 is within the central area of the dam basin. This liner system comprises (from top down), a 300mm thick layer of tailings, above liner drains, 1.5mm smooth HDPE liner underlain by a 300mm ripped and recompacted in-situ base layer.

Liner area 2 is present at the outer walls of the facility where high liner stresses exist and a 150T geogrid (or similar approved) is required. The geogrid (or similar approved) will be placed from the toe wall inwards for 50m. This liner system comprises (from top down), a 300mm thick layer of tailings, a 150T size geogrid

(or similar approved), a 300mm thick layer of tailings, above liner drains, 1.5mm double textured HDPE liner underlain by a 300mm ripped and recompacted in-situ base layer.

The TSF underdrainage system is provided above the liner to intercept seepage through the facility. The above liner drains lower the phreatic surface, thereby improving the overall stability of the facility. The above liner drains comprise of blanket drains and herringbone drains.

The herringbone drains pipes comprise of 160mm slotted Drainex HDPE pipes surrounded in 19mm stone which is enclosed in a geofabric. These drains are spaced 100m apart. The blanket drains comprise of 160mm slotted Drainex HDPE pipes surrounded in 19mm stone overlain by a layer of 6mm stone and graded filter sand which is enclosed in a geofabric.

All above liner drains in the south-east section discharge into the solution trench located to the south of Valley TSF and water will flow to the existing Return Water Dam (RWD). The above liner drains on the north-western section discharge into the solution trench located to the north-west of Valley TSF and will flow to the new RWD.

The under-liner leakage detection drains on the Valley TSF comprise of 160mm slotted Drainex HDPE pipes surrounded in 19mm stone which is enclosed in a geofabric. Similarly to the above-liner drains, the south-eastern under liner drains flow to the existing RWD and the north-western section discharges into the new RWD.

A 150mm thick reinforced concrete lined solution trench is provided along the north-west, south and south-eastern sections of the TSF. The trapezoidal solution trench is 1m deep with side slopes of 1V:1.5H and a base width of 1m. The solution trench on the north-western section of the TSF will accommodate the maximum peak discharge from the penstock of 1.02m<sup>3</sup>/sec and flows into the new RWD. The solution trench on the south and south-eastern sections of the TSF will accommodate drain flow only of 46.14m<sup>3</sup>/day and flows into the existing RWD.

A hydrotechnical assessment was done to determine climatic and meteorological data. This data was used to size the new RWD situated north-west of the TSF and the associated water infrastructure. A capacity assessment was carried out on the existing RWD, situated south-west of the TSF.

The new Return Water Dam has a total storage capacity of 220 000m<sup>3</sup> which is sufficient to ensure that it does not spill more than once every 50 years with the inflow from the penstock and underdrains on the north-west of the TSF, when operated at a level of 0.3m.

The new Return Water Dam liner system comprises 200mm high geocells filled with 20Mpa concrete, underlain by a 1.5mm thick smooth HDPE liner and a 300mm in-situ base preparation layer. The underdrainage comprises 160mm slotted HDPE pipes encased in 19mm washed stone. The stone will be wrapped in geofabric.

A concrete lined spillway is provided at the new RWD to safely discharge excess water without overtopping of the RWD embankment walls. The RWD spillway has a freeboard of 800mm and has been designed to discharge the 1:10 000 24-hour Probable Maximum Flood volume of 9.9m<sup>3</sup>/sec.

A silt trap is installed upstream of the new RWD. The silt trap includes infrastructure to enable cleaning. The silt trap allows solids to settle out of the water before entering the RWD, thereby minimising sedimentation in the RWD. The silt trap is a 2.0m deep reinforced concrete water retaining structure with a concrete spillway to route de-silted water to the RWD.

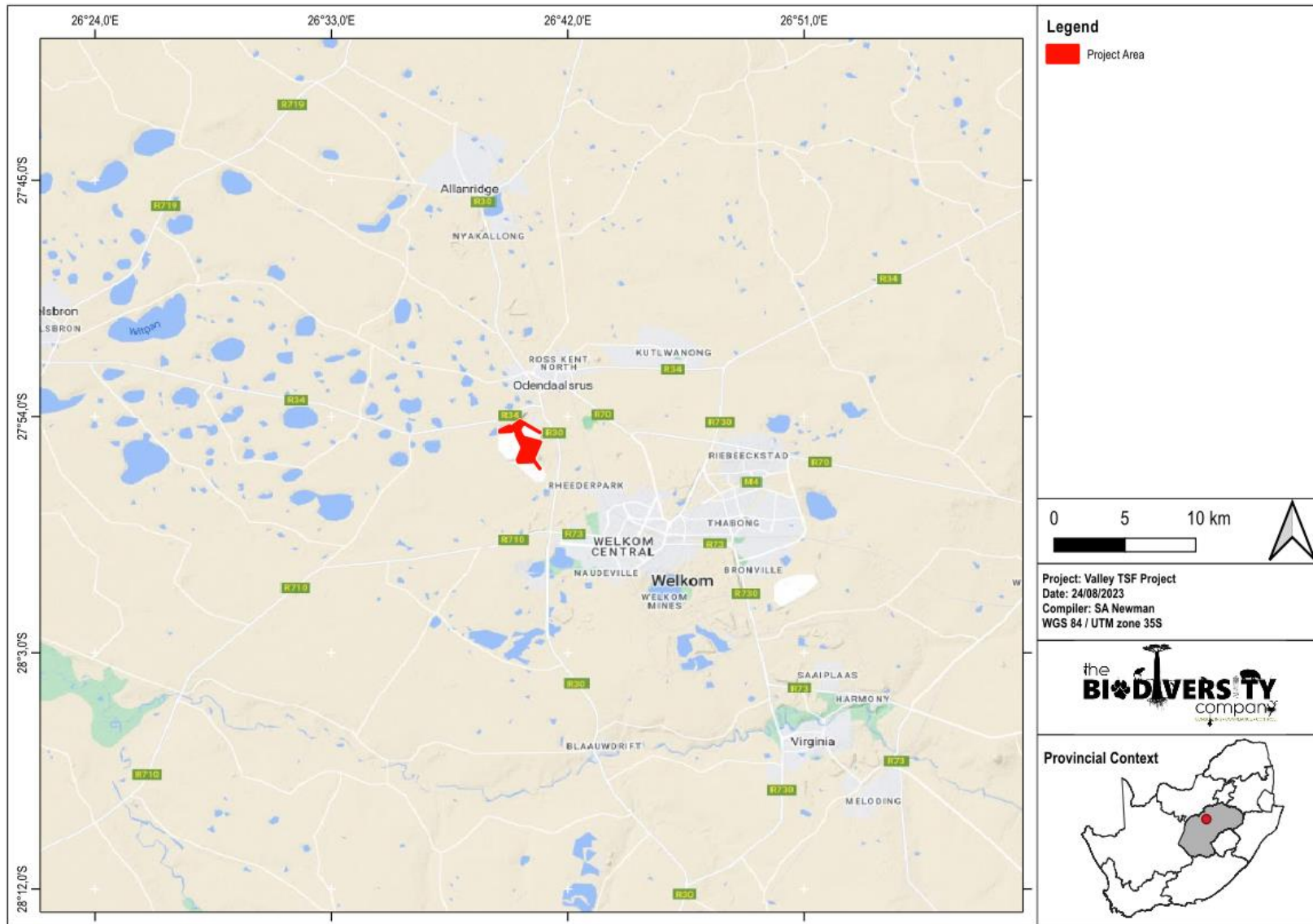
A capacity assessment was done on the existing RWD, which has a capacity of 300 000m<sup>3</sup>. The inputs to this dam are low, as only drain water and rainfall will flow to the RWD. Due to evaporation and seepage, the dam is not expected to hold more than 50 000m<sup>3</sup> and easily accommodates the expected inputs.

Concrete poles with warning signs will be installed around the TSF. A 5m wide access road is provided around the facility for operational and monitoring requirements.

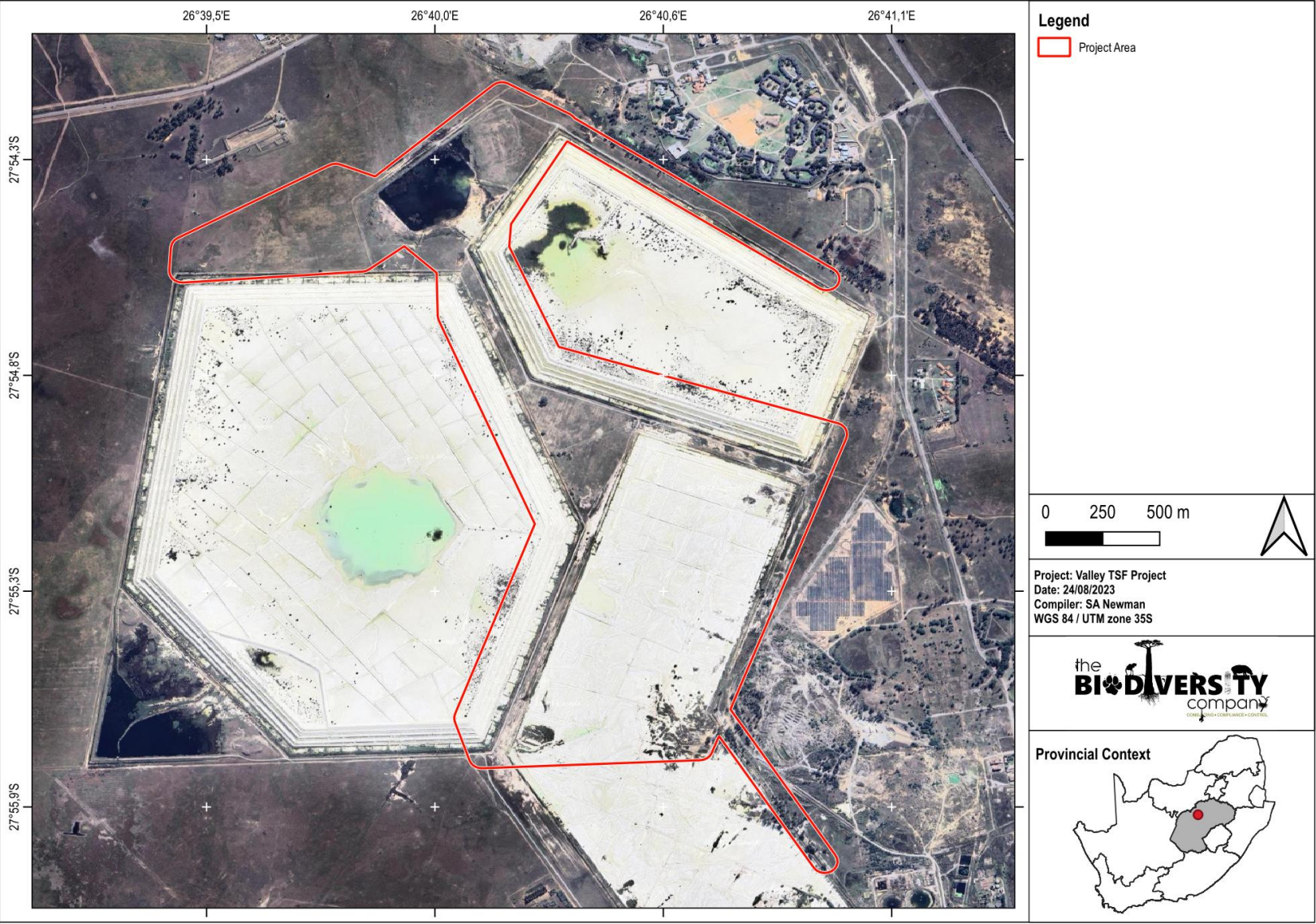
The facility is to be constructed and operated to ensure that the future designed outer slope profile is achieved and to ensure the safe, efficient and environmentally responsible management of the Valley TSF and associated infrastructure.

.





**Figure 1-1** *Map illustrating the regional locality of the Project Area*



**Figure 1-2** Map illustrating the Project Area



### 1.3 Report Legislative Framework

In line with the protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity, as per Government Notice 320 published in terms of NEMA, dated 20 March 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” – section 3, subsection 1:

- An applicant intending to undertake an activity identified in the scope of the protocol, on a site identified on the screening tool as being of ‘Very High’ sensitivity for terrestrial biodiversity, must submit a Terrestrial Biodiversity Specialist Assessment; however
- Where the information gathered from the site sensitivity verification differs from the designation of ‘Very High’ terrestrial biodiversity sensitivity on the screening tool and it is found to be of a ‘Low’ sensitivity, then a Terrestrial Biodiversity Compliance Statement must be submitted.

The information obtained from a site sensitivity verification, which involved both a desktop assessment as well as a field survey, confirmed that the proposed footprint area is of a ‘Low’ sensitivity. Therefore, this report constitutes a Terrestrial Biodiversity Compliance Statement.

As per sections 2 and 3 of the protocol discussed above, a Terrestrial Biodiversity Compliance Statement must contain the information as presented in Table 1-1 below.

**Table 1-1** *Terrestrial Biodiversity Compliance Statement information requirements as per the relevant protocol, including the location of the information within this report*

Information to be Included (as per GN 320, 20 March 2020)	Report Section
Methodology used to undertake the site assessment and survey, and prepare the compliance statement, including relevant equipment and modelling used	2
Description of the assumptions and any uncertainties or gaps in knowledge or data	1.3
A baseline profile description of biodiversity and ecosystems of the site	3.1.1
Site sensitivity verification: Desktop Analysis using satellite imagery and available information	3.2.1
A statement on the duration, date and season of the site inspection	3.1
Site sensitivity verification: Onsite inspection, include a description of current land use and vegetation found on-site	3.1.2
Site sensitivity verification: Photographs/evidence of environmental sensitivity	3.1.2
Screening tool confirmation/dispute: The assessment must verify the “low” sensitivity of the site, in terms of plant, animal, and terrestrial biodiversity themes	3.2.1
Proposed impact management outcomes or monitoring requirements for inclusion in the EMP	5
Indicate whether or not the proposed development will have any impact on the terrestrial environment, animals and/or plants	6
A signed statement of independence by the specialist	8.1
Specialist details, including a CV	8.2

A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

## 1.4 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- It is assumed that all information received from the client and landowner is accurate;
- All datasets accessed and utilised for this assessment are considered to be representative of the most recent and suitable data for the intended purposes;
- The assessment area (Project Area) was based on the footprint areas as provided by the client, and any alterations to the area and/or missing GIS information pertaining to the assessment area would have affected the area surveyed and hence the results of this assessment;
- Additional areas were added to the layout after the field assessment had already been completed, therefore, these areas have been assessed at a desktop level only, making use of representative sampling based on the nearby areas which were surveyed;
- The area was surveyed during a single site visit, therefore, this assessment does not consider temporal trends (note that the data collected is considered sufficient to derive a meaningful baseline);
- The single site visit was conducted during the early dry season, and this means that certain flora and fauna would not have been present or observable due to seasonal constraints, however, most species have likely been recorded;
- This report must be considered in conjunction with the accompanying wetland report (TBC, 2023);
- Whilst every effort was made to cover as much of the Project Area as possible, representative sampling is completed, and by its nature it is possible that some plant and animal species that are present within the Project Area were not recorded during the field investigations; and
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features may be offset by up to 5 m.

## 2 Methods

### 2.1 Desktop Assessments

The desktop assessment was principally undertaken using a Geographic Information System (GIS) to access the latest available spatial datasets to determine if any are applicable to the site. These datasets and their respective dates of publishing are provided below.

Existing ecologically relevant data layers were incorporated into GIS software to establish how the proposed project might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- Terrestrial Critical Biodiversity Area for Free State (DESTEA, 2015);
- 2018 National Biodiversity Assessment (NBA, 2018) (Skowno *et al.*, 2019);
- Red List of Ecosystems (RLE) 2021 (Skowno & Monyeke, 2021);
- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018);
- South Africa Protected and Conservation Areas Databases, 2022 (DFFE, 2022 & DFFE, 2022a);
- National Protected Areas Expansion Strategy, 2016 (DEA, 2016);
- Important Bird and Biodiversity Areas, 2015 (Marnewick *et al.*, 2015);
- South African Inventory of Inland Aquatic Ecosystems (SAIIAE), NBA 2018 Rivers and Wetlands (Awuah, 2018 & Van Deventer *et al.*, 2019);
- National Freshwater Priority Areas, Rivers and Wetlands, 2011 (Nel, 2011); and
- Strategic Water Source Areas, 2021 (Lötter & Le Maitre, 2021).

### 2.2 Biodiversity Field Survey

A single season field survey was undertaken on the 11<sup>th</sup> of April 2023, which constitutes an early dry season survey, to determine the presence of any local SCC and to achieve the delineation of local habitat types and their associated sensitivities. Effort was made to cover all the different habitat types within the Project Area, within the limits of time and access. This site visit is considered sufficient for the project.

### 2.3 Terrestrial Site Ecological Importance

The different habitat types within the Project Area were delineated and identified based on observations made during the field survey, and information from available satellite imagery. These habitat types were assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of SCC and their ecosystem processes.

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present in the Project Area) and Receptor Resilience (RR) (its resilience to impacts).

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor. The criteria for the CI and FI ratings are provided in Table 2-1 and Table 2-2 respectively.

**Table 2-1 Summary of Conservation Importance (CI) criteria**

Conservation Importance	Fulfilling Criteria
<b>Very High</b>	Confirmed or highly likely occurrence of Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Extremely Rare or CR species that have a global extent of occurrence (EOO) of < 10 km <sup>2</sup> . 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 an EN ecosystem type. Globally significant populations of congregatory species (> 10% of global population).
<b>High</b>	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km <sup>2</sup> . 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).
<b>Medium</b>	Confirmed or highly likely occurrence of populations of Near Threatened (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.
<b>Low</b>	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.
<b>Very Low</b>	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

**Table 2-2 Summary of Functional Integrity (FI) criteria**

Functional Integrity	Fulfilling Criteria
<b>Very High</b>	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.
<b>High</b>	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, with no signs of major past disturbance and good rehabilitation potential.
<b>Medium</b>	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 and a few signs of minor past disturbance. Moderate rehabilitation potential.
<b>Low</b>	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.
<b>Very Low</b>	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

BI can be derived from a simple matrix of CI and FI as provided in

Table 2-3.

**Table 2-3** *Matrix used to derive Biodiversity Importance (BI) from Functional Integrity (FI) and Conservation Importance (CI)*

Biodiversity Importance		Conservation Importance				
		Very high	High	Medium	Low	Very low
Functional Integrity	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

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor, as summarised in Table 2-4.

**Table 2-4** *Summary of Receptor Resilience (RR) criteria*

Resilience	Fulfilling Criteria
<b>Very High</b>	Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
<b>High</b>	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: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
<b>Medium</b>	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: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
<b>Low</b>	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: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
<b>Very Low</b>	Habitat that is unable to recover from major impacts, or species that are unlikely to: (i) remain at a site even when a disturbance or impact is occurring, or (ii) return to a site once the disturbance or impact has been removed.

After the determination of BI and RR, the SEI can be ascertained using the matrix as provided in Table 2-5.

**Table 2-5** *Matrix used to derive Site Ecological Importance from Receptor Resilience (RR) and Biodiversity Importance (BI)*

Site Ecological Importance		Biodiversity Importance				
		Very high	High	Medium	Low	Very low
Receptor Resilience	Very Low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very High	Medium	Low	Very low	Very low	Very low

Interpretation of the SEI in the context of the proposed project is provided in Table 2-6.

**Table 2-6** *Guideline for interpreting Site Ecological Importance in the context of proposed activities*

Site Ecological Importance	Interpretation in relation to proposed development activities
<b>Very High</b>	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.
<b>High</b>	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.
<b>Medium</b>	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
<b>Low</b>	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
<b>Very Low</b>	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

The SEI evaluated for each taxon can be combined into a single multi-taxon evaluation of SEI for the assessment area. Either a combination of the maximum SEI for each receptor should be applied, or the SEI may be evaluated only once per receptor but for all necessary taxa simultaneously. For the latter, justification of the SEI for each receptor is based on the criteria that conforms to the highest CI and FI, and the lowest RR across all taxa.



### 3 Results & Discussion

#### 3.1 Desktop Assessments

##### 3.1.1 Ecologically Important Landscape Features

Table 3-1 below has been produced as a result of the spatial data collected and analysed (as provided by various sources such as the national and provincial environmental authorities and SANBI). It presents a summative breakdown of the ecological boundaries considered and the associated relevance that each has to the region or Project Area. Where a feature is regarded as relevant it is considered an ecologically important landscape feature and discussed further as part of the sub-sections that follow.

**Table 3-1** *Summary of the spatial relevance of the project area to local ecologically important landscape features*

Desktop Information Considered	Relevance	Reasoning
Provincial Conservation Plan	Yes	Project Area intercepts a terrestrial ESA 1, ESA 2, ~0.2 ha of CBA 1 in the south-eastern corner, 'Degraded' and 'Other'
NBA 2018: Ecosystem Threat Status	Yes	Project Area situated in a 'Least Concern' ecosystem
NBA 2018: Ecosystem Protection Level	Yes	Project Area situated in a 'Poorly Protected' ecosystem
Red List of Ecosystems (2021)	Yes	Project Area situated in a 'Least Concern' ecosystem
Protected and Conservation Areas (SAPAD & SACAD)	No	The nearest protected area Newlands Game Ranch is situated ~13.5 km north-east of the Project Area
National Protected Areas Expansion Strategy (NPAES)	No	The Project Area does not fall within 5 km of any relevant areas
Important Bird and Biodiversity Areas (IBA)	No	Sandveld Bloemhof Dam Nature Reserves is the nearest IBA situated ~60 km north-west of the Project Area
Strategic Water Source Areas	No	The Project Area does not overlap with a SWSA
National Freshwater Ecosystem Priority Areas	Yes	The Project Area and its 500 m Regulated Area overlap with unclassified FEPA wetlands
South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	Yes	The Project Area and its 500 m Regulated Area overlap with 'Least Concern' wetlands

##### 3.1.2 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 236 bird species have the potential to occur in the vicinity of the project area. The SCC expected can be seen in Table 3-2; and seven of these have a moderate-high likelihood of occurrence based on the suitable habitat and food sources present in close proximity to the project area.

**Table 3-2** *List of bird species of regional or global conservation importance that are expected to occur in close vicinity to the project area.*

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional	Global	
<i>Calidris ferruginea</i>	Sandpiper, Curlew	LC	NT	Moderate
<i>Charadrius pallidus</i>	Plover, Chestnut-banded	NT	NT	Low
<i>Ciconia abdimii</i>	Stork, Abdim's	NT	LC	Low
<i>Ciconia nigra</i>	Stork, Black	VU	LC	Low
<i>Eupodotis caerulescens</i>	Korhaan, Blue	LC	NT	Low
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC	Moderate
<i>Gyps africanus</i>	Vulture, White-backed	CR	CR	Low

<i>Mycteria ibis</i>	Stork, Yellow-billed	EN	LC	High
<i>Oxyura maccoa</i>	Duck, Maccoa	NT	VU	Moderate
<i>Phoeniconaias minor</i>	Flamingo, Lesser	NT	NT	Moderate
<i>Phoenicopterus roseus</i>	Flamingo, Greater	NT	LC	Moderate
<i>Rostratula benghalensis</i>	Painted-snipe, Greater	NT	LC	High
<i>Sagittarius serpentarius</i>	Secretarybird	EN	EN	Low

*Calidris ferruginea* (Curlew Sandpiper) is migratory species which breeds on slightly elevated areas in the lowlands of the high Arctic and may be seen in parts of South Africa during winter. During winter, the species occurs at the coast, but also inland on the muddy edges of marshes, large rivers and lakes (both saline and freshwater), irrigated land, flooded areas, dams and salt pans (IUCN, 2017). Due to the presence of some of these habitat types in close proximity to the project area the likelihood of occurrence of this species was rated as moderate.

*Falco biarmicus* (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups up to 20 individuals but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. The likelihood of incidental records of this species in the project area is rated as moderate due to the presence of many bird species on which Lanner Falcons may predate.

*Mycteria ibis* (Yellow-billed Stork) is listed as EN on a regional scale and LC on a global scale. This species is migratory and has a large distributional range which includes much of sub-Saharan Africa. It is typically associated with freshwater ecosystems, especially wetlands and the margins of lakes and dams (IUCN, 2017). The presence of water bodies within close proximity to the project area creates a high possibility that this species may occur there.

*Oxyura maccoa* (Maccoa Duck) has a large northern and southern range, South Africa is part of its southern distribution. During the species' breeding season, it inhabits small temporary and permanent inland freshwater lakes, preferring those that are shallow and nutrient-rich with extensive emergent vegetation such as reeds (*Phragmites* spp.) and cattails (*Typha* spp.) on which it relies for nesting (IUCN, 2017). The likelihood of occurrence in the project area is rated as moderate due to the availability of somewhat suitable habitat.

*Phoeniconaias minor* (Lesser Flamingo) is listed as NT on a global and regional scale whereas *Phoenicopterus roseus* (Greater Flamingo) is listed as NT on a regional scale only. Both species have similar habitat requirements, and the species breed on large undisturbed alkaline and saline lakes, salt pans or coastal lagoons, usually far out from the shore after seasonal rains have provided the flooding necessary to isolate remote breeding sites from terrestrial predators and the soft, muddy material for nest building (IUCN, 2017). *Phoenicopterus roseus* is known to occur in areas not far from the project area therefore the likelihood of occurrence is rated as moderate.

*Rostratula benghalensis* (Greater Painted-snipe) shows a preference for recently flooded areas in shallow lowland freshwater temporary or permanent wetland, it has a wide range of these freshwater habitats which they occur in, in this case, sewage pools, reservoirs, mudflats overgrown with marsh grass which may possibly exist within the project area, thus the likelihood of occurrence is high.

### 3.1.3 Bats

The IUCN Red List Spatial Data and the MammalMap database lists nine (9) bat species that could be expected to occur within the area. One (1) of these expected species are regarded as SCC, but has a low likelihood of occurrence.



**Table 3-3** *List of bat species of conservation concern that may occur in the project area as well as their global and regional conservation statuses.*


Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional	Global	
<i>Eidolon helvum</i>	African Straw-colored Fruit Bat	LC	NT	Low
<i>Eptesicus hottentotus</i>	Long-tailed Serotine Bat	LC	LC	Moderate
<i>Myotis welwitschii</i>	Welwitsch's Hairy Bat	LC	LC	Low
<i>Neoromicia capensis</i>	Cape Serotine Bat	LC	LC	Low
<i>Neoromicia zuluensis</i>	Aloe Bat	LC	LC	Low
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	LC	LC	Moderate
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC	LC	Low
<i>Scotophilus dinganii</i>	Yellow House Bat	LC	LC	Low
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC	LC	Low

### 3.2 Biodiversity Field Survey

The following sections discuss the results from the field survey that was conducted for the proposed project, which was undertaken on the 11<sup>th</sup> of April 2023. Each habitat unit is described in Table 3-4.

**Table 3-4**      **Sensitivity summary of the habitat types delineated within the Project Area**

Habitat	Description	SEI	Photographs
<b>Modified</b>	<p>This habitat unit includes all areas that maintain little to no native vegetation and/or where anthropogenic activity has substantially modified an area's primary ecological functions and species composition. This habitat unit no longer maintains its functional integrity and does not contribute significantly to ecosystem services. This habitat unit is characterised by areas used for mining related activities, primarily existing TSF's.</p> <p>No fauna or flora SCC were recorded or are expected.</p>	<b>Very Low</b>	
<b>Water Resource</b>	<p>This habitat unit is made up of wetlands and dams, and is dominated by hydrophytes.</p> <p>No fauna or flora SCC were recorded or are expected.</p> <p>More information on this habitat unit can be found in the accompanying wetland report (TBC, 2023).</p>	<b>Medium</b>	

<p><b>Degraded Grassland</b></p>	<p>This habitat unit is characterised by open grassland impacted by alien plant populations, low pioneer grasses, and alien invasive plant (AIP) species. The habitat is constantly disturbed in nature and cannot recover to a more natural state due to ongoing disturbances and impacts received from grazing, edge effects from land use and mismanagement. Dominant species include <i>Eragrostis gummiiflua</i> and <i>Cynodon dactylon</i>. <i>Vachellia karroo</i> were also recorded within this habitat unit. Alien invasive plant (AIP) species include <i>Verbena brasiliensis</i>, <i>Opuntia sp.</i> and <i>Flaveria bidentis</i>.</p> <p>No fauna or flora SCC were recorded or are expected.</p>	<p><b>Low</b></p>	
----------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------	-------------------------------------------------------------------------------------

### 3.2.1 Avifauna and Bat Assessment

During the field assessment 34 avifauna species were observed (Table 3-5). No bat species were observed during the field assessment and limited species are expected to occur within the Project Area due to the small and modified nature of the area. No SCC species were observed, however, *Mycteria ibis* (Stork, Yellow-billed) and *Phoenicopiterus roseus* (Flamingo, Greater) are known to occur in areas in close proximity to the project area.

**Table 3-5 A list of avifaunal species recorded for the project area**

Species	Common Name	Conservation Status	
		Regional	Global
<i>Acridotheres tristis</i>	Myna, Common	Unlisted	LC
<i>Afrotis afraoides</i>	Korhaan, Northern Black	Unlisted	LC
<i>Alopochen aegyptiaca</i>	Goose, Egyptian	Unlisted	LC
<i>Anas erythrorhyncha</i>	Teal, Red-billed	Unlisted	LC
<i>Apus apus</i>	Swift, Common	Unlisted	LC
<i>Ardea cinerea</i>	Heron, Grey	Unlisted	LC
<i>Bostrychia hagedash</i>	Ibis, Hadedda	Unlisted	LC
<i>Bubulcus ibis</i>	Egret, Cattle	Unlisted	LC
<i>Burhinus capensis</i>	Thick-knee, Spotted	Unlisted	LC
<i>Charadrius tricollaris</i>	Plover, Three-banded	Unlisted	LC
<i>Cisticola juncidis</i>	Cisticola, Zitting	Unlisted	LC
<i>Columba livia</i>	Dove, Rock	Unlisted	LC
<i>Corvus albus</i>	Crow, Pied	Unlisted	LC
<i>Elanus caeruleus</i>	Kite, Black-shouldered	Unlisted	LC
<i>Estrilda astrild</i>	Waxbill, Common	Unlisted	LC
<i>Euplectes orix</i>	Bishop, Southern Red	Unlisted	LC
<i>Euplectes progne</i>	Widowbird, Long-tailed	Unlisted	LC
<i>Fulica cristata</i>	Coot, Red-knobbed	Unlisted	LC
<i>Lanius collaris</i>	Fiscal, Common (Southern)	Unlisted	LC
<i>Myrmecocichla formicivora</i>	Chat, Anteater	Unlisted	LC
<i>Numida meleagris</i>	Guinea fowl, Helmeted	Unlisted	LC
<i>Phalacrocorax africanus</i>	Cormorant, Reed	Unlisted	LC
<i>Phalacrocorax lucidus</i>	Cormorant, White-breasted	Unlisted	LC
<i>Plectropterus gambensis</i>	Goose, Spur-winged	Unlisted	LC
<i>Plocepasser mahali</i>	Sparrow-weaver, White-browed	Unlisted	LC
<i>Ploceus velatus</i>	Masked-weaver, Southern	Unlisted	LC
<i>Pternistis swainsonii</i>	Spurfowl, Swainson's	Unlisted	LC
<i>Spilopelia senegalensis</i>	Dove, Laughing	Unlisted	LC
<i>Streptopelia capicola</i>	Turtle-dove, Cape	Unlisted	LC
<i>Tachybaptus ruficollis</i>	Grebe, Little	Unlisted	LC
<i>Upupa africana</i>	Hoopoe, African	Unlisted	LC



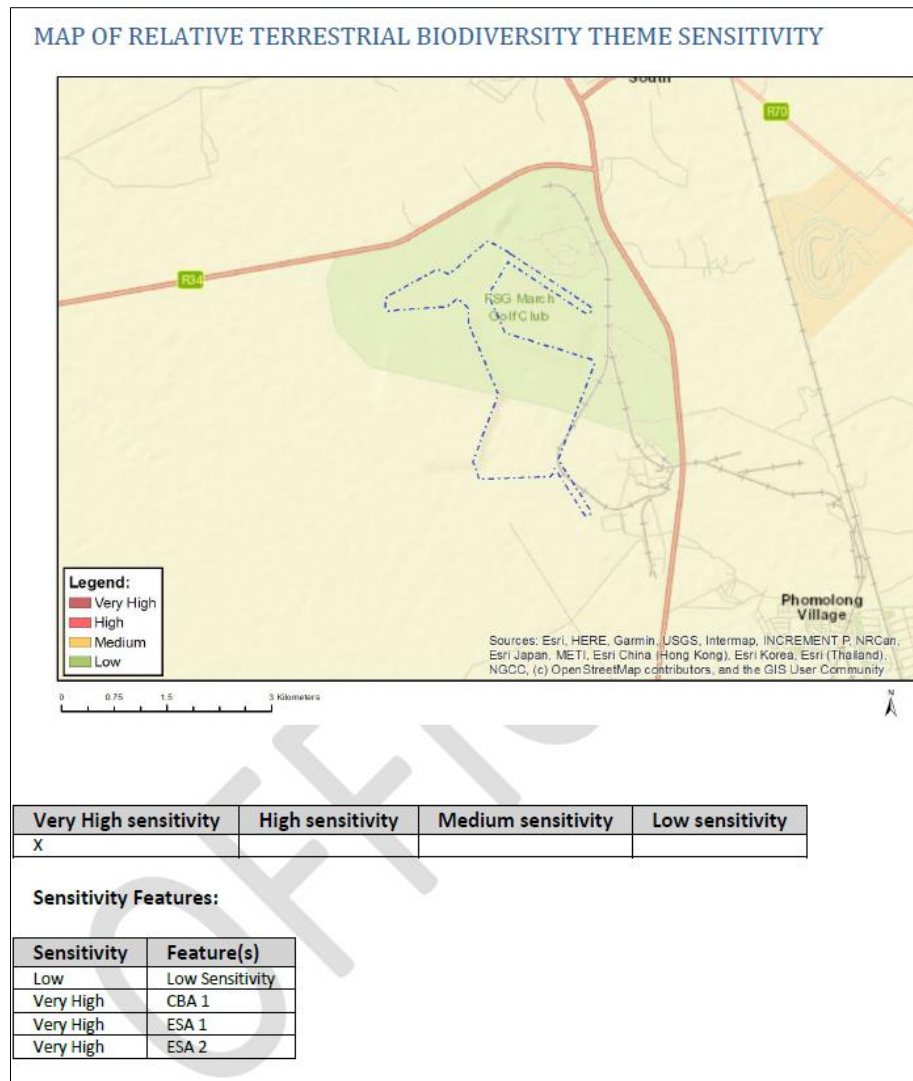
<i>Urocolius indicus</i>	Mousebird, Red-faced	Unlisted	LC
<i>Vanellus armatus</i>	Lapwing, Blacksmith	Unlisted	LC
<i>Vanellus coronatus</i>	Lapwing, Crowned	Unlisted	LC

### 3.2.2 Screening Tool Comparison

The allocated sensitivities for each of the relevant themes are either disputed or validated for the overall Project Area in Table 3-6 below. A summative explanation for each result is provided as relevant. The specialist-assigned sensitivity ratings are based largely on the SEI process followed in the previous section, and consideration is given to any observed or likely presence of SCC or protected species. The screening tool terrestrial theme sensitivity can be seen in Figure 3-1 below.

**Table 3-6 Summary of the screening tool vs. specialist assigned sensitivities**

Screening Tool Theme	Screening Tool	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Animal Theme	High	Low	Disputed – Habitat is severely degraded, and most of the Project Area is Modified, with the remaining grassland portions situated between and adjacent to two TSFs. No SCC were recorded, nor expected.
Plant Theme	Low	Low	Validated – Habitat is severely degraded, and most of the Project Area is Modified, with the remaining grassland portions situated between and adjacent to two TSFs. No SCC were recorded, nor expected.
Terrestrial Theme	Very High	Low	Disputed – Habitat is severely degraded, and within close proximity to mining activities – situated between and adjacent to two TSFs. Most of the ESA portion of the Project Area is modified, and the Project Area only overlaps with 0.2 ha of CBA.



**Figure 3-1** *Terrestrial Biodiversity Theme Sensitivity for the Project Area (National Environmental Screening Tool, 2023)*

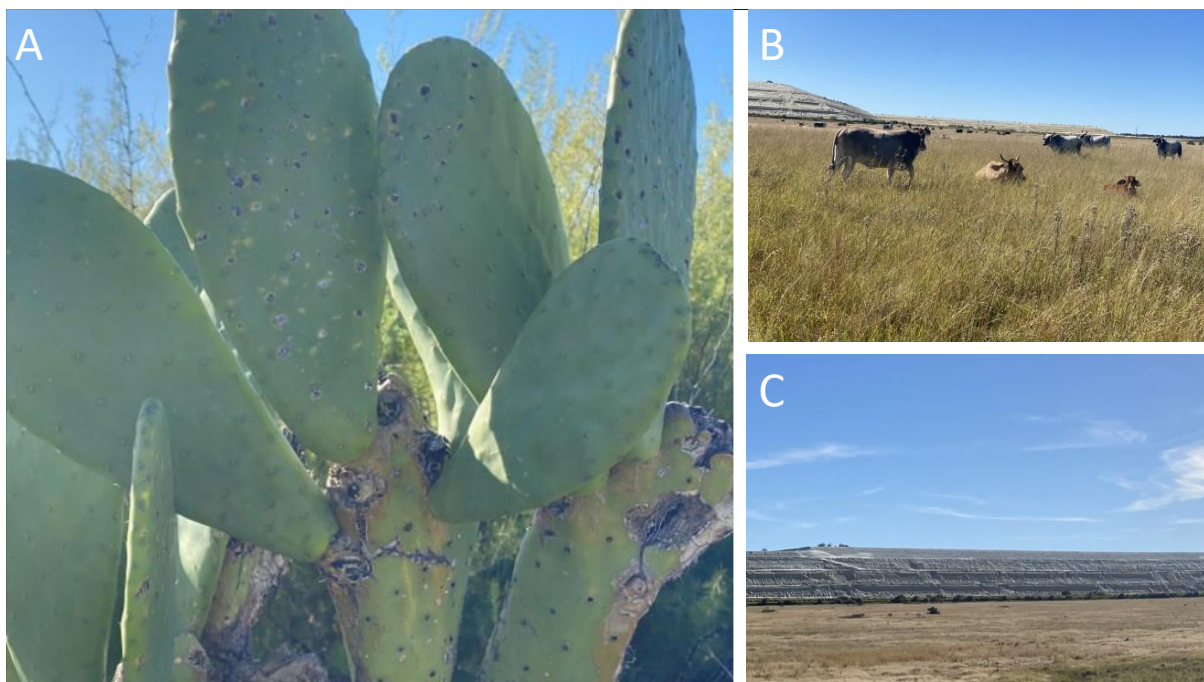


## 4 Biodiversity Risk Assessment

### 4.1 Present Impacts to Biodiversity

Considering the fact that anthropogenic activities have historically taken place throughout most of the region, and continue to do so, several significantly negative impacts to biodiversity were observed within and adjacent to the PAOI (Figure 4-1). These include:

- Mining activities;
- Historic land modification largely in the form of road and powerline infrastructure, and the associated land clearing and edge effects;
- Livestock grazing;
- Minor and major gravel roads (and associated vehicle traffic and the possibility of wildlife road mortalities);
- Pipeline infrastructure; and
- Invasive Alien Plant infestations.



**Figure 4-1** *Photograph illustrating current negative impacts associated with the PAOI: A) Alien and Invasive Plant infestation; B) Livestock grazing and C) Mining Activities.*

### 4.2 Loss of Irreplaceable Resources

The proposed activities are likely to be of a low impact and will result in the loss of the following important ecological resources:

- Indigenous vegetation.

The majority of the PAOI comprised of modified and degraded grassland habitat, which has been impacted upon by anthropogenic related activities and retains a low level of functionality. No flora or fauna SCC were observed or are expected to reside within the project area due to the small and

modified nature of the area. As such the recommendations put forward by the specialist at the end of this report must be implemented and mitigations must be put in place and implemented to prevent the total destruction and loss of all local natural resources.

## 5 Impact Management and Mitigation Plan

The aim of the management outcomes is to present mitigation actions in such a way that they can be incorporated into the Environmental Management Programme (EMPr), and possible biodiversity management programme, for the project, which should in turn allow for a more successful implementation and auditing of the mitigations and monitoring guidelines. Table 5-1 presents the recommended mitigation measures and the respective time frames, targets, and performance indicators relative to the terrestrial assessment.

The focus of mitigation measures is to reduce the significance of the likely impacts associated with the development, and thereby:

- Prevent the further loss and fragmentation of vegetation communities within the CBA and ESA in the vicinity of the Project Area;
- Reduce the negative fragmentation effects of the development and enable the safe movement of fauna species;
- Prevent the direct and indirect loss and disturbance of flora and fauna species and communities; and
- Adequately follow the guidelines for interpreting the Site Ecological Importance ratings assigned to the Project Area (see Table 2-6).

**Table 5-1** *Project specific mitigation measures including requirements for timeframes, roles and responsibilities*

Management outcome: Vegetation and Habitats				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Laydown and construction preparation activities (such as cement mixing, temporary toilets, etc.) must be limited to already modified areas and should take up the smallest footprint possible.	Construction Phase	Project manager, Environmental Officer	Development footprint	Ongoing
It is recommended that areas to be developed/disturbed be specifically demarcated so that during the construction/activity phase, only the demarcated areas be impacted upon.	Construction Phase	Project manager, Environmental Officer	Development footprint	Ongoing
Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should not be fragmented or disturbed further.	Construction Phase	Project manager, Environmental Officer	Development footprint	Ongoing
All vehicles and personnel must make use of existing roads and walking paths, especially construction/operational vehicles.	Construction Phase	Project manager, Environmental Officer	Development footprint	Ongoing
The clearing of vegetation must be minimised where possible. All activities must be restricted to within the authorised areas.	Life of operation	Project manager, Environmental Officer	Areas of indigenous vegetation	Ongoing
Any observed SCC flora or protected plants must be clearly demarcated prior to the commencement of site clearing. If construction activities are likely to affect any SCC or protected plants these individuals must be relocated as part of a plant rescue and protection plan, and a permit must be obtained before doing so.	Planning Phase	Environmental Officer	Protected plants and SCC	During phase
Any materials may not be stored for extended periods of time and must be removed from the Project Area once the construction phase has been concluded. No permanent construction phase structures should be permitted. Construction buildings should preferably be prefabricated or constructed of re-usable/recyclable materials. No storage of vehicles or equipment will be allowed outside of the designated laydown areas.	Construction and Operational Phase	Environmental Officer, Design Engineer, and Contractor	Laydown areas	Ongoing

Areas that are denuded during construction need to be re-vegetated with indigenous vegetation according to a habitat rehabilitation plan, to prevent erosion during flood and wind events and to promote the regeneration of functional habitat. This will also reduce the likelihood of encroachment by alien invasive plant species. All grazing mammals must be kept out of the areas that have recently been re-planted.	Operational phase	Environmental Officer & Contractor	Assess the state of rehabilitation and encroachment of alien vegetation	Quarterly for up to two years after the closure
<p>A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site.</p> <ul style="list-style-type: none"> <li>Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use.</li> <li>No servicing of equipment on site unless necessary.</li> <li>All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers.</li> <li>Appropriately contain any generator diesel storage tanks, machinery spills (e.g., accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them from leaking and entering the environment.</li> <li>Construction activities and vehicles could cause spillages of lubricants, fuels and waste material negatively affecting the functioning of the ecosystem.</li> <li>All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas outside of the Project Area.</li> </ul>	Life of operation	Environmental Officer & Contractor	Spill events, Vehicles dripping.	Ongoing
It must be made an offence for any staff member to take any indigenous plant species out of any portion of the Project Area, or to bring any alien plant species into any portion of the Project Area. This is to prevent the spread of exotic or invasive species or the illegal collection of plants.	Life of operation	Project manager, Environmental Officer	Any instances	Ongoing
A fire management plan needs to be compiled and implemented to restrict the impact fire would have on the surrounding areas.	Life of operation	Environmental Officer & Contractor	Fire Management	During Phase
All construction waste must be removed from site at the closure of the construction phase.	Construction phase	Environmental Officer & Contractor	Construction waste	During Phase
Precautions must be taken against the erosion damage that would be caused by unplanned pipe leaks. Monitoring of the pipeline must be	Closure Phase/Rehabilitation phase	Environmental Officer & Contractor	Erosion Management and Control/ Leaks	During Phase and Ongoing Monitoring

undertaken to detect leaks and monitoring should be undertaken at least once a week.				
<b>Management outcome: Avifauna &amp; Bats</b>				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
<p>Areas developed/disturbed be specifically demarcated so that during the construction/activity phase, only the demarcated areas be impacted upon.</p> <p>Minimisation of light pollution and artificial habitat creation. Only use lights with low sensitivity motion sensors that switch off automatically. Only use lights if/when required for the operation.</p> <p>Minimise noise disturbances. All noises to be within the prescribed limits provided by the appointed noise study, ensuring best practices are followed.</p> <p>All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area.</p> <p>All vehicles accessing the site should adhere to a low speed limit on site (40 km/h max) to avoid collisions with susceptible avifauna, such as nocturnal and crepuscular species (e.g. nightjars and owls) which sometimes forage or rest on roads, especially at night.</p>	Construction Phase	Project manager, Environmental Officer	Development footprint	Ongoing
	Life of operation	Project manager, Environmental Officer	Development footprint	Ongoing
	Life of operation	Project manager, Environmental Officer	Development footprint	Ongoing
	Construction Phase	Project manager, Environmental Officer	Development footprint	Ongoing
	Construction and Operational Phase	Environmental Officer, Design Engineer, and Contractor	Collisions with avifauna	Ongoing
<b>Management outcome: Fauna</b>				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
A qualified environmental control officer must be on site when activities begin. A site walk through is recommended by a suitably qualified ecologist prior to any activities taking place and any SSC or protected species should be noted. In situations where these species are observed and must be removed, the proponent may only do so after the required permission/permits have been obtained in accordance with national and provincial legislation. In the abovementioned situation the development and implementation of a search, rescue and recovery program is suggested for the protection of these species. Should animals not move out of the area on their own, relevant specialists must be contacted to advise on how the species can be relocated.	Construction Phase	Environmental Officer, Contractor	Presence of any floral or faunal SCC	During phase

Clearing and disturbance activities must be conducted in a progressive linear manner, always outwards and away from the centre of the Project Area and over several days, so as to provide an easy escape route for all small mammals and herpetofauna.	Construction Phase	Environmental Officer & Contractor	Progressive land clearing operations and the movement of fauna	Ongoing
The areas to be disturbed must be specifically and responsibly demarcated to prevent the movement of staff or any individual into the surrounding environments, signs must be put up to enforce this.	Construction/Operational Phase	Project manager, Environmental Officer	Infringement into these areas	Ongoing
The duration of the activities should be minimised to as short a term as possible, to reduce the period of disturbance on fauna.	Construction	Project manager, Environmental Officer & Design Engineer	Construction/Closure Phase	Ongoing
Noise must be kept to an absolute minimum during the evenings and at night to minimise all possible disturbances to reptile species and nocturnal mammals.	Construction/Operational Phase	Environmental Officer	Noise levels	Ongoing
No trapping, killing, or poisoning of any wildlife is to be allowed and Signs must be put up to enforce this. Monitoring must take place in this regard.	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing
Outside lighting should be designed and limited to minimise impacts on fauna. All outside lighting should be directed away from any sensitive areas. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (green/red) lights should be used wherever possible.	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Light pollution and period of light	Ongoing
All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limits, to respect all forms of wildlife. Speed limits must be enforced to ensure that road killings and erosion is limited.	Life of operation	Health and Safety Officer	Compliance to the training	Ongoing
Schedule activities and operations during least sensitive periods, to avoid migration, nesting, and breeding seasons.	Life of operation	Project manager, Environmental Officer & Design Engineer	Activities should take place during the day	Ongoing
Any holes/deep excavations must be dug in a progressive manner and shouldn't be left open overnight. Should any holes remain open overnight they must be properly covered temporarily to ensure that no small fauna species fall in. Holes must be subsequently inspected for fauna prior to backfilling.	Planning and Construction	Environmental Officer & Contractor, Engineer	Presence of trapped animals and open holes	Ongoing
If fencing is required: wildlife-permeable fencing with holes large enough for mongoose and other smaller mammals should be installed, the holes must not be placed in the fence where it is next to a major road as this will increase road killings in the area.	Planning and construction	Environmental Officer & Contractor, Engineer	Fauna movement corridor	Ongoing



Use environmentally friendly cleaning and dust suppressant products.	Construction and operation	Environmental Officer & Contractor, Engineer	Presence of chemicals in and around the Project Area	Ongoing
<b>Management outcome: Alien species</b>				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
An Alien Invasive Plant Management Plan must be compiled and implemented. This should regularly be updated to reflect the annual changed in AIP composition.	Life of operation	Project manager, Environmental Officer & Contractor	Manage and assess presence and encroachment of alien vegetation	Twice a year
The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprints of the roads must be kept to prescribed widths.	Construction/Operational Phase	Project manager, Environmental Officer & Contractor	Footprint Area	Life of operation
A pest control plan must be put in place and implemented; it is imperative that poisons not be used to control pests.	Life of operation	Environmental Officer & Health and Safety Officer	Evidence or presence of pests	Life of operation
<b>Management outcome: Dust</b>				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes the wetting of exposed soft soil surfaces. No non-environmentally friendly suppressants may be used as this could result in the pollution of water sources.	Construction phase	Contractor	Dustfall	Dust monitoring program.
<b>Management outcome: Waste management</b>				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Waste management must be a priority and all waste must be collected and stored effectively and responsibly according to a site-specific waste management plan. Dangerous waste such as metal wires and glass must only be stored in fully sealed and secure containers, before being moved off site as soon as possible.	Life of operation	Environmental Officer & Contractor	Waste Removal	Weekly
Litter, spills, fuels, chemical and human waste in and around the Project Area must be minimised and controlled according to the waste management plan.	Construction/Closure Phase	Environmental Officer & Health and Safety Officer	Presence of Waste	Daily

Cement mixing may not be performed on the ground. It is recommended that only closed side drum or pan type concrete mixers be utilised. Any spills must be immediately contained and isolated from the natural environment, before being removed from site.	Construction Phase	Environmental Officer & Contractor	Cement mixing and spills	Every occurrence
Toilets at the recommended Health and Safety standards must be provided. Portable toilets must be emptied regularly to prevent overflow. Once no longer required, they must be pumped dry to prevent leakage into the surrounding environment and removed from site.	Life of operation	Environmental Officer & Health and Safety Officer	Number of toilets per staff member. Waste levels	Daily
The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility within every 10 days at least.	Life of operation	Environmental Officer & Health and Safety Officer	Availability of bins and the collection of the waste	Ongoing
Where a registered disposal facility is not available close to the Project Area, the Contractor shall provide a method statement with regards to waste management. Under no circumstances may domestic waste be burned on site or buried on open pits.	Life of operation	Environmental Officer, Contractor & Health and Safety Officer	Collection/handling of the waste	Ongoing
Refuse bins will be responsibly emptied and secured. Temporary storage of domestic waste shall be in covered and secured waste skips. Maximum domestic waste storage period will be 10 days.	Life of operation	Environmental Officer, Contractor & Health and Safety Officer	Management of bins and collection of waste	Ongoing, every 10 days
<b>Management outcome: Environmental awareness training</b>				
Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
All personnel and contractors are to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof.				
Discussions are required on sensitive environmental receptors within the Project Area to inform contractors and site staff of the presence of protected species, their identification, conservation status and importance, biology, habitat requirements and management requirements in line with the Environmental Authorisation and within the EMP.	Pre-construction phase	Health and Safety Officer, Environmental Officer	Compliance to the training	Ongoing
Contractors and employees must all undergo the induction and must be made aware of any sensitive areas to be avoided.				
<b>Management outcome: Erosion</b>				



Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Speed limits must be put in place to reduce erosion. Soil surfaces must be wetted as necessary to reduce the dust generated by the project activities. Speed bumps and signs must be erected to enforce slow speeds.	Life of operation	Project manager, Environmental Officer	Water Runoff from road surfaces	Ongoing
Only existing access routes and walking paths may be made use of.	Life of operation	Project manager, Environmental Officer	Routes used within the area	Ongoing
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events etc.	Life of operation	Project manager, Environmental Officer	Re-establishment of indigenous vegetation	Progressively
A stormwater management plan must be compiled and implemented if applicable.	Life of operation	Project manager, Environmental Officer	Management plan	Before construction phase: Ongoing

## 6 Conclusion and Impact Statement

The Project Area is predominantly made up of modified habitat, and what little grassland remains is severely degraded and experiencing high levels of impacts due to the proximity to mining activities. The north-western portions of the Project Area intercept ESA 1 areas, however, these are constantly disturbed in nature and cannot recover to a more natural state due to ongoing disturbances and impacts received from grazing, edge effects from land use and mismanagement.

Completion of the terrestrial biodiversity assessment led to a disputing of the 'Very High' classification for the terrestrial biodiversity theme sensitivity as allocated by the National Environmental Screening Tool. The Project Area is instead assigned an overall sensitivity of 'Low', with the modified areas assigned a sensitivity of 'Very Low' and degraded grassland a sensitivity of 'Low'. The water resource habitat is assigned a sensitivity of 'Medium' and more information regarding this unit can be found in the accompanying wetland report (TBC, 2023).

### 6.1 Impact Statement

The option to include or exclude a liner for the TSF project has no bearing on the biodiversity assessment. The proposed development, and either option can be favourably considered for authorisation.

It is the opinion of the specialists that the project may be favourably considered, provided that the mitigation measures presented in this report and accompanying wetland report be implemented correctly, along with the recommendations below. The location, state and size of the ecosystem means that it is unlikely that any functional habitat or SCCs will be lost as a result of the impacts arising from the proposed activities.

### 6.2 Specialist Recommendations

It is important to consider that undeveloped portions of land can still contribute to land management objectives and protection targets to some degree. It is recommended that care be taken during construction to adhere to mitigation measures. An AIP management plan must be implemented as a priority to prevent the further spread and proliferation of AIP species to the surrounding grassland areas. Installation of leak warning and detection systems on all pipelines must also be made a priority to prevent damage caused by pipe leaks on the surrounding natural areas, particularly near to water resources.

This report should be considered in conjunction with the associated wetland report and all management outcomes and put forward by the wetland specialist must be implemented.

## 7 References

Awuah, A. 2018. NBA 2018 Rivers and NBA 2018 National Wetland Map 5. South African National Biodiversity Institute (SANBI), Newlands, Cape Town.

Department of Environmental Affairs (DEA). 2016. National Protected Areas Expansion Strategy for South Africa 2016. Department of Environmental Affairs, Pretoria, South Africa.

Department of Forestry, Fisheries and the Environment (DFFE). 2022. South Africa Protected Areas Database (SAPAD\_OR\_2022\_Q1). Published 2022/06/30. Available at: <http://egis.environment.gov.za>.

Department of Forestry, Fisheries and the Environment (DFFE). 2022a. South Africa Conservation Areas Database (SACAD\_OR\_2022\_Q1). Published 2022/06/30. Available at: <http://egis.environment.gov.za>.

Goff, F., Dawson, G., & Rochow, J. 1982. Site examination for threatened and endangered plant species. *Environmental Management*, 6(4), 307-316.

IUCN. 2021. The IUCN Red List of Threatened Species. Version 2021-3. <https://www.iucnredlist.org>. The International Union for Conservation of Nature. Accessed: May 2023.

Lötter, M.C. & Le Maitre, D. 2021. Fine-scale delineation of Strategic Water Source Areas for surface water in South Africa using Empirical Bayesian Kriging Regression Prediction: Technical report. Prepared for the South African National Biodiversity Institute (SANBI), Pretoria. 33 pages.

Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.

Mucina, L. & Rutherford, M.C. (Eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria, South African.

Mucina, L., Rutherford, M.C. & Powrie, L.W. (Eds.). 2007. Vegetation map of South Africa, Lesotho and Swaziland. 1:1 000 000 scale sheet maps. 2nd ed. South African National Biodiversity Institute, Pretoria.

National Environmental Screening Tool. 2022. National Environmental Screening Tool, 2022. Available from the Department of Forestry, Fisheries and the Environment website: <https://screening.environment.gov.za/screeningtool/index.html#/pages/welcome>.

NBA. 2018. Terrestrial Ecosystem Threat Status and Protection Level 2018. <http://bgis.sanbi.org/>. (Accessed: Mar 2022).

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801. Water Research Commission, Pretoria.

POSA. 2019. South African National Biodiversity Institute. Botanical Database of Southern Africa (BODATSA) [dataset]. <http://posa.sanbi.org/>. (Accessed: May 2023).

SADAP (South Africa Protected Areas Database) and SACAD (South Africa Conservation Areas Database) (2022). <http://egis.environment.gov.za>

SANBI (South African National Biodiversity Institute). 2017. Technical guidelines for CBA Maps: Guidelines for developing a map of Critical Biodiversity Areas & Ecological Support Areas using systematic biodiversity planning. A., Holness, S. & Daniels, F. (Eds). 1st Edition. South African National Biodiversity Institute, Pretoria.

SANBI (South African National Biodiversity Institute). 2018. Terrestrial ecosystem threat status and protection level layer [Vector] 2018. Available from the Biodiversity GIS website: <http://bgis.sanbi.org/SpatialDataset/Detail/2675>. downloaded: March 2022.

Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (eds.). 2019. South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm. South African National Biodiversity Institute, Pretoria.

Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. and Van der Colff D. 2019. *South African National Biodiversity Assessment 2018: Technical Report*. Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. <http://hdl.handle.net/20.500.12143/6230>.

## 8 Appendix Items

### 8.1 Appendix A: Specialist Declarations

#### DECLARATION

I, Sarah Newman, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Sarah Newman

Environmental Consultant

The Biodiversity Company

August 2023

## DECLARATION

I, Carami Burger, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Carami Burger

Environmental Consultant

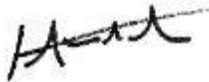
The Biodiversity Company

August 2023

## DECLARATION

I, Andrew Husted, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Andrew Husted

Terrestrial Ecologist

The Biodiversity Company

August 2023

## 8.2 Appendix B: Specialist CVs

### Sarah Newman

M.Sc Entomology

Cell: +27 73 391 6933

Email: [sarah@thebiodiversitycompany.com](mailto:sarah@thebiodiversitycompany.com)

Identity Number: 9312170034086

Date of birth: 17 December 1993



#### Profile Summary

Work experience in South Africa, Lesotho and Costa Rica.

Extensive experience working in the Sani Pass region of southern Africa investigating the patterns and drivers of ant diversity across an elevation gradient.

Experience with sea turtle monitoring and conservation in Costa Rica.

#### Areas of Interest

Entomology, Zoology, Biodiversity, Conservation and Community Ecology.

#### Key Experience

- Terrestrial Ecological Assessments
- Monitoring programmes
- Field work and research
- Taxonomic classification of insects

#### Country Experience

South Africa  
Lesotho  
Costa Rica

#### Nationality

South African

#### Languages

English – Proficient  
Afrikaans – Conversational  
Spanish – Basic

#### Qualifications

- MSc Entomology (*Distinction*), University of Pretoria
- BSc (Hons) Zoology, University of Pretoria
- BSc Zoology, University of Pretoria
- Cand Sci Nat (158474)

CURRICULUM VITAE: Sarah Newman



---

CURRICULUM VITAE: Sarah Newman

---

**OVERVIEW**

An overview of the specialist technical expertise include the following:

- Terrestrial Ecological Assessments
- Faunal surveys which include mammals, birds, amphibians and reptiles
- Management plan compilation (Fire Management Plan)

**EMPLOYMENT EXPERIENCE**

**Environmental Consultant at The Biodiversity Company (November 2022 - Present)**

Terrestrial biodiversity surveys and assessments.

**Research Technician (Contract) for the University of Pretoria (February 2022 – July 2022)**

Taxonomic identification of invertebrates.

**Sea Turtle Research Assistant for Ecology Project International at Pacuare Reserve, Costa Rica (February 2021 – November 2021)**

Conducted sea turtle monitoring, conservation activities and data management, along with overseeing jaguar camera trapping surveys and performing teaching activities with visiting student groups and tourists.

**Compliance and Regulatory Officer for Cell Path Services (Pty) Ltd (June 2019 – November 2020)**

Ensured the company adhered to all regulatory requirements outlined by the relevant regulatory bodies.

**ACADEMIC QUALIFICATIONS**

**University of Pretoria, Pretoria (2018): Master of Science (MSc) in Entomology with *Distinction***

Title: Taxonomic and Functional Diversity of Ants Across Environmental Gradients

**University of Pretoria, Pretoria (2016): Bachelor of Science Honours (BSc (Hons)) in Zoology**

Title: Rolling versus tunnelling: An evolutionary history of dung relocation and burial behaviour in African dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae)

**University of Pretoria, Pretoria (2015): Bachelor of Science (BSc) in Zoology**

---

CURRICULUM VITAE: Sarah Newman

## Carami Burger

B.Sc. Honours – Ecological Interactions and  
Ecosystem Resilience (Cum Laude)

(Pr Sci Nat)

Cell: +27 83 630 9077

Email: [Carami@thebiodiversitycompany.com](mailto:Carami@thebiodiversitycompany.com)

Identity Number: 9606250185084

Date of birth: 25 June 1996



### Profile Summary

Working experience in South Africa and Mozambique.

Specialist experience with infrastructure development, road development, renewable energy, mining and prospecting.

Specialist expertise include terrestrial ecology, wetland resources, rehabilitation and management plans, environmental compliance and monitoring.

### Areas of Interest

Renewable Energy & Bulk Services Infrastructure Development, Mining, Farming, Sustainability and Conservation.

### Key Experience

- Environmental Impact Assessments (EIA)
- Basic Assessments
- Terrestrial Ecological Assessments
- Wetland Delineation and Ecological Assessments
- Environmental Management Programmes (EMPr)
- Rehabilitation Plans
- Invasive Species Plans
- Search and Rescue Plans
- Environmental Compliance Audits
- Water Use License Applications
- Dust Fallout Monitoring
- Water Quality Monitoring

### Countries worked in

South Africa  
Mozambique

### Nationality

South African

### Languages

English – Proficient

Afrikaans – Proficient

### Qualifications

- BSc Hons Ecological Interactions and Ecosystem Resilience.
- BSc Botany and Zoology.
- Pr Sci Nat (121757)

---

CURRICULUM VITAE: Carami Burger

---

**OVERVIEW**

An overview of the specialist technical expertise includes the following:

- Terrestrial Ecological Assessments.
- Faunal surveys which include mammals, birds, amphibians and reptiles.
- Wetland Ecological Assessment.
- Management plan compilation (Plant Search and Rescue, Rehabilitation, Site Clearance, Alien Invasive Species Plans).
- Compliance audits.
- Water Use Licenses.
- Water Quality and Dust Fall Monitoring.

**EMPLOYMENT EXPERIENCE**

**The Biodiversity Company (May 2022 - Present)**

Ecologist.

**EP3 Environmental (June 2019 - April 2022)**

Senior Consultant and Ecologist

**Scientific Aquatic Services (SAS) (November 2018 - June 2019)**

Internship

**ACADEMIC QUALIFICATIONS**

**North-West University of Potchefstroom (2017): BACCALAUREUS SCIENTIAE HONORIBUS (Hons) – Ecological Interactions and Ecosystem Resilience (Cum Laude)**

**Title:** Mini-Dissertation on ecological information in Environmental Impact Assessments (EIA) at Mooi River Mall.

**North-West University of Potchefstroom (2013): BACCALAUREUS SCIENTIAE IN NATURAL AND ENVIRONMENTAL SCIENCES. Majors: Botany and Zoology.**

---

## Andrew Husted

M.Sc Aquatic Health (*Pr Sci Nat*)

Cell: +27 81 319 1225

Email: [andrew@thebiodiversitycompany.com](mailto:andrew@thebiodiversitycompany.com)

Identity Number: 7904195054081

Date of birth: 19 April 1979



### Profile Summary

Working experience throughout South Africa, West and Central Africa and also Armenia & Serbia.

Specialist experience in exploration, mining, engineering, hydropower, private sector and renewable energy.

Experience with project management for national and international multi-disciplinary projects.

Specialist guidance, support and facilitation for the compliance with legislative processes, for in-country requirements, and international lenders.

Specialist expertise include Instream Flow and Ecological Water Requirements, Freshwater Ecology, Terrestrial Ecology and also Ecosystem Services.

### Areas of Interest

Sustainability and Conservation.

Instream Flow and Ecological Water Requirements.

Publication of scientific journals and articles.

### Key Experience

- Familiar with World Bank, Equator Principles and the International Finance Corporation requirements
- Environmental, Social and Health Impact Assessments (ESHIA)
- Environmental Management Programmes (EMP)
- Ecological Water Requirement determination experience
- Wetland delineations and ecological assessments
- Rehabilitation Plans and Monitoring
- Fish population structure assessments
- The use of macroinvertebrates to determine water quality
- Aquatic Ecological Assessments
- Aquaculture

### Country Experience

Botswana, Cameroon  
Democratic Republic of Congo  
Ghana, Ivory Coast, Lesotho  
Liberia, Mali, Mozambique  
Nigeria, Republic of Armenia,  
Senegal, Serbia, Sierra Leone, South Africa  
Tanzania

### Nationality

South African

### Languages

English – Proficient

Afrikaans – Conversational

German - Basic

### Qualifications

- MSc (University of Johannesburg) – Aquatic Health.
- BSc Honours (Rand Afrikaans University) – Aquatic Health
- BSc Natural Science
- Pr Sci Nat (400213/11)
- Certificate of Competence: Mondi Wetland Assessments
- Certificate of Competence: Wetland WET-Management
- SASS 5 (Expired) – Department of Water Affairs and Forestry for the River Health Programme
- EcoStatus application for rivers and streams

#### EMPLOYMENT EXPERIENCE

The Biodiversity Company (January 2015 – Present)

Director / Ecologist.

Digby Wells Environmental (August 2008 – December 2014)

Freshwater & Terrestrial Ecologist

PREVIOUS EMPLOYMENT: Econ@UJ (University of Johannesburg)

Freshwater Ecologist

#### ACADEMIC QUALIFICATIONS

University of Johannesburg, Johannesburg, South Africa (2009): MAGISTER SCIENTIAE (MSc) - Aquatic Health:

Title: *Aspects of the biology of the Bushveld Smallscale Yellowfish (Labeobarbus polylepis): Feeding biology and metal bioaccumulation in five populations.*

Rand Afrikaans University (RAU), Johannesburg, South Africa (2004): BACCALAUREUS SCIENTIAE CUM HONORIBUS (Hons) – Zoology

Rand Afrikaans University (RAU), Johannesburg, South Africa (2001 - 2004): BACCALAUREUS SCIENTIAE IN NATURAL AND ENVIRONMENTAL SCIENCES. Majors: Zoology and Botany.

#### PUBLICATIONS

Desai M., Husted A., Fry C., Downs C.T., & O'Brien G.C. 2019. Spatial shifts and habitat partitioning of ichthyofauna within the middle–lower region of the Pungwe Basin, Mozambique. *Journal of Freshwater Ecology*, 34(1), 685–702. doi: 10.1080/02705060.2019.1673221

Tate R.B. and Husted, A. 2015. Aquatic Biomonitoring in the upper reaches of the Boesmanspruit, Carolina, Mpumalanga, South Africa. *African Journal of Aquatic Science*.

Tate R.B. and Husted A. 2013. Bioaccumulation of metals in *Tilapia zillii* (Gervai, 1848) from an impoundment on the Badeni River, Cote D'Ivoire. *African Journal of Aquatic Science*.

O'Brien G.C., Bulfin J.B., Husted A. and Smit N.J. 2012. Comparative behavioural assessment of an established and new Tigerfish (*Hydrocynus vittatus*) population in two manmade lakes in the Limpopo catchment, Southern Africa. *African Journal of Aquatic Science*.

Tomschi H., Husted A., O'Brien G.C., Cloete Y., Van Dyk C., Pieterse G.M., Wepener V., Nel A. and Reisinger U. 2009. Environmental study to establish the baseline biological and physical conditions of the Letsibogo Dam near Selebi Phikwe, Botswana. EC Multiple Framework Contract Beneficiaries.8 ACP BT 13 – Mining Sector (EDMS). Specific Contract N° 2008/166788. Beneficiary Country: Botswana. By: HPC HARRESS PICKEL CONSULT AG

Husted A. 2009. Aspects of the biology of the Bushveld Smallscale Yellowfish (*Labeobarbus polylepis*): Feeding biology and metal bioaccumulation in five populations. The University of Johannesburg (Thesis).