PROSPECTING RIGHT APPLICATION FOR TARGETED BLOCKS WITHIN THE KURUMAN, BARKLY WEST, HAY & HOPETOWN MAGISTERIAL DISTRICTS, NORTHERN CAPE PROVINCE, SOUTH AFRICA

Wetland/Aquatic and Terrestrial Desktop Sensitivity & Familiarisation

Version 1.1

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Details of Specialist Team

The relevant experience of specialist team members involved in the compilation of this report are briefly summarized below.

Specialist	Role	Details
Ryan Kok (*Pr.Sci.Nat.*) Wetland & Aquatic Ecologist Eco-Pulse	Project manager, Fieldwork, Desktop Mapping, co-author & sign-off	Ryan is a Scientist and Wetland / Aquatic and Terrestrial Ecologist at Eco-Pulse with a BSc degree in Environmental Science, BSc Honours and MSc degree in Biological & Ecological Sciences. He is a registered Professional Natural Scientist (Pr. Sci. Nat.) with 7 years' experience, having worked extensively on numerous specialist ecological assessment projects, for wetland/aquatic habitats in KZN, the Free State, Gauteng, Eastern Cape, Northern Cape, the North West and Mpumalanga.
Ross Van Deventer (M.Sc.) Senior Wetland & aquatic ecologist	Fieldwork, Desktop Mapping, and co-author	Ross has an MSc (Environmental Science) with training in integrated environmental management along with specialist training in the field of water resource management and aquatic science. His specialised training is further complemented by experience gained at Eco-Pulse through a broad range of wetland and aquatic studies. He is competent in the application of current best practise guidelines and assessments tools with a growing experience base in water quality assessments. Ross has gained sound experience in undertaking specialist fish, diatom, water quality, habitat integrity and aquatic macroinvertebrate (SASS5) assessments.

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1. INTRODUCTION

1.1 Project Background & Study Area

The applicant plans to apply for prospecting rights for lithium, lead, copper, zinc, and sulphides within the Northern Cape Province (refer to Figure 1). Greenmined Environmental was appointed by the applicant to conduct the required Environmental Impact Assessment (EIA) for the prospecting right (PR). At the time of this report, the project was in the early planning phase. Several properties had been identified for potential prospecting, but individual drill sites had not been identified and finalized.

As part of the initial planning phase, the client aims to gain a deeper understanding of the freshwater (wetlands/rivers) and terrestrial habitats within properties identified in order to implement best impact avoidance and minimization minimize measures though careful planning. Greenmined Environmental appointed Eco-Pulse for the initial phase, which includes the compilation of a sensitivity map to inform project planning in the interest of impact avoidance and minimization.

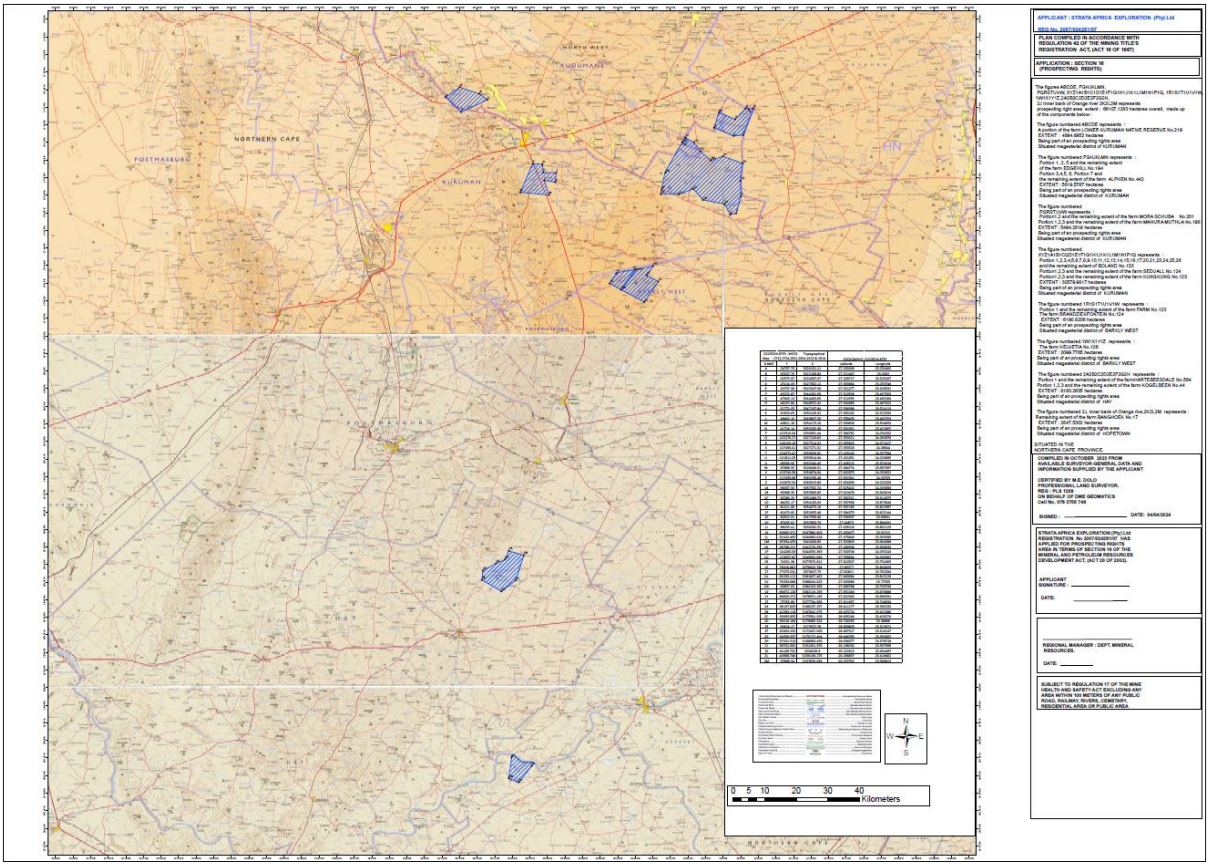


Figure 1. Locality map showing the targeted blocks for prospecting right, in the Northern Cape Province.

1.2 Purpose of Assessment

The aim of the mapping exercise was to provide spatial environmental sensitivity information, in the form of maps, to the design team to inform the sitting potential prospecting pits outside of sensitive ecosystems

and habitat. This approach aligns with the widely accepted mitigation hierarchy that seeks to avoid and minimize impacts as a priority through careful layout planning and project design (Figure 2).

Amongst other things, the National Environmental Management Act No. 107 of 1998 (NEMA), states:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied:
- that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied
- that a risk-averse and cautious approach is applied, which considers the limits of current knowledge about the consequences of decisions and actions.

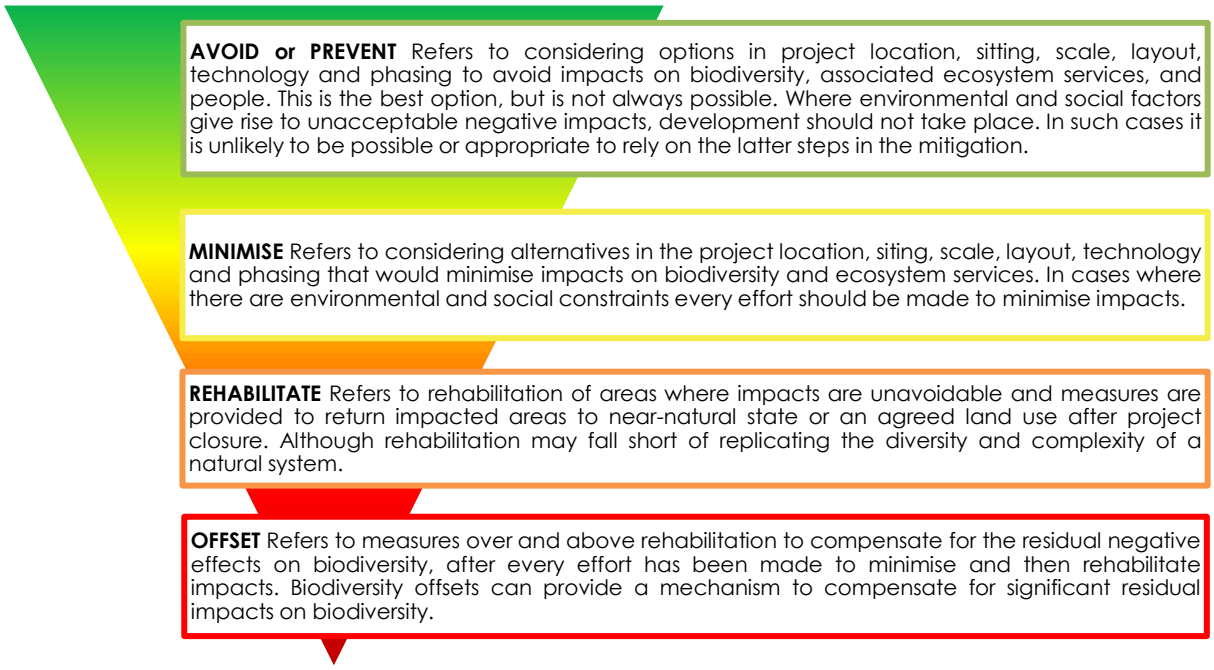


Figure 2. Diagram illustrating the 'mitigation hierarchy' (after DEA et al., 2013).

1.3 Scope of Work

Freshwater (Wetland and Aquatic) & Terrestrial Habitat Familiarisation Trip

- Conducting a verification field trip before commencing the desktop sensitivity mapping process. This trip will involve visiting various freshwater ecosystem types and vegetation communities across the study area which are accessible, providing valuable insight into their characteristics, extent, and surroundings.
- The data collected during this trip will then inform the desktop sensitivity mapping process.

Terrestrial Vegetation/Habitat Desktop Sensitivity

- Desktop assessment of the floral and faunal species of conservation concern that may occur within the development footprint based on available species records for the region (e.g., POSA database, SABAP2, Red Data Lists, etc.).

- Review of any documented and available studies/information for the development site and surrounding areas.
- Contextualization of the study area in terms of important biophysical characteristics and conservation planning using available spatial datasets and conservation plans
- Desktop mapping of all 'untransformed' terrestrial vegetation and habitat within the prospecting boundaries.
- Determine high sensitivity / no-go areas based on the available desktop information.
- Provision of a Desktop Terrestrial Biodiversity report accompanied by a sensitivity map for the project to guide prospecting sites for prospect planning.

Freshwater (Wetland and Aquatic) Habitat Desktop Sensitivity

- Mapping of watercourses (wetlands and rivers) using GIS within the targeted prospecting right boundaries. Desktop mapping will be undertaken using available GIS datasets as well as available digital imagery and elevation contour data.
- Classification of wetlands and rivers/streams at a desktop level using the National Wetland Classification Guidelines (Ollis et al., 2013) and grouping of wetlands and rivers/streams into 'Process Units' (i.e., watercourses with similar attributes such as HGM type, slope, level of disturbance/impact, etc.).
- Review of freshwater ecosystem context as well as the ecological and conservation setting in the prospecting right areas, based on available literature, existing databases (e.g., SANBI, NFEPA and other provincial databases).
- Provision of a freshwater ecosystem extent and classification map.
- Determine high sensitivity / no-go areas to include in project planning.
- Provision of a desktop freshwater assessment (wetland and aquatic) report accompanied by a delineation and sensitivity map for the project to guide prospecting location planning.
- Recommendations and adjustments for prospecting site locations.

2. ASSUMPTIONS AND LIMITATIONS

- The maps developed and presented are preliminary in nature and of moderate confidence overall. They are based on rapid field verification efforts and will need to be refined and updated when prospecting sites are selected. The maps should be used for planning purposes. Higher resolution and more focused delineation will need to be undertaken at selected pits sites.
- Several of the points flagged for field verification could not be accessed.
- Discontinuous drainage features were observed in the study area as steep topographical setting transitioned to flat, low energy environments. At the transition, channels dissipated and could be identified. These drainage features were mapped as discontinuous. This was based on field observations.
- Digitizing watercourses was based on the interpretation of multiple lines of evidence, including elevation contour information, colour satellite imagery, contours data and professional

experience. To spite this, there is a likelihood that certain smaller, discrete wetland ecosystem were missed, particularly in properties where access was limited.

3. METHODS

This section sets out the methods for the development of terrestrial and freshwater ecosystem sensitivity maps to inform project planning.

3.1 Terrestrial Vegetation/Habitats

This section sets out the method applied to the terrestrial vegetation/habitat sensitivity map.

3.1.1 Field Preparation

- In preparation for field work, available desktop terrestrial databases were reviewed and clipped to the study area for refinement at a later stage. This included:
    - National Vegetation Map 2018 (NBA, 2018)
    - Red List Ecosystem Remnants (2021)
    - South African Protected Areas Database (Q3 2023)

3.1.2 Species of Conservation Concern Potential Occurrence (POC) Assessment

The purpose of conducting the potential occurrence assessment was to identify Species of Conservation Concern (SCC), which are species with significant conservation value in preserving South Africa's biodiversity. This assessment aimed to flag the potential presence of SCC, helping to focus future surveys on these species or determine the need for more detailed studies. South African conservation agencies use the IUCN Red List Categories and Criteria, adapted regionally, to assess the conservation status of species within the country's borders. This regional assessment considers only species' distributions within South Africa, excluding populations beyond its borders. As a result, a species may have different conservation statuses on the national Red List compared to the global IUCN Red List. The national list of SCC includes range-restricted species that are not declining but are nationally listed as Rare or Extremely Rare, in addition to species assessed under IUCN criteria. This approach also incorporates endemic or range-restricted species and provincially protected species into conservation modelling efforts, as outlined in Figure 3.

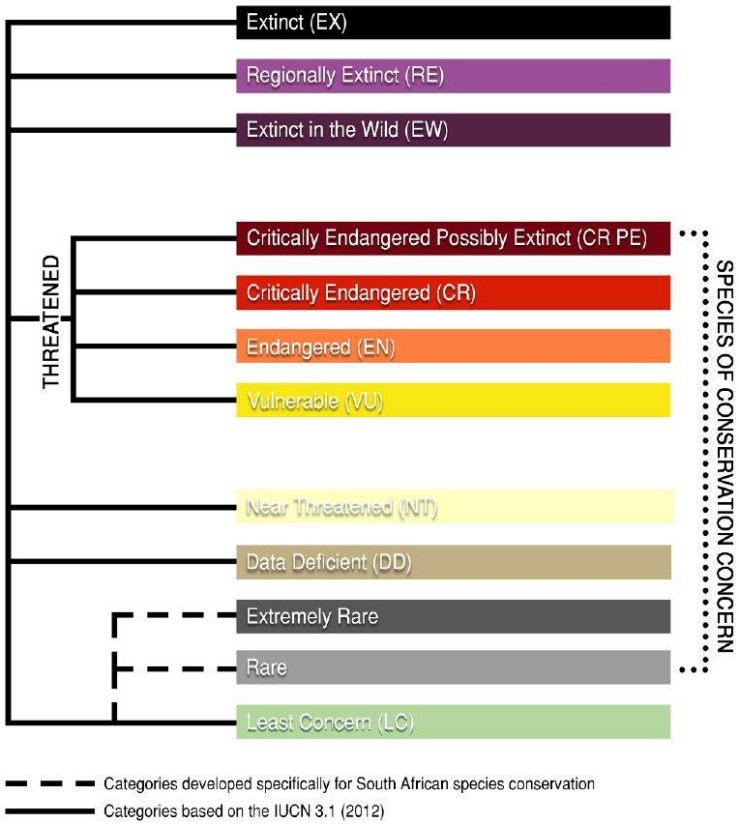


Figure 3. The different categories of SCC modified from the IUCN's extinction risk categories (reproduced in part from IUCN, 2012) - extracted directly from SANBI (2020).

A description of the different South African Plant Red List categories as well as all species that form part of the larger complement considered as SCC is provided in Table 1 (Categories marked with N are non-IUCN national Red List categories for species not in danger of extinction but considered of conservation concern; the IUCN equivalent of these categories is Least Concern (LC).

Table 1. Description of South African Plant Red List Categories (Source: SANBI on-line at http://redlist.sanbi.org/eiaguidelines.php).

Status		Category	Description
SPECIES OF CONSERVATION CONCERN	EXTINCT/APPROACH-ING EXTINCTION	**Extinct (EX)**	A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
		Regionally Extinct (RE)	A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
		Extinct in the Wild (EW)	A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.

Status		Category	Description
	THREATENED SPECIES	**Critically Endangered, Possibly Extinct (CR PE)**	Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered
		Critically Endangered (CR)	A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
		Endangered (EN)	A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
		Vulnerable (VU)	A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
	OTHER SPECIES OF CONSERVATION CONCERN	**Near Threatened (NT)**	A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.
		Critically Rare^{N}	A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
		Rare^{N}	A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria.
		Declining	A species is Declining when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline of the species.
		Data Deficient - Insufficient Information (DDD)	A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.
OTHER CATEGORIES		**Data Deficient - Taxonomically Problematic (DDT)**	A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
		Least Concern (LC)	A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
		Not Evaluated (NE)	A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in Plants of southern Africa: an online checklist are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

Flora and fauna of conservation significance (including threatened, protected and rare species) likely to occur in the various habitats of the study area were assessed at a desktop level using information obtained from the following documents, on-line services and GIS information:

- List of SCC obtained from the EIA screening tool[1]
- SANBI's Plants of South Africa website (POSA) that allows the interrogation of the Botanical Database of Southern Africa (BODATSA) (http://posa.sanbi.org);
- Outputs of the KZN Terrestrial Conservation Plan (CPLAN) (EKZNW, 2010 & 2016);
- Outputs of the South African Bird Atlas Project (SABAP) (http://sabap2.adu.org.za/);
- Outputs of the South African Frog Atlas Project (SAFAP) (http://safap2.adu.org.za/);
- Atlas of African Orchids (http://vmus.adu.org.za/);
- iNaturalist (https://www.inaturalist.org);
- Geographical distribution data in Biodiversity Management Plans;
- Data from the Animal Demography unit (ADU, 2021);
- Various resources and references for Red Data listed species in South Africa (such as the Red Data Lists of Plants, Mammals, Reptiles and Amphibians); and
- Specialist knowledge and experience on the flora and fauna of KZN, their ranges and habitat requirements.

The habitat requirements/preferences for each plant/animal SCC was reviewed (based on available literature) and then compared with the habitat occurring on the site in order to estimate the likelihood of these species occurring on the target property (as per the assessment matrix in Table 2).

Table 2. Generic matrix used for the estimation and rating of flora/fauna species potential occurrence based on known habitat requirements/preferences and ranges.

		SPECIES HABITAT REQUIREMENTS/PREFERENCES			
		Fully met	**Largely met**	**Partially met**	**Not met**
		Natural condition	**Fair condition**	**Poor-Fair condition**	**Poor condition/ Transformed**
SPECIES DISTRIBUTION/ RANGE	**Habitat occurs within known species geographic/altitudinal range**	Highly Probable	Possible	Unlikely	Highly unlikely or Improbable
	Habitat occurs on the edge of known species geographic/altitudinal range	Possible	Possible	Unlikely	Highly unlikely or Improbable
	Habitat occurs outside of known species geographic/altitudinal range	Unlikely	Unlikely	Highly unlikely or Improbable	Highly unlikely or Improbable

[1] **Note**: In the event that a SCC is either not listed in the Screening Tool Report or it erroneously lists a SCC as highly unlikely to occur within the proposed development footprint, this will be indicated and an explanation/motivation for exclusion or inclusion of the relevant SCC will be provided. Moreover, in the event that the inclusion or exclusion of an SCC affects the outcome of the impact significance assessment, this will also be stipulated as part of the reporting process.

Table 3 below was then used to rate the likelihood of occurrence as either being "Low", "Medium" or "High" or "Confirmed[2]" (if species were observed during fieldwork on site within the development footprint, they were categorised as confirmed).

Table 3. Likelihood of occurrence rating derived from rationale base on distribution and habitat preferences of species at a desktop level, and field-based observations at a site level.

Likelihood of Occurrence Rating	Rationale
Confirmed	Species was observed on-site
High: probable	Highly Probable
Medium: possible	Possible
Medium: unlikely	Unlikely
Low	Highly unlikely or Improbable

3.1.3 Terrestrial Ecosystem Mapping

- The terrestrial ecosystem remaining extent layer from the 2021 National Biodiversity Assessment was clipped to the study area. This layer was then refined at a scale of 1:5 000 to 1: 3 000.
- Refinements were made based on a review of recent Google Earth and Bing colour aerial imagery. Rapid present ecological state (PES) categories were assigned to the refined remaining extent layer as follows:
    - **A/B PES** – Natural or largely natural primary terrestrial ecosystem.
    - **C/D PES** – Terrestrial ecosystem which has experienced a degree of degradation, but which still retains some ecosystem functionality.
    - **E/F PES** – Degraded / transformed terrestrial ecosystem type.
- The refined remaining extent layer was unioned with the national vegetation map shapefile layer (SANBI, 2018). All terrestrial areas beyond refined remaining extent layer were assumed to be secondary and / or transformed. These areas were therefore assigned a either a C/D or E/F PES rating. Retained within the terrestrial ecosystem layer for the study area is the national biodiversity assessment Ecosystem Threat Status (ETS) for each terrestrial ecosystem type. The refined wall-to-wall study area terrestrial ecosystem layer was then unioned with the Northern Cape Province Biodiversity Plan GIS layer (Holness and Oosthuysen, 2016). This provincial conservation plan divides the province into the following categories:
    - **Critical Biodiversity Area (CBA) Irreplaceable (CBA1)** – Areas that irreplaceable for meeting biodiversity targets. There are no or very few other options for meeting biodiversity targets for the features associated with the site.
    - **Critical Biodiversity Area (CBA) Optimal (CBA2)** – Areas that have selected as the best option for meeting biodiversity targets based on complementarity, efficiency, and / or avoidance of conflict with other land or resources.

[2] Definitive answers regarding the presence or absence of a particular SCC are not always possible. In such situations, the precautionary principle is applied so that preventative action is taken in the face of uncertainty. For species that are difficult to detect, it is not always possible to provide compelling evidence that a species does not occur. Therefore, if the habitat conditions appear suitable and there is data to suggest that the species did or could occur (e.g., confirmed records on adjacent properties), then the precautionary approach is to assume that the species does indeed occur there, and mitigation and management decisions need to be made accordingly.

- **Ecological Support Area (ESA)** – Areas that must be maintained in at least fair ecological condition (semi-natural / moderately modified) to support the ecological functioning of a CBA or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets for ecosystem types or species when it is not possible or not necessary to meet them in natural or near-natural areas.
- **Other Natural Area –** Areas in good or fair ecological condition that are not required to meet biodiversity targets for ecosystem types, species, or ecological purposes.

3.1.4 Field Verification & Familiarization Process

The aim of the field familiarization process was to visit representable examples of the various vegeation types which occur within the targeted blocks and nearby the properties to improve the accuracy of the mapping.

- Field familiarization involved visiting accessible field points and collecting basic data regarding the type, condition, impacts and sensitivity of the terrestrial habitat. Field work also involved validating existing datasets.
- Depending on access, a combination of information was captured, including:
  - Vegetation type;
  - Habitat condition;
  - Levels of degradation;
  - Visual Impacts; and
  - Digital photography of Terrestrial ecosystems observed.

3.1.5 Rating Ecological Sensitivity

The desktop terrestrial and freshwater ecosystem layers were unioned to create a consolidated sensitivity layer.

Table 4. Numerical ratings were assigned to different ecosystem types based on the National Biodiversity Assessment Ecosystem Threat Status as follows:

Ecosystem Threat Status (SANBI, 2018)	Numerical Rating
Least Concern	0.25

Table 5. Numerical ratings were then applied to terrestrial ecosystem based on the Northern Cape Province Biodiversity Plan. Ratings were as follows:

Northern Cape (Holness and Oosthuysen, 2016)	Numerical Rating
CBA1	1.0
CBA2	0.8
ESA	0.5
Other	0.2
N/A	0.0

Table 6. Numerical rating applied to Protected Areas. Ratings were as follows:

South African Protected Areas Database (Q3 - 2023)	Numerical Rating
Protected Area	1.0

Table 7. Terrestrial ecosystem rapid PES categories were assigned numerical values as follows:

PES Category	Numerical Rating
A/B	1.0
C/D	0.5
E/F	0.0

The maximum numerical score from the Ecosystem Threat Status, Northern Cape Biodiversity Plan, and the South African Protected Areas Database conservation status was calculated. For terrestrial ecosystem this score was adjusted based on the rapid PES rating to determine final numerical sensitivity rating. This was done using the following formula:

Final Numerical Sensitivity Rating
=
Max numerical score from Ecosystem threat status, Northern Cape Biodiversity Plan and South African Protected Areas Database
X
Numerical score from Rapid PES Category

Table 8. Numerical sensitivity ratings were assigned final sensitivity classes as follows:

Ecological Sensitivity Class	Numerical Rating	Interpretation for drill well siting
High	0.68-1.0	Areas to be avoided when siting drilling wells as these are ecologically sensitive.
Moderate	0.33 – 0.67	Potentially suitable areas for siting drilling wells. These areas should however be avoided if possible.
Low	0.0-0.33	Areas which are suitable for the siting of drilling wells from an ecological sensitivity perspective.

3.2 Freshwater ecosystems (wetlands, rivers, and streams)

This section sets out the method applied to the freshwater ecosystem sensitivity map and associated buffers.

3.2.1 Desktop Analysis & Field Preparation

- In preparation for field work, available desktop wetland and river inventories were reviewed and clipped to the study area for refinement at a later stage. This included:
    - NBA (SANBI, 2021) wetland and rivers
    - NFEPA (CSIR, 2011) wetlands
    - Surveyor general 1:50 000 river lines
- Desktop datasets were reviewed and rapidly refined through digitization at scales of 1:3000 to 1:6000 using available elevation contour data and color satellite imagery. This was done to prioritize points of interest for field verification and familiarization. A combination of Google, Bing and ESRI satellite imagery was used.
- Multiple field verification points were then added to the GIS project and placed at locations within or near watercourses. Depending on access, the points were placed at logical, seemingly accessible locations within or near the properties under investigation. Due to the rapid nature of the field familiarization process, the aim of the field familiarization was to visit a suite of representative freshwater ecosystems within or nearby the properties under investigation.

3.2.2 Field Verification & Familiarization Process

The aim of the field familiarization process was to visit a suite of freshwater ecosystem within and nearby the properties to improve the accuracy of the mapping.

- Field familiarization involved visiting accessible field points and collecting basic data regarding the extent, type, and sensitivity of the freshwater ecosystem. Field work also involved validating existing inventory datasets and, in some instances, noting their inaccuracy.
- At selected sites, where access allowed, soil was sampled to determine the presence of wetland habitat using a hand operated soil auger. Soil sample locations were recorded using a Garmin Montana 700 hand-held GPS unit.
- Depending on access, a combination of the information was captured, including:
    - The presence or absence of wetland and/or riverine habitat.
    - Soil texture, colour and soil mottling.
    - Topographical features such as terrain, gradient, changes in elevation, the presence of a channel, channel banks, a river bed, macro-channel banks, riparian and wetland vegetation.
    - Digital photography of freshwater ecosystems observed.

3.2.3 Mapping of Freshwater Ecosystems & Drainage Features

- Following field familiarization efforts, the desktop river and wetland inventory maps was updated and refined based on field data. Digitization was undertaken at scales of 1:3000 to 1:5000 using available elevation contour data and colour satellite imagery. A combination of Google, Bing and ESRI satellite imagery was used.
- Each digitized freshwater feature was then classified into a type based on the guidance set out by Ollis, et al (2013).
- Wetlands were digitized as polygon features using available contour data, satellite imagery and the benchmarking data collected during field efforts.
- For large perennial rivers, which was limited to the Orange River, the active channel and riparian zones was delineated as a polygon feature. This was later buffered to generate a recommended set back (See Section 3.1.2).
- For smaller, non-perennial streams and drainage lines that convey surface water following rainfall events or during wetter periods, the 1:50k river lines were refined to best represent the drainage line or channel. A variable width buffer was then applied to the line depending on the stream order and local topographic setting. Buffer widths were assigned to each class/ order of stream and drainage line by benchmarking the average with of each type across the study area. The variably buffed lines then formed a polygon feature that represented the channel for each non-perennial stream class mapped. This was later buffered to generate a recommended set back (See Section 3.1.2). Table 9 below summarises the variable buffer widths applied to each class/ order of smaller river and stream.
- Due to the generally arid nature of the study area, certain valley settings were not associated with a wetlands or defined river channel. These 'valley lines' do however convey surface water run-off intermittently following rainfall events. These topographical settings were defined as ephemeral drainage lines and should be avoided.

Table 9. Variable buffer widths applied to establish river and stream polygon feature.

River/ stream class	Buffer width[3]	Active channel[4] width
1 – Ephemeral headwater drainage lines and first order streams	2.5m	5m
2 – Ephemeral second order headwater streams	5m	10m
3 – Seasonal and/or third order streams	7.5m	15m
4 – Large perennial rivers	n/a – active channel digitized individually. This only applied to the Orange River in the study area.	

[3] Is the width of buffer applied to line feature to generate active channel polygon. This was not an impact buffer. Refer to Section 2.14 for impact avoidance and mitigation buffers recommended.
[4] Represents an estimate of the edge of the active channel or drainage feature and was used to generate impact avoidance and mitigation buffers. See Section 2.1.4.

3.2.4 Aquatic Impact Mitigation Buffers

The aim of the buffers (development setbacks) is to protect sensitive ecosystem such as wetlands, rivers, and streams from key risk associated with prospecting. By incorporating buffers into planning now, freshwater ecosystem is accounted for early in project planning, reducing impact potential down the line. The National Buffers Model for wetlands, river, and estuaries, published by the WRC (Macfarlane & Bredin, 2017). was consulted to determine a generic aquatic buffer for freshwater ecosystem. Ordinarily, the buffer model requires site specific information for each freshwater ecosystem to inform buffer widths that considers the nature of the environmental and the risks associated with the planned activity. Due to the scale of the project area and the early planning phase of the project, a generic aquatic buffer was applied to all aquatic ecosystems. This was based on the 'mining – prospecting' land use type contained in the buffer tool. The tool was then applied for a range of variables and ecosystem types and a generic width was established.

4. INTERPRETATION & USE OF SENSITIVITY MAPS

4.1.1 Planning Recommendations for Terrestrial Ecosystems

Terrestrial vegetation/habitat map

Terrestrial ecosystems were categorized into sensitivity classes following the guidelines in section 2.1.5, guiding the placement of prospecting pits. Consequently, areas categorized as 'High' and 'Moderate' sensitivity in terrestrial ecosystems should be avoided, while targeted prospecting activities are recommended within areas classified as 'Low' sensitivity.

4.1.2 Planning Recommendations for Freshwater Ecosystems

Freshwater ecosystem map

Unlike the terrestrial ecosystem sensitivity map, which has several sensitivity classes to inform siting of prospecting pits, freshwater ecosystems should be avoided irrespective of their sensitivity and ecosystem threat status. As such, all freshwater ecosystem boundaries should be considered high sensitivity and avoided. Watercourses such as rivers, wetland and drainage lines collect, retain, and convey surface water in the landscape and are sensitive to erosion and water quality impacts due to their location in the landscape.

Aquatic impact buffer map

According to the buffer model, the key risk associated with prospecting are sediment and turbidity impacts and water quality impacts from heavy metals (Table 2). Importantly, buffers are only suited to mitigate against certain impacts. These have been displayed in bold text in Table 2. Buffers are capable of mitigating two of the key impacts identified by the model. Based on the tool outputs for the range of ecosystems and site variables tested, an aquatic impact buffer of 40m is recommended. In addition, to the freshwater ecosystem themselves, aquatic buffers should be considered 'Moderate' sensitivity and ideally avoided too. The buffers will aid in the protection of sensitive freshwater ecosystems and mitigate against key risk identify by the buffer model.

Table 10. Desktop Threat Rating for the prospecting development type (after Macfarlane & Bredin, 2017).

Threat Posed by the proposed land use / activity		Desktop Threat Rating
Construction Phase	1. Alteration to flow volumes	N/A
	2. Alteration of patterns of flows (increased flood peaks)	VL
	3. Increase in sediment inputs & turbidity	H
	4. Increased nutrient inputs	N/A
	5. Inputs of toxic organic contaminants	N/A
	6. Inputs of toxic heavy metal contaminants	L
	7. Alteration of acidity (pH)	N/A
	8. Increased inputs of salts (salinization)	N/A
	9. Change (elevation) of water temperature	VL
	10. Pathogen inputs (i.e. disease-causing organisms)	VL
Operational Phase	1. Alteration to flow volumes	L
	2. Alteration of patterns of flows (increased flood peaks)	L
	3. Increase in sediment inputs & turbidity	L
	4. Increased nutrient inputs	L
	5. Inputs of toxic organic contaminants	L
	6. Inputs of toxic heavy metal contaminants	M
	7. Alteration of acidity (pH)	L
	8. Increased inputs of salts (salinization)	L
	9. Change (elevation) of water temperature	L
	10. Pathogen inputs (i.e. disease-causing organisms)	VL

Table 11. All freshwater ecosystems were assigned sensitivity rating of High and buffer zones 'Moderate'. Sensitivity ratings were assigned final sensitivity classes as follows:

Ecological Sensitivity Class	Interpretation for drill well siting
High	Areas to be avoided when siting drilling wells as these are ecologically sensitive.
Moderate	Potentially suitable areas for siting drilling wells. These areas should however be avoided if possible.

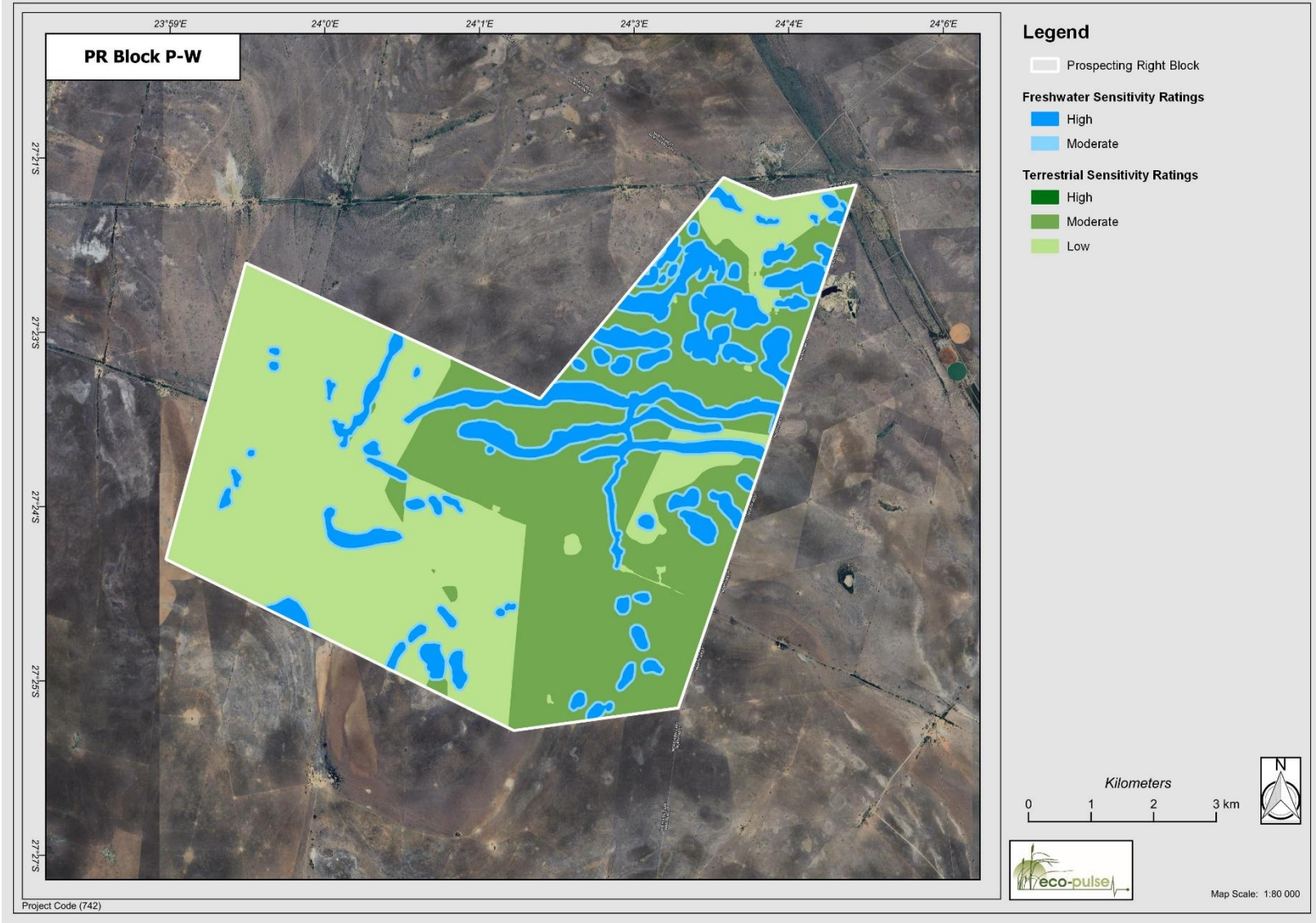
5. CONCLUSION & WAY FORWARD

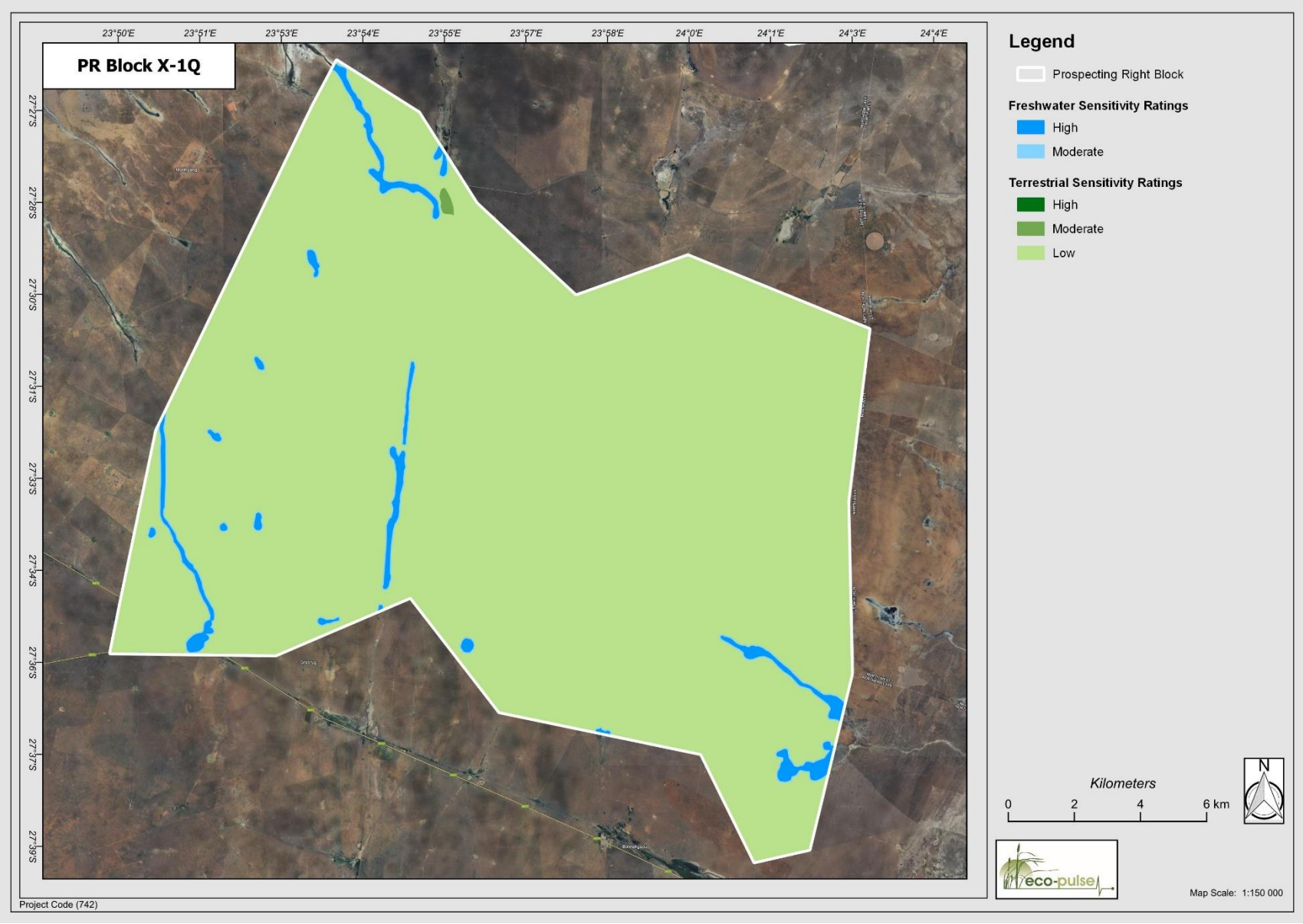
The sensitivity layers created for terrestrial and freshwater ecosystems in the initial phase are crucial for planning purposes. It is imperative to avoid sensitive areas, particularly those classified as 'High' sensitivity, to protect the environment and minimize project risks. These layers should be utilized alongside other informative data, such as geological surveys, to pinpoint potential prospecting locations.

Furthermore, it's anticipated that additional fieldwork will be necessary at selected prospecting sites. This fieldwork will help refine ecological sensitivity assessments and provide essential data for phase 2 of the assessment process. Phase 2 involves conducting detailed baseline studies and impact assessments, which are integral to inform environmental authorization. These activities align with EIA regulations and

Water Use License (WUL) requirements, ensuring compliance and thorough environmental management throughout the project lifecycle.

6. ANNEXURE A: DESKTOP SENSITIVITY MAPS




PR Block X-1Q
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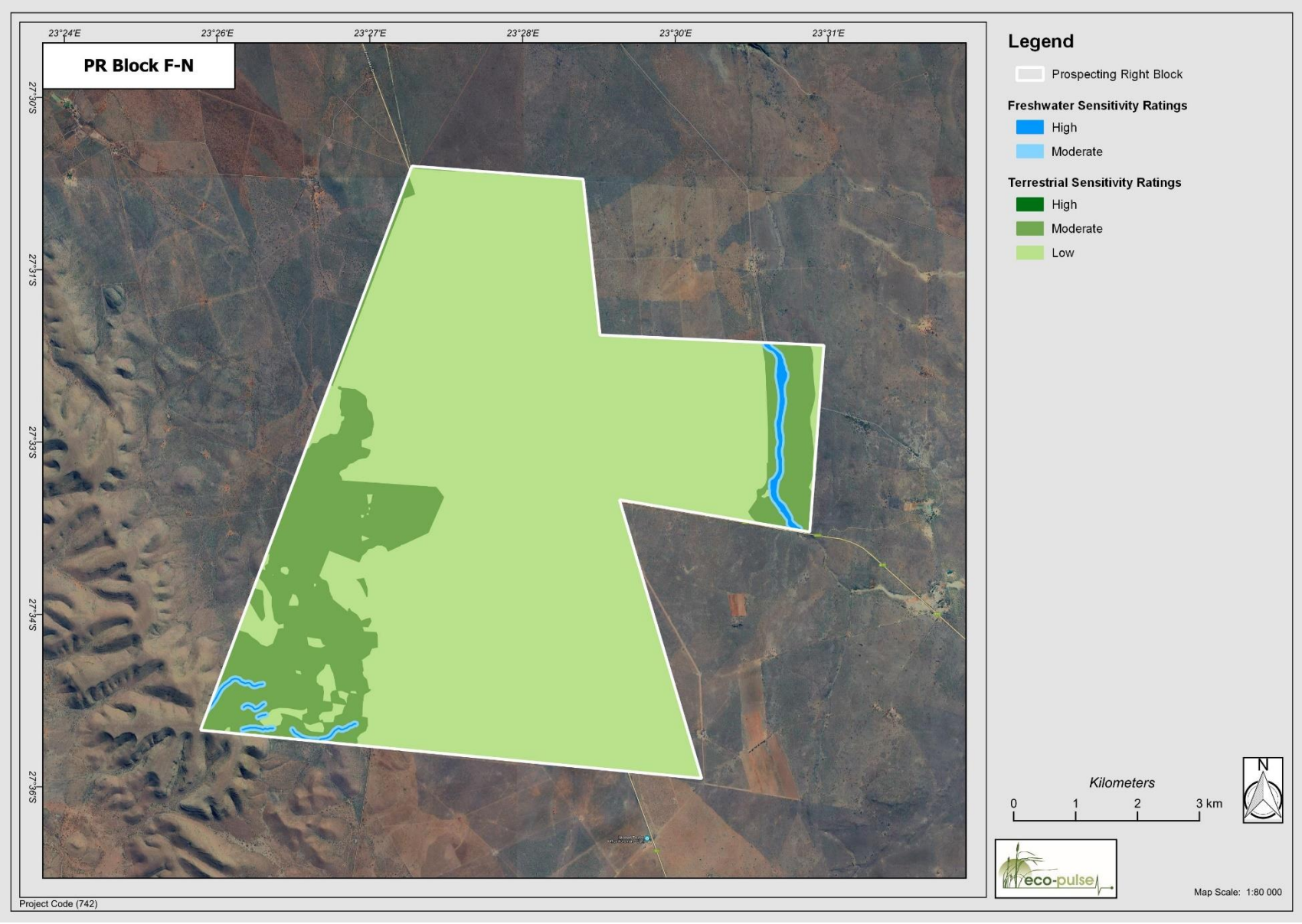
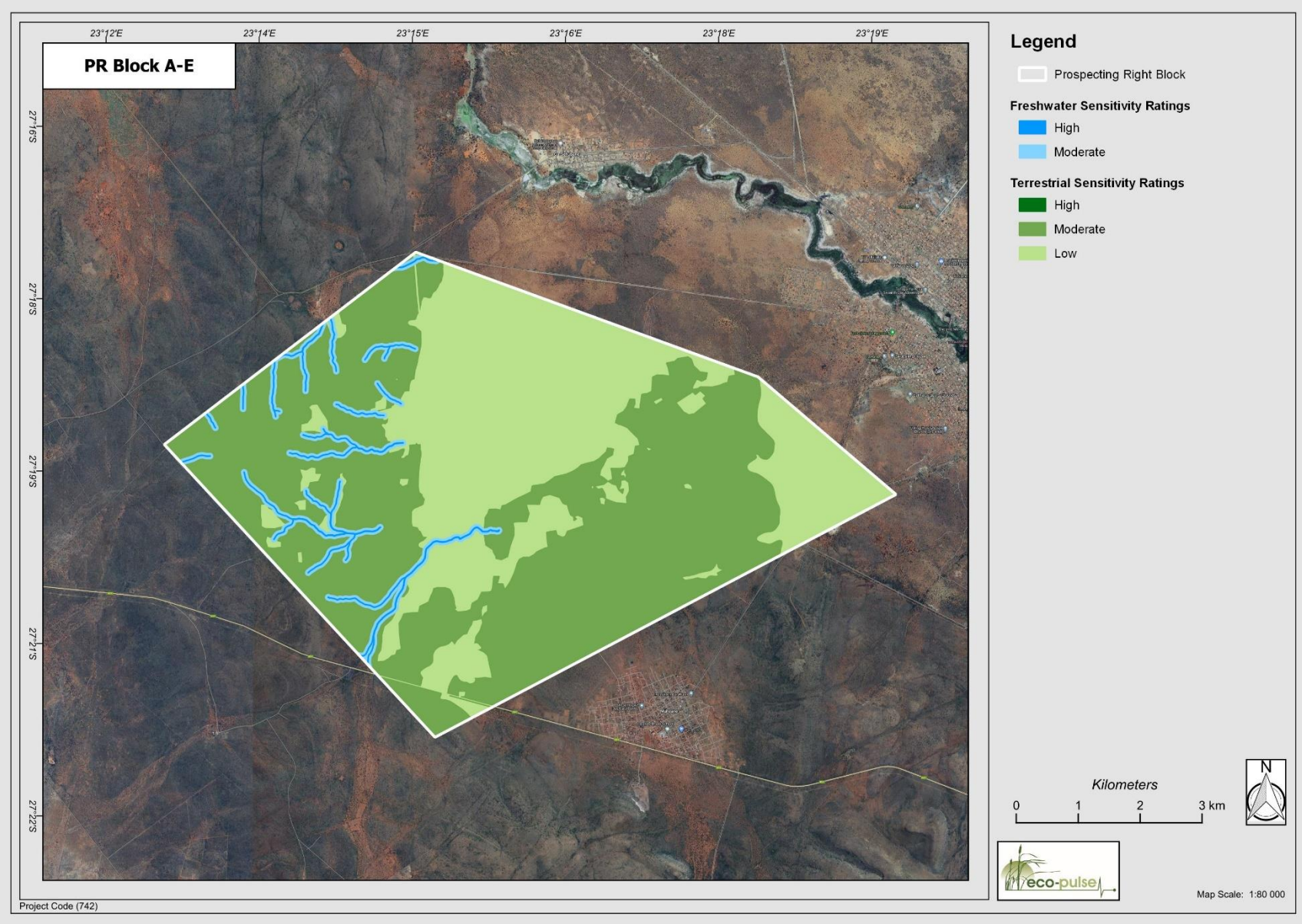
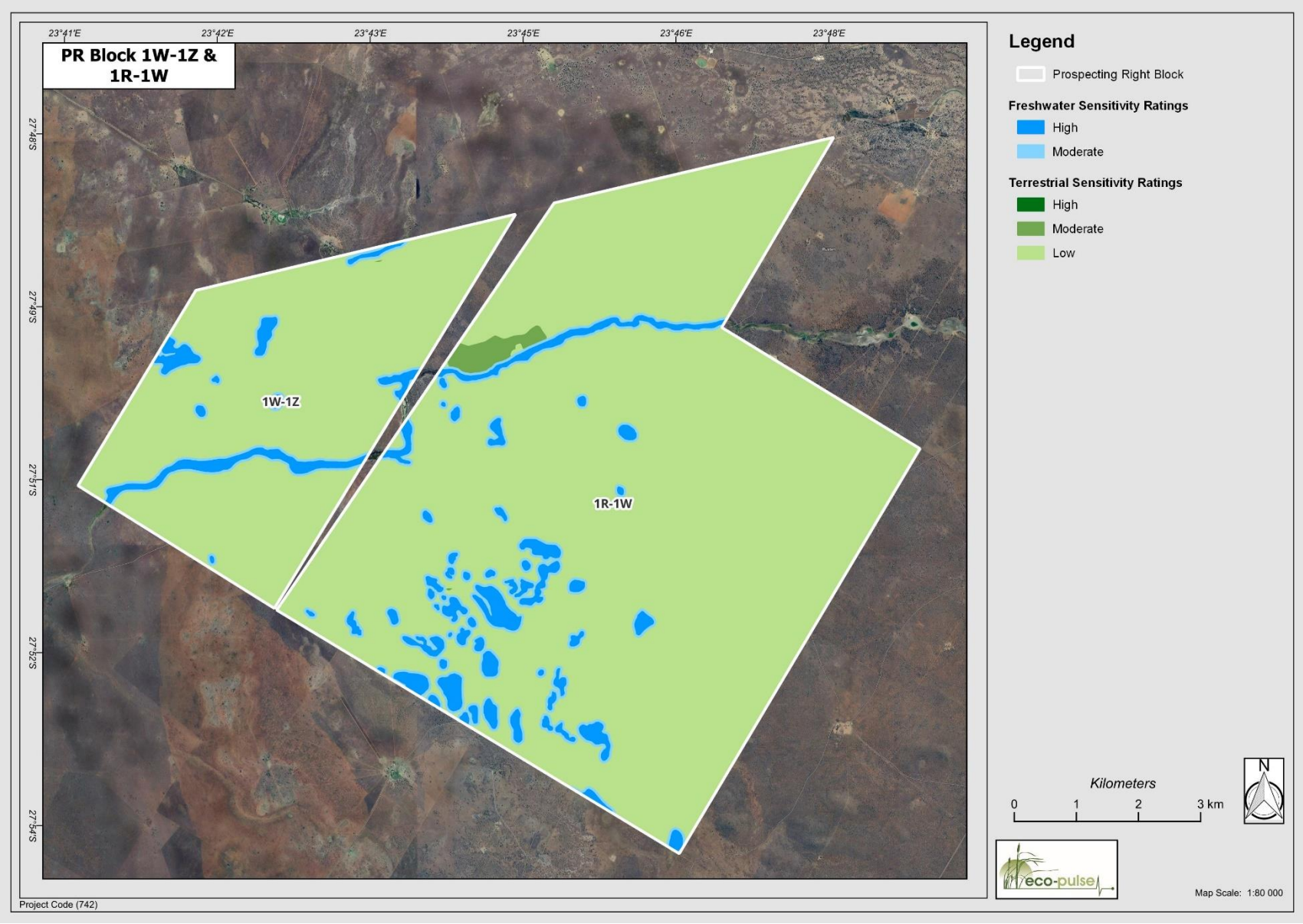
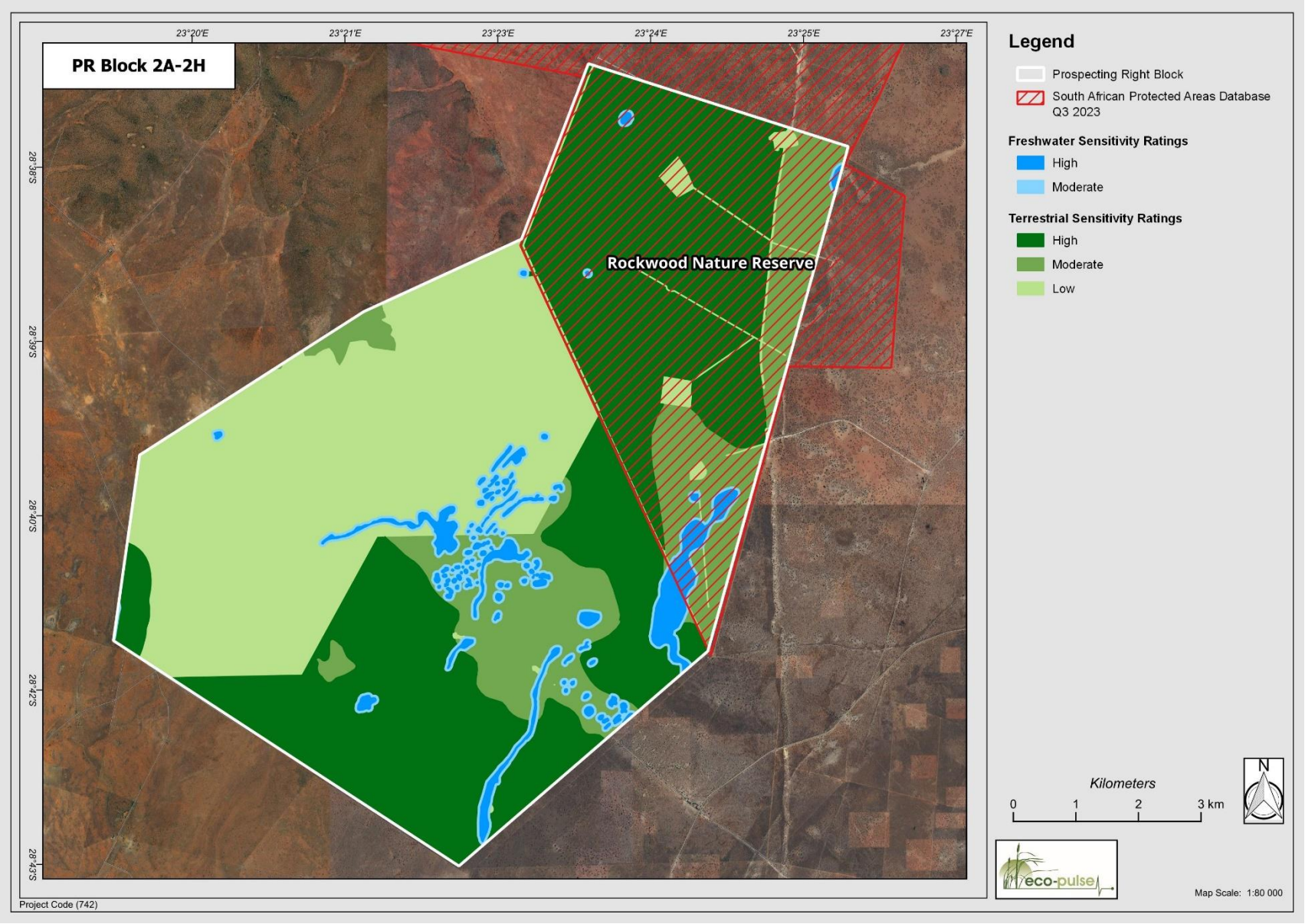
23°51'E
23°53'E
23°54'E
23°55'E
23°57'E
23°58'E
24°0'E
24°1'E
24°3'E
24°4'E
27°27'S
27°28'S
27°30'S
27°31'S
27°33'S
27°34'S
27°36'S
27°37'S
27°39'S
Legend
Prospecting Right Block
Freshwater Sensitivity Ratings
High
Moderate
Terrestrial Sensitivity Ratings
High
Moderate
Low
Kilometers
0
2
4
6 km
N
eco-pulse
Map Scale: 1:150 000
Project Code (742)


PR Block F-N
23°24'E
23°26'E
23°27'E
23°28'E
23°30'E
23°31'E
27°30'S
27°31'S
27°33'S
27°34'S
27°36'S
Legend
Prospecting Right Block
Freshwater Sensitivity Ratings
High
Moderate
Terrestrial Sensitivity Ratings
High
Moderate
Low
Kilometers
0
1
2
3 km
N
eco-pulse
Map Scale: 1:80 000
Project Code (742)


PR Block A-E
23°12'E
23°14'E
23°15'E
23°16'E
23°18'E
23°19'E
27°16'S
27°18'S
27°19'S
27°21'S
27°22'S
Legend
Prospecting Right Block
Freshwater Sensitivity Ratings
High
Moderate
Terrestrial Sensitivity Ratings
High
Moderate
Low
Kilometers
0
1
2
3 km
N
eco-pulse
Map Scale: 1:80 000
Project Code (742)


PR Block 1W-1Z & 1R-1W
23°41'E
23°42'E
23°43'E
23°45'E
23°46'E
23°48'E
27°48'S
27°49'S
27°51'S
27°52'S
27°54'S
1W-1Z
1R-1W
Legend
Prospecting Right Block
Freshwater Sensitivity Ratings
High
Moderate
Terrestrial Sensitivity Ratings
High
Moderate
Low
Kilometers
0
1
2
3 km
N
eco-pulse
Map Scale: 1:80 000
Project Code (742)


PR Block 2A-2H
Rockwood Nature Reserve
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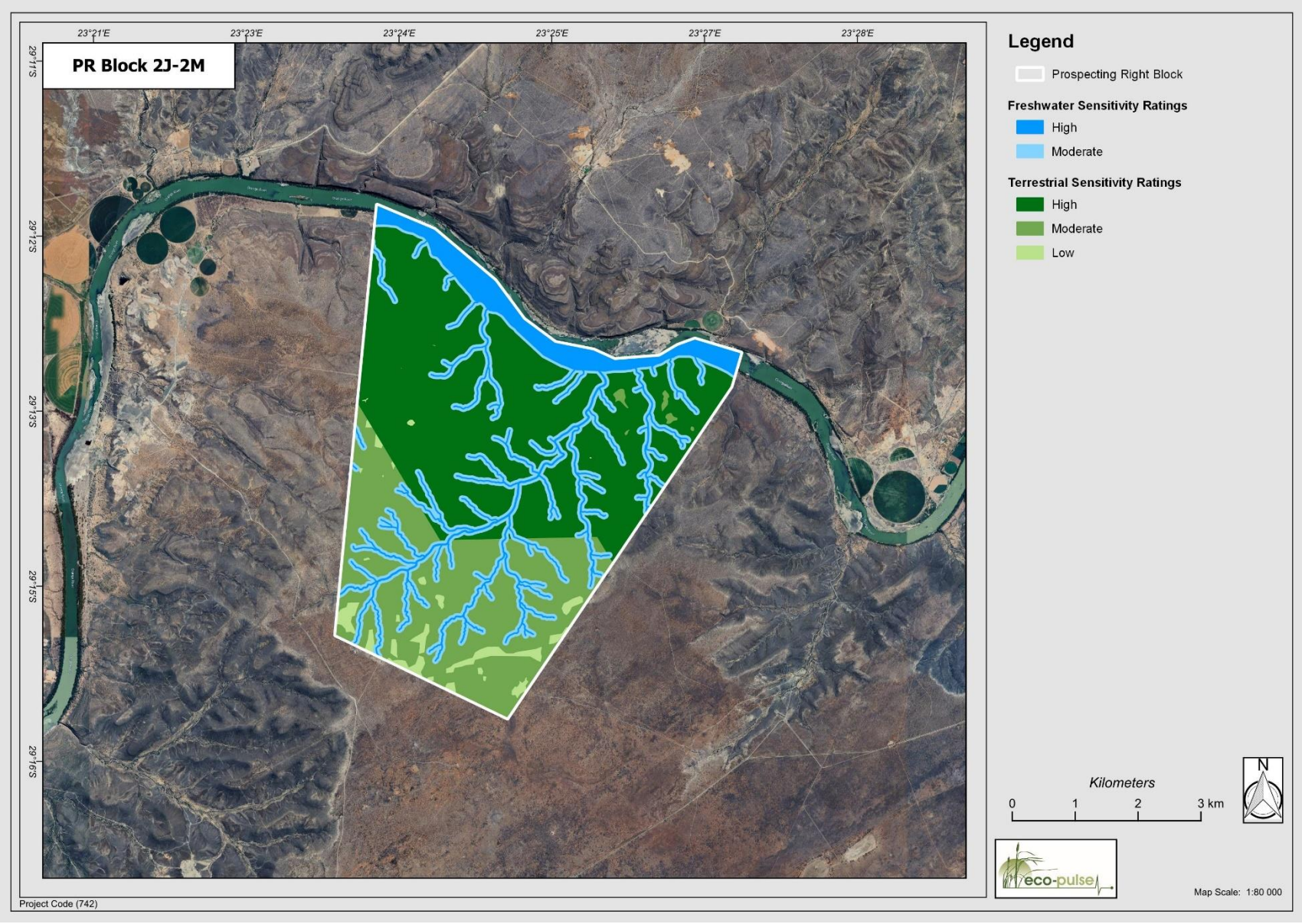
23°21'E
23°23'E
23°24'E
23°25'E
23°27'E
28°38'S
28°39'S
28°40'S
28°42'S
28°43'S
Legend
Prospecting Right Block
South African Protected Areas Database Q3 2023
Freshwater Sensitivity Ratings
High
Moderate
Terrestrial Sensitivity Ratings
High
Moderate
Low
Kilometers
0
1
2
3 km
N
eco-pulse
Map Scale: 1:80 000
Project Code (742)


PR Block 2J-2M
23°21'E
23°23'E
23°24'E
23°25'E
23°27'E
23°28'E
29°11'S
29°12'S
29°13'S
29°15'S
29°16'S
Legend
Prospecting Right Block
Freshwater Sensitivity Ratings
High
Moderate
Terrestrial Sensitivity Ratings
High
Moderate
Low
Kilometers
0
1
2
3 km
N
eco-pulse
Map Scale: 1:80 000
Project Code (742)

7. ANNEXURE B: SHAPEFILE METADATA

1. Terrestrial Metadata

Attribute Column	Description
Name	Prospecting Right Block Name
Name_18	Vegetation Type
MAPCODE18	Map code as per the National Vegetation Map (SANBI, 2018)
BIOME	Name of the biome as per the National Vegetation Map (SANBI, 2018)
BIOREGION	Name of bioregion as per the National Vegetation Map (SANBI, 2018)
NBA2018_PL	Protection Level as per the National Vegetation Map (SANBI, 2018)
NBA2018_RL	Red List Ecosystem Threat Level as per the National Vegetation Map (SANBI, 2018)
PES_Cat	Rapid rating for Present Ecological State (PES) for terrestrial ecosystems.
Type_1	Land cover type and condition
CBA_Cat	Conservation planning category according to the Northern Cape Biodiversity Plan (Collins, 2018).
SAPAD	South African Protected Area Database for the third quarter (Q3) of 2023
Eco_Sc	Numerical score associated with the ETS
CBA_Sc	Numerical score associated with the conservation planning category according to the Free State Province Biodiversity Plan (Holness and Oosthuysen, 2016).
PA_Sc	Numerical score associated with the SAPAD
MAX_Sc	Maximum score from Eco_Sc, CBA_Sc & PA_Sc
PES_Sc	Numerical score associated with the PES Category
REF_Sc	Final numerical sensitivity score
RATING	Final ecological sensitivity class

2. Freshwater Metadata

OBJECTID	Unique ID
Class	1 – Ephemeral headwater drainage lines and first order streams 2 – Ephemeral second order headwater streams 3 – Seasonal and/or third order streams 4 - Perennial Lowland River (active channel) 4 - Perennial Lowland River (riparian zone) 5 - Channelled Valley-Bottom Wetland 6 - Depression Wetland 7 - Seep wetland 8 - Unchannelled Valley-Bottom wetland
ETS2018	Cr – Critically Endangered LT – Least Threatened LC – Least Concern
EPL2018	NP – Not Protected PP – Poorly Protected
CS_L4A	Channelled Valley-Bottom Depression Lowland Mountain Stream Seep Unchannelled Valley-Bottom Upper Foothills
RATING	High

3. Freshwater Ecosystem Buffer Metadata

OBJECTID	Unique ID
BUFF_WIDTH	40m
RATING	Moderate

8. ANNEXURE C: DESKTOP SCC LIKELIHOOD OF POTENTIAL OCCURRENCE ASSESSMENT

The determination of ecological importance requires the consideration of whether the vegetation community described and classified in this assessment provide habitat for rare or threatened flora and fauna. In order to inform the EIS assessment and flag the need for additional floral or faunal surveys, a desktop likelihood of occurrence assessment of threatened flora and fauna was undertaken based on available data on species records and distributions, habitat preference and the recorded vegetation condition that acted as proxy for habitat condition and suitability.

Flora Likelihood of Occurrence

Interrogation of SANBI's online New POSA species database and the EIA online screening tool highlighted the potential occurrence of numerous protected, endemic and threatened species within the study area. Review of the habitat preference of threatened species against vegetation communities recorded within the study area highlighted the potential presence of one species which are considered Endangered, Vulnerable, Near Threatened, Data Deficient, Rare and/or Endemic. No species were flagged by POSA. Details of the assessment results are provided in Table 11.

Table 1. Potential occurrence of flora species within the study area.

Scientific Name	Threat Status	Habitat Preferences	Rationale	POC	Source
Antimima lawsonii	Rare	A South African endemic, confined to the Kimberley district in the Northern Cape.	Highly unlikely or Improbable	Low	EIA Screening Tool

Fauna Likelihood of Occurrence

The findings of the desktop faunal likelihood of occurrence (LOC) assessment have been summarised in this section of the report. Potential amphibians, avifauna (birds), mammals, reptiles and invertebrates of conservation concern (i.e. Red-Dated Listed Species: CR: Critically Endangered, EN: Endangered, VU: Vulnerable, NT: Near Threatened) are documented below. *Note that species of Least Concern (LC), endemic species and species with restricted ranges have been excluded from the assessment, with the focus being on Red-Data species.*

A. Mammals

Review of the available Red List databases highlighted eight mammal species of conservation concern modelled to occur within and around the study area. Conservation important small mammal species are unlikely to occur within transformed habitats in the study area, although some species may potentially utilise the more intact remnant primary grassland patches (see Table 12 below for details). Larger mammal species have either been eradicated or have moved away from the area due to the presence of human activity and disturbance associated with human occupation in the area.

Table 2. Potential occurrence of mammal species within the study area.

Species Name	Threat Status	Habitat Requirements/ Preferences	Rationale	POC	Source
Southern African Hedgehog *(Atelerix frontalis)*	NT	The distribution mainly falls within savannah and grassland vegetation types, within which it is found in a wide variety of semi-arid and sub-temperate habitats, including scrub brush, western Karoo, grassland and suburban gardens (Skinner & Chimimba 2005). They require ample ground cover, for cover, nesting and insect food sources (Skinner & Chimimba 2005). Key grassland vegetation types include the Soweto Highveld, Eastern Highveld, Rand Highveld, Carletonville Dolomite, Vaal-Vet Sandy and Frankfort Highveld Grasslands. The main savannah vegetation types include Polokwane Plateau Bushveld, Central Sandy Bushveld, Kimberley Thornveld, Moot Plains Bushveld, and Queenstown Thornveld (Mucina & Rutherford 2006). Northern Upper Karoo vegetation is also one of the important vegetation types for the species.	Unlikely	Medium: unlikely	Mammal Map
Temminck's Ground Pangolin *(Smutsia temminckii)*	VU	It is a predominantly solitary, terrestrial species that is present in various woodland and savannah habitats, preferring arid and mesic savannah and semi-arid environments at lower altitudes, often with thick undergrowth, where average annual rainfall ranges between 250 and 1,400 mm (Skinner & Chimimba 2005). They also occur in floodplain grassland, rocky slopes and sandveld up to 1,700 m (Coulson 1989; Pietersen 2013), but are absent from Karroid regions, tropical and coastal forests, Highveld grassland and coastal regions. The range is believed to largely be determined by the presence and abundance of ant and termite prey species and the availability of dens or above-ground debris in which to shelter.	Unlikely	Medium: unlikely	Mammal Map

Species Name	Threat Status	Habitat Requirements/ Preferences	Rationale	POC	Source
Black-footed Cat *(Felis nigripes)*	VU	The Black-footed Cat is one of the world's smallest cats, with females weighing an average of 1.3 kg and males larger at 1.93 kg (Sliwa 2013). The conspecific and more common African Wildcat (Felis silvestris) is considerably larger (females 3.9 kg; males 5.1 kg) (Sliwa et al. 2010). Unlike most cat species, these cats are predominantly ground dwellers and will not readily take to trees. They lead a solitary existence except when with kittens or during brief mating periods. Black-footed Cats are extremely secretive in nature. They are strictly crepuscular and nocturnal and are active throughout the night, even hunting at temperatures of –8˚C (Olbricht & Sliwa 1997). During the day, the cats make use of dens. The species prefers hollowed out abandoned termite mounds when available (especially for the kittens, Figure 3), but will use dens dug by other animals such as Springhares, Cape Ground Squirrels (Xerus inauris) and Aardvark (Orycteropus afer). It is a specialist of open, short grass areas with an abundance of small rodents and ground roosting birds.	Possible	Medium: possible	Mammal Map
Vlei Rat (*Otomys auratus)*	NT	This species is associated with mesic grasslands and wetlands within alpine, montane and sub-montane regions (Monadjem et al. 2015), typically occurring in dense vegetation in close proximity to water (for example, Wandrag et al. 2002; Watson 2006). In the Drakensberg range, O. angoniensis occurs on the lower slopes in savannah habitats, O. auratus and O. laminatus occur at mid-elevation in grasslands and O. sloggetti at the highest elevations in alpine heath habitats (Monadjem et al. 2015). Where O. auratus and O. angoniensis co-occur at the same site, the former is associated with sedges and grasses adapted to densely vegetated wetlands with wet soils, while the latter is associated with plant species that typically grow in the drier margins of wetlands (Davis 1973).	Highly unlikely or Improbable	Low	Mammal Map
Leopard (*Panthera pardus)*	VU	The Leopard has a wide habitat tolerance, including woodland, grassland savannah and mountain habitats but also occur widely in coastal scrub, shrubland and semidesert (Hunter et al. 2013; Stein et al. 2016). Densely wooded and rocky areas are preferred as choice habitat types.	Highly unlikely or Improbable	Low	Mammal Map
African wild dog *(Lycaon pictus)*	EN	Wild Dogs can survive in most habitat types as long as the habitat is large enough, contains sufficient suitable prey and is free from direct threats such as accidental and deliberate persecution. In most areas within the assessment region Common Impala (Aepyceros melampus) is the principal prey species, and the remainder of the diet is likely to include Greater Kudu (Tragelaphus strepticeros), Common Duiker (Sylvicapra grimmia) and/or Nyala (Tragelaphus angasi). Common Warthogs (Phacochoerus africanus) are also taken in some populations. They will give chase of larger species, such as Common Eland (Tragelaphus oryx) and African Buffalo (Syncerus caffer), but rarely kill such prey.	Highly unlikely or Improbable	Low	Mammal Map

Species Name	Threat Status	Habitat Requirements/ Preferences	Rationale	POC	Source
Dent's Horseshoe Bat (*Rhinolophus denti)*	NT	This species is associated with arid savannah habitats where suitable roosting sites occur; typically restricting it to broken country with rocky outcrops or suitable caves (Monadjem et al. 2010). Even the most southeasterly record in Africa comes from the drier southwestern part of the Free State Province (Watson 1998). Colonies are largely dependent on caves, caverns, crevices in rocky outcrops, abandoned mines (including asbestos mines; M. C. Schoeman unpubl. data), and similar habitats for roosting (Herselman & Norton 1985; Churchill et al. 1997), although they have also been found roosting in hollow trees, as well as under the thatched roof of a house and in a road culvert (Shortridge 1934). As it is not able to fly large distances, due to its short, broad wings (Schoeman & Jacobs 2008), its home range is thus suspected to be under 10 km2. In the assessment region, the species is recorded from Kalahari Duneveld, Eastern Kalahari Bushveld and Dry Highveld Grassland. It is a clutter forager, with its diet consisting mainly of Lepidoptera.	Possible	Medium: possible	Mammal Map
Acinonyx jubatus (*Acinonyx jubatus)*	VU	The free-roaming population in northern South Africa is connected through Botswana to Namibia and to a limited extent through Zimbabwe to the rest of southern Africa. Thus, the range within the assessment region is contiguous with the rest of the southern African range but it is unclear whether dispersal or movement actually occurs along these borders. Similarly, there are known Cheetah occurrences in the Mozambique side of the Great Limpopo Transfrontier Park (GLTP) (IUCN SSC 2007) (this population established following the dropping of fences with KNP in 2003), and there may be links through to Gonarezhou National Park in Zimbabwe which has resident Cheetah.	Possible	Medium: possible	Mammal Map

B. Avifauna (birds)

Birds of conservation concern were identified through use of the South African Bird Atlas Project (SABAP) database (available online at http://sabap2.adu.org.za/). Whilst the majority of species recorded by the SABAP2 are considered locally common birds, there are six bird species that are considered to be of conservation concern based on their threat status (Table 13, below).

Table 3. Potential occurrence of avifaunal species within the study area.

Species Name	Threat Status	Habitat Requirements/ Preferences	Rationale	POC	Source
Ludwig's Bustard *(Neotis ludwigii)*	EN	Within the region, it occurs predominantly in the dry Karoo region of western South Africa (Herholdt 1988), extending eastwards into Free State, southwards into Eastern Cape and Western Cape provinces and northwards into Northern Cape. Ludwig's Bustard occurs in the flat, open, semi-arid shrublands of the Succulent Karoo, Nama Karoo and Namib (Allan 1994). It is tolerant of a variety of habitats and, depending on rainfall, may be found in the western grasslands of Free State and Eastern Cape, the southern Kalahari and cultivated fields and pastures (Allan 1994).	Highly Probable	High: probable	EIA Screening Tool
Burchell's Courser *(Cursorius rufus)*	VU	SABAP2 records show that it still persists in scattered locations in the dry interior, with concentrations of records in south-western Free State, Northern Cape and North West.Burchell's Courser shows a preference for open, desert and semi-desert habitats, often occurring in the most sparsely vegetated areas available (Cohen and Spottiswoode 2000). Typical habitats include heavily grazed or burnt grassland, stony or gravelly plains, stubbly sandveld, dry riverbeds and edges of saline pans (Hockey and Douie 1995, Maclean and Herremans 1997). Historically it may have been associated with large ungulate herds, and it is still regularly seen in the vicinity of wild ungulate herds and to some extent, domestic grazers, for example, around stock watering points. It occasionally makes use of ploughed fields or cereal croplands with small emerging seedlings (Lloyd 2005).	Possible	Medium: possible	EIA Screening Tool
Caspian Tern *(Hydropogne caspia)*	VU	The species breeds colonially, with the season varying between localities (Crawford 1997). The number of colonies used for breeding and the numbers of birds present at each varies widely between years (Crawford 1997). Breeding habitat used along the coast is largely offshore islands with an increasing use of sandy beaches and islands at salt works, where protection is offered (du Toit et al. 2003). Breeding at inland sites takes place on small, low islets in pans and dams. Caspian Terns are intolerant of any form of disturbance while breeding. A generation length of 12.2 years is provided by BirdLife International (2014). Hunting is carried out 3-20 m above the water, parallel to, and within 100 m of the shoreline. Birds dive head first into water when catching prey (Cyrus and McLean 1994) and feed throughout the day with most activity during the morning. Their diet consists almost entirely of fish of 5-20 cm in length and weighing 10-20 g.	Possible	Medium: possible	EIA Screening Tool
Secretary Bird *(Sagittarius serpentarius)*	VU	The species prefers open grassland and scrub, with the ground cover shorter than 50 cm and with sufficient scattered trees as roost/nest sites. It extends into savannah where sufficiently open areas exist (Boshoff and Allan 1997, Dean and Simmons 2005). It is absent from Mountain Fynbos, forest, dense woodland and very rocky, hilly or mountainous woodland (Boshoff and Allan 1997). It occurs from sea-level to montane grasslands over 2000 m. Nests are large, stick platforms usually built on top of isolated flat-crowned trees, and particularly vachellias (acacias); where indigenous thorny trees are not available, alien pines or wattles may also be used (Tarboton 2011).	Highly Probable	High: probable	EIA Screening Tool

Species Name	Threat Status	Habitat Requirements/ Preferences	Rationale	POC	Source
Verreaux's Eagle *(Aquila verreauxii)*	VU	Verreaux's Eagle has a wide distribution throughout Africa, stretching from Eritrea and Ethiopia in the north, southward to South Africa (Ferguson-Lees and Christie 2001). Within the region, the species is distributed across five different biomes: Fynbos, Grassland, Savannah, Nama-Karoo and Succulent Karoo. Within these biomes, it is mainly restricted to mountainous terrain (Davies and Allan 1997) because of its hunting and breeding biology. The distribution is closely linked to the presence of Rock Hyrax Procavia capensis (Gargett and Mundy 1990).	Highly Probable	High: probable	SABAP2
Bateleur *(Terathopius ecaudatus)*	EN	Within South Africa, the species has been largely extirpated outside of protected areas, with Kruger National Park now holding the majority of the regional population, followed by Kgalagadi Transfrontier Park and the northern KwaZulu-Natal parks of Hluhluwe-iMfolozi Park and iSimangaliso Wetland Park. The adults are largely sedentary (Brown et al. 1982), while juveniles disperse from their natal areas (Simmons 2005). The species is found in savannah and open to moderately dense woodland, including Kalahari thornveld, Vachellia (Acacia) savannah and Mopane Colophospermum mopane woodlands (Simmons 1997, Simmons 2005) as well as semi-desert shrubland. It is absent from mountains, heavily wooded and treeless habitats. The species is a scavenger and hunter, with juveniles and immatures in Kruger National Park scavenging up to 85% of prey items.	Unlikely	Medium: unlikely	SABAP2

C. Reptiles

No reptile SCC are expected to occur within site areas.

D. Amphibians

No frog SCC are expected to occur within site areas.

E. Invertebrates

Very few formal surveys of invertebrates have been carried out in the study area. A review of the EIA Screening Tool Report for the site, LepiMap, SpiderMap, ScorpionMap, OdonataMap accessed from http://vmus.adu.org.za/; no SCC are expected to occur within site areas.