APPENDIX E: SPECIALIST STUDIES

- Terrestrial Biodiversity Study
- Freshwater Ecosystem Study
- Soils and Agricultural Study
- Cultural/Heritage (Desktop) Study
- Palaeontology (Desktop) Study
- Financial Provision

- Terrestrial Biodiversity Study

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TERRESTRIAL BIODIVERSITY ASSESSMENT OF THE PROSPECTING SITE AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED PROSPECTING ACTIVITIES ON PORTION OF OF THE FARM RUIGHOEK, NORTH WEST PROVINCE

Prepared for

SLR Consulting

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SAS Environmental Group of Companies

EXECUTIVE SUMMARY

Scientific Terrestrial Services CC (STS) was appointed by SLR Consulting (SLR) to conduct a terrestrial biodiversity assessment as part of the Environmental Authorisation (EA) process for the proposed prospecting project to be conducted by Pilanesberg Platinum Mine (PPM) on a 4.7 hectare (ha) section of land on Portion 5 of the farm Ruighoek, near Rustenburg North West Province. For ease of reference the 4.7 ha area in which the proposed prospecting activities will take place will henceforth be referred to as the "**study area**" and Portion 5 of the farm Ruighoek as "**the farm portion**". The proposed prospecting activities include the drilling of nine boreholes and the prospecting of five trenches.

Given safety concerns related to the presence of illegal miners within the vicinity of the study area, access to the study area in which prospecting activities is proposed was not possible during the site assessment. STS was however permitted to access certain points of interest (POIs) as deemed "safe" by the Pilanesberg Platinum Mine (PPM) security team. These POIs were thus used to infer the present ecological state (PES), sensitivity, and the floral and faunal communities associated with the study area.

Following the field assessment, three habitat units were distinguished for the study area. These habitat units were inferred using satellite imagery as a guide (to assess historic impacts), together with field experience in the area, and the extrapolation of habitat integrity and species composition from nearby POIs:

1. **Thornveld Habitat** – this habitat unit is in the west of the study area and is largely homogenous, supporting a moderate to moderately low species richness;
2. **Degraded Thornveld Habitat**[1] – this habitat unit is located within the central regions of the study area and is likely the result of current and historic anthropogenic impacts; and
3. **Freshwater Habitat**: This habitat unit was the smallest habitat unit within the study area and is associated with the ephemeral Mothlabe River.

From a floral perspective, the sensitivities associated with each of the habitat units was as follows: the Thornveld and the Degraded Thornveld Habitats were of a **moderately low sensitivity**, and the Freshwater Habitat was of **intermediate sensitivity.** From a faunal perspective, the Freshwater Habitat and Thornveld scored an **intermediate sensitivity** and the Degraded Thornveld on the was considered to be of **moderately low faunal sensitivity.**

No species of conservation concern (SCC), including Red Data List (RDL) species, Threatened or Protected Species (TOPS), nationally protected trees (as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA)), or species protected by the Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983) (TNCO), were observed during the field assessments. However, suitable habitat to support several protected species is present within the study area. If the proposed prospecting activities are authorised, it is recommended that a summer season walkthrough of the study area be conducted, and all SCC be marked and considered for possible relocation to suitable habitat in the nearby, natural surrounding areas. It is recommended that for species that cannot be relocated, seedlings and /or seeds of these species are harvested form the prospecting footprint area before clearing activities commence and grown under nursery conditions with the purpose to use these species for rehabilitation at a later stage. Permits from the relevant authorities will be required before any removal or relocation of any species of SCC can take place. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation.

No faunal SCC or signs thereof were observed during the site assessment and the likelihood of most SCC (listed in Appendix I) occurring within the study area, is reduced by bush encroachment, possible human-wildlife conflict and disturbances that exist in the area as a result of an extensive informal community and illegal mining present in the region. However, it cannot be ruled out that eight SCC as listed in section 4.3 of this report will not make use of the study area, as their distribution ranges and habitat requirements for foraging overlap the study area. However, the study area is not considered crucial habitat from a faunal SCC perspective, and it is unlikely that potentially occurring SCC that utilise

[1] The habitat description of the Degraded habitat unit is limited to observations of nearby POIs. The nearby POIs assessed do not necessarily provide an accurate indication of the conditions and impacts experienced within this habitat unit (particularly within the study area) and thus habitat descriptions are based on satellite imagery and prior field experience within the area.

the study area, will be significantly impacted by the proposed prospecting development and its activities considering the localised extent of the proposed activities and the ability of most SCC to move to surrounding areas. In the event that any faunal SCC are encountered during the course of the proposed prospecting activities, is advised that an appropriate relocation plan, guided by the relevant specialist and provincial authorities, be created and implemented. Any species found as listed under NEMBA: TOPS list of 2007, (refer to Table I8 in Appendix I of this report) will require a permit, should they need to be relocated during prospecting activities.

The study area is not located within a threatened vegetation type or within a protected area. According to the North West Biodiversity Sector Plan (NWBSP), the study area is located within an area classified as a Critical Biodiversity Area 2 (CBA2). Given the level of anthropogenic influences experienced across the study area and greater surrounding areas, e.g., intense grazing pressures and subsequent woody encroachment, alien and invasive plant (AIP) proliferation, etc., the presence of CBA2 habitat was not confirmed for either the Thornveld or the Degraded Thornveld Habitat units. Although the Freshwater Habitat has been impacted by anthropogenic influences (e.g., dumping) and edge effects (e.g., erosion and AIP proliferation), it still has the potential to provide important ecological services within the study area and the greater surrounding areas, e.g., including connective and dispersal corridors, albeit in an altered fashion. As such, the freshwater habitat is considered representative of CBA2 habitat. Provided that mitigation measures are appropriately implemented, the associated impacts to the CBA habitat, i.e., that within the freshwater habitat, can be reduced to lower levels. Given that the proposed prospecting activities are localised in scale and extent, such activities are unlikely to have a significant impact on the immediate area.

From a floral perspective, the impacts associated with the proposed prospecting activities ranged from medium to low prior to the implementation of mitigation measures. With mitigation fully implemented, all impacts associated with the floral component of the study areas can be reduced. From a faunal perspective, the impacts associated with proposed prospecting activities ranged from Medium to Low without the implementation of mitigation measures. Should all mitigatory measures stipulated in this report be effectively adhered to, impacts to the faunal assemblage can be reduced.

As access to the study area itself was not possible, the conclusions drawn from this report should be interpreted with this limitation in mind. This report thus serves as a baseline for planning purposes only. Once final prospecting layouts have been finalised, the report should be updated, and a subsequent field assessment of the study area be conducted by a suitably qualified specialist to confirm and/or update the ecological particulars (e.g., habitats, community compositions, and sensitivities) associated with the floral and faunal communities within the study area.

It is the opinion of the ecologists that this study provides the relevant information required to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

DOCUMENT GUIDE

The table below provides a guide to the reporting of biodiversity impacts as they relate to 1) Government Notice No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Biodiversity** as published in Government Gazette 43110 dated 20 March 2020, and 2) Government Notice No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Plant and Animal Species** as published in Government Gazette 43855 dated 30 October 2020.

Theme-Specific Requirements as per Government Notice No. 320 Terrestrial Biodiversity Theme – Very High Sensitivity Rating as per Screening Tool Output		
No.	**SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS**	**Section in report/Notes**
2	**Terrestrial Biodiversity Specialist Assessment**	
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	Appendix J
2.2	The assessment must be undertaken on the preferred site and within the proposed prospecting footprint.	Section 1
2.3	**The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:**	
2.3.1	A description of the ecological drivers or processes of the system and how the proposed development will impact these;	Section 4
2.3.2	Ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site;	Section 4
2.3.3	The ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	Section 4
2.3.4	The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Area (*FEPA*) sub catchments;	Section 4
2.3.5	A description of terrestrial biodiversity and ecosystems on the preferred site, including: a) main vegetation types; b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified; c) ecological connectivity, habitat fragmentation, ecological processes and fine scale habitats; and d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;	Section 3 (desktop analysis) The Zeerust Thornveld and Pilanesberg Mountain Bushveld were identified as the main vegetation types. Refer to Figures 6 and 7 in section 3.
2.3.6	The assessment must identify any alternative prospecting footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	Not Applicable.
2.3.7	**The assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:**	
2.3.7.1	Terrestrial Critical Biodiversity Areas (CBAs), including: *a) the reasons why an area has been identified as a CBA;* *b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;* *c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);* *d) the impact on ecosystem threat status;* *e) the impact on explicit subtypes in the vegetation;* *f) the impact on overall species and ecosystem diversity of the site; and* *g) the impact on any changes to threat status of populations of species of conservation concern in the CBA;*	Section 3 (desktop analysis) and 4 The study area is within 10 km of CBAs and ESAs.
2.3.7.2	Terrestrial Ecological Support Areas (ESAs), including:	

	a) *the impact on the ecological processes that operate within or across the site;* b) *the extent the proposed development will impact on the functionality of the ESA; and* c) *loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;*	
2.3.7.3	Protected areas as defined by the National Environmental Management: Protected Areas Act, 2003 including- a) *an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;*	Section 3 (desktop analysis) The study area is located within 10 km of 3 protected areas.
2.3.7.4	Priority areas for protected area expansion, including- a) *the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;*	Section 3 (desktop analysis) The study area is not located within 10 km of any priority areas of protected area expansion.
2.3.7.5	SWSAs including: a) *the impact(s) on the terrestrial habitat of a SWSA; and* b) *the impacts of the proposed development on the SWSA water quality and quantity (e.g., describing potential increased runoff leading to increased sediment load in water courses);*	Section 3 (desktop analysis) No SWSAs were associated with the study area nor were any located within 10 km of the study area.
2.3.7.6	FEPA sub catchments, including- a) *the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;*	Not Applicable
2.3.7.7	Indigenous forests, including: a) *impact on the ecological integrity of the forest; and* b) *percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.*	Not Applicable
2.4	**The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.**	
	Results of the **Floral Assessment** as well as conclusions on Terrestrial Biodiversity as it relates to vegetation communities and the results of the **Faunal Assessment** as well as conclusions on Terrestrial Biodiversity as it relates to faunal communities are in **Sections 4 – 6.**	
3	**Terrestrial Biodiversity Specialist Assessment Report**	
3.1	**The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:**	
3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix J
3.1.2	A signed statement of independence by the specialist;	Appendix J
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 1.2
3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 2 Appendices C, D & E
3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.4
3.1.6	A location of the areas not suitable for development, which are to be avoided during prospecting and operation (where relevant);	Section 5
	Impact Assessment Requirements 3.1.7 Additional environmental impacts expected from the proposed development; 3.1.8 Any direct, indirect and cumulative impacts of the proposed development; 3.1.9 The degree to which impacts and risks can be mitigated; 3.1.10 The degree to which the impacts and risks can be reversed; 3.1.11 The degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 6

	3.1.12 Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	
3.1.13	A motivation must be provided if there were prospecting footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	**Not Applicable to this report**
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Executive Summary & Section 7
3.1.15	Any conditions to which this statement is subjected.	Section 5 & 6
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.	This report is submitted to the EAP and applicant and will be appended to the EIA / EMP by the EAP in due course as part of the application process
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	

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GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson *et al*. (2011), Hui and Richardson (2017) and Wilson *et al*. (2017), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), and the associated Alien and Invasive Species Regulations, 2020].

Alien species (syn. exotic species; non-native species)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Biological diversity or Biodiversity (as per the definition in NEMBA)	The variability among living organisms from all sources including, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.
Biome - as per Mucina and Rutherford (2006)	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate, and major large-scale disturbance factors (such as fires).
Bioregion (as per the definition in NEMBA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act;
Critical Biodiversity Area (CBA)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation, and ridges.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g., southern Africa), national (South Africa), provincial, regional, or even within a particular mountain range.
Ecological Support Area (ESA)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Ground-truth	Ground truth is a term used in various fields to refer to information provided by direct observation (i.e., empirical evidence) as opposed to information provided by inference.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
Important Bird and Biodiversity Area (IBA)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (as per the definition in NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.
Listed alien species	All alien species that are regulated in South Africa under the NEMBA, Alien and Invasive Species Regulations, 2020.
Least Threatened	Least threatened ecosystems are still largely intact.
Merensky Reef (UG2)	The Merensky Reef is a layer of igneous rock in the Bushveld Igneous Complex (BIC) in the North West, Limpopo, Gauteng and Mpumalanga provinces of South Africa which together with an underlying layer, the Upper Group 2 Reef (UG2), contains most of the world's known reserves of platinum group metals (PGMs) or platinum group elements (PGEs)—platinum, palladium, rhodium, ruthenium, iridium and osmium. The Reef is 46

	cm thick and bounded by thin chromite seams or stringers.The composition consists predominantly of cumulate rocks, including leuconorite, anorthosite, chromitite, and melanorite.
Native species (syn. indigenous species)	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g., species are still native if they increase their range as a result of watered gardens but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
Red Data Listed (RDL) species	According to the Red List of South African plants (http://redlist.sanbi.org/) and the International Union for Conservation of Nature (IUCN), organisms that fall into the Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Species of Conservation Concern (SCC)	The term SCC in the context of this report refers to all RDL and IUCN listed threatened species as well as protected species of relevance to the project.

LIST OF ACRONYMS

AIP	Alien and Invasive Plant
BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CR	Critically Endangered
DEDECT	Department: Economic Development, Environment, Conservation and Tourism
DFFE	Department of Forestry, Fisheries, and the Environment
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
E-GIS	Environmental Geographical Information Systems
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
GBIF	Global Biodiversity Information Facility
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
Ha	Hectare
IBA	Important Bird and Biodiversity Area
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature
LC	Least Concern
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential Evaporation
MASMS	Mean Annual Soil Moisture Stress (% of days when evaporative demand was more than double the soil moisture supply)
MAT	Mean Annual Temperature
MFD	Mean Frost Days
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMPPA	National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
NPAES	National Protected Area Expansion Strategy
NWBSP	North West Biodiversity Sector Plan
P	Protected
PES	Present Ecological State
POC	Probability of Occurrence
POIs	Points of Interest
QDS	Quarter Degree Square
RDL	Red Data Listed
SABAP 2	South African Bird Atlas Project 2
SACAD	South African Conservation Areas Database
SACNASP	South African Council for Natural Scientific Professionals
SANBI	South African National Biodiversity Institute
SanParks	South African National Parks
SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
SWSA	Strategic Water Source Area
TNCO	Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983)
TOPS	Threatened or Protected Species
TSP	Threatened Species Programme
VEGMAP	National Vegetation Map Project
VU	Vulnerable
WSAs	Water Source Areas

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services CC (STS) was appointed by SLR Consulting (SLR) to conduct a terrestrial biodiversity assessment as part of the Environmental Authorisation (EA) process for the proposed prospecting project to be conducted by Pilanesberg Platinum Mine (PPM) on a 4.7 hectare (ha) section of land on Portion 5 of the farm Ruighoek near Rustenburg North West Province. For ease of reference the 4.7 ha area in which the proposed prospecting activities will take place will henceforth be referred to as the "**study area**" and the Ruighoek farm portion 5 as "**the farm portion**".

The study area is located in a rural area of the Bojanala Platinum District Municipality, approximately 500 m west of Tlhatlhaganyane village and 3 km west of the Pilanesberg National Park. Historically the study area has been excluded from any intensive development and therefore remains in a "natural" state. However, illegal mining activities and human presence in the vicinity have disturbed the landscape.

1.2 Project Description

The proposed prospecting activities include the drilling of nine boreholes and the construction of five trenches, to explore platinum reserves in a UG2 subcrop of the Merensky Reef that runs along the western side of the study area.Please refer to Figure 3 for the layout of the proposed prospecting activities.

This report, after consideration of the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), the regulatory authorities and the developing proponent, by means of the presentation of results and recommendations as to the viability of the proposed development activities from a biodiversity resource management perspective.

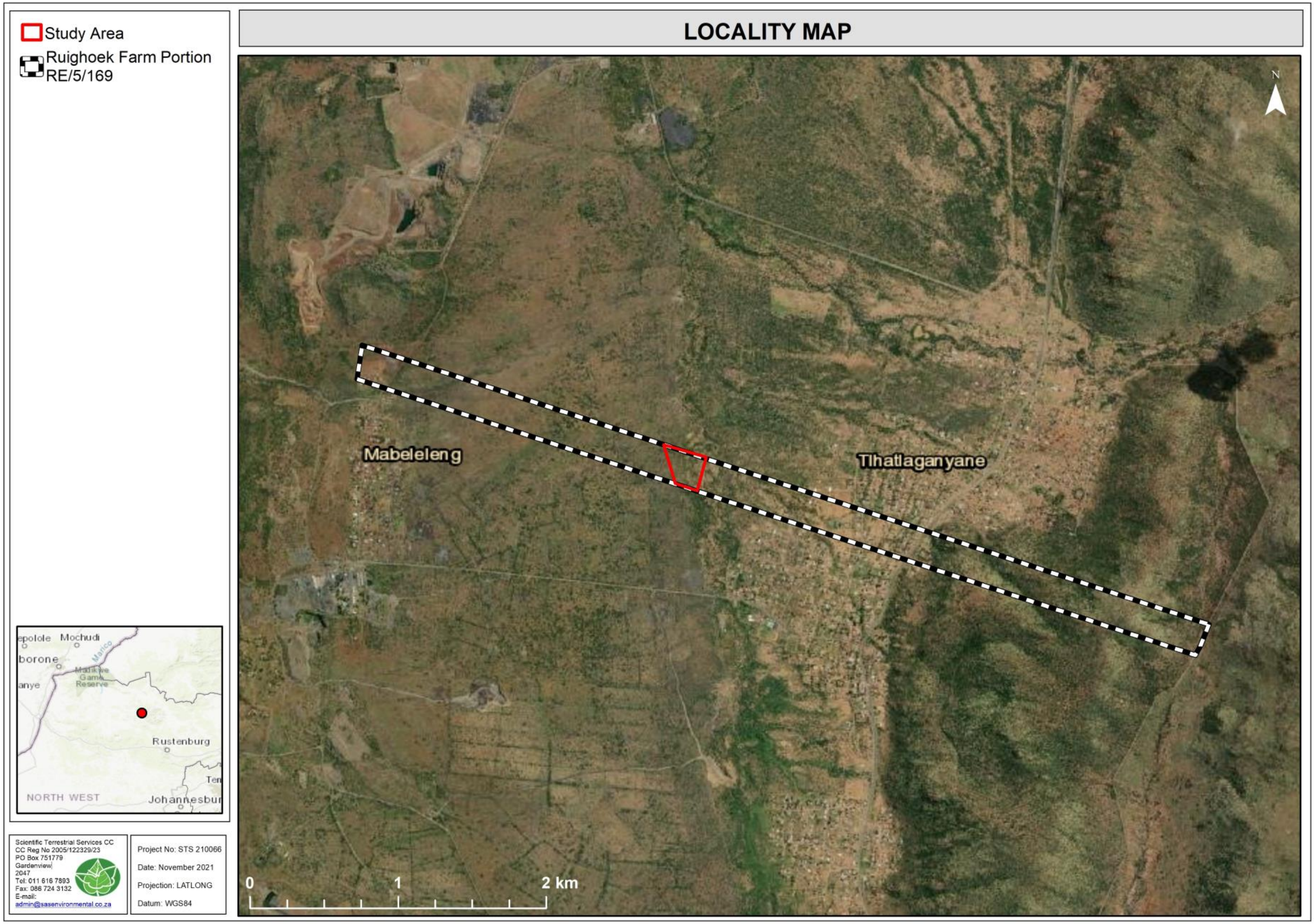

Figure 1: Digital Satellite image depicting the location of the study area in relation to surrounding areas.

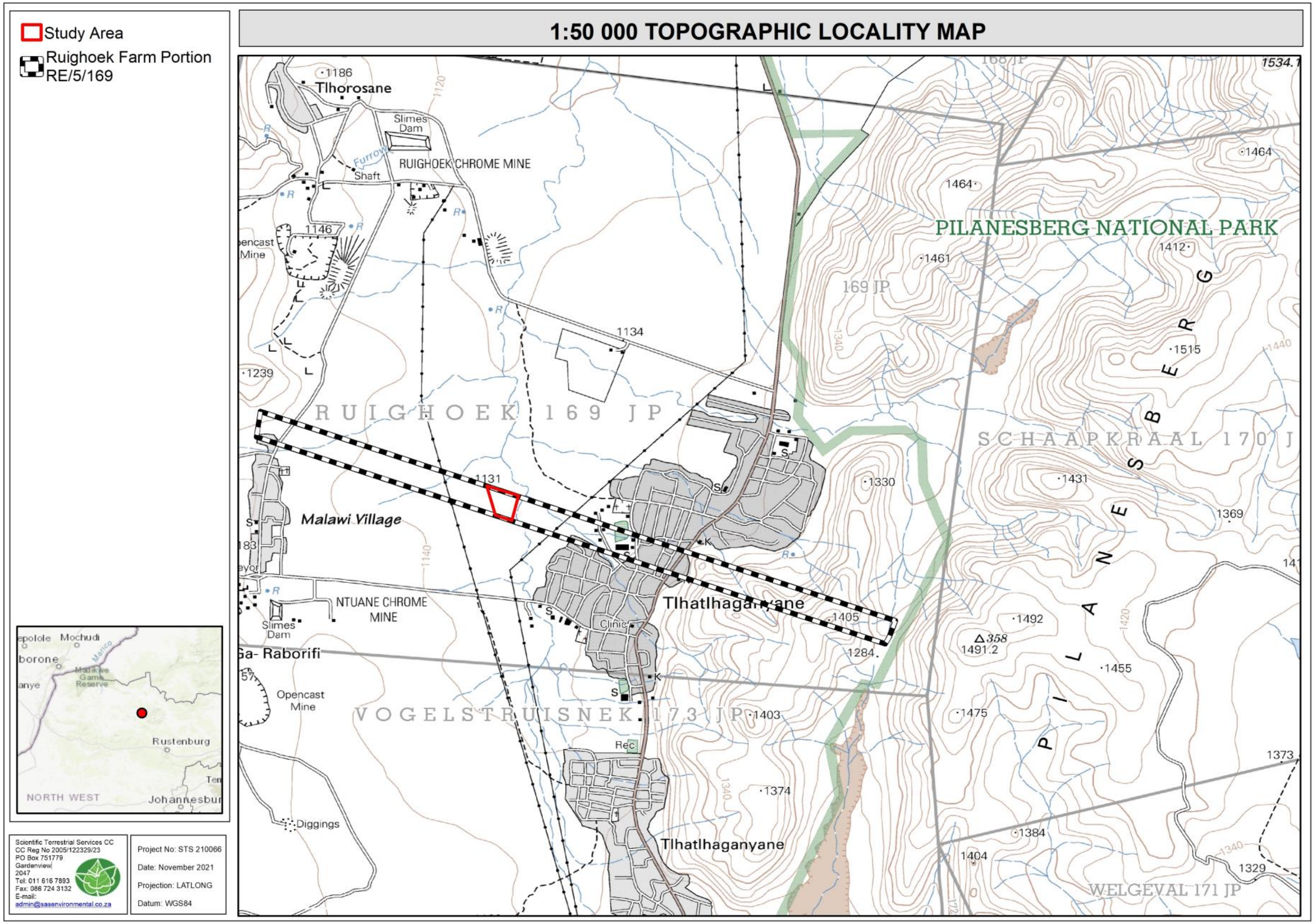

Figure 2: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

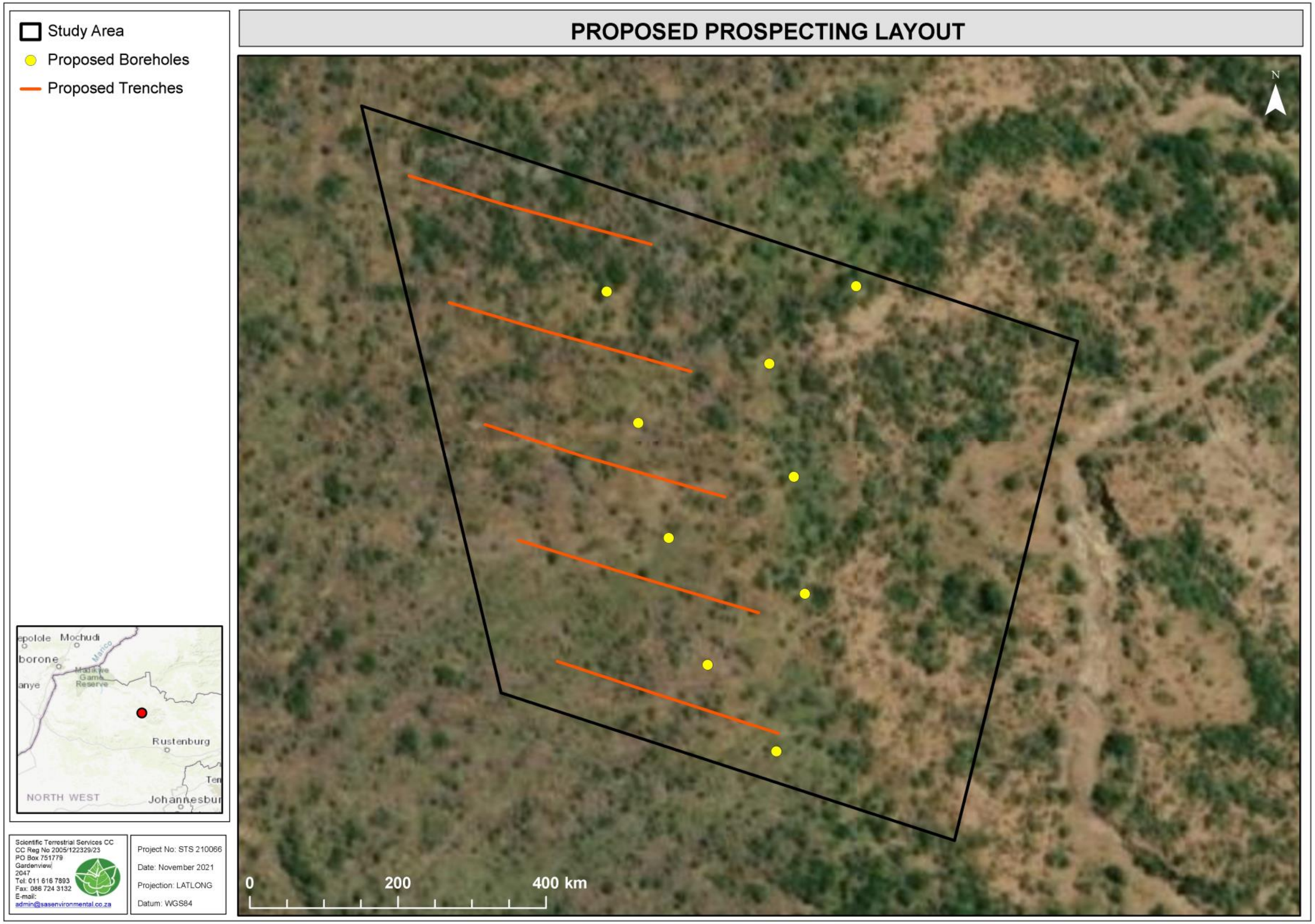

Figure 3: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.3 Project Scope

Specific outcomes in terms of this report are outlined below:

- To state the indemnity and terms of use of this report (Appendix A) as well as to provide the details of the specialists who prepared the reports (Appendix J);
- To outline the legislative requirements that were considered for the assessment (Appendix B of this report);
- Compile a desktop assessment with all relevant information as presented by South African National Biodiversity Institute (SANBI)'s Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org) and the Environmental Geographical Information Systems (E-GIS) website (https://egis.environment.gov.za/). The desktop assessment aims to gain background information on the physical habitat and potential floral and faunal ecology associated with the study area;
- To define the Present Ecological State (PES) of the biodiversity of the study area;
- To determine and describe habitats, communities and the ecological state of the study area;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including the potential for suitable habitat to occur within the study area for SCC;
- To identify and consider all sensitive landscapes, including rocky ridges, wetlands or any other special features such as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs);
- To determine the environmental impacts that the proposed prospecting activities might have on the biodiversity associated with the study area; and
- To develop mitigation and management measures for all phases of the development.

1.4 Assumptions and Limitations

The following assumptions and limitations apply to this report:

- Due to safety concerns pertaining to the presence of illegal miners both within the study area as well as the greater surrounding areas (Figure 4), access to the study area was not permitted during the field assessment. Instead, STS was permitted to access certain points of interest (POIs) (Figure 5) as deemed "safe" by the PPM security team. These POIs, considered representative of the study area, were thus used to infer the potential PES, sensitivity, and the floral and faunal communities that may be associated with the study area. Although these POIs are useful in extrapolating information for both the floral and faunal communities of the study area, they do not provide an exact indication of the ecological conditions, historic impacts and species communities associated with the study area. Conclusions drawn thereof should make note of this limitation. This report thus serves as a baseline for planning purposes only. Once final prospecting layouts have been finalised, the report should be updated, and a subsequent field assessment of the study area be conducted by a suitably qualified specialist to confirm and/or update the ecological particulars associated with the floral and faunal communities within the study area;

- The biodiversity desktop assessment is confined to the study area and the farm portion. It does not include detailed results of the adjacent properties, although the sensitivity of surrounding areas has been included on the relevant maps;
- As access to the study area itself was not possible during the field assessment, habitat delineations are based on satellite imagery, extrapolated data from the assessed POIs, available desktop data and prior field experience in the area and are thus deemed to be an adequate reflection of the habitat types within the study area. Additionally, species compositions for each habitat unit have been extrapolated from nearby POIs that were accessed during the field assessment and are considered to be highly representative of the typical species assemblages present within the study area;
- Due to most faunal taxa's nature and habits, it is unlikely that all species would have been observed during a field assessment of limited duration. As such, background data (desktop) and literature studies (previous work undertaken in the area) were used to further infer faunal species composition and sensitivities in relation to the available habitat;
- Some floral and faunal SCC identities will not be made known in this report (due to the limited field duration and seasonal variation), although their potential to occur on-site will still be assessed. As per the best practice guideline that accompanies the SANBI protocol and the National Web-based Environmental Screening Tool (hereafter referred to as the "**National Screening Tool**"), the name of the certain sensitive species may not appear in the final Environmental Impact Assessment (EIA) report nor any of the specialist reports released into the public domain. It will be referred to as sensitive plants, and its threat status included, e.g., critically endangered sensitive plants.

Figure 4: Photographs illustrating the presence of illegal mining within the vicinity of the study area. Dumping of waste material is evident throughout the area.

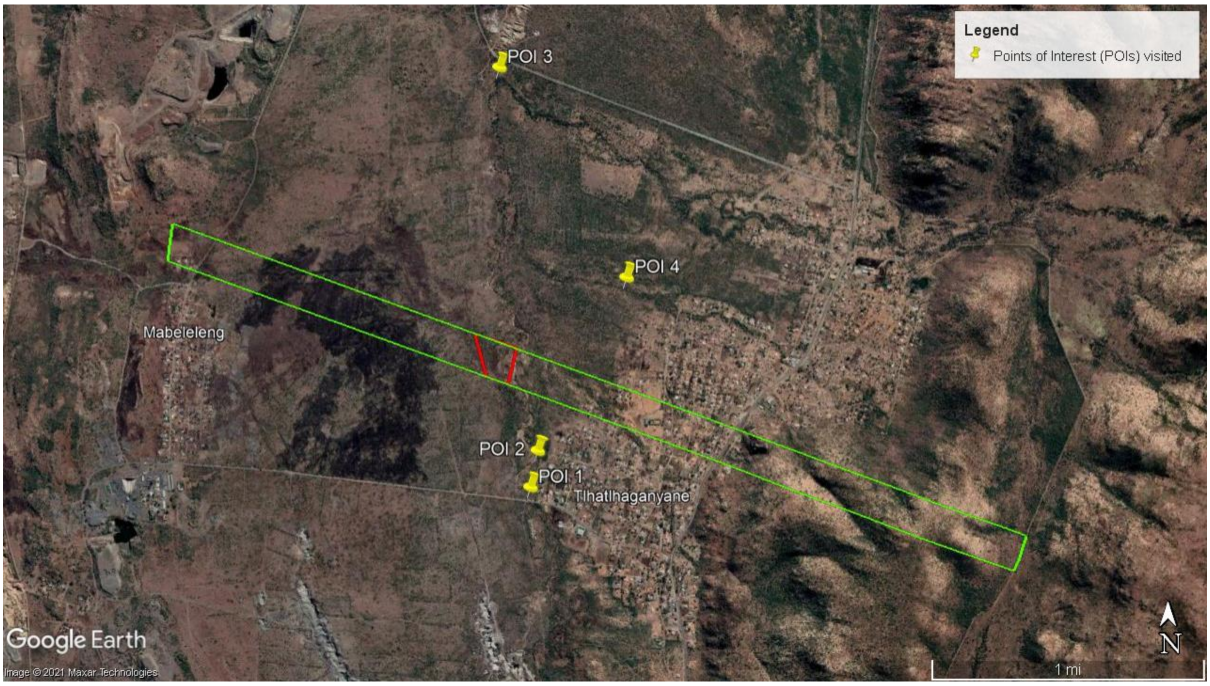

Figure 5: Google earth imagery depicting the four POIs visited by the STS team during the field assessment. The proposed prospecting area is in red and the farm portion in green.

1.5 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996[2];
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPPA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);

[2] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

  - Government Notice (GN) number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 October 2020 as it relates to the NEMBA;
  - GN number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 October 2020;
- Government Gazette 45421 dated 10 May 2019 as it relates to the Department of Forestry, Fisheries, and the Environment (DFFE's) (previously the Department of Environmental Affairs (DEA)) national environmental screening report required with an application for EA as identified in regulation 16(1)(v) of Environment Impact Assessment (EIA) Regulations, 2014, as amended:
  - GN No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity as published in Government Gazette 43110 dated 20 March 2020; and
  - GN No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant and Terrestrial Animal Species as published in Government Gazette 43855 dated 30 October 2020; and
- The Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 Of 1983) (Tnco)

The details of each of the above, as they pertain to this study, are provided in **Appendix B** of this report.

2. ASSESSMENT APPROACH

2.1 Desktop Research Approach

Maps and digital satellite images were generated prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. The biodiversity desktop assessment is confined to the study area and does not include the neighbouring and adjacent properties, although the sensitivity of surrounding areas is included on the respective maps. Relevant databases and documentation that were considered during the assessment of the study area included [3]:

[3] Datasets obtained from:

- SANBI BGIS (2019). The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: http://bgis.sanbi.org as retrieved in 2019; and
- DEA Environmental Geographical Information Systems (E-GIS) website. URL: https://egis.environment.gov.za/

- 2010 National Protected Area Expansion Strategy (NPAES) (Government of South Africa. 2010; DEA & SANBI, 2009), including the below-listed vector datasets:
    - NPAES Study areas 2010: National Protected Areas Expansion Strategy: Study areas for protected area expansion (South African National Parks (SanParks), 2010);
    - NPAES Formal: Polygons of formal protected national parks areas in South Africa (SANParks/SANBI, 2013); and
    - NPAES Protected Areas – Informal: Informal conservation areas in South Africa (SANParks/SANBI, 2012).
- The South African Conservation Areas Database, Quarter 2 (SACAD, 2021);
- The South African Protected Areas Database, Quarter 2 (SAPAD, 2021);
- The National Vegetation Map Project (VEGMAP), with the below vector dataset used for information on Biomes, Bioregions and Vegetation Type(s):
    - 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018a);
- The National List of Threatened Ecosystems 2011 (SANBI 2011; South Africa, 2011);
- From the National Biodiversity Assessment (NBA, 2018) Terrestrial Assessment project (Skowno *et al*., 2019):
    - 2018 Terrestrial ecosystem threat status and protection level - remaining extent (SANBI, 2018b); and
    - 2018 Terrestrial ecosystem threat status and protection level layer (SANBI, 2018c);
- The Important Bird and Biodiversity Areas (IBA) Programme and vector dataset (BirdLife South Africa, 2015; Marnewick *et al*., 2015a and 2015b), in conjunction with the South African Bird Atlas Project 2 (SABAP 2);
- The International Union for Conservation of Nature (IUCN);
- The National Screening Tool (accessed 2021); and
- From the 2017 Strategic Water Source Areas (SWSA) project:
    - 2017 SWSA **Surface water** (Water Research Commission, 2017).

2.2 General Approach

An on-site visual assessment of the study area was conducted to confirm the assumptions made during the consultation of the background maps and to determine whether the ecological status of the habitat associated with the study area has changed.

The vegetation surveys are based on the subjective sampling method which is a technique where the specialist chooses specific sample sites within the area of interest, based on their professional experience and background research done for the site, to allow representative recordings of floral communities and optimal detection of SCC (**Appendix C**).

For the faunal field surveys, a reconnaissance 'walkabout' was undertaken in faunal POIs to identify faunal habitat types and define the faunal assemblage, including potential SCC likely to occur within the proposed footprint area. A detailed explanation of the method of assessment is provided in **Appendix D** of this report. The faunal categories covered in this assessment include mammals, avifauna, herpetofauna and general invertebrates.

The below list includes the steps followed during the preparation for, and the undertaking of, the field assessments:

- To guide the selection of appropriate sample sites, background data and digital satellite images were consulted before going to the site, during which broad habitats, vegetation types and potentially sensitive sites were identified. The results of these analyses were then used to focus the fieldwork on specific areas of concern and to identify areas where targeted investigations were required (e.g., for SCC detection and within the direct footprint of the proposed prospecting area);
- Databases used for background information include the SANBI Threatened Species Programme (TSP), the NBA (2018), National Threatened Ecosystems (2011), SAPAD & SACAD (Quarter 2, 2021), NPAES (2011), and IUCN;
- The study area itself was inaccessible at the time of the field assessments. As such, habitat units were developed using data from nearby POIs. Within these POIS, the subjective sampling method was used. This methods requires that field assessments take place on foot. Based on the broad habitat units delineated before going to the site, and points of interest recorded, which is updated based on on-site observations, the selected sample areas were surveyed on foot, following subjective transects, to identify the occurrence of the dominant plant species and habitat diversities, but also to detect SCC which tend to be sparsely distributed; and
- Photographs were taken of the vegetation community with the respective POIs (which were used to infer on the ecological community of the study area), as well as photos of all detected SCC (where such species were not flagged on the National Screening Tool as sensitive species for which identities may not be made known).

For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to **Appendix E** of this report.

2.3 Sensitivity Mapping

All the ecological features associated with the study area were considered, and sensitive areas were delineated using a Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study Area

The following table contains data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable high-quality data, the various databases do not always provide an entirely accurate indication of the area's actual biodiversity characteristics, and as such require ground truthing.

Table 1: Summary of the terrestrial conservation characteristics for the study area and farm portion (Quarter Degree Square (QDS 2526BB)).

DESCRIPTION OF THE VEGETATION TYPE(S) RELEVANT TO THE ACCORDING TO THE 2018 FINAL VEGETATION MAP OF SOUTH AFRICA, LESOTHO AND MUCINA AND RUTHERORD (2006)										
BIOME	The study area is situated within the **Savanna Biome.**									
BIOREGION	The study area is situated within the **Central Bushveld Bioregion**.									
VEGETATION TYPES	Majority of the farm portion and the entire study area is situated within the **Zeerust Thornveld (SVcb 3)** towards the west					A smaller portion in the eastern side of the farm portion is located within the **Pilanesberg Mountain Bushveld (SVcb 5)**				
CLIMATE	Summer rainfall with very dry winters. MAP has a relatively narrow range: 550–600 mm. Frost fairly frequent in winter. Mean monthly maximum and minimum temperatures 36.7°C and –0.4°C for January and June.					Summer rainfall with very dry winters. MAP from about 600–700 mm. Frost fairly frequent in winter in lower-lying areas, less so on the hills. Mean monthly maximum and minimum temperatures for Manyane Gate (eastern entrance to Pilanesberg Game Reserve) 36.7°C and –2.2°C for February and July, respectively. See also climate diagram for SVcb 5 Pilanesberg Mountain Bushveld.				
	MAP (mm)	**MAT (°C)**	**MFD (Days)**	**MAPE (mm)**	**MASMS (%)**	**MAP (mm)**	**MAT (°C)**	**MFD (Days)**	**MAPE (mm)**	**MASMS (%)**
	586	18.6	23	2484	79	640	17.9	19	2378	77
ALTITUDE (M)	1000–1250					1100–1500				
DISTRIBUTION	North-West Province: Extends along the plains from the Lobatsi River in the west via Zeerust, Groot Marico and Mabaalstad to the flats between the Pilanesberg and western end of the Magaliesberg in the east (including the valley of the lower Selons River).					North-West Province: Hills and mountains immediately north of Sun City and west of Heystekrand (Mankwe District).				
GEOLOGY & SOILS	Sediments of the Pretoria Group (Transvaal Supergroup) in this area, particularly the Silverton and Rayton Formations, are mostly shale with less quartzite and conglomerate. Carbonates, volcanic rocks, breccias and diamictites also occur in the Pretoria Group. Bronzite, harzburgite, gabbro and norite of the Rustenburg Layered Suite (Bushveld Igneous Complex) are also found. Soils are mostly deep, red-yellow, apedal, freely drained with high base status also with some vertic or melanic clays. Land types mainly Ae and Ea.					The alkaline complex consists of potassium- and sodium-rich, silica-poor rocks, mainly foyaite, lava and tuff with some syenite. Wide range of elements found, particularly rare earth elements and fluorine in the form of CaF_2 (flourite). Due to the original volcanic actions, subsequent fracturing, emplacement of intrusions, collapse and resurgence of magma and radial emplacement of dykes, a complex geological pattern exists. Pilanesberg is one of the very few large alkaline ring complexes in the world, approximately 1.3 gya old. Soils are shallow, rocky lithosols on the hills and mountains of the Glenrosa and Mispah soil forms, but with deeper soils on the valley floors. Land type is mostly Ib.				
CONSERVATION	**Least threatened**. Target 19%. Less than 4% statutorily conserved, spread between four reserves including the Pienaar and Marico Bushveld Nature Reserves. Some 16% transformed mainly by cultivation, with some urban or built-up. A few areas with scattered plants of the alien *Cereus jamacaru* and several other alien species very scattered elsewhere. Erosion is mainly very low to low.					**Least threatened.** Target of 24% exceeded, with 96% statutorily conserved in the Pilanesberg Game Reserve. Almost 2% transformed, mainly by urban development on the periphery. Prior to the proclamation of the reserve in 1979 some of the area had been intensively farmed and included some bush-clearing. Some of these areas are still visible, for example high grass cover and low tree cover in the lowlands. A few old mining sites occur. There are some scattered alien plant populations of *Cereus jamacaru*. Erosion is very low.				

<table>
<tr><td>VEGETATION & LANDSCAPE FEATURES (DOMINANT FLORAL TAXA IN APPENDIX F)</td><td>Deciduous, open to dense short thorny woodland, dominated by Acacia species with herbaceous layer of mainly grasses on deep, high base-status and some clay soils on plains and lowlands, also between rocky ridges of SVcb 4 Dwarsberg-Swartruggens Mountain Bushveld.</td><td>A near circular (diameter 23–27 km) complex constituting an intrusive and extrusive massif with the original volcanic caldera almost eroded away leaving a broken ring of hills and low mountains as well as the eroded intrusions of the core remaining in the form of many hills and low mountains. Valley floors between the hills and mountains tend to be at most 1–2 km wide. Broad-leaved deciduous bushveld with trees and shrubs with grass layer on slopes of mountains and hills, with mountain summits more grassy and valley floors sometimes less woody but the latter may be related to past disturbance (see section on Conservation below).</td></tr>
<tr><td colspan="3">CONSERVATION DETAILS PERTAINING TO THE AREA OF INTEREST (VARIOUS DATABASES)</td></tr>
<tr><td colspan="3">NATIONAL BIODIVERSITY ASSESSMENT (NBA):
Ecosystem types are categorised as “Not Protected”, “Poorly Protected”, “Moderately Protected” and “Well Protected” based on the proportion of each ecosystem type that occurs within a protected area recognised in the National Environmental Management: Protected Areas act, 2003 (act no. 57 of 2003) (NEMPAA), and compared with the biodiversity target for that ecosystem type.
The ecosystem protection level status is assigned using the following criteria:
I. If an ecosystem type has more than 100% of its biodiversity target protected in a formal protected area either a or b, it is classified as well protected,
II. When less than 100% of the biodiversity target is met in formal a or b protected areas it is classified it as moderately protected,
III. If less than 50% of the biodiversity target is met, it is classified it as poorly protected, and
If less than 5% it is hardly protected.</td></tr>
<tr><td>NBA (2018)[4] Figure 6:

1) ECOSYSTEM THREAT STATUS
2) ECOSYSTEM PROTECTION LEVEL</td><td colspan="2">The study area and the western section of the farm portion is located within the Zeerust Thornveld which is considered a Least Concern (LC) ecosystem and is currently poorly protected (pp). A smaller section on the eastern side of the farm portion is located within the Pilanesberg Mountain Bushveld (LC), which is currently Well Protected (WP)

The NBA is the primary tool for monitoring and reporting on the state of biodiversity in South Africa. Two headline indicators that are applied to both ecosystems and species are used in the NBA: threat status[5] and protection level[6].</td></tr>
<tr><td>NATIONAL THREATENED ECOSYSTEMS (2011)</td><td colspan="2">Neither the study area or the farm portion are situated within any threatened ecosystems

For Environmental Impact Assessments (EIAs), the 2011 National list of Threatened Ecosystems remains the trigger for a Basic Assessment in terms of Listing Notice 3 of the EIA Regulations published under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).</td></tr>
</table>

[4] The uncoloured sections in the map in figure 5 are wheres in which no data is available

[5] Ecosystem threat status tells us about the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Figure 3). The conceptual ‘end point’ of decline for an ecosystem is termed ‘collapse’ and is equivalent to extinction in the species Red Listing framework. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Concern (LC), based on the proportion of each ecosystem type that remains in good ecological condition relative to a series of thresholds.

[6] Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Not Protected, Poorly Protected, Moderately Protected or Well Protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the National Environmental Management: Protected Areas Act (Act 57 of 2003)3.

SAPAD (2021, Q2); SACAD (2021, Q2; NPAES (2010) (Figure 7)	The SACAD (2021) database does not indicate any conservation areas within a 10 km radius of the farm portion. However, the South African Protected Areas Database (SAPAD, 2021), and the National Protected Areas Expansion Strategy (NPAES, 2009) indicates that the **Pilanesberg National Park and Provincial Nature Reserve** is within a 5 to 10 km zone of the study area farm portion. The farm portion immediately borders the reserve in the east.
IBA (2015) (Figure 8)	The study area is located within a 10km radius of the Pilanesberg National Park Bird Area. This area is home to some 300 species.
NATIONAL WEB BASED SCREENING TOOL (2020)[7]	
The screening tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the ea process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed prospecting footprint to avoid sensitive areas	
COMBINED TERRESTRIAL THEME	For the terrestrial biodiversity theme, the entire study area is considered to have a **Very High sensitivity**. According to the screening tool, this triggered sensitivity is based on the occurrence of a Critical Biodiversity Area 2 (CBA 2) and Freshwater Ecosystem Priority Area (FEPA) catchment in and around the study area.
PLANT SPECIES THEME	For the plant species theme, the entire study area is considered to have a **Medium sensitivity.** The species triggering this outcome is the potential occurrence of the Vulnerable (VU) plant species *Cullen holubii*.
ANIMAL SPECIES THEME	For the animal species theme, majority of the study area is considered to have a **High sensitivity**. The species triggering this outcome is the potential occurrence of *Sagittarius serpentarius* (Secretarybird, VU). A much smaller section in the west of the study area is assigned a **Low animal sensitivity**.
STRATEGIC WATER SOURCE AREAS FOR SURFACE WATER (2017)	
Surface water SWSAS are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. They include transboundary areas that extend into Lesotho and Swaziland. The sub-national water source areas (WSAS) are not nationally strategic as defined in the report but were included to provide a complete coverage	
NAME & CRITERIA	No SWSA is located within 10 km of the study area and farm portion.
NORTH WEST BIODIVERSITY SECTOR PLAN (2015) – FIGURE 8	
CRITICAL BIODIVERSITY AREAS (CBAS)	Small sections in the eastern side of the farm portion are situated within a CBA 1. The remainder of the farm portion and the entire study area are situated in a CBA 2. **DEFINITIONS:** CBAs include natural or near-natural terrestrial and aquatic features that were selected based on an area's biodiversity characteristics, spatial configuration, and requirement for meeting both biodiversity pattern and ecological process targets. CBAs include irreplaceable sites where no other options exist for meeting targets for biodiversity features, as well as best-design sites (i.e., CBA Important Areas) which represent an efficient configuration of sites to meet targets in an ecologically sustainable way that is least conflicting with other land uses and activities. These areas need be maintained in the appropriate condition for their category. Some CBAs are degraded or irreversibly modified but are still required for achieving specific targets, such as cultivated lands for threatened species. **REASONS IDENTIFIED AS CBA 1:** According to NWBSP (READ, 2015) the small eastern section of the farm portion has been identified as CBA1 as it is considered to be an irreplaceable site for achieving biodiversity targets; it acts as a critical linkage in the provincial biodiversity corridor network being within 5 km of a protected area, the Pilanesberg National Park; it is considered important terrestrial habitat by experts and contains "kloofs" or cliffs that are important against climate change.

[7] No maps are shown when the entire area of investigation is located within a single sensitive or important feature.

	REASONS IDENTIFIED AS CBA 2: According to NWBSP (READ, 2015) the study area has been identified as CBA2 for three reasons. Firstly, it contains critical remnant patches of provincially endemic vegetation types of more than 10 ha. These are vegetation types whose biodiversity target can only be achieved in the North West (NW) Province. Secondly, the study area is considered to contain important natural features in the form of springs, scenic habitat etc. Thirdly the study area is considered important habitat for wildlife, identified as being important for maintaining SCC (free-ranging red hartebeest (*Alcelaphus buselaphus*), black-footed cat (*Felis nigripes*), vulture nesting areas and Important Bird Areas.		
ECOLOGICAL SUPPORT AREAS (ESAS)	A small section in the east and western side of the farm portion are located in an ESA 1. **DEFINITIONS**: **ESAs** include Natural, near natural, degraded or heavily modified areas required to be maintained in an ecologically functional state to support Critical Biodiversity Areas and/or Protected Areas. ESAs maintain the ecological processes on which Critical Biodiversity Areas and Protected Areas depend. Some ESAs are irreversibly modified but are still required as they still play an important role in supporting ecological processes. **REASONS IDENTIFIED AS ESA1** According to NWBSP (READ, 2015) these areas have been identified as ESA1 as it is considered an important natural biodiversity corridor, it contains important habitats in the form of hills and ridges, and is an existing or proposed protected area development corridor, in this case for the Pilanesberg-Madikwe Heritage Park.		
IMPORTANCE OF THE STUDY AREA TO THE MINING AND BIODIVERSITY GUIDELINES (2013)			
HIGHEST BIODIVERSITY IMPORTANCE	The entire study area and mid-section of the farm portion are situated within an area considered to be of highest biodiversity importance with a highest risk for mining.	**HIGH BIODIVERSITY IMPORTANCE**	The far eastern and western section of the farm portion is situated within an area considered to be of high biodiversity importance with a high risk to mining.

EOO = Extent of Occurrence; NBA = National Biodiversity Assessment; SAPAD = South African Protected Areas Database; SACAD = South African Conservation Areas Database; NPAES = National Protected Areas Expansion Strategy; IBA = Important Bird Area; MAP = Mean annual precipitation; MAT = Mean annual temperature; MAPE = Mean annual potential evaporation; MFD = Mean Frost Days; MASMS = Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply); CBA = Critical Biodiversity Areas; ESA = Ecological Support Areas; Strategic Water Source Areas; Water Source Areas.

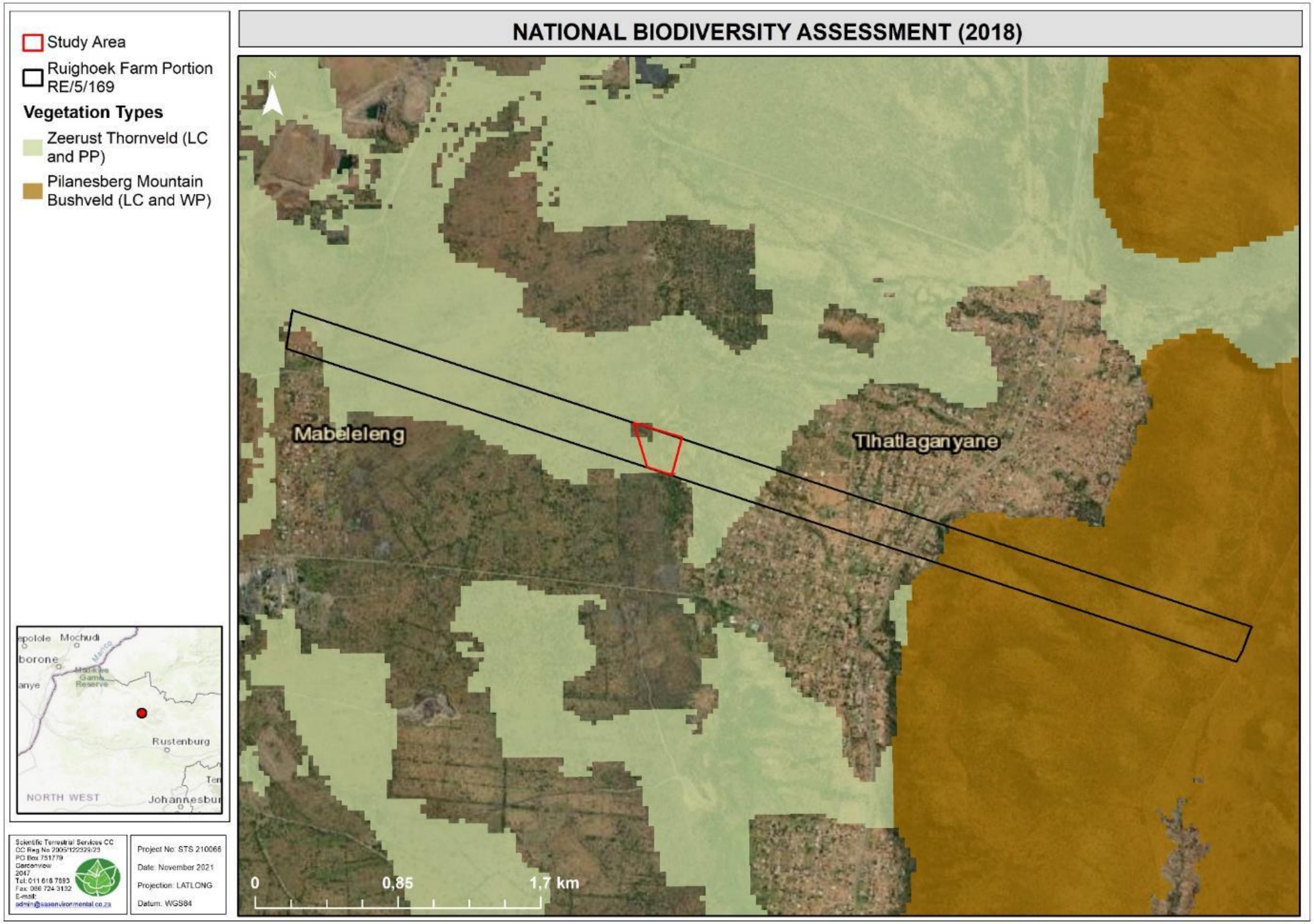

Figure 6: The study area in relation to the remaining extent of the vegetation types according to the National Biodiversity Assessment (NBA, 2018).

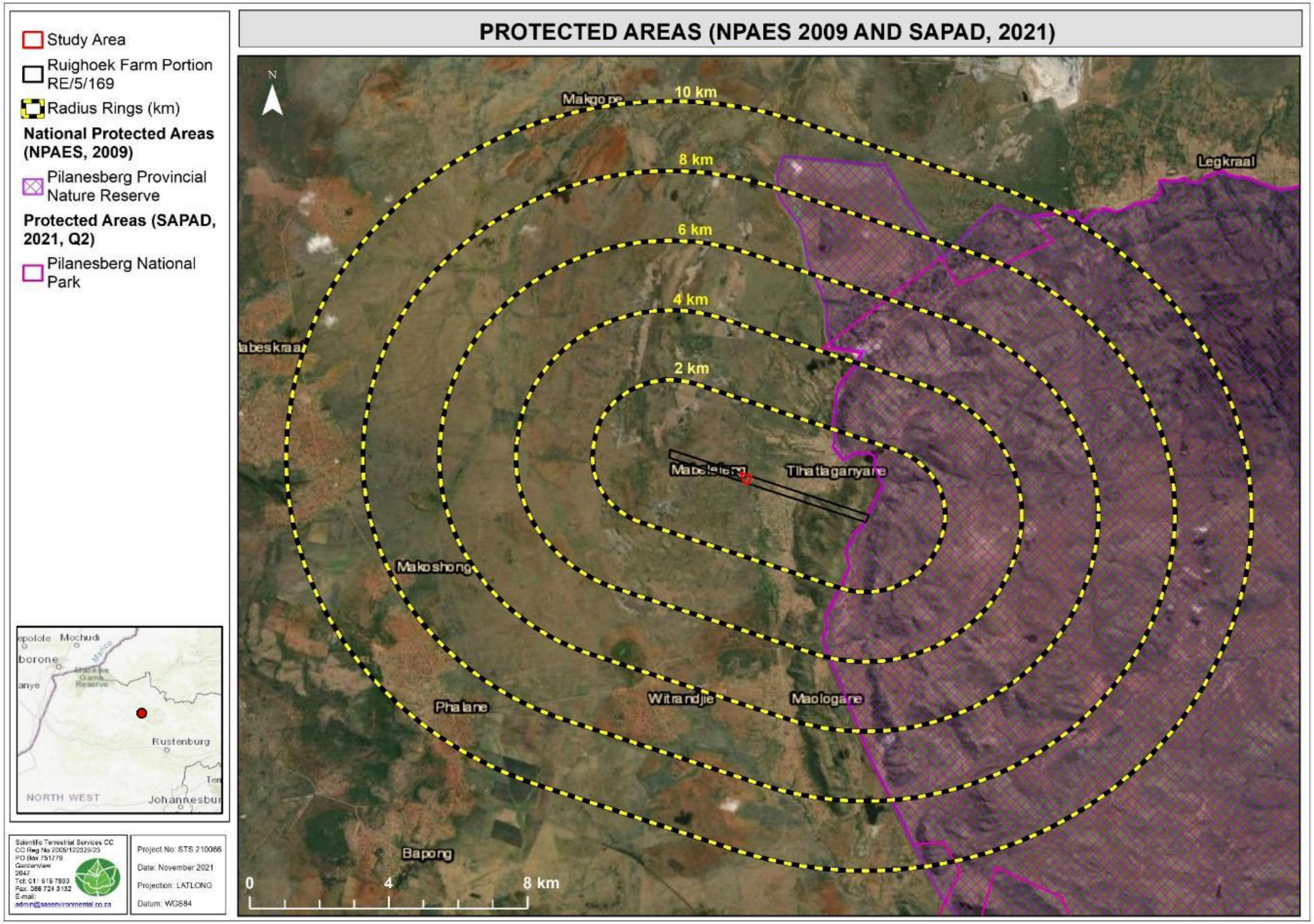

Figure 7: The protected areas within 10 km of the study area, according to NPAES (2009) and SAPAD (2021).

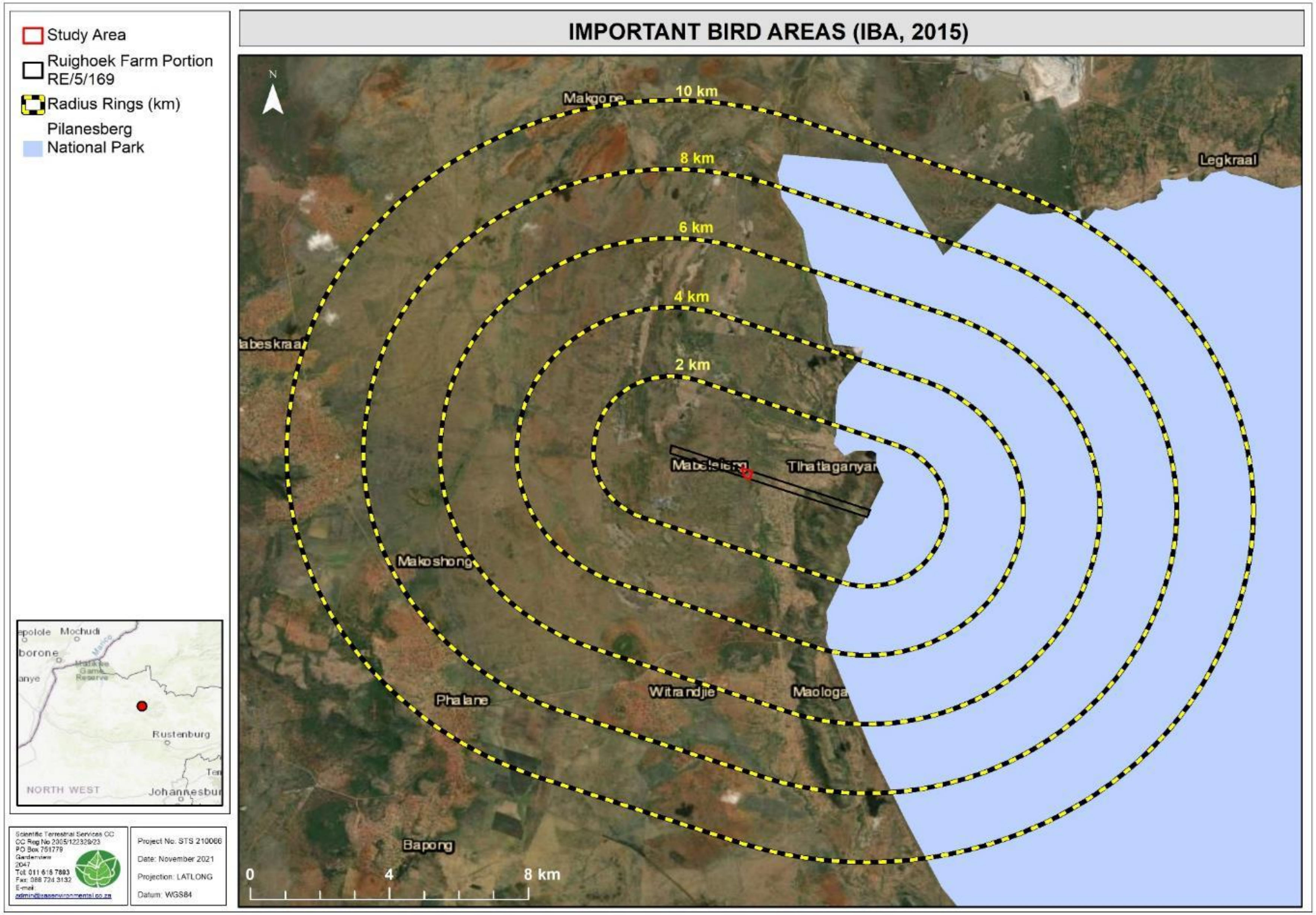

Figure 8: Important Bird Areas (IBAs) within 10 km of the study area, according to the IBA (2015).

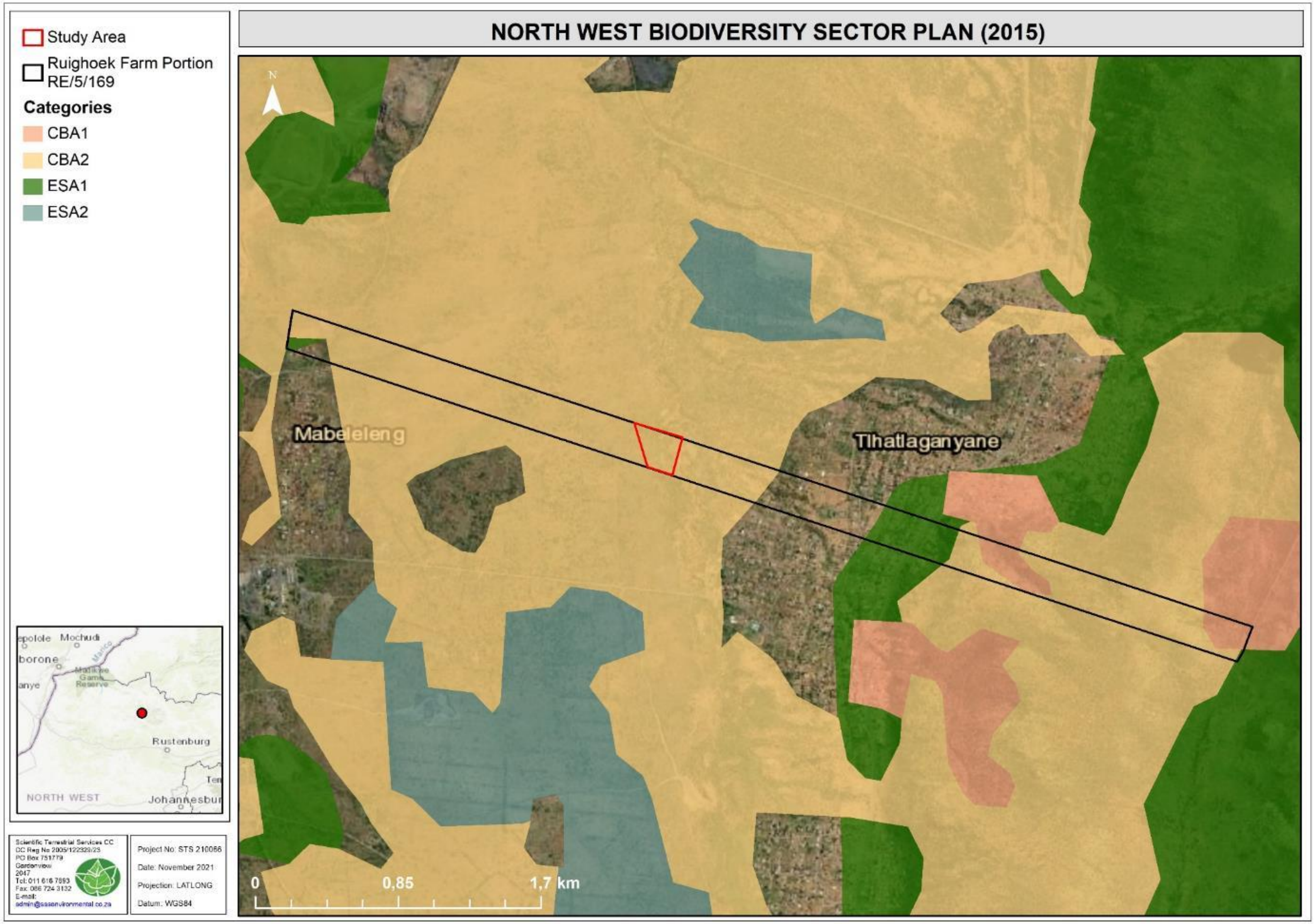

Figure 9: The study area in relation to the North West Biodiversity Sector Plan (2015).

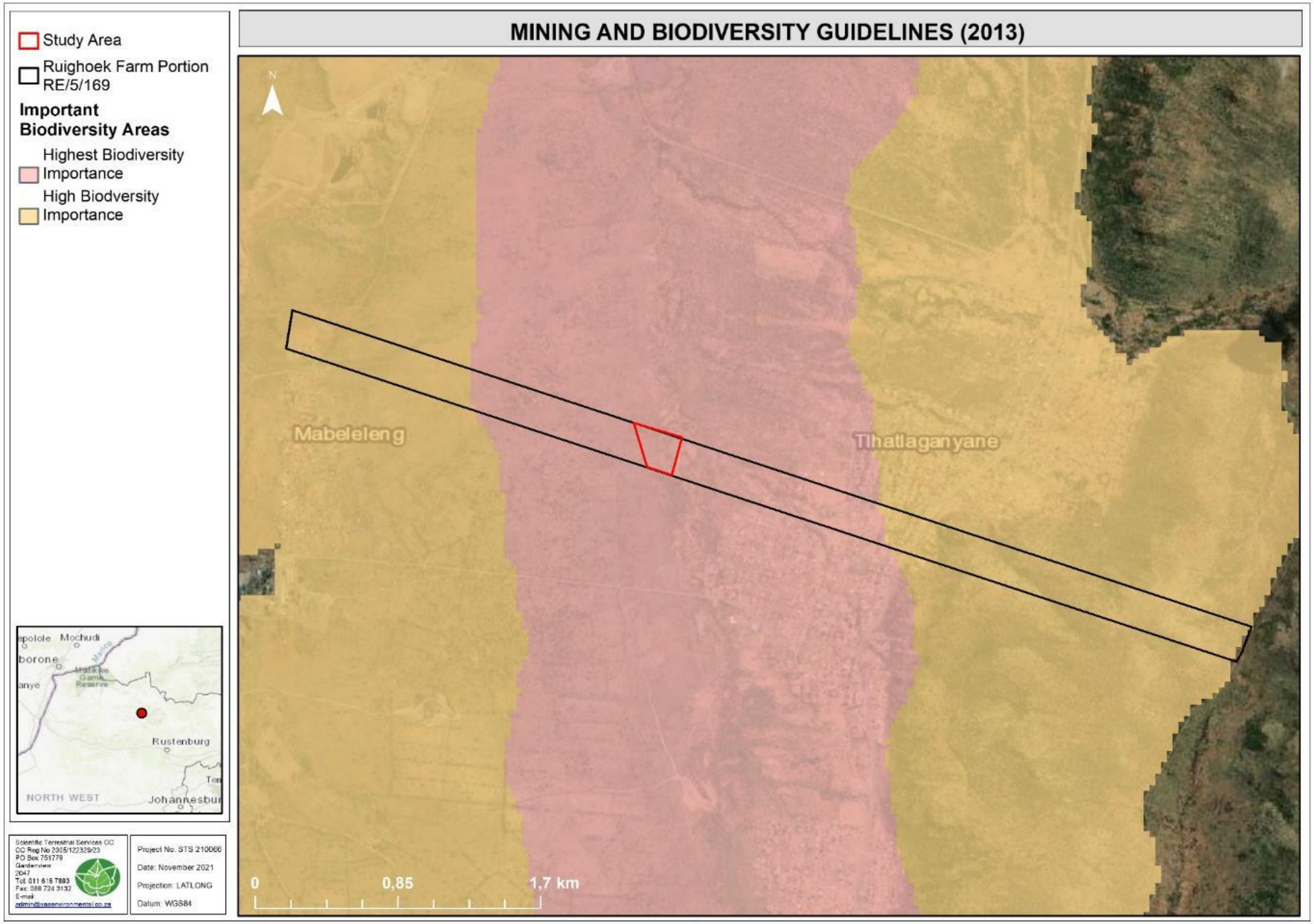

Figure 10: Important biodiversity areas associated with the farm portion and study area, according to the Mining and Biodiversity Guidelines (2013).

4. BIODIVERSITY ASSESSMENT RESULTS

The farm portion is situated within both the Zeerust Thornveld and the Pilanseberg Mountain Bushveld. However, the study area is soley situated within the Zeerust Thornveld, i.e., the reference vegetation type. The Zeerust Thornveld is listed as least concern in both Mucina and Rutherford (2006) and in the updated 2018 Vegetation Map of South Africa, Lesotho, and Swaziland (SANBI, 2018a)).

Mucina and Rutherford (2006) describe the Zeerust Thornveld as consisting of "deciduous, open to dense short, thorny woodland, which is dominated by *Vachellia* and *Senegalia* species with an herbaceous layer of mainly grasses on deep, high base-status and some clay soils on plains and lowlands. The vegetation type is also found between the rocky ridges of the Dwarsberg-Swartruggens Mountain Bushveld".

4.1 Ground-truthed vegetation characteristics

Overall, the habitat within the study area was well-vegetated in which indigenous vegetation[8] was present. The biodiversity of the study area can thus be defined under three broad habitat units as described below (Figure 11). Using satellite imagery as a guide (to assess historic impacts), together with field experience in the area, and the extrapolation of habitat integrity and species composition from nearby POIs.

The study area, which is situated soley within the Zeerust Thornveld vegetation type, was chacterised by three broad habitat units[9], which included:

4. **Thornveld Habitat** – this habitat unit is in the west of the study area and is largely homogenous, supporting a moderate to moderately low species richness;
5. **Degraded Thornveld Habitat** – this habitat unit is located within the central regions of the study area and is likely the result of current and historic anthropogenic impacts; and
6. **Freshwater Habitat**: This habitat unit was the smallest habitat unit within the study area and is associated with the ephemeral Mothlabe River.

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[8] The NEMA definition of indigenous vegetation: "Indigenous vegetation: refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding 10 years.

[9] As access to the study area was not possible, habitat unit delineations are based on satellite imagery and field experience within the area. As such, it should be noted that the extent and current PES have been extrapolated from the PES and associated historic impacts from nearby points of interest accessed during the field assessment. Furthermore, species compositions for each habitat have been extrapolated from nearby POIs that were accessed during the field assessment.

For a breakdown of the floral communities, habitat characteristics and conservation sensitivities associated with the above-mentioned habitat units, refer to Section 4.2. The faunal results are further discussed in Section 4.3.

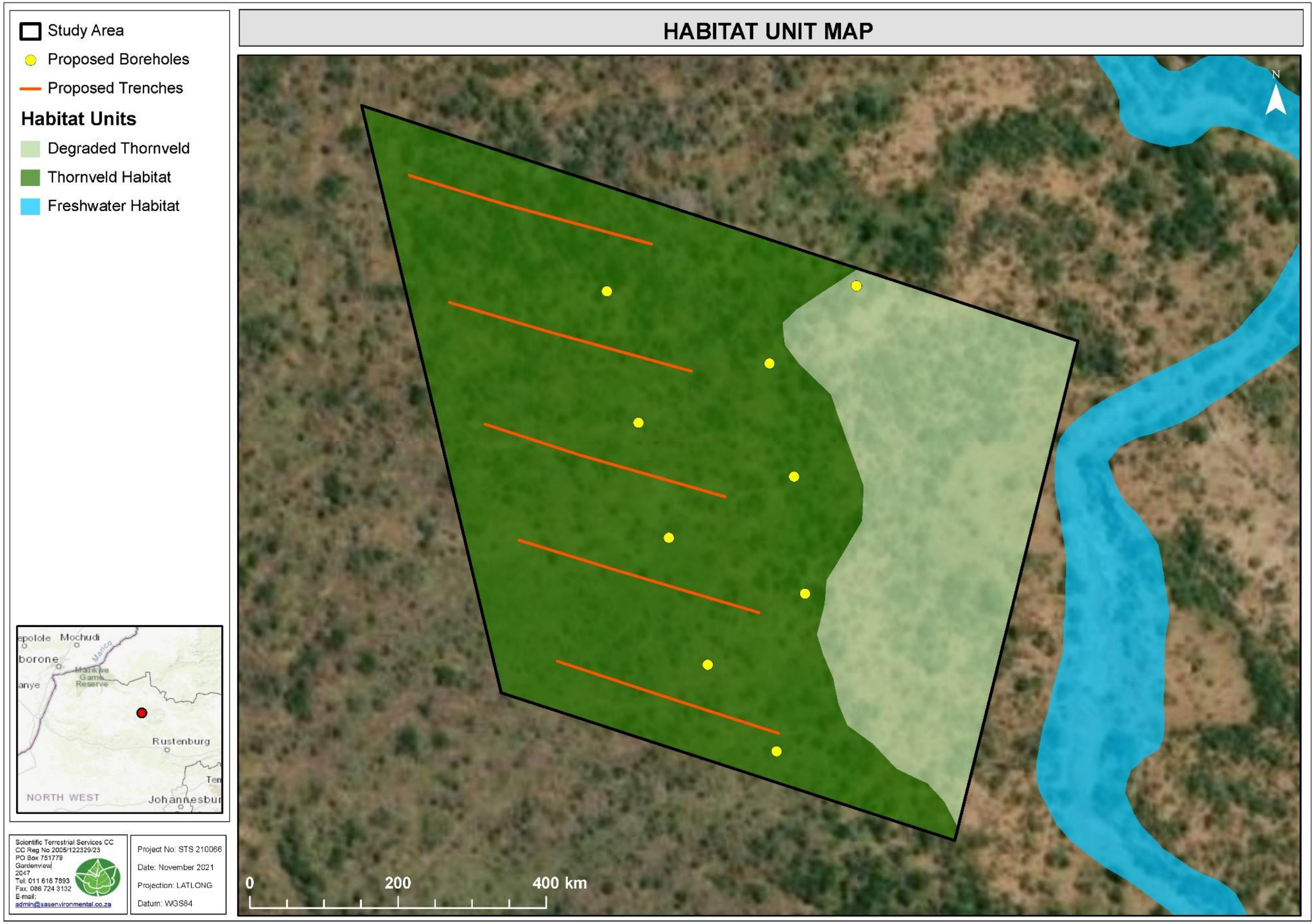


Figure 11: Habitat units identified in the study area during the 2021 assessment.

4.2 Floral Assessment Results

HABITAT OVERVIEW
Overall, the study area supported a moderate to moderately low species diversity. The three broad habitat units that have been extrapolated for the study area included i) Thornveld Habitat, ii) Degraded Thornveld Habitat, and iii) Freshwater Habitat (discussed in more detail below). Refer to the photographs below for a visual representation of the habitat units and examples of species recorded within these habitats. **Thornveld Habitat** – this habitat unit is in the west of the study area and is largely homogenous, supporting a moderate to moderately low species richness. Overall indigenous vegetation dominated, although alien and invasive plant (AIP) species were recorded throughout the habitat, albeit in moderately low densities. Woody encroachment, although not prolific within the habitat, was evident and the main encroaching species identified included *Dichrostachys cinerea* and *Senegalia mellifera* subsp. *detinens*. The Thornveld habitat has been subject to current and historic anthropogenic influences, including altered fire regimes, intense grazing practices, AIP proliferation, wood harvesting, current and historic illegal mining practices, and historic agricultural practices. The floral community, as extrapolated from nearby POIs, was dominated by thorny trees, such as *Vachellia karoo, Vachellia nilotica, Ziziphus mucronata, Dichrostachys cinerea*, and *Senegalia mellifera* subsp. *detinens.* Less dominant woody species included *Boscia foetida* subsp. *rehmanniana*, *Grewia flava*, and *Searsia lancea*. The grass layer was variable; areas either supported a moderate coverage of grass species or bare areas were often present (attributed to extensive grazing practices). The forb layer was poorly represented as is typical for the reference vegetation type. Given that the habitat unit has been subjected to several anthropogenic impacts, and the subsequent change in floral species composition that is associated with such impacts, the Thornveld habitat is not considered to be fully representative of the reference vegetation type. In terms of species composition, the Thornveld habitat did share several species that are fairly characteristic of the reference vegetation type, however, the structure of the habitat has largely been impacted (through woody encroachment and wood harvesting) and is thus not considered representative of the reference vegetation type. **Degraded Thornveld Habitat** – this habitat unit is located within the central regions of the study area and is likely the result of current and historic anthropogenic impacts. In particular, this habitat is likely the result of i) impacts, such as sand mining, that have occurred in the nearby Freshwater Habitat (i.e., associated with the Mothlabe River) in the east which have subsequently impacted the extent and ecological condition of the Degraded Thornveld habitat, and ii) the predisposition of the Freshwater system being prone to erosion and increased levels of siltation and sediment deposition, which has resulted in episodic sediment deposition within the Degraded Thornveld habitat. Overall, the Degraded Thornveld habitat supported a lower diversity and abundance of floral species than that of the neighbouring Thornveld habitat. Woody vegetation was less dense than in the neighbouring Thornveld habitat and typical woody species encountered included *Boscia foetida* subsp. *rehmanniana*, *Grewia flava*, and *Searsia lancea.* The grass and forb layers were poorly represented. Typical grass species included *Heteropogon contortus* and *Aristida congesta* subsp. *congesta* and typical forb species included *Polygala hotentota* and *Jatropha latifolia.* Overall, given the impacted nature of the Degraded Habitat and the altered species composition, this habitat is not considered to be representative of the reference vegetation type. **Freshwater Habitat** - The Freshwater Habitat is located within the east of the study area and comprised the smallest of the habitat units. The Freshwater habitat is associated with a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA) (e.g., the Mothlabe River). Sections of the Freshwater Habitat within the study area could not be assessed during the field assessment given safety concerns. POIs upstream and downstream were subsequently assessed. During the time of the field assessment, most of the Freshwater Habitat features were dry. Across the POIs the floral community ranged from semi- to strongly riparian[10] in nature. Soil erosion was often associated with the Freshwater Habitat, with bare soils present throughout (the tendency of this habitat to soil erosion has likely resulted / exacerbated the creation of the Degraded Thornveld to the west of the Freshwater Habitat). Overall species composition within the Freshwater Habitat was moderate to moderately low. Common graminoid species recorded within the habitat included *Phragmites australis, Eragrostis lehmanniana, Bulbostylis hispidula* subsp. *pyriformis* and *Digitaria eriantha*. Woody species frequently rerecorded included *S. lancea* and *Z. mucronata*. Compared to the Thornveld and Degraded Thornveld Habitats, this habitat unit supported the highest density of AIP species (e.g., *Tagetes minuta, Bidens pilosa, Hibisus trionum*, and *Xanthium strumarium*). This habitat unit has been significantly impacted by anthropogenic activities, e.g., sand mining, AIP proliferation, dumping (especially waste material from illegal mining activities), erosion and insizement of the channels. Despite the degraded and impacted nature of this habitat unit, the Freshwater habitat unit is considered unique in the landscape as it provides habitat for species that have a higher affinity for wetter soils and provides potential corridors (e.g., dispersal) across the landscape.

[10] "Riparian habitat" (as per the National Water Act, 1998 (Act No. 36 of 1998) includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

HABITAT OVERVIEW

Photographs: a) typical Thornveld Habitat, b) typical Thornveld habitat in which woody encroachment is evident, c) typical Freshwater Habitat associated with the study area (with evident dumping in the drainage line), and d) Freshwater Habitat in which erosion is evident. At the time of the assessment the river was dry.

Photographs: a) *Polygala hotentotta* (a forb species frequently recorded during the field assessment), b) *Jatropha zeyheri* (a forb species recorded during the field assessment), c -d) AIP species, namely *Xanthium strumarium* (c) and *Argemone ochroleuca* subsp. *Ochroleuca* (d), recorded during the field assessment.

Photographs of typical woody species recorded during the field assessment: a) *Ziziphus mucronata*, b) *Ehretia rigida* in bud, c) *Senegalia mellifera* subsp. *detinens* in fruit, and d) *Boscia foetida subsp. rehmanniana* in fruit.

<table>
<tr><th colspan="3">HABITAT OVERVIEW</th></tr>
<tr><th>Thornveld Habitat</th><th>Degraded Thornveld Habitat</th><th>Freshwater Habitat</th></tr>
<tr><th colspan="3">Vegetation structure</th></tr>
<tr><td>Semi-open to closed woodland (as per Diagram A1 in Appendix A) characterised by low herb and forb diversity and generally a homogenous grass layer.
Overall, the structure and species composition of this habitat is no longer considered fully representative of the reference vegetation type.</td><td>Semi-open to open woodland (as per Diagram A1 in Appendix A) often characterised by bare (i.e., unvegetated) areas and less abundant vegetation cover.
Overall, the structure and species composition of this habitat is no longer considered representative of the reference vegetation type.</td><td>Semi-open to open woodland (as per Diagram A1 in Appendix A). Overall species richness was moderate to moderately low.
Overall, the structure and species composition of this habitat is no longer considered fully representative of the reference vegetation type.</td></tr>
<tr><th colspan="3">SPECIES OF CONSERVATION CONCERN</th></tr>
<tr><td colspan="3">In terms of Section 56 of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA), threatened species are Red Data Listed (RDL) species falling into the Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected (P) categories of ecological status. During the October 2021 field assessment, no RDL species were identified within the study area.

The National Web-based Environmental Screening Tool indicated that the study area is in an area of medium sensitivity from a Plant Species Theme perspective. However, no SCC as identified by the screening tool (namely Cullen holubii (VU)) were recorded with this habitat unit. The Probability of Occurrence (POC) for this species within the study area is deemed to be Medium. Thus, the medium sensitivity as denoted by the screening tool was not supported for the Plant Species Theme.

The Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983) (TNCO) provides a list of Protected Plants (Schedule 11) and Specially Protected Species (Schedule 12) for the North West Province. These species were also considered as part of the SCC assessment for the study area because they are considered important provincially. Provincially protected species recorded and their associated POC for TNCO protected species are presented below for the habitat units:
➢ <u>Thornveld & Degraded Thornveld Habitat</u>:
- Spirostachys africana (POC = High; Status = LC);
- Scadoxis puniceus (POC = High; Status = LC);
- Ammocharis coramica (POC = Medium; Status = LC); and
- Huernia, Orbea & Stapelia species (POC = Medium).
➢ <u>Freshwater Habitat</u>:
- Spirostachys africana (POC = Medium; Status = LC).

Additionally, several protected tree species, as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA), were included in the SCC assessment and several species were observed within the Habitat unit/s. The POC calculations for these species are presented below:
➢ <u>Mowed Road Verge Habitat</u>:
- Sclerocarya birrea subsp. caffra (POC = High; Status = LC);
- Combretum imberbe (POC = High; Status = LC); and
- Boscia albitrunca (POC = High; Status = LC).

The Threatened or Protected Species (TOPS) List as per the 2007 Regulations provides a list of protected species for the Limpopo Province. Suitable habitat was identified for the following species within the following habitat units:
➢ <u>Thornveld, Degraded Thornveld units</u>:</td></tr>
</table>

HABITAT OVERVIEW
- *Harpagophytum procumbens* (POC = High; Status = LC). Permits from the North West Department of Rural, Environmental and Agricultural Development (NWDREAD) and authorisation from the Department of Forestry, Fisheries, and the Environment (DFFE) should be obtained to remove, cut, or destroy any of the above-mentioned protected and/or threatened species before any vegetation clearing may take place. Refer to **Appendix H** for the complete SCC assessment results.
PRESENCE OF UNIQUE LANDSCAPES
Overall, the study area has been modified or degraded by anthropogenic influences (e.g., illegal mining and dumping of associated waste material, AIP proliferation, grazing pressures etc.), and the vegetation communities are no longer considered representative of the reference vegetation types. The Terrestrial Sensitivity for the entire study area is considered to have a **very high sensitivity**. The triggered sensitivity feature included the presence of a CBA2[11]. Given the level of anthropogenic influences experienced across the study area and greater surrounding areas, the presence of CBA2 habitat was not confirmed for either the Thornveld or the Degraded Thornveld Habitat units. Although the Freshwater Habitat has been impacted by anthropogenic influences (e.g., dumping) and edge effects (e.g., erosion and AIP proliferation), it still has the propensity to provide important ecological services within the study area and the greater surrounding areas, e.g., including connective and dispersal corridors, albeit in an altered fashion. As such, the Freshwater habitat is considered representative of CBA2 habitat.
CONCLUDING REMARKS
From a floral perspective, the Thornveld and Degraded Thornveld Habitat is deemed to be of a moderately low ecological importance whereas the Freshwater habitat is deemed to be of intermediate ecological importance within the greater landscape. Key considerations: - The reference vegetation type, as per Mucina & Rutherford (2006), included the **Zeerust Thornveld**. Given the overall degraded nature of the habitats within the study area, as well as the alteration of natural fire regimes and grazing pressure experienced within the habitats, none of the Habitat units are considered representative of the reference vegetation types. - This report serves as a baseline for planning purposes only. Once final prospecting layouts have been finalised, it is recommended that the report be updated, and a subsequent field assessment of the study area be conducted by a suitably qualified specialist to confirm and/or update the habitat units and associated floral communities within the study area. - No SCC species were recorded within the habitats, however, the propensity of the study area, particularly within the Thornveld and the Degraded Thornveld Habitat unit, to support several SCC species (i.e., as per the TNCO, NFA, and/or TOPS species and threatened RDL species) is deemed to be moderate to high. If the proposed prospecting activities are authorised, it is recommended that a summer season walkthrough of the study area be conducted, and all SCC marked and considered for possible relocation to suitable habitat in the nearby, natural surrounding areas. It is recommended that for species that cannot be relocated, seedlings and /or seeds of these species are harvested from the prospecting footprint area before clearing activities commence and grown under nursery conditions with the purpose to use these species for rehabilitation at a later stage. Permits from the relative authorities will be required before any removal or relocation of any protected SCC can take place.

[11] CBA2 = areas characterized by ecosystems and species that are fully or largely intact and undisturbed in nature. These are biodiversity features that are approaching but have not passed their limits of acceptable change. These consist of areas with intermediate irreplaceability or some flexibility in terms of meeting biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve biodiversity targets, although loss of these sites would require alternative sites to be added to the portfolio of CBAs. CBA2s should be maintained in a natural or near-natural state to maximize the retention of biodiversity pattern and ecological process.

HABITAT OVERVIEW
- In terms of the National Web-based Environmental Screening Tool outcome, the study area (and its associated habitat units) does not match the medium sensitivity assigned to the Plant Species Theme, especially as suitable habitat to support the triggering sensitive species was not recorded during the field assessment. The study area is located within important biodiversity features such as CBA2. CBA2 habitat was not identified within either the Thornveld or the Degraded Thornveld habitat units, however, CBA2 habitat was identified within Freshwater Habitat, especially as the propensity of the Freshwater habitat to provide functions of CBA habitat is apparent. Given that some CBA habitat was confirmed within the within the Freshwater Habitat, the very high sensitivity assigned to the Terrestrial Biodiversity Theme was confirmed for the Freshwater habitat but not for the remaining Thornveld and Degraded Thornveld Habitat Units. - Due to the entire study area already being exposed to continued disturbance (e.g., illegal mining and grazing pressures) and edge effect impacts (e.g., woody encroachment and AIP proliferation) in all the habitat units, the entire study area and greater surrounding areas are susceptible to woody encroachment and AIP proliferation. Care must be taken to limit edge effects on the surrounding natural areas. Furthermore, it is recommended that an encroachment and AIP species management plan be developed to manage the proliferation of indigenous woody species and AIPs within the study area and the greater surrounding areas. - All the natural areas outside of the authorised footprint must be demarcated as “no-go” areas to ensure no footprint creep takes place.

4.3 Faunal Assessment Results

Selected examples of faunal habitat and species recorded in the vicinity of the study area

Photos from left to right: Left – Representative image of the Freshwater habitat which was dry during the time of the field assessment and will provide movement corridors for mammals. **Middle** – evidence of high human presence was observed at the Freshwater POIs in the form of waste disposal. **Right** – open spaces persist amongst encroached areas of the Thornveld habitat that may allow fauna, including *Sagittarius serpentarius* (Secretarybird, NT) to pass through and even forage in this habitat unit.

Fauna recorded in POIS: – Droppings of *Phacochoerus africanus* (Common Warthog, LC). **Middle** – A swallow nests likely belonging to *Cecropis cucullata* (Greater-Striped Swallow, LC) was observed under bridges. **Right** – A species of short-horned grasshopper (*Catantops* sp) was frequently observed in all habitats.

Faunal Habitat Overview

From observations in the faunal POIs, it can be extrapolated that the study area hosts a moderate to moderately low faunal diversity overall. Very few faunal species and signs thereof were observed, likely due to the short time duration of the field assessment. Another likely factor limiting faunal diversity, particularly mammals on site, is the high human presence in the nearby village that has likely resulted in many wild species being hunted or deterred from the area. Additionally, the study area has been impacted upon by anthropogenic influences (e.g., illegal mining, sand mining, AIP proliferation and livestock grazing pressures). The herbaceous layer in large portions of the Thornveld and Degraded Thornveld habitat is likely depleted or degraded to an extent that it is unfavourable as a food resource for wild grazers. Faunal accessibility, resources and diversity in the Thornveld habitat is likely further limited by bush encroachment. The abundance of *Vachellia* and other savanna trees will, however, support common mammalian and invertebrate browsers and will provide nesting sites for various common avifaunal species. Several birds of prey that may breed in the cliffs of the Pilanesberg National Park may also forage over the study area. There is a possibility that several SCC may utilise the Thornveld Habitat as foraging or traversing grounds. The Thornveld habitat is thus considered to be of moderate importance from a faunal perspective despite its degraded condition. The ephemeral nature of the Freshwater Habitat, limits the faunal assemblage on site to mostly common water-independent, disturbance adapted species (see Appendix G, Table G) for a list of all faunal species observed or expected to occur in the study area). The Freshwater Habitat is heavily impacted by anthropogenic activities, e.g., sand mining, waste dumping, AIP proliferation erosion and insizement of the channels. Despite its impacted condition, the Freshwater habitat unit is considered unique in the landscape as it provides an important movement corridor for fauna through the woody encroached habitats. The Freshwater Habitat is therefore deemed to be of moderate importance from a faunal perspective. The Degraded Thornveld Habitat unit is considered to be of lowest importance from a faunal perspective as it offers the least amount of habitat and food availability. Trees and for common arboreal invertebrates and reptiles. No faunal SCC were observed during the field assessment, however the distribution range and habitat requirements of the eight species described below overlap the study area and therefore have an increased POC on site. The screening tool indicated that the avifaunal SCC, *Sagittarius serpentarius* (Secretarybird, NT) has a high POC on site. Ground-truthed observations by STS disputes the "High" POC of this species and instead assigns a "Medium" sensitivity at most as bush encroachment has reduced the availability of open areas (requirement of the species) on site.

FAUNAL SCC

Species	Habitat and Resources in the Study Area	Provincial Status	POC	Species	Habitat and Resources in the Study Area	Provincial Status	POC
Eidolon helvum (African Straw-coloured Fruit-bat)	This species is adapted to a wide range of habitats including dry savanna like the Degraded Thornveld and Thornveld habitats. It can persist in modified habitats, thus the villages in the area will not be a deterrent. It eats mostly fruit but will also eat bark, flowers and leaves which will be provided by trees in the area (Bergmans, 1990).	Near Threatened (NT)	**Medium**	*Polemaetus bellicosus* (Martial Eagle)	Inhabits open and wooded savanna, including thornbush which as observed in the Thornveld habitat unit. Pylons, which provide an artificial nesting site for the species were observed in the vicinity of the study area.	VU	**Medium**
Harpactira hamiltoni (Highveld Baboon Spider, Protected)	*Harpactira hamiltoni* is a fossorial species, living in deep burrows they either modify from a crevice between rocks, or constructed themselves beneath rocks, tree stumps and even at the base of shrubs	Protected (P)	**Medium**	*Sagittarius serpentarius* (Secretarybird)	The species inhabits open landscapes, ranging from open plains and grasslands to lightly wooded savanna. No breeding habitat was available on site, or in the immediate surroundings, but open areas between trees in study area may be used as foraging grounds for this highly nomadic species.	NT	**Medium**
Ardeotis kori (Kori Bustard)	It occurs in flat, arid and mostly open country (del Hoyo et al. 1996). The Thornveld habitat had various open areas through which this large bird may forage. This species has been recorded previously in the vicinity of the study area.	Vulnerable (VU)	**Medium**	*Torgos tracheliotus* (Lappet-faced Vulture)	Far ranging species that may feed on carcasses of dead animals if present in the study area. Unlikely to nest in the study area.	VU	**Medium**
Pyxicephalus adspersus (Giant Bullfrog)	Inhabits a variety of vegetation types including savanna. It typically breeds in seasonal, shallow, grassy pans in flat, open areas but also utilizes shallow water on the margins of waterholes and in ephemeral rivers. The species can travel up to 1 km from water while foraging and searching for habitat in which to aestivate. The species may potentially breed in ephemeral puddles that may form in the Freshwater habitat after heavy rains in the summer. They may also traverse other habitat units while foraging.	Protected	**Medium**	*Python natalensis* (Southern African Rock Python	Occurs mainly in savanna and woodland which are present in all habitat units, especially the Freshwater Habitat (when dry) and Thornveld habitat in the study area.	P	**Medium**

CONCLUDING REMARKS

The drilling of nine boreholes and the construction of five trenches will not result in the loss of sensitive habitat for faunal assemblages. The footprints of the proposed infrastructure are relatively small and are currently not planned to cross the Freshwater Habitat and won't impede corridors. As such, disturbance levels and the perceived impacts are not anticipated to significantly alter the local faunal habitat and diversity from the current environmental conditions, provided mitigation measures stipulated in this report are adhered to.

4.4 Alien and Invasive Plant (AIP) Species

South Africa is home to an estimated 759 naturalised or invasive terrestrial plant species (Richardson et al., 2020), with 327 plant species, most of which are invasive, listed in national legislation[12]. Many introduced species are beneficial, e.g., almost all agriculture and forestry production are based on alien species, with alien species also widely used in industries such as horticulture. However, some of these species manage to “escape” from their original locations, spread and become invasive. Although only a small proportion of introduced species become invasive (~0.1–10%), those that do proceed to impact negatively on biodiversity and the services that South Africa’s diverse natural ecosystems provide (from ecotourism to harvesting food, cut flowers, and medicinal products) (van Wilgen and Wilson, 2018).

4.4.1 Legal Context

South Africa has released several Acts legislating the control of alien species. Currently, invasive species are controlled by the NEMBA – Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 October 2020. AIP species defined in terms of NEMBA are assigned a category and listed within the NEMBA List of Alien and Invasive Species (2020) in accordance with Section 70(1)(a) of the NEMBA:

- **Category 1a** species are those targeted for urgent national eradication;
- **Category 1b** species must be controlled as part of a national management programme, and cannot be traded or otherwise allowed to spread;
- **Category 2** species are the same as category 1b species, except that permits can be issued for their usage (e.g., invasive tree species can still be used in commercial forestry, providing a permit is issued that specifies where they may be grown and that permit holders “*Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3*”); and
- **Category 3** are listed invasive species that can be kept without permits, although they may not be traded or further propagated, and must be considered a Category 1b species if they occur in riparian zones.

[12] Government Notice number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004).

Duty of care related to listed invasive species are referred to in NEMBA Section 73[13]. The motivation for this duty of care is both environmentally and economically driven. Management of alien species in South Africa is estimated to cost at least ZAR 2 billion (US$142 million) each year - this being the amount currently spent by the national government's DFFE - i.e., the Working for Water programme (van Wilgen, 2020). Managing AIPs early on will reduce clearing costs in the long run.

4.4.2 Site Results

A total of 11 AIP species were recorded during the field assessment. These species were recorded in the POIs and greater surrounding areas. Thus, they are highly likely to be recorded within the habitat units associated with the study area.

Of the 11 AIP species recorded within the study area, five species are listed under NEMBA category 1b, and one species is listed under NEMBA category 2. The remaining five species are not currently listed in the NEMBA Alien and Invasive Species List of 2020 and thus are not regarded as invasive species. Several of these species are rather seen as problem plants, especially *Bidens Pilosa, Tagetes minuta*, *Sesbania sesban*, and *Agave americana*. Although these species may not pose an immediate risk of displacing native flora, they can become problematic after disturbance events and due to their pioneering nature, will colonise disturbed habitat more readily than native flora.

It is recommended that the study area be targeted for AIP control, especially along the Freshwater Habitat where AIP propagules can be transported to downstream sites.

Refer to table 2 for more details on the AIPs recorded within the study area.

[13] Section 73(2): A person who is the owner of land on which a listed invasive species occurs must-

a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and
c) take all the required steps to prevent or minimise harm to biodiversity.

Table 2: Alien and invasive alien species associated with the study area.

Scientific name	Common name	Origin	NEMBA Category	Thornveld Habitat	Degraded Thornveld Habitat	Freshwater Habitat
Woody Species						
Melia azedarach	Syringa	Asia	1b			x
Sesbania sesban	Egyptian river hemp	NE Africa	NL	x		x
Herbaceous Species						
Argemone ochroleuca subsp. *ochroleuca*	Mexican poppy	Mexico	1b	x	x	x
Xanthium strumarium	Common cocklebur	Central & South America	1b	x	x	x
Zinnia peruviana	Zinnia	Peru	NL	x	x	
Bidens pilosa	Blackjack	South America	NL	x	x	x
Tagetes minuta	Khaki weed	South America	NL	x	x	x
Succulent Species						
Agave americana	Century plant	South America	NL	x	x	
Agave sisalana	Sisal	South America	2	x	x	
Opuntia cf. *ficus-indica*	Sweet prickly pear	South America	1b	x	x	
Graminoid Species						
Pennisetum setaceum	Fountain grass	Americas	1b	x	x	

5. SENSITIVITY MAPPING

The Screening Tool identified the study area to be in a **medium sensitivity** area for the Plant Species Theme, a **high sensitivity** area for the Animal Species Theme, and a **Very High Sensitivity** area for the Terrestrial Biodiversity Theme. Based on the *ground-truthed* results of the site visit, Table 3 below presents the sensitivity of each identified habitat unit for both flora and fauna along with an associated conservation objective and implications for development.

Figures 12 and 13 conceptually illustrate areas of ecological sensitivity – depicting the combined sensitivity for flora and fauna. The study area is depicted according to its sensitivity in terms of the presence or potential for SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity.

Table 3: A summary of the Floral sensitivity of each habitat unit and implications for development.

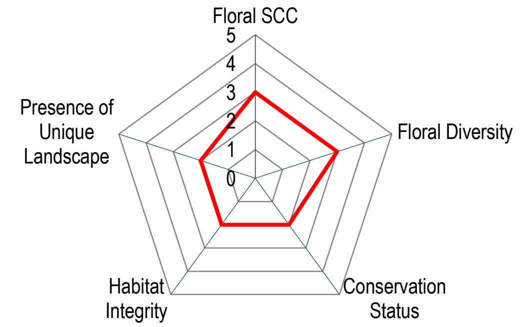
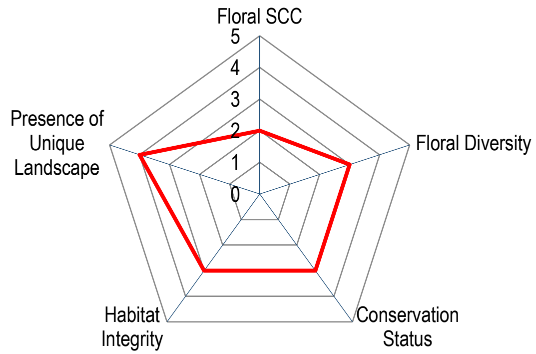
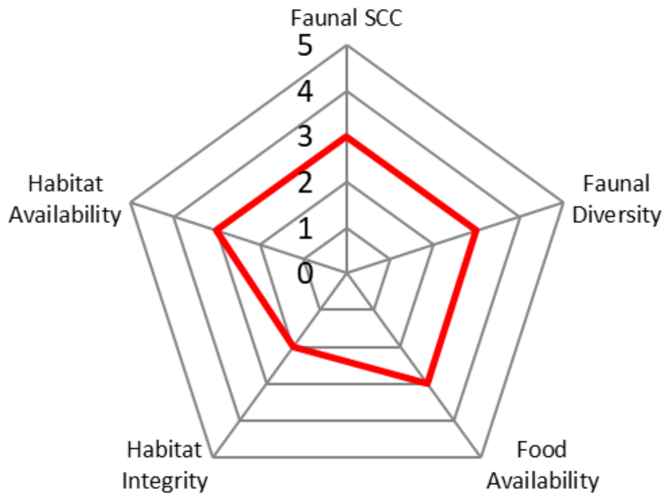
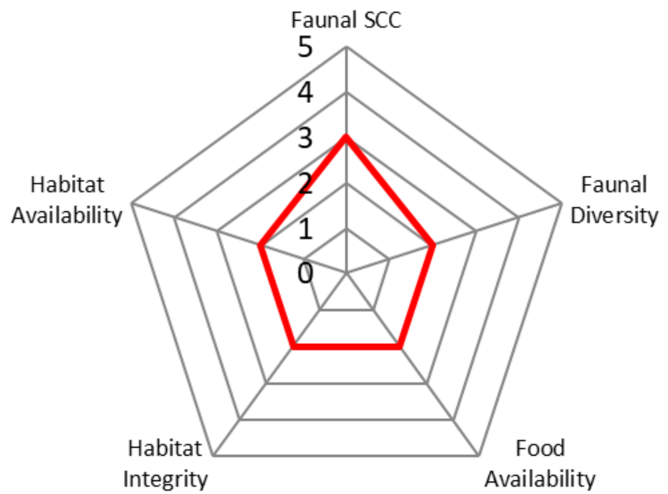
Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
Moderately low 	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	**Thornveld Habitat** **&** **Degraded Thornveld Habitat**	- Meets the definition of Indigenous Vegetation, albeit in a degraded state. - Habitat units have been degraded due to current and historic disturbances (e.g., grazing pressures, illegal mining and associated dumping of waste material, AIP proliferation, woody encroachment, etc.,). - The floral communities within this habitat unit have shifted away from the reference vegetation type. Floral species diversity is moderate to moderately low. - No floral SCC were recorded within the habitat units, however, habitat to support SCC (i.e., as per the TNCO, TOPS, and NFA) is deemed likely. - No significant biodiversity features, i.e., CBA2 habitat, is present.
Intermediate 	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.	**Freshwater Habitat**	- Meets the definition of Indigenous Vegetation, albeit in a degraded state. - Habitat has been degraded by dumping as is evident with the presence of AIPs. - Habitat associated with a moderate to moderately low floral species diversity. - No floral SCC were recorded within the habitat units, however, habitat to support SCC (i.e., as per the TNCO, TOPS, and NFA) is deemed likely. - Despite its level of degradation, this habitat has the propensity to provide important ecological functions (e.g., dispersal corridors) within the study area and the greater surrounding areas because of the presence of CBA2 habitat.

Table 4: A summary of the Faunal sensitivity of each habitat unit and implications for development.

Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
Intermediate 	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.	**Freshwater Habitat & Thornveld habitat**	- The Freshwater Habitat, albeit impacted by anthropogenic activities and AIP proliferation provides important movement corridors for fauna amongst woody encroached environs, enhancing habitat connectivity. - The protected, explosive breeding amphibian species, *Pyxicephalus adspersus* (Giant Bullfrog) has been recorded in the study area's QDS and may therefore use the Freshwater Habitat to breed, when temporary pools form in it following rains. - Although encroached and in close proximity of a large human settlement the Thornveld habitat still provides suitable habitat and food resources for a diversity of common mammals, avifauna, invertebrates and reptiles. - Eight SCC, including the avifauna listed by the DFFE screening tool, *Sagittarius serpentarius* (Secretarybird, NT) may potentially use the Degraded Thornveld as foraging grounds. These listed SCC are not, however, considered range restricted and are not reliant on the study area for their continued survival.
Moderately low 	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	**Degraded Thornveld Habitat**	- The habitat unit has been degraded due to current and historic disturbances (e.g., grazing pressures, illegal sand mining, AIP proliferation, woody encroachment, increased levels of erosion etc.,). - No faunal SCC are expected to occur within or utilise this habitat unit. - Large areas remain unvegetated, thereby providing little faunal habitat herein. - Dead wood and fallen trees may still, however, provide habitat and areas of refuge to smaller invertebrates and reptiles.

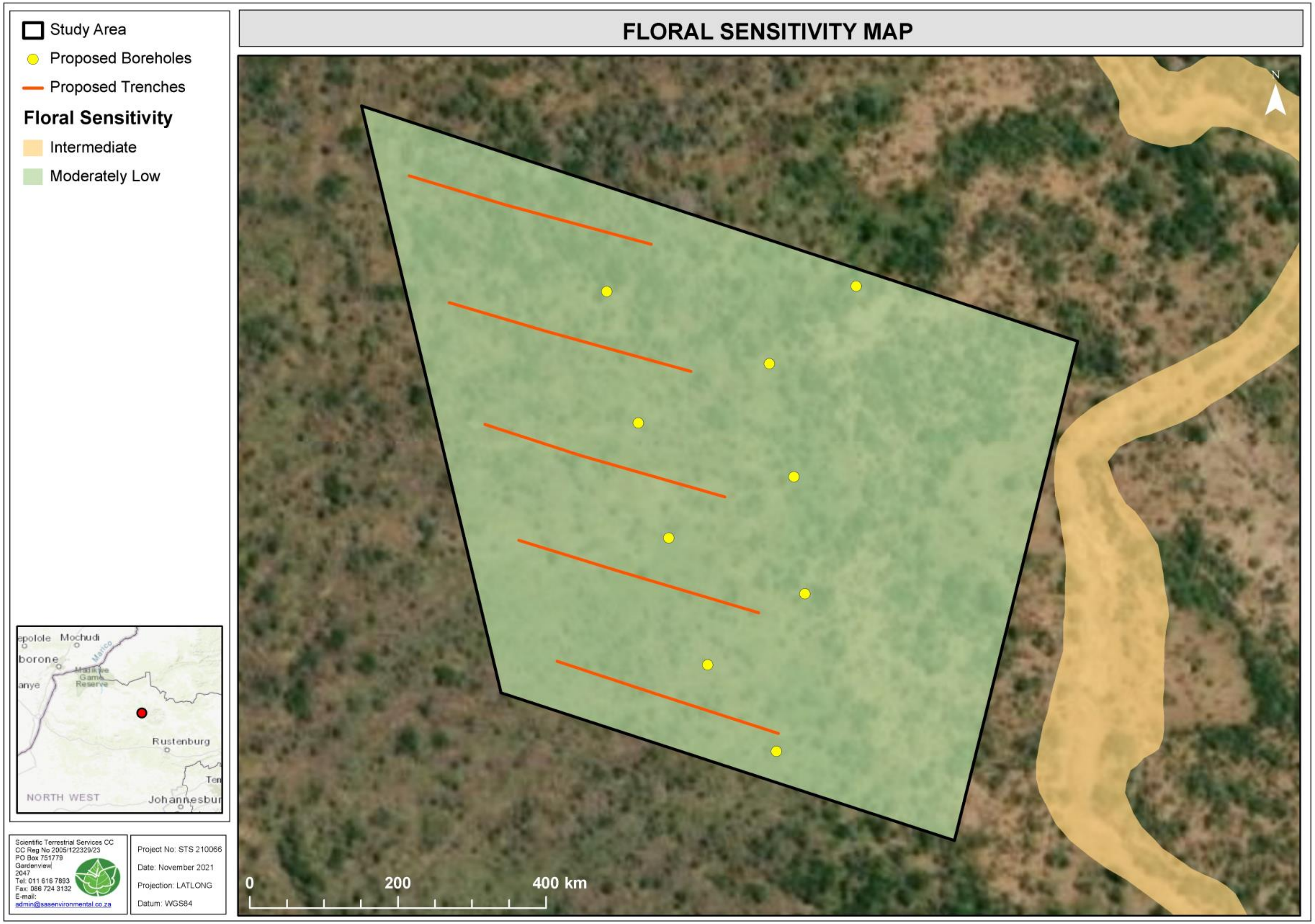


Figure 12: Floral sensitivity map of the study area.

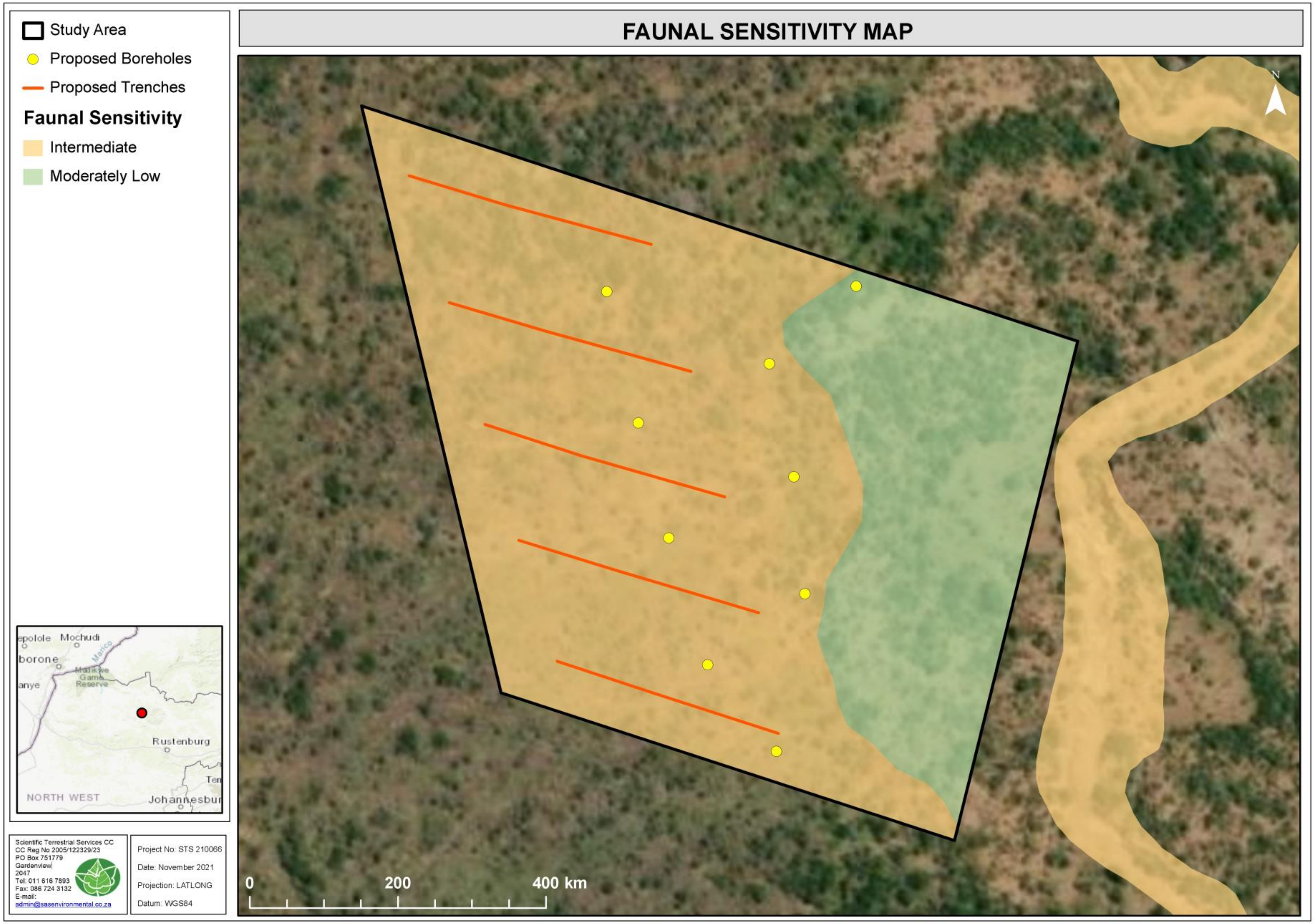


Figure 13: Faunal sensitivity map of the study area.

6. IMPACT ASSESSMENT

The below section provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented (**Section 6.4)**. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

An impact assessment and discussion of all potential i) Planning ii) Prospecting phase, and iii) Rehabilitation Phase impacts are provided for the floral and faunal components of the focus area.

<u>Proposed Activity Description</u>**:**
Prospecting activities, including the drilling of nine boreholes and the construction of five trenches, has been proposed by the proponent. At present, the proposed boreholes and trench layouts are located within the Thornveld and Degraded Thornveld Habitat units. No prospecting activities are currently proposed for the Freshwater Habitat and as such the Freshwater Habitat is not anticipated to be impacted directly although it will be impacted indirectly by such activities). If the provided prospecting activity layouts are amended/altered and the proposed prospecting activities are subsequently located within any Freshwater Habitat, then a new impact assessment will need to be conducted.

Table 5 below lists all activities part of the proposed prospecting operation and their anticipated impacts to biodiversity in the study area. Within table 5, several impacts associated with the proposed prospecting activities have been identified for the study area. For the purpose of the impact assessment (Section 6.2, Tables 6 & 7), these impacts have been grouped into two main categories (dependent on the nature thereof) including i) impacts on habitat diversity (for both floral and faunal components) and ii) impacts on SCC (for both floral and faunal components).

6.1 Activities and Aspects

Table 5: Activities and Aspects likely to impact on the faunal and floral resources of the study area.

ACTIVITIES AND ASPECTS REGISTER
Planning Phase
- Potential failure to conduct a summer season walkthrough of the study area and identify floral SCC within the prospecting site. - Potential failure to obtain permits for protected floral species that must be removed if in the prospecting footprints. - Potential failure to relocate floral SCC to suitable habitat outside the prospecting footprints. - Potential failure to conduct a site-walkdown prior to vegetation clearing to determine the presence of faunal SCC; - Potential failure to obtain the necessary permits for the removal of protected faunal species should they be needed, resulting in delays to the prospecting activities and relocation of such SCC. - **Impact**: Loss of floral and faunal SCC within the prospecting footprint areas in the study area.
- Inconsiderate planning of prospecting locations within the study area leading to the loss of potential floral and faunal species and/or habitat for such species, as well as unnecessary edge effect impacts on areas outside of the proposed prospecting activities footprint. - **Impact:** Degradation and modification of the receiving environment, loss of floral habitat.
- Potential failure to design and implement an AIP Management/Control plan before the commencement of prospecting activities, resulting in the spread of AIPs from the prospecting footprint to surrounding natural habitat. - **Impact:** Spreading of AIPs, leading to potential loss of floral species diversity from surrounding natural habitat. Loss of faunal niche habitat, limiting the re-establishment potential of faunal species and of potential faunal SCC due to proliferation of unfavourable AIPs.
- Potential failure to have a Rehabilitation Plan developed and ready for implementation before the commencement of prospecting activities. - **Impact**: Rehabilitation of disturbed areas should occur concurrently and without a rehabilitation plan in place prior to the prospecting phase, there could be potential delays in the implementation of the rehabilitation plan at later stages, thus leading to the loss of viable soils for optimal plant growth.
- Potential inadequate design of infrastructure leading to pollution of soils because of, e.g., leaks from infrastructure failure. - **Impact**: Contaminated soils potentially leading to a loss of viable growing conditions for plants and results in a decrease of floral and faunal habitat, diversity, and SCC – rehabilitation effort will also be increased as a result.
- Potential failure to set up an Erosion Control Plan for sloped areas, as well as designing inadequate stormwater management measures that could lead to increased erosion. Loss of a nutrient-rich topsoil layer and degradation of soil structure may also result. - **Impact:** Loss of floral and faunal habitat outside of the direct, authorised prospecting footprint.
Prospecting Phase
- Site clearing and the removal of vegetation at prospecting locations. - **Impact:** Loss of floral and faunal habitat, diversity, and the possible loss of floral and faunal SCC.
- Drilling trenches and boreholes in the Degraded Thornveld and Thornveld habitat units resulting in added noise pollution and possibly injuring fossorial faunal species buried in the proposed excavation sites. - Impact: Loss of faunal diversity in the study area, possibly injury and increased mortality of fossorial species including potentially occuring arachnid and herpetofaunal SCC.
- Potential for further faunal habitat fragmentation resulting from poorly rehabilitated areas and inadequate planning or impeding of migratory corridors following the proposed activities. - **Impact:** Long-term changes in faunal habitat, reduced faunal movement and potential loss of SCC.
- Potential failure to monitor the success of relocated floral SCC. - **Impact:** Loss of SCC individuals.
- Overexploitation through the removal and/or collection of floral SCC beyond the direct footprint area. - **Impact**: Local loss of floral SCC abundance and diversity.
- Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the further transformation of adjacent natural habitat. - **Impact:** Loss of favourable floral habitat outside of the direct prospecting footprint, including a decrease in species diversity and a potential loss of floral SCC.

ACTIVITIES AND ASPECTS REGISTER
- Additional pressure on floral habitat by increased human movement associated with the proposed prospecting and prospecting activities, including increased vehicular movement, contributing to: • Overexploitation through the removal and/or collection of floral SCC beyond the direct footprint area; • Increased introduction and spread of AIPs; • Increased woody encroachment; and • Increased risk of fire frequency. - **Impact:** Loss of floral habitat and the potential loss of floral SCC.
- Additional pressure on faunal habitat as a result of an increased human presence associated with the proposed prospecting activities, contributing to: • Potential hunting/trapping/removal/collection of faunal species or potential SCC within the study area; • Potential overexploitation through the trapping and/or hunting of faunal species, including faunal SCC, beyond the direct footprint area; and • Increased human activity will lead to the displacement and/or loss of potential faunal SCC. - **Impact:** Loss of sensitive faunal habitat and local faunal abundance and diversity, including SCC.
- Potentially poorly managed edge effects: • Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to the continual proliferation of AIP species and woody encroachment in disturbed areas and subsequent spread to surrounding natural areas altering the floral and faunal habitat; and • Compaction of soils outside of the study area due to indiscriminate driving of prospecting vehicles through natural vegetation. - **Impact:** Loss of floral and faunal habitat, diversity, and SCC within the direct footprint of the proposed prospecting activities. Loss of surrounding floral and faunal diversity and floral SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.
- Impaired water quality and reduced flow of Freshwater Habitats due to altered hydrology in the area because of poor management of sediment loads and the potential for the accumulation of vegetation cuttings and debris resulting from vegetation clearing activities. - **Impact**: Loss of favourable floral and faunal habitat and consequently a further loss of diversity and species reliant on the current pattern, flow, and timing of water in the landscape as well as the chemical constituency of the local water resources.
- Dust generated during prospecting activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants[14] and potentially further decreasing optimal growing /re-establishing conditions. - **Impact:** Declines in plant functioning leading to loss of floral species and habitat for optimal growth which may reduce forage and habitat availability for fauna.
- Possible increased fire frequency during prospecting activities. - **Impact:** Loss or alteration of floral and faunal habitat and species diversity.
- Decreased ecoservice provision & decreased ability to support biodiversity by Freshwater Habitats due to vegetation and soil disturbance. - **Impact:** Loss or alteration of Freshwater Habitat and associated species diversity.
- On-going disturbance during the prospecting phase may lead to erosion and sedimentation of surrounding floral and faunal habitat. - **Impact:** Degradation of favourable habitat and limited potential for floral and therefore also faunal re-establishment leading to loss of floral and faunal habitat and diversity within the local area.
Rehabilitation Phases
- Potentially ineffective rehabilitation of exposed and impacted areas leading to a shift in vegetation type will unfavourably alter floral habitat. - **Impact:** Permanent loss of floral habitat, diversity, and SCC due to loss of favourable habitat to reinstate floral SCC. Higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity.
- Ineffective rehabilitation of exposed and impacted areas potentially leading to unsuitable vegetation succession and a possible reduction of faunal diversity and occurrence of potential faunal SCC over the long-term. - **Impact:** Permanent loss of faunal habitat, diversity and SCC, and a higher likelihood of edge effect impacts on adjacent and nearby natural faunal habitat of increased sensitivity. Further reduction of available habitat in the long-term, compounding the limiting factors to faunal assemblages.
- Potential poor management and failure to appropriately monitor rehabilitation efforts, leading to: • Landscapes left fragmented, resulting in reduced dispersal capabilities of floral and faunal species and a decrease in floral and faunal diversity;

[14] Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.).

ACTIVITIES AND ASPECTS REGISTER
• Compacted soils and increased AIP cover and woody encroachment limiting the re-establishment of natural vegetation; • Increased risk of erosion in areas left disturbed. - **Impact:** Long-term (or permanent) loss of floral and faunal habitat, diversity, and SCC.
- Potentially poorly implemented and monitored AIP Management programme, leading to the reintroduction and proliferation of AIP species within the area. - **Impact:** Permanent loss of surrounding natural floral and faunal habitat, diversity, and SCC.
- Potentially poorly implemented and monitored woody encroachment programme, leading to the reintroduction and proliferation of indigenous encroachment species within the area. - **Impact:** Permanent loss of surrounding natural floral and faunal habitat, diversity, and SCC.
- Potential poor monitoring of relocated SCC. - **Impact:** Loss of SCC from the study area and poorly reinstated and represented floral SCC within rehabilitated areas.

6.2 Impact Assessment Tables

The below section provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented (**Section 6.4)**. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

The tables below provide the results of the floral and faunal impact assessments, respectively. As impacts pertaining to the Thornveld and the Degraded Thornveld Habitat are considered to be similar, the associated impacts were considered concurrently in the floral impact assessment.

A discussion is provided for flora and fauna separately in **Sections 6.3.1** (floral component) and **6.3.2** (faunal component) respectively.

Table 6: Summary of the Impact Assessment of the i) Planning, ii) Prospecting phase, and iii) Rehabilitation Phases associated with the floral component within the study area.

Habitat Unit	UNMANAGED						MANAGED					
	Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
PLANNING PHASE												
Impact of floral Habitat and Diversity												
Thornveld & Degraded Thornveld Habitat	M	L	L	Medium	Definite	**Medium**	L	L	VL	Very Low	Probable	**Very Low**
Freshwater Habitat	M	L	M	Medium	Definite	**Medium**	L	L	L	Low	Probable	**Low**
Impact on Floral SCC												
Thornveld & Degraded Thornveld Habitat	M	L	L	Medium	Definite	**Medium**	L	L	VL	Very Low	Probable	**Very Low**
Freshwater Habitat	L	L	VL	Low	Definite	**Low**	L	L	VL	Very Low	Probable	**Very Low**
PROSPECTING PHASE												
Impact of floral Habitat and Diversity												
Thornveld & Degraded Thornveld Habitat	M	L	M	Medium	Definite	**Medium**	L	L	L	Low	Probable	**Low**
Freshwater Habitat	M	L	M	Medium	Definite	**Medium**	L	L	VL	Very Low	Conceivable	**Insignificant**

Habitat Unit	UNMANAGED						MANAGED					
	Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
Impact on Floral SCC												
Thornveld & Degraded Thornveld Habitat	M	L	M	Medium	Probable	**Medium**	L	L	L	Low	Probable	**Low**
Freshwater Habitat	L	L	M	Low	Probable	**Low**	L	L	VL	Very Low	Conceivable	**Insignificant**
REHABILITATION PHASE												
Impact of floral Habitat and Diversity												
Thornveld & Degraded Thornveld Habitat	M	H	L	Medium	Definite	**Medium**	L	M	VL	Low	Probable	**Low**
Freshwater Habitat	M	H	M	Medium	Definite	**Medium**	L	M	VL	Very Low	Conceivable	**Insignificant**
Impact on Floral SCC												
Thornveld & Degraded Thornveld Habitat	M	M	L	Low	Probable	**Low**	L	L	VL	Low	Probable	**Low**
Freshwater Habitat	M	L	L	Very Low	Probable	**Low**	L	L	VL	Very Low	Conceivable	**Insignificant**

Table 7: Summary of the Impact Assessment of the i) Planning, ii) Prospecting and iii) Rehabilitation Phases associated with the faunal communities within the study area.

Habitat Unit	UNMANAGED						MANAGED					
	Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
PLANNING PHASE												
Impact on Faunal Habitat and Diversity												
Degraded Thornveld & Thornveld Habitat	M	L	L	Medium	Definite	**Medium**	L	L	VL	Very Low	Probable	**Very Low**
Freshwater Habitat	M	L	M	Medium	Definite	**Medium**	L	L	L	Low	Probable	**Low**
Impact on Faunal SCC												
Degraded Thornveld & Thornveld Habitat	M	L	L	Medium	Definite	**Medium**	L	L	VL	Very Low	Probable	**Very Low**
Freshwater Habitat	L	L	VL	Low	Definite	**Low**	L	L	VL	Very Low	Probable	**Very Low**
PROSPECTING PHASE												
Impact on Faunal Habitat and Diversity												
Degraded Thornveld & Thornveld Habitat	M	L	M	Medium	Definite	**Medium**	L	L	L	Low	Probable	**Low**
Freshwater Habitat	M	L	M	Medium	Definite	**Medium**	L	L	VL	Very Low	Conceivable	**Insignificant**
Impact on Faunal SCC												
Degraded Thornveld & Thornveld Habitat	M	L	M	Medium	Probable	**Medium**	L	L	L	Low	Probable	**Low**

Habitat Unit	UNMANAGED						MANAGED					
	Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
Freshwater Habitat	L	L	M	Low	Probable	**Low**	L	L	VL	Very Low	Conceivable	**Insignificant**
REHABILITATION PHASE												
Impact on Faunal Habitat and Diversity												
Degraded Thornveld & Thornveld Habitat	M	H	L	Medium	Definite	**Medium**	L	M	VL	Low	Probable	**Low**
Freshwater Habitat	M	H	M	Medium	Definite	**Medium**	L	M	L	Very Low	Conceivable	**Insignificant**
Impact on Faunal SCC												
Degraded Thornveld & Thornveld Habitat	M	M	L	Low	Probable	**Low**	L	L	VL	Low	Probable	**Low**
Freshwater Habitat	M	L	L	Very Low	Probable	**Low**	L	L	VL	Very Low	Conceivable	**Insignificant**

6.3 Impact Discussion

The direct impact of the proposed prospecting activities on the floral ecology of the study area is not anticipated to be detrimental. Due to the already degraded and modified nature of the habitat units, particularly the Thornveld and Degraded Thornveld Habitats, the associated impacts are anticipated to remain localised – given that mitigation measures are adequately implemented.

The overall impact significance prior to the implementation of mitigation measures varied between medium and low for the Thornveld Habitat, Degraded Thornveld Habitat, and the Freshwater Habitat. With the implementation of mitigation measures, the proposed impact significance varied between low and insignificant for all of the Habitat units within the study area.

6.3.1 Impact on Floral Ecology

Impact on Floral Habitat and Diversity

The impact assessment was undertaken on all aspects of floral ecology deemed likely to be affected by the proposed prospecting activities. The proposed prospecting activities will result in the localised clearance of vegetation which may lead to a loss of floral habitat and diversity within the study area. Although, the prospecting activities may be associated with the loss of floral species in the footprint area, it is not likely to impact floral communities at a larger local and regional (provincial) level.

The development of the proposed prospecting activities within the Thornveld and the Degraded Thornveld Habitat units (of moderately low sensitivity from a floral perspective) will result in the loss of the associated floral habitat. However, these habitats are largely modified and degraded in nature. As such a significant loss of the associated modified floral communities is not anticipated. The proposed prospecting activities are thus not likely to impact floral communities at a larger local and regional (provincial) level.

The development of the proposed prospecting activities within the Freshwater Habitat unit (of intermediate sensitivity from a floral perspective) should not result in the loss of the associated floral habitat as prospecting activities are not proposed to directly impact this habitat unit (i.e., no drilling or trenching is currently proposed for this habitat). Despite this, the Freshwater Habitat is still susceptible to indirect effects (e.g., edge effects) associated with the proposed prospecting activities. Although this habitat unit has been subject to anthropogenic impacts which has subsequently lead to a degradation in ecological condition, the Freshwater Habitat still provides important ecological functions within the study area and the surrounding areas. As such, strict mitigation measures are to be implemented to ensure that this habitat is not impacted further by the proposed prospecting activities.

Provided that strict mitigation measures are implemented, it is anticipated that the impact on floral habitat and diversity will be localised in extent and will not impact ecological functioning, ecological corridors, or floral conservation targets for the region.

Negative impacts likely to be associated with the floral ecology within the study area includes, but are not limited to, the following:

- Placement of infrastructure and/or prospecting material within natural habitat outside of the authorised footprint;
- Destruction of floral habitat during the prospecting activities (i.e., particularly during the mining phase); and
- AIP proliferation increased woody encroachment, and increased erosion within disturbed areas.

Impact on Floral Species of Conservation Concern

No floral RDL, TOPS, NFA trees or provincially protected species as listed under the TNCO were recorded within the study area. However, suitable habitat for such species is present within the footprint areas. Thus, if the proposed prospecting activities are authorised, it is recommended that, prior to any prospecting activities, a summer season walkdown be undertaken and all potentially occurring protected floral species within the final prospecting footprint be marked by means of a Global Positioning System (GPS). All floral SCC, as per the RDL, TNCO, the NFA, and TOPS List that are marked should be investigated for potential relocation to suitable habitat outside the direct footprint (as far as is feasible). Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. Rescue and relocation of SCC should be done by a suitably qualified specialist and either relocated (if feasible) to suitable habitat outside of the prospecting footprint or moved to registered nurseries such as the Agricultural Research Council (ARC) or the SANBI. Any other floral SCC encountered during the prospecting phase of the proposed prospecting activities should also be relocated by a suitably qualified specialist and, where required, the necessary permits should be applied for. Permits from the NWDREAD and the DFFE should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place.

It is recommended that for species that cannot be relocated, seedlings and /or seeds of these species are harvested from the prospecting footprint area before clearing activities commence and be grown under nursery conditions with the purpose to use these species for rehabilitation at a later stage.

Impact on CBAs, ESAs, Threatened Vegetation and Protected Areas

Due to their largely modified and degraded natures, neither the Thornveld nor the Degraded Thornveld habitat units within the study area were considered representative of the reference vegetation type, namely the Zeerust Thornveld.

The study area is not located within a threatened vegetation type or within a protected area. According to the NWBSP, the study area is located within an area classified as CBA2. Given the level of anthropogenic influences experienced across the study area and greater surrounding areas, e.g., intense grazing pressures and subsequent woody encroachment, AIP proliferation, etc., the presence of CBA2 habitat was not confirmed for either the Thornveld or the Degraded Thornveld Habitat units. Although the Freshwater Habitat has been impacted by anthropogenic influences (e.g., dumping) and edge effects (e.g., erosion and AIP proliferation), it still has the propensity to provide important ecological services within the study area and the greater surrounding areas, e.g., including connective and dispersal corridors, albeit in an altered fashion. As such, the Freshwater habitat is considered representative of CBA2 habitat. However, if mitigation measures are appropriately implemented, the associated impacts to the CBA habitat, i.e., that within the Freshwater Habitat, can be reduced to lower levels. Given this, the proposed prospecting activities are localised in scale and extent, such activities are unlikely to have a significant impact on the immediate area.

Probable Residual Impacts

Even with extensive mitigation, residual impacts on the receiving floral ecological environment are deemed likely. The following points highlight the key latent impacts that have been identified:

- Further loss of floral habitat and species diversity outside of the footprint area, especially surrounding, natural thornveld areas and the downstream habitat associated with the Freshwater Habitat, due to footprint creep or poorly managed edge effects; and
- Continued AIP proliferation and woody encroachment to adjacent natural vegetation communities (with the Freshwater Habitat of greatest concern).

Cumulative Impacts

The greatest threat to the floral ecology within the study area and the local region is the ongoing proliferation of poorly managed AIP species and woody encroachment which can result in an overall cumulative loss of native floral communities within the area.

6.3.2 Impact on Faunal Ecology

Impact on faunal habitat and diversity

Without mitigation, perceived impacts to faunal communities during all phases of the proposed prospecting activities are anticipated to range from Medium to Low. Following mitigation, impacts to the Freshwater Habitat can be reduced to insignificant levels during prospecting activities, whilst impacts to the Thornveld and Degraded Thornveld habitat canbe reduced to Low and to Very Low.

An increased impact significance prior to mitigation in the Thornveld and Degraded Thornveld habitat is largely based on the assumption that mitigation measures will not be implemented, that areas outside of the proposed prospecting activities footprint will also be cleared, edge effects will not be managed, and that no SCC rescue and relocation (if needed), rehabilitation, or alien plant management will be carried out. It is, however, possible to implement effective mitigatory measures to prevent excessive loss of faunal habitat and species diversity in these two habitat units. Currently, a limited section of the study area will be cleared for the proposed prospecting activities. Furthermore, the proposed activities will be situated in habitat units that are already degraded. It is therefore possible to keep the extent and intensity of impacts to faunal communities in these habitat units to a minimum with adherence to mitigatory measures stipulated in section 6.4.

No loss of faunal habitat is anticipated in the Freshwater Habitat as no prospecting is currently planned to take place therein. Despite this, the Freshwater Habitat is still susceptible to indirect effects (e.g., edge effects) associated with the proposed prospecting activities and impacts can increase if edge effects are not managed. Although this habitat unit is degraded by anthropogenic activities, it still provides important ecological functions within the study area and the surrounding areas by providing a faunal movement corridor and ephemeral water resource. As such, strict mitigation measures are to be implemented to ensure that this habitat is not impacted further by the proposed prospecting activities.

Impact on Important Faunal SCC

No faunal SCC or signs thereof were observed in the sample areas assessed and the likelihood of most SCC (listed in Appendix I) occurring within the study area, is reduced by bush encroachment, possible human-wildlife conflict and disturbances that exist in the area as a result of an extensive informal community and illegal mining present on site. However, best prospecting practices must still be employed alongside the recommended mitigatory measures to ensure no further habitat degradation occurs, notably as access to the exact site was not possible and as such, all cautionary principles must be applied. Best practice and well manage prospecting is important to assist in future rehabilitation activities, increasing the potential that SCC may make use of the study area post rehabilitation. It cannot be ruled out that the following eight SCC will not occur in or make use of the study area, as their distribution ranges and habitat requirements for foraging overlap the study area. These SCC are:

- *Eidolon helvum* (African Straw-coloured Fruit-bat, NT) in the Thornveld Habitat;
- *Torgos tracheliotus* (Lappet-faced Vulture, VU) may forage over the study area;
- *Ardeotis kori* (Kori Bustard, VU) in the Thornveld Habitat;
- *Pyxicephalus adspersus* (Giant Bullfrog, Protected) may breed in ephemeral puddles in the Freshwater Habitat and may be found 1 km into adjacent terrestrial habitats while foraging or aestivating;
- *Harpactira hamiltoni* (Highveld Baboon Spider, P) will burrow underground in all habitat units;
- *Polemaetus bellicosus* (Martial Eagle, VU) may forage over the study area;
- *Sagittarius serpentarius* (Secretarybird, NT) may traverse through open areas in the Degraded Thornveld or Degraded Thornveld habitat; and
- *Python natalensis* (Southern African Rock Python, Protected).

The availability of large cliff faces within 2 km of the study area, provides ideal roosting and breeding locations for many of the abovementioned avifaunal SCC. While these cliffs are outside the proposed prospecting activities footprint, these species may still forage across the study area and the surrounding areas. It is therefore imperative, that strict measures must be implemented against potential poisoning of vulture species by site personnel for traditional medicine, as this is a leading cause in the decline of vulture populations in South Africa (IUCN, 2021). Similarly, no poisoning of potential food sources for vultures should be tolerated.

The loss of faunal habitat and associated disturbances will impact potentially occurring SCC residing or relying on resources within the study area, but this will be a localised area and unlikely to be significant, given the relatively small footprint size of the proposed prospecting activities and the ability of avifaunal and mammalian SCC to move away from disturbance.

Herpetofaunal and invertebrate SCC are of most concern, as their decreased dispersal ability makes them susceptible to increased fatality risks during habitat clearing activities. As such, it is strongly advised that a rescue and relocation plan is designed and ready to be implemented prior to development for *Harpactira hamiltoni* (Highveld Baboon Spider, P), *Pyxicephalus adspersus* (Giant Bullfrog, P) and *Python natalensis* (Southern African Rock Python.

In the unlikely event that other SCC are encountered during the prospecting phase it is advised that an appropriate relocation plan, guided by the relevant specialist and provincial authorities, be created and implemented. Any species found to be listed under NEMBA: TOPS list of 2007, (refer to Table I8 in Appendix I of this report) will require a permit, should they need to be relocated. Overall, the study area is not considered crucial habitat from a faunal SCC perspective, and it is unlikely that SCC that utilise the study area, will be significantly impacted by the localised proposed prospecting development and its activities.

<u>Probable Residual Impacts</u>

Even with extensive mitigation, residual impacts on the receiving faunal ecological environment are likely. The following points highlight the key residual impacts that have been identified. It should be noted, however, that these impacts are also a result of the already degraded state of the environment due to the high human activities and are therefore not solely due to the proposed activities:

- Continued degradation of natural habitat adjacent to the proposed sites as a result of edge effects;
- Altered faunal species diversity;
- Potential loss of faunal SCC or habitat thereof;
- Potential loss of faunal abundance in the local area;
- Edge effects such as further habitat fragmentation and AIP proliferation; and
- Disturbed areas are highly unlikely to be rehabilitated to baseline levels of ecological functioning and loss of faunal habitat and species diversity will most likely be long term (life of proposed prospecting activities and due to increased human presence).

Possible cumulative Impacts

The local area has already been subjected to impacts as a result of historic and current illegal mining and high human presence in a nearby village. Development for the proposed prospecting activities will nonetheless lead to common faunal species being displaced from the proposed footprint areas into adjacent habitats. This may lead to increased competition for space and food resources, however, given the moderate abundance and replaceability of faunal diversity in the footprint areas, this impact is not expected to be significant. Edge effects and AIP proliferation are more concerning over the long-term. AIP proliferation will ultimately lead to loss of viable habitat, on a potentially increased scale in the surrounding areas, displacing faunal species further as indigenous floral species (faunal habitat and food resources) are displaced and lost. An additional cumulative impact that could increase during and post the prospecting activities, if not mitigated, is increased littering and dumping of other waste material in sensitive areas or outside designated areas, which will negatively impact faunal habitat on an increased scale over time.

6.4 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed prospecting activities in order to suitably manage and mitigate the ecological impacts that are associated with all phases of the proposed development. Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to floral and faunal diversity, habitat and SCC can be mitigated and minimised.

Table 8: A summary of the mitigatory requirements for floral & faunal resources.

Project phase	Planning Phase
Impact Summary	Loss of floral & faunal habitat, species diversity, and SCC
Proposed mitigation and management measures:	
Floral Habitat and Diversity - Minimise loss of indigenous vegetation where possible through adequate planning and, where necessary, by considering the sensitivity map of the biodiversity report; - Prospecting equipment to be utilised must be in good working condition, all possible precautions taken to prevent potential spills and /or leaks; and - Prior to the commencement of prospecting activities, an AIP Management/Control Plan should be compiled for implementation: o Removal of AIPs should preferably commence during the prospecting phase and continue throughout the rehabilitation phase. AIPs should be cleared within the study area before any vegetation clearing activities commence, thereby ensuring that no AIP propagules are spread with prospecting rubble, or soils contaminated with AIP seeds during the prospecting phase; and o An AIP Management/Control Plan should be implemented by a qualified professional. No chemical control of AIPs to occur without a certified professional or within the Freshwater Habitat. **Floral and Faunal SCC** - Although no floral SCC were recorded during the field assessment, suitable habitat for such species is present within the study area. It is recommended that, prior to the commencement of any prospecting activities, a summer season walkthrough of the study area be conducted and all floral SCC identified and marked by means of a GPS. - If SCC/protected species (both floral and faunal) are encountered and will be affected by the proposed prospecting activities, these species must, where possible, be relocated to suitable habitat surrounding the disturbance footprint. Appropriate permits from the respective authorities will need to be applied for before any protected species are removed/relocated. - Prior to vegetation clearing activities, the site should be inspected for the presence of faunal SCC, including reptiles and scorpions. If located, these species should be carefully rescued and relocated as per an approved rescue and relocation plan.	
Project phase	Prospecting Phase
Impact Summary	Loss of floral & faunal habitat, species diversity, and SCC
Proposed mitigation and management measures:	
Prospecting footprint - The prospecting footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management); - The prospecting footprint should be demarcated to ensure that prospecting activities are restricted to these areas and do not expand beyond the areas demarcated for development. A shade cloth/mesh barrier is considered desirable as this will provide a visual obtrusion for faunal species; - Appropriate sanitary facilities must be provided during the prospecting activities and must be removed to an appropriate waste disposal site; - No hunting/trapping or collecting of faunal species is allowed; - Barrier fences should be erected around the sections that will be excavated in order to prevent faunal species from accessing the prospecting site; - Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved prospecting footprint; - No access road must be cleared during the prospecting activities. Any additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimum; - No collection of indigenous floral and faunal species must be allowed by prospecting personnel, especially with regards to floral and faunal SCC (if encountered); - Care should be taken during the prospecting activities to limit edge effects to surrounding natural habitat. This can be achieved by: o Demarcating all footprint areas during prospecting activities (no development may occur outside of the authorised footprint area); o All soils compacted, especially outside of the prospecting footprint, as a result of prospecting activities should be ripped and profiled and re-seeded; o Manage the spread of AIP species, which may affect remaining natural habitat within surrounding areas. Specific mention in this regard is made to Category 1b and 2 species identified within the prospecting footprint areas (refer to section 4.4 of this report); o If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral and faunal rehabilitation later down the line. Spill kits should be kept on-site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the re-collection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil; o Upon completion of the prospecting activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area.	

- Smaller species of invertebrates and reptiles are likely to be less mobile during the colder period, as such should any be observed in the footprint areas during clearing and operational activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Operational personnel are to be educated about these species and the need for their conservation. Harmless reptiles should be carefully relocated by a suitably nominated prospecting person or nominated mine official. For larger venomous snakes, a suitably trained mine official should be contacted to affect the relocation of the species, should it not move off on its own.	
Alien Vegetation	
- Edge effects arising from the proposed prospecting activities, such as erosion, woody encroachment, and AIP species proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b and 2 AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020) (section 1.5 of this report); - Ongoing AIP monitoring and clearing/control should take place throughout the prospecting phase of the proposed prospecting activities; and - Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards.	
Floral SCC	
- No collection of floral SCC must be allowed by prospecting personnel; and - Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC outside of the proposed prospecting footprint area, particularly within the Freshwater Habitat.	
Faunal SCC	
- No collection of faunal SCC within the study area may be undertaken by any prospecting personnel; - Edge effect control needs to be implemented to prevent further degradation and potential loss of faunal SCC habitat outside of the proposed prospecting activities footprint; - Should any other faunal species protected under the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), the North West Biodiversity Management Act, 2016 (Act No. 4 of 2016) or the Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983) (TNCO) be encountered, prospecting should be halted and authorisation to relocate such species must be obtained from the or the Department of Environment, Forestry and Fisheries (DFFE) and North West Department: Economic Development, Environment, Conservation and Tourism (DEDECT); - Smaller species such as scorpions and reptiles are likely to be less mobile during the colder period, as such should any be observed in the study site during clearing and operational activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Operational personnel are to be educated about these species and the need for their conservation. Harmless scorpion or reptiles should be carefully relocated by a nominated prospecting person or staff member. For venomous snakes or scorpions, a suitably trained official or specialist should be contacted to affect the relocation of the species, should it not move off on its own. - All faunal species rescued must be relocated to a suitable offset site, with similar habitat conditions. The relevant permits must be applied for from DEDECT prior to the commencement of the prospecting phase; and - Edge effect control needs to be implemented to ensure no further degradation and potential loss of faunal SCC outside of the proposed project footprint area	
Fire	
- No illicit fires must be allowed during the prospecting activities.	
Rehabilitation	
- Rehabilitation of natural vegetation should proceed in accordance with the rehabilitation plan – concurrent rehabilitation is recommended. This rehabilitation plan should consider all phases of the prospecting activities indicating rehabilitation actions to be undertaken during and once prospecting has been completed, - An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on flora and fauna throughout the prospecting and rehabilitation phases. - Any natural areas beyond the direct footprint, which have been affected by prospecting personnel must be rehabilitated using indigenous species; - When rehabilitating a footprint site, it is imperative that as far as possible the habitat that was present prior to disturbances is recreated, so that faunal species that were displaced by vegetation clearing activities are able to recolonize the rehabilitated area; - Rehabilitation must be implemented concurrently as per the rehabilitation plan, and disturbed areas must be rehabilitated as soon as such areas become available. This will not only reduce the total disturbance footprint but will also reduce the overall rehabilitation effort and costs associated with it; and - All soils compacted because of prospecting activities falling outside of the project area should be ripped and profiled. Special attention should be paid to AIP control within these areas.	
Project phase	Rehabilitation Phase

Impact Summary	Loss of floral & faunal habitat, species diversity, and SCC
Proposed mitigation and management measures:	
Prospecting footprint - No additional habitat is to be disturbed during the Decommissioning & Rehabilitation Phase of the prospecting activities; - No vehicles are allowed to indiscriminately drive through sensitive habitat and natural areas; - No dumping of litter must be allowed on-site; and - No dumping of litter or garden refuse must be allowed on-site. As such it is advised that vegetation cuttings from landscaped areas be carefully collected and disposed of at a separate waste facility.	
Alien Vegetation - Edge effects arising from the proposed activities, such as erosion and AIP proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b and 2 AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020) (section 1.5 of this report); - Ongoing AIP monitoring and clearing/control should take place throughout the Decommissioning & Rehabilitation Phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas; - Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility, which complies with legal standards; and - Floral monitoring should be done annually during rehabilitation activities for a period of at least three years. Please also refer to the monitoring guidelines in section 6.5.	
Floral SCC - Monitoring of rescued and relocated floral SCC should continue during the rehabilitation phase until it is evident that the species have successfully established; - As far as possible, no collection of floral SCC/protected or medicinal floral species within the study area or adjacent natural habitat must be allowed during the Decommissioning & Rehabilitation Phase of the proposed prospecting activities; and - Edge effect control (e.g., erosion and woody encroachment control) needs to be implemented to prevent further degradation and potential loss of floral SCC/protected species or suitable habitat for such species outside of the proposed prospecting activities footprint.	
Faunal SCC - No collection of faunal SCC within the study area may be allowed by operational and maintenance personnel; - No collection or hunting of faunal SCC is allowed by operational and maintenance personnel. - Should any other faunal species protected under the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004: TOPS 2007 species list) or the Mpumalanga State of the Environment Report (2003) be encountered, a suitably qualified specialist should be consulted. Should it be deemed necessary to move the taxa authorisation to relocate such species must be obtained from DEDECT or the Department of Forestry, Fisheries and the Environment (DFFE).	
Rehabilitation - All infrastructure footprints that will be decommissioned should be concurrently rehabilitated in accordance with a rehabilitation plan compiled by a suitable specialist; - Where bare soils are left exposed as a result of prospecting activities, they should be immediately rehabilitated. Rehabilitated efforts should continue to be monitored throughout the operational phase, until natural processes will allow the ecological functioning and biodiversity of the area to be re-instated; - Following heavy rains, access roads and areas adjacent to the mining footprints are to be inspected for signs of erosion, which if found must be immediately rectified through appropriate erosion control measures; - All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated as per the post-closure land-use objective; and - Rehabilitation efforts must be implemented for a period of at least five years after decommissioning. A mix of indigenous grass seeds can be used during rehabilitation activities.	

6.5 Floral Monitoring

A floral monitoring plan must be designed and implemented throughout all phases of the proposed infrastructure development, should it be approved. The following points aim to guide the design of the monitoring plan, and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements:

- Permanent monitoring plots must be established within (target area) and surrounding (reference area) all rehabilitated areas. These plots must be designed to accurately monitor the following parameters:
  - Species diversity and species abundance;
  - Recruitment of indigenous species and of alien and invasive species, including alien vs Indigenous plant ratios;
  - Erosion levels and the efficacy of erosion control measures; and
  - Vegetation community structure, including species composition and diversity which should be compared to pre-development conditions and work towards the post-closure objective.
- Monitoring of all the natural areas should continue throughout the Decommissioning & Rehabilitation Phase to ensure these systems are not adversely affected by associated activities;
- The rehabilitation plan must be continuously updated (i.e. adaptive management) in accordance with the monitoring results to ensure that optimal rehabilitation measures are employed. Adaptive management is an integral part of any rehabilitation plan as it assesses monitoring results to allow rehabilitation measures to be revisited and to be adapted accordingly;
- Results of the monitoring activities must be considered during all phases of the proposed development and action must be taken to mitigate impacts as soon as negative effects from nearby mining activities become apparent; and
- The method of monitoring must be designed to be subjective and repeatable to ensure consistent results.

7. CONCLUSION

Scientific Terrestrial Services CC (STS) was appointed by SLR Consulting (SLR) to conduct a terrestrial biodiversity assessment as part of the Environmental Authorisation (EA) process for the proposed prospecting project to be conducted by Pilanesberg Platinum Mine (PPM) on a 4.7 hectare (ha) section of land on Ruighoek farm, portion 5 near Rustenburg North West Province. For ease of reference the 4.7 ha area in which the proposed prospecting activities will take place was referred to as the "study area" and the Ruighoek farm portion 5 as "the farm portion".

Given safety concerns related to the presence of illegal miners within the vicinity of the study area, access to the study area in which prospecting activities is proposed was not possible during the site assessment. STS was, however, permitted to access certain POIs as deemed "safe" by the PPM security team. These POIs were thus used to infer the PES, sensitivity, and the floral and faunal communities associated with the study area.

Following the field assessment, three habitat units were distinguished for the study area. These habitat units were inferred using satellite imagery as a guide (to assess historic impacts), together with field experience in the area, and the extrapolation of habitat integrity and species composition from nearby POIs:

1. **Thornveld Habitat** – this habitat unit is in the west of the study area and is largely homogenous, supporting a moderate to moderately low species richness;
2. **Degraded Thornveld Habitat –** this habitat unit is located within the central regions of the study area and is likely the result of current and historic anthropogenic impacts; and
3. **Freshwater Habitat**: This habitat unit was the smallest habitat unit within the study area and is associated with the ephemeral Mothlabe River.

From a floral perspective, the sensitivities associated with each of the habitat units was as follows: the Thornveld and the Degraded Thornveld Habitats were of a **moderately low sensitivity**, and the Freshwater Habitat was of **intermediate sensitivity.**

From a faunal perspective the Freshwater Habitat and Thornveld scored an **intermediate sensitivity** as these habitats provide ecological functions despite being impacted by anthropogenic activities. The Freshwater Habitat provides a faunal movement corridor and ephemeral water resource, should it receive water following rains. The Thornveld will support mostly common browsers and provide nesting sites for various avifauna. Additionally eight SCC may potentially forage in the Thornveld Habitat, hence its increased sensitivity. The Degraded Thornveld on the other hand, was considered to be of **moderately low** faunal sensitivity as past disturbances have rendered many sections of the unit barren, containing a homogenous layer of artificial rocky deposits that may only be favourable to common reptiles and invertebrates.

No SCC, including RDL species, TOPS, nationally protected trees (as per the NFA), or species protected by the TNCO, were observed during the field assessments. However, suitable habitat to support several protected species is present within the study area. If the proposed prospecting activities are authorised, it is recommended that a summer season walkthrough of the study area be conducted, and all SCC marked and considered for possible relocation to suitable habitat in the nearby, natural surrounding areas. It is recommended that for species that cannot be relocated, seedlings and /or seeds of these species are harvested from the study area before clearing activities commence and grown under nursery conditions with the purpose to use these species for rehabilitation at a later stage. Permits from the relevant authorities will be required before any removal or relocation of any species of SCC can take place. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation.

No faunal SCC or signs thereof were observed during the site assessment and the likelihood of most SCC (listed in Appendix I) occurring within the study area, is reduced by bush encroachment, possible human-wildlife conflict and disturbances that exist in the area as a result of an extensive informal community and illegal mining present on site. However, it cannot be ruled out that the eight following SCC will not occur in the study area, as their distribution ranges and habitat requirements for foraging overlap the study area. These SCC are:

- *Eidolon helvum* (African Straw-coloured Fruit-bat, NT) in the Thornveld Habitat;
- *Torgos tracheliotus* (Lappet-faced Vulture, VU) may forage over the study area;
- *Ardeotis kori* (Kori Bustard, VU) in the Thornveld Habitat;
- *Pyxicephalus adspersus* (Giant Bullfrog, Protected) may breed in ephemeral puddles in the Freshwater Habitat and may be found 1 km into adjacent terrestrial habitats while foraging or aestivating;
- *Harpactira hamiltoni* (Highveld Baboon Spider, P) will burrow underground in all habitat units;
- *Polemaetus bellicosus* (Martial Eagle, VU) may forage over the study area;
- *Sagittarius serpentarius* (Secretarybird, NT) may traverse through open areas in the Degraded Thornveld or Thornveld habitat; and
- *Python natalensis* (Southern African Rock Python, Protected).

In the event that the abovementioned SCC and any other SCC listed in Appendix I are encountered during any development phase of the prospecting activities, it is advised that an appropriate relocation plan, guided by the relevant specialist and provincial authorities, be created and implemented. Any species found to be listed under NEMBA: TOPS list of 2007, (refer to Table I8 in Appendix I of this report) will require a permit, should they need to be relocated during development. Overall, the study area is not considered crucial habitat from a faunal SCC perspective, and it is unlikely that potentially occurring SCC that utilise the study area, will be significantly impacted by the proposed prospecting development and its activities considering the localised extent of the proposed prospecting footprint and the ability of most SCC to move to surrounding areas.

The study area is not located within a threatened vegetation type or within a protected area. According to the NWBSP, the study area is located within an area classified as a CBA2. Given the level of anthropogenic influences experienced across the study area and greater surrounding areas, e.g., intense grazing pressures and subsequent woody encroachment, AIP proliferation, etc., the presence of CBA2 habitat was not confirmed for either the Thornveld or the Degraded Thornveld Habitat units. Although the Freshwater Habitat has been impacted by anthropogenic influences (e.g., dumping) and edge effects (e.g., erosion and AIP proliferation), it still has the propensity to provide important ecological services within the study area and the greater surrounding areas, e.g., including connective and dispersal corridors, albeit in an altered fashion. As such, the Freshwater habitat is considered representative of CBA2 habitat. Provided that mitigation measures are appropriately implemented, the associated impacts to the CBA habitat, i.e., that within the Freshwater Habitat, can be reduced to lower levels. Given that the proposed prospecting activities are localised in scale and extent, such activities are unlikely to have a significant impact on the immediate area.

From a floral perspective, the impacts associated with the proposed prospecting activities ranged from medium to low prior to the implementation of mitigation measures. With mitigation fully implemented, all impacts associated with the floral component of the study areas can be reduced. From a faunal perspective, the impacts associated with proposed prospecting activities ranged from from Medium in the Degraded Thornveld and Thornveld to Low in the Freshwater Habitat. Should all mitigatory measures stipulated in section 6.4 be effectively adhered to, impacts in these habitat units will likely decrease to Low, in the Freshwater Habitat and Very Low levels in the Degraded Thornveld and Thornveld.

As access to the study area itself was not possible, the conclusions drawn from this report should be interpreted with this limitation in mind. This report thus serves as a baseline for planning purposes only. Once final prospecting layouts have been finalised, the report should be updated, and a subsequent field assessment of the study area be conducted by a suitably qualified specialist to confirm and/or update the ecological particulars (e.g., habitats, community compositions, and sensitivities) associated with the floral and faunal communities within the study area.

It is the opinion of the ecologists that this study provides the relevant information required to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

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APPENDIX A: Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions, and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by seasonality, time and budgetary constraints relevant to the type and level of investigation undertaken as well as the project program and STS CC and its staff, at their sole discretion, reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field or pertaining to this investigation.

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APPENDIX B: Legislative Requirements

CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA, 1996 (ACT 108 OF 1996)

The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) (NEMA)

The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R982 of 2014) and well as listing notices 1, 2 and 3 (GN R983, R984 and R985 of 2014), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.

NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004 (ACT 10 OF 2004) (NEMBA)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.
Furthermore, a person may not carry out a restricted activity involving either:

a) A specimen of a listed threatened or protected species;
b) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

GOVERNMENT NOTICE NUMBER R.1020: ALIEN AND INVASIVE SPECIES REGULATIONS, 2020 (IN GOVERNMENT GAZETTE 43735), INCLUDING GOVERNMENT NOTICE NUMBER 1003: ALIEN AND INVASIVE SPECIES LISTS, 2020 (IN GOVERNMENT GAZETTE 43726) AS IT RELATES TO THE NEMBA

NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aims to:

- ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur,
- ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and
- ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act no 10 of 2004) as:

(a) A species that is not an indigenous species; or
(b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Categories according to NEMBA (Alien and Invasive Species Regulations, 2020):

- ➢ **Category 1a:** Invasive species that require compulsory control;
- ➢ **Category 1b:** Invasive species that require control by means of an invasive species management programme;
- ➢ **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and
- ➢ **Category 3:** Ornamentally used plants that may no longer be planted.

CONSERVATION OF AGRICULTURAL RESOURCES ACT, 1983 (ACT 43 OF 1983) (CARA)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the prospecting and operation, phases.

This Act must be interpreted and applied in accordance with the national environmental management principles set out in Section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

TRANSVAAL NATURE CONSERVATION ORDINANCE, 1983 (ORDINANCE NO. 12 OF 1983) (TNCO)

This Ordinance will be repealed in as far as it relates to the North West Province when the North West Biodiversity Management Act, 2017 comes into force.

Applicable Legislation and Guidelines used to Compile the Report

FAUNA AND FLORA SCHEDULES IN THE ORDINANCE

-Schedule 2: Protected game
-Schedule 2A: Specially protected game
-Schedule 4: Protected wild animals
-Schedule 7: Invertebrata
-Schedule 11: Protected plants
-Schedule 12: Specially protected plants

Subject to the provisions of this Ordinance, no person shall pick a protected plant. Unless he is the holder of a permit which authorises him to do so. Subject to the provisions of this Ordinance, no person shall hunt protected game: Provided that upon the written application of the owner of land a permit may be issued. Any person who contravenes or fails to comply with subsection (1) shall be guilty of an offence.

CHAPTER VIII - ENDANGERED AND RARE SPECIES OF FAUNA AND FLORA [Section 97(1)]

Every species of fauna and flora referred to in -

a. Appendix I;
b. Appendix II: to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington DC 1973), as amended up to 6 June 1981, and any readily recognisable part or derivative thereof, shall be an endangered species or a rare species of fauna and flora respectively.

NORTH WEST BIODIVERSITY MANAGEMENT ACT, NO 4 OF 2016

The purpose of this act is to provide for the management and conservation of the North West province's biophysical environment and protected areas within the framework of the National Biodiversity Management Act, 1998 (Act No 107 of 1998); to provide for the protection of species and ecological systems that warrant provincial protection; to provide for the sustainable use of indigenous biological resources; and to provide for matters therewith.

NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT, 2003 (ACT NO. 57 OF 2003) AS AMENDED[15] (NEMPAA)

The objective of this act is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological biodiversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; for the continued existence, governance and functions of South African National Parks; and for matters in connection thereof.

[15] Amendments to the NEMPAA:

- National Environmental Management: Protected Areas Amendment Act 31 of 2004 – Gazette No. 27274, No. 131. Commencement date: 1 November 2005 [Proc. No. R. 58, Gazette No, 28123]
- National Environment Laws Amendment Act 14 of 2009 – Gazette No.32267, No. 617. Commencement date: 18 September 2009 [Proc. 65, Gazette No. 32580]
- National Environmental Management: Protected Areas Amendment Act 15 of 2009 – Gazette No. 32660, No. 748. Commencement date: 23 October 2009 – except for sections 1 and 8 [Proc. No. 69, Gazette No. 32660]
- Schedule 2 amended by Government Notice R236 in Government Gazette 36295 dated 27 March 2013. Commencement date: 1 April 2013 of sections 1 and 8 (relating to Schedule 2) of the National Environmental Management Protected Areas Amendment Act, 15 of 2009 [Proc. No. 7, Gazette No. 36296]
- National Environmental Management: Protected Areas Amendment Act 21 of 2014 - Government Notice 445 in Government Gazette 37710 dated 2 June 2014. Commencement date: 2 June 2014.
- Schedule 2 amendment by General Notice 2 of 2016 in Government Gazette 39728 dated 25 February 2016. Commencement date: 25 February 2016.

APPENDIX C: Floral Method of Assessment

Floral Species of Conservational Concern Assessment

Prior to the site visit, a record of floral SCC and their habitat requirements was developed for the study area, which includes consulting the National Web-based Environmental Screening Tool. Because not all SCC have been included in the Screening Tool layers (e.g., NT and DD taxa), it remains important for the specialist to be on the lookout for additional SCC. For this study, two primary sources were consulted and are described below.

The National Web-Based Environmental Screening Tool

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the study area. Each of the themes in the Screening Tool consists of theme-specific spatial datasets which have been assigned a sensitivity level namely, "*low*", "*medium*", "*high*" and "*very high*" sensitivity. The four levels of sensitivity are derived and identified in different ways, e.g. for **confirmed** areas of occupied habitat for SCC a Very High and High Sensitivity is assigned and for areas of suitable habitat where SCC may occur based on spatial models only, a Medium Sensitivity is assigned. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below[16]:

- **Very High**: Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km^2 are considered Critical Habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) D criteria of the IUCN or species listed as Critically/ Extremely Rare under South Africa's National Red List Criteria. For each species reliant on a Critical Habitat, all remaining suitable habitat has been manually mapped at a fine scale.
- **High**: Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2000) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat.
- **Medium**: Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
- **Low**: Areas where no SCC are known or expected to occur.

BRAHMS Online Website

The Botanical Database of Southern Africa (BODATSA) is accessed to obtain plant names and floristic details (http://posa.sanbi.org/) for species of conservation concern within a selected boundary;

- This website provides access to South African plant names (taxa), specimens (herbarium sheets) and observations of plants made in the field (botanical records). Data is obtained from the BODATSA, which contains records from the National Herbarium in Pretoria (PRE), the

[16] More details on the use of the Screening Tool for Species of Conservation Concern can be found in the below resources:
- South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.
- The National Web based Environmental Screening Tool website: https://screening.environment.gov.za/screeningtool/#/pages/welcome

Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).
- Information on habitat requirements etc. is obtained from the SANBI Red List of South African Plants website (http://redlist.sanbi.org/).
- Typically, data is extracted for the Quarter Degree Square (QDS) in which the study area is situated but where it is deemed appropriate, a larger area can be included.

NEMBA TOPS Species

The Threatened or Protected Species (TOPS) Regulations (R 152 of 2007) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), were taken into consideration.

Specially Protected and Protected Species

The Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA) provides a list of Specially Protected Plants (Schedule 11) and Protected Plants (Schedule 12) for the Limpopo Province. These species formed part of the SCC assessment. The list is alliable online at the following link: https://www.unodc.org/res/cld/document/limpopo-environmental-management-act-7-of-2003_html/Limpopo_Enviro_Management_Act.pdf

NFA Species

Tree species as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA), were included in the SCC assessment.

Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC is described:
- "**Confirmed'**: if observed during the survey;
- "**High**": if within the species' known distribution range and suitable habitat is available;
- "**Medium**": if either within the known distribution range of the species or if suitable habitat is present; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

Low POC	Medium POC	High POC	Confirmed

The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance, and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):
- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases. Whether the habitat is representative of a Critical Biodiversity Area or forms part of an Ecological Support Area is also taken into consideration;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and

- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. To present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table C1: Floral habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

Vegetation Surveys

When planning the timing of a floristic survey, it is important to remember that the primary objective is not an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in the area of interest, to optimise the detection of SCC and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).

The vegetation survey incorporates the subjective (or stratified) sampling method. Subjective sampling is a sampling technique in which the specialist relies on his or her own professional experience when choosing sample sites within the study area. This allows representative recordings of floral communities and optimal detection of SCC. Subjective sampling is used to consider different areas (or habitat units) which are identified within the main body of a habitat/study area.

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a study area equally and thus increase the potential to miss floral SCC. Random sampling methods also tend to require more time in the field to locate the amount of SCC that can be detected using subjective sampling methods - In the context of an EIA where time constraints are often restrictive, priority needs to be given to collecting data in the shortest time possible without compromising the efficiency of locating SCC (SANBI, 2020).

Vegetation structure has been described following the guideline in Edwards (1983). Refer to Figure C1 below:

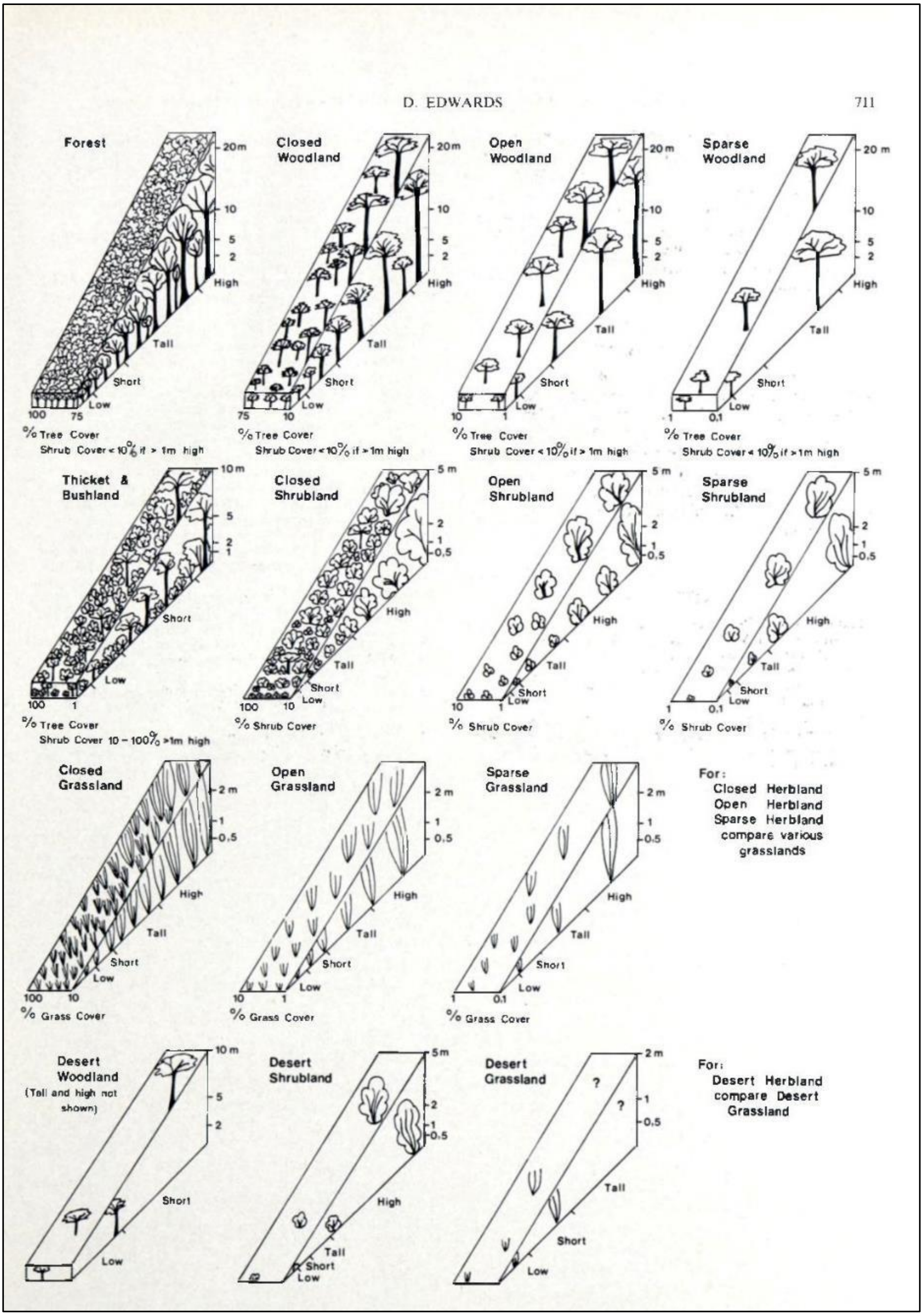

Figure C1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.

APPENDIX D: Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the study area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations.

Mammals

Mammal species were recorded during the field assessment with the use of visual identification, spoor, call, and dung. Specific attention was paid to mammal SCC as listed by the IUCN, 2015.

Avifauna

The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) was compared with the recent field survey of avifaunal species identified on the study area. Field surveys were undertaken utilising visual observation and bird call identification techniques in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Reptiles

During the field assessment, suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected for the presence of reptiles, and any individuals encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the study area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Amphibians

Identifying amphibian species is done using direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the study area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Invertebrates

Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken.

It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the study area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Arachnids

Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC species within the study area.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC is described:

- "**Confirmed'**: if observed during the survey;
- "**High**": if within the species' known distribution range and suitable habitat is available;
- "**Medium**": if either within the known distribution range of the species or if suitable habitat is present; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Faunal Habitat Sensitivity

The sensitivity of the study area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and sensitivity of the study area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;
- **Food Availability:** The availability of food within the study area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contributes equally to the mean score, which determines the suitability and sensitivity of the study area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilisation of the study area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table D1: Faunal habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1.0 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤ 5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX E: Impact Assessment Methodology

The Impact Assessment Methodology is as per the SLR Consulting (South Africa) (Pty) Ltd methodology.

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
INTENSITY = VL							
DURATION	Very long	**VH**	Low	Low	Medium	Medium	High
	Long term	**H**	Low	Low	Low	Medium	Medium
	Medium term	**M**	Very Low	Low	Low	Low	Medium
	Short term	**L**	Very low	Very Low	Low	Low	Low
	Very short	**VL**	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	**VH**	Medium	Medium	Medium	High	High
	Long term	**H**	Low	Medium	Medium	Medium	High
	Medium term	**M**	Low	Low	Medium	Medium	Medium
	Short term	**L**	Low	Low	Low	Medium	Medium
	Very short	**VL**	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	**VH**	Medium	High	High	High	Very High
	Long term	**H**	Medium	Medium	Medium	High	High
	Medium term	**M**	Medium	Medium	Medium	High	High
	Short term	**L**	Low	Medium	Medium	Medium	High
	Very short	**VL**	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	**VH**	High	High	High	Very High	Very High
	Long term	**H**	Medium	High	High	High	Very High
	Medium term	**M**	Medium	Medium	High	High	High
	Short term	**L**	Medium	Medium	Medium	High	High
	Very short	**VL**	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	**VH**	High	High	Very High	Very High	Very High
	Long term	**H**	High	High	High	Very High	Very High
	Medium term	**M**	Medium	High	High	High	Very High
	Short term	**L**	Medium	Medium	High	High	High
	Very short	**VL**	Low	Medium	Medium	High	High
			VL	**L**	**M**	**H**	**VH**
			A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
			EXTENT				

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

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

Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development.

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[17] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation, or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to prospecting and operation.

[17] Mitigation measures should address both positive and negative impacts

APPENDIX F: Vegetation Type(s)

Zeerust Thornveld (SVcb 3)

Figure D1: SVcb 3 Zeerust Thornveld: Moderately dense bushveld dominated by *Acacia tortilis* in the valley of the Doring River on Rykvoorby north of Zeerust, North West Province. Image by M.C. Mucina in Mucina and Rutherford (2006) page 461.

Remarks: This unit is somewhat more temperate than the SVcb 1 Dwaalboom Thornveld that borders it to the north.

Table D1: Floristic species of *The Dwaalboom Thornveld* (Mucina & Rutherford, 2012).

Plant Community	Species
Dominant and typical floristic species	
Woody Layer	
Tall Trees	*Acacia burkei* (d), *A. erioloba* (d).
Small Trees	*Acacia mellifera* subsp. *detinens* (d), *A. nilotica* (d), *A. tortilis* subsp. *heteracantha* (d), *Rhus lancea* (d), *Acacia fleckii*, *Peltophorum africanum*, *Terminalia sericea*.
Tall Shrubs	*Diplorhynchus condylocarpon* (d), *Elephantorrhiza burkei* (d), *Grewia flava*, *Hibiscus calyphyllus*, *Mundulea sericea*, *Steganotaenia araliacea*, *Vitex rehmannii*.
Low Shrubs	*Agathisanthemum bojeri*, *Chaetacanthus costatus*, *Clerodendrum ternatum*, *Indigofera filipes*, *Rhus grandidens*, *Sida chrysantha*, *Stylosanthes fruticosa*.
Herbaceous Layer	
Herbs	*Blepharis integrifolia, Chamaecrista absus, C. mimosoides, Cleome maculata, Dicoma anomala, Kyphocarpa angustifolia, Limeum viscosum, Lophiocarpus tenuissimus.*
Graminoids	*Eragrostis lehmanniana (d), Panicum maximum (d), Aristida congesta, Cymbopogon pospischilii.*
Endemic Taxon	
Low Shrub:	*Rhus maricoana.*

*(d) is for dominant

Pilanesberg Mountain Bushveld (SVcb 5)

Figure D2: SVcb 5: Pilanesberg Mountain Bushveld: Bushveld with Combretum molle on south facing slopes above Mankwe dam in the centre of Pilanesberg Game Reserve . Image by M.C. Mucina in Mucina and Rutherford (2006) page 463

Remarks: This unit is a meeting ground for several species of *Grewia*, for example northwestern limits of *G. occidentalis*, southwestern limits of *G. monticola* and *G. hexamita* and southeastern limits of *G. retinervis.* The vegetation of the southern slopes of this unit is similar to that of the southern slopes of the northeastern end of the Magaliesberg (SVcb 9 Gold Reef Mountain Bushveld) whereas the northern slopes of the two units have distinct physiognomic differences **(**

Table D2: Floristic species of *The Dwaalboom Thornveld* (Mucina & Rutherford, 2012).

Plant Community	Species
Dominant and typical floristic species	
Woody Layer	
Small Trees	*Combretum apiculatum* (d), *C. molle* (d), *C. zeyheri* (d), *Strychnos cocculoides* (d), *Croton gratissimus*, *Englerophytum magalismontanum*, *Rhus leptodictya*, *Vangueria parvifolia*.
Tall Shrubs	*Diplorhynchus condylocarpon* (d), *Elephantorrhiza burkei* (d), *Grewia flava*, *Hibiscus calyphyllus*, *Mundulea sericea*, *Steganotaenia araliacea*, *Vitex rehmannii*.
Low Shrubs	*Polygala hottentotta*
Herbaceous Layer	
Herbs	*Abutilon pycnodon, Chamaesyce inaequilatera, Hermannia depressa, Nidorella resedifolia, Xerophyta retinervis.*
Succulent Herbs	*Crassula lanceolata* subsp. *transvaalensis*.
Graminoids	*Chrysopogon serrulatus* (d), *Elionurus muticus* (d), *Panicum maximum* (d), *Themeda triandra* (d), *Enneapogon scoparius*, *Hyperthelia dissoluta*, *Panicum deustum*.
Endemic Taxon	
Tall Shrub:	*Erythrophysa transvaalensis.*

*(d) is for dominant

APPENDIX G: Species List

Observed Floral Species

Table G1: Dominant floral species[18] encountered within each of the habitat units during the field assessment. AIP species recorded during the field assessment are indicated with an asterisk (*).

Scientific Name	Thornveld Habitat	Degraded Thornveld Habitat	Freshwater Habitat
Woody Species			
**Melia azedarach*			x
**Sesbania sesban*			x
Asparagus laricinus	x	x	x
Asparagus suaveolens	x	x	
Boscia foetida subsp. *rehmenniana*	x	x	x
Clematis brachiata	x	x	
Combretum erythrophyllum	x		
Combrtum molle	x		
Dichrostachys cinerea	x	x	
Ehretia rigida subsp. *nervifolia*	x		
Euclea undulata	x		
Gomphocarpus fruticosus	x	x	x
Grewia flava	x		
Gymnosporia buxifolia	x		
Psiadia punctulata	x	x	
Searsia lancea	x	x	x
Senegalia mellifera subsp. Detinens	x	x	
Tapinanthus oleifolius	x	x	x
Tarchonanthus camphoratus	x	x	x
Vachellia karroo	x		
Vachellia nilotica	x		
Vachellia tortilis subsp. *heteracantha*	x	x	
Ziziphus mucronata	x	x	x
Herbaceous Species			
**Argemone ochroleuca* subsp. *ochroleuca*	x	x	x
**Bidens pilosa*	x	x	x
**Tagetes minuta*	x	x	x
**Xanthium strumarium*	x	x	x
**Zinnia peruviana*	x	x	
Commicarpus pentandrus	x		x
Dicoma tomentosa	x	x	
Geigeria burkei	x		x

[18] As access to the focus area was not possible, species compositions for each habitat have been extrapolated from nearby POIs that were accessed during the field assessment.

Jatropha zeyheri	x	x	
Justica sp.	x	x	
Kyphocarpa angustifolia	x	x	x
Laggera decurrens	x	x	
Leonotis cf. ocymifolia	x		
Polygala hotentotta	x	x	x
Senna italica subsp. arachioides	x	x	
Sida cordifolia	x		
Vernonia sp.	x	x	
Zornia glochidiala	x		
Succulent Species			
**Agave americana*	x	x	
Viscum cf. *rotundifolium*	x	x	x
Aloe marlothii	x	x	
Aloe transvaalensis	x	x	
Kalanchoe sp.	x	x	
**Agave sisalana*	x	x	
**Opuntia cf. ficus-indica*	x	x	
Graminoid Species			
**Pennisetum setaceum*	x	x	
Aristida congesta subsp. *barbicollisis*	x	x	x
Aristida congesta subsp. *congesta*	x		x
Bothriochloa insculpta			x
Brachiaria nigropedata		x	
Chloris virgata		x	x
Cymbopogon sp.	x		
Cynodon dactylon	x	x	x
Digitaria eriantha	x	x	x
Heteropogon contortus	x	x	x
Melinis repens	x	x	x
Panicum maximum	x	x	x
Trachypogon spicatus	x		
Urochloa mosambicensis	x	x	

Faunal Species Observed or Expected to Occur in the Study Area

Table G2: Mammal species observed within the study area.

Scientific Name	Common Name	Conservation Status
MAMMALS (observed)		
Phacochoerus africanus	Common Warthog	LC
Lepus saxatilis	Scrub Hare	LC
Papio ursinus	Chacma Baboon	LC
AVIFAUNA (observed) please see Table I10 in appendix I for a more comprehensive bird species list for the area according to SABAP 2		
Cecropis cucullata	Greater-Striped Swallow	LC
INVERTEBRATES (Observed)		
Catantops sp	Short-horned Grasshopper	NYBA
INVERTEBRATES WITH DISTRIBUTION AND HABITAT REQUIREMENTS OVERLAPPING THE STUDY AREA		
ARACHNIDS (SPIDERS)		
Nephila senegalensis	Banded-legged golden orb-web spider	NYBA
Cyrtophora citricola	Tropical tent-web spiders	NYBA
Stegodyphus sp.	Community nest spiders	NYBA
Family Pisauridae	Nursery-web spiders	NYBA
Brachionopus sp.	Pygmy baboon spiders	NYBA
Harpactira hamiltoni	**Highveld baboon spider**	**P**
Idiothele nigrofulva	Common Trapdoor spider	NYBA
LEPIDOPTERA (BUTTERFLIES AND MOTHS)		
Coeliades pisistratus	Two-pip policeman	LC
Metisella willemi	Netted sylph	LC
Sarangesa phidyle	Small elfin	LC
Anthene amarah amarah	Black-striped ciliate blue	LC
Axiocerses amanga amanga	Bush scarlet	LC
Azanus jesous	Topaz babul blue	LC
Azanus moriqua	Black-bordered babul blue	LC
Stugeta bowkeri tearei	Bowker's marbled sapphire	LC
Tarucus sybaris sybaris	Dotted pierrot	LC
Tuxentius melaena melaena	Black pie	LC
Zizeeria knysna knysna	African grass blue	LC
Zizula hylax	Tiny grass blue	LC
Acraea aglaonice	Clear-spotted acraea	LC
Acraea anemosa	Broad-bordered acraea	LC
Acraea neobule neobule	Wandering donkey acraea	LC
Byblia ilithyia	Spotted joker	LC
Danaus chrysippus orientis	African plain tiger	LC
Hypolimnas misippus	Common diadem	LC
Junonia hierta cebrene	Yellow pansy	LC
Neptis saclava marpessa	Spotted sailer	LC
Precis archesia archesia	Garden inspector	LC
Belenois aurota	Pioneer caper white	LC
Catopsilia florella	African migrant	LC
Colotis annae annae	Scarlet tip	LC
Colotis auxo auxo	Sulphur orange tip	LC
Colotis evagore antigone	Small orange tip	LC
Colotis evenina evenina	African orange tip	LC
Colotis pallene	Bushveld orange tip	LC
Colotis vesta argillaceus	Southern veined arab	LC
		LC
Pinacopteryx eriphia eriphia	Zebra white	

Scientific Name	Common Name	Conservation Status
HERPETOFAUNA WITH DISTRIBUTION AND HABITAT REQUIREMENTS OVERLAPPING THE STUDY AREA		
AMPHIBIANS*		
Poyntonophrynus fenoulheti	Northern Pygmy Toad	LC
Poyntonophrynus vertebralis	Southern Pygmy Toad	LC
Schismaderma carens	Red Toad	LC
Sclerophrys garmani	Olive Toad	LC
Kassina senegalensis	Bubbling Kassina	LC
Phrynomantis bifasciatus	Banded Rubber Frog	LC
Xenopus laevis	Common Platanna	LC
Ptychadena anchietae	Plain Grass Frog	LC
Ptychadena mossambica	Broadbanded Grass Frog	LC
Cacosternum boettgeri	Common Caco	LC
Pyxicephalus adspersus	**Giant Bull Frog**	**NT and Protected**
Pyxicephalus edulis	**Lesser Bull Frog**	**LC and Protected**
Tomopterna cryptotis	Tremelo Sand Frog	LC
Tomopterna natalensis	Natal Sand Frog	LC
Chiromantis xerampelina	Southern Foam Nest Frog	LC
REPTILES		
Acanthocercus atricollis	Southern Tree Agama	LC
Dendroaspis polylepis	Black Mamba	LC
Chondrodactylus turneri	Turner's Gecko	LC
Hemidactylus mabouia	Common Tropical House Gecko	LC
Lygodactylus capensis	Common Dwarf Gecko	LC
Pelomedusa galeata	South African Marsh Terrapin	NE
Python natalensis	Southern African Python	LC
Trachylepis punctatissima	Speckled Rock Skink	LC
Trachylepis varia sensu lato	Common Variable Skink Complex	LC
Stigmochelys pardalis	Leopard Tortoise	LC
Varanus albigularis albigularis	Rock Monitor	LC
Bitis arietans arietans	Puff Adder	LC

P = Protected; NT = Near Threatened; LC = Least Concern, NE = Not Evaluated; NYBA = Not yet been assessed by the IUCN, N/A = Not Applicable.

APPENDIX H: Floral SCC

South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. For the POC assessment, a list of Red Data Listed (RDL) species previously recorded within the 10 km of the study area was pulled from the Botanical Database of Southern Africa (BODATSA) (http://posa.sanbi.org/). This list was further cross-checked with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) TOPS flora) to identify provincially protected species previously recorded for the area.

Definitions of the national Red List categories

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).

- **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.
- **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.
- **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.
- **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.
- **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.
- N**Critically Rare** 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.
- N**Rare** 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. The four criteria are as follows:
  - Restricted range: Extent of Occurrence <500 km^2, OR
  - Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy, typically smaller than 20 km^2, OR

- Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
- Small global population: Less than 10 000 mature individuals.

- **Least Concern** 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.
- **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.
- **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.
- **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.

The below tables present the results of the POC assessment.

NATIONALLY PROTECTED SPECIES

POC for RDL Floral SCC i) as obtained from BODATSA, & ii) as identified by the screening tool

Table H1: Table illustrating nationally protected species including Red Data List (RDL) species i) as obtained from POSA for the focus area, and ii) as identified by the National Screening Tool.

Species	National status	Habitat	POC
Cullen holubii	VU	**Range**: Zeerust to Bela Bela **Major habitats**: Zeerust Thornveld, Springbokvlakte Thornveld **Description**: Bushveld on sandy flats **Population trend**: Decreasing	**Medium**
Stenostelma umbelluliferum	NT	**Range**: Pretoria North and adjacent areas in North West Province **Major habitats**: Savanna **Description**: Deep black turf in open woodland mainly in the vicinity of drainage lines. The species is perennial and dies back to a dormant state as an underground tuber after fruiting. The plants seem to thrive in disturbed areas, possibly because disturbed habitats favour the establishment of seedlings and, in the absence of competition, the spread of the species **Population trend**: Decreasing	**Low**

NEMBA TOPS List for South Africa[19]

Table H2: Protected Plants as per the NEMBA 2007 TOPS List for South Africa[20] for the North West Province.

Scientific Name	Threat Status	Region	POC
Harpagophytum procumbens	P	**Range:** Free State, Limpopo, Northern Cape, North West. **Major Habitats**: Nama Karoo & Savanna. **Description:** Well drained sandy habitats in open savanna and woodlands. **Population trend:** Stable.	High

P = Protected.

Table H3: Protected Tree species as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA) that have distributions overlapping with the focus area.

Species	National status	Habitat	POC
Vachellia erioloba	LC	**Range**: Widespread in the arid northern provinces of South Africa, also Namibia, Botswana, Zimbabwe, southern Angola, and south-western Zambia **Major habitats**: Widespread **Description**: Savanna, semi-desert, and desert areas with deep, sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops **Population trend**: Decreasing	**Low**
Boscia albitruca	LC	**Range**: Botswana, Limpopo, Gauteng, North-West, Swaziland, the Free State, Northern Cape and KwaZulu-Natal. It also extends into Zambia, Zimbabwe and Mozambique **Major habitats**: This species is found in the drier parts of southern Africa, in areas of low rainfall. **Population trend:** unknown**.**	**High**
Pittosporum viridiflorum	LC	**Range**: Not endemic to South Africa **Major habitats**: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West, Western Cape	**Low**
Sclerocarya birrea subsp. *caffra*	LC	**Range**: Not endemic to South Africa **Major habitats**: Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West	**High**
Prunus africana	VU	**Range**: Widespread in Africa from the southern Cape, through KwaZulu-Natal, Swaziland and northwards into Zimbabwe and central Africa and the islands of Madagascar and Comoros. **Major habitats**: Eastern Valley Bushveld, Gold Reef Mountain Bushveld, Ohrigstad Mountain Bushveld, Poung Dolomite Mountain Bushveld, Mamabolo Mountain Bushveld, Soutpansberg Mountain Bushveld, Northern Coastal Forest, Scarp Forest, Northern Mistbelt Forest, Southern Mistbelt Forest, Northern Afrotemperate Forest **Description**: Evergreen forests near the coast, inland mistbelt forests and afromontane forests up to 2100 m **Population trend**: Decreasing	**Low**

[19] National Environmental Management: Biodiversity Act 10 of 2004 - Threatened or Protected Species Regulations, 2007. Government Notice R152 in Government Gazette 29657 dated 23 February 2007. Commencement date: 1 June 2007 [GN R150, Gazette no. 29657], as amended.

[20] National Environmental Management: Biodiversity Act 10 of 2004 - Threatened or Protected Species Regulations, 2007. Government Notice R152 in Government Gazette 29657 dated 23 February 2007. Commencement date: 1 July 2007 [GN R150, Gazette no. 29657], as amended.

Species	National status	Habitat	POC
Erythrophysa transvaalensis	LC	**Range**: North-western Limpopo Province to Rustenburg, also extending to Botswana and Zimbabwe **Major habitats**: Savanna **Description**: Rocky hillsides and stony koppies **Population trend**: Stable	**Low**
Combretum imberbe	LC	**Range**: Not endemic to South Africa **Major habitats**: Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West **Population trend**: Decreasing	**High**

Provincially Protected Flora (i.e., TNCO)

Table B4: Protected Plants as per the Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983) (TNCO) which provides a list of Protected Plants (Schedule 11) and Specially Protected Species (Schedule 12).

Schedule 11 (Protected Plant Species)		
Common Name	**Scientific Name**	**POC**
All species of tree moss	*Porothamnium, Pilotrichella* and *Papillaria* spp.	Low
All species of true ferns excluding the bracken fern	Class Filicinae excluding *Pteridium aquilinum*	Low
All plants of cycads not occurring in Transvaal	All plants of the genus *Encephalartos* not occurring and the seedlings of the species of cycads in Transvaal and the seedlings of the species referred to in Schedule 12 (a) of *Encephalartos* referred to in Schedule 12 (a)	Low
All species of yellow wood	*Podocarpus* spp.	Low
All species of wild cypress	*Widdringtonia* spp.	Low
Borassus palm	*Borassus aethiopicum*	Low
All species of arum lilies	*Zantedeschia* spp.	Low
All species of flame lilies	*Gloriosa* spp.	Low
All species of Christmas bells	*Littonia* spp.	Low
All species of red-hot pokers	*Kniphofia* spp.	Low
All species of aloes excluding (a) All species not occurring in the Transvaal; (b) the following species: Aculeata, Ammophilla, Arborescens, Barbertoniae, Castanea, Davyana, Globuligemma, Grandidentata, Grandidentata, Lutescens, Marlothii, Mutans, Parvibracteata, Transvaalensis and Wickensii	All species of *Aloes* excluding (a) All species not occurring in the Transvaal; (b) the following species: *A. aculeata, A. ammophilla, A. arborescens, A. barbetoniae, A. castanae, A. davyana, A. globulligemma, A. grandidentata, A. lutescens, A. marlothii, A. mutans, A. parvibracteata, A. transvaalensis*, and *A. wickensii*	Low
All species of agapanthus	*Agapanthus* spp.	Low
blue squill	*Schilla natalensis*	Low
All species of pineapple flower	*Eucomis* spp.	Low
All species of galtonia	*Galtonia* spp.	Low
All species of dracaena	*Dracaena* spp.	Low
All species of paint brush	*Haemanthus* spp.	Low
All species of paint brush	*Scadoxis* spp.	High
All species of clivia	*Clivia* spp.	Low
All species of nerine	*Nerine* spp.	Low
Pink brunsvigia	*Brunsvigia radulosa*	Low
All species of crinum	*Crinum* spp.	Low

Ground lily	*Ammocharis coramica*	Medium
All species of fire lily	*Cyrtanthus* spp.	Low
All species of elephant's foot	*Dioscorea* spp.	Low
All species of irises	*Dietes* spp.	Low
River lily	*Schizostylis* coccinea	Low
All species of hairbells	*Dierama* spp.	Low
All species of babiana	*Babiana* spp.	Low
All species of gladioli	*Gladiolus* spp.	Low
All species of laparousia	*Lapeirousia* spp.	Low
All species of watsonias	*Watsonia* spp.	Low
Wild banana	*Ensete ventricosum*	Low
Schedule 11 (Protected Plant Species)		
Common Name	**Common Name**	**POC**
Transvaal strelitzia	Strelitzia caudata	Low
Wild ginger	Kaempferia aethiopica	Low
Wild ginger	*Burmannia madagascariensis*	Low
All species of orchids excluding those species not occurring in Transvaal occurring in Transvaal	Orchidaceae spp. excluding those species not occurring in Transvaal occurring in Transvaal	Low
All species of proteas excluding those species not occurring in Transvaal occurring in Transvaal	*Protea* spp. excluding those species not occurring in Transvaal occurring in Transvaal	Low
Pincushion	*Leucospermum gerrardii*	Low
Pincushion	*Leucospermum saxosum*	Low
Stone plant	*Frithia pulchra*	Low
Stone plant	*Lithops leslieii*	Low
Schreber's waterlily	*Brasenia schreberi*	Low
All species of waterlilies	*Nymphaea spp.*	Low
Wonderplant	*Tinospora fragosum*	Low
Black stinkwood	*Ocotea bullata*	Low
Stinkwood	*Ocotea kenyensis*	Low
Kiaat	*Pterocarpus angolensis*	Low
Tamboti	*Spirostachys africana*	High
The following euphorbias: Barnardii, Clivicola, Grandialata, Groenewaldii, Knobelii, Perangusta, Restricta, Rowlandii, Tortirama and Waterbergensis	The following species of the Genus *Euphorbia*: *E. barnardii, E. clivicola, E. grandialata, E. groenewaldii, E. knobelli, E. perangusta, E. restricta, E. rowlandii, E. tortirama,* and *E. waterbergensis*	Low
Baobab	*Adansonia digitata*	Low
All species of begonias	*Begonia* spp.	Low
All species of cabbage trees	*Cussonia* spp.	Low
The following species of ericas (heaths): Alopecurus, Cerinthoides and Oatesii	The following species of the genus *Erica*: *E. alopecurus, E. cerinthoides* and *E. oatesii*	Low
Big leaf fever tree	*Anthocleista grandiflora*	Low
The following species of impala lilies: Obesum, Oleifolium and Swazicum	the following species of the genus *Adenium*: *A. obesum, A. oleifolium* and *A. swazicum*	Low
Kudu lily	*Pachypodium saundersii*	Low
All species of *Brachystelma*	*Brachystelma* spp.	Low

All species of *Ceropegia*	*Ceropegia* spp.	Low
All species of *Riocreuxias*	*Riocreuxia* spp.	Low
All species of Ghaap	*Tavaresia* spp.	Low
All species of *Huerniopsis* and *Heurnia*	*Huerniopsis* and *Huernia* spp.	Medium
All species of *Duvalia*	*Duvalia* spp.	Low
All species of stapeliads	*Stapelia* spp.	Medium
Stapeliad	*Hoodia lugardii*	Low
All species of *Orbeanthus*	*Orbeanthus* spp.	Low
All species of *Orbeas*	*Orbea* spp.	Medium
All species of P*achycymbiums*	*Pachycymbium* spp.	Low
All species of O*rbeopsis*	*Orbeopsis* spp.	Low
All species of Primulas	*Streptocarpus* spp.	Low
Schedule 12 (Specially Protected Plant Species)		
In this schedule "seedling" means a cultivated plant of which the diameter of the trunk or bulb, either above or below the ground, does not exceed 150 mm.		
(a) All plants, excluding seedlings, of the following cycads of the Genus *Encephalartos*:		
Dolomiticus	*E. dolomiticus*	Low
Dyer	*E. dyerianus*	Low
Middelburg	*E. middelburgensis*	Low
Eugene marais	*E. eugene*	Low
Maraisii heenan	*E. heenanu*	Low
Inopinus	*E. inopinus*	Low
Laevifolius	*E. laevifolius*	Low
Lanatus	*E. lanatus*	Low
Lebombo	*E. lebomboensis*	Low
Ngoyanus	*E. ngoyanus*	Low
Paucidentatus	*E. paucidentatus*	Low
Modjadje	*E. transvenosus*	Low
Villosus	*E. villosus*	Low
(b) All plants of the following cycad *Encephalartos* species:		
Cupidus	*E. cupidus*	Low
Humilus	*E. humilus*	Low

APPENDIX I: Faunal SCC

Faunal Species of Conservation Concern

Table I1: Mammal species of conservation concern in the North West Province (NWBSP, 2015).

Scientific Name	Common Name	Friedmann & Daly (2004)	IUCN Status	POC
Acinonyx jubatus	Cheetah	VU	VU	Low
Atelerix frontalis	African Hedgehog	NT	LC	Medium
Ceratotherium simum	White Rhino	LC	NT	Low
*Chrysospalax villosus**	Rough-haired golden mole*	CR	VU	Low
Cloeotis percivali	Short-eared trident bat	CR	LC	Low
Crocuta crocuta	Spotted Hyena	NT	LC	Low
Damaliscus lunatus	Tsessebe	EN	LC	Low
Dasymys incomtus	African Marsh Rat	NT	LC	Low
Diceros bicornis mnor	Black Rhinoceros	CR	CR	Low
Eidolon helvum	Straw-Coloured Fruit Bat	NT	NT	Medium
Felis nigripes	Black-Footed Cat	LC	VU	Low
Hippopotamus amphibius	Hippo	LC	VU	Low
Hippotragus equinus	Roan Antelope	VU	LC	Low
Hippotragus niger	Sable Antelope	VU	LC	Low
Hyaena brunnea	Brown Hyena	NT	NT	Low
Leptailurus serval	Serval	NT	LC	Low
Loxodonta africana	African Savanna Elephant	LC	VU	Low
Lutra (Hydrictis) maculicollis	Spotted-necked otter	NT	NT	Low
Lycaon pictus	African Wild dog	EN	EN	Low
Mellivora capensis	Honey Badger	NT	LC	Low
Miniopterus schreibersii	Shreibers' Long-Fingered Bat	NT	NT	Low
Myotis tricolor	Temminck's Hairy Bat	NT	LC	Low
Mystromys albicaudatus	White-tailed mouse	EN	VU	Low
Ourebia ourebi	Oribi	EN	LC	Low
Panthera leo	Lion	LC	VU	Low
Panthera pardus	Leopard	LC	VU	Low
Pelea capreolus	Grey Rhebok	LC	LC	Low
Pipistrellus rusticus	Rusty Pipistrelle	NT	LC	Low
Redunca arundinum	Southern Reedbuck	LC	LC	Low
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	NT	LC	Low
Rhinolophus darlingi	Darling's Horseshoe Bat	NT	LC	Low
Rhinolophus denti	Dent's Horseshoe Bat	NT	LC	Low
Smutsia temminckii	Ground Pangolin	VU	VU	Low

CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, DD = Data Deficient; LC = Least Concern
*** This species was previously listed in the North West Province Environmental Outlook Report of 2008 (NW DACE, 2008). The NWBSP states that an on the ground effort is required to determine whether any golden moles are present within the province.**

Table I2: Avifaunal species of conservation concern in the North West Province (NWBSP, 2015).

Scientific name	Common name	Provincial (2012)	IUCN Status	POC
Alcedo semitorquata	Half-collared Kingfisher	NT	LC	Low
Anastomus lamelligerus	African Openbill Stork	NT	LC	Low
Anthropoides paradiseus	Blue Crane	VU	VU	Low
Aquila rapax	Tawny Eagle	VU	LC	Medium
Ardeotis kori	Kori Bustard	VU	NT	Medium
Buphagus erythrorhynchus	Red-billed Oxpecker	NT	LC	Low
Certhilauda chuana	Short-clawed Lark	NT	LC	Low
Charadrius pallidus	Chestnut-banded Plover	NT	NT	Low
Ciconia nigra	Black Stork	NT	LC	Low
Circus macrourus	Pallid Harrier	NT	NT	Low
Circus maurus	Black Harrier	NT	VU	Low
Circus ranivorus	African Marsh Harrier	VU	LC	Low
Ephippiorhynchus senegalensis	Saddle-billed Stork	EN	LC	Low
Eupodotis senegalensis	White-bellied Korhaan	VU	LC	Low
Falco biarmicus	Lanner Falcon	NT	LC	Low
Falco naumanni	Lesser kestrel	VU	LC	Low
Falco peregrinus	Peregrine Falcon	NT	LC	Low
Glareola nordmanni	Black-winged Pratincole	NT	NT	Low
Gorsachius leuconotus	White-backed Night Heron	VU	LC	Low
Gyps africanus	African White-backed Vulture	VU	CR	Low
Gyps coprotheres	Cape Vulture	VU	EN	Low
Hieraaetus ayresii	Ayres's Eagle	NT	LC	Low
Leptoptilos crumeniferus	Marabou Stork	NT	LC	Low
Mirafra cheniana	Melodious Lark	NT	LC	Low
Mycteria ibis	Yellow-billed Stork.	NT	LC	Low
Neotis denhami	Denhams Bustard	VU	NT	Low
Pelecanus onocrotalus	Great White Pelican	NT	LC	Low
Pelicanus rufescens	Pink-backed Pelican	VU	LC	Low
Phoenicopterus minor	Lesser Flamingo	NT	NT	Low
Phoenicopterus ruber	Greater Flamingo	NT	LC	Low
Podica senegalensis	African Finfoot	VU	LC	Low
Polemaetus bellicosus	Martial Eagle	VU	EN	Medium
Pterocles gutturalis	Yellow-throated Sandgrouse	NT	LC	Low
Rostratula benghalensis	Greater Painted Snipe	NT	LC	Low
Rynchops flavirostris	African Skimmer	Regionally EX	NT	Low
Sagittarius serpentarius	Secretarybird	NT	VU	Medium
Sterna caspia	Caspian Tern	NT	LC	Low
Terathopius ecaudatus	Bateleur	VU	NT	Low
Torgos tracheliotus	Lappet-faced Vulture	VU	EN	Medium
Tyto capensis	African Grass Owl	VU	LC	Low

CR = Critically endangered; EN = Endangered; VU = Vulnerable, NT = Near Threatened, EX = Extinct, LC = Least concern,

Table I3: Reptile species of conservation concern in the North West Province (NWBSP, 2015).

Scientific name	Common name	Power & Verbugt (2014)	IUCN Status	POC
Chamaesaura aenea	Coppery Grass Lizard	NT	NYBA	Low
Crocodylus niloticus	Nile Crocodile	VU	LC	Low
Homoroselaps dorsalis	Striped Harlequin snake	NT	LC	Low
Python natalensis	Southern African Python	LC	NYBA	Medium

NT = Near Threatened, VU = Vulnerable; NYBA= Not Yet Been Assessed, LC = Least Concern

Table I4: Amphibian species of conservation concern in the North West Province (NWBSP, 2015).

Scientific Name	Common Name	Power & Verbugt (2014)	IUCN Status	POC
Pyxicephalus adspersus	African Giant Bullfrog	NT	LC	Medium

NT = Near Threatened, LC = Least Concern

Table I5: Arachnid species of conservation concern in the North West Province (NWBSP, 2015).

Scientific name	Common Name	IUCN Status
Aelurillus cristatopalpus	Jumping Spiders	NYBA
Afromarengo bimaculata	Jumping Spiders	NYBA
Ariadna similis	Jack-in-a-box Spiders	NYBA
Austrachelas merwei	Corrinid Sac Spider	NYBA
Cyatholipus isolatus	Spotted Tree Sheet-web Spiders	NYBA
Diores femoralis	Zodariid Ground Spiders	NYBA
Diphya simoni	Long-jawed Orb Weavers	NYBA
Eusparassus borakalalo	Huntsman Spiders	NYBA
Evarcha flagellaris	Jumping Spiders	NYBA
Galeosoma coronatum	Armoured Trapdoor Spiders	NYBA
Galeosoma crinitum	Armoured Trapdoor Spiders	NYBA
Galeosoma scutatum	Armoured Trapdoor Spiders	NYBA
Idiops pallus	Armoured Trapdoor Spiders	NYBA
Langona manicata	Jumping Spiders	NYBA
Pseudicius gracilis	Jumping Spiders	NYBA
Rhene konradi	Jumping Spiders	NYBA
Setaphis sexmaculata	Ground Spiders	NYBA

NYBA = Not Yet Been Assessed

Table I6: Threatened invertebrate species of North West Province (NW DACE, 2008).

Scientific name	Common Name	NW Status 2008	POC
Metisella meninx	Marsh Sylph	VU	Low
Lepidochrysops praeterita	Highveld Blue	EN	Low
Platylesches dolomitica	Hilltop Hopper	VU	Low
Lepidochrysops hypopolia	Morant's blue	EX	Low

EN = Endangered, VU = Vulnerable, EX=Extinct, NYBA= Not Yet Been Assessed

Table I7: Red Data faunal species listed in the Transvaal Nature Conservation Ordinance, 1983 (Act No. 12 of 1983).

Schedule 2A (Protected Game)			
Reptiles and Mammals			
Scientific Name	**Common Name**	**South African (RSA) Red List Status**	**POC**
Pyxicephalus adspersus	Bullfrog	NT (RSA) and Protected (P) by NEMBA	Medium
Varanus niloticus, Varanus Albigularis and all species of the Sub Order Serpentes	All species of reptiles excluding the water orcas, rock orcas and all species of snakes	Varied	Medium
Atelerix frontalis	Southern African Hedgehog	NT	Low
Cercopithecus albogularis	Samango monkey	VU	Low
Otolemur crassicaudatus	Thick-tailed Greater Bushbaby	LC	Low
Galago moholi	Night ape/Lesser Bushbaby	LC	Medium
Manis/Smutsia temminckii	Ground Pangolin	VU	Low
Proteles cristatus	Aardwolf	LC	Low
Hyaena brunnea	Brown hyaena	NT	Low
Orycteropus afer	Antbear	LC	Low
Equus zebra zebra	Cape Mountain zebra	LC	Low
Equus zebra	Hartmann's zebra	VU	Low
Hippopotamus amphibius	Hartmannae hippopotamus	LC	Low
Giraffa camelopardalis	Giraffe	LC	Low
Tragelaphus angasi	Nyala	LC	Low
Tragelaphus oryx	Common Eland	LC	Low
Cephalophus natalensis	Red duiker	NT	Low
Philantomba monticola	Blue duiker	VU	Low
Redunca arundinum	Southern Reedbuck	LC	Low
Redunca fulvorufula	Mountain reedbuck	EN	Low
Kobus ellipsiprymnus	Waterbuck	LC	Low
Hippotragus niger	Sable antelope	VU	Low
Hippotragus equinus	Roan antelope	EN	Low
Oryx gazella	Gemsbok	LC	Low
Connochaetes gnou	Black wildebeest	LC	Low
Alcelaphus buselaphus	Red hartebeest	LC	Low
Damaliscus orcas dorcas	Bontebok	LC	Low
Damaliscus lunatus	Tsessebe	LC	Low
Oreotragus oreotragus	Klipspringer	LC	Low
Ourebia ourebi	Oribi	EN	Low
Raphicerus campestris	Steenbok	LC	High
Raphicerus sharpei	Sharpe's grysbok	LC	Low
Neotragus moschatus	Suni	EN	Low
Pelea capreolus	Grey Rhebuck	NT	Low
Birds – any wild bird excluding a) bird which is ordinary game (as listed below)			
Plectropterus gambensis	Spur-winged goose	LC	Low
Alopochen aegyptiacus	Egyptian goose	LC	Low
Anas undulata	Yellow-billed duck	LC	Low

Anas erythrorhyncha	Red-billed teal	LC	Low
Peliperdix coqui	Coqui francolin	LC	Medium[21]
Dendroperdix sephaena	Crested francolin	LC	Medium
Scleroptila afra	Grey-winged francolin	LC	Low
Scleroptila shelleyi	Shelley's francolin	LC	Medium
Scleroptila levaillantii	Red-winged francolin	LC	Medium
Scleroptila levaillantoides/gutturalis	Orange River francolin	LC	Low
Pternistis adspersus	Red-billed spurfowl	LC	Low
Pternistis natalensis	Natal spurfowl	LC	High
Birds – any wild bird excluding b) Schedule 3 Ordinary game as per the following list			
Phalacrocorax lucidus	White-breasted cormorant	LC	Low
Phalacrocorax africanus	Reed cormorant	LC	Low
Streptopelia semitorquata	Red-eyed turtle dove	LC	High
Streptopelia capicola	Cape turtle dove	LC	Confirmed
Streptopelia senegalensis	Laughing dove	LC	Confirmed
Family colidae	All species of mousebirds	LC	High
Crovus albus	Pied crow	LC	High
Corvus capensis	Cape crow	LC	High
Pycnonotus nigricans	Red-eyed bulbul	LC	Low
Pycnnonotus barbatus	Black-eyed bulbul	LC	High
Onychognathus morio	Red-winged starling	LC	High
Passer melanurus	Cape sparrow	LC	Confirmed
Ploceus cucullatus	Village weaver	LC	High
Ploceus capensis	Cape weaver	LC	High
Schedule 2A (Specially Protected Game)			
Loxodonta africana	Elephant	LC	Low
All species of the Family Rhinocerotidae	All species of rhinoceros	NT-CR	Low
Schedule 4 (Protected Wild animals)			
Lycaon pictus	Wild dog	EN	Low
Acinonyx jubatus	Cheetah	VU	Low
Panthera pardus	Leopard	VU	Low
Panthera leo	Lion	LC	Low
Syncerus caffer	African buffalo	LC	Low
Schedule 7 (Invertebrate species)			
Harpactira spp.	All species of baboon spiders belonging to:	Protected	Medium
Pterinochilus spp.	The genera referred to hereby	Exotic	Medium
Poecilmitis aureus	Golden copper butterfly	Exotic	Medium
Charaxes spp.	All species of charaxes (emperor butterflies)	Exotic	Medium
Aloeides dentatis dentatis	Scarce copper butterfly	Exotic	Low

R = Rare; NYBA = Not Yet Been Assessed by the IUCN

[21] All faunal species listed under the Transvaal Nature Conservation Ordinance, 1983 (Act No. 12 of 1983) that are common (Least Concern) or are Exotic are not included in the SCC assessment or discussion of this report, as they are not threatened and unlikely to be significantly impacted by the proposed prospecting activities.

Table I8: NEMBA TOPS list (2007) of all faunal SCC that require a permit should they need to be relocated as a result of the proposed mining activities and activities and its activities.

Scientific Name	Common Name
CRITICALLY ENDANGERED SPECIES	
REPTILIA	
Caretta caretta	Loggerhead Sea Turtle
Dermochelys coriacea	Leatherback Sea Turtle
Eretmochelys imbricate	Hawksbill Sea Turtle
AVES	
Grus carunculatus	Wattled Crane
Hirundo atrocaerulea	Blue Swallow
Neophron percnopterus	Egyptian Vulture
Poicephalus robustus	Cape Parrot
MAMMALIA	
Bunolagus monticularis	Riverine Rabbit
Chrysospalax	Rough-haired Golden Mole
ENDANGERED SPECIES	
REPTILIA	
Chelonia mydas	Green Turtle
Cordylus giganteus	Giant Girdled Lizard
Lepidochelys olivacea	Olive Ridley Turtle
Psammobates geometricus	Geometric Tortoise
AVIFAUNA	
Anthropoides paradiseus	Blue Crane
Balearica regulorum	Grey Crowned Crane
Ephippiorhynchus senegalensis	Saddle-billed Stork
Gypaetus barbatus	Bearded Vulture
Gyps africanus	White-backed Vulture
Gyps coprotheres	Cape Vulture
Necrosyrtes	Hooded Vulture
Pelecanus rufescens	Pink-backed Pelican
Scotopelia peli	Pel's Fishing Owl
Torgos tracheliotus	Lappet-faced Vulture
MAMMALIA	
Amblysomus robustus	Robust Golden Mole
Damaliscus tunatus	Tsessebe
Diceros bicornis	Black Rhinoceros
Equus zebra	Mountain Zebra
Lycaon pictus	African Wild Dog
Neamblysomus gunningi	Gunning's Golden Mole
Ourebia ourebi	Oribi
Paraxerus palliatus	Red Squirrel
Petrodromus tetradactylus	Four-toed Elephant-shrew
INVERTEBRATA	
Colophon spp – species	Stag Beetles
VULNERABLE SPECIES	
AVES	
Trigonoceps occipitalis	White-headed Vulture
Aquila rapax	Tawny Eagle
Ardeotis kori	Kori Bustard
Ciconia nigra	Black Stork
Circaetus fasciolatus	Southern Banded Snake Eagle
Eupodotis caerulescens	Blue Korhaan
Falco fasciinucha	Falcon
Falco naumanni	Lesser Kestrel

Scientific Name	Common Name
Falco peregrinus	Peregrine Falcon
Geronticus calvus	Bald Ibis
Neotis ludwidii	Ludwig's Bustard
Polemaetus bellicosus	Martial Eagle
Terathopius ecaudatus	Bateleur
Tyto capensis	Grass Owl
MAMMALIA	
Acinonyx jubatus	Cheetah
Chrysospalax trevelyani	Giant Golden Mole
Cricetomys gambianus	Giant Rat
Damaliscus pyrgorgus pygargus	Bontebok
Dendrohyrax arboreus	Tree Hyrax
Hippotragus equinus	Roan Antelope
Pholidota temminckii	Pangolin
Neamblysomus julianae	Juliana's Golden Mole
Neotragus moschatus	Suni
Panthera leo	Lion
Panthera pardus	Leopard
Philantomba monticola	Blue Duiker
INVERTEBRATA	
Peripatopsis alba	White Cave Velvet Worm
PROTECTED SPECIES	
AMPHIBIA	
Pyxicephalus adspersus	Giant Bullfrog
Pyxicephalus edulis	Afiican Bullfrog
REPTILIA	
Bitis gabonica	Gaboon Adder
Bitis schneideri	Namaqua Dwarf Adder
Bradypodion taeniabronchum	Smith's Dwarf Chameleon
Cordylus cataphractus	Girdled Lizard
Crocodylus niloticus	Nile crocodile
Python natalensis	African Rock Python
AVES	
Bucowus leadeateri	Southern Ground-Hornbill
Circus ranivorus	African Marsh Harrier
Neotis denhami	Denham's Bustard
Spheniscus	Jackass Penguin
MAMMALIA	
Atelerix frontalis	South African Hedgehog
Ceratotherium simum	White Rhinoceros
Connochaetes	Black Wildebeest
Crocuta crocuta	Spotted Hyaena
Felis nigripes	Black-footed Cat
Parahyaena brunnea	Brown Hyaena
Leptailurus serval	Serval
Loxodonta africana	African elephant
Lutra maculicollis	Spotted-necked Otter
Millivora capensis	Honey Badger
Raphicerus sharpei	Sharpe's Grysbok
Redunca	Reedbuck
Vulpes chama	Cape **Fox**
INVERTEBRATA	
Aloeides clarki	Coega Copper Butterfly
Echinodiscus bisperforatus	Pansy Shell

Scientific Name	Common Name
Dromica spp – All species	Tiger Beetles
Graphipterus assimilis	Velvet Ground Beetle
Hadogenes spp -species	Flat Rock Scorpions
Opisthacanthus spp – All species	Creeping Scorpions
Opistophthalmus spp – All species	Burrowing Scorpions
Haliotis midae	South African Abalone
Harpactira spp – All species	Common Baboon Spiders
Ceratogyrus spp – All species	Horned Baboon Spiders
Pterinochilus spp – All species	Golden Baboon Spiders
Ichnestoma – Aspecies	Fruit Chafer Beetles
Manticora spp – Aspecies	Monster Tiger Beetles
Megacephala asperata	Tiger Beetle
Megacephala regalis	Tiger Beetle
Nigidius auriculatus	Stag beetle
Oonotus adspersus	Stag Beetle
Oonotus interioris	Stag Beetle
Oonotus rex	Stag Beetle
Oonotus sericeus	Stag Beetle
Platychile pallida	Tiger Beetle
Prosopocoilus petitclerci	Stag Beetle
Prothyma guttipennis	Tiger Beetle

Table I9: Animal species triggering the high sensitivity for the Animal Species Theme as identified by the National Web-based Screening Tool.

Scientific name	Common Name	IUCN	POC
Sagittarius serpentarius	Secretary bird	**EN**	**Medium**

South African Bird Atlas Project 2 list

Table I10: Avifaunal Species for the pentads: 2510_2650 and 2510_2655 the 2526BB.

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2510_2650	http://sabap2.birdmap.africa/coverage/pentad/2510_2650
2510_2655	http://sabap2.birdmap.africa/coverage/pentad/2510_2655

APPENDIX J: Declaration and Specialists CV's

1. (a) (i) Details of the specialist who prepared the report

Samantha-Leigh Daniels	PhD Candidate Plant Science (University of Pretoria)
Paige van Niekerk	BSc (Hons) Animal, Plant and Environmental Science (University of Witwatersrand)
Christopher Hooton	BTech Nature Conservation (Tshwane University of Technology)
Nelanie Cloete	MSc Botany and Environmental Management (University of Johannesburg)

1. (A). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Nelanie Cloete		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047		
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	Nelanie@sasenvgroup.co.za		
Qualifications	MSc Environmental Management (University of Johannesburg) MSc Botany (University of Johannesburg) BSc (Hons) Botany (University of Johannesburg) BSc (Botany and Zoology) (Rand Afrikaans University)		
Registration / Associations	Professional member of the South African Council for Natural Scientific Professions (SACNASP) Member of the South African Association of Botanists (SAAB) Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group Member of the Grassland Society of South Africa (GSSA)		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Samantha-Leigh Daniels, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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

----

Signature of the Specialist

I, Paige van Niekerk, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;

- I have not, 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

----

Signature of the Specialist

I, Christopher Hooton, declare that -

- I act as the **independent specialist (reviewer)** 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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.

Specialist Signature

I, Nelanie Cloete, declare that -

- I act as the **independent specialist (reviewer)** 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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

----

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF SAMANTHA-LEIGH DANIELS

PERSONAL DETAILS

Position in Company	Contract Ecologist
Joined SAS Environmental Group of Companies	2020

EDUCATION

Qualifications

PhD (Plant Science) (University of Pretoria)	Present
MSc (Plant Science) (University of Pretoria)	2017
BSc (Hons) Zoology & Entomology (University of Pretoria)	2014
BSC Zoology & Entomology (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, KwaZulu-Natal, North West, Limpopo

KEY SPECIALIST DISCIPLINES

Experience

- Desktop Delineations
- Invertebrate and plant surveys along the Sani Pass as part of an ongoing research project
- Bush encroachment surveys within Mpumalanga
- Grassland Surveys at Rietvlei Nature Reserve

Training

- Plant species identification
- Herbarium usage and protocols

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF PAIGE FRANCES VAN NIEKERK

PERSONAL DETAILS

Position in Company	Faunal Ecologist
Joined SAS Environmental Group of Companies	2020

EDUCATION

Qualifications

BSc (Hons) Animal, Plant and Environmental Sciences (University of the Witwatersrand)	2019
B.Tech Nature Conservation (Tshwane University of Technology)	2017
N. Diploma Nature Conservation (Tshwane University of Technology)	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Limpopo, Northern Cape, North West

KEY SPECIALIST DISCIPLINES

Terrestrial Ecological Assessments:

- Detailed Faunal Field Assessments, Fauna Ecology and Species Assemblage Reports
- Ecological Scan
- Red Data/Species of Special Concern Faunal Species Assessments
- Consulting maps, aerial photographs and digital satellite images
- Desktop studies, Mapping and General GIS
- Compilation of Impact Assessments
- Faunal Field Data Analysis and Preparation

Training

- ArcGIS and Global Mapper, GIS Mapping
- Philosophy of Science
- Statistics for field biology
- Academic writing
- Advanced grass identification course by Frits van Oudtshoorn
- Venomous snake handling and identification

**SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF CHRISTOPHER HOOTON**

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Biodiversity Specialist
Joined SAS Environmental Group of Companies	2013

EDUCATION

Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Free State
Africa – Zimbabwe, Sierra Leone, Zambia

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Faunal Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning

Freshwater Assessments

- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION CURRICULUM VITAE OF NELANIE CLOETE

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Botanical Science and Terrestrial Ecology
Joined SAS Environmental Group of Companies	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 400503/14)
Member of the South African Association of Botanists (SAAB)
Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group
Member of the Grassland Society of South Africa (GSSA)
Member of the Botanical Society of South Africa (BotSoc)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State
Africa - Democratic Republic of the Congo (DRC)

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments
- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments
- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Plant species and Landscape Plan

Legislative Requirements, Processes and Assessments
- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

- Freshwater Ecosystem Study

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FRESHWATER ECOSYSTEM ASSESSMENT AS PART OF THE ENVIRONMENTAL AUTHORISATION (EA) PROCESS FOR THE PROPOSED RUIGHOEK PROSPECTING RIGHT EXPANSION PROJECT, NEAR RUSTENBURG, NORTH-WEST PROVINCE.

Prepared for

SLR Consulting (South Africa) (Pty) Ltd.

December 2021 (Amended April 2022)

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SAS Environmental Group of Companies

EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed by SLR Consulting (South Africa) (Pty) Ltd to conduct a freshwater ecosystem assessment as part of the Environmental Authorisation (EA) process for the proposed Ruighoek prospecting project to be conducted by Pilanesberg Platinum Mine (PPM) on a 4.7-hectare (ha) section of land on Ruighoek farm, portion 5 near Rustenburg, North-West Province. For ease of reference, the 4.7 ha area in which the proposed prospecting activities will take place will henceforth be referred to as the "proposed prospecting area" whilst the prospecting activities will be referred to as the "proposed prospecting activities". The proposed prospecting activities include the drilling of nine (9) boreholes and the construction of five (5) trenches to explore platinum reserves in the UG2 subcrop of the Merensky Reef that runs along the western side of the proposed prospecting area.

A field assessment was undertaken in October 2021 to identify any potential freshwater ecosystems that will potentially be impacted by the prospecting activities. Due to safety and security concerns related to illegal mining within the proposed prospecting area, representative points of interest (POIs) as deemed "safe" by the PPM security team were assessed to infer the potential present ecological state (PES), sensitivity, and ecological service provisioning of the freshwater ecosystems associated with the prospecting and investigation area (defined as a 500 m radius around the study area, in line with GN 509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)). A single freshwater ecosystem, namely the Mothlabe River was identified to traverse the proposed prospecting area which was delineated using desktop methods and augmented based on POI's assessed along the downgradient and upgradient reach of the river. The Mothlabe River was classified to be in a moderately modified ecological condition. The ecological service provisioning provided by the river ranged from very low to very high whilst the ecological importance and sensitivity was assessed to be moderate.

Following the freshwater ecosystem assessment, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2016) was applied to determine the significance of impacts of the proposed prospecting activities on the reach of the Mothlabe River that traverses the prospecting area. It is worth noting that a finalised construction method statement was not available at the time of the compilation of this report and thus, the DWS Risk Assessment Matrix (2016) was applied based on the conceptual layout plan (five trenches and nine borehole localities) as provided by the client (SLR Consulting, 2021) which was optimised to ensure that no prospecting activities will be undertaken within the delineated boundaries of the freshwater ecosystems, with specific mention of the Mothlabe River and its associated 100 m GN 509 and GN 704 Zone of Regulation (ZoR) and 32 m NEMA ZoR. Based on the findings of the Risk Assessment, the proposed prospecting activities will pose a "Low" risk to the Mothlabe River, provided that the mitigation measures as outlined in this report are strictly adhered to.

Provided that the delineated boundaries of the freshwater ecosystems and associated ZoR's (100 m GN 509 and GN 704 ZoR as well as 32 m NEMA ZoR) will be avoided, from a freshwater ecosystem management perspective, the proposed prospecting activities can be considered feasible. It should be noted that in the event of significant mining resources being identified during the prospecting activities, it is noted that no mining will be allowed within the Mothlabe River, Unnamed tributary of the Mothlabe River and Ephemeral drainage lines (located within the investigation area) and 32 m NEMA and 100 m GN 509 and GN 704 ZoR, unless further authorisations are obtained.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed by SLR Consulting (South Africa) (Pty) Ltd to conduct a freshwater ecosystem assessment as part of the Environmental Authorisation (EA) process for the proposed Ruighoek prospecting project to be conducted by Pilanesberg Platinum Mine (PPM) on a 4.7-hectare (ha) section of land on Ruighoek farm, portion 5 near Rustenburg North-West Province. For ease of reference, the 4.7 ha area in which the proposed prospecting activities will take place will henceforth be referred to as the "proposed prospecting area" whilst the prospecting activities will be referred to as the "proposed prospecting activities". The proposed prospecting activities include the drilling of nine boreholes and the construction of five trenches to explore platinum reserves in the UG2 subcrop of the Merensky Reef that runs along the western side of the proposed prospecting area.

The purpose of this report is to define the ecology of the area in terms of freshwater ecosystems characteristics, including mapping of the freshwater ecosystems, discuss key ecological drivers and to define the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS), as well as the socio-cultural and ecological service provision of the freshwater ecosystems utilising current industry "best practice" assessment methods in order to ascertain what, if any, impact the activities will have on the freshwater ecosystems associated with the proposed prospecting area. Additionally, this report aims to define the Recommended Management Objectives (RMO), Recommended Ecological Category (REC) and Best Attainable State (BAS) for the freshwater ecosystems. The assessment took the following approach:

- A desktop study was conducted, in which possible freshwater ecosystems were identified for in-field, and relevant national and provincial databases were consulted;
- The field assessment was undertaken in October 2021 to ground-truth the freshwater ecosystems associated with the proposed prospecting activities. Due to safety and security concerns related to illegal mining within the proposed prospecting area, representative points of interest (POIs) as deemed "safe" by the PPM security team were assessed to infer the potential present ecological state (PES), sensitivity, and ecological service provisioning of the freshwater ecosystems associated with the prospecting and investigation area (defined as a 500 m radius around the prospecting area, in line with GN 509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998));
- The freshwater ecosystems were then classified according to the Ollis *et al*. (2013) classification system and the characteristics of each was defined including the PES, EIS, REC, RMO and BAS.

The results of the field assessment are presented in Section 4 and 5 of this report, and are summarised in the table below:

Table A: Summary of the freshwater ecosystem assessment results.

Freshwater ecosystem	PES	Ecoservices importance	EIS	REC / RMO / BAS
Mothlabe River	Category C (Moderately modified)	Ranged from Very Low to High	Moderate	C/ Maintain/ C

Following the freshwater ecosystem assessment, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2016) was applied to determine the significance of impacts of the proposed prospecting activities on the reach of the Mothlabe River that traverses the prospecting area. It is worth noting that a finalised construction method statement was not available at the time of the compilation of this report and thus, the DWS Risk Assessment Matrix (2016) was applied based on the conceptual layout plan (five trenches and nine borehole localities) as provided by the client (SLR Consulting, 2021) which was optimised to ensure that no prospecting activities will be undertaken within the delineated boundaries of the freshwater ecosystems, with specific mention of the Mothlabe River and its associated

100 m GN 509 and GN 704 Zone of Regulation (ZoR) and 32 m NEMA ZoR. Based on the findings of the Risk Assessment, the proposed prospecting activities will pose a “Low” risk to the Mothlabe River, provided that the mitigation measures as outlined in this report are strictly adhered to. The summary of the risk assessment is provided in the table below:

Table B: Summary of the DWS Risk Assessment outcomes.

No.	Phases	Activity	Risk Rating
1	Construction Phase	Site clearing prior to commencement of prospecting activities and the set-up of contractor camps.	L
2		Groundbreaking, excavation and creation of boreholes and trenches outside of the 100 m GN 509 and GN 704 and 32 m NEMA ZOR of the Mothlabe River.	L
3	Rehabilitation phase	Site decommissioning, rehabilitation of prospected areas and removal of alien invasive plants (AIP's) within the proposed prospecting area, adjacent to the Mothlabe River once prospecting has been undertaken.	L

Provided that the delineated boundaries of the freshwater ecosystems and associated ZoR’s (100 m GN 509 and GN 704 ZoR as well as 32 m NEMA ZoR) will be avoided, from a freshwater ecosystem management perspective, the proposed prospecting activities can be considered feasible. It should be noted that in the event of significant mining resources being identified during the prospecting activities, it is noted that no mining will be allowed within the Mothlabe River, Unnamed tributary of the Mothlabe River and Ephemeral drainage lines (located within the investigation area) and 32 m NEMA and 100 m GN 509 and GN 704 ZoR, unless further authorisations are obtained.

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirements	Section in report
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Front Page and Appendix E
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution, and movement patterns	Section 4
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 3 and 4
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 3
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 3
2.3	Identify any alternative development footprints within the preferred development site which would be of a “low” sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	Section 6
2.4	Assessment of impacts - a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 6
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 6
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	Section 6
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). d. Assessment of the risks associated with water use/s and related activities.	Section 6
2.4.4	How will the development impact on the functionality of the aquatic feature including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system); b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of overabstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); and e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal).	Section 6
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 6
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 6

2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	Section 6
3.	**The report must contain as a minimum the following information:**	
3.1	Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae;	Appendix H
3.2	A signed statement of independence by the specialist;	Appendix H
3.3	The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 1.2, 2 and Appendix C
3.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.3
3.6	Areas not suitable for development, to be avoided during construction and operation (where relevant);	Section 5
3.7	Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts;	Section 5
3.8	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol;	Section 5
3.9	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 5 and 6
3.10	A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being not considered; and	Section 6
3.11	A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected.	Section 7
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 5
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 6
3.14	A motivation must be provided if there were development footprints identified as perparagraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a "low" aquatic biodiversity and sensitivity and that were not considered appropriate.	
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 7
3.16	Any conditions to which this statement is subjected.	Section 7

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animans and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation	To determine the boundary of a wetland/ river based on soil, vegetation and/or topography and hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endorheic	As it relates to a depression wetland: inward-draining with no transport of water into downstream systems via subsurface or surface flow. Water leaves via evapotranspiration and infiltration only.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas.
Fluvial:	Resulting from water movement.
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater
Perennial:	Flows all year round.
RAMSAR:	The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius.
AIP	Alien Invasive Plant
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DRDLR	Department of Rural Development and Land Reform's
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
m	Meter
MAP	Mean Annual Precipitation
MR	Mining Right
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NBA	National Biodiversity Assessment
NWA	National Water Act
PES	Present Ecological State
PPM	Pilanesberg Platinum Mine
REC	Recommended Ecological Category
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SQR	Sub quaternary catchment reach
STS	Scientific Terrestrial Services
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed by SLR Consulting (South Africa) (Pty) Ltd to conduct a freshwater ecosystem assessment as part of the Environmental Authorisation (EA) process for the proposed Ruighoek prospecting project to be conducted by Pilanesberg Platinum Mine (PPM) on a 4.7-hectare (ha) section of land on Ruighoek farm, portion 5 near Rustenburg North-West Province. For ease of reference, the 4.7-ha area in which the proposed prospecting activities will take place will henceforth be referred to as the "proposed prospecting area" whilst the prospecting activities will be referred to as the "proposed prospecting activities".

The proposed prospecting area is located in a rural area of the Bojanala Platinum District Municipality, approximately 500 m west of Tlhatlhaganyane village and 3 km west of the Pilanesberg National Park. Historically, the proposed prospecting area has been excluded from any intensive development and therefore, was expected to remain in a relatively natural state. However, illegal mining activities and human presence in the vicinity have severely disturbed the landscape. The proposed prospecting activities include the drilling of nine (9) boreholes and the construction of five (5) trenches to explore platinum reserves in the UG2 subcrop of the Merensky Reef that runs along the western side of the proposed prospecting area.

In order to identify all freshwater ecosystems that may potentially be impacted by the proposed prospecting activities, a 500 m "zone of investigation" around the prospecting area, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was used as a guide in which to assess possible sensitivities of the receiving environment. This 500 m "zone of investigation" will henceforth be referred to as the 'investigation area'. The location of the proposed prospecting area and associated investigation area are depicted in Figures 1 and 2, below. A conceptual layout of the locality of the prospecting activities (trenches and boreholes) are depicted in Figure 3, below.

The purpose of this report is to define the ecology of the area in terms of freshwater ecosystems characteristics. This will include mapping of the freshwater ecosystems, discussion of key ecological drivers and to define the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS), as well as the socio-cultural and ecological service provision of the freshwater ecosystems utilising current industry "best practice" assessment methods in order to ascertain what impact, if any, the activities will have on the freshwater ecosystems within the prospecting and investigation area. Additionally, this report aims to define the Recommended Management Objectives (RMO), Recommended Ecological Category (REC) and Best Attainable State (BAS) for the freshwater ecosystems.

The DWS Risk Assessment Matrix as promulgated in Government Notice 509, published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the perceived impacts associated with the proposed prospecting activities on the receiving freshwater environment. In addition, mitigatory measures were developed, which aim to minimise the perceived impacts associated with the proposed prospecting activities, followed by an assessment of the significance of the impacts, post-mitigation. This report, after consideration and a description of the ecological integrity of the freshwater ecosystems, must guide the EAP and relevant authorities, by means of a reasoned opinion and recommendations as to the viability of the proposed prospecting activities from a freshwater ecosystem management point of view.

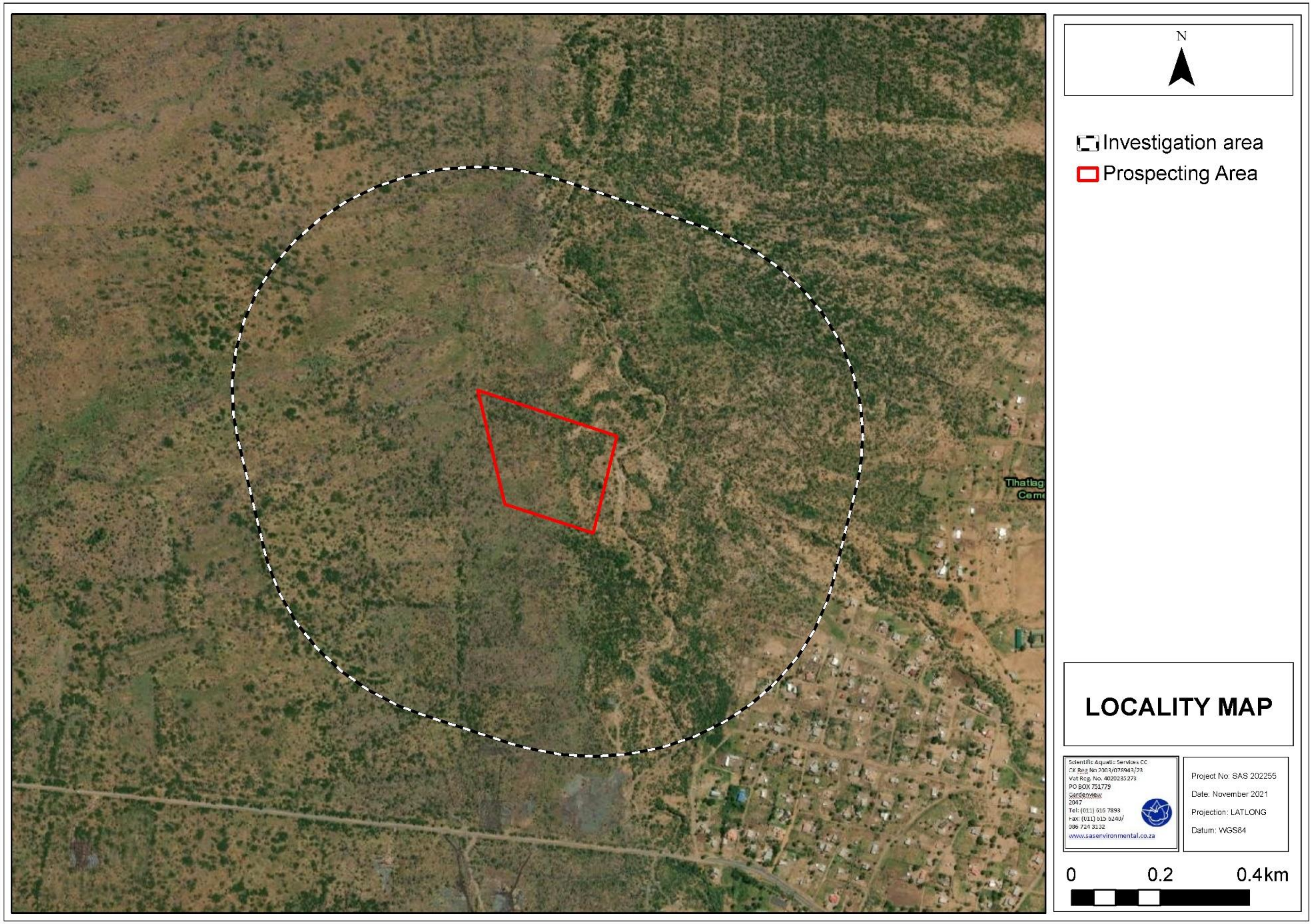

Figure 1: Digital satellite image depicting the location of the proposed prospecting and investigation areas in relation to the surrounding environment.

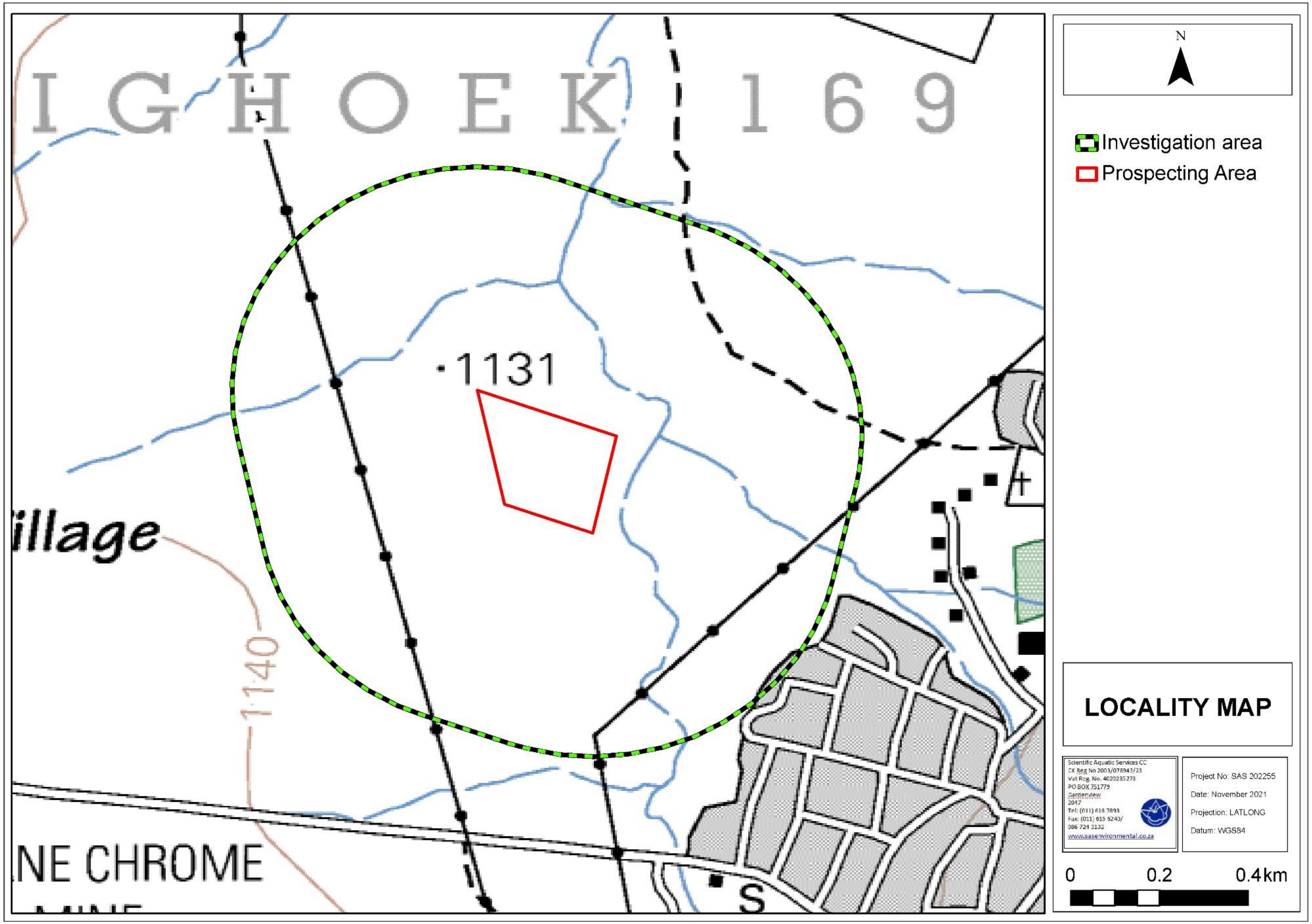

Figure 2: The proposed prospecting and investigation area depicted on a 1:50 000 topographical map in relation to the surrounding environment.

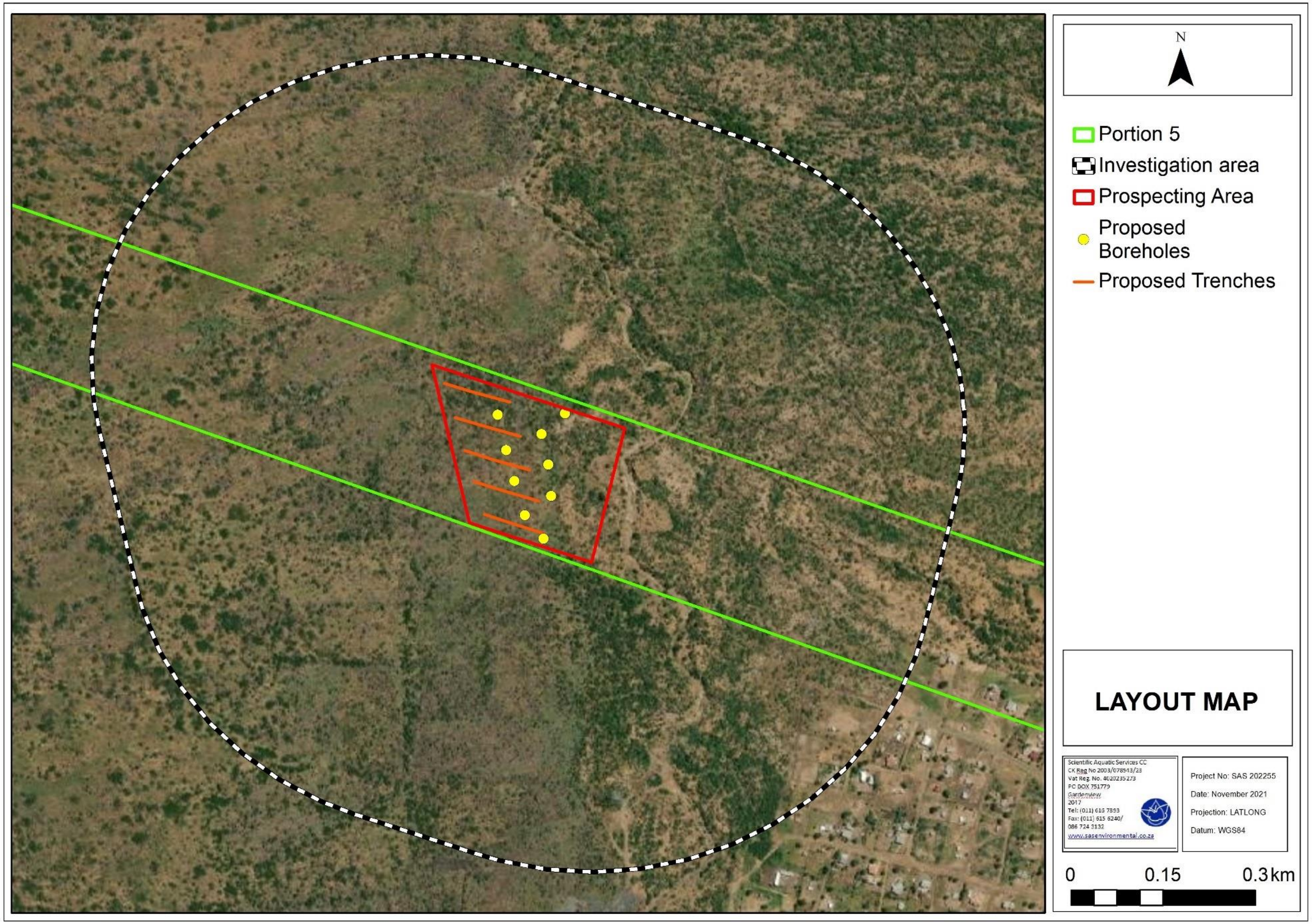

Figure 3: The layout associated proposed prospecting activities (boreholes and trenches) within the footprint of the proposed prospecting area as provided by SLR consulting (2021).

1.2 Scope of Work

Specific outcomes in terms of this report are outlined below:

- A background study of relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas (NFEPA, 2011) database; the Department of Water and Sanitation Research Quality Information Services (DWS RQIS PES/EIS), 2014 database, the North-West Biodiversity Sector Plan (NWBSP, 2015) and National Biodiversity Assessment (NBA, 2018) was undertaken to aid in defining the PES and EIS of the freshwater ecosystems;
- All freshwater ecosystems within the investigation area were delineated using desktop methods in accordance with GN509 of 2016 as it relates to activities as stipulated in the National Water Act, 1998 (Act No. 36 of 1998) and verified where possible according to the "Department of Water Affairs and Forestry (DWAF)[1] (2005)[2]: A practical field procedure for identification of wetlands and riparian areas". Aspects such as soil morphological characteristics, vegetation types and wetness were used to verify the freshwater ecosystems;
- The freshwater ecosystem classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The general habitat integrity of the proposed prospecting area was discussed based on the application of the Index of Habitat Integrity (IHI) according to the method described by Kleynhans *et al*., (2008);
- The EIS of the freshwater ecosystem was determined according to the method described by Rountree and Kotze*,* (2013);
- The freshwater ecosystems were mapped according to the hydrogeomorphic (HGM) units in relation to the proposed prospecting activities and surrounding landscape. In addition to the freshwater ecosystem boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;
- Allocation of a suitable RMO, REC and BAS for the freshwater ecosystems based on the results obtained from the PES and EIS assessments; and
- To present management and mitigation measures which should be implemented going forward to assist in minimising the impact on the receiving environment.

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[1] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA) and subsequently as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.

[2] Even though an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this is still considered a draft document currently under review.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- According to the layout (Figure 3), the proposed surface infrastructure and prospecting activities will only be located within the left portion of the proposed prospecting area, avoiding the delineated boundary of the freshwater ecosystems (discussed further in Section 4);
- Because of safety concerns pertaining to the presence of illegal miners both within the proposed prospecting area as well as the greater surrounding areas (including the investigation area), access to the prospecting area was not possible during the field assessment undertaken in October 2021. Instead, SAS was permitted to access certain points of interest (POIs) as deemed "safe" by the PPM security team. Thus, these POIs were used to infer the potential PES, sensitivity, and ecological service provisioning of the freshwater ecosystems associated with the proposed prospecting and investigation area. Although these POIs are useful in extrapolating information regarding the freshwater ecosystems associated with the proposed prospecting area, they do not provide an exact indication of the ecological conditions, historic impacts and species communities associated with the footprint of the prospecting area itself. As such, any conclusions drawn thereof should make note of this limitation and this report thus serves as a baseline for planning purposes only. It should be noted that in the event that prospecting indicate that mining is feasible, the freshwater ecosystem assessment should be appropriately updated with further detailed field work. This will include a subsequent field assessment of the proposed prospecting area which should be conducted by a suitably qualified freshwater specialist to confirm and/or update the ecological particulars associated with the freshwater ecosystems within the proposed prospecting and investigation area;
- As access to the proposed prospecting area itself was not possible during the field assessment in October 2021, the freshwater ecosystem delineations as presented in this report are based on digital satellite imagery, extrapolated data from the assessed POIs, available desktop databases, contour lines, topographic maps, historical aerial photographs and prior field experience in the area, and are thus deemed to be an adequate reflection of the freshwater ecosystems within the prospecting and associated investigation area;
- The delineations as presented in this report are regarded as a best estimate of the outermost/ temporary zone boundaries based on the site conditions present at the time of assessment;

- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the freshwater ecosystems will need to be surveyed and pegged according to surveying principles and with survey equipment;
- Due to high levels of disturbance associated with the POI's assessed and to extrapolate the reach of the freshwater ecosystems traversing the prospecting area, (impacts associated illegal mining activities) vegetation and topography was not always a reliable indicator of the presence of freshwater ecosystems. As such, in highly disturbed areas, the vegetation and topography indicators were considered less reliable indicators and these areas required subsequent refinement with digital satellite imagery;
- The freshwater ecosystems in the surrounding area are largely non-perennial systems that only become active in response to extreme rainfall events. Given the absence of such events, most areas currently show terrestrial characteristics and as such the delineation of the boundaries of these systems proved difficult in some areas. To mitigate this limitation, digital satellite imagery over time was used to verify these boundaries. Despite this, the delineations as presented in this report are regarded as a best estimate of the boundaries based on the site conditions present, as observed during the site assessment and are deemed accurate enough to guide the authorisation process;
- Wetland, riparian and terrestrial ecosystem zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative hydrophytic plant species. Within this transition zone, some variation of opinion on the freshwater ecosystem boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With regards to data sources used to provide background information on the sensitivity of the assessed areas, it is important to note that although all data sources provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the prospecting area's actual site characteristics at the scale required to inform the EA processes.

1.4 Legislative Requirements and Provincial Guidelines

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in Appendix B:

- Constitution of the Republic of South Africa, 1996[3];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- Government Notice 704 as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- The Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA);
- The North-West Biodiversity Management Act, 2016 (Act No. 4 of 2016);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Environmental Management: Biodiversity Act: Alien and Invasive Species Regulations, 2014;
- The Department of Environment, Forestry and Fisheries (DEFF), (2020) National Web-based Environmental Screening Tool (hereafter the “screening tool”).

2 ASSESSMENT APPROACH

2.1 Freshwater Ecosystem Definition

For the purposes of this investigation, the definition of a watercourse and wetland habitat were taken as per that in the National Water Act, 1998 (Act No. 36 of 1998). The definitions are as follows:

A **watercourse** means:
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the *Gazette,* declare to be a watercourse,
and a reference to a watercourse includes where relevant, its bed and banks.

[3] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the ‘Constitution of the Republic of South Africa, 19996”. It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

Wetland habitat is "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

Thus, for the purposes of this investigation, the definition of a freshwater ecosystem is considered to be synonymous with the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998) and the terms may be used interchangeably in this report.

2.2 Freshwater Ecosystem Field Verification

As mentioned in Section 1.3 use was made of historical aerial photographs and current digital satellite imagery, topographic maps, and available provincial and national freshwater databases to aid in the delineation of those portions of the freshwater ecosystems associated with the proposed prospecting area, following the field assessment. The following was taken into consideration when utilising the above during delineation:

- Linear features: since water flows/moves through the landscape, freshwater ecosystems often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with freshwater ecosystems: a distinct increase in density as well as shrub size near flow paths;
- Hue: water flow paths often show as white/grey or black and outcrops or bare soil displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with freshwater ecosystem vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery, these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

The freshwater ecosystem delineation was verified in the field at pre-selected points (POIs) along representative reaches, upgradient and downgradient of the system that flows through the proposed prospecting area, due to safety and security concerns associated with illegal mining activities. As such, the delineation at the representative reaches assessed took place according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” (DWAF, 2008) whilst the reach within the proposed prospecting area was undertaken primarily using desktop methods. The foundation of the method is based on the fact that freshwater ecosystems have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soil;
- Vegetation adapted to saturated soil; and
- The presence of alluvial soil in stream systems.

The field assessment was undertaken in October 2021 during the spring season, during which the presence of any freshwater ecosystem (riparian or wetland) characteristics as defined by DWAF (2008) were noted (please refer to Section 4 of this report). In addition to the delineation process, detailed assessments of the delineated freshwater ecosystems were undertaken, at which time, factors affecting the integrity of the freshwater ecosystems were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the freshwater ecosystems. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

2.3 Sensitivity Mapping

All freshwater ecosystems associated with the proposed prospecting area were delineated using desktop methods, with the delineations being ground-truthed in the field as best as possible at certain pre-selected “safe” points with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto digital satellite imagery and topographic maps. The sensitivity map presented in Section 5 should guide the design and layout of the proposed prospecting area.

2.4 Risk Assessment and Recommendations

Following the completion of the assessment, the DWS Risk Assessment was conducted (please refer to Appendix D for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed prospecting area. These recommendations also include general ‘best practice’ management measures, which apply to the proposed prospecting area as a whole, and which are presented in Appendix F. Mitigation measures have been developed to address issues in all phases throughout the life of the proposed prospecting area including construction phase and small-scale rehabilitation, which is anticipated to be undertaken “post construction”. The detailed site-specific mitigation measures are outlined in Section 6 of this report.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Analyses of Relevant Databases

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard style” report (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for integration of results by the reader. Where required, further discussion and interpretation is provided.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the assessed areas actual site characteristics at the scale required to inform the EA processes. Nevertheless, this information is considered useful as background information to the study, is important in legislative contextualisation of risk and impact, and was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance. It must, however, be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified information must carry more weight in the decision-making process. Actual site conditions at the time of the assessment may differ to the background information provided by various datasets. Please refer to Section 4 for details pertaining to the site investigation.

Table 1: Desktop data relating to the characteristics of the freshwater ecosystems associated with the prospecting and investigation area.

Aquatic ecoregion and sub-regions in which the prospecting area is located	
Ecoregion	Bushveld Basin
Catchment	Limpopo
Quaternary Catchment	A24D
WMA	Crocodile West and Marico
subWMA	Lower Crocodile
Detail of the prospecting area terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database.	
FEPACODE	The proposed prospecting and investigation areas fall within a sub quaternary catchment classed as a Freshwater Ecosystem Protected Area (FEPA). FEPAs are considered to be important to achieve biodiversity targets for river ecosystems and threatened fish species and were identified in rivers that are currently in a good ecological condition (A or B ecological category). The FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.
NFEPA Wetlands	According to the NFEPA (2011) database, there are no wetlands associated with the prospecting and investigation area.
Wetland Vegetation Type	The prospecting area is situated within the Central Bushveld Group 2 (Zeerust Thornveld) Wetland Vegetation Type, classified as least threatened and poorly protected according to Mbona *et al.* (2015).
NFEPA Rivers (Figure 4)	According to the NFEPA (2011) database, the Motlhabe River traverses the investigation area, ±500 m from the prospecting area.

Detail of the prospecting area in terms of the North-West Biodiversity Spatial Plan (2015)	
Aquatic Critical Biodiversity Areas (CBAs) and Ecological Support Area (ESAs) (Figure 5)	Critical Biodiversity Areas (CBA's) include natural and near-natural terrestrial and aquatic features that are required to meet targets for biodiversity patterns and ecological processes. Furthermore, CBAs are area's considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges. Ecological Support Areas (ESAs) are natural, near natural, degraded or heavily modified areas required to be maintained in an ecologically functional state to support CBAs and/or Protected Areas. According to the North-West Biodiversity Sector Plan (2015) a large portion of the prospecting area falls within areas identified as a CBA 2 and ESA 1 whilst the investigation area is situated within areas identified as CBA 1 and 2, and an ESA 1 and 2.
Landcover category (Figure 6)	According to the North-West Biodiversity Sector Plan (2015), the entire prospecting area and investigation area are classified as natural landcover. A small portion towards the south-east of the investigation area is classified as settlement/ mine landcover.
Dominant characteristics of the Bushveld Ecoregion Level 2 (8.06) (Kleynhans *et al.*, 2007).	
Dominant primary terrain morphology	Slightly undulating plains
Dominant primary vegetation types	Clay Thorn Bushveld
Altitude (m.a.m.s.l.)	900 to 1300
MAP (mm)	400 to 600
Coefficient of Variation (% of MAP)	25 to 34
Rainfall concentration index	60 to >65
Rainfall seasonality	Mid-summer
Mean annual temp. (°C)	18 to 22
Winter temperature (July)	0 to 22
Summer temperature (Feb)	16 to 32
Median annual simulated runoff (mm)	20 to 100

Ecological Status of the most proximal sub-quaternary reach (DWS, 2014) (Figure 7).	
Sub-quaternary reach	A24D- 00716 (Motlhabe River)
SQR Point Proximity to prospecting area	±3.2 km north of the prospecting area
Assessed by expert?	Yes
PES Category Median	Largely Modified (Class D)
Mean Ecological Importance (EI) Class	Moderate
Mean Ecological Sensitivity (ES) Class	Low
Stream Order	1
Default Ecological Class (based on median PES and highest EI or ES mean)	Class C

National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (National Wetland Map 5 is included in the NBA) (Figure 8).	National web based Environmental Screening Tool (2021) (Figure 9).	
The NBA 2018: SAIIAE database indicates the presence of a channeled valley bottom wetland associated with the prospecting and investigation area classified to be critically endangered (ETS) and not protected (EPL). The database identified the Mothlabe River within 500 m of the prospecting area classified to be in a natural to largely natural ecological condition (RIVERCON AB) and PES score of Category D. No NBA artificial wetlands were identified within the prospecting and investigation area.	The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	The aquatic sensitivity of the prospecting area is considered to have very high aquatic sensitivity due to being associated with a freshwater ecosystem priority area, quaternary catchments, wetlands, and aquatic CBAs.
Mining and Biodiversity Guidelines (2012)		
According to the Mining and Biodiversity Guidelines database (2012), the prospecting area is currently ranked to be of highest biodiversity importance – highest risk of mining.		

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; m.a.m.s.l = Metres Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA = National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; PA = Protected Area PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area.

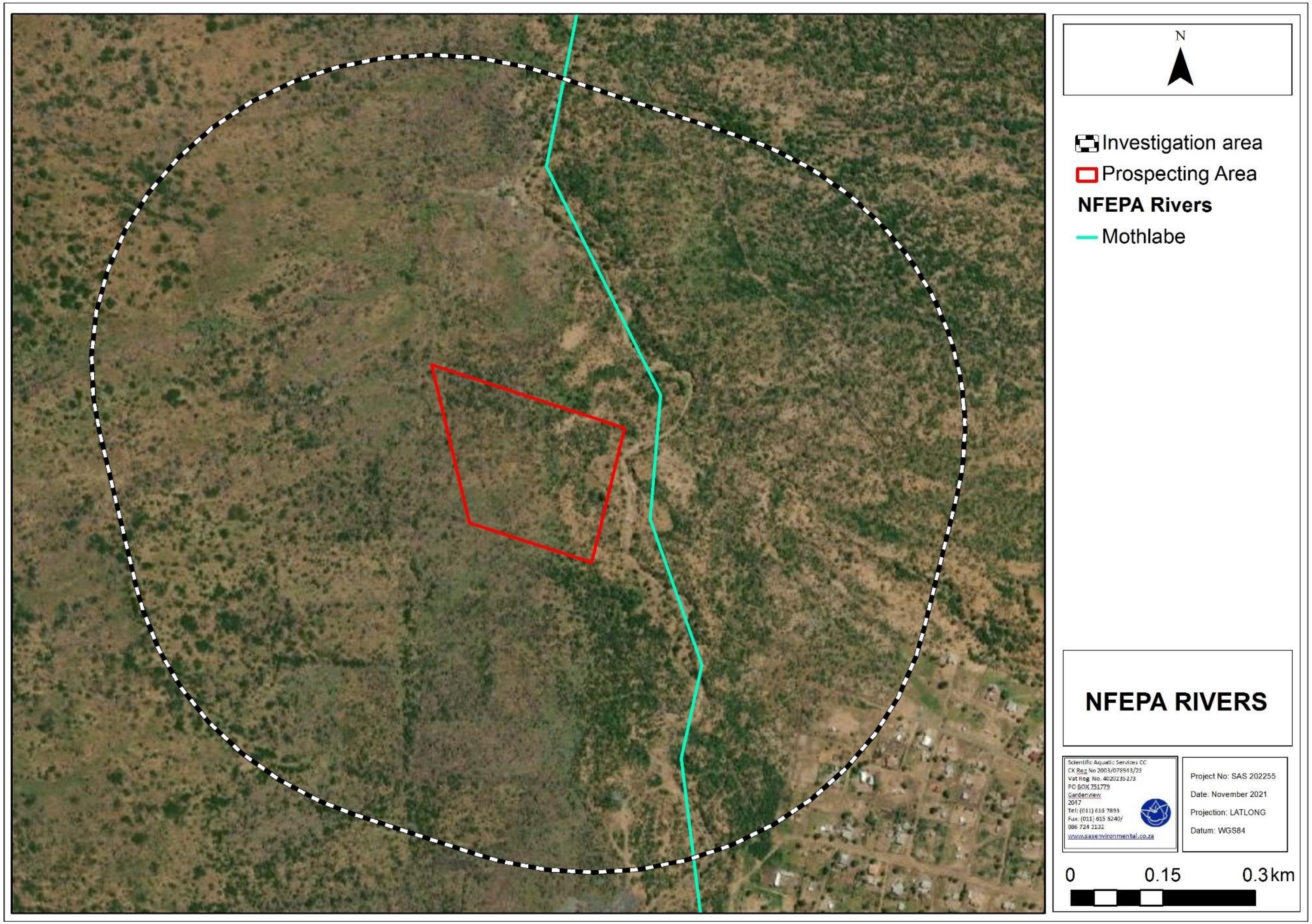


Figure 4: Rivers associated with the proposed prospecting and investigation area according to the NFEPA (2011) database.

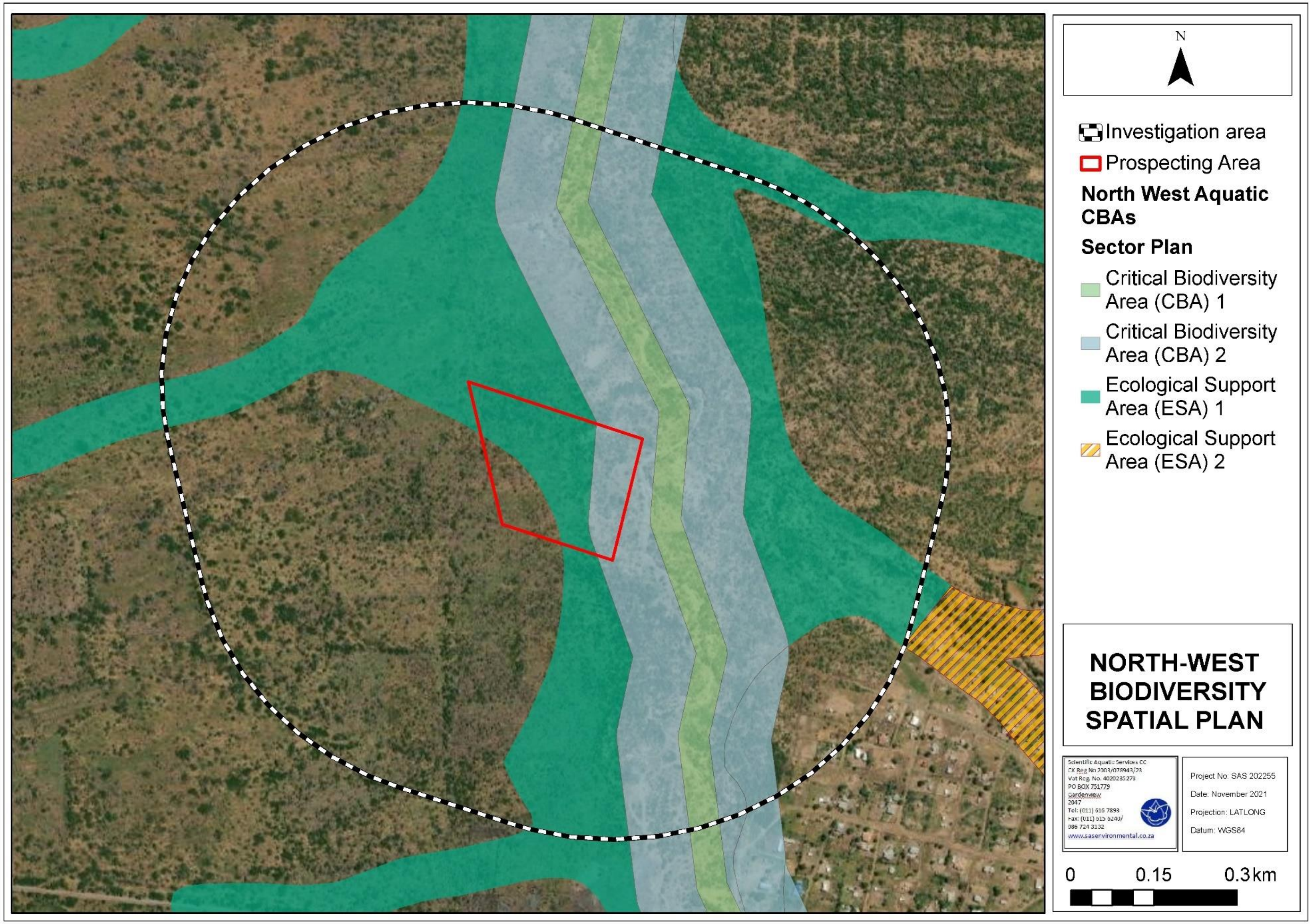


Figure 5: The Aquatic ESA's and Other Natural Areas associated with the proposed prospecting and investigation areas according to the North-West Biodiversity Spatial Plan (2015).

Figure 6: The Landcover category associated with the proposed prospecting and investigation areas according to the North-West Biodiversity Spatial Plan (2015).

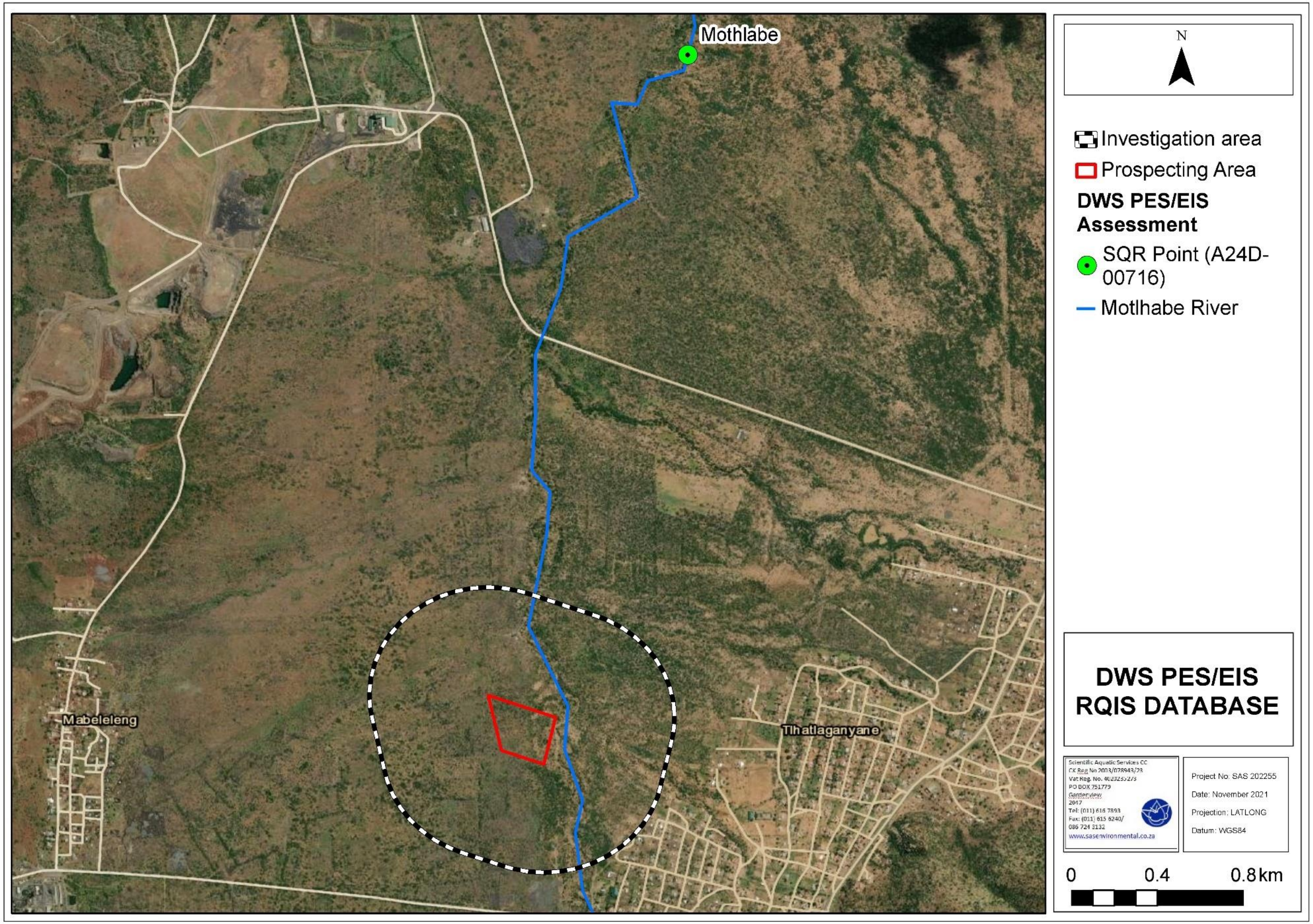


Figure 7: The SQR monitoring points associated with the Mothlabe River in relation to the proposed prospecting and investigation area.

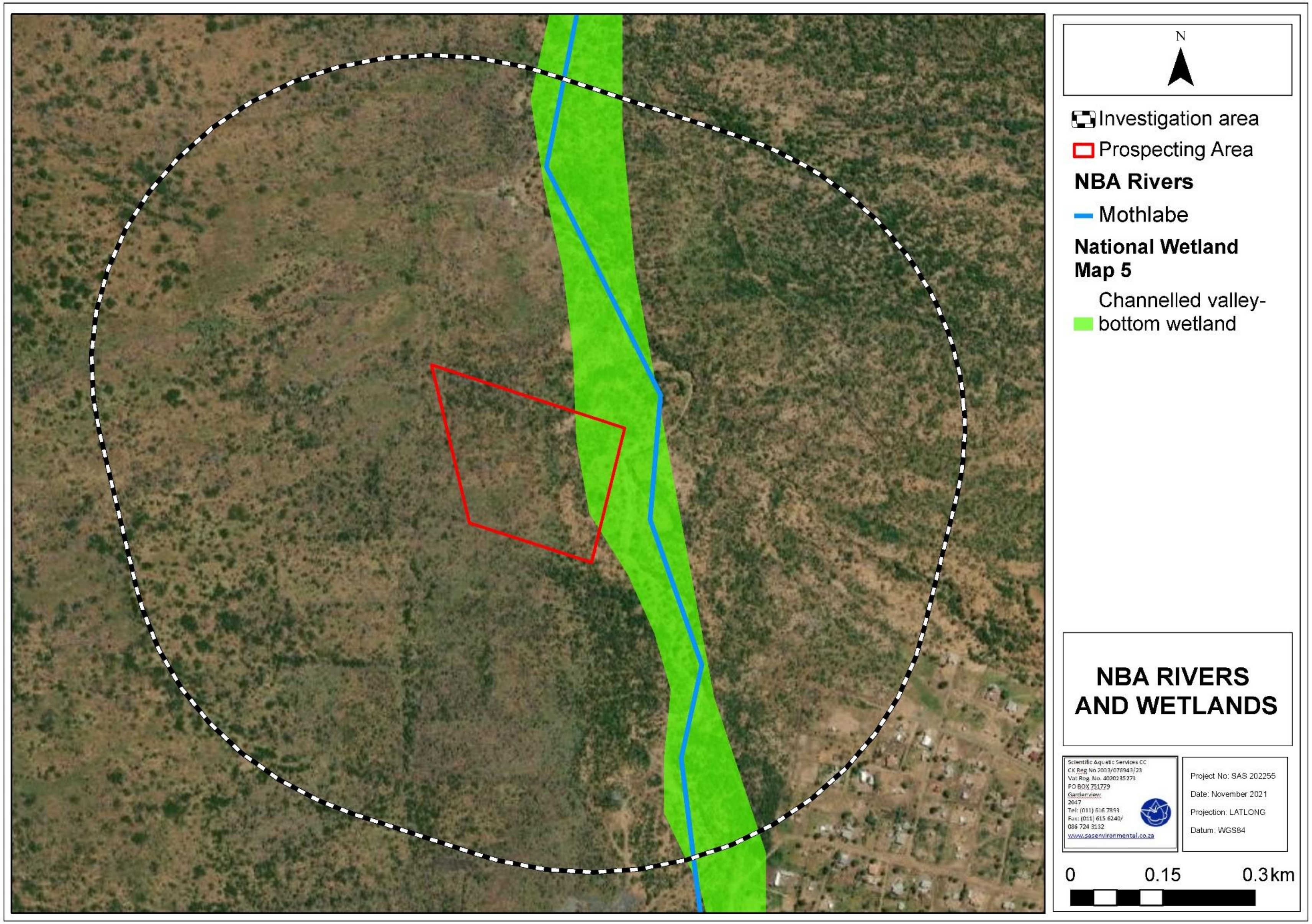


Figure 8: Rivers and wetlands associated with the proposed prospecting and investigation area according to the National Biodiversity Assessment (NBA) (2019).

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

Figure 9: The National web-based Environmental Screening Tool (2021) indicating the aquatic sensitivity applicable to the proposed development and associated investigation area.

3.2 Ecological Status of Sub-Quaternary Catchments [DWS Resource Quality Services (RQS) PES/EIS Database]

The reach of the Mothlabe River that flows 500 m east of the proposed prospecting area falls within the Bushveld Basin Aquatic Ecoregion and within the A24D-00716 sub-quaternary reach (SQR) of the Limpopo Catchment area. According to the PES/EIS database as developed by the DWS RQIS department, the following SQR A24D-00716 monitoring point for the Mothlabe River is applicable which is located approximately 3.2 km north of the proposed prospecting area. The following macro-invertebrate taxa has previously been reported from SQR A24D-00716 (Motlhabe River):

- According to the EI data for the SQR A24D-00716 (Mothlabe River), no fish species are potentially expected to occur at this monitoring site:
- The EI data for SQR A24D-00716 (Mothlabe River) indicates that no macro-invertebrate taxa are expected to occur at this site.

Table 2: Summary of the ecological status of the sub-quaternary catchment (SQ) reach associated with the freshwater ecosystems in proximity of the proposed prospecting area based on the DWS RQS PES/EIS database.

Ecological status	A24D-00716
PES Category Median	Largely Modified (Class D)
Mean EI class	Moderate
Mean ES class	Low
Length	32,90 km
Stream order	1
Default EC	Moderate (Class C)
Instream habitat continuity MOD	Moderate
RIP/wetland zone continuity MOD	Moderate
Potential instream habitat MOD activities	Large
Riparian/wetland zone MOD	Large
Potential flow MOD activities	Moderate
Potential physico-chemical MOD activities	Large
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Low
Habitat diversity class	High
Habitat size (length) class	Moderate
Instream migration link class	Moderate
Riparian-wetland zone migration link	High
Riparian-wetland zone habitat integrity class	Moderate
Instream habitat integrity class	Moderate
Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	Very High
Riparian-wetland natural vegetation rating based on expert rating	Low
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	Very Low
Stream size sensitivity to modified flow/water level changes description	High
Riparian-wetland vegetation intolerance to water level changes description	Low

EI = Ecological Importance; ES = Ecological Sensitivity; EC = Ecological Category; default based on median PES and highest of EI or ES means; MOD = Modification

4 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

4.1 Freshwater Ecosystem Characterisation

In preparation for the site assessment, aerial photographs, digital satellite imagery and provincial and national freshwater databases (as outlined in Section 2 of this report) were used to identify areas of interest at a desktop level. All possible measures were undertaken to ensure all freshwater ecosystems which may be affected by the proposed prospecting and associated investigation areas were identified, delineated and assessed based on the field limitations surrounding the project.

During the assessment, various freshwater ecosystems were identified within the investigation area of the proposed prospecting area, however, a single freshwater ecosystem traverses the eastern portions of the proposed prospecting area and is deemed to be at risk from the prospecting activities The freshwater ecosystem was classified as follows:

- The Mothlabe River.

The freshwater ecosystem was classified according to the Classification System (Ollis *et al*., 2013) as Inland Systems, falling within the Bushveld Basin Aquatic Ecoregion. The wetland vegetation group associated with the proposed prospecting area is the Central Bushveld Group 2, which is considered to be Least threatened according to Mbona *et al.* (2015). At Levels 3 (Landscape Unit) and 4 (HGM Type) of the Classification System (Ollis *et al*., 2013), the systems were classified as per the summary in Table 3, below.

Table 3: Characterisation of the freshwater ecosystems associated with the proposed prospecting area according to the Classification System (Ollis *et. al*., 2013).

Freshwater Ecosystem	Level 3: Landscape unit	Level 4: HGM Type
Mothlabe River	**Valley floor:** The base of a valley, situated between two distinct valley side-slopes.	**River**: A linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit.

An Unnamed tributary of the Mothlabe and various Ephemeral Drainage Lines (EDL's) were situated within the investigation area of the proposed prospecting area, however, these were not assessed quantitatively since these are located upgradient and will not be encroached by any proposed prospecting activities and thus, the prospecting activities pose no quantum of risk to these freshwater ecosystems. These freshwater ecosystems were, however, mapped using desktop methods and augmented with available field data and are conceptually depicted in the delineation map presented in Figure 11.

4.2 Freshwater Ecosystem Delineation

As noted in Section 2.1, the freshwater ecosystems associated with the proposed prospecting area were initially delineated using desktop methods (use of aerial photographs, digital satellite imagery and topographical maps), and refined in the field by ground-truthing representative “safe” points at the upgradient and downgradient reach of the river, due to inaccessibility and safety concerns which prevented field verification of the river reach that traverses the prospecting area. The delineations as presented in this report are thus, regarded as a best estimate of the freshwater ecosystem boundaries based on the field conditions present at the time of assessment.

The following indicators were used to delineate the boundaries of the outermost/ temporary zone boundaries associated with the identified freshwater ecosystems:

- Terrain units were used as the primary indicator, as the terrain of the prospecting area, particularly low-lying areas where water is likely to collect and/or move through the landscape;
- Vegetation was utilised as the secondary indicator, particularly along river reaches which possessed a distinct riparian zone. Vegetation along the Mothlabe River provided an indication of the presence and position of movement of increased volumes of water within the system;
- The presence of alluvial soil deposits (Figure 10) was a useful indicator in conjunction with topography and vegetation in delineating the boundary associated with the freshwater ecosystem.

Figure 10: Indication of alluvial deposition within the Mothlabe River as well as riparian vegetation along the reach of the river, downgradient of the proposed prospecting area.

4.3 Field Verification Results

Following the field visit, various assessments were undertaken to determine the PES, EIS, and ecological service provision of the Mothlabe River as well as to assign an appropriate REC, RMO and BAS for the river, the methodology used is described in Section 1.2 and Appendix C of this report. Figure 11 below, provides a visual representation of all freshwater ecosystems and Table 4 provides the findings for the assessed Mothlabe River.

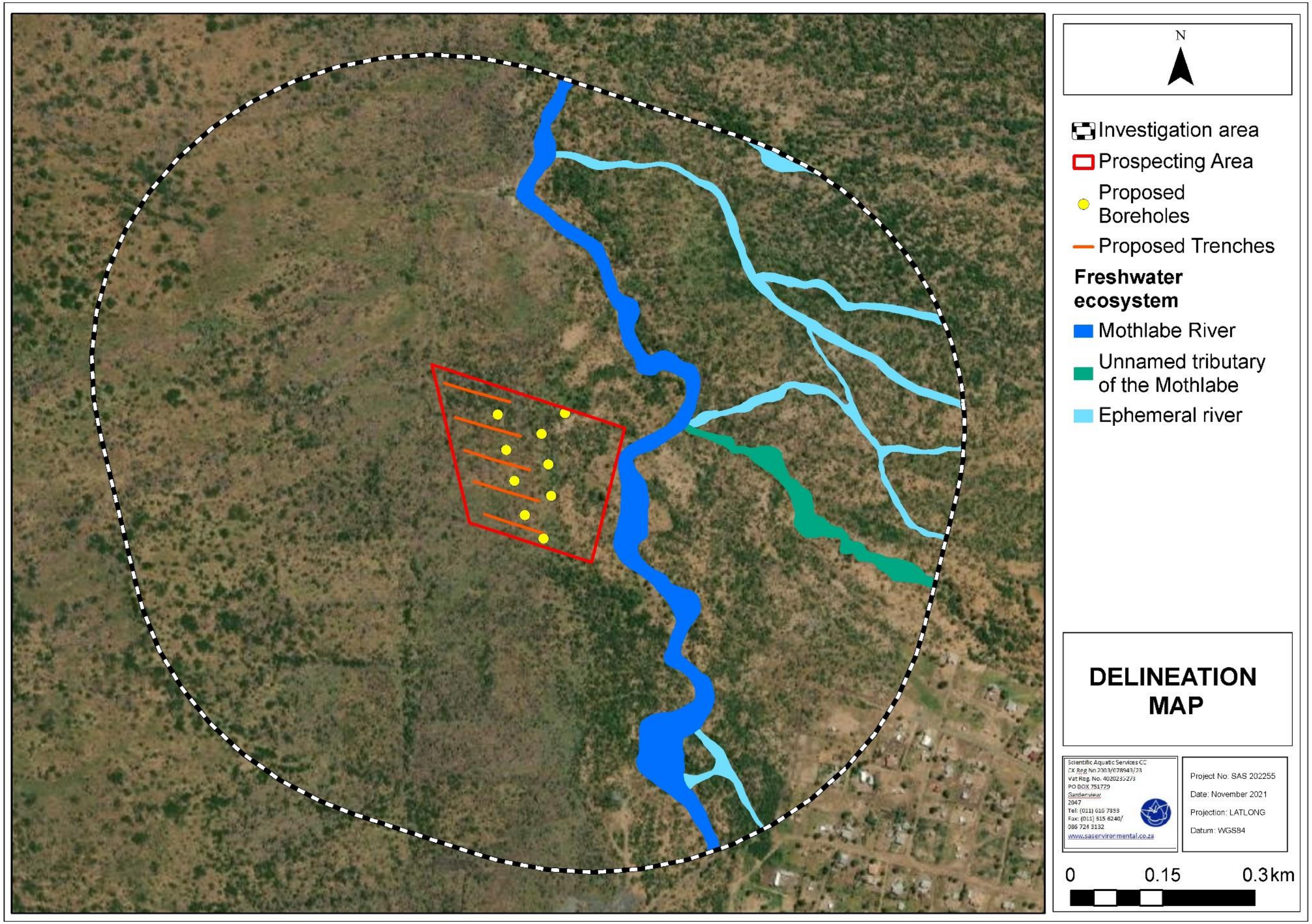
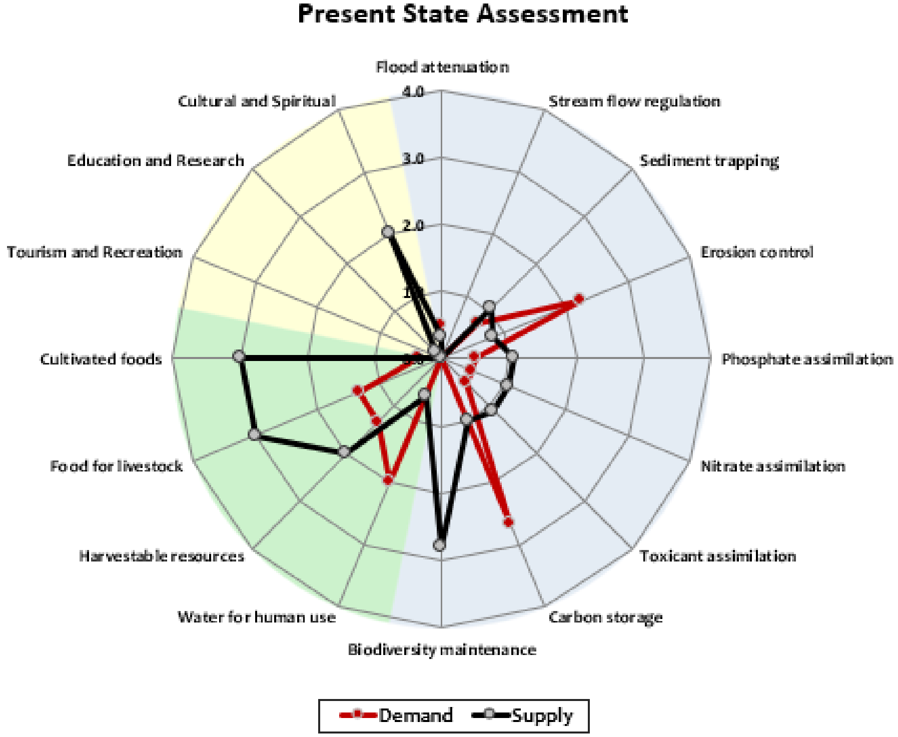


Figure 11: The location of the delineated freshwater ecosystems associated with the proposed prospecting and associated investigation area.

Table 4: Summary of the assessment of the representative reach of the Mothlabe River.

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:

</td>
<td colspan="2">
Figure 12: (Top left and right) representative photograph of the upgradient reach [4] of the Mothlabe River (inset: culvert that aims to maintain hydraulic connectivity underneath a gravel access road traversing the river); and (bottom left and right) downgradient reach [5] of the Mothlabe River indicating deposition and erosion (inset: waste and rubble collecting at a culvert further downgradient).</td></tr>
<tr><td>PES and VEGRAI discussion</td>
<td>Riparian IHI PES Category: C (Moderately modified)
VEGRAI Category: C
The Mothlabe River was assessed to be in a moderately modified ecological condition. The primary modifiers identified to be affecting the river include the alteration of the hydrological regime by means of roadways and culverts and increased catchment runoff (conveyed by means of the Unnamed tributary and EDL's) which have altered the natural flow regime of the river. The river is also subject to cattle grazing and incipient erosion which have resulted in channel bank collapse in numerous areas along the river. In addition, extensive litter and debris was observed within the instream channel, particularly at culvert outlets.</td>
<td>Ecoservice provision</td>
<td>Ecoservices importance category: Ranges from Very Low to Very High
The Mothlabe River provides a very low degree of importance of regulating and supporting services such as flood attenuation, sediment trapping, phosphate nitrate and toxicant assimilation. The degree of importance score for carbon storage and biodiversity maintenance, however, was low and very low respectively and whilst biodiversity maintenance was supplied to a high degree, the demand was very low. The importance score for provisioning services was very low for water for human use, low for harvestable resources and cultivated foods and moderate for food for livestock. Whilst both food for livestock and cultivated foods were supplied to a high degree, demand for these services was considered low.</td></tr>
</table>

[4]Representative reach assessed was upgradient of the reach that traverses the proposed prospecting area.
[5]Representative reach assessed was downgradient of the reach that traverses the proposed prospecting area.

<table>
<tr><td></td><td>Alterations of the naturally occurring vegetation community was also observed with invasive and encroacher species prevalent along the riparian zone of the Mothlabe River from the historical disturbances such as facilitation of roadways and erosion as well as the illegal mining activities occurring within the proposed prospecting area.</td><td></td><td>The importance score for cultural services was very low across all components namely tourism and recreation, education and research and cultural and spiritual significance and whilst supply for cultural and spiritual services was moderate, the demand was very low.</td></tr>
<tr><td>EIS discussion</td><td>EIS Category: (Moderate)
Despite the moderately modified ecological condition of the Mothlabe River, the system was assessed to be of “Moderate” EIS. The Moderate EIS was in part due to the hydro-functional importance of the river including sediment trapping and assimilation of phosphates, nitrates and toxicants as well as biodiversity maintenance supplied. Whilst socio-cultural services were potentially supplied by the river, the use was considered largely limited with the exception of food for livestock and cultivated foods which were noted to be used during the field assessment.</td><td>REC, RMO & BAS Category</td><td>REC: C/ BAS: C/ RMO: Maintain
The Recommended Management Objective (RMO) for the Mothlabe River based on the PES and EIS scores is to maintain the ecostatus of the river at a Recommended Ecological Category (REC) and Best Attainable State (BAS) of a Category C. Any planned activities and prospecting must first avoid the river before mitigation measures are implemented (in-line with the mitigation hierarchy) for any potential impacts to ensure that at a minimum the RMO is achieved.</td></tr>
<tr><td colspan="4">Freshwater ecosystem drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):</td></tr>
<tr><td colspan="4">Similar to other freshwater ecosystems within the region, the Mothlabe River is an ephemeral river that lacks flow for the majority of the year. Whilst this is noted, current modifiers of the rivers hydrological regime include the creation of roadways and associated culvert crossings which albeit aim to maintain the natural flow patterns within the river, have still altered the natural pattern, timing and flow of water within the Mothlabe River. It is also considered likely that surrounding residential settlements and catchment hardening have further contributed to alterations of the natural flood peaks and flow patterns within the landscape and by extension, the Mothlabe River. In addition, whilst not observed during the field assessment (safety and security concerns), it is the opinion of the ecologist that illegal mining activities would likely have also contributed to alteration of the hydrological regime within the affected reach of the river.

In-situ water quality parameters were not measured as the Mothlabe River was dry at the time of assessment in October 2021. It is likely however, that the water quality within the river (during periods of flow) would be impaired. This is due to the degree of illegal mining and cattle trampling as well as catchment wide runoff that enters the Mothlabe River and may result in deteriorated water quality.

During the field assessment it was observed that erosion and subsequent deposition is actively occurring within the Mothlabe River. Channel bank collapse as well as sedimentation and scouring was visibly observed and is likely to be increased during periods of flow and high rainfall. Cattle grazing and trampling in the area was also noted and thus, may also contribute negatively to collapse along the riverbanks. In addition, alteration of the hydrological regime has likely also altered the natural sediment fluxes within the river.

The habitat and biota associated with the Mothlabe River was considered likely to have been altered by the disturbance within and along the river. This includes the creation of residential settlements approximately 150 m south-east and upgradient of the river as well as frequent livestock grazing (goats and cows) and erosion which has likely cumulatively resulted in alteration of the vegetation structure and composition in disturbed portions of the river. Furthermore, the illegal mining within the active river channel is considered likely to have resulted in removal and transformation of the naturally occurring vegetation associated with the river. The riparian zone of the Mothhlabe River was relatively distinct and noted to be dominated by Searsia lancea and Ziziphus mucronata, however, some alien invasive plant (AIP) encroachment by Tagetes minuta, Bidens pilosa, and Xanthium strumarium has occurred and has altered the natural vegetation community. Noting these alterations, the river is still considered likely to provide breeding and feeding habitat for less sensitive species including small mammals, reptiles, amphibians, avifauna and insects. It is also considered likely that reliance on the use of this river may become elevated during periods of flow and high rainfall and thus, it is still considered to provide habitat for biota despite its non-perennial nature and lack of sufficient surface water flow. For a detailed overview of fauna and flora, please refer to the “Terrestrial Biodiversity Assessment of the prospecting site as part of the Environmental Authorisation process for the proposed prospecting activities on portion of the farm Ruighoek, North-West Province” (STS, 2021).</td></tr>
<tr><td>Extent of modification anticipated</td><td colspan="3">It is noted that the layout of prospecting activities has been optimised to ensure that no prospecting will occur within the Mothlabe River itself according to information as provided by the client (SLR Consulting, 2021) which will significantly limit impacts that occur on the river... Should prospecting activities occur outside of the Mothlabe river and and associated ZoR, any impacts are considered likely to be fully reversible.</td></tr>
<tr><td colspan="4">Impact Significance and Business Case:</td></tr>
<tr><td>Low</td><td colspan="3">The Mothlabe River traverses the proposed prospecting area and is considered to be at risk from the proposed prospecting activities. It is worth noting, however that according to the proposed layout plan, no prospecting activities will be undertaken within the delineated boundary of the river and associated 32 m NEMA ZoR and 100 m GN 509 and GN 704 ZoR, which significantly reduces the significance of risk. Whilst this is noted, the potential for indirect and edge-effects are still considered likely. Thus, the implementation of strict mitigation measures is advised to adequately mitigate against potential impacts that may occur. These include:
It is the recommendation of the freshwater ecologist that delineated boundary of the Mothlabe River as well as the 100 m GN 509 and 32 m NEMA ZOR must be clearly demarcated as "no go area’s" in which no prospecting activities are recommended to be undertaken which will significantly reduce the degree of potential impacts that may occur on the river;
Prospecting activities should take place during the dry winter season when the river is usually dry in order to limit potential impacts to the Mothlabe River as a result of prospecting activities.</td></tr>
</table>

5 LEGISLATIVE REQUIREMENTS, NATIONAL AND PROVINCIAL GUIDELINES PERTAINING TO THE APPLICATION OF ZONES OF REGULATION AND BUFFER ZONES.

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone. However, in summary, it is considered to be “a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another”. Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted, however, that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

The definition and motivation for a regulated zone of activity as well as buffer zones for the protection of the freshwater ecosystems can be summarised as follows:

Table 5: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998).	**Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No.36 of 1998)** In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21(c) and 21(i) is defined as: • the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the absence of a determined 1 in 100-year flood line or riparian area the area within **100 m from the edge of a watercourse** where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a 500 m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.

Regulatory authorisation required	Zone of applicability
	Government Notice 704 Regulations as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act 36 of 1998) regarding the use of water for mining and related activities aimed at the protection of water resources. These Regulations were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the proposed mining activities comply with Regulation GN 704 of the National Water Act, 1998 (Act No. 36 of 1998) which contains regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:* *(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year floodline or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;* According to the above, the activity footprint must fall outside of the 1:100 year flood line of the aquatic resource or 100m from the edge of the resource, whichever distance is the greatest.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended must be taken into consideration if any activities (for example, access roads) are to take place within the applicable zone of regulation. This must be determined by the EAP in consultation with the relevant authorities.	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA regulations, 2014 (as amended) states that: *The development of:* *(xii) Infrastructure or structures with a physical footprint of <u>100 square meters</u> or more;* *Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse.*

In terms of GN 509 of the National Water Act, 1998 (Act No. 36 of 1998), a 100 m zone of regulation is applicable to any riparian area, in the absence of a modelled 1:100-year flood line. In addition, for mining related projects, a 100 m zone of regulation in terms of GN704 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) is also applicable to the freshwater ecosystems associated with the proposed prospecting and associated investigation area. A 32 m zone of regulation in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) is also applicable to the freshwater ecosystems. Thus, the relevant authorisations will need to be obtained prior to commencement of any proposed prospecting activities should they occur within the regulated areas. The respective zones of regulation as stipulated above are depicted in Figure 13, below.

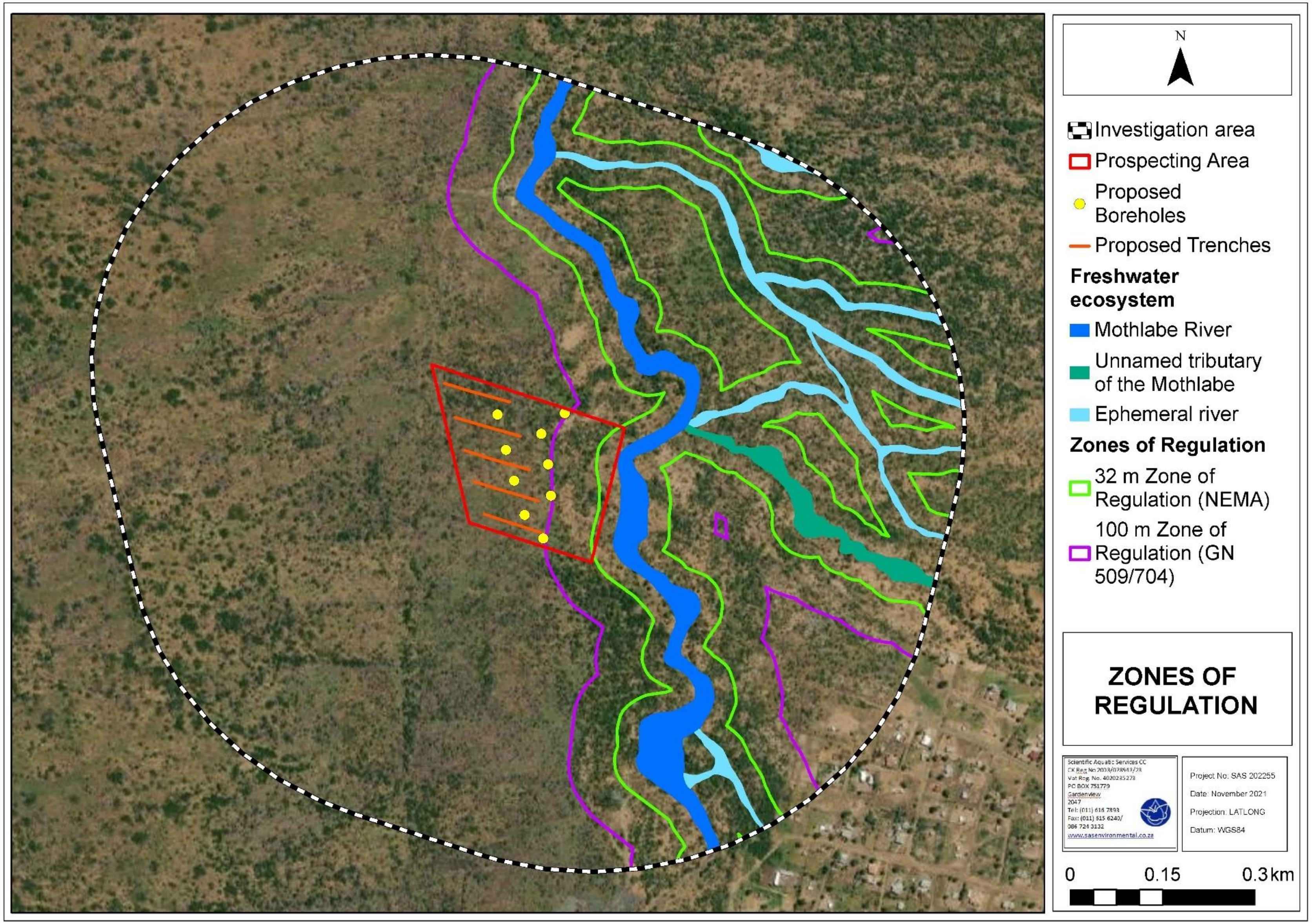


Figure 13: Conceptual presentation of the zones of regulation in terms of National Environmental Management Act, 1998 (Act No. 107 of 1998) and GN509 and GN 704 of the National Water Act, 1998 (Act No. 36 of 1998) in relation to the delineated freshwater ecosystems within the proposed prospecting and associated investigation area.

6 RISK ASSESSMENT

This section presents the significance of potential impacts on the Mothlabe River associated with the proposed prospecting area. When evaluating the perceived impacts of the proposed prospecting activities, the risk significance was ascertained based on the assumption that the recommended mitigation measures will be implemented to reduce the risk significance. Thus, the risk assessment provided in this report presents the perceived impact significance *post-mitigation*.

At the time of the compilation of this report, no specific construction method statement, was provided. As a result, the risk assessment was based purely on the indicative localities and layout of the five trenches and nine boreholes as provided by the client (SLR consulting, 2021). Should a more detailed layout become available pertaining to the field-specific construction methods, the Risk Assessment scoring may need to be reconsidered and adequately adjusted.

6.1 Risk Assessment Analysis

6.1.1 Consideration of impacts

The DWS approved Risk Assessment Matrix as promulgated in Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the assessed freshwater ecosystems:

The points below summarise the considerations undertaken as part of the Risk Assessment:

- As part of the proposed prospecting activities, nine boreholes and five trenches are planned to occur within the western extent of the proposed prospecting area, outside the boundaries of the Mothlabe River, Unnamed tributary and associated EDL's (Refer to Figure 13, above). As such, no prospecting is to occur directly within the Mothlabe River or any other freshwater ecosystems within the investigation of the proposed prospecting area. Therefore, the Unnamed tributary and EDL's were not assessed further as part of this Risk Assessment as there is no anticipated quantum of risk to these freshwater ecosystems.
- Proposed prospecting activities have been optimised to occur outside of the 100 m ZoR in terms of GN 509 of 2016 and GN 704 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), of the freshwater ecosystems. As such, all legal issues

pertaining to aspects and activities relating to the proposed prospecting activities were scored as a "1".

- Although the current ecological condition of the freshwater ecosystems is not directly factored in the determination/calculation of the risk significance, this was taken into consideration since the anticipated degree of impact is likely linked to the ecological integrity and overall ecological importance and sensitivity of the respective freshwater ecosystem.
- The risk assessment was applied assuming that a high level of mitigation is implemented, thus the results of the risk assessment provided in this report presents the perceived impact significance *post-mitigation.*
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the Department of Forestry, Fisheries and the Environment (DFFE) (formerly the Department of Environmental Affairs (DEA *et al.*, 2013)) would be followed; i.e. the impacts would be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required.
- Most impacts are considered to be easily detectable; however, impacts such as surface and groundwater contamination would entail specific monitoring (when practical) to ascertain the occurrence of impacts (specifically that relating to toxicity). It should further be noted that no mitigation regarding any waste-water was included in this Risk Assessment. As such, once final plans are available and should waste water be generated from the prospecting activities, a suitably qualified aquatic specialist/ groundwater specialist should be consulted to discuss treatment and release of waste-water.

There are four key ecological impacts on the Mothlabe River that are anticipated to occur:

- Loss of freshwater habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the freshwater ecosystems; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, these impacts can be adequately minimised or avoided provided the mitigation measures provided in this report are implemented and adhered to. A summary of the risk assessment is provided in the Table 6 below, followed by a discussion of the outcome thereof.

Table 6: Summary of the risk assessment applied to the reach of the Mothlabe River that traverses the proposed prospecting area.

No.	Phases	Activity	Aspect	Impact	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of impact
1	Construction Phase	Site clearing prior to commencement of prospecting activities and the set-up of contractor camps.	• Removal of vegetation adjacent to the Mothlabe River; leading to exposure and associated disturbance to soil; • Increased likelihood of dust generation into the Mothlabe River due to exposed soil; • Removal of topsoil and creation of topsoil stockpiles adjacent to the Mothlabe River; • Potential creation of gravel access roads to facilitate laydown of contractor camps, ablution facilities and subsequent construction activities; and • Movement of construction	• Potential for increased runoff as result of reduced vegetation cover and soil from cleared area's and thus potential for increased sedimentation of the Mothlabe River; • Potential smothering of the vegetation within the Mothlabe River as a result of increased sediment leading to altered freshwater habitat; • Disturbance of soil leading to potential increased AIP's along the footprint of the proposed prospecting area, adjacent to the Mothlabe River; and • Anthropogenic and noise-pollution to biota that utilise the Mothlabe River.	4.25	9	38.25	L	• It is the recommendation of the freshwater ecologist that delineated boundary of the Mothlabe River as well as the 100 m GN 509 and GN 704 and 32 m NEMA ZOR must be clearly demarcated as "no go area's" in which no prospecting activities are recommended to be undertaken which will significantly reduce the degree of potential impacts that may occur on the river; • Ensure contractor laydown areas are placed outside of the Mothlabe River and associated 100 m GN 509 ZoR and a designated contractor laydown area should be approved by the Environmental Control Officer (ECO) prior to use; • Existing access roads must be utilised as far as possible to facilitate the proposed prospecting activities with construction vehicles being restricted to designated roads and existing gravel access roads in order to avoid crossing the Mothlabe River; • Limit clearing of vegetation and associated soil disturbances to essential areas only (footprint of the 9 boreholes and 5 trenches); • Protect exposed soil by means of a geotextile such as hessian sheeting; and • Any temporary stockpiling of soil and overburden material is to be placed outside of the delineated boundary of the Mothlabe River and associated 32 m ZoR and should be covered with a suitable geotextile such as hessian sheeting.	Fully reversible

No.	Phases	Activity	Aspect	Impact	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of impact
			vehicles, equipment and personnel adjacent of the Mothlabe River.							
2		Groundbreaking, excavation and creation of boreholes and trenches outside of the 100 m GN 509 and GN 704 ZOR of the Mothlabe River.	• Trenching and pitting in the proposed prospecting area to expose potential ore bodies and to determine the extent of the occurrence; • Borehole drilling which will be undertaken in conjunction with trenching as part of the prospecting and exploration program; • The movement of construction machinery, personnel and equipment to facilitate prospecting activities adjacent to the Mothlabe River.	• Disturbances of soil leading to increased AIP proliferation within the catchment of the Mothlabe River; • Altered runoff patterns within the landscape, potentially resulting in increased erosion and sedimentation of the Mothlabe River; • Potential sediment laden runoff resulting in impacts on water quality and contamination of soil within the Mothlabe River; • Potential spills and leaks from construction machinery and equipment and associated runoff into the Mothlabe River.	3	9	27	L	• It is recommended that prospecting activities take place during the dry winter season when the river is usually dry in order to limit potential impacts to the Mothlabe River as a result of prospecting activities; • It is essential that the sensitivity map (delineated boundary of the Mothlabe River and the associated 100 m GN 509 and 32 m NEMA ZoR) be considered during the selection of the localities that will be utilised for prospecting activities, which will aid in the conservation of the Mothlabe River and other freshwater ecosystems located within the prospecting and associated investigation area; • All prospecting activity should be excluded from all freshwater ecosystems located within the proposed prospecting and associated investigation area; • Strictly ensure that excavated trenches are filled to the original state and rehabilitated completely before proceeding to the next trench; • Where possible, prospecting should be limited to non-invasive prospecting methods with invasive prospecting methods conducted only after a comprehensive physical survey including geological mapping has been undertaken to identify target areas; • The duration of impacts should be minimised as far as possible by minimising the time in which these prospecting activities (adjacent to the Mothlabe River and setback buffer) are undertaken. Therefore, the period for undertaking the proposed prospecting activities should be kept as short as possible;	Fully reversible

No.	Phases	Activity	Aspect	Impact	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of impact
									• Existing access and gravel roads should be utilised wherever possible to provide access to the prospecting area, and no new roads should be created within the freshwater ecosystems, with specific mention of the Mothlabe River, in order to minimise loss of riparian habitat; • In the event of significant mining resources being identified during the prospecting activities, it is noted that no mining will be allowed within the Mothlabe River, Unnamed tributary of the Mothlabe River and Ephemeral drainage lines (located within the investigation area) and 32 m NEMA and 100 m GN 509 and GN 704 ZoR, unless further authorisations are obtained • Protect exposed soil and soil stockpiles from wind and limit the time in which soil is exposed, by covering with a suitable geotextile such as hessian sheeting; • Any remaining soil following the completion of prospecting activities is to be recompacted to a depth of 450 mm, and all construction material must be removed from site upon the completion of prospecting; • All waste is to be removed from the proposed prospecting area and disposed at a registered waste disposal facility; • Vehicles should be regularly inspected for leaks and be refueled on sealed surfaces to prevent ingress into soil. When not in use, all vehicles must be parked on a non-permeable surface outside the setback buffer of the Mothlabe River, on a suitable platform area or have drip trays under to prevent any leakage and or leaching into the freshwater ecosystems; • Any construction vehicles and equipment are to be serviced at the contractor laydown area, outside the boundary of the Mothlabe River and associated 100 m GN 509 and GN 704 ZoR as well as that of the Unnamed	

No.	Phases	Activity	Aspect	Impact	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of impact
									tributary and EDL's situated within the investigation area; • Minimise footprints prior to commencement of prospecting activities and control all edge effects such as proliferation of alien invasive plants (AIP's), disturbances of soil, dumping of prospecting waste and overburden material to avoid impacts and contamination of the Mothlabe River; • Prospecting vehicles must remain on demarcated roads and existing gravel access roads and should avoid traversing the freshwater ecosystems and associated setback buffers; and • Any topsoil stockpiles must not be placed directly adjacent to the Mothlabe River and setback buffer in order to avoid sedimentation and erosion that may occur.	
3	Rehabilitation phase	Site decommissioning, rehabilitation of prospected areas and removal of AIP's within the proposed prospecting area, adjacent to the Mothlabe River, once prospecting has been undertaken.	• Movement of vehicles, machinery, equipment and personnel adjacent to the Mothlabe River to facilitate rehabilitation; • Reprofiling of prospected and disturbed areas within the proposed prospecting area; and • Removal of AIP's within all	• Potential sedimentation of the Mothlabe River as a result of reprofiling of prospected areas and removal of AIP's; • Potential erosion and incision of the Mothlabe River from altered flow patterns within the landscape; • Potential for smothering of vegetation and deteriorated water	3.25	5	16	L	• The contractor laydown area should be rehabilitated with indigenous species when construction is completed. Monitoring of these rehabilitated areas should take place for a year after the proposed prospecting has been completed in order to ensure adequate vegetation growth; • All soil compacted as a result of prospecting activities should be ripped and reprofiled to natural levels and revegetated with indigenous vegetation. Special attention should be paid to alien and invasive plant control within these areas; • All areas affected by prospecting activities should be rehabilitated upon closure of the trenches and boreholes. All boreholes should be sealed. Areas should be reseeded with indigenous grasses as required; • Vegetation growth should be promoted as much as possible within the proposed prospecting areas following	Fully reversible

No.	Phases	Activity	Aspect	Impact	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of impact
			prospecting areas, especially those located adjacent to the Mothlabe River.	quality from sediment laden runoff associated with reprofiling and AIP removal.					prospecting activities in order to protect and bind the disturbed soil; • Strategies to minimise the spread of alien vegetation must be put in place; and • All rehabilitated areas should be rehabilitated to a point where natural processes will allow the pre-prospecting ecological functioning and biodiversity of the area to be re-instated to an acceptably functional state.	

According to the risk assessment above, the activities associated with the proposed prospecting activities will pose a “Low” risk to the Mothlabe River provided that the prospecting activities avoid the delineated boundary of the river as well as the associated 100 m GN 509 and GN 704 ZoR and the 32 m NEMA ZoR. Should the proposed prospecting activities be undertaken within the applicable ZoR’s in terms of the 32 m Zone of regulation as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the 100 Zone of Regulation in terms of GN 509 and GN 704 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), the relevant authorisations will require to be applied for and obtained prior to the commencement of the proposed prospecting activities.

6.2 Cumulative Impacts

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified in Section 6.1.1 above. Freshwater ecosystems within the region are under continued threat due to growing mining intensification and increased demand for human settlements which further increases grazing pressures in the surrounding landscape. This in addition, places a strain on available water sources required for domestic use, cattle and to support growing mining in the area.

Direct and indirect impacts identified within freshwater ecosystems bordering current or historical mining activities include an alteration of the natural hydrological regime, deterioration of water quality and increase in AIP’s entering the system due to regular disturbance of soil and removal of indigenous vegetation. Mining activities in the area have also resulted in the reduction of functional freshwater habitat and continued mining activities will contribute to the degradation of water quality, and loss of indigenous vegetation, especially if potential impacts are not managed in line with the mitigation hierarchy. Based on the proposed plans and provided the prospecting activities remain outside the delineated Mothlabe River and its associated 32 m NEMA and100 m GN 509 and GN 704 ZoR, the proposed prospecting activities will not contribute significantly to cumulative impacts on the freshwater ecosystems.

7 CONCLUSION

A freshwater ecological assessment was conducted as part of the Environmental Authorisation process for the proposed Ruighoek prospecting project to be conducted by Pilanesberg Platinum Mine (PPM) on a 4.7-hectare (ha) section of land on Ruighoek farm, portion 5 near Rustenburg North-West Province. The proposed prospecting activities include the drilling of nine boreholes and the construction of five trenches to explore platinum reserves in the UG2 subcrop of the Merensky Reef that runs along the western side of the proposed prospecting area.

One freshwater ecosystem, namely the Mothlabe River was identified to be associated with the proposed prospecting area. The results of the freshwater ecosystem assessment are summarised in the table below:

Table 7: Summary of results of the field assessment as discussed in Section 4.

Freshwater ecosystem	PES	Ecoservices importance	EIS	REC / RMO / BAS
Mothlabe River	Category C (Moderately modified)	Ranged from Very Low to Very High	Moderate	C/ Maintain/ C

Following the freshwater ecosystem assessment, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2016) was applied to determine the significance of impacts of the proposed prospecting activities on the reach of the Mothlabe River that traverses the prospecting area. It is worth noting that a finalised construction method statement was not available at the time of the compilation of this report and thus, the DWS Risk Assessment Matrix (2016) was applied based on the conceptual layout plan (five trenches and nine borehole localities) as provided by the client (SLR Consulting, 2021) which was optimised to ensure that no prospecting activities will be undertaken within the delineated boundaries of the freshwater ecosystems, with specific mention of the Mothlabe River and its associated 100 m GN 509 and GN 704 Zone of Regulation (ZoR) and 32 m NEMA ZoR. Based on the findings of the Risk Assessment, the proposed prospecting activities will pose a “Low” risk to the Mothlabe River, provided that the mitigation measures as outlined in this report are strictly adhered to.

Provided that the delineated boundaries of the freshwater ecosystems and associated ZoR’s (100 m GN 509 and GN 704 ZoR as well as 32 m NEMA ZoR) will be avoided, from a freshwater ecosystem management perspective, the proposed prospecting activities can be considered feasible. It should be noted that in the event of significant mining resources being identified during the prospecting activities, it is noted that no mining will be allowed within the

Mothlabe River, Unnamed tributary of the Mothlabe River and Ephemeral drainage lines (located within the investigation area) and 32 m NEMA and 100 m GN 509 and GN 704 ZoR, unless further authorisations are obtained.

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APPENDIX A – Terms of Use and Indemnity

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B – Legislation

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act (NEMA) (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Water Act (NWA) (Act No. 36 of 1998)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	**Ecosystems that are threatened or in need of protection** (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. *(b)* An MEC for environmental affairs in a province may, by notice in *the Gazette,* publish a provincial list of ecosystems in the province that are threatened and in need of protection. (2) The following categories of ecosystems may be listed in terms of subsection (1): *(a)* critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation; *(b)* endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; (c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and *(d)* protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs *(a), (b)* or (c).
Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette 40166 of 2016, as it relates to the National	NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004)	Alien species are defined, in terms of the NEMBA as: (a) A species that is not an indigenous species; or (b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2017): ➢ **Category 1a:** Invasive species that require compulsory control; ➢ **Category 1b:** Invasive species that require control by means of an invasive species management programme; ➢ **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and ➢ **Category 3:** Ornamentally used plants that may no longer be planted.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: a) The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; b) In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or c) A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and stormwater management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.
National Environmental Management: Waste Act, No 59 of 2008 (NEMWA)	NEMWA, which reforms the law regulating waste management, in order to protect the health and the environment by providing reasonable measures for the prevention of pollution; provides for national norms and standards for regulating the management of waste by all spheres of government and provides for the licensing and control of waste management activities.

APPENDIX C – Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the watercourses present or in close proximity of the prospecting area are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present in the vicinity of or within the prospecting area.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The watercourses encountered within the prospecting area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.

Table C1: Proposed classification structure for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Unit for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the Classification System, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean[6] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

[6] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) group's vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the National Freshwater Ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the Classification System, for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table C2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et al*., 2009).

3. WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever-changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation
Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment
A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment
Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems above.

Quantification of Present State of a wetland
The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial *extent* of the impact of individual activities and then separately assessing the *intensity* of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall *magnitude* of impact. The impact scores, and Present State categories are provided in the table below.

Table C3: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D

Impact category	Description	Impact score range	Present State category
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change
As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (table below).

Table C4: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland
Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

4. Watercourse Function Assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[7] The assessment of the ecosystem services supplied by the identified watercourses was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;

[7] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the watercourses. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the watercourses.

Table C5: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

5. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purposed of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C6) of the wetland system being assessed.

Table C6: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

6. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C7: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unnacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A watercourse may receive the same class for the REC as the PES if the watercourse is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the watercourse.

Table C8: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

7. General Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table C8 below.

Table C9: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans *et al.* 2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 - 19

8. The Riparian Vegetation Response Assessment Index (VEGRAI)

VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results (Kleynhans *et al.*, 2007a). Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Riparian vegetation is described in the National Water Act (NWA; Act 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soil, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Table C10: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

9. Freshwater ecosystem delineation

The freshwater ecosystem delineation took place according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” published by DWAF in 2008. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

According to the DWA (2005) like wetlands, riparian areas have their own unique set of indicators. It is possible to delineate riparian areas by checking for the presence of these indicators. Some areas may display both wetland and riparian indicators and can accordingly be classified as both. If you are adjacent to a watercourse, it is important to check for the presence of the riparian indicators described below, in addition to checking for wetland indicators, to detect riparian areas that do not qualify as wetlands. The delineation process requires that the following be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005).

APPENDIX D – Risk Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[8]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as freshwater features, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[9].

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[8] The definition has been aligned with that used in the ISO 14001 Standard.

[9] Some risks/impacts that have low significance will however still require mitigation

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

"RISK ASSESSMENT KEY" (Based on DWS 2015 publication: Section 21 c and i water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table D3: Duration (How long does the aspect impact on the resource quality)

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

Table D4: Frequency of the activity (How often do you do the specific activity)

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table D6: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table D8: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA

Table D9: Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.

vii) Risks/Impacts were assessed for construction phase and operational phase; and
  - Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[10] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
  - Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Table D10: Reversibility of impacts on the freshwater ecosystems.

Reversibility Rating:	**Irreversible** (the activity will lead to an impact that is permanent)
	Partially reversible (The impact is reversible to a degree e.g. acceptable revegetation measures can be implemented but the pre-impact species composition and/or diversity may never be attained. Impacts may be partially reversible within a short (during construction), medium (during operation) or long term (following decommissioning) timeframe
	Fully reversible (The impact is fully reversible, within a short, medium or long-term timeframe)

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecosystems affected by the proposed prospecting activities.

[10] Mitigation measures should address both positive and negative impacts

APPENDIX E – Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES) AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the Ecoservices assessment applied to the Mothlabe River

CONDENSED SUMMARY SHEET									
		Present State				Future State			
	ECOSYSTEM SERVICE	Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.3	0.5	0.0	Very Low	0.3	0.5	0.0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!	-	-	#VALUE!	#VALUE!
	Sediment trapping	1.0	0.8	0.0	Very Low	1.0	0.8	0.0	Very Low
	Erosion control	0.8	2.3	0.4	Very Low	0.8	2.3	0.4	Very Low
	Phosphate assimilation	1.1	0.5	0.0	Very Low	1.1	0.5	0.0	Very Low
	Nitrate assimilation	1.1	0.5	0.0	Very Low	1.1	0.5	0.0	Very Low
	Toxicant assimilation	1.1	0.5	0.0	Very Low	1.1	0.5	0.0	Very Low
	Carbon storage	1.0	2.7	0.8	Low	1.3	2.7	1.1	Low
	Biodiversity maintenance	2.8	0.0	1.3	Moderately Low	2.8	0.0	1.3	Moderately Low
PROVISIONING SERVICES	Water for human use	0.6	2.0	0.1	Very Low	0.6	2.0	0.1	Very Low
	Harvestable resources	2.0	1.3	1.2	Low	2.0	1.3	1.2	Low
	Food for livestock	3.0	1.3	2.2	Moderate	3.0	1.3	2.2	Moderate
	Cultivated foods	3.0	0.3	1.7	Moderately Low	2.5	0.3	1.2	Low
CULTURAL SERVICES	Tourism and Recreation	0.0	0.0	0.0	Very Low	0.0	0.0	0.0	Very Low
	Education and Research	0.1	0.0	0.0	Very Low	0.1	0.0	0.0	Very Low
	Cultural and Spiritual	2.0	0.0	0.5	Very Low	2.0	0.0	0.5	Very Low

Table E2: Presentation of the results the EIS for the Mothlabe River

Mothlabe River		
Ecological Importance and Sensitivity	Score (0-4)	Confidence (1-5)
Biodiversity support	A (average)	(average)
	0.33	3.33
Presence of Red Data species	0	3
Populations of unique species	0	4
Migration/breeding/feeding sites	1	3
Landscape scale	B (average)	(average)
	1.00	3
Protection status of the wetland	1	3
Protection status of the vegetation type	1	3
Regional context of the ecological integrity	1	3
Size and rarity of the wetland type/s present	1	3
Diversity of habitat types	1	3
Sensitivity of the wetland	C (average)	(average)
	1.33	3
Sensitivity to changes in floods	1	3
Sensitivity to changes in low flows/dry season	2	3
Sensitivity to changes in water quality	1	3
Hydro-Functional Importance	Score (0-4)	
Regulating – **Flood attenuation**	2	4

Mothlabe River				
Ecological Importance and Sensitivity			Score (0-4)	Confidence (1-5)
	Streamflow regulation		0	4
	Water Quality Enhancement	***Sediment trapping***	0	4
		Phosphate assimilation	1	4
		Nitrate assimilation	1	4
		Toxicant assimilation	1	4
		Erosion control	1	4
	Carbon storage		1	4
Direct Human Benefits			Score (0-4)	Confidence (1-5)
Subsistence benefits	***Water for human use***		1	4
	Harvestable resources		2	4
	Cultivated foods		3	4
Cultural benefits	***Cultural heritage***		2	4
	Tourism and recreation		0	4
	Education and research		0	4

Table E3: Presentation of the results of the IHI applied to the Mothlabe River.

	MRU
RIPARIAN IHI	
Base Flows	0.0
Zero Flows	1.5
Moderate Floods	1.5
Large Floods	1.5
HYDROLOGY RATING	**1.1**
Substrate Exposure (marginal)	2.0
Substrate Exposure (non-marginal)	1.5
Invasive Alien Vegetation (marginal)	0.5
Invasive Alien Vegetation (non-marginal)	1.0
Erosion (marginal)	2.0
Erosion (non-marginal)	1.5
Physico-Chemical (marginal)	1.0
Physico-Chemical (non-marginal)	1.0
Marginal	2.0
Non-marginal	2.0
BANK STRUCTURE RATING	**2.0**
Longitudinal Connectivity	2.5
Lateral Connectivity	2.5
CONNECTIVITY RATING	**2.5**
RIPARIAN IHI %	**63.9**
RIPARIAN IHI EC	**C**
RIPARIAN CONFIDENCE	**2.0**

APPENDIX F – Risk Assessment Outcome

Table F1: Summary of the scorings of the DWS risk assessment matrix (2016) applied to the reach of the Mothlabe River that traverses the proposed prospecting area.

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Reversibility of Impact
1	Construction Phase	Site clearing prior to commencement of prospecting activities and the set-up of contractor camps.	• Removal of vegetation adjacent to the Mothlabe River; leading to exposure and associated disturbance to soil; • Increased likelihood of dust generation into the Mothlabe River due to exposed soil; • Removal of topsoil and creation of topsoil stockpiles adjacent to the Mothlabe River; • Potential creation of gravel access roads to facilitate laydown of contractor camps, ablution facilities and subsequent construction activities; • Movement of construction vehicles, equipment and personnel adjacent of the Mothlabe River.	• Potential for increased runoff as result of reduced vegetation cover and soil from cleared area's and thus potential for increased sedimentation of the Mothlabe River; • Potential smothering of the vegetation within the Mothlabe River as a result of increased sediment leading to altered freshwater habitat; • Disturbance of soil leading to potential increased AIP's along the footprint of the proposed prospecting area, adjacent to the Mothlabe River; • Anthropogenic and noise-pollution to biota that utilise the Mothlabe River.	1	1	2	1	1.3	1	2	4.25	5	2	1	1	9	38	L	70	Fully Reversible

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Reversibility of Impact
2		Groundbreaking, excavation and creation of boreholes and trenches outside of the 100 m GN 509 and GN 704 ZOR of the Mothlabe River.	• Trenching and pitting in the proposed prospecting area to expose potential ore bodies and to determine the extent of the occurrences; • Borehole drilling which will be undertaken in conjunction with trenching as part of the prospecting and exploration program; • The movement of construction machinery, personnel and equipment to facilitate prospecting activities adjacent to the Mothlabe River; • Proliferation of AIP's surrounding prospecting activities undertaken adjacent to the Mothlabe River.	• Disturbances of soil leading to increased AIP proliferation within the catchment of the Mothlabe River; • Altered runoff patterns within the landscape, potentially resulting in increased erosion and sedimentation of the Mothlabe River; • Potential sediment laden runoff resulting in impacts on water quality and contamination of soil within the Mothlabe River; • Potential spills and leaks from construction machinery and equipment and associated runoff into the Mothlabe River.	1	1	1	1	1	1	1	3	5	2	1	1	9	27	L	70	Fully Reversible

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Reversibility of Impact
3	Rehabilitation phase	Site decommissioning, rehabilitation of prospected areas and removal of AIP's within the proposed prospecting area, adjacent to the Mothlabe River once prospecting has been undertaken.	• Movement of construction vehicles, machinery, equipment and personnel adjacent to the Mothlabe River to facilitate rehabilitation; • Reprofiling of prospected and disturbed areas within the proposed prospecting area; • Removal of AIP's within the prospecting area, adjacent to the Mothlabe River.	• Potential sedimentation of the Mothlabe River as a result of reprofiling of prospected areas and removal of AIP's; • Potential erosion and incision of the Mothlabe River from altered flow patterns within the landscape; • Potential for smothering of vegetation and deteriorated water quality from sediment laden runoff associated with reprofiling and AIP removal.	1	1	2	1	1.3	1	1	3.25	1	2	1	1	5	16	L	70	Fully reversible

APPENDIX G – Impact Analysis and Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecosystem ecology and biodiversity, will include any activities which take place in close proximity to the proposed servitude that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater ecosystem identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should only encroach into the freshwater ecosystem considered absolutely essential;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes should avoid freshwater ecosystem areas and be restricted to existing roads along the tarred access road which traverses the freshwater ecosystem;
- Appropriate sanitary facilities must be provided for the life of the repair and maintenance phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the re-collection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Proliferation of alien and invasive species is expected within any disturbed areas. Whilst not considered severe at this time, the vegetation component within the freshwater ecosystem environment is already transformed. However, alien invasive species are opportunistic, and where disturbances do occur, they will promulgate; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered within the freshwater ecosystem must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998); and
- Species specific and area specific eradication recommendations:
    - Footprint areas should be kept as small as possible when removing alien plant species; and
    - No vehicles should be allowed to drive through designated sensitive freshwater ecosystems areas during the eradication of alien and weed species.

Soils

- Sheet runoff from compacted areas should be slowed down by the strategic placement of berms;
- It is considered ideal that activities occur within the dry season (low rainfall) to minimise impacts of sedimentation;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils;
- Temporary stockpiling of excavated material from trenches can be retained alongside trenches, as required for backfilling. Any soil to be stockpiled for longer than a month should be moved to a designated stockpile area which should be located outside the 32 m ZoR, as approved by the Environmental Control Officer (ECO);
- All soils compacted during the repair and maintenance phase should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area as well as immediate vicinity of the proposed work area should be removed.

APPENDIX H – Specialist information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden	MSc (Environmental Management) (University of Johannesburg)
Kim Marais	Bsc Hons (Zoology) (University of the Witwatersrand)
Sashin Pillay	Bsc Honours (Biological Science) (University of KwaZulu-Natal)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Physical address:	29 Arterial Road West, Oriel		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	Stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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

----

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation

4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use License Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

Position in Company	Senior Scientist
	Water Resource Manager
Joined SAS Environmental Group of Companies	2015

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)

Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand)	2012
BSc (Zoology and Conservation) (University of the Witwatersrand)	2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment)	2019
Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, KwaZulu-Natal, Northern Cape, Eastern Cape,

Africa - Uganda

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plan

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF SASHIN PILLAY

PERSONAL DETAILS

Position in Company	Junior Ecologist
Joined SAS Environmental Group of Companies	2019

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the Gauteng Wetlands Forum
Member of the South African Wetland Society (SAWS)

EDUCATION

Qualifications

BSc (Hons) Biological Sciences (Aquatic Ecology) (University of KwaZulu-Natal)	2017
BSc (Environmental and Life Sciences) (University of KwaZulu-Natal)	2016

SHORT COURSES

Additional Training

Back-2-Basics wetland workshop presented by Piet-Loius Grundling	(2020)
Environmental management training course by Enaq Environmental Consulting	(2018)
Young-Leaders academy, leadership development programme	(2012)

AREAS OF WORK EXPERIENCE

South Africa – KwaZulu-Natal, Gauteng, Mpumalanga, Free-State, Limpopo

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, IHIA)
- Toxicological Analysis
- Water quality Monitoring

- Soils and Agricultural Study

Soil and Agricultural Assessment for the Prospecting Right Application for Portion 5 of the Farm Ruighoek 169 JP

Submitted by TerraAfrica Consult cc

Mariné Pienaar
(MSc. Environmental Science)
(SACNASP Registered Scientist)

5 February 2022

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1. INTRODUCTION

Pilanesberg Platinum Mines (Pty) Ltd (PPM) proposes to secure a Prospecting Right for Portion 5 of the Farm Ruighoek 169 JP (Figure 1). The area under consideration is located adjacent to an area where Mining Rights (320/2002, 228/2002, 321/2002 and 67/2002) have been granted to PPM by the Department of Mineral Resources and Energy (DMRE) (previously the Department of Minerals and Energy (DME)). To ensure a development pipeline of the existing operations in the area, PPM are proposing to obtain a prospecting right from the DMRE for Portion 5 of Ruighoek 169 JP. Portion 5 of Ruighoek 169 JP measures approximately 122.7 ha in extent. The prospecting right area, located on Portion 5 of Ruighoek 169 JP, is approximately 4.7 ha in extent (refer to **Figure 1**).

The proposed prospecting activities are located within the Rustenburg Local Municipality (RLM), the Bojanala Platinum District Municipality (BPDM) and the Mankwe Magisterial District, in the North West province. The prospecting right area is located approximately 60 km and 24 km north-west of Rustenburg and Sun City, respectively. Various smaller towns and villages are in close proximity to the prospecting area, namely Mabeleleng (± 2.5 km south); Tlhatlhaganyane (±4 km south-east); Makgope (± 8 km north-west); and Mkoshong (± 9.5 km south-west). An important area of interest, the Pilanesberg National Park, is located approximately 4 km to the east.

A Basic Assessment (BA) Process is required as part of the Prospecting Right Application. SLR Consulting (South Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by PPM to manage the BA process. TerraAfrica Consult cc was appointed by SLR Consulting to conduct the soil and agricultural assessment for the BA Process required for the proposed Prospecting Right.

2. DETAILS OF THE SPECIALIST

The report is prepared by Mariné Pienaar of TerraAfrica Consult CC. Mariné is a scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and is specialised in the fields of Agricultural Science and Soil Science. Her SACNASP Registration Number is 400274/10 (see Appendix 2). Mariné holds a BSc. degree in Agricultural Science (with specialisation in Plant Production) from the University of Pretoria and a MSc. Degree in Environmental Science from the University of the Witwatersrand.

The full details and contact details of the specialist are attached as Appendix B: Curriculum Vitae of Specialist.

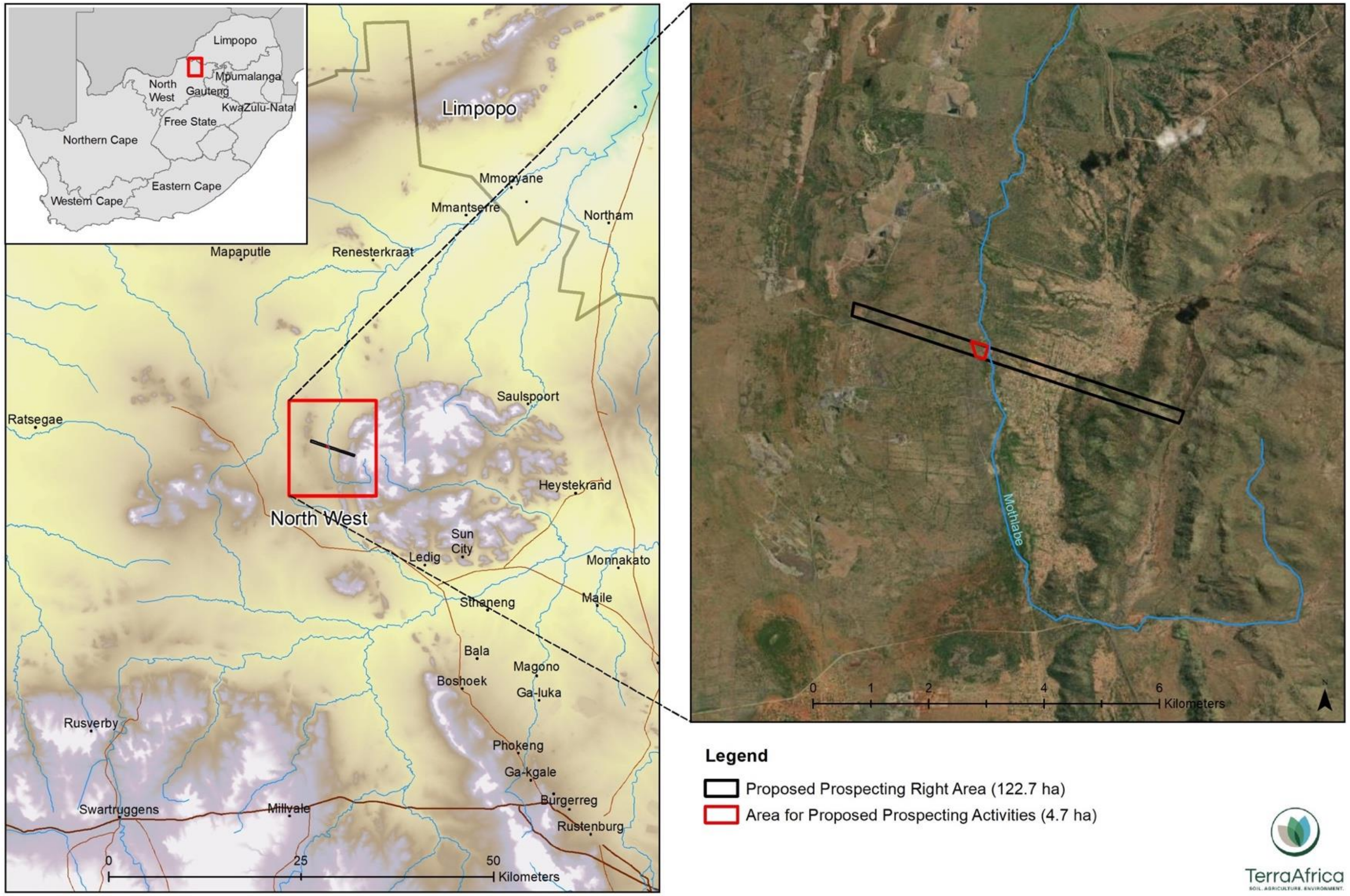

Figure 1: Locality of the prospecting right application area and area for proposed prospecting activities on Portion 5 of the Farm Ruighoek 169 JP

3. PROJECT DESCRIPTION

The target minerals for the project are platinum group metals (PGMs) including gold, nickel, copper, cobalt and other metals and minerals associated therewith (excluding chrome). The planned timeframe to complete the proposed prospecting work is provided in **Table 1**.

Table 1: Proposed Work Programme for the prospecting activities

Activity	Timeframe
Phase I – Trenching and Analysis; and Initial Diamond Drilling, Logging and Reef Sample Analysis	12 months (year 1)
Phase II – Environmental Study of Prospecting Right Area; 3D Modelling; and Metallurgical Test Work and Geotechnical Investigation	24 months (year 2 – 3)

The prospecting activities would be conducted in a phased approach (refer to Table 2), with each phase dependent on results of the preceding phase. The two phases are explained in the following sections.

3.1 Phase I – Soil Sampling and Initial Analysis

Phase 1 will consist of a programme where 9 boreholes will be drilled, logged and sampled. The information is required to establish the depth of the PGM-bearing reefs, comprising the UG2 Chromitite and Merensky Reef, and to check the grade and quantity of the reefs. Samples will be submitted for assay for PGMs, Cu & Ni. The boreholes are planned to be between 20 and 150m deep. In addition to the boreholes, 5 trenches of around 100m long will be dug to establish the sub-outcrop position of the PGM reefs. The trenches will be around 1.5m deep and 1m wide.

3.2 Phase II – Final Drilling and Investigation

A geological/structural model will be compiled so that the dimensions and locality of the mineral resource can be established. This will be followed by the compilation of a resource model. The geological and resource models will incorporate all the information from the adjacent properties, where a significant amount of drilling has been done.

4. PURPOSE AND OBJECTIVES OF THE ASSESSMENT

The overarching purpose of the Soil and Agricultural Compliance Specialist Assessment (from here onwards also referred to as the Soil and Agricultural Assessment) that will be included in the Basic Assessment Report (BAR), is to ensure that the sensitivity of the site to the proposed prospecting activities, is sufficiently considered. Also, that the information provided in this report, enables the Competent Authority to come to a sound conclusion on the impact of the proposed project on the food production potential of the area where prospecting is proposed.

To meet this objective, site sensitivity verification must be conducted of which the results must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as was indicated by the National Environmental Screening Tool.
- It must contain proof in the form of photographs of the current land use and environmental sensitivity pertaining to the study field.
- All data and conclusions are submitted together with the BAR [prepared in accordance with the National Environmental Management Act, 1998 (107 of 1998) (NEMA)] for the proposed prospecting right application on Portion 5 of the Farm Ruighoek 169 JP.

According to Government Notice (GN)320, the agricultural compliance statement that is submitted must meet the following requirements:

- It must be applicable to the preferred site and the proposed development footprint.
- It has to confirm that the site is of “low” or “medium” sensitivity for agriculture.
- It has to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site.

5. LEGISLATIVE FRAMEWORK FOR THE ASSESSMENT

The report follows the protocols as stipulated for the Agricultural Assessment in GN320 of 2020 (GN320). This Notice provides the procedures and minimum criteria for reporting in terms of Sections 24(5)(a) and (h) and 44 of the NEMA. It replaces the previous requirements of Appendix 6 of the EIA Regulations of NEMA. Table 2 details the relevant sections of the report where the GN320 requirements have been addressed.

Table 2: Summary of report references of the GN320 requirements

GNR 320 requirements of an Agricultural Compliance Statement (Low to Medium Sensitivity)	Reference in this report
3.1. The compliance statement must be prepared by a soil scientist or agricultural specialist registered with the SACNASP.	Section 2; and Appendix B
3.2. The compliance statement must: 3.2.1. be applicable to the preferred site and proposed development footprint;	Sections 9 and 10
3.2.2. confirm that the site is of "low" or "medium" sensitivity for agriculture; and	Section 10
3.2.3. indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site.	Sections 12 and 13
3.3. The compliance statement must contain, as a minimum, the following information: 3.3.1. contact details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment including a curriculum vitae;	Section 2; and Appendix B
3.3.2. a signed statement of independence;	Appendix A

3.3.3. a map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;	Figure 10 Section 10
3.3.4. confirmation from the specialist that all reasonable measures have been taken through micro-siting to avoid or minimise fragmentation and disturbance of agricultural activities;	Section 11
3.3.5. a substantiated statement from the soil scientist or agricultural specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development;	Section 13
3.3.6. any conditions to which the statement is subjected;	Section 13
3.3.7. in the case of a linear activity, confirmation from the agricultural specialist or soil scientist, that in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;	N/A – not a linear activity
3.3.8. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and	Section 12
3.3.9. a description of the assumptions made as well as any uncertainties or gaps in knowledge or data.	Section 8
3.4. A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	This report forms part of the BA process reports for authorisation

In addition to the specific requirements for this study, the following South African legislation is also considered applicable to the interpretation of the data and conclusions made with regards to environmental sensitivity:

- The Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal. This Act requires the protection of land against soil erosion and the prevention of water logging and salinisation of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.
- Section 3(a) of the Subdivision of Agricultural Land Act (SALA) 70 of 1970 states that agricultural land must not be subdivided. However, it is assumed that the area where the proposed infrastructure amendments will be located, has already been rezoned from Agriculture to Mining and therefore the SALA will not be applicable.

6. TERMS OF REFERENCE

In addition to the requirements stipulated in GN320, the following Terms of Reference as stipulated by SLR applies to this report:

- Conduct a site visit to verify the soil properties of the area where the proposed prospecting activities will be located, inclusive of a 50 m buffered area.

- Identify and assess potential impacts on both agricultural potential as well as soil, resulting from the proposed project.
- Identify and describe potential cumulative soil, agricultural potential and land capability impacts resulting from the proposed development in relation to proposed and existing developments in the surrounding area.
- Recommend mitigation and management measures to reduce the anticipated impacts on the soil and agricultural properties of the area identified for the proposed prospecting activities.

7. METHODOLOGY

7.1. Desktop analysis of satellite imagery and other spatial data

The most recent aerial photography of the area available from Google Earth was obtained. The satellite imagery was analysed to determine areas of existing impact and land uses within the study area as well as the larger landscape. Prior to the site visit, a number of geo-referenced data sets were analysed to understand what the likely baseline properties of the proposed study area and surrounding area will be. The data sets that were analysed are:

- The National Land Capability Evaluation Raster Data Layer was obtained from the Department of Agriculture, Land Reform and Rural Development (DALRRD) to determine the land capability classes of the area. The data was developed using a spatial evaluation modelling approach (DALRRD, 2016).
- The long-term grazing capacity for South Africa 2018 (South Africa, 2018). This data set includes incorporation of the RSA grazing capacity map of 1993, the Vegetation type of SA 2006 (as published by Mucina L. & Rutherford M.C.), and the Land Types of South Africa data set. The values indicated for the different areas represent long term grazing capacity with the understanding that the veld is in a relatively good condition.
- The North West Field Crop Boundaries (Crop Estimates Consortium, 2019) were analysed to determine whether any crop production areas are present within the proposed Ruighoek 169JP Portion 5 Prospecting Right Area. The crop production areas may include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, viticulture, old fields, small holdings and subsistence farming.
- The High Potential Agricultural Areas for Cultivation: North West Province, 2019 were screened to determine whether any of the proposed prospecting activities will fall within such an area. These are large, relatively homogeneous areas of land within the province regarded as having high potential and capability to contribute towards food production in both the province and the country (DALRRD, 2019).
- Land type data for the project assessment zone was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units.

7.2. Site survey

The site survey was scheduled for 15 September 2021. The aim of the site survey was to classify soil within the area indicated for the proposed prospecting activities by using a hand-held auger.

However, upon arrival at the PPM offices on the morning of 15 September, the site survey team was advised not to enter the proposed prospecting right area as PPM became aware of illegal mining activities in the proposed prospecting right area. It was stated that the illegal miners may carry firearms and may act hostile when they observe other people evaluating the soil. PPM then requested that the assessment be completed without an on-site verification of the proposed prospecting right area.

7.3. Land capability

Since a soil classification survey could not conducted, the land capability raster data of the area according to DALRRD (2016) was used for the land capability classification. This model comprises of fifteen (15) land capability evaluation classes with Class 01 as the lowest possible class and Class 15 as the highest possible class. This approach considers the three main contributing factors to land capability in the following weighted ratio:

- Soil capability contributes 30%;
- Climate capability contributes 40%; and
- Terrain capability contributes the remaining 30%.

Since the proposed prospecting activities categorises under the mining sector with the DMRE as the Competent Authority, the second land capability classification is done using the guidelines outlined in Section 7 of "The Chamber of Mines Handbook of Guidelines for Environmental Protection (Volume 3, 1981)" (now called the Minerals Council of South Africa). The Minerals Council of South Africa's pre-mining land capability system differs from the DALRRD system (described in Section 7.1 above) in that it classifies the capability of land only into four major classes that includes wetland land capability but ignores different grades of suitability for agricultural production.

Table 3 indicates the set of criteria for each land capability class, according to these guidelines.

Table 3: Summary of land capability classification criteria as per the Minerals Councils of South Africa Guidelines

Criteria for Wetland	➢ Land with organic soils or ➢ A horizon that is gleyed throughout more than 50 % of its volume and is significantly thick, occurring within 750 mm of the surface.
Criteria for Arable Land	➢ Land, which does not qualify as a wetland, ➢ The soil is readily permeable to the roots of common cultivated plants to a depth of 750 mm, ➢ The soil has a pH value of between 4,0 and 8.4,

	➢ The soil has a low salinity and SAR, ➢ The soil has a permeability of at least 1,5-mm per hour in the upper 500-mm of soil ➢ The soil has less than 10 % (by volume) rocks or pedocrete fragments larger than 100-mm in diameter in the upper 750-mm, ➢ Has a slope (in %) and erodibility factor (K) such that their product is <2.0, ➢ Occurs under a climatic regime, which facilitates crop yields that are at least equal to the current national average for these crops or is currently being irrigated successfully.
Criteria for Grazing Land	➢ Land, which does not qualify as wetland or arable land, ➢ Has soil, or soil-like material, permeable to roots of native plants, that is more than 250-mm thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100-mm, ➢ Supports, or is capable of supporting, a stand of native or introduced grass species, or other forage plants, utilizable by domesticated livestock or game animals on a commercial basis.
Criteria for Wilderness Land	➢ Land, which does not qualify as wetland, arable land or grazing land.

7.4. Impact assessment methodology

Below are the tables with the steps followed to do the impact rating according to the methodology prescribed by SLR.

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.

	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

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

	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short	VL	Low	Low	Low	Medium	Medium

INTENSITY = H

DURATION	Very long	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short	VL	Low	Medium	Medium	Medium	High

INTENSITY = VH

DURATION	Very long	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short	VL	Low	Medium	Medium	High	High

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

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

8. STUDY GAPS, LIMITATIONS AND ASSUMPTIONS

The following limitations are part of the assessment:

- The main limitation of the assessment is that the on-site verification could not be conducted as a result of the presence of illegal miners who are armed and potentially dangerous, in the proposed prospecting right area.
- Following the limitation of no site access, photographic evidence could not be collected of the soil forms present and the current land uses.
- Although land type data was used for the analysis of the terrain and soil properties of the proposed prospecting right area, the land type classification system still refers to the soil forms described in the first edition of the South African soil classification system of 1977. Since then, the classification system has been updated twice and the most recent update of 2018, includes several new soil forms that are not included in the land type descriptions.
- The anticipation and rating of impacts are based on the report author's knowledge and experience on the nature of construction and operation of mining infrastructure. Therefore, it is done as accurately as possible but must not be considered as absolute measures.

The following assumptions were made during the assessment and reporting phases:

- The assessment of the anticipated impacts assumes that the proposed prospecting activities will stay within the confines as depicted in
- **Figure *11***.
- It was assumed that the prospecting activities will be limited to drilling and trenching.
- It is assumed that the prospecting activities will only have one project phase where vegetation in the area of the trenches are removed, soil and rock material underneath are removed and stockpiled, the mineral samples removed and the trenches rehabilitated immediately after that.
- It is also assumed that the area where trenching and drilling will take place will not be fenced off during the prospecting activities on site and that the area will be still be accessible to the community's livestock.

There are no other assumptions, study gaps or limitations to the data presented in the report, unless explicitly stated in the relevant sections.

9. RESULTS OF DESKTOP ASSESSMENT

9.1 Land type classification

The proposed prospecting right area includes two land types i.e. Land Type Ea69 and Land Type Ib115 (refer to **Figure 2**). The eastern third of the prospecting right area consists of Land Type Ib115 while the western two-thirds of the area consists of Land Type Ea69. The prospecting activities area consists of Land Type Ea69 only. The area west of the proposed prospecting right area consists of Land Type Fb147 and the area approximately 4.5 km south of the prospecting right area, consists of Land Type Fb144.

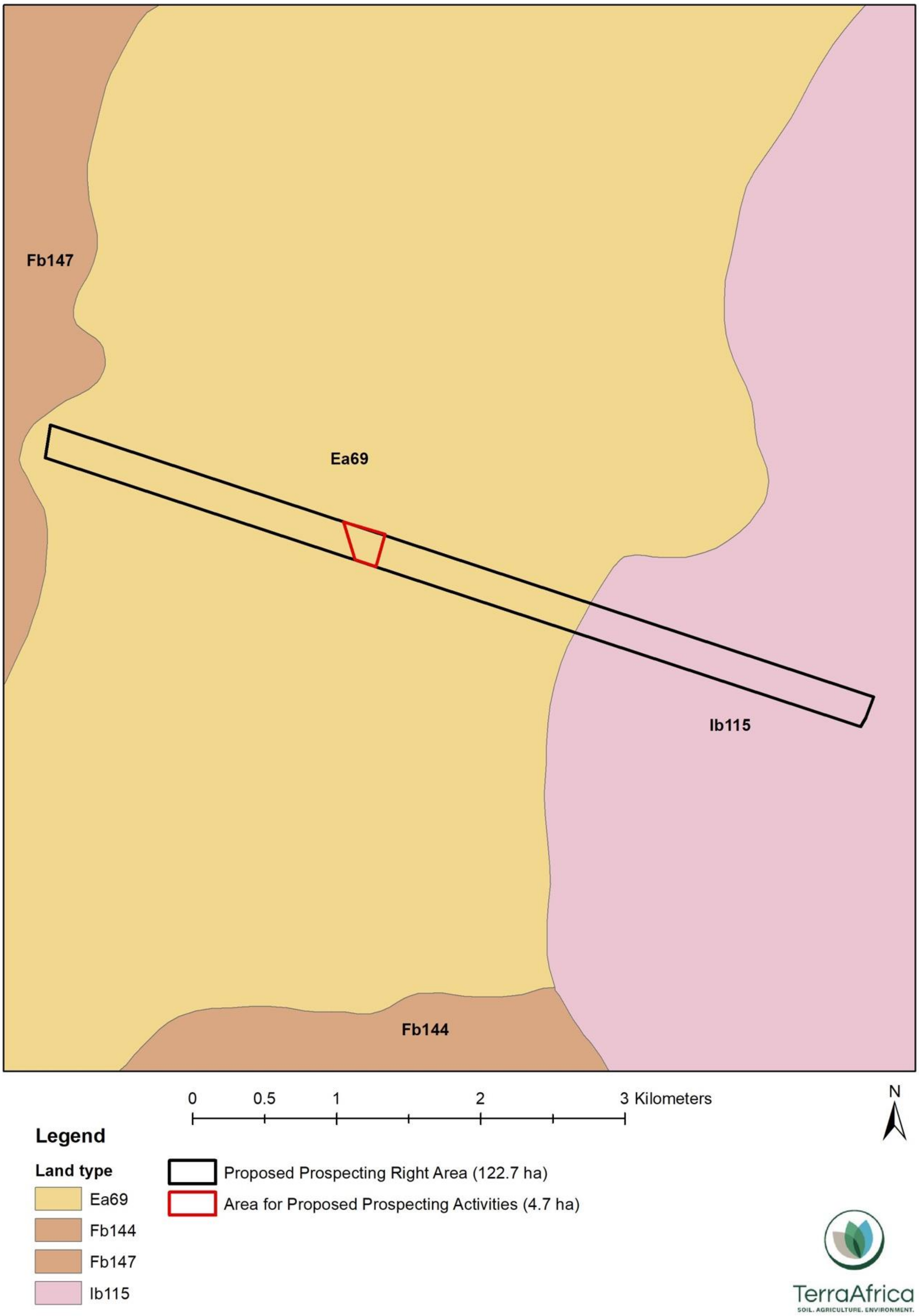

Figure 2: Land type map of the proposed Ruighoek Prospecting Right Area and area for proposed prospecting activities

The mapping unit Ea indicates that the area consists of dark and/or red coloured soils with clayey texture and high base status. Land types of the Ea group consist of more than 50% soils with vertic, melanic or red structured diagnostic horizons. Mapping unit Ib indicates land types with exposed rock, stones or boulders covering more than 80% of the area. The Fb land types outside the prospecting right area indicate land where lime occurs regularly in the valley bottom soils. The two land types within the prospecting right area are discussed in detail below and the complete data sheets are attached as Appendix C.

Land Type Ea69:

According to the land type data sheet of Land Type Ea69, the terrain consists of four terrain units (**Figure 3**), with 40% mid-slopes (Terrain unit 3) and 31% footslopes (Terrain unit 4). These flat footslope positions are flat (0 to 2% slope) and have slope length of 500 to 2000 m while the mid-slopes are steeper with slope between 2 and 25% and slope length between 100 and 1000 m. Both these terrain units consist largely of Arcadia soils with clay content of the vertic topsoil ranging between 40 and 60%. The crests (Terrain unit 1) have 60% Arcadia soils and the valley bottoms (Terrain unit 5), have 33% Arcadia soils. The remainder of the soil forms within each of the terrain units include Shortlands, Swartland, Rensburg, Mispah, Glenrosa, Dundee and Bonheim soils. It also includes Hutton soils that have topsoil clay content between 25 and 40% and subsoil clay content between 35 and 60%.

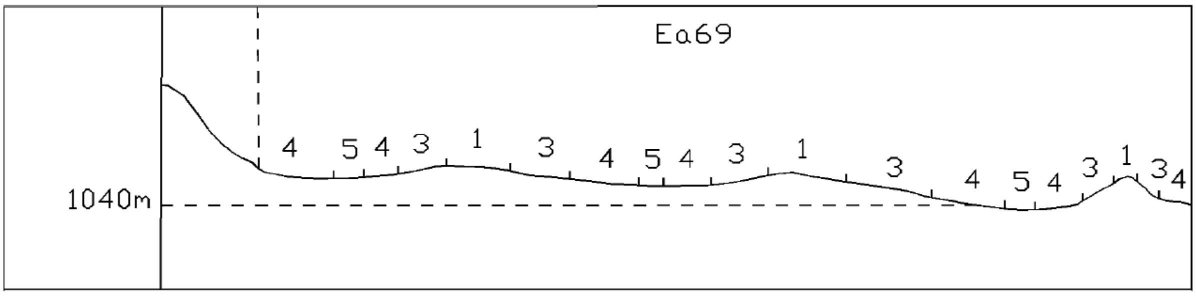

Figure 3: Terrain form sketch of Land Type Ea69

Land Type Ib115:

The terrain of Land Type Ib115 consists of five terrain units (**Figure 4**), with 67% mid-slopes (Terrain unit 3) and 18% footslopes (Terrain unit 4). The remaining areas include 6% crests (Terrain unit 1), 4% scarps (Terrain unit 2) and 5% valley bottoms (Terrain unit 5). The mid-slopes have slope ranging between 10 and 100% and slope lengths between 500 and 700 m. The area of mid-slopes consist of 91% rock, 7% shallow Glenrosa soils (depth ranging between 0.5 and 0.25 m) and 1% each Mispah and Hutton soils. The footslopes are dominated by a combination of Hutton, Glenrosa and Mispah soils while there is also approximately 11% each of soils of the Wasbank and Longlands forms. Bonheim, Estcourt, Westleigh and Glencoe soils may also be present within the footslopes. The valley bottoms consist of about 40% Dundee soils, 20% Valsrivier and Bonheim soils, 20% rock, 12% Glenrosa soils and 8% Estcourt soils. While the scarps consist of 100% rock, the crests consist of 50% rock and 50% Glenrosa soils between 0.05 and 0.25 m deep.

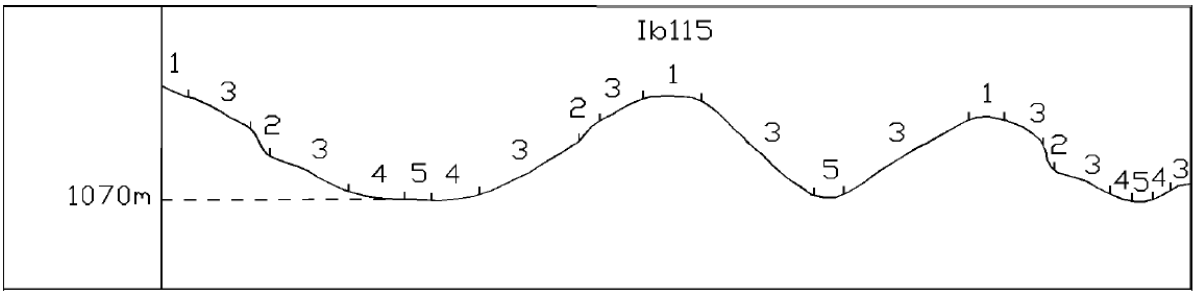

Figure 4: Terrain form sketch of Land Type Ib115

9.2. Land capability

Following the DALRRD (2016) land capability classification for the area, the proposed prospecting right area consists of eight different land capability classes ranging from Class 01 (Very low) to Class 08 (Moderate) (see **Figure 5**). The entire area for the proposed prospecting activities (4.7 ha), consists of land with Class 08 (Moderate) land capability. The prospecting right area both east and west of the proposed area of prospecting activities also consists of land with Class 08 (Moderate) land capability. Land with Moderate (Class 08) land capability is considered suitable for rainfed crop production but with climate and/or terrain limitations that limits the suitability.

About a third of the most eastern section of the proposed prospecting right area consists of land with Class 01 (Very low) to Class 07 (Low-Moderate) land capability that indicate these areas have different degrees of suitability for livestock farming but no suitability for rainfed crop production. Following the analysis of the land type classification data (see **Section 9.1**), the terrain limitations are likely the key factor that excludes rainfed crop production as a viable agricultural land use in this area. The area is characterised by rock and very shallow soils underlain by rock and lithic material that are not suitable for crop production. The western end of the proposed prospecting right area consists mainly of land with Low-Moderate (Class 07) land capability with very small areas of Moderate (Class 08) and Low-Moderate (Class 06) land capability in between.

The areas located east and west of the proposed prospecting right area consist of a mixture of lower land capability classes (Class 01 to Class 07) that also indicate different degrees of suitability for livestock farming and no suitability for rainfed crop production. The areas north and south of the proposed prospecting right area consist mainly of land with Moderate (Class 08) land capability that have suitability for rainfed crop production but with limitations imposed by the climate and/or terrain.

Since no soil classification and terrain assessment data could be collected, the DALRRD (2016) land capability classification was used to derive the land capability classification of the area according to the guidelines of the Minerals Council of South Africa. For this classification, the DALRRD land capability classes of the proposed prospecting right area and surrounding area, were converted into the four land capability classes as follow:

- Wilderness land capability includes Classes 01 to 04
- Grazing land capability includes Classes 05 to 07

- Arable/Grazing land capability includes Class 08 and 09

Following this classification, the area identified for the proposed prospecting activities has either arable or grazing land capability (refer to **Figure 6**).

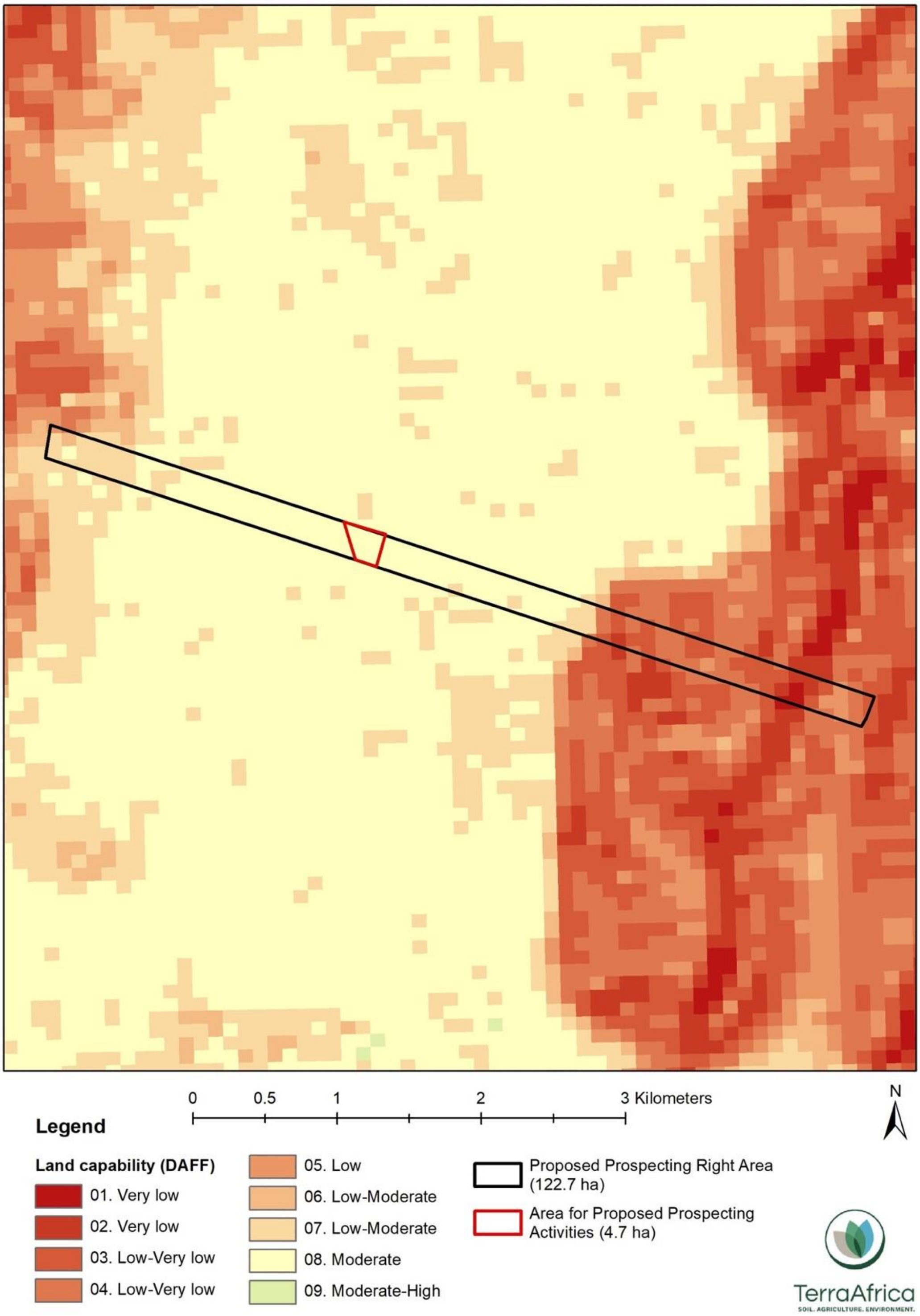

Figure 5: Land capability of the proposed Ruighoek Prospecting Right Area and area for proposed prospecting activities (data source: DALRRD, 2016)

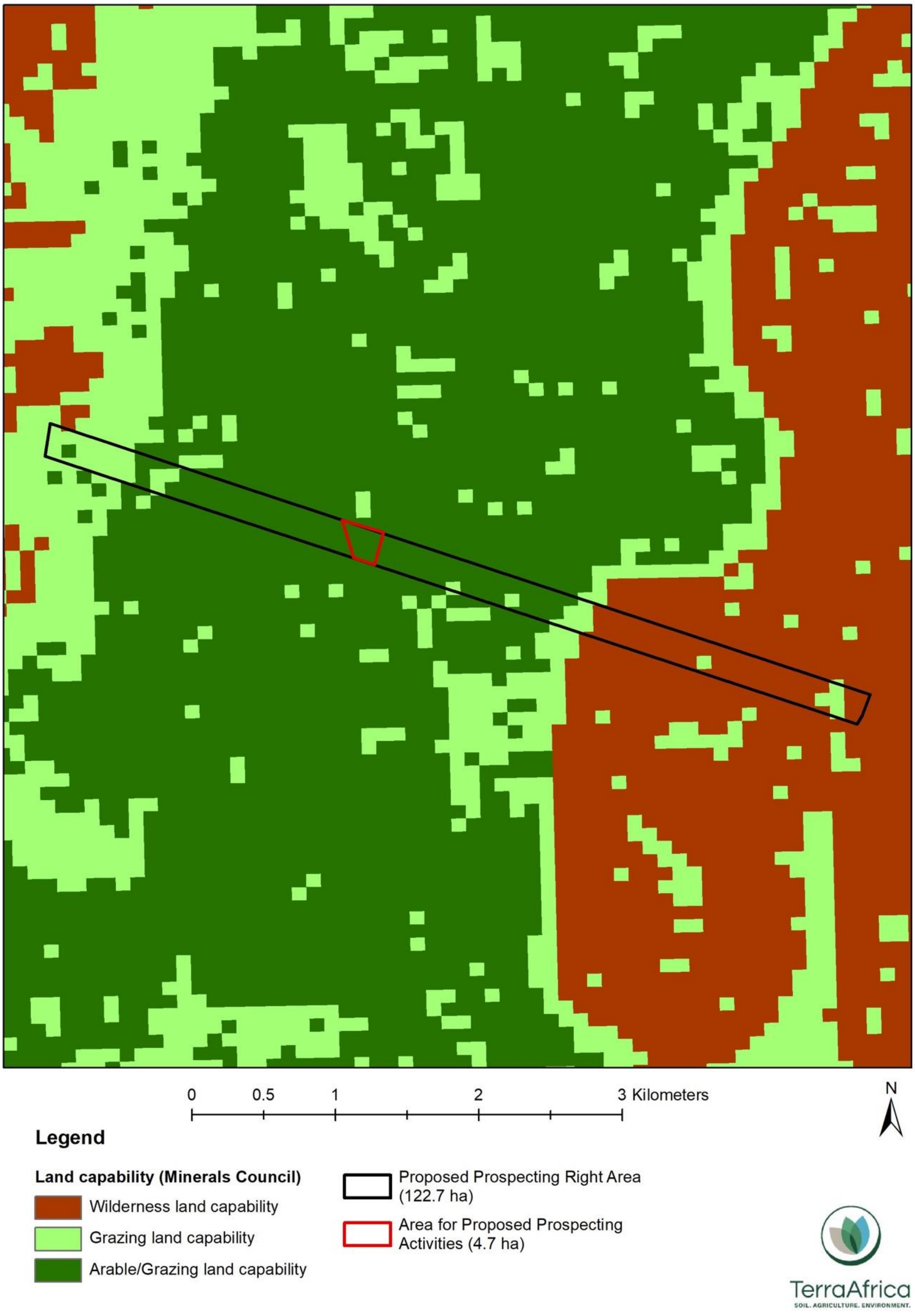

Figure 6: Land capability of the proposed Ruighoek Prospecting Right Area and area for proposed prospecting activities according to guidelines of Minerals Council of South Africa

9.3. Agricultural production

The field crop boundaries data layers of the North West Province (Crop Estimates Consortium, 2019), were depicted for the proposed prospecting right area and the larger area surrounding it (see **Figure *7***). The data indicates one crop field with subsistence farming within the proposed prospecting right area. The crop field is located in the north-western corner of the area proposed for the prospecting activities. More areas with subsistence farming are located south and north of the proposed prospecting right area.

The crop field that falls within the area proposed for the prospecting activities, is categorised as Subsistence Farming 1. Following the metadata description of the field boundaries (Crop Estimates Consortium, 2019), Subsistence Farming 1 is small scale or emerging farming where the output is produced primarily for home consumption. Subsistence Farming 1 is usually found close to small villages in and around rangeland areas. It usually consists of many small fields and it is difficult to distinguish between the different field crop boundaries, because of the field crop boundaries being very small (5 to 10 ha) on the imagery.

Although this small area within the area proposed for the prospecting activities is shown as a subsistence crop field, the analysis of aerial imagery has shown that this area has exactly the same vegetation as the surrounding area. Therefore, it is more likely that this area has either reverted back to natural vegetation that is used for livestock grazing or otherwise, it used to be an old crop field that was left fallow and therefore the natural vegetation returned. The aerial imagery doesn't indicate any signs of crop production within this area.

The area is more likely used for livestock grazing by the local community. The area has low-moderate grazing capacity of 17 ha/LSU (refer to **Figure 8**). However, it is not anticipated that the prospecting activities will include fencing of the area and therefore livestock grazing can continue around the prospecting activities.

To determine whether the proposed prospecting activities will affect any High Potential Agricultural Areas (HPAAs), the prospecting right area was projected in relation to the areas delineated for North West province (DALRRD, 2019) (refer to **Figure 9**). The proposed prospecting right area falls outside any HPAA and the nearest HPAA is approximately 11 km west of the prospecting right area. Three other rainfed HPAAs are located 20 km or further away to the north and south of the prospecting right area. One Category B irrigated HPAA is located about 25 km south-west of the proposed prospecting right area. The proposed prospecting activities will therefore not result in any fragmentation of an HPAA.

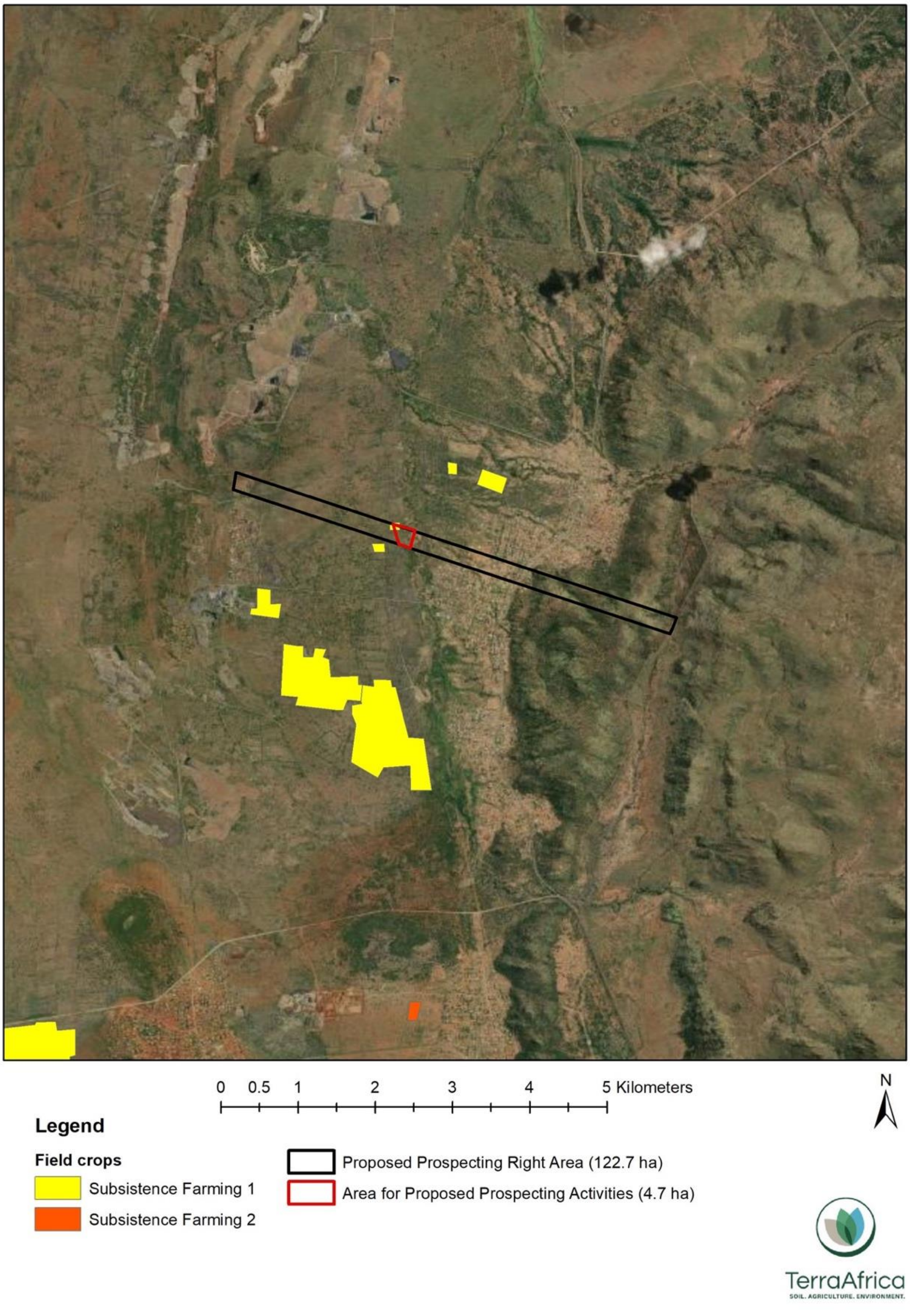

Figure 7: Field crop boundaries within and around the proposed Ruighoek Prospecting Right Area (data source: Crop Estimates Consortium, 2019)

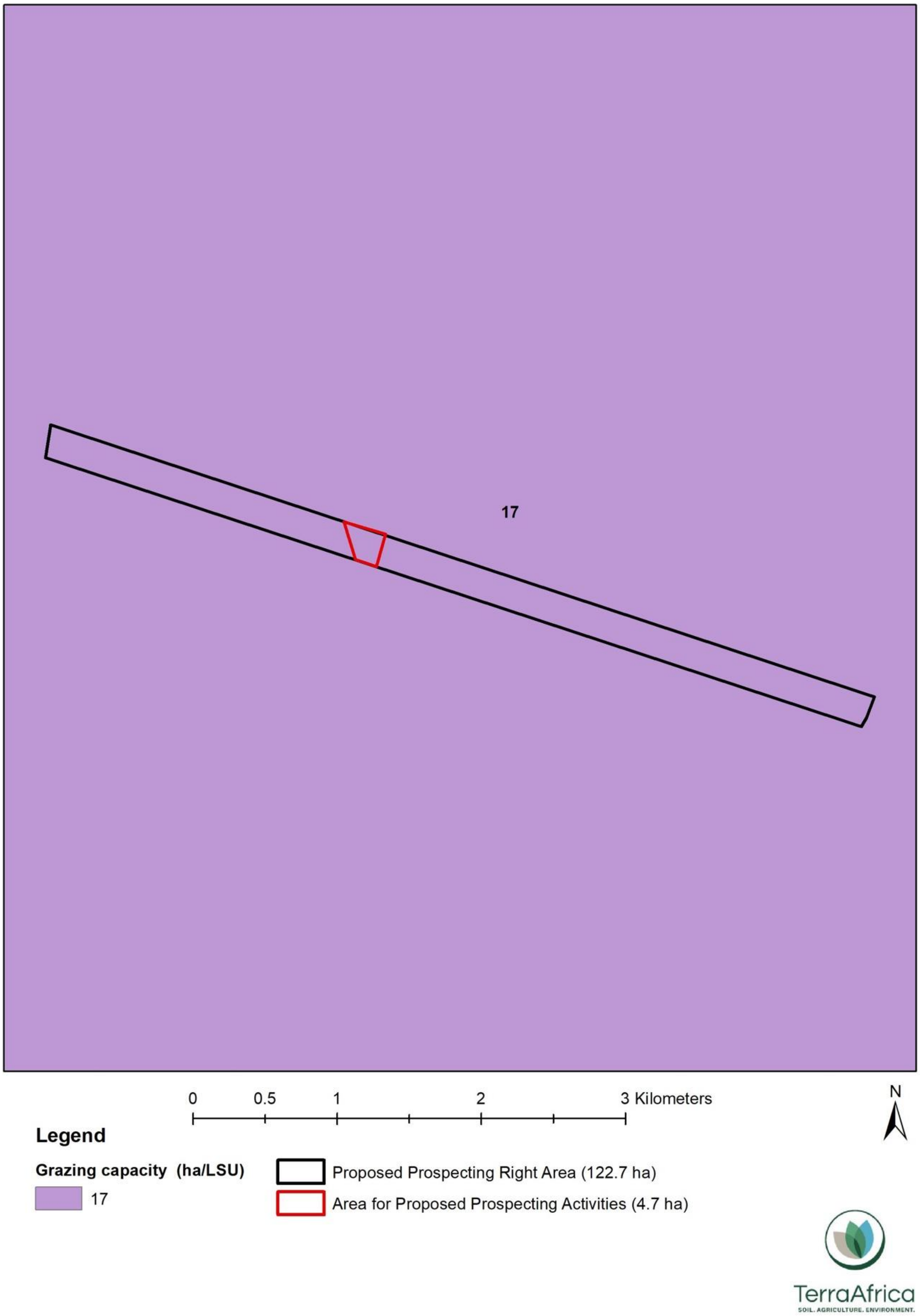

Figure 8: Long-term grazing capacity of proposed Ruighoek Prospecting Right Area and surrounding area (data source: South Africa, 2018)

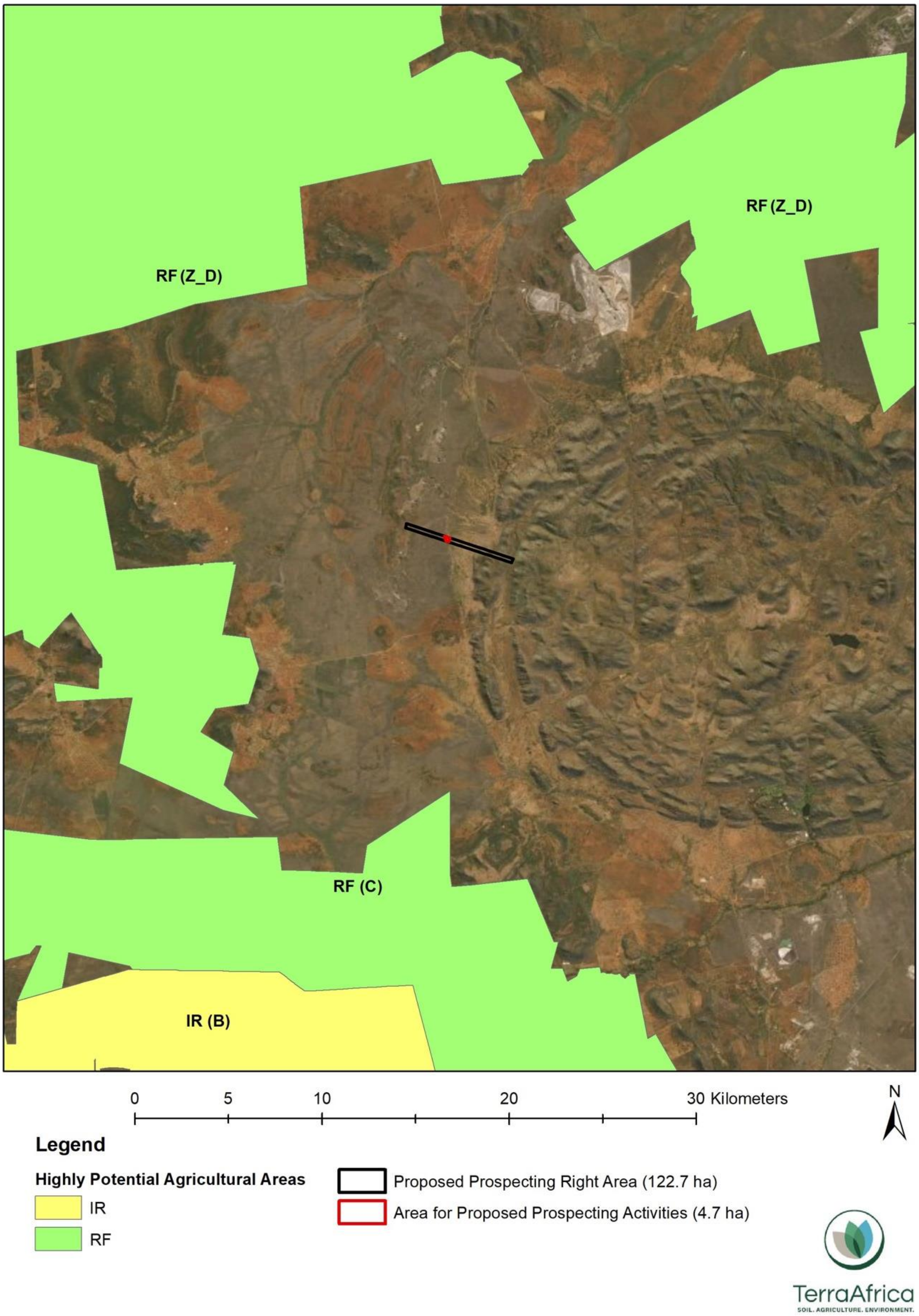

Figure 9: High Potential Agricultural Areas of North West province in relation to the proposed Ruighoek Prospecting Right Area (data source: DALRRD, 2019)

10. SITE SENSITIVITY TO THE PROPOSED DEVELOPMENT

The combined Agricultural Sensitivity of the area considered for the proposed Ruighoek Prospecting Right Area, was determined by using the National Environmental Screening Tool (www.screening.environment.gov.za). The Agricultural Theme of the screening tool considers a combination of the national land capability raster data, as well as the field crop boundaries as compiled by the DALRRD (DALRRD 2016, DALRRD 2019).

The screening report was generated by SLR on 13 September 2021. The requirements of GN320 stipulates that a 50 m buffered area around the development footprint must be assessed with the screening tool. The map shows the area proposed for the prospecting activities on Portion 5 of the Farm Ruighoek 169 JP as well as a buffer area of between 150 and 500 m. The results provided by the screening tool indicated that the entire site has Medium sensitivity to the proposed development, except for a block with High sensitivity located in the north-western corner (**Figure 10**). The entire area assessed is surrounded by land with Medium agricultural sensitivity except for one block of High sensitivity located south-west of the area proposed for the prospecting activities. The two blocks of High sensitivity land are associated with the field boundaries present in the area (refer to **Section 9.3**).

From the results of the desktop assessment described in **Section 9** above, it is confirmed by the specialist that the area proposed for prospecting activities within the proposed Ruighoek Prospecting Right Area have Medium sensitivity to the proposed prospecting activities (see **Figure *11***). While the aerial imagery does not show any signs of current crop production activities, the data sets analysed indicate that the area has Moderate (Class 08) land capability that is suitable for rainfed crop production with limitations. Also, that there is a possibility that there is or used to be a crop field within the area. However, the grazing capacity is low-moderate at 17 ha/LSU and although the area can be used for livestock grazing, livestock numbers will have to be limited to prevent land degradation. Some areas already degraded by illegal mining activities may have Low sensitivity but the presence and extent of such areas could not be determined in the absence of an on-site verification visit.

11. MICRO-SITING AND CONSIDERATION OF ALTERNATIVE LAYOUTS

The proposed area of prospecting activities was selected based on geological resource maps and represents the area that is most likely to be representative of the minerals present. Therefore, no alternative layouts were considered as the layout provided is the one that will optimise. The current layout of the proposed trenches and pits also only affects land with Medium sensitivity and no areas with High sensitivity are considered.

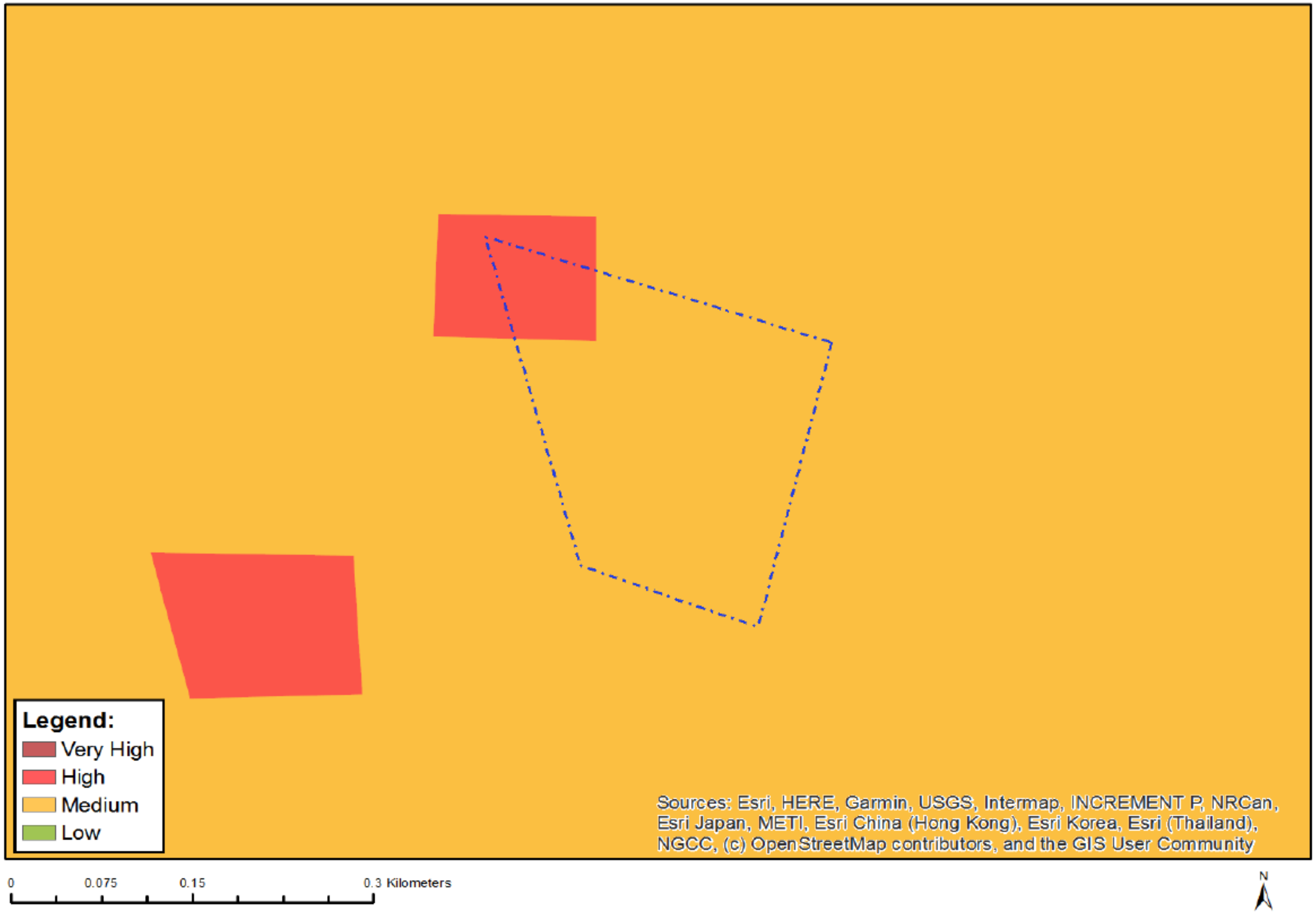

Figure 10: Agricultural Combined Sensitivity of the area for the proposed prospecting activities within the proposed Ruighoek Prospecting Right Area (Environmental Screening Tool, DEA)

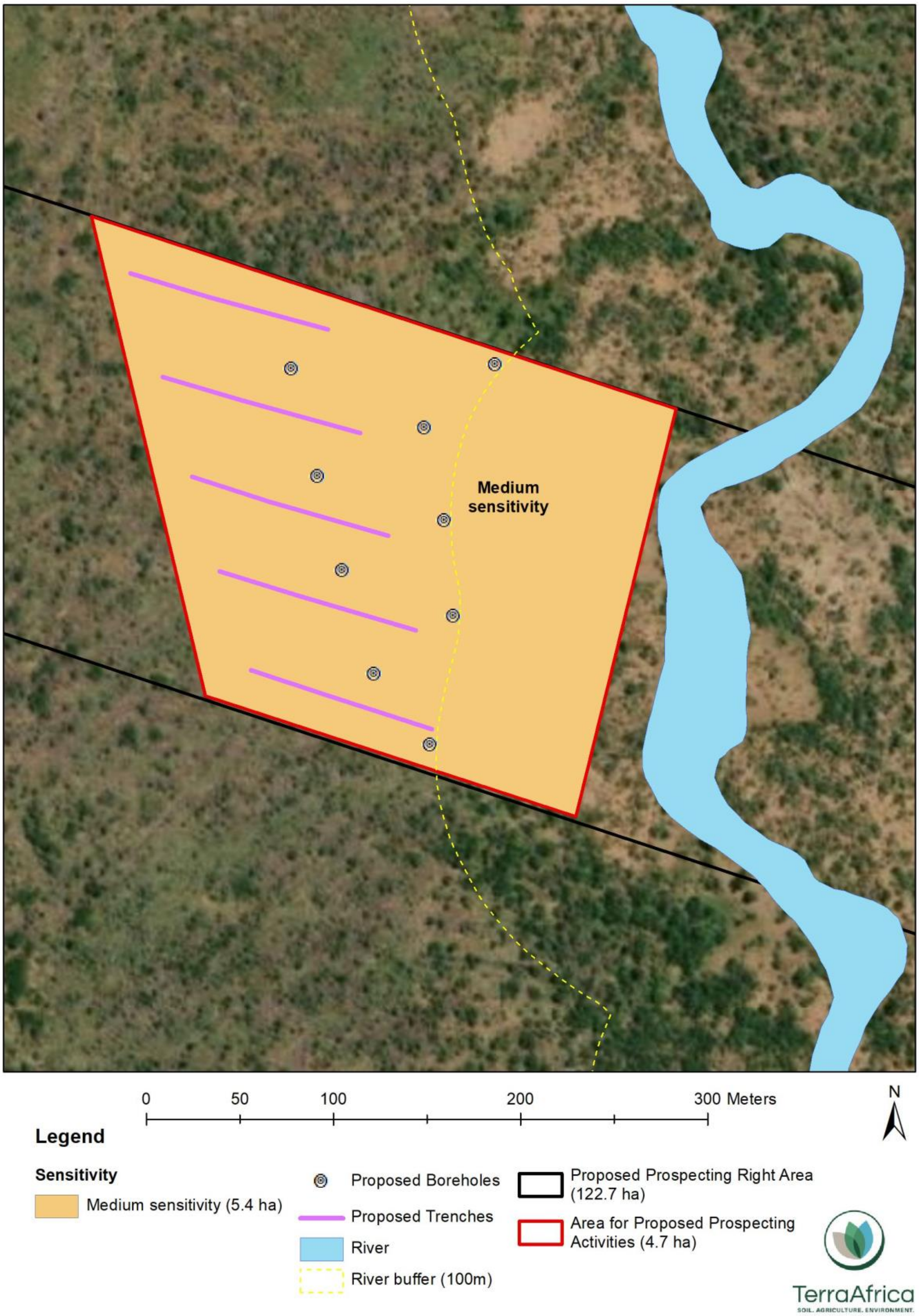

Figure 11: Sensitivity rating of the area for the proposed prospecting activities within the proposed Ruighoek Prospecting Right Area

12. IMPACT ASSESSMENT

Following the proposed Prospecting Works Programme (refer to **Table 1**), the drilling and trenching activities will be conducted within one year. It is anticipated that there will only be one phase during which the trenches will be dug, samples removed and the trenches closed again and the soil levelled where the disturbance has taken place. The drilling and trenching will have minimal impacts on the soil and no impacts on the agricultural production potential of the area as there are currently no crop fields (according to Google Earth imagery). It is assumed that the prospecting team would allow the livestock to graze unhindered in the areas around the trenches and drill holes.

The impacts on soil during the trenching activities, are described and rated below.

12.1.1 Soil erosion

Soil erosion will occur as a result of vegetation removal from the soil surface prior to the trenches being dug. This is a short-term risk that will last for a year or slightly more until the prospecting activities have ceased and vegetation cover has re-established on the surface. In the case of the unmitigated scenario, the extent of soil erosion can be the whole site. The consequence of unmitigated soil erosion will be low and since the probability of this impact is Medium, the significance of the impact is Very Low.

Although impacts of very low significance do not require mitigation measures, it is recommended that the following mitigation measures be included in the EMPr of the proposed prospecting right application:

- Limit vegetation clearance to only the areas where trenches will be dug.
- Plan the vegetation clearance activities associated with the trenching, for dry seasons (late autumn, winter and early spring).
- Monitor the trenches once they have been closed for up to one year after the prospecting activities to ensure that natural vegetation re-establishes itself on the surfaces where the trenches were dug.

Through the implementation of the mitigation measures, the intensity of the impact can be reduced to a negligible change that only affects the area where the trenching will take place (Very Low extent). In the mitigated scenario, the impact is still anticipated to be of Low duration (one year or slightly longer). The consequence of the mitigated soil erosion risk is Very Low and the significance of the mitigated scenario, is also Very Low. The rating of the unmitigated and mitigated impact significance, is presented in **Table 4**.

Table 4: Significance rating of soil erosion before and after the implementation of mitigation measures

Scenario	Intensity	Duration	Extent	Consequence	Significance
Unmitigated	L	L	L	L	VL
Mitigated	VL	L	VL	VL	VL

12.1.2 Disturbance of original soil profiles

During trenching both the topsoil and subsoil horizons as well as the parent material underneath will be brought to the surface and stockpiled. This will result in disturbance of the original horizon sequences and the creation of a mixture of soil materials that are returned to the trenches after the samples are removed. The mixing of soil horizons destroys the soil structure, often resulting in a compacted soil mixture with reduced water infiltration rate and aeration that limits root growth.

The disturbance of the original soil profiles is considered a minor deterioration (Low intensity). In the unmitigated scenario, the duration of this impact will be Very High as it is either permanent or will last for more than 20 years. The extent of this impact is Very Low as it will only affect the areas where the trenching will take place. This impact is of Low consequence but the probability of it occurring, is Definite (Very High probability). The significance of the impact in the unmitigated scenario is Low.

Implementation of the following mitigation measures will reduce the impact of soil disturbance:

- Only remove soil in areas where the indicated trenches will be dug. No additional areas must be disturbed outside of the indicated trenches.
- The soil of a trench must be stockpiled separately from the underlying parent material and rock.
- Soil from a specific trench must be used to rehabilitate the trench from which it was removed. Soil must not be moved around between trenches.
- Rehabilitation of a trench must first return the rock and parent material and lastly the soil from the soil stockpile.

The implementation of the mitigation measures will reduce the intensity of the impact to Very Low and the duration to Low (reversible over time in an approximate period of between 1 and 5 years). This will result in the impact having Very Low consequence and also Very Low significance.

The rating of the unmitigated and mitigated impact significance, is presented in **Table 5**.

Table 5: Significance rating of soil disturbance before and after the implementation of mitigation measures

Scenario	Intensity	Duration	Extent	Consequence	Significance
Unmitigated	L	H	VL	L	L
Mitigated	VL	L	VL	VL	VL

12.1.3 Soil chemical pollution

The area will be accessed by the vehicles and earthmoving equipment (such as an excavator) as well as the drill rig, to drill the prospecting boreholes and dig the trenches. Oil and fuel spills and leakages from the vehicles and equipment can be a source of soil pollution. The prospecting team may generate domestic waste in the area proposed for prospecting during the year that the prospecting activities will take place.

Soil chemical pollution because of potential oil and fuel spillages from vehicles as well as the generation of domestic waste, is considered to be a moderate deterioration of the soil resource. This impact will be localised within the site boundary and will have medium significance on the soil resource when not managed. However, with proper waste management and immediate clean-up as mitigation measures, the significance of this impact can be reduced to very low (post-mitigation).

During the construction phase, soil chemical pollution must be minimised through implementation of the following mitigation measures:

- Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained using a drip tray with plastic sheeting filled with absorbent material;
- Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids, recovering contaminated soils and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area; and
- Avoiding waste disposal at the site wherever possible, by leaving domestic waste inside the vehicles and equipment and discarding it in waste bins off-site.

The rating of the unmitigated and mitigated impact significance, is presented in **Table 6**.

Table 6: Significance rating of soil chemical pollution before and after the implementation of mitigation measures

Scenario	Intensity	Duration	Extent	Consequence	Significance
Unmitigated	L	H	L	M	M
Mitigated	L	H	VL	L	VL

13. ACCEPTABILITY STATEMENT

The proposed activities within the Ruighoek Prospecting Right Area will encompass borehole drilling and trenching over a period of one year. This will allow PPM to extract mineral samples for analysis to determine if the area has sufficient mineral resources for possible future mining.

Although the proposed area could not be accessed during the planned site visit due to illegal mining activities, several desktop data sets and aerial imagery could be analysed to gain an understanding of the baseline soil and agricultural properties of the area. The proposed prospecting area consists of melanic and vertic soils in the middle section of the area and rock and shallow, lithic soils towards the eastern third of the prospecting right area.

The land capability of the middle area can be classified as Arable and/or Grazing land and although the area has suitability for rainfed crop production, aerial imagery shows no signs of current crop production activities within the proposed prospecting right area. It is therefore assumed that the area is currently used for livestock grazing for the local community. The prospecting right area is at least 10 km away from any High Potential Agricultural Area as delineated by DALRRD (2019). It is assumed that the trenching and drilling activities will not include any fencing of the area and that community livestock can continue to graze there. There are therefore no anticipated impacts on the agricultural production in the area.

Three impacts on soil quality are anticipated i.e. soil erosion, disturbance of original soil horizon organisation and soil pollution. In the unmitigated scenario, soil erosion is an impact of Very Low significance, soil profile disturbance an impact of Low significance and soil pollution one of Medium significance. With the implementation of the mitigation measures stipulated in Section 12, the impacts can be reduced as follows:

- Soil erosion will remain an impact of Very Low significance.
- Soil horizon disturbance will be reduced to an impact of Very Low significance.
- Soil pollution will be reduced to an impact of Very Low significance.

It is therefore of my opinion that the proposed project is acceptable as the prospecting activities will only be a temporary change to soil properties of the area and will not affect the current land use of the property.. It follows that best practice regarding soil management must be implemented.

It is also recommended that a site walk-over be conducted prior to the initiation of the prospecting activities to determine whether there are any subsistence crop fields in the area. Although aerial imagery shows that there are no such fields, the field boundaries of DALRRD (2019) show that there may be a block of subsistence farming within this area. If that is the case, the crop field must be avoided and trenches and drilling holes must be moved to exclude the crop field.

14. REFERENCE LIST

Crop Estimates Consortium, 2019. *Field crop boundary data layer (NW province)*, 2019. Pretoria. Department of Agriculture, Land Reform and Rural Development.

Department of Agriculture, Land Reform and Rural Development, 2019. *High potential agricultural areas 2019 – Spatial data layer*, *North West Province*, 2021. Pretoria.

Department of Agriculture, Land Reform and Rural Development, 2016. *National land capability evaluation raster data: Land capability data layer*, 2016. Pretoria.

Land Type Survey Staff, 1972 – 2006. *Land Types of South Africa data set*. ARC – Institute for Soil, Climate and Water. Pretoria.

South Africa, 2018. *Long-term grazing capacity for South Africa*: Data layer. Government Gazette Vol. 638, No. 41870. 31 August 2018. Regulation 10 of the Conservation of Agricultural Resources Act (CARA): Act 43 of 1983. Pretoria. Government Printing Works.

The Soil Classification Working Group, 2018. *Soil Classification – Taxonomic System for South Africa.* Dept. of Agric., Pretoria.

APPENDIX A: DECLARATION OF INDEPENDENCE

DECLARATION OF THE SPECIALIST

Note: Duplicate this section where there is more than one specialist.

I MARINÉ PIENAAR... as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that:

- In terms of the general requirement to be independent:
  - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity; or
  - am not independent, but another specialist (the "Review Specialist") that meets the general requirements set out in Regulation 13 of the NEMA EIA Regulations has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
- In terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all of the requirements;
- I have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any Report, plan or document prepared or to be prepared as part of the application; and
- I am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations.

Signature of the EAP:

2022-01-07

Date:

TERRA AFRICA CONSULT CC

Name of company (if applicable):

FORM NO. BAR10/2019

APPENDIX B: CURRICULUM VITAE OF SPECIALIST

+2782-828-3587

mpienaar@terraafrica.co.za

linkedin.com/in/marinepienaar

Wolmaransstad,
South Africa

EXPERTISE

Soil Quality Assessment

Soil Policy and Guidelines

Agricultural Agro-Ecosystem Assessment

Sustainable Agriculture

Data Consolidation

Land Use Planning

Soil Pollution

Hydropedology

EDUCATION

MASTER'S DEGREE
Environmental Science
University of Witwatersrand
2010 – 2018

BACHELOR'S DEGREE
Agricultural Science
University of Pretoria
2001 – 2004

PROFESSIONAL PROFILE

I contribute specialist knowledge on agriculture and soil management to ensure long-term sustainability of projects in Africa. For the past thirteen years, it has been my calling and I have consulted on more than 200 projects. My clients include environmental and engineering companies, mining houses, and project developers. I enjoy the multi-disciplinary nature of the projects that I work on and I am fascinated by the evolving nature of my field of practice. The next section provide examples of the range of projects completed. A comprehensive project list is available on request.

PROJECT EXPERIENCE

Global Assessment on Soil Pollution

Food and Agricultural Organisation (FAO) of the United Nations (UN)

Author of the regional assessment of Soil in Sub-Saharan Africa. The report is due for release in February 2021. The different sections included:

- Analysis of soil and soil-related policies and guidelines for each of the 48 regional countries
- Description of the major sources of soil pollution in the region
- The extent of soil pollution in the region and as well as the nature and extent of soil monitoring
- Case study discussions of the impacts of soil pollution on human and environmental health in the region
- Recommendations and guidelines for policy development and capacitation to address soil pollution in Sub-Saharan Africa

Data Consolidation and Amendment

Range of projects: Mining Projects, Renewal Energy

These projects included developments where previous agricultural and soil studies are available that are not aligned with the current legal and international best practice requirements such as the IFC Principles. Other projects are expansion projects or changes in the project infrastructure layout. Tasks on such projects include the incorporation of all relevant data, site verification, updated baseline reporting and alignment of management and monitoring measures.

Project examples:

- Northam Platinum's Booysendal Mine, South Africa
- Musonoi Mine, Kolwezi District, Democratic Republic of Congo
- Polihali Reservoir and Associated Infrastructure, Lesotho
- Kaiha 2 Hydropower Project, Liberia
- Aquarius Platinum's Kroondal and Marikana Mines

PROFESSIONAL MEMBERSHIP

South African Council for Natural Scientific Professions (SACNASP)

Soil Science Society of South Africa (SSSSA)

Soil Science Society of America (SSSA)

Network for Industrially Contaminated Land in Africa (NICOLA)

LANGUAGES

English (Fluent)

Afrikaans (Native)

French (Basic)

PRESENTATIONS

There is spinach in my fish pond
TEDx Talk
Available on YouTube

♦

Soil and the Extractive Industries
Session organiser and presenter
Global Soil Week, Berlin (2015)

♦

How to dismantle an atomic bomb
Conference presentation (2014)
Environmental Law Association (SA)

PROJECT EXPERIENCE (Continued)

Agricultural Agro-Ecosystem Assessments

Range of projects: Renewable Energy, Industrial and Residential Developments, Mining, Linear Developments (railways and power lines)

The assessments were conducted as part of the Environmental and Social Impact Assessment processes. The assessment process includes the assessment of soil physical and chemical properties as well as other natural resources that contributes to the land capability of the area.

Project examples:

- Mocuba Solar PV Development, Mozambique
- Italthai Railway between Tete and Quelimane, Mozambique
- Lichtenburg PV Solar Developments, South Africa
- Manica Gold Mine Project, Mozambique
- Khunab Solar PV Developments near Upington, South Africa
- Bomi Hills and Mano River Mines, Liberia
- King City near Sekondi-Takoradi and Appolonia City near Accra, Ghana
- Limpopo-Lipadi Game Reserve, Botswana
- Namoya Gold Mine, Democratic Republic of Congo

Sustainable Agriculture

Range of projects: Policy Development for Financial Institutions, Mine Closure Planning, Agricultural Project and Business Development Planning

Each of the projects completed had a unique scope of works and the methodology was designed to answer the questions. While global indicators of sustainable agriculture are considered, the unique challenges to viable food production in Africa, especially climate change and a lack of infrastructure, in these analyses.

Project examples:

- Measurement of sustainability of agricultural practices of South African farmers – survey design and pilot testing for the LandBank of South Africa
- Analysis of the viability of avocado and mango large-scale farming developments in Angola for McKinsey & Company
- Closure options analysis for the Tshipi Borwa Mine to increase agricultural productivity in the area, consultation to SLR Consulting
- Analysis of risks and opportunities for farm feeds and supplement suppliers of the Southern African livestock and dairy farming industries
- Sustainable agricultural options development for mine closure planning of the Camutue Diamond Mine, Angola

PROFESSIONAL DEVELOPMENT

Contaminated Land Management 101 Training
Network for Industrially Contaminated Land in Africa
2020

Intensive Agriculture in Arid & Semi-Arid Environments
CINADCO/MASHAV R&D Course, Israel
2015

World Soils and their Assessment Course
ISRIC – World Soil Information Centre, Netherlands
2015

Wetland Rehabilitation Course
University of Pretoria
2010

Course in Advanced Modelling of Water Flow and Solute Transport in the Vadose Zone with Hydrus
University of Kwazulu-Natal
2010

Environmental Law for Environmental Managers
North-West University Centre for Environmental Management
2009

PROJECT EXPERIENCE (Continued)

Soil Quality Assessments

Range of projects: Rehabilitated Land Audits, Mine Closure Applications, Mineral and Ore Processing Facilities, Human Resettlement Plans

The soil quality assessments included physical and chemical analysis of soil quality parameters to determine the success of land rehabilitation towards productive landscapes. The assessments are also used to understand the suitability for areas for Human Resettlement Plans

Project examples:

- Closure Planning for Yoctolux Colliery
- Soil and vegetation monitoring at Kingston Vale Waste Facility
- Exxaro Belfast Resettlement Action Plan Soil Assessment
- Soil Quality Monitoring of Wastewater Irrigated Areas around Matimba Power Station
- Keaton Vanggatfontein Colliery Bi-Annual Soil Quality Monitoring

REFERENCES

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APPENDIX C: LAND TYPE DATA SHEETS

LAND TYPE / *LANDTIPE*...................... : **Ea69**

CLIMATE ZONE / *KLIMAATSONE* .... : 17S

Area / *Oppervlakte* .... : 43371 ha

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 400 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*

2426 Thabazimbi (21 ha) 2526 Rustenburg (43350 ha)

Inventory by / *Inventaris deur :*

R W Bruce

Modal Profiles / *Modale profiele :*

P737

Terrain unit / *Terreineenheid* .... :	1	3	4	5
% of land type / *% van landtipe* .... :	20	40	31	9
Area / *Oppervlakte (ha)* .... :	8674	17348	13445	3903
Slope / *Helling (%)* .... :	0 - 2	2 - 25	0 - 2	0 - 2
Slope length / *Hellingslengte (m)* .... :	50 - 700	100 - 1000	500 - 2000	50 - 200
Slope shape / *Hellingsvorm* .... :	Y	Z-X	Z-X	X-Z
MB0, MB1 (ha) .... :	6506	15267	13445	3903
MB2 - MB4 (ha) .... :	2169	2082	0	0

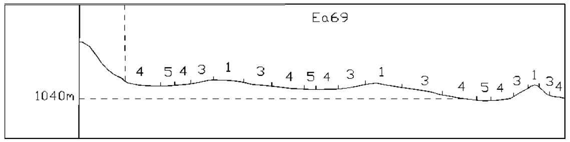
Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** **(mm)**	**MB** :	**ha**	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**	**Total** / ***Totaal*** **ha**	**%**	**Clay content %** / ***Klei-inhoud %*** **A**	**E**	**B21**	**Hor**	**Texture** / ***Tekstuur*** **Class / *Klas***	**Depth limiting material** / ***Diepte-beperkende materiaal***
Rock / Rots		4 :	1128	13	1041	6					2169	5.0						
Arcadia Ar40	500-1200+	0 :	5204	60	12838	74	10218	76	1288	33	29549	68.1	40-60			A	Cl	so
Glendale Sd21, Shortlands Sd22	600-1200+	0 :	607	7	1561	9	807	6			2975	6.9	30-40		35-60	B	fi/coSaCl-Cl	so
Shorrocks Hu36, Makatini Hu37, Marikana Hu38	600-1200+	0 :	694	8	867	5	672	5			2234	5.2	25-40		30-60	B	fi/coSaCl-Cl	so
Lindley Va41, Nyoka Sw41	250-300	0 :					1479	11	195	5	1674	3.9	20-30		35-55	B	fi/coSaCl-Cl	B2
Rensburg Rg20	700-1000	0 :							1327	34	1327	3.1	40-60			A	Cl	G
Mispah Ms10, Klipfontein Ms11, Trevanian Gs17, Williamson Gs16, Robmore Gs18	100-300	3 :	607	7	694	4					1301	3.0	15-20			A	fi/coSaLm	R,hp,so
Jozini Oa36, Dundee Du10	900-1200+	0 :							859	22	859	2.0	15-35		15-35	B	fi/coSaClLm	R,so,gc
Tshipise My20, Pafuri My21, Graythorne Mw21	250-400	3 :	434	5	347	2					781	1.8	30-40			A	SaClLm-SaCl	so,R
Rasheni Bo21, Stanger Bo11, Glengazi Bo31	600-1000	0 :					269	2	234	6	503	1.2	35-45		40-55	A	fi/coSaCl	gc

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)

Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe :* A2

Terrain form sketch / *Terreinvormskets*



Geology: Predominantly norite and pyroxenite of the Bushveld Complex; diabase and red syenite of the Pilanesberg Complex in places.

Geologie: Hoofsaaklik noriet en pirokseniet van die Kompleks Bosveld; diabaas en rooi sieniet van die Kompleks Pilanesberg op plekke.

LAND TYPE / *LANDTIPE*...................... : **Ib115**

CLIMATE ZONE / *KLIMAATSONE* .... : 584S

Area / *Oppervlakte* .... : 50000 ha

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 100 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*

2526 Rustenburg (50000 ha)

Inventory by / *Inventaris deur :*

R W Bruce

Modal Profiles / *Modale profiele :*

P753

Terrain unit / *Terreineenheid* .... :	1	2	3	4	5
% of land type / *% van landtipe* .... :	6	4	67	18	5
Area / *Oppervlakte (ha)* .... :	3000	2000	33500	9000	2500
Slope / *Helling (%)* .... :	0 - 6	>100	10 - 100	3 - 8	1 - 8
Slope length / *Hellingslengte (m)* .... :	25 - 200	25 - 100	500 - 700	100 - 1000	10 - 75
Slope shape / *Hellingsvorm* .... :	Y	Z	X-Z	X	X-Z
MB0, MB1 (ha) .... :	0	0	335	5310	1700
MB2 - MB4 (ha) .... :	3000	2000	33165	3690	800

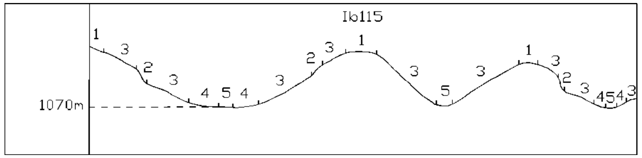
Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** **(mm)**	**MB** :	**ha**	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**	**Total** / ***Totaal*** **ha**	**%**	**Clay content %** / ***Klei-inhoud %*** **A**	**E**	**B21**	**Hor**	**Texture** / ***Tekstuur*** **Class / *Klas***	**Depth limiting material** / ***Diepte-beperkende materiaal***
Soil-rock complex		:																		
Grond-rotskompleks:		:																		
Rock/Rots		4 :	1500	50	2000	100	30485	91	360	4	500	20	34845	69.7						
Mispah Ms10, Glenrosa Gs15, Platt Gs14, Robmore Gs18, Trevanian Gs17	50-250	3 :	1500	50			2345	7	1170	13	300	12	5315	10.6	12-25			A	me/coSaLm-SaClLm	R,so
Klipfontein Ms11	50-400	3 :					335	1	2160	24			2495	5.0	12-25			A	me/coSaLm-SaClLm	hp
Shorrocks Hu36	300-1200	0 :					335	1	1890	21			2225	4.5	15-25		20-35	B	me/coSaClLm	so,R,hp
Arcadia Ar40, Dundee Du10	600-1200+	0 :									1000	40	1000	2.0	35-50			A	Cl	R,so
Sandvlei Wa31, Winterveld Wa32	300-600	0 :							990	11			990	2.0	12-25	12-25		E	coSaLm-SaClLm	hp
Chitsa Lo32	600-900	0 :							990	11			990	2.0	15-20	15-20	25-35	E	coSaLm	B2gc
Lindley Va41, Glengazi Bo31	150-250	0 :							450	5	500	20	950	1.9	15-40		35-60	B	coSaCl-Cl	B2
Balfour Es35, Estcourt Es36	200-350	0 :							270	3	200	8	470	0.9	10-20	10-20	30-40	E	LmcoSa-SaLm	B2
Davel We32	150-450	0 :							450	5			450	0.9	10-20		25-35	B	coSaClLm-SaCl	B2gc
Leslie Gc36	350-600	0 :							270	3			270	0.5	15-20		20-30	B	me/coSaClLm	hp

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)

Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe :* C5

Terrain form sketch / *Terreinvormskets*



Geology: Nepheline syenite, red syenite, trachyte, phonolite, leucitophyre, porphyrite, tuff and breccia of the Pilanesberg Complex.

Geologie: Nefelien sieniet, rooi sieniet, tragiet, fonoliet, leusitofier, porfiriet, tuf en breksie van die Kompleks Pilanesberg.

- Cultural/Heritage (Desktop) Study

Prepared for:
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A HERITAGE DESKTOP STUDY FOR A PROPOSED PROSPECTING APPLICATION FOR PORTION 5 OF THE FARM RUIGHOEK 169JP NEAR THE PILANESBERG, NORTH- WEST PROVINCE

Prepared by:
Dr Julius CC Pistorius
Archaeologist and Heritage Consultant
8 5th Avenue, Cashan x 1
Rustenburg 0299
March 2022

EXECUTIVE SUMMARY

This document contains the report on the results of a desktop heritage study which was done for Pilanesberg Platinum Mines (Pty) Ltd (hereafter referred to as PPM) for a Proposed Prospecting Right for Portion 5 of the farm Ruighoek 169JP near the Pilanesberg in the North-West Province.

To comply with legislation PPM requires knowledge of the presence, relevance and the significance of any heritage resources that may occur in the prospecting area to take pro-active measures about any heritage remains that may be affected, damaged, or destroyed when the prospecting activities are conducted. SLR Consulting (South Africa) (Pty) Ltd (SLR) and PPM therefore commissioned the author to undertake a heritage desktop study for the area to be affected by the prospecting activities.

The aims with the desktop study were the following:

- To establish whether any of the types and ranges of heritage resources as outlined in Section 38 of the National Heritage Resources Act, 1999 (No. 25 of 1999) (NHRA) do occur in the prospecting area.
- To propose mitigation measures for those types and ranges of heritage resources that may be affected by the proposed prospecting activities.

Google Earth imagery, amongst some of the sources used for the desktop heritage study for the proposed prospecting area, revealed possible rudimentary stone walled sites in the northern part of the prospecting area. However, it is uncertain whether the images on Google imagery in fact represent stone walls or merely patterns according to which vegetation growth occurred.

If any stone walled sites may occur, they may be affected by the three northern most boreholes as well as the two northern most trenches.

Consequently, detailed chance-find procedures are outlined should any stone walled sites or any other heritage resources such as graves be encountered or exposed during the proposed prospecting activities (outlined in detail).

Mitigation measures may also include shifting the positions of the boreholes and the trenches to avoid the rudimentary stone walls.

In the event of a chance-find, whether heritage resources, graves, or graveyards a Phase 2 rescue operation may be required subject to permits issued by the South African Heritage Resources Agency (SAHRA) for this purpose.

Disclaimer:

It is possible that this desktop study may have missed heritage resources in the prospecting area because no ground survey was conducted due to security issues in the area. It is also possible that heritage resources may occur below the surface of the earth and may only be exposed once prospecting commences. Google Earth imagery was also not conclusive in outlining the possible presence of rudimentary stone walled sites in the northern part of the prospecting area.

ACRONYMS AND ABBREVIATIONS

ASAPA	Association of South African Professional Archaeologists
BP	Before Present
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIA	Early Iron Age
EMPr	Environmental Management Programme
EMPR	Environmental Management Programme Report
ESA	Early Stone Age
GPS	Global Positioning System
GY	Graveyard
HIA	Heritage Impact Assessment
LIA	Late Iron Age
LSA	Late Stone Age
MIA	Middle Iron Age
MPRDA	Mineral and Petroleum Resources Development Act, Act No 28 of 2002
MSA	Middle Stone Age
NEMA	National Environmental Management Act, Act No 107 of 1998
NEM: WA	National Environmental Management: Waste Act, Act No 59 of 2008
NHRA	National Heritage Resources Act, Act No 25 of 1999
No	Number
NWA	National Water Act, Act No 36 of 1998
PHRA	Provincial Heritage Resource Agency
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SLR	SLR Consulting (South Africa) (Pty) Ltd
ToR	Terms of Reference

TERMINOLOGY

Terms that may be used in this report are briefly outlined below:

1. Conservation: The act of maintaining all or part of a resource (whether renewable or non-renewable) in its present condition to provide for its continued or future use. Conservation includes sustainable use, protection, maintenance, rehabilitation, restoration, and enhancement of the natural and cultural environment.

2. Cultural resource management: A process that consists of a range of interventions and provides a framework for informed and value-based decision-making. It integrates professional, technical and administrative functions and interventions that impact on cultural resources. Activities include planning, policy development, monitoring and assessment, auditing, implementation, maintenance, communication, and many others. All these activities are (or will be) based on sound research.

3. Cultural resources: A broad, generic term covering any physical, natural and spiritual properties and features adapted, used and created by humans in the past and present. Cultural resources are the result of continuing human cultural activity and embody a range of community values and meanings. These resources are non-renewable and finite. Cultural resources include traditional systems of cultural practice, belief or social interaction. They can be, but are not necessarily identified with defined locations.

4. Heritage resources: The various natural and cultural assets that collectively form the heritage. These assets are also known as cultural and natural resources. Heritage resources (cultural resources) include all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources, as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

5. In-Situ Conservation: The conservation and maintenance of ecosystems, natural habitats and cultural resources in their natural and original surroundings.

6. Iron Age: Refers to the last two millennia and 'Early Iron Age' to the first thousand years AD. 'Late Iron Age' refers to the period between the 16th century and the 19th century and can therefore include the Historical Period.

7. Maintenance: Keeping something in good health or repair.

8. Pre-historical: Refers to the time before any historical documents were written or any written language developed in a particular area or region of the world. The historical period and historical remains refer, for the Project Area, to the first appearance or use of 'modern' Western writing brought to the Eastern Highveld by the first Colonists who settled here from the 1840's onwards.

9. Preservation: Conservation activities that consolidate and maintain the existing form, material and integrity of a cultural resource.

10. Recent past: Refers to the 20th century. Remains from this period are not necessarily older than sixty years and therefore may not qualify as archaeological or historical remains. Some of these remains, however, may be close to sixty years of age and may, soon, qualify as heritage resources.

11. Protected area: A geographically defined area designated and managed to achieve specific conservation objectives. Protected areas are dedicated primarily to the protection and enjoyment of natural or cultural heritage, to the maintenance of biodiversity, and to the maintenance of life-support systems. Various types of protected areas occur in South Africa.

12. Reconstruction: Re-erecting a structure on its original site using original components.

13. Replication: The act or process of reproducing by new construction the exact form and detail of a vanished building, structure, object, or a part thereof, as it appeared at a specific period.

14. Restoration: Returning the existing fabric of a place to a known earlier state by removing additions or by reassembling existing components.

15. Stone Age: Refers to the prehistoric past, although Late Stone Age people lived in South Africa well into the Historical Period. The Stone Age is divided into an Earlier Stone Age (3 million years to 150 000 thousand years ago) the Middle Stone Age (150 000 years to 40 000 years ago) and the Late Stone Age (40 000 years to 200 years ago).

16. Sustainability: The ability of an activity to continue indefinitely, at current and projected levels, without depleting social, financial, physical and other resources required to produce the expected benefits.

17. Translocation: Dismantling a structure and re-erecting it on a new site using original components.

18. Project Area: refers to the area (footprint) where the developer wants to focus its development activities.

19. Phase I archaeological studies refer to surveys using various sources of data in order to establish the presence of all possible types and ranges of heritage resources in any given Project Area (excluding paleontological remains as these studies are done by registered and accredited palaeontologists).

20. Phase II studies include in-depth cultural heritage studies such as archaeological mapping, excavating and sometimes laboratory work. Phase II work may include the documenting of rock art, engraving or historical sites and dwellings; the sampling of archaeological sites or shipwrecks; extended excavations of archaeological sites; the exhumation of human remains and the relocation of graveyards, etc. Phase II work involves permitting processes, requires the input of different specialists and the co-operation and approval of the South African Heritage Resources Agency (SAHRA).

CONTENTS

1 INTRODUCTION

1.1 Background and context

This document contains the results of a desk top heritage study which was done for Pilanesberg Platinum Mines (Pty) Ltd (hereafter referred to as PPM) for a proposed Prospecting Right (PR) for Portion 5 of the farm Ruighoek 169JP near the Pilanesberg in the North-West Province**.**

For the proposed prospecting activities to be approved a Basic Assessment (BA) process is required. SLR Consulting (South Africa) (Pty) Ltd (SLR) (hereafter referred to as SLR), an independent firm of environmental consultants, has been appointed by PPM to manage the BA process. Consequently, SLR commissioned the author to undertake a heritage desk top study for the proposed prospecting area.

1.2 Aim of this report

To comply with legislation PPM requires knowledge of the presence, relevance and the significance of any heritage resources that may occur in the prospecting area to take pro-active measures about any heritage remains that may be affected, damaged, or destroyed when the prospecting activities are conducted. SLR therefore commissioned the author to undertake a heritage desk top study for the area to be affected by the prospecting activities.

The aims of the desktop study were the following:

- To establish whether any of the types and ranges of heritage resources as outlined in Section 38 of the National Heritage Resources Act, 1999 (No. 25 of 1999) (NHRA) do occur in the prospecting area.
- To establish the significance of these heritage resources as well as the level of significance of any possible impact on these heritage resources.
- To propose mitigation measures for those types and ranges of heritage resources that may be affected by the proposed prospecting activities.

1.3 Assumptions and limitations

The findings, observations, conclusions, and recommendations reached in this report are based on the author’s best scientific and professional knowledge and available information. It is important to note that a site visit was not undertaken to the project area, due to safety concerns. However, the larger project area has been surveyed on several former occasions in the past when heritage surveys were done for various mining companies (See Part 11, ‘Bibliography relating to heritage studies’). The author reserves the right to modify aspects of the report including the recommendations when new information becomes available, particularly if this information may have an influence on the reports results and recommendations.

2 DETAILS OF THE SPECIALIST

Profession: Archaeologist, Museologist (Museum Scientists), Lecturer, Heritage Guide Trainer and Heritage Consultant

Qualifications:

BA (Archaeology, Anthropology and Psychology) (UP, 1976)

BA (Hons) Archaeology (distinction) (UP, 1979)

MA Archaeology (distinction) (UP, 1985)

D Phil Archaeology (UP, 1989)

Post Graduate Diploma in Museology (Museum Sciences) (UP, 1981)

Work experience:

Museum curator and archaeologist for the Rustenburg and Phalaborwa Town Councils (1980-1984)

Head of the Department of Archaeology, National Cultural History Museum in Pretoria (1988-1989)

Lecturer and Senior lecturer Department of Anthropology and Archaeology, University of Pretoria (1990-2003)

Independent Archaeologist and Heritage Consultant (2003-)

Accreditation: Member of the Association for Southern African Professional Archaeologists. (ASAPA)

Summary: Julius Pistorius is a qualified archaeologist and heritage specialist with extensive experience as a university lecturer, museum scientist, researcher and heritage consultant. His research focussed on the Late Iron Age Tswana and Lowveld-Sotho (particularly the Bamalatji of Phalaborwa). He has published a book on early Tswana settlement in the North-West Province and has completed an unpublished manuscript on the rise of Bamalatji metal workings spheres in Phalaborwa during the last 1 200 years. He has excavated more than twenty LIA settlements in North-West and twelve IA settlements in the Lowveld and has mapped hundreds of stone walled sites in the North-West. He has written a guide for Eskom's field personnel on heritage management. He has published twenty scientific papers in academic journals and several popular articles on archaeology and heritage matters. He collaborated with environmental companies in compiling State of the Environmental Reports for Ekhurhuleni, Hartebeespoort and heritage management plans for the Magaliesberg and Waterberg. Since acting as an independent consultant he has done approximately 800 large to small heritage impact assessment reports. He has a longstanding working relationship with Eskom, Rio Tinto (PMC), Rio Tinto (EXP), Impala Platinum, Angloplats (Rustenburg), Lonmin, Sasol, PMC, Foskor, Kudu and Kelgran Granite, Bafokeng Royal Resources, Pilanesberg Platinum Mine (PPM) etc. as well as with several environmental companies.

3 DECLARATION OF INDEPENDANCE

I, Dr Julius CC Pistorius, declare the following:

- I act as an independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even, if this result in views and findings that are not favourable for the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialists report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the applications;
- I will comply with the Act, Regulations and other applicable legislation;
- I will consider, to the extent possible, the matters listed in Regulation 13;
- I understand to disclose to the applicant and the competent authority all material information in my possession
- All the particulars furnished by me in this form are true and correct 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; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

3 March 2022

4 LEGAL FRAMEWORK

South Africa's heritage resources ('national estate') are protected by international, national, provincial and local legislation which provides regulations, policies and guidelines for the protection, management, promotion and utilisation of heritage resources. South Africa's 'national estate' includes a wide range of various types of heritage resources as outlined in Section 3 of the NHRA (see Box 1).

At a national level, heritage resources are dealt with by the National Heritage Council Act, 1999 (No. 11 of 1999) and the NHRA. According to the NHRA, heritage resources are categorized using a three-tier system, namely Grade I (national), Grade II (provincial) and Grade III (local) heritage resources.

At the provincial level, heritage legislation is implemented by Provincial Heritage Resources Agencies (PHRA's) which apply the NHRA together with provincial government guidelines and strategic frameworks. Metropolitan or Municipal (local) policy regarding the protection of cultural heritage resources is also linked to national and provincial acts and is implemented by the SAHRA and the PHRA's.

4.1 Legislation relevant to heritage resources

Legislation relevant to South Africa's national estate includes the following:

1. National Environmental Management Act, 1999 (No. 107 of 1998) (NEMA)
2. Minerals and Petroleum Resources Development Act, 2022 (No. 28 of 2002) (MPRDA)
3. National Heritage Resources Act 1999, (No. 25 of 1999) (NHRA).

Box 1: Types and ranges of heritage resources (the national estate) as outlined in Section 3 of the NHRA

The National Heritage Resources Act (Act No 25 of 1999, Art 3) outlines the following types and ranges of heritage resources that qualify as part of the National Estate, namely:

(a) places, buildings structures and equipment of cultural significance;
(b) places to which oral traditions are attached or which are associated with living heritage;
(c) historical settlements and townscapes;
(d) landscapes and natural features of cultural significance;
(e) geological sites of scientific or cultural importance;
(f) archaeological and palaeontological sites;
(g) graves and burial grounds including-
 (i) ancestral graves;
 (ii) royal graves and graves of traditional leaders;
 (iii) graves of victims of conflict;(iv) graves of individuals designated by the Minister by notice in the Gazette;
 (v) historical graves and cemeteries; and
 (vi) other human remains which are not covered by in terms of the Human Tissues Act, 1983 (Act No 65 of 1983);
(h) sites of significance relating to the history of slavery in South Africa;
(i) movable objects, including -
(i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
 (ii) objects to which oral traditions are attached or which are associated with living heritage;
 (iii) ethnographic art and objects;
 (iv) military objects;
 (v) objects of decorative or fine art;
 (vi) objects of scientific or technological interest; and
 (vii) books, records, documents, photographs, positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No 43 of 1996).

The National Heritage Resources Act (Act No 25 of 1999, Art 3) also distinguishes nine criteria for places and objects to qualify as 'part of the national estate if they have cultural significance or other special value …'. These criteria are the following:

(a) its importance in the community, or pattern of South Africa's history;
1. its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
2. its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
3. its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
1. its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
2. its importance in demonstrating a high degree of creative or technical achievement at a particular period;
3. its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; (h)
4. its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
(i) sites of significance relating to the history of slavery in South Africa.

The NEMA stipulates under Section 2(4)(a) that sustainable development requires the consideration of all relevant factors including (iii) the disturbance of landscapes and sites that constitute the nation's cultural heritage must be avoided, or where it cannot be altogether avoided, is minimised and remedied. Heritage assessments are implemented in terms of the NEMA Section 24 to give effect to the general objectives. Procedures considering heritage resource management in terms of the NEMA are summarised under Section 24(4) as amended in 2008. In addition to the NEMA, the National Environmental Management: Protected Areas Act, 2003 (No. 57 of 2003) may also be applicable. This act applies to protected areas and world heritage sites, declared as such in terms of the World Heritage Convention Act, 1999 (No. 49 of 1999).

4.1.2 MPRDA

The MPRDA stipulates under Section 5(4) no person may prospect for or remove, mine, conduct technical co-operation operations, reconnaissance operations, explore for and produce any mineral or petroleum or commence with any work incidental thereto on any area without (a) an approved Environmental Management Programme (EMPr) or approved environmental management plan, as the case may be.

4.1.3 NHRA

According to Section 3 of the NHRA the 'national estate' comprises a wide range and various types of heritage resources (refer to Box 1).

4.1.3.1 Heritage Impact Assessment studies

According to Section 38 of the NHRA, a Heritage Impact Assessment (HIA) process must be followed under the following circumstances:

1. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300 m in length;
2. The construction of a bridge or similar structure exceeding 50 m in length;
3. Any development or activity that will change the character of a site and which exceeds 5 000 m^2 or which involve three or more existing erven or subdivisions thereof
4. Re-zoning of a site exceeding 10 000 m^2; and
5. Any other category provided for in the regulations of SAHRA, a provincial or local heritage authority or any other legislation such as NEMA, MPRDA, etc.

4.1.3.2 Section 34 (Buildings and structures)

Section 34 of the NHRA provides for general protection of structures older than 60 years. According to Section 34(1) no person may alter (demolish) any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure means any building, works, device or any other facility made by people and which is fixed to land and which includes fixtures, fittings and equipment associated with such structures.

Alter means any action which affects the structure, appearance or physical properties of a place or object, whether by way of structural or any other works such as painting, plastering, decorating, etc.

Most importantly, Section 34(1) clearly states that no structure or part thereof may be altered or demolished without a permit issued by the relevant PHRA. These permits will not be granted without a HIA being completed. A destruction permit will thus be required before any removal and/or demolition may take place, unless exempted by the PHRA according to Section 34(2) of the NHRA.

4.1.3.3 Section 35 (Archaeological and palaeontological resources and meteorites)

Section 35 of the NHRA provides for the general protection of archaeological and palaeontological resources, and meteorites. In the event that archaeological resources are discovered during the course of development, Section 38(3) specifically requires that the discovery must immediately be reported to the PHRA, or local authority or museum who must notify the PHRA. Furthermore, no person may without permits issued by the responsible heritage resources authority:

1. Destroy, damage, excavate, alter, deface, or otherwise disturb any archaeological or paleontological site or any meteorite;
2. Destroy, damage, excavate, remove from its original position, collect, or own any archaeological or paleontological material or object or any meteorite;
3. Trade in, sell for private gain, export, or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite; or bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological

and paleontological material or objects, or use such equipment for the recovery of meteorites; and

4. Alter or demolish any structure or part of a structure which is older than 60 years.

Heritage resources may only be disturbed or moved by an archaeologist after being issued with a permit received from SAHRA. To demolish heritage resources, the developer has to acquire a destruction permit from SAHRA.

4.1.3.4 Section 36 (Burial grounds and graves)

Section 36 of the NHRA allows for the general protection of burial grounds and graves. Should burial grounds or graves be found during development, Section 36(6) stipulates that such activities must immediately cease, and the discovery reported to the responsible heritage resources authority and the South African Police Service (SAPS). Section 36 also stipulates that no person without a permit issued by the relevant heritage resources authority may:

(a) Destroy, damage, alter, exhume, or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) Destroy, damage, alter, exhume, or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

(c) Bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Section 36 of the NHRA divides graves and burial grounds into the following categories:

1. Ancestral graves;
2. Royal graves and graves of traditional leaders;
3. Graves of victims of conflict;
4. Graves designated by the Minister;
5. Historical graves and cemeteries; and
6. Human remains.

Human remains less than 60 years old are subject to provisions of the National Health Act, 2003 (No. 61 of 2003), Ordinance 12 of 1980 (Exhumation Ordinance) and Ordinance No 7 of 1925 (Graves and dead bodies Ordinance, repealed by Mpumalanga). Municipal bylaws with regard to graves and graveyards may differ. Professionals involved with the exhumation and relocation of graves and graveyards must establish whether such bylaws exist and must adhere to these laws.

Unidentified graves are handled as if they are older than 60 years until proven otherwise.

Permission for the exhumation and relocation of graves older than sixty years must also be gained from descendants of the deceased (where known), the National Department of Health, Provincial Department of Health, Premier of the Province, and local police. Furthermore, permission must also be gained from the various landowners (i. e. where the graves are located and where they are to be relocated) before exhumation can take place.

Human remains can only be handled by a registered undertaker, or an institution declared under the Human Tissues Act, 1983 (No. 65 of 1983).

4.1.3.5 Section 37 (Public monuments and memorials)

Section 37 makes provision for the protection of all public monuments and memorials in the same manner as places which are entered in a heritage register referred to in Section 30 of the NHRA.

4.1.3.6 Section 38 (Heritage Resource Management)

Section 38 (8): The provisions of this section do not apply to a development as described in Section 38 (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (No. 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act No 50 of 1991), or any other legislation. Section 38(8) ensures cooperative governance between all responsible authorities through ensuring that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of Subsection (3), and any comments and recommendations of the relevant heritage resources authority about such development have been taken into account prior to the granting of the consent.

5 THE PROJECT AREA

5.1 Location

PPM proposes to secure a prospecting right for portion 5 of the farm Ruighoek 169JP. The area under consideration is located adjacent to an area where mining rights have been granted to PPM. Therefore, the procurement of a prospecting right is to ensure a continuation of the development of the existing operations in the area. The prospecting right area is located approximately 60 km and 28 km north-west of Rustenburg and Sun City, respectively. Various smaller towns and villages are near to the prospecting area, namely Mabeleleng (± 4 km south); Tlhatlhaganyane (± 7 km east); Makgope (± 8 km north-west); and Mkoshong (± 4.5 km south-west). An important area of interest, the Pilanesberg National Park, is located approximately 4 km to the east (see **Error! Reference source not found.**).

Figure 1: Portion 5 of the farm Ruighoek 169JP, west of the Pilanesberg is a long, narrow strip of land (grey coloured) stretching from the western edge of the Pilanesberg to the Tlhorosane hills in the west (above).

5.2 The altered state of the study area

Parts of the wider area, including portion 5 of the farm Ruighoek 169JP, have long been utilised for agricultural activities, such as dry land agriculture. However, the nature and character of the study area and beyond has also been scarred by prospecting activities conducted for chrome and other resources during the early decades of the 1900's. However, some of these disturbances may also have been caused by illegal mining activities during the more recent past.

These disturbances comprise of long scars that stretch across the land some of which are also visible near the prospecting area.

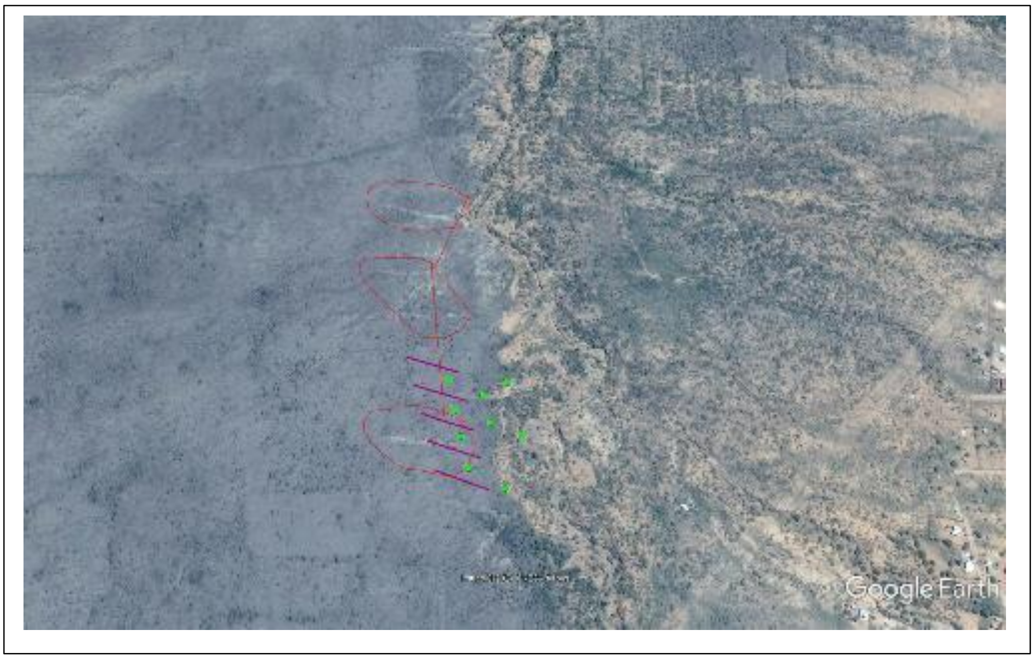

Figure 2: Note white scar marks on the land left by earlier prospecting activities near and in the proposed prospecting area (above).

5.3 Earlier heritage studies

A considerable number of heritage studies have been conducted during the last two to three decades for different development projects in the proximity of the study area. A number of these studies are listed in Part 11, Bibliography relating to earlier heritage studies'.

These studies have pointed out that the main types and ranges of heritage resources in the area comprise stone walled sites dating from the Late Iron Age. These sites are limited to the presence of outcrops of syenite as these sites were constructed with the stone from these kopjes. Most of these sites are small and do not cover as extensive surface areas as contemporary stone walled sites elsewhere in the North-West. Very few informal graveyards or graves were recorded as burials mostly occur in formalised graveyards located in the various towns between the Pilanesberg in the east and the Tlhorosane hills further to the west.

5.4 The nature of the prospecting activities

Portion 5 of the farm Ruighoek 169JP measures approximately 130 ha in extent. The prospecting right area, located on Portion 5 of the Ruighoek 169 JP, is approximately 5 ha in extent. The prospecting right area comprises a long narrow piece of land running from the Tlhorosane hills in the west to the Pilanesberg in the east. The target minerals for the project are Platinum Group Metals (PGM) including gold, nickel, copper, cobalt and other metals and minerals associated therewith (excluding chrome). The planned timeframe to complete the proposed prospecting work is provided in

.

Table 1: Proposed Work Programme

Activity	Timeframe
Phase I – Trenching and Analysis; and Initial Diamond Drilling, Logging and Reef Sample Analysis	12 months (year 1)
Phase II – Environmental Study of Prospecting Right Area; 3D Modelling; and Metallurgical Test Work and Geotechnical Investigation	24 months (year 2 – 3)

The prospecting activities would be conducted in a phased approach with each phase dependent on results of the preceding phase (Table 1). The two phases are explained in the following sections.

- **Phase I – Soil Sampling and Initial Analysis**

Phase 1 will consist of a programme where nine boreholes will be drilled, logged, and sampled. The information is required to establish the depth of the PGM-bearing reefs, comprising the UG2 Chromitite and Merensky Reef, and to check the grade and quantity of the reefs. Samples will be submitted for assay for PGMs, copper and nickel. The boreholes are planned to be between 20 – 150 m deep. In addition to the boreholes, five trenches of around 100 m long will be dug to establish the sub-outcrop position of the PGM reefs (Figure 3). The trenches will be around 1.5 m deep and 1 m wide.

- **Phase II – Final Drilling and Investigation**

A geological/structural model will be compiled so that the dimensions and locality of the mineral resource can be established. This will be followed by the compilation of a resource model. The geological and resource models will incorporate all the information from the adjacent properties, where a significant amount of drilling has been done.

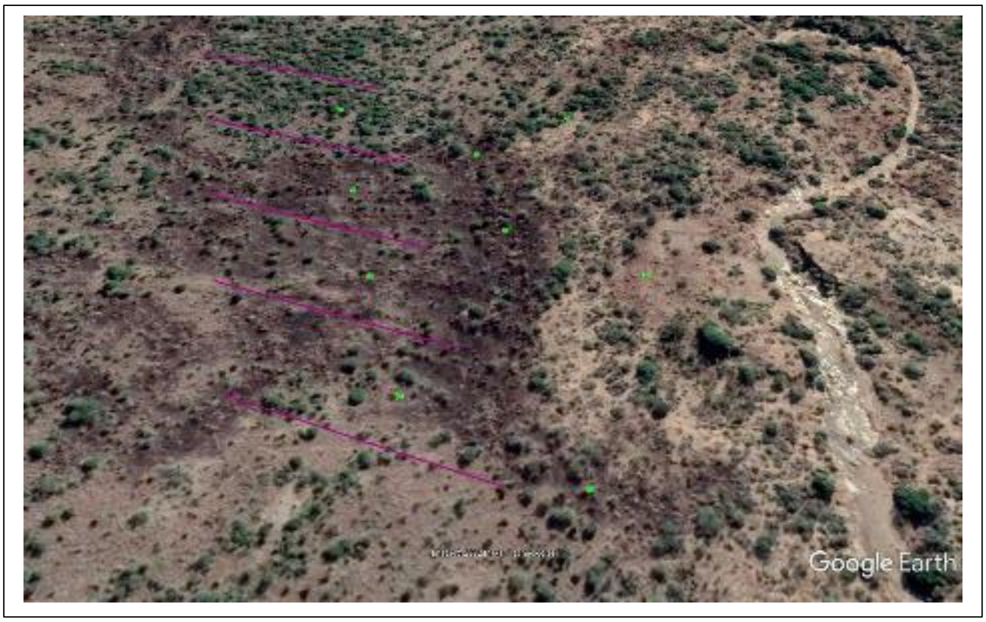

Figure 3: Proposed prospecting activities include drilling of boreholes (green dots) and excavations of trenches (red lines) (above).

6 APPROACH AND METHODOLOGY

This heritage desk top study was conducted by means of the following:

6.1 Earlier heritage surveys

A foot survey of the proposed prospecting area was not possible due to illegal mining activities which are currently ongoing near the project area and possible associated safety issues.

However, the larger project area has been subject to several heritage assessments studies in the past (see Part 11, 'Bibliography relating to heritage studies').

Google Earth imagery was used to establish the presence of any possible heritage resources in proposed developmental areas.

6.2 Databases, literature surveys and maps

Databases kept and maintained at institutions such as the PHRA, the Archaeological Data Recording Centre at the National Flagship Institute (Museum Africa) in Pretoria and SAHRA's national archive (referred to as the South African Heritage Resources Information System, [SAHRIS]) were consulted to determine whether any heritage resources of significance had been identified during earlier heritage surveys in or near the proposed prospecting area.

Literature relating to the pre-historical and the historical unfolding of the region where the project area is located was reviewed (see Part 6, 'Contextualising the Project Area' and Part 10, 'Select Bibliography).

6.3 Consultation process undertaken and comments received from stakeholders

No specific consultation process was neceassary for the heritage desktop study. All the necessasary stakeholder consultation processes for the project is being done by SLR as part of the public participation process.

7 THE HERITAGE DESKTOP STUDY

7.1 Earlier heritage surveys

As noted earlier, a considerable number of heritage studies have been done in the past near the proposed prospecting area (see Part 11, 'Bibliography relating to heritage studies'). These studies indicate that the most common type and range of heritage resource which does occur in this area consists of stone walled sites which date from the Late Iron Age (AD1600 to AD1820)

The proposed prospecting area stretches across a long, narrow piece of land from the western edge of the Pilanesberg to the Tlhorosane hills in the west. This piece of land cuts across a broad swath of land situated between the Pilanesberg in the east and the Matlapynsberg further to the west and incorporates the Tlhorosane hills situated mid-way between these mountain ranges. This land belongs to the Batlhako tribe who occupied this part of the North-West from AD1690 to the present.

Figure 4- Some stone walled settlements (yellow pointers) located in the Tlhorosane hills in the village of Mabelaleng (above).

Members of the Tlhako occupy most of the towns in this region. Older, pre-historical and historical settlements constructed with stone walls belonging to this group, and perhaps other groups with unknown identities, occur along this swath of land. Most of these settlements are concentrated along the Tlhorosane hills. Lower numbers and smaller sites occur on the level plain. Some of the important key settlements in the area include Legatalle located in the Tlhorosane hills in the town of Mabelaleng.

Legatalle was the capital of the Tlhako ruler Motsitsi (AD1740 - ?). The name Mabelaleng is derived from one of his wives. This is the only place in Tswana history (according to the author) which have been named in honour of a women. Motsitsi, and his son Molotsi who also lived here until the early nineteenth century, are well remembered from oral history. Mabelaleng may have been a successful medicine woman.

The eastern end of the prospecting area ends in the foothills of the Pilanesberg within the Tlhako Meele's sphere of influence. According to oral tradition several holy places for worship are in this part of the Pilanesberg. Their presence and location would have to be confirmed by fieldwork and advising spokespersons.

7.2 The prospecting area

Google Earth imagery suggests that some rudimentary stone walled sites may be located towards the northern part of the prospecting area. However, this is not certain as the imagery, even when using the historical timeline, is not unequivocally clear whether the outlines visible on the imagery in fact represent rudimentary stone walls or merely follow patterns of vegetation growth which can be interpreted as stone walls.

However, if any stone walled sites do occur, they may be affected by the three northern most boreholes as well as the two northern most trenches.

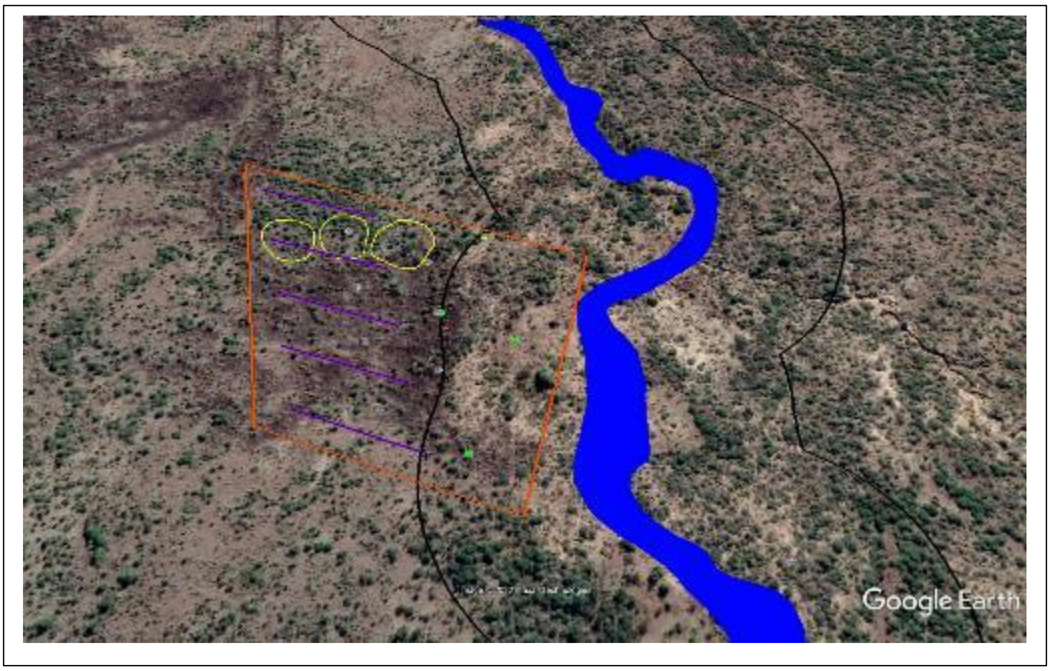

Figure 5- Possible stone walls demarcated with yellow lines according to Google imagery. However, is not clear whether these in fact represent stone walls or merely patterns according to which vegetation growth occurred (above).

7.3 Summary

The desktop heritage study for the proposed prospecting area revealed possible rudimentary stone walled sites in the northern part of the prospecting area. However, it is uncertain whether the images on Google imagery in fact represent stone walls or merely patterns according to which vegetation growth occurred.

If any stone walled sites may occur, they may be affected by the three northern most boreholes as well as the two northern most trenches.

Mitigation measures may include shifting the positions of the boreholes and the trenches to avoid these potential rudimentary stone walls.

Consequently, detailed chance-find procedures are outlined should any stone walled sites or any other heritage resources such as graves be encountered or exposed during the proposed prospecting activities (see below).

7.4 Chance-find procedures

If any heritage resources are exposed during any phase of the proposed prospecting activities the following chance-find procedures must be implemented, namely:

- The person or group (identifier) who identified or exposed the heritage resource must cease all activity in the immediate vicinity of the site.
- The identifier must immediately inform the senior on-site manager of the discovery.
- The senior on-site manager must make an initial assessment of the extent of the find and confirm that further work has stopped and ensure that the site is secured, and that controlled access is implemented.
- The senior on-site manager will inform the Environmental Officer (EO) and Health and Safety (HS) officers of the chance-find and its immediate impact on the project. The EO will then contact the project archaeologist.
- The project archaeologist will do a site inspection and confirm the significance of the discovery, recommend appropriate mitigation measures, and notify the SAHRA Archaeology, Palaeontology and Meteorites Unit (Natasha Higgitt/Phillip Hine 021 462 5402); and
- Based on the comments received from the authorities the project archaeologist will provide the mine with a Terms of References Report and associated costs if mitigation measures must be implemented.

If any graves or graveyards are exposed during any phase of the proposed prospecting activities the following chance-find procedures must be implemented, namely:

- The project archaeologist must confirm the presence of graveyards and graves and follow the following procedures.
- Inform the local SAPS and traditional authority.
- The project archaeologist in conjunction with the SAPS and traditional authority will inspect the possible graves and make an informed decision whether the remains are of forensic, recent, cultural-historical or of archaeological significance.
- Should it be concluded that the find is of heritage significance and therefore protected in terms of heritage legislation the project archaeologist will notify the SAHRA Burial Grounds and Graves Unit (Thingahangwi Tshivhase /Mimi Seetelo 012 320 8490); and
- The project archaeologist will provide advice with mitigation measures for the graveyards and graves.

Mitigation measures may also include shifting the positions of the boreholes and the trenches to avoid the rudimentary stone walls.

In the event of a chance-find, whether heritage resources, graves, or graveyards a Phase 2 rescue operation may be require subject to permits issued by SAHRA for this purpose.

8 CONCLUSION AND RECOMMENDATIONS

Google Earth imagery, amongst some of the sources used for the desktop heritage study for the proposed prospecting area, revealed possible rudimentary stone walled sites in the northern part of the prospecting area. However, it is uncertain whether the images on Google imagery in fact represent stone walls or merely patterns according to which vegetation growth occurred.

If any stone walled sites may occur, they may be affected by the three northern most boreholes as well as the two northern most trenches.

Consequently, detailed chance-find procedures are outlined should any stone walled sites or any other heritage resources such as graves be encountered or exposed during the proposed prospecting activities (outlined in detail).

Mitigation measures may also include shifting the positions of the boreholes and the trenches to avoid the rudimentary stone walls.

In the event of a chance-find, whether heritage resources, graves, or graveyards a Phase 2 rescue operation may be require subject to permits issued by SAHRA for this purpose.

DR JULIUS CC PISTORIUS
Member ASAPA

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- Palaeontology (Desktop) Study

Palaeontological Impact Assessment for the Prospecting Right Application on Farm Ruighoek 169 JP, west of Pilanesberg, North West Province

Desktop Study (Phase 1)

For

SLR Consulting (South Africa) (Pty) Ltd

26 February 2022

Prof Marion Bamford
Palaeobotanist
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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, mASSAf
Experience: 33 years research and lecturing in Palaeontology
25 years PIA studies and over 300 projects completed

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by SLR Consulting (South Africa) (Pty) Ltd. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A Palaeontological Impact Assessment was requested for the prospecting right application by Pilanesberg Platinum Mines (Pty) Ltd on the Farm Ruighoek 169JP, to the west of Pilanesberg, North West Province. They plan to dig trenches and put in boreholes.

To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the Quaternary sands and alluvium that are unlikely to preserve any fossils although the lithology is indicated as moderately sensitive on the South African Heritage Resources Information System (SAHRIS) Palaeosensitivity map. Nonetheless, a Fossil Chance Find Protocol should be added to the Environmental Management Programme (EMPr). Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the contractor/environmental officer/other designated responsible person once excavations/drilling/mining activities have commenced. The **Impact is insignificant** both before and after mitigation, therefore, as far as the palaeontology is concerned, the project should be authorised.

Table of Contents

1. Background

Pilanesberg Platinum Mines (Pty) Ltd is applying for a Prospecting Right on portion 5 of the farm Ruighoek 169JP, therefore a Basic Assessment (BA) in terms of the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) promulgated under the National Environmental Management Act, 107 of 1998 (NEMA) is being done by SLR Consulting (South Africa) (Pty) Ltd (SLR).

The Pilanesberg Platinum Mine (PPM) is an open pit platinum and chrome mining and mineral processing operation and comprises various onsite infrastructure such as an open pit mine (West Pit), temporary and permanent waste rocks dumps (WRDs), a processing plant complex, a tailings scavenger plant, a chrome recovery plant, a tailings storage facility (TSF) and support infrastructure. The current mining operation involves accessing the two commonly exploited 'Platinum Group Metals (PGM)-bearing' reef horizons, the Merensky (silicate) and UG2, in a single open-cast mining operation. In addition to the existing infrastructure, an Environmental Authorisation (EA) was issued by the Department of Mineral Resources and Energy (DMRE) on 21 July 2020 for a plant expansion on site, known as the KELL plant, for which construction is due to commence early 2022. (Figures 1, 2).

The mineral processing operations at PPM comprise a silicate (Merensky-Pseudo reef) section and a UG2 section to cater for the different reefs being mined. The mineral processing operations incorporate the following main components:

- Run of Mine (ROM) crushing and screening.
- Dense Medium Separation (DMS) for a proportion of the silicate ores.
- DMS waste storage.
- Milling and flotation circuits (one UG2 ore circuit and one Merensky ore circuit).
- Merensky (silicate) concentrator plant.
- UG2 concentrator plant.
- TSF.
- Chemical storage, mixing and dosing systems.
- Final concentrate storage and loading facilities.

DESCRIPTION OF THE PROPOSED PROJECT

<u>1a - Details of the Prospecting Right Area</u>

Pilanesberg Platinum Mines (Pty) Ltd proposes to secure a prospecting right (PR) for portion 5 of the farm Ruighoek 169JP. The area under consideration is located adjacent to an area where mining rights (MRs) have been granted. Therefore, the procurement of a PR is to ensure a development pipeline of the existing operations in the area.

The PR area is located approximately 60 km and 28 km north-west of Rustenburg and Sun City, respectively. Various smaller towns and villages are in close proximity to the prospecting area, namely Mabeleleng (± 4 km south); Tlhatlhaganyane (± 7 km east); Makgope (± 8 km north-west); and Mkoshong (± 4.5 km south-west). An important area of interest, the Pilanesberg National Park, is located approximately 4 km to the east (refer to Figure 1, 2).

Portion 5 of the farm Ruighoek 169JP measures approximately 130 ha in extent. The PR area, located on portion 5 of the farm Ruighoek 169 JP, is approximately 5 ha in extent. The co-ordinates of the boundary points of the proposed PR area are illustrated in Table 1.

Table 1: Co-ordinates of the Prospecting Right Area

Point	**Latitude**	**Longitude**
A	25º 12’ 48.58’’ S	26º 55’ 51.74’’ E
B	25º 12’ 52.12’’ S	26º 56’ 52.12’’ E
C	25º 12’ 59.21’’ S	26º 56’ 00.11’’ E
D	25º 12’ 57.24’’ S	26º 55’ 53.74’’ E

<u>1b - Details of Prospecting Activities</u>

The target minerals for the project are PGMs including gold, nickel, copper, cobalt and other metals and minerals associated therewith (excluding chrome). The planned timeframe to complete the proposed prospecting work is provided below.

The Proposed Work Programme is as follows:

- Phase I – Trenching and Analysis; and Initial Diamond Drilling, Logging and Reef Sample Analysis – planned 12 months (year 1)
- Phase II – Environmental Study of Prospecting Right Area; 3D Modelling; and Metallurgical Test Work and Geotechnical Investigation - planned 24 months (year 2 – 3)

The prospecting activities would be conducted in a phased approach, with each phase dependent on results of the preceding phase. The two phases are explained in the following sections.

<u>1c - Phase I – Soil Sampling and Initial Analysis</u>

Phase 1 will consist of a programme where nine boreholes will be drilled, logged and sampled. The information is required to establish the depth of the PGM-bearing reefs, comprising the UG2 Chromitite and Merensky Reef, and to check the grade and quantity of the reefs. Samples will be submitted for assay for PGMs, copper and nickel. The boreholes are planned to be between 20 – 150 m deep. In addition to the boreholes, five trenches of around 100 m long will be dug to establish the sub-outcrop position of the PGM reefs. The trenches will be around 1.5 m deep and 1 m wide.

<u>1d - Phase II – Final Drilling and Investigation</u>.

A geological/structural model will be compiled so that the dimensions and locality of the mineral resource can be established. This will be followed by the compilation of a resource model. The geological and resource models will incorporate all the information from the adjacent properties, where a significant amount of drilling has been done.

A Palaeontological Impact Assessment (PIA) was requested for the proposed project. To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 25 of 1999 (NHRA), a desktop PIA was completed for the proposed development and is reported herein.

Table 2: NEMA and EIA Regulations, 2014 (as amended) - Requirements for Specialist Reports (Appendix 6).

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report,	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the Environmental Management Programme (EMPr)	Section 8, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 6

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Sections 6, 8
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies of any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

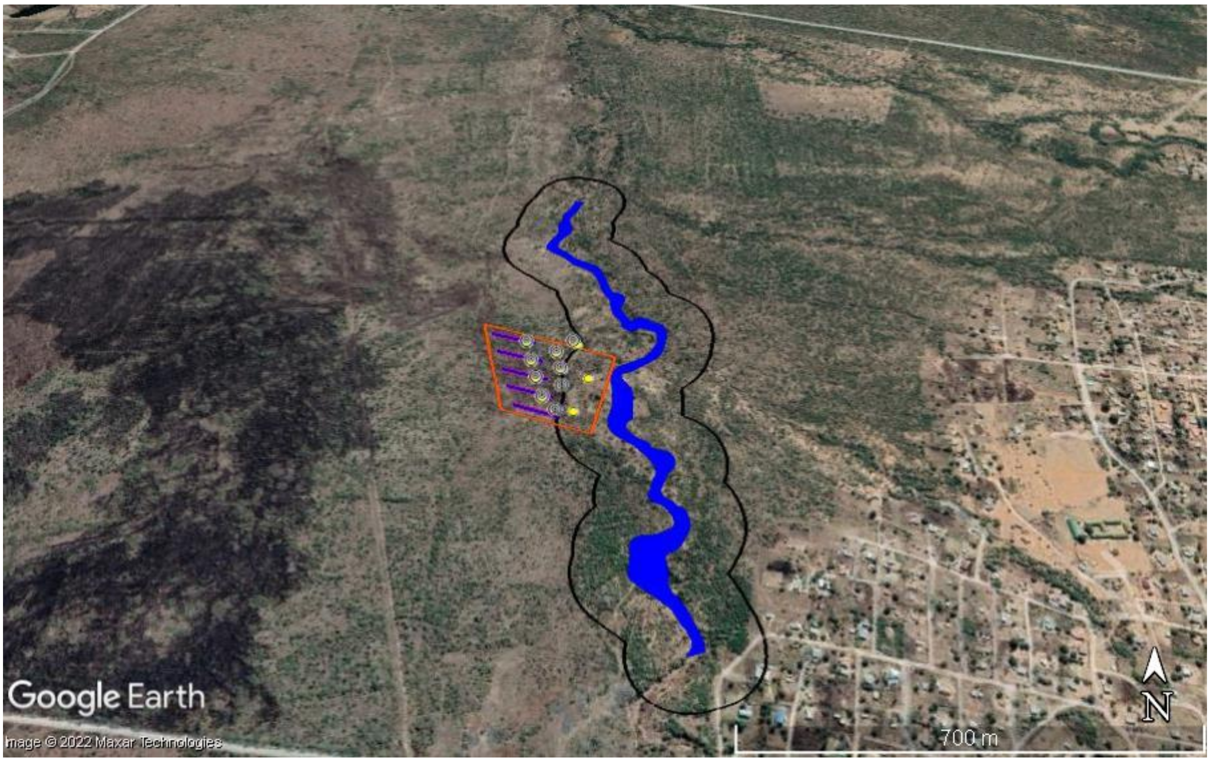

Figure 1: Google Earth map of the general area to show the relative landmarks. Portion 5 of the farm Ruighoek 169JP is shown by the orange line. Blue is the wetland buffer zone.

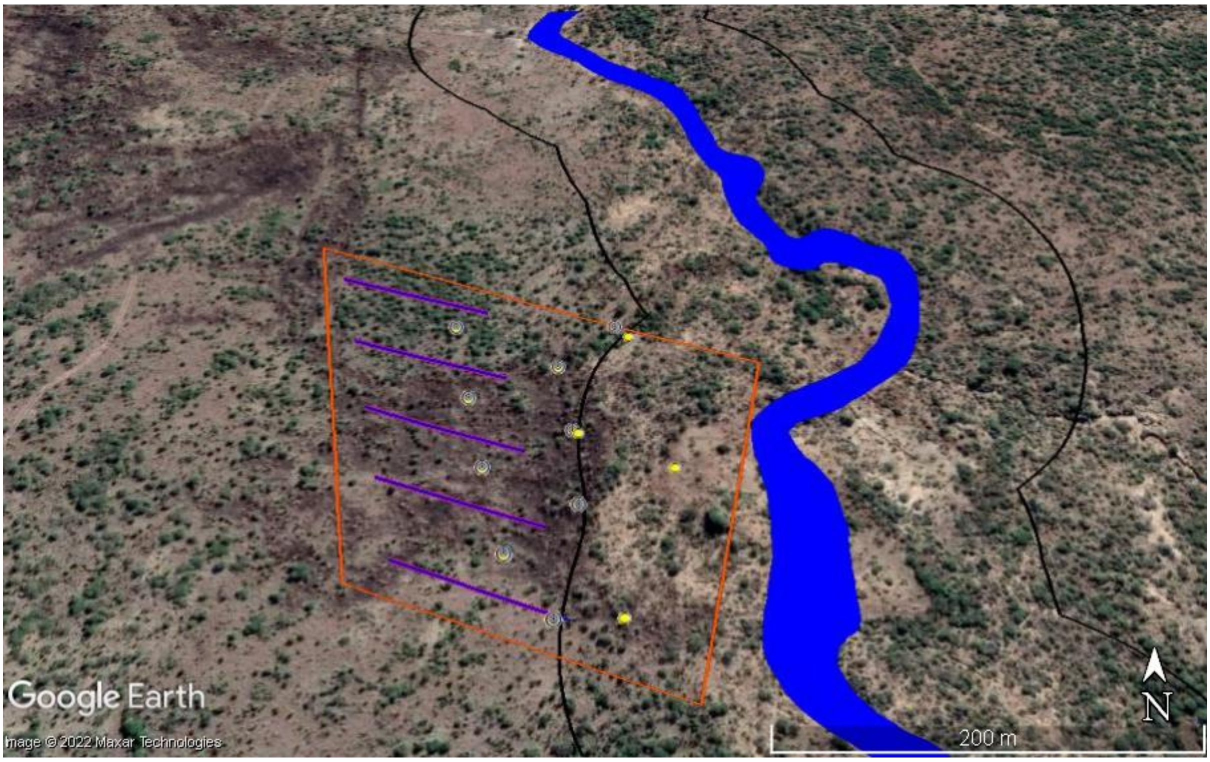

Figure 2: Google Earth Map of the proposed prospecting on portion 5 of Farm Ruighoek 169JP. Purple lies are tranches and yellow dots are the boreholes. Blue band is the wetland buffer zone. Orange line is the full extent of portion 5 of the farm Ruighoek 169JP area.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

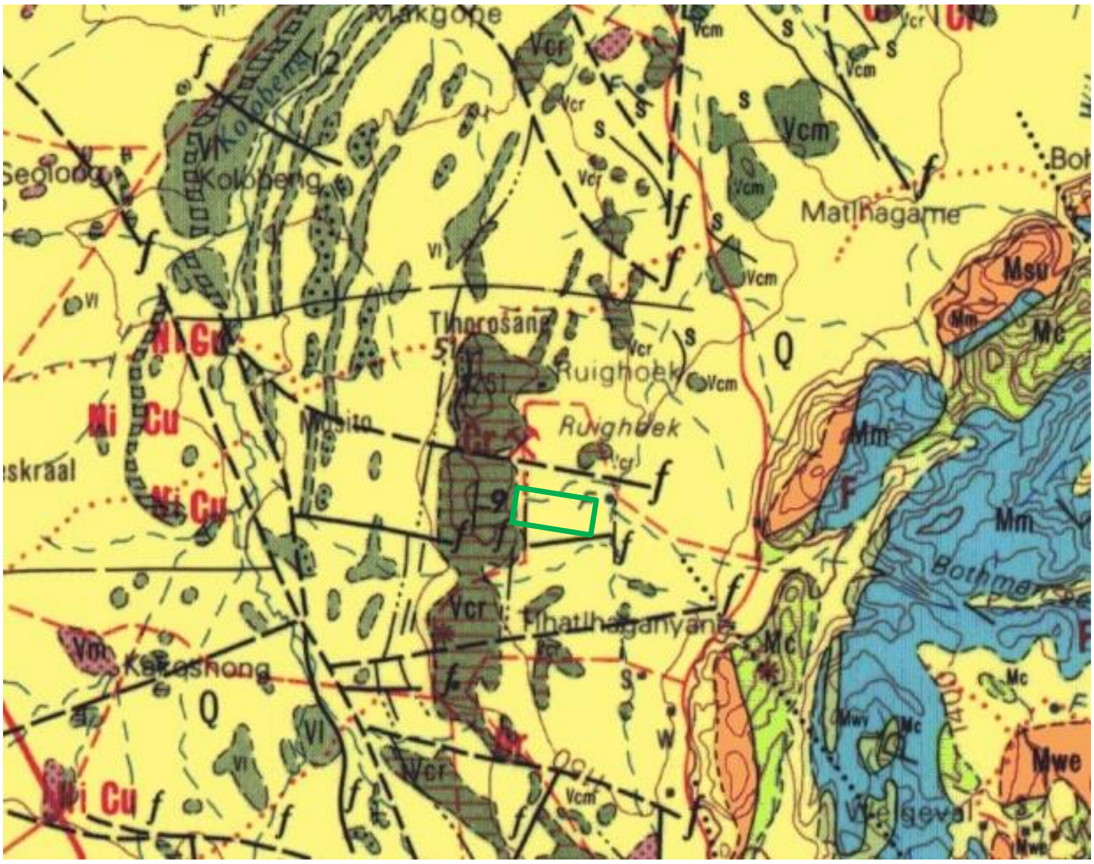

Figure 3: Geological map of the area around portion 5 of the farm Ruighoek 169JP (green rectangle). Abbreviations of the rock types are explained in Table 3. Map enlarged from the Geological Survey 1: 250 000 map 2526 Rustenburg.

Table 3: Explanation of symbols for the geological map and approximate ages (Cawthorn et al., Partridge et al., 2006; Verwoerd, 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Mc	Chakise Foyaite, Pilanesberg Complex	Foyaite	Mesoproterozoic Ca 1306 – 1180 Ma
Msu	Sun City Syenite, Pilanesberg Complex	Syenite	Mesoproterozoic Ca 1306 – 1180 Ma
M	Mamkwe Fm	Lava, tuff, breccia	
Vg	Pyramid Gabbro-norite, Rustenburg Layered Suite, Bushveld Complex	Gabbro, norite	Palaeoproterozoic Ca 2055 Ma

Symbol	Group/Formation	Lithology	Approximate Age
Vcm	Matlagame Norite, Rustenburg Layered Suite, Bushveld Complex	Norite	Palaeoproterozoic Ca 2055 Ma
Vcr	Ruighoek Pyroxenite, Rustenburg Layered Suite, Bushveld Complex	Pyroxenite	Palaeoproterozoic Ca 2055 Ma

The project area lies in the Palaeoproterozoic Transvaal Basin that is filled with several cycles of sedimentation from about 2 600 to 2055 million years ago. Then a series of volcanic rocks intruded through the sequence and these are called the Rustenburg Layered Suite of the Bushveld Igneous Complex. These volcanic rocks do not preserve any fossils but as they are rich in platinum group elements they have been well researched (Cawthorn et al., 2006 and many recent publications).

Around 1450 million years ago there was a series of volcanic and plutonic activities that produced the Pilanesberg Alkaline Province, amongst others (Verwoerd, 2006). Today this large geological structure is about 530 m^2 and rises 300-600 m above the surrounding area (ibid). The rocks are volcanic in origin and so not preserve fossils.

In more recent times the overlying sediments have been eroded from this region and replaced by Tertiary and Quaternary sands. This fluvial and aeolian sourced cover is extensive and covers large parts of the northwest and west of South Africa. According to Partridge et al. (2006) these sands form one of the largest palaeo-ergs in the world. The younger strata have been re-dated by Matmon et al., (2015) who indicated that in the southern Kalahari, the majority of deposition occurred rapidly at 1.0–1.2 Ma.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for prospecting is indicated as moderately sensitive and this applies to the surface deposits of sand and alluvium. Such young sands are unlikely to preserve fossils because the medium is transported, loose and well aerated so does not provide the necessary conditions (burial in an anoxic, low energy environment; Briggs and MacMahon, 2016). Sands, however, may bury features that could preserve fossils, such as palaeo-pans or palaeo-springs. Pans are much more common farther to the north-west (Goudie and Wells, 1995). Furthermore, such features are usually visible in the satellite imagery but nothing of this nature is visible on the Google Earth map (Figure 2).

If palaeo-pans or palaeo-springs are present then they would preserve vertebrate bones that are usually fragmented, calcified wood pieces or archaeological artefacts.

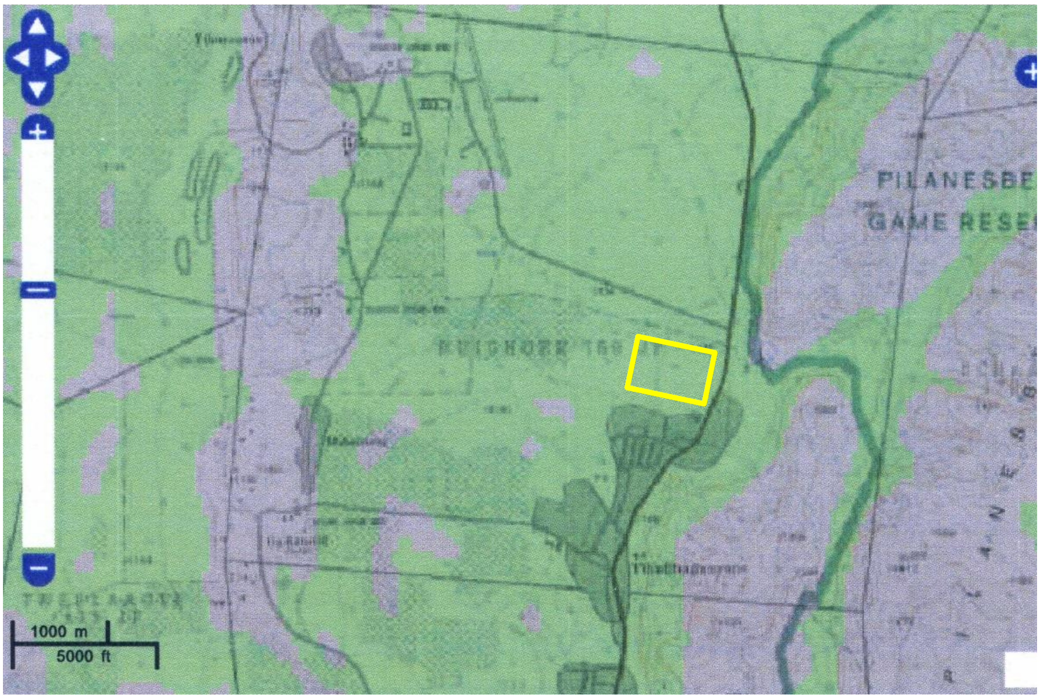

Figure 4: South African Heritage Resources Information System (SAHRIS) palaeosensitivity map for the site for the proposed PR application on portion 5 of the farm Ruighoek 169JP (yellow rectangle). Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as moderately sensitive (green) for the Quaternary alluvium and sands so a Desktop study is required.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in the SLR Impact Assessment Methodology included in Appendix C.

Table 4: For the Palaeontological Impact using the criteria:

Phase	Prospecting (excavation of trenches, boreholes)	
Feature	Pre-mitigation	Post-mitigation
Mitigation – remove any fossils found (see Section 8)	No action	Follow Fossil Chance Find Protocol – remove any fossils found
Intensity	Low	Low positive
Duration	Low	Low
Extent	Very low	Very low
Consequence	Low	Low
Probability (from above)	Unlikely – Very Low	Unlikely – Very Low

Significance (Consequence x probability)	Insignificant	Insignificant

Phase: Only the prospecting phase is relevant to the PIA. Rehabilitation would occur later, i.e. after mitigation.

Mitigation: Implement the Fossil Chance Find Protocol (Section 8 and Appendix A). If fossils occur on site they need to be photographed, removed and stored in a safe place for a palaeontologist to assess.

Intensity: Fossils have not been recorded from the area and are unlikely to be present. They would be fragmented and out of context so of limited scientific value. If fossils are found after excavations this would be a positive addition to our knowledge.

Duration: Once rescued, fossils would be removed from the site and have no impact on future activities.

Extent: Only fossils on the surface of or underground the trenches and boreholes would be affected.

Summary: Based on the nature of the project, surface activities may impact upon the fossil heritage only if preserved in the trench and borehole areas. The geological structures suggest that the rocks below ground (RLS) are too old to contain fossils and the wrong kind as igneous/volcanic rocks do not preserve fossils. The soils and alluvium on the surface do not preserve fossils. Taking account of the defined criteria, the potential impact to fossil heritage resources is insignificant, both before and after mitigation.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the gabbro, norite, pyroxenites and surface sand and alluvium are typical for the country and do not contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the Quaternary sand and alluvium, nor in any of the volcanic rocks that are expected to occur below ground (the target of the prospecting activity). There is a very small chance that fossils may occur in features such as palaeo-pans or palaeo-springs, but no such feature is visible in the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once trenching and drilling have commenced then they should be photographed, rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be **insignificant**. As far as the palaeontology is concerned, the project should be authorised.

7. References

Briggs, D.E.G., McMahon, S., 2016. The role of experiments in the taphonomy of exceptional preservation. Palaeontology 59, 1-11.

Cawthorn, R.G., Eales, H.V., Walraven, F., Uken, R., Watkeys, M.K., 2006. The Bushveld Complex. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 261-281.

Goudie, A.S., Wells, G.L., 1995. The nature, distribution and formation of pans in arid zones. Earth Science Reviews 38, 1–69.

Matmon, A., Hidy, A.J., Vainer, S., Crouvi, O., Fink, D., 2015. New chronology for the southern Kalahari Group sediments with implications for sediment-cycle dynamics and early hominin occupation. Quaternary Research. 84 (1), 118–132. http://dx.doi.org/10.1016/j.yqres.2015.04.009.

Partridge, T.C., Botha, G.A., Haddon, I.G., 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 585-604.

Verwoerd, W.J., 2006. The Pilanesberg alkaline province. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 281-383.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling / mining activities begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations/mining commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone, coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones. (for example see Appendix A - Figure 5). This information will be built into the EMP's training and awareness plan and procedures.

4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the contractor/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered, then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished, then no further monitoring is required.

9. Appendix A – Examples of fossils from the Quaternary

A – leaf impression in sandstone; B – silicified wood fragments in a stream bed; C – fossil bone fragments in the shales.

Figure 5: Photographs of fossils that could be found in Quaternary alluvium and sands. Note the fragmentary nature.

10. Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD January 2022

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.
NRF Rating: C-2 (1999-2004); B-3 (2005-2015); B-2 (2016-2020); B-1 (2021-2026)

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative

ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees
All at Wits University

Degree	Graduated/completed	Current
Honours	13	0
Masters	11	3
PhD	11	6
Postdoctoral fellows	15	1

viii) Undergraduate teaching
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 45 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 12-20 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Associate Editor Open Science UK: 2021 -
Review of manuscripts for ISI-listed journals: 30 local and international journals
Reviewing of funding applications for NRF, PAST, NWO, SIDA, National Geographic, Leakey Foundation

x) Palaeontological Impact Assessments
Selected from the past five years only – list not complete:

- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for EnviroPro
- Skeerpoort Farm Mast 2020 for HCAC

- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for EnviroPro
- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe

xi) Research Output

Publications by M K Bamford up to January 2022 peer-reviewed journals or scholarly books: over 160 articles published; 5 submitted/in press; 10 book chapters.
Scopus h-index = 30; Google scholar h-index = 35; -i10-index = 92
Conferences: numerous presentations at local and international conferences.

11. Appendix C – SLR Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
INTENSITY = VL							
DURATION	Very long	**VH**	Low	Low	Medium	Medium	High
	Long term	**H**	Low	Low	Low	Medium	Medium
	Medium term	**M**	Very Low	Low	Low	Low	Medium
	Short term	**L**	Very low	Very Low	Low	Low	Low
	Very short	**VL**	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	**VH**	Medium	Medium	Medium	High	High
	Long term	**H**	Low	Medium	Medium	Medium	High
	Medium term	**M**	Low	Low	Medium	Medium	Medium
	Short term	**L**	Low	Low	Low	Medium	Medium
	Very short	**VL**	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	**VH**	Medium	High	High	High	Very High
	Long term	**H**	Medium	Medium	Medium	High	High
	Medium term	**M**	Medium	Medium	Medium	High	High
	Short term	**L**	Low	Medium	Medium	Medium	High
	Very short	**VL**	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	**VH**	High	High	High	Very High	Very High
	Long term	**H**	Medium	High	High	High	Very High
	Medium term	**M**	Medium	Medium	High	High	High
	Short term	**L**	Medium	Medium	Medium	High	High
	Very short	**VL**	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	**VH**	High	High	Very High	Very High	Very High
	Long term	**H**	High	High	High	Very High	Very High
	Medium term	**M**	Medium	High	High	High	Very High
	Short term	**L**	Medium	Medium	High	High	High
	Very short	**VL**	Low	Medium	Medium	High	High

VL	L	M	H	VH
A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
EXTENT				

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

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

- Financial Provision

E-TEK CONSULTING

REHABILITATION, DECOMMISSIONING AND MINE CLOSURE PLAN FOR THE PROPOSED PROSPECTING RIGHT AT

PILANESBERG PLATINUM MINES

FY2021

[GNR 1147 – APPENDIX 4]

REPORT STATUS: FINAL

REPORT NO: RPT00372/F

FEBRUARY 2022

DOCUMENT CONTROL

CLIENT: **Pilanesberg Platinum Mines**

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DOCUMENT TITLE: **Rehabilitation, Decommissioning and Mine Closure Plan for the proposed prospecting right at Pilanesberg Platinum Mines FY2021**

Order Number:

Project Number: PN100485

Report Number: RPT00372/F

AUTHOR/S: Closure Plan: Anja Esterhuizen – Environmental Consultant

Closure Cost Estimation: Leon Koekemoer – Estimator

REVIEWER/S: Jeanette Erasmus – Environmental Manager

DOCUMENT DISTRIBUTION:

REVISION	STATUS	ISSUED TO		DATE
		NAME	DESIGNATION	
0	Draft Report	Kate Hamilton	SLR Associate Environmental Consultant	22/10/2021
1	Revision 1	Kate Hamilton	SLR Associate Environmental Consultant	24/11/2021
F	Final Report	Kate Hamilton	SLR Associate Environmental Consultant	21/02/2022

DETAILS OF PRACTITIONERS

NAME	EXPERIENCE / PROFESSIONAL REGISTRATION
Jeanette Erasmus *Director &* *Environmental Manager*	Jeanette obtained her B.Sc. Honours degree in Geography and Environmental studies in 2005, during that time, she worked as a Research Assistant at the Research Focus Area for Environmental Science and Management at the North-West University. She obtained her M.Sc. degree in Environmental Management, Cum Laude, in 2006 while working as an Environmental Consultant. Since then, she is working as an Environmental Manager. Jeanette is a member of the Land Rehabilitation Society of Southern Africa (LaRSSA) and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP). Her key experience includes the compilation of closure plans, risk assessments and gap analyses for closure planning as well as the project management of projects for mine closure planning, rehabilitation and remediation of disturbed areas. She also assists clients with facilitation of onsite workshops and training in understanding the mine closure planning process and management of associated liabilities.
Leon Koekemoer *Director & Estimator*	Leon has a National Diploma in Building (N.Dip. Building) and is an Associate Member of the Association of South African Quantity Surveyors (ASAQS), registration no. 29649790 and a member of the Land Rehabilitation Society of Southern Africa (LaRSSA). He was a Senior Project Manager for Beckers Building Contractors from 2005 – 2011, where his key roles included project management, cost control and quality control. Leon specialises in the development of closure liabilities and models as well as assisting and advising in the closure planning process for mining and industrial sites. His key experience includes the calculation of environmental liabilities and the representation thereof in closure models. His expertise allows him to address all categories associated with liabilities such as closure liability cash flows, rehabilitation cash flows, auditing of liabilities and operational closure costing.
Anja Esterhuizen *Environmental Consultant*	Anja completed her B.Sc. degree in Environmental Science in 2014, her B.Sc. Honours degree with distinction in Environmental Science in 2015 and her M.Sc. in Environmental Science in 2018. During 2015, she was appointed as Head Demonstrator in Botany as well as

NAME	EXPERIENCE / PROFESSIONAL REGISTRATION
	Demonstrator in Geology at the North-West University. Anja also acted as Research Assistant at Plant Ecology during 2015. Anja is a registered Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP), registration no. 121093 Anja has been employed by E-TEK Consulting as an Environmental Consultant since 2016 and have given valuable insights with regards to ecological, soil, geologic and other environmental aspects. Her focus is the compilation of closure plans, including state of the environment reports, risk assessments and gap analyses for closure planning. She also assists the Environmental Manager with preparations for onsite workshops and client liaison.

NEMA (ACT NO. 107 OF 1998): FINANCIAL PROVISIONING REGULATIONS, 2015 (NO. R. 1147)

&

REFERENCE IN THIS DOCUMENT

THE REGULATIONS APPENDIX 4	DESCRIPTION OF MINIMUM REQUIRED CONTENT	SECTION IN THIS DOCUMENT
(a)(i) (a)(ii)	Detail of Practitioner/s which compiled the Plan, including professional registrations, qualifications and experience	**Pages ii - iv**
(b)	The context of the project	**1 and 2**
(b)(i)	Material information and issues that have guided the development of the plan	
(b)(ii)	An overview of: (aa) environmental and (bb) social context That may influence, or be influenced by, the closure activities and post-mining land use	**4**
(b)(iii)	Stakeholder issues and comments that have informed the plan	**9**
(b)(iv)	The mine plan and schedule for the full approved operations, which includes: (aa) appropriate description of the mine plan; (bb) drawings and figures to indicate how the mine develops; (cc) what areas are disturbed; and (dd) how infrastructure and structures develops during operations	**2**
(c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy, including:	**8**
(c)(i)	A description of the risk assessment methodology including risk identification and quantification (all areas)	

THE REGULATIONS APPENDIX 4	DESCRIPTION OF MINIMUM REQUIRED CONTENT	SECTION IN THIS DOCUMENT
(c)(ii)	An identification of indicators that are most sensitive to potential risks and the monitoring of such risks (to inform rehabilitation and remediation activities)	
(c)(iii)	An identification of conceptual closure strategies to avoid, manage and mitigate the impacts and risk	
(c)(iv)	Reassessment of the risks to determine whether, after the implementation of the closure strategy, the latent or residual risk has been avoided and / or how it has resulted in avoidance, rehabilitation and management of impacts and whether this is acceptable to the mining operation and stakeholders;	
(c)(v)	An explanation of changes to the risk assessment results, as applicable in annual updates to the plan	
(d)	Design principles	**7**
(d)(i)	The legal and governance framework and interpretation of these requirements for the closure design principles;	**3**
(d)(ii)	Closure vision, objectives and targets, which must reflect the local environmental and socio-economic context and reflect regulatory and corporate requirements and stakeholder expectations;	**5**
(d)(iii)	Description and evaluation of alternative closure and post closure options (where these exist, that are practicable within which the operation is located)	**7**
(d)(iv)	A motivation for the preferred closure action within the context of the risks and impacts that are being mitigated;	
(d)(v)	A definition and motivation of the closure and post closure period, taking cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient	

THE REGULATIONS APPENDIX 4	DESCRIPTION OF MINIMUM REQUIRED CONTENT	SECTION IN THIS DOCUMENT
	to demonstrate that relinquishment criteria have been achieved;	
(d)(vi)	Details associated with any on-going research on closure options;	
(d)(vii)	A detailed description of the assumptions made to develop closure actions (in absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking)	
(e)	A proposed final post-mining land use which is appropriate, feasible and possible of implementation, including:	6
(e)(i)	Descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders;	
(e)(ii)	A map of the proposed final post-mining land use;	
(f)	Closure actions, including:	7
(f)(i)	The development and documenting of a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options, which must include all areas, infrastructure, activities and aspects both within the mine lease area and off of the mine lease area associated with mining for which the mine has the responsibility to implement closure actions;	
(f)(ii)	The development and maintenance of a list and assessment of threats and opportunities and any uncertainties associated with the preferred closure option, which list will be used to identify and define any additional work that is needed to reduce the level of uncertainty;	

THE REGULATIONS APPENDIX 4	DESCRIPTION OF MINIMUM REQUIRED CONTENT	SECTION IN THIS DOCUMENT
(g)	A schedule of actions for final rehabilitation, decommissioning and closure	10
(g)(i)	Scheduled to be linked to the mine works programme, if greenfields, or to the current mine plan, if brownfields;	
(g)(ii)	Schedule to include assumptions and schedule drivers;	
(g)(iii)	Including a spatial map or schedule, showing planned spatial progression throughout operations;	
(h)	An indication of the organisational capacity that will be put in place to implement the plan, including:	
(h)(i)	Organisational structure as it pertains to the plan;	
(h)(ii)	Responsibilities;	
(h)(iii)	Training and capacity building that may be required to build closure competence;	
(i)	An indication of gaps in the plan, including an auditable action plan and schedule to address the gaps;	7
(j)	Relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators;	
(k)	Closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether ongoing or once-off, are realistically estimated and incorporated into the estimates, on condition that:	11
(k)(i)	Cost estimates for operations, or components of operations that are more than 30 years from closure will be prepared as conceptual estimates with an accuracy of ± 50 per cent. Cost estimates will have an accuracy of ± 70 per cent for operations, or components of operations, 30 or less years (but more than	

THE REGULATIONS APPENDIX 4	DESCRIPTION OF MINIMUM REQUIRED CONTENT	SECTION IN THIS DOCUMENT
	ten years) from closure and ± 80 per cent for operations, or components of operations ten or less years (but more than five years) from closure. Operations with 5 or less years will have an accuracy of ± 90 per cent. Motivation must be provided to indicate the accuracy in the reported number and as accuracy improves, what actions resulted in an improvement in accuracy;	
(k)(ii)	The closure cost estimation must include: (aa) an explanation of the closure cost methodology; (bb) auditable calculations of costs per activity or infrastructure; (cc) cost assumptions;	
(k)(iii)	The closure cost estimate must be updated annually during the operation's life to reflect known developments, including changes from the annual review of the closure strategy assumptions and inputs, scope changes, the effect of a further year's inflation, new regulatory requirements and any other material developments;	
(l)	Monitoring, auditing and reporting requirements (which relates to the risk assessment, legal requirements and knowledge gaps as a minimum) and must include:	12
(l)(i)	A schedule outlining internal, external, and legislated audits of the plan for the year, including: (aa) the person responsible for undertaking the audit(s); (bb) the planned date of audit and frequency of audit; (cc) an explanation of the approach that will be taken to address and close out audit results and schedule;	
(l)(ii)	A schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders;	

THE REGULATIONS APPENDIX 4	DESCRIPTION OF MINIMUM REQUIRED CONTENT	SECTION IN THIS DOCUMENT
(l)(iii)	A monitoring plan which outlines: (aa) parameters to be monitored, frequency of monitoring and period of monitoring; (bb) an explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities;	
(m)(i)	Motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps as per 2(i).	**12**

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TERMS AND ABBREVIATIONS

TERMS & ABBREVIATIONS	DESCRIPTION
BoQ	Bill of Quantities
Closure	This involves the application for closure certificate and initiation of transfer of on-going care and maintenance to third parties
DEA	Department of Environmental Affairs
DMRE	Department of Mineral Resources and Energy
DHSWS	Department of Human Settlements, Water and Sanitation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EMP	Environmental Management Plan
E-TEK	E-TEK Consulting (Pty) Ltd
GDP	Gross Domestic Product
GG	Government Gazette
ICMM	International Council on Mining and Metals
I&APs	Interested and Affected Parties
KPIs	Key Performance Indicators
LoM	Life of Mine or Scheduled closure that happens at the planned date and/or time horizon
Post-closure	The period after mine closure
Premature or Un-scheduled Closure	Immediate closure of a site, representing decommissioning and reclamation of the site in its present state
Rehabilitation	The return of a disturbed area to its original state, or as close as possible to this state
SoER	State of Environment Report
The Regulations	The Financial Provisioning Regulations, 2015, published under Government Notice No. R. 1147 of 20 November 2015
WHO	World Health Organisation

TERMS & ABBREVIATIONS	DESCRIPTION
WRD	Waste Rock Dump
ZOI	Zones of Influence
CAPI	Computer Assisted Personal Interview
CAWI	Computer Assisted Web Interview

EXECUTIVE SUMMARY

Project Description

E-TEK Consulting (Pty) Ltd was requested by SLR Consulting (South Africa) Pty Ltd (SLR) to conduct a liability assessment for the proposed prospecting right at Pilanesberg Platinum Mines (PPM). The closure liability assessment needs to comply with the National Environmental Management Act No 107 of 1998 (GNR 1147 – Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations), previously governed by the Mineral and Petroleum Resources Development Act (MPRDA).

PPM is a subsidiary of Sedibelo Platinum Mines (SPM) and is located on the Western Limb of the Bushveld Igneous Complex (BIC). PPM is in the process of applying for a prospecting right on Portion 5 of Ruighoek 169 JP.

This document is referred to as the Final Decommissioning, Rehabilitation and Mine Closure Plan for the proposed prospecting right at PPM. This is Appendix 4, as stated in the Financial Provisioning Regulations, 2015 published under Government Notice No. R 1147 of 20 November 2015 (referred to hereafter as GNR 1147) as well as Section 24 of the National Environmental Management Act 107 of 1998.

Purpose and Approach

PPM is in the process of applying for a prospecting right on Portion 5 on Ruighoek 169 JP, with the total extent of portion 5 being 130 hectares (ha) and the disturbance due to prospecting activities estimated at approximately 5 ha.

The main purpose is to provide PPM with a document that can act as a guideline document during operational and rehabilitation activities and thereby assist them in its closure planning process and managing of the liability estimate.

The development of this plan is mainly guided by:

- Section 3: Statutory and Corporate related requirements to ensure legal compliance;
- Section 4: The State and context of the surrounding Bio-Physical - and Social Environment in which the operations are located;
- Section 5: Closure objectives and targets;
- Section 6: Post-Mining Land use/s;
- Section 7: Design principles, Closure activities and Technical solutions (Rehabilitation and Closure criteria) and
- Section 8: Closure Risk assessment (following a risk-based approach);

The approach included a comprehensive literature review of all the applicable PPM rehabilitation and closure documentation as well as discussions, meetings and workshops with the relevant parties.

Closure Objectives and Post-Mining Land Use

Closure objectives and targets are being considered as part of the ongoing Mine Closure planning process and reflects the underlying principles for the Closure vision.

These principles deal with the local environmental context, socio-economic context, regulatory and corporate requirements as well as stakeholder expectations.

In order to identify a post-mining land use, the following were considered:

- A proposed final post-mining land use which is appropriate, feasible and implementable; and
- Descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders.

The 2016 Preliminary Closure Plan indicated, through a SWOT analysis, that the most likely post-mining land use is a Wilderness Area which should be incorporated into the Heritage Park Corridor.

The post-mining land use should fit into the surrounding land uses, in order to ensure long-term sustainability of the rehabilitated mining areas. Refer to Section 6.

Rehabilitation and Closure Criteria & Risk Assessment

All potential risks, associated with the closure of the Ruighoek Portion 5 proposed prospecting area, were identified during desktop studies of the site, as well as discussions with relevant parties. Rehabilitation and Closure criteria or mitigation measures were established for each of these risks.

The risks were individually evaluated in terms of a risk matrix and ranked for the closure scenarios before and after implementation of the Rehabilitation and Closure criteria or mitigation measures. Refer to Section 7 for the Rehabilitation and Closure criteria sheet and Section 8 and Appendix B for the detailed Closure Risk Assessment.

All risks identified during the Risk Assessment Process can be mitigated with no associated residual activities or risks, therefore no risks were identified as having a medium, significant or high-risk post-mitigation.

Current and Post-closure Monitoring

There are current Monitoring programmes in place at PPM and were included as part of previous EMPs.

Closure Cost Estimation

The financial provision has been calculated to support the minimum requirements of GNR 1147 – Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations. This report provides the financial provision required for a closure scenario based on FY2021 (Current Value).

The following table presents a list of all the typical closure components identified during mine closure processes, and which represents a liability in the current calculation:

Table 1: List of Closure Components

CLOSURE COMPONENTS		APPLICABLE
1	INFRASTRUCTURAL ASPECTS	
1.1	Plant and Related Structures	No
1.2	Shafts, Adits and Declines	No
1.3	Supporting Infrastructure	No
1.4	Underground Infrastructure	No
1.5	Social Infrastructure	No
1.6	Off-Site Infrastructure	No
1.7	Linear Items	No
1.8	Waste Disposal	No
1.9	River Diversion	No
2	MINING ASPECTS	
2.1	Opencast / Pit Areas	No
2.2	Waste Rock Dumps - Overburden and Spoils	No
2.3	Coarse Residue Deposits - Processing Waste	No
2.4	Fine Residue Deposits - Processing Waste	No
3	BIO-PHYSICAL CLOSURE ASPECTS	
3.1	Water Resources	No
3.2	Climate Change	No
3.3	Sensitive Habitats and Biodiversity	No
3.4	Land Use and Land Capability	No
3.5	Soil	No
3.6	Other; Air Quality and Topography	No
4	SOCIAL CLOSURE ASPECTS	
4.1	Employees	No
4.2	Interested and Affected Parties	No
4.3	Government	No
5	GENERAL ASPECTS	
5.1	General Surfaces	Yes
5.2	Post-Closure Monitoring and Maintenance	Yes
5.3	Specialist Studies	No

The following should be noted:

- The area is currently undisturbed, and the proposed prospecting activities are set to commence after authorization has been granted (some illegal mining activities are taking place, the extent is however unknown and the disturbed areas due to this are not considered for this Closure Plan).
- Prospecting activities will take place in Y2022 and rehabilitated immediately after.

All relevant information supporting the financial provision was sourced from SLR and rates were obtained from E-TEK's existing database. In consultation with demolition and earthworks contractors these rates represent market conditions for Y2021.

The costing model that has been utilized to calculate the financial provision is aligned to the **closure components** as set out in Table 1.

The financial provision for the proposed prospecting activities at Ruighoek Portion 5 were calculated based on the requirements of Appendix 4 (Final Rehabilitation, Decommissioning and Mine Closure Plan) of GNR 1147. The requirements of GNR 1147 indicates that financial provision should be provided for the greatest number out of the 10 Year liability forecast. The closure forecast is based on the following timelines:

- Year 1 – Premature Closure (FY2021); and
- Year 2 – 10 Closure Forecast (FY2022 – FY2030).

Based on the calculations it was determined that PPM will be required to financially provide for **FY2022 of the closure forecast.** The closure forecast was based on the schedule provided as part of the project description of all listed activities forming part of Phase I.

The total **financial provision required** for Ruighoek Portion 5 proposed prospecting activities (including preliminary and general (P&G's), contingencies and VAT) has been estimated to be **R390 543.02** (Refer to Appendix C for the detail cost breakdown per component and closure forecast).

Rehabilitation and Closure Plan Overview

It is important to understand that a closure plan is the product of a dynamic approach and should therefore be reviewed and updated to ensure that all aspects and associated costs are taken into consideration. All the information should be incorporated into all mining strategies, planning and operational processes. This will ensure that the objectives set out within the document are reached and will also provide potential opportunities to reduce closure costs.

Table 2: Financial Provision Summary

PILANESBERG PLATINUM MINE APPENDIX 4 - EXECUTIVE SUMMARY FINANCIAL PROVISION FOR CLOSURE PLAN												
CLOSURE PLAN COSTS (INCLUDES P&G'S, CONTINGENCIES AND VAT AND EXCLUDES ESCALATION)			Premature Closure	Closure Forecast	Closure Forecast	Closure Forecast	Closure Forecast	Closure Forecast	Closure Forecast	Closure Forecast	Closure Forecast	Closure Forecast
CLOSURE COMPONENTS			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	**INFRASTRUCTURAL ASPECTS**		**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**
1,1	PLANT AND RELATED STRUCTURES		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
1,2	SHAFTS, ADITS AND DECLINES		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
1,3	SUPPORTING INFRASTRUCTURE		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
1,4	UNDERGROUND INFRASTRUCTURE		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
1,5	SOCIAL INFRASTRUCTURE		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
1,6	OFF-SITE INFRASTRUCTURE		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
1,7	LINEAR ITEMS		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
1,8	WASTE DISPOSAL		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
1,9	RIVER DIVERSION		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
2	**MINING ASPECTS**		**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**
2,1	OPENCAST / PIT AREAS		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
2,2	WASTE ROCK DUMPS - OVERBURDEN AND SPOILS		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
2,3	COARSE RESIDUE DEPOSITS - PROCESSING WASTE		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
2,4	FINE RESIDUE DEPOSITS - PROCESSING WASTE		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
3	**BIO-PHYSICAL CLOSURE ASPECTS**		**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**
3,1	WATER RESOURCES		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
3,2	SENSITIVE HABITATS AND BIODIVERSITY		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
3,3	LAND USE AND LAND CAPABILITY		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
3,4	SOIL		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
3,5	OTHER; AIR QUALITY AND TOPOGRAPHY		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
4	**SOCIAL CLOSURE ASPECTS**		**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**
4,1	EMPLOYEES		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
4,2	INTERESTED AND AFFECTED PARTIES		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
4,3	GOVERNMENT		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
5	**GENERAL ASPECTS**		**R -**	**R 251 557,50**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**
5,1	GENERAL SURFACES		R -	R 142 982,50	R -	R -	R -	R -	R -	R -	R -	R -
5,2	POST CLOSURE MONITORING AND MAINTENANCE		R -	R 108 575,00	R -	R -	R -	R -	R -	R -	R -	R -
5,3	SPECIALIST STUDIES		R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
	SUB-TOTAL 1		**R -**	**R 251 557,50**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**
	Weighted Preliminary and General	25%	R -	R 62 889,38	R -	R -	R -	R -	R -	R -	R -	R -
	Weighted Contingencies	10%	R -	R 25 155,75	R -	R -	R -	R -	R -	R -	R -	R -
	SUB-TOTAL 2 FOR P&G's AND CONTINGENCIES		**R -**	**R 88 045,13**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**
	SUB-TOTAL 3		**R -**	**R 339 602,63**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**
	VAT	15%	R -	R 50 940,39	R -	R -	R -	R -	R -	R -	R -	R -
	GRAND-TOTAL		**R -**	**R 390 543,02**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**	**R -**

1. INTRODUCTION

Regulations Reference: (b) & (b)(i)	**This Section deals with the context of the project, as well as the material information and issues that have guided the development of the plan.**

1.1. PROJECT DESCRIPTION AND CONTEXT

Sedibelo Platinum Mines Limited (SPM) is involved in the exploration, development, operation and processing of Platinum Group Metals (PGM) mineral deposits in the Bushveld Igneous Complex (BIC) in South Africa. Pilanesberg Platinum Mines (PPM) is a subsidiary of Sedibelo Platinum Mines (SPM) and is located on the Western Limb of the BIC (Sedibelo Platinum Mines Ltd, 2021).

PPM is in the process of applying for a prospecting right on Portion 5 of Ruighoek 169 JP which will also include the following:

Phase I – Soil Sampling and Initial Analysis

Phase 1 will consist of a programme where nine (9) boreholes will be drilled, logged and sampled. The information is required to establish the depth of the PGM-bearing reefs, comprising the UG2 Chromitite and Merensky Reef as well as determine the grade and quantity of the reefs. In addition to the boreholes, five (5) trenches will be dug to establish the sub-outcrop position of the PGM reefs.

Phase II – Final Drilling and Investigation.

A geological/structural model will be compiled so that the dimensions and locality of the mineral resource can be established. This will be followed by the compilation of a resource model.

1.2. APPROACH AND CLOSURE PLANNING

PPM is committed to implementing standards and statutory requirements pertaining to Mine Closure Planning and the associated Financial Provision. As a way of complying with all the drivers, the need is to compile a Closure and Rehabilitation Plan and Closure Liability Assessment for the prospecting right area.

E-TEK Consulting (Pty) Ltd was requested by SLR Consulting (South Africa) Pty Ltd (SLR) to conduct a liability assessment for the prospecting right at Portion 5 of Ruighoek 169 JP. The closure liability assessment needs to comply with the National Environmental Management Act No 107 of 1998 (GNR 1147 – Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations), previously governed by the Mineral and Petroleum Resources Development Act (MPRDA).

The detail of the approach may be different for diverse operations / mines and are most likely influenced by:

- legislative and corporate requirements;
- opportunities and constraints; and
- needs and expectations of stakeholders

Documentation has been aligned with and compiled towards identifying the most appropriate post-mining land use/s and closure-related performance objectives to guide the transition of operations within the new prospecting area to closure as seamlessly as possible.

It should also ensure compliance with the Legal framework for Mine closure in South-Africa. Refer to the applicable sections in this plan, for the detailed information that has guided the development of this plan.

The following are key drivers:

- Section 3: Statutory and Corporate related requirements to ensure legal compliance;
- Section 4: The State and context of the surrounding Bio-Physical - and Social Environment in which the mine is located;
- Section 6: Post-Mining Land uses;
- Section 7: Design principles, Closure activities and Technical solutions; and
- Section 8: Closure Risk assessment

2. MINE SITE CONTEXT

Regulations Reference: (b)(iv)	This Section describes the regional and local setting of the mine, as well as the site description and mine plan for the full approved operations.

2.1. REGIONAL AND LOCAL SETTING

PPM is situated on the Western Limb of the BIC in the Pilanesberg in the Moses Kotane Local Municipality within the Bojanala Platinum District Municipality, approximately 207km (by road) north west of Johannesburg and 60km north west of the city of Rustenburg, North West Province (see Figure 1 for the regional setting and Figure 2 for the local setting of the mine).

2.2. SITE DESCRIPTION AND MINE PLAN

Refer to the Mine Site Layout plan in Appendix A for the detail of the prospecting rights area.

PPM is in the process of applying for a prospecting right on Portion 5 on Ruighoek 169 JP, with the total extent of portion 5 being 130 hectares (ha) with the disturbance due to prospecting activities estimated at approximately 5 ha.

No Infrastructural and Socio-economic closure components are currently relevant to Mine Closure Planning for the prospecting right at Ruighoek Portion 5. The State of the Environment (SOE) is however outlined in Section 4.

2.3. DETAIL OF MINE OWNER AND MINING AUTHORISATION HOLDER

Pilanesberg Platinum Mines is a subsidiary of Sedibelo Platinum Mines.

Name and Address of Pilanesberg Platinum Mines:

Address: Unit FF04
Southdowns Office Park
Cnr John Voster and Karee Road
Irene Ext 54
Gauteng
0157

Phone: +27 (0) 14 555 1800

Chief Operating Officer:

The following are the details for the General Manager at the time of compilation of this closure plan:

Name:	Casper Badenhorst
Address:	Unit FF04
	Southdowns Office Park
	Cnr John Voster and Karee Road
	Irene Ext 54
	Gauteng
	0157
Phone:	+27 (0) 14 555 1800

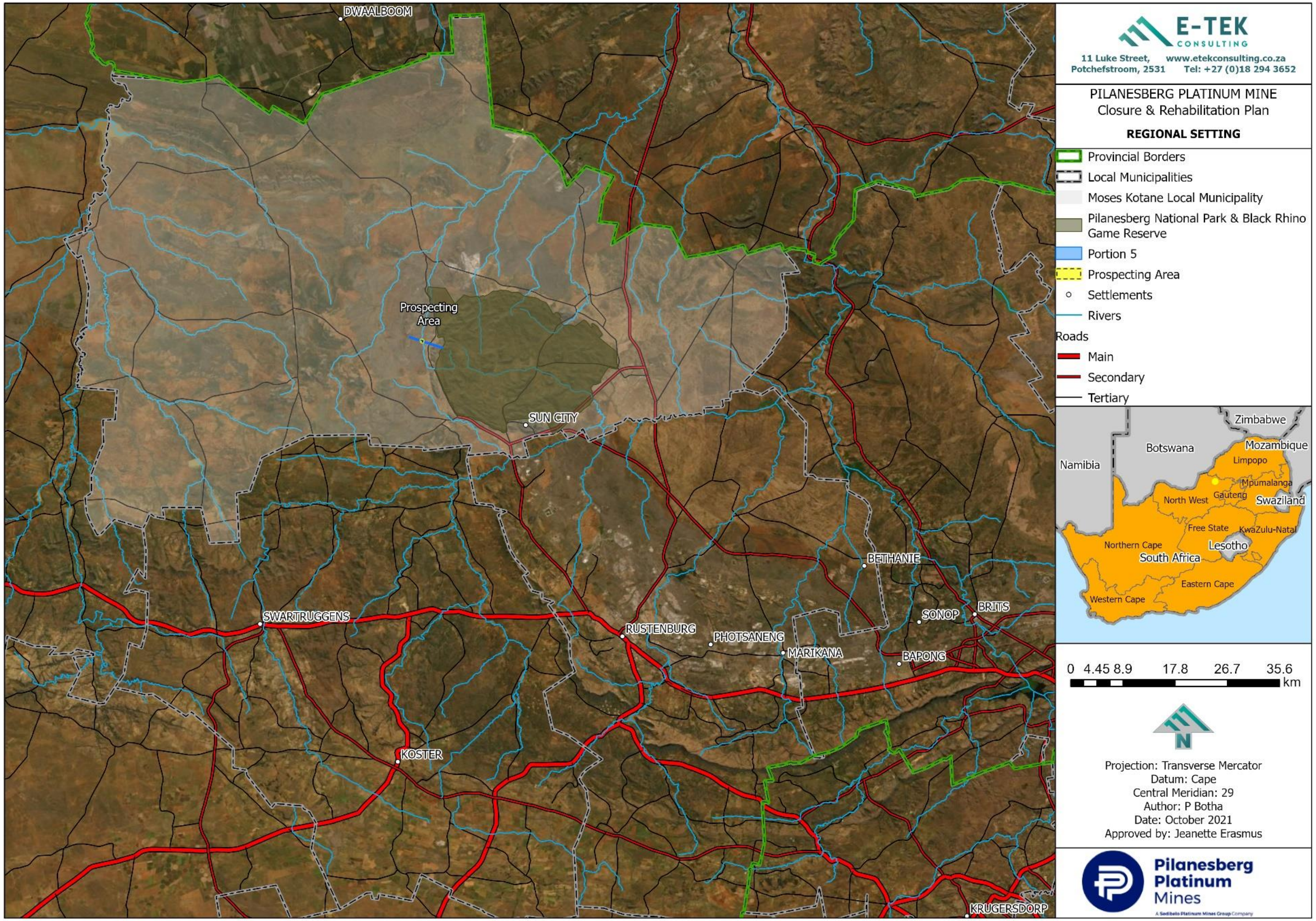

Figure 1: Regional setting of the Ruighoek Portion 5 Prospecting Area

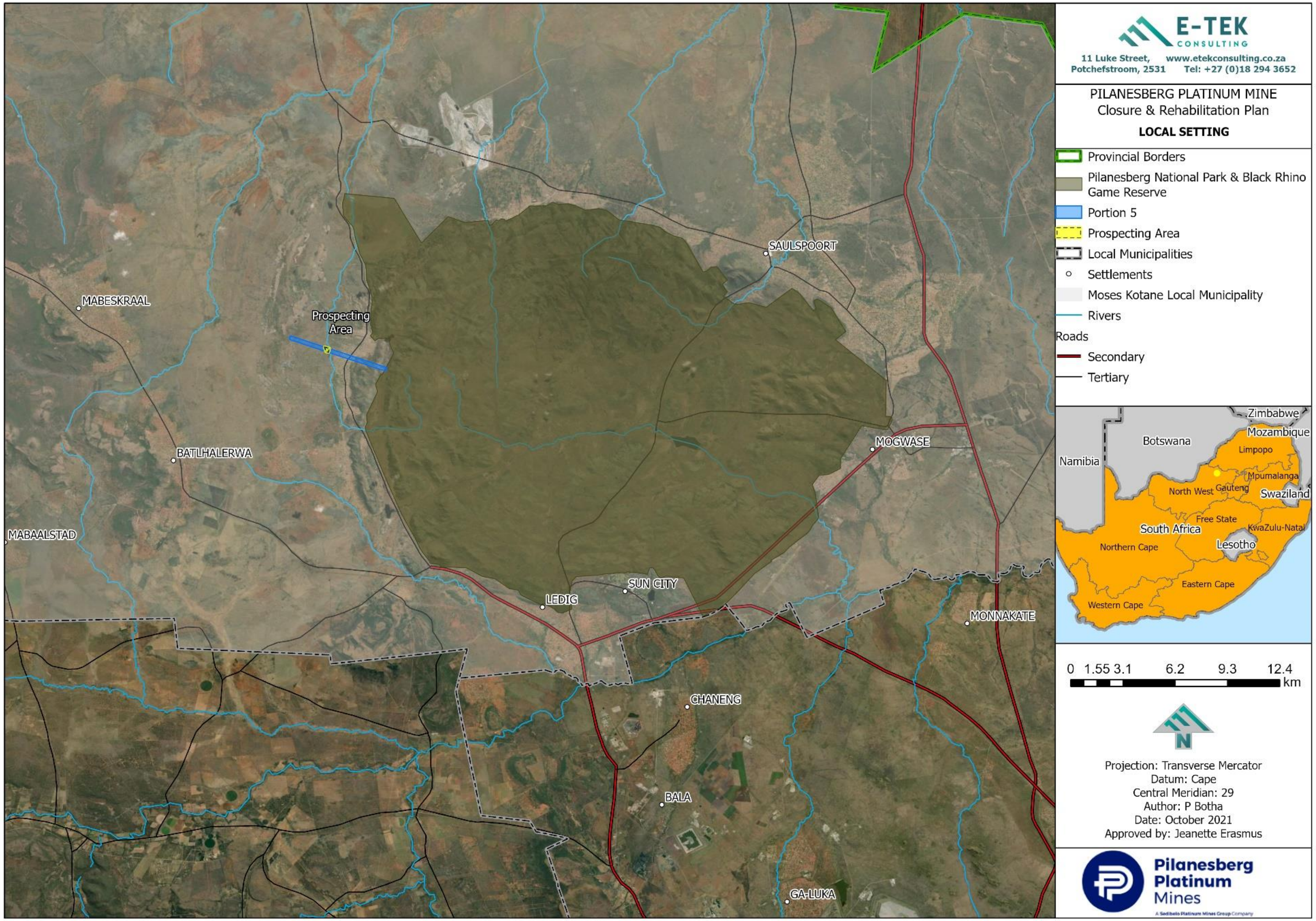

Figure 2: Local setting of the Ruighoek Portion 5 Prospecting Area

3. STATUTORY AND CORPORATE RELATED REQUIREMENTS

Regulations Reference: (b), (b)(i) & (d)(i)	This Section deals with the context of the project, as well as the material information and issues that have guided the development of the plan. It also outlines the Legal and Governance framework and interpretation of the requirements for the closure design principles.

3.1. PPM RELATED CONTEXT

3.1.1. Land Ownership

The prospecting rights falls on Portion 5 of Ruighoek 169 JP. The area under consideration is located adjacent to an area where Mining Rights 320/2002, 228/2002, 321/2002 and 67/2002 have been granted to PPM by the Department of Mineral Resources and Energy (DMRE).

The current landowners listed for portion 5 of Ruighoek 169 JP are included in the table below:

Table 3: Landowners of Portion 5 of Ruighoek 169 JP

AREA	LANDOWNER NAME	SHARES
Portion 5 of Ruighoek 169 JP	Ralegase Amon	0.2
	Moloana Moses	0.1
	Moloana Johannes B-E	0.02
	Moloana Wilhelmina	0.02
	Moloana Ngadi Joseph	0.04
	Motene Lukas	0.04
	Maloana Thomas	0.04
	Mampu David B-E	0.02
	Mampu Regina	0.02
	Moloana Lukas	0.2
	Moloana Masuputse	0.2
	Moloana Moses	0.1

3.1.2. Environmental Management Programme

The original EIA/EMP was approved by the DMRE in November 2007 and the Department of Agriculture, Conservation, Environment and Rural Development (DACERD) in February 2008 (Metago, 2011). Since the approval of the original EIA/EMP, PPM has submitted four EIA/EMP amendments to provide for the planned changes to the Pilanesberg Platinum Mines.

The first amendment which was submitted in June 2009 covered a road diversion, relocation of approved infrastructure and the addition of support infrastructure. This amendment has been authorised by North West Department of Economics, Development, Environment, Conservation and Tourism (NWDEDECT) and included a road diversion, relocation of approved infrastructure and the addition of support infrastructure (Metago, 2011).

The second amendment was submitted by PPM to the DMRE in August 2011 to amend their current closure objectives which includes the Tuschenkomst pit backfilling and re-establishment of land to a water supply and tourism hub facility. The third EIA/EMP amendment was compiled in 2011 and was submitted as an amendment to extend the Tuschenkomst open pit (Metago, 2011). The fourth EIA/EMP amendment, compiled in 2012, was submitted to apply for the mining of near-surface chrome seams by means of open pit mining methods and to establish related surface infrastructure within the existing mine boundary on the farms Witkleifontein 136 JP and Tuschenkomst 135 JP (SLR, 2012).

3.2. SOUTH AFRICAN LAWS AND REGULATIONS

Table 4: South African laws and regulations applicable to mine closure

LEGISLATION	OBJECTIVE AND RELEVANCE TO CLOSURE
Acts of parliament: **Constitution of the Republic of South Africa of 1996**	Provides inter *alia* for the right to an environment that is not harmful to human health or wellbeing, and to secure ecologically sustainable development.
Companies Act 71 of 2008	Deals inter alia with registration and liquidation of companies and thus the regulation of mining company rights and liabilities with regards to mine closure
National Environmental Management Act 107 of 1998	Framework law giving effect to the constitutional environmental right. Provides the framework for regulatory tools in respect of environmental impacts, including mining and mine closure.

LEGISLATION	OBJECTIVE AND RELEVANCE TO CLOSURE
Minerals Act 50 of 1991	Repealed by the MPRDA below, however, still relevant as holders of old order rights issued in terms of this act are still held liable for ensuring sustainable mine closure and rehabilitation.
Minerals and Petroleum Resources Development Act 28 of 2002, as amended	Main legislative provision for the granting of mineral rights. Also, the relinquishment of such rights and associated closure liabilities after successful closure and rehabilitation. Introduces the various financial vehicles which may be used to provide for closure and rehabilitation funding.
Mineral and Petroleum Resources Development Act 49 of 2008	Amendment of the above act, which started to align environmental and mining law provisions so as to avoid duplication and to allow for one system of regulation and authorisation.
Income Tax Act 58 of 1962	Regulates the payment of taxes by inter *alia* mining companies. Relevant in respect of the financial provisions required by the MPRDA above so as to ensure that sufficient funds are available to rehabilitate and close mining operations as well as providing for certain tax exemptions in respect of funds related to rehabilitation.
National Water Act 36 of 1998	Regulates the protection of the water resources and the use of water on *inter alia* mining areas. Furthermore, contains provisions relevant to mine closure with regard to water resource protection form pollution and environmental degradation.
Water Services Act 108 of 1997	Deals with the provision of *inter alia* drinking water services and quality to people, and furthermore regulates the situations where mines have undertaken to provide such services. Relevant in terms of mine closure as such services are often required despite closure of a specific site.
Mine Health and Safety Act 29 of 1996	Deals with the health and safety of employees throughout the entire mining life cycle including closure and rehabilitation operations.

LEGISLATION	OBJECTIVE AND RELEVANCE TO CLOSURE
Nuclear Energy Act 46 of 1999	Regulates the management and safety of nuclear or radioactive sources including naturally occurring radioactive matter, e.g. certain tailings facilities as well as contaminated mining plant and equipment.
Hazardous Substances Act of 1973 (Group IV Hazardous Substances)	Regulates the management and safety of sealed nuclear sources throughout the entire mining life cycle, including decommissioning and disposal at the time of closure.
National Environmental Management: Waste Act 59 of 2008 as amended by the	Regulates *inter alia* the generation, storage, management, transport and disposal of waste including mining waste such as residue deposits and residue stockpiles. Furthermore, regulates the rehabilitation of contaminated land and waste disposal facilities including mining waste facilities.
National Environmental Management Laws Amendment Act 26 of 2014	Introduces amendments in line with the MPRDA amendment act above to align the regulation and authorisation of mining activities between different acts and government departments such as the Department of Environmental Affairs and Department Mineral Resources.
National Environmental Management: Biodiversity Act 10 of 2004	Regulates the protection of biodiversity and the use of alien and invasive species on mining sites
National Environmental Management: Protected Areas Act 57 of 2003	Prohibits mining in certain protected areas.
National Environmental Management: Air Quality Act 39 of 2004	Regulates activities which may have a detrimental effect on ambient air quality including certain processes and dust generating activities such as tailings deposition.
Conservation of Agricultural Resources Act 43 of 1983	Regulates the eradication of weeds and invader plants on mining sites
National Heritage Resources Act 25 of 1999	Regulates the protection and conservation of the country's heritage resources, including mining related heritage where applicable.

LEGISLATION	OBJECTIVE AND RELEVANCE TO CLOSURE
Other legal measures **Land Use Planning Ordinances (provincial government level).**	Regulates the zoning of land for mining purposes, as well as the re-zoning of mining land post closure
Local by-laws (local municipality level).	Regulates a variety of issues on mine sites in terms of local regulations
Common law/case law.	Regulates issues such as nuisance, neighbour law, and all possible issues which may emanate from mine closure processes.
Regulations **GNR 1147 in Government Gazette (GG) 39425, 20 November 2015. Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations.**	The primary regulations pertaining to the provisions of finances for the closure and rehabilitation of mine sites, throughout the lifecycle of the mine.
GNR 982, 983, 984 and 985 in GG 38282 of 4 December 2014. Environmental Impact Regulations and Listed Activities.	Lists certain activities which require an environmental assessment and authorisation before they may be undertaken. Mine closure is specifically listed and is thus subject to an environmental assessment and the issuance of an environmental authorisation with approved closure plan.
GNR 632 in GG 39020 of 24 July 2015. Regulations for the management of residue deposits and residue stockpiles.	Sets out the regulatory framework for the management of residue deposits and stockpiles as well as the closure and rehabilitation of such facilities.
MPRDA: GNR 527 in GG 26275, 23 April 2004. Chapter 2: 'Mineral and Petroleum, Social and Environmental Regulations'.	Provided for the substantive regulations to give effect to the provisions of the Mineral and Petroleum Resources Act. Included several provisions relating to mine closure and rehabilitation
GNR 704 in GG 20119 of 4 June 1999, "Regulations of Use of Water for Mining and Related Activities	Regulates the use of water on mining areas and introduces controls to prevent and mitigate the pollution of water resources within mining areas.

LEGISLATION	OBJECTIVE AND RELEVANCE TO CLOSURE
aimed at the Protection of Water Resources".	Also regulates the management of residue deposits and residue stockpiles so as to prevent water resource pollution.
GNR 331 in GG 37603, 2 May 2014 "National Norms and Standards for the Remediation of Contaminated Land and Soil Quality".	Regulates the remediation of contaminated land including land contaminated by mining activities.
Regulations 847, 848 of 1994 of the Nuclear Energy Act 46 of 1999.	To be read with the Nuclear Energy Act above.
Other measures: accords, policies and strategies: The 1970 Fanie Botha Accord stated that mines that closed before 1956 are the responsibility of government, with those that closed afterwards to be remediated by the responsible company (Johannesburg Inner City Business Coalition (JCBC), undated).	The accord has for all intents and purposes been negated by the promulgation of the 2008 amendments to the Mineral and Petroleum resources act, which infers liability for closure to historic sites despite the 1956 cut off.
A Strategic Framework for Implementing Sustainable Development in the South African Minerals Sector: Towards Developing Sustainable Development Policy and Meeting Reporting Commitments (DME, 2007 & DME, 2009).	[Self-explanatory]
White Paper: A Minerals and Mining Policy for South Africa (the Minerals White Paper) N 2359/1998 in Government Gazette No 19344, 20 October 1998).	Sets out government policy for the exploitation of minerals in the country with specific focus on sustainability and equity.
White Paper on Environmental Policy for South Africa (The CONNEP White	Government policy regarding the achievement of South Africa's environmental right and the regulation of activities

LEGISLATION	OBJECTIVE AND RELEVANCE TO CLOSURE
Paper) (Department of Environment Affairs and Tourism, 1997).	which may have a detrimental impact on the environment, which by implication includes mining and mine closure.
White Paper on Integrated Pollution and Waste Management for South Africa: A Policy on Pollution Prevention, Waste Minimisation, Impact Management and Remediation March 2000. GN R227 GG 20978 of 17 March 2000 (DEAT, 2000).	Commits South Africa to a regulatory approach which implements inter alia the waste management hierarchy, and by implication applies to mining waste which includes residue deposits and residue stockpiles.
Water Conservation and Water Demand Management Strategy for the Industry, Mining and Power Generation Sector, August 2004.	[Self-explanatory]
National Water Resource Strategy II of 2013.	South Africa's strategy for the integrated management of the country's water resources, including the protection of water resources form pollution sources such as mine sites.

3.3. GOVERNMENT/INDUSTRY GUIDELINES AND PRACTICES

Table 5: Closure specific guidelines, Policies and Best practices

DOCUMENT DESCRIPTION	OBJECTIVE AND RELEVANCE TO CLOSURE
Environmental protection and rehabilitation • Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine, • DME Guideline document 2004 available at http://www.dmr.gov.za/publications/summary/21-mineral-policy/588-guideline-document-for-the-evaluation-of-the-quantum-of-closure.html. • Handbook of Guidelines for Environmental Protection, Chamber of Mines (CEM (SA)) (Chamber of Mines of South Africa, 1979) Volume 1/1983: The design, operation and closure of metalliferous and coal residue deposits. • Volume 2/1979: The vegetation of residue deposits against water and wind erosion • Volume 3/1981: The rehabilitation of land disturbed by surface coal mining in South Africa. • Volume 5/1982: The Chamber of Mines erosion tester (comet) instrument (for determining the erodibility of slime). • Volume 7: Statutory requirements for environmental management. • Guidelines for the Rehabilitation of Mined Land (DMR: Chamber of Mines and Coaltech Research Association, 2007). • Template guide for: “Environmental Management Plan for Small-Scale Mining”. (DMR, 1998). • Mine Residue – Code of Practice (SABS 0286:1998). • Anglo American Mine Closure Toolbox Version 1 (AAplc) (Botha & Coombes, 2007). • Anglo American Mine Closure Toolbox Version 2 (AAplc) (Anglo American Plc, 2013).	Several guidelines have been published in South Africa relating to the protection of the environment as well as mine site rehabilitation. Although not being law these guidelines provide for substantive considerations which may be used by either regulators or mines in pursuing sustainable mine closure and rehabilitation.

DOCUMENT DESCRIPTION	OBJECTIVE AND RELEVANCE TO CLOSURE
Soil, waste and biodiversity • Framework for the Management of Contaminated Land DEA 2010. • Minimum Requirements for Waste Disposal by Landfill; Handling, Classification and Disposal of Hazardous Waste; Water Monitoring at Waste Management Facilities (DWAF, 1998). • Mining and Biodiversity Guideline – Mainstreaming biodiversity into the mining sector of 2013 (DEA, DMR, CM, South African Mining and Biodiversity Forum and South African National Biodiversity Institute, 2013).	As above, these guidelines pertain to particular aspects of protection of the environment relevant to mine site rehabilitation.
Water • Water Conservation and Water Demand Management (WC/WDM) Guideline for the Mining Sector in South Africa, June 2011 (DWA, 2011). • Guideline Document for the implementation of Regulations on use of water for Mining and related activities aimed at the protection of Water Resources, Second Edition, May 2000. • Best Practice Guidelines for Water Resource Protection in the South African Mining Industry (Department of Water Affairs, 2006): • Series A: Best Practice (BP) Guideline A1.1: Small Scale Mining Practices, Aug. 2006. • Series A: BP Guideline A1: Small Scale Mining, Aug. 2006. • Series A: BP Guideline A2: Water Management for Mine Residue Deposits, Jul. 2008 • Series A: BP Guideline A3: Hydrometallurgical Plants, Jul. 2007 • Series A: BP Guideline A4: Pollution Control Dams, Aug. 2007 • Series A: BP Guideline A5: Water Management for Surface Mines, Jul. 2008 • Series A: BP Guideline A6: Water Management for Underground Mines, Jul. 2008.	A series of guidelines drafted by the Department of Water Affairs with several relating specifically to mining and mine closure activities. The aim behind the guidelines being to ensure practices consistent with the National Water Act and the National Water Resource Strategy discussed above and in so doing ensuring protection of the water resource.

DOCUMENT DESCRIPTION	OBJECTIVE AND RELEVANCE TO CLOSURE
• Series G: BP Guideline G1: Storm Water Management, Aug. 2006. • Series G: BP Guideline G2: Water and Salt Balances, Aug. 2006. • Series G: BP Guideline G3: Water Monitoring Systems, Jul. 2007. • Series G: BP Guideline G4: Impact Prediction, Dec. 2008. • Series G: BP Guideline G5: Water Management Aspects for Mine Closure, Dec. 2008 • Series H: BP Guideline H1: Integrated Mine Water Management, Dec. 2008. • Series H: BP Guideline H2: Pollution Prevention & Minimization of Impacts, Jul. 2008. • Series H: BP Guideline H3: Water Reuse & Reclamation, Jun. 2006. • Series H: BP Guideline H4: Water Treatment, Sep. 2007.	
Socio-economic • Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine (DME/DMR, 2005). • The Socio Economic Aspects of Mine Closure and Sustainable Development: Guideline for the Socio-Economic Aspects of Closure of 2010 (see Stacey *et al.*, 2010).	Socio economic guidelines for the closure of mines, providing substantive guidance on mine closure costing and socio-economic impact mitigation for closure.

3.4. THE LEGAL FRAMEWORK APPLICABLE TO MINE CLOSURE IN SOUTH AFRICA.

Historically, the MPRDA[1] obligated the holder of rights or permits (here after the holder) to rehabilitate the environment to: its natural state; or a predetermined state; or a land use which conforms to the generally accepted principle of sustainable development (South Africa, 2002: Swart, 2003). It also states that ‘the holder is responsible for any environmental damage,

[1] Section 38(d) of the Minerals and Petroleum Resources Development Act 28 of 2002

pollution or ecological degradation inside and outside of its boundaries.'[2] It is also required that holders of rights must: 'give effect to the general objectives of integrated environmental management laid down in Chapter 5 of National Environmental Management Act'; and 'must consider, investigate, assess and communicate the impact of the mining activity on the environment in terms of s. 24(7) of NEMA'[3].

Notwithstanding the relevant provisions of NEMA, mining companies were at the time required by the MPRDA to undertake an Environmental Impact Assessment (EIA) process, and to submit an Environmental Management Plan (EMP) for approval by the DMRE.[4] The EMP was required to include the environment, socio-economic conditions and cultural heritage affected by the prospecting or mining operations, as well as baseline information to determine protection and mitigation measures (Limpitlaw, 2005:Joughin, 1997) [5] Additionally, the EMP had to describe "…the manner in which the holder intends to: (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) contain or remedy the cause of pollution or degradation and migration of pollutants; and (iii) comply with any prescribed waste standard or management standards or practices."[6] The EMP furthermore had to include the environmental objectives and goals for mine closure rehabilitation as well as a closure plan as outlined in Government Notice Regulation 527 regulation 62;[7] management of identified environmental risks and liabilities and financial provision, i.e. both the methods of determining the provision and the quantum thereof [8].

In theory, the estimation of financial provisions, as provided for in the MPRDA,[9] should have been in sync with the EMP and may have been based either on rehabilitation and closure cost estimation models developed by the mining concern or the DMRE guidelines (DMR, 2005). Methods of financial provision for the rehabilitation, management, and remediation of negative environmental impacts included: an approved contribution to a trust fund; a financial guarantee from a South African registered bank, or any other bank, or financial institution approved by the Director-General; a deposit into the account specified by the Director-General; and any

[2] Section 38(e) of the Minerals and Petroleum Resources Development Act 28 of 2002

[3] Section 38(a)-(b) of the Minerals and Petroleum Resources Development Act 28 of 2002

[4] Section 39(1) of the Minerals and Petroleum Resources Development Act 28 of 2002

[5] Section 39(a)-(b) of the Minerals and Petroleum Resources Development Act 28 of 2002

[6] Section 39(3d) of the Minerals and Petroleum Resources Development Act 28 of 2002

[7] Reg 62 in GN R527 in GG 26275 of 1 May 2004

[8] Reg 52 in GN R527 in GG 26275 of 1 May 2004

[9] Section 41 of the Minerals and Petroleum Resources Development Act 28 of 2002

other methods as the Director-General may determine.[10] Mining companies were required to annually assess their environmental liability and increase their financial provision in line with such an assessment.[11] Ministerial powers to recover costs in the event of urgent remedial measures, and to remedy environmental damage were and are still provided for.[12] Finally, if a permit renewal was needed, the MPRDA[13] obligates the holder to report his or her environmental performance, rehabilitation to be completed and estimated cost thereof. In July 2013 s38-42 were repealed pending the much-anticipated move of the regulation of environmental considerations across to the NEMA dispensation. This created a temporary lacunae in the law, yet these sections were at the time still implemented as if still in force by the regulator.[14] Some months later in 2013 it was revealed that NEMA s24 (discussed below) would cater for these provisions.

At present the application for closure of a mine is regulated by both the provisions contained within the MPRDA s43[15] and those contained in NEMA[16] as discussed below. Mindful of the proposed amendments to s43 as contained within the MPRDA amendment Bill 2013, the current regulation of mine closure is discussed. [17] In terms of the MPRDA mine closure is largely regulated by section 43 as stated above. Section 43 provides an outline of the process which should be followed by regulatory bodies to grant closure certificates. Section 43(1) states that the holder of a mining right remains responsible for any environmental liability, pollution or ecological degradation, and the management thereof, until the Minister has issued a closure certificate. Section 43(4) of the MPRDA outlines the requirements which should be adhered to when applying for mine closure, as well as the submission process. Fundamentally, section 43(5) of the MPRDA stipulates that no closure certificate may be issued unless the Chief Inspector and each government department charged with the administration of any law which relates to any matter affecting the environment have confirmed in writing that the provisions pertaining to health and safety and management of potential pollution to water resources, the pumping and treatment of extraneous water and compliance to the conditions of the environmental authorisation have been addressed.

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[10] Reg 53(1) in GN R527 in GG 26275 of 1 May 2004

[11] Section 41(3) of the Minerals and Petroleum Resources Development Act 28 of 2002

[12] Section 45-46 of the Minerals and Petroleum Resources Development Act 28 of 2002

[13] Section 24(2) of the Minerals and Petroleum Resources Development Act 28 of 2002

[14] National Environmental Management Act No 107 of 1998

[15] Section 43 of the Minerals and Petroleum Resources Development Act 28 of 2002

[16] National Environmental Management Act No 107 of 1998

[17] Minerals and Petroleum Resources Development Amendment Bill in GG 36523 of 31 May 2013

In assisting the Department of Human Settlements, Water and Sanitation (DHSWS, previously DWS) in reaching such confirmation, the Best Practice (BP) Guidelines as listed above have been published (DWS, 2006). The above provisions of the MPRDA as amended, have extended the scope of the original section 43(1). These extended liabilities included in s43(1) now state that the holder of inter alia a mining right, remains responsible, apart from the original provisions relating to health, safety and water pollution for any: environmental liability; pollution; ecological degradation; the pumping and treatment of extraneous water; compliance to the conditions of the environmental authorisation, and; the management and sustainable closure thereof, until the Minister has issued a closure certificate in terms of the MPRDA. Inter alia the Department of Environmental Affairs has to be approached for comment as per the dictum of section 43(1).[18] This is a departure from the original prescription that only the DMRE and the DHSWS be consulted with regard to mine closure. The MPRDA also requires that the Council of Geoscience confirms in writing that all requisite reports in terms of section 21(1) have been compiled and submitted before a closure certificate is issued.[19]As noted above, the 8th of December 2014 saw a shift in terms the regulation of environmental impacts emanating from mining activities. Accordingly, provisions relating to the closure of mines are now contained within NEMA, specifically section 24 and accompanying regulations. At present all environmental considerations and impacts on mines are regulated in terms of the NEMA. The regulating authority, however, still remains DMRE, albeit that they now have to apply the NEMA rules. In accordance with section 24 N of NEMA, an Environmental Management Programme (EMPr) is required for any EIA submitted in relation to mining activities 24N(1A). Such an EMPr must contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of prospecting or mining operations or related mining activities which may occur inside and outside the boundaries of the operations in question. In effect giving credence to the requirements of the MPRDA as discussed above.

Similar to the provisions contained within the repealed MPRDA sections, these requirements serve to hold mines liable for environmental pollution and degradation emanating from their mining activities. In order to ensure that such liabilities can be covered by the mine in question, section 24O of NEMA prescribes that when considering an application, the competent authority must consider the applicants ability to comply with the prescribed financial

[18] Section 43(1) of the Minerals and Petroleum Resources Development Act 28 of 2002

[19] Section 21(1) of the Minerals and Petroleum Resources Development Amendment Act no 49 of 2008. The MPRDAA deals with data in respect of reconnaissance and prospecting, as well as the keeping of records, and submission of information relating thereto to the Council of Geoscience.

provisions.[20] The financial provision referenced in section 24O is detailed in section 24P of NEMA, which requires that an applicant for an authorisation pertaining to mining or related activities must comply with the prescribed financial provision for the rehabilitation, closure and on-going post decommissioning management of negative environmental impacts.[21] This financial provision must be annually assessed on the basis of the mines environmental liability to the satisfaction of the minister of mineral resources. An annual independent audit is furthermore required in order to illustrate the adequacy of the financial provision.[22] Such a financial provision has to be maintained until such time as the minister issues a mine with a closure certificate.[23] The minister does, however, maintain the prerogative to retain any part of the financial provisions as is deemed fit so as to rehabilitate the closed mining or prospecting operation in respect of latent or residual environmental impacts. Further provisions with regard to the financial provisions for mine closure in terms of NEMA are contained within the regulations pertaining to the financial provision for the rehabilitation, closure and post closure of prospecting, exploration, and mining or production operations.[24] Section 24R of NEMA deals with environmental liabilities and states that the holder of a right, holder of and old order right, or holder of works (the listing of the different types of rights spanning the history of mining rights in South Africa, thus implying retrospectively of this section) remains responsible for any environmental liability, pollution, or ecological degradation, the pumping and treatment of extraneous water, the management and sustainable closure thereof, until the minister of mineral resources has issued a closure certificate in terms of the MPRDA. In effect, 24R applies a retrospective liability on mines, even those which were closed before the enactment of the MPRDA. This liability is also contained within section 28 of NEMA, albeit indirectly. In gearing up for the implementation of the NEMA provisions in so far as they relate to mining, and particularly mine closure, the DEA have drafted a number of regulations to flesh out the regulatory provisions as discussed above. These regulations deal with inter alia the financial provision for mine closure, as discussed above, and the management of residue deposits and

[20] Section 24O1(b)(iiiA) of the National Environmental Management Act No 107 of 1998

[21] Section 24P(1) of the National Environmental Management Act No 107 of 1998

[22] Section 24P(3) of the National Environmental Management Act No 107 of 1998

[23] Section 24P(5) of the National Environmental Management Act No 107 of 1998

[24] GNR 1147 in GG 39425 of 20 November 2015.

residue stockpiles.[25] This provision, namely 24R, read in accordance with the proposed perpetual liability amendment provision as contained in section 43 of the MPRDA bill 2013 [26]

One of the most significant changes to the regulatory regime is the requirement as of December 2014 for mines to conduct an EIA for closure. A closure certificate is thus required in terms of s43 of the MPRDA, along with an Environmental Authorisation in terms of s24 of NEMA, before a mine is deemed to have closed. The result being two authorisations, issued by the same ministry, along with approval from all other ministries related to the environment as discussed above. The required EIA in terms of Section 24 and GNR 983, must be accompanied by an approved closure plan in terms of GNR 982, which stipulates which closure activities will be undertaken, and how any adverse or negative environmental impacts will be mitigated.

It is against this background that the following closure plan has been drafted in accordance with GNR 1147 and the requirements stipulated therein for closure plans.

[25]The Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits from a Prospecting, Mining, Exploration or Production Operation were published in GNR 632 of 24 July 2015 in GG 39020.

[26] Section 43 of the Minerals and Petroleum Resources Development Amendment Bill in GG 36523 of 31 May 2013

4. STATE OF THE ENVIRONMENT

Regulations Reference: (b)(ii)	This Section gives an overview of the environmental and social context that may influence, or be influenced by, the closure activities and post-mining land use.

4.1. BIO-PHYSICAL ENVIRONMENT

This section of the Rehabilitation and Closure Plan gives a broad description of the regional state of the environment within which the mine will be developed and will be closed. It should therefore be read within the context of mine closure.

The description of environmental and social aspects allows for proactive decisions to be made in line with sustainability principles while also keeping closure in mind.

Refer to the 2012 EMP for detailed management or sector plans for the different components (geology, soils, biodiversity etc.). The following sections should be updated as more recent information becomes available.

4.1.1. Water Resources

According to the Department of Water Affairs (2012), freshwater is becoming more scarce due to unsustainable use, climate change, resource pollution, increased demand and wastage. The increase in water abstraction has also led to the decline in biodiversity and ecosystem productivity in certain areas. Wetland areas are being destroyed and some rivers are drying up, contributing to the increase in endangered fish species. Settlements, mining, agriculture and industrial activities all have the potential to negatively affect the surface and ground water quality, it is therefore important to monitor and maintain water resources (Department of Water Affairs, 2012).

4.1.1.1. Surface water

The Pilanesberg mountain range influences the surface water drainage within the area. The Mothlabe River drains just east of the prospecting rights area and joins with the Kolobeng River and Magoditshane River System which flows northeast and joins the Crocodile River (refer to Figure 3).

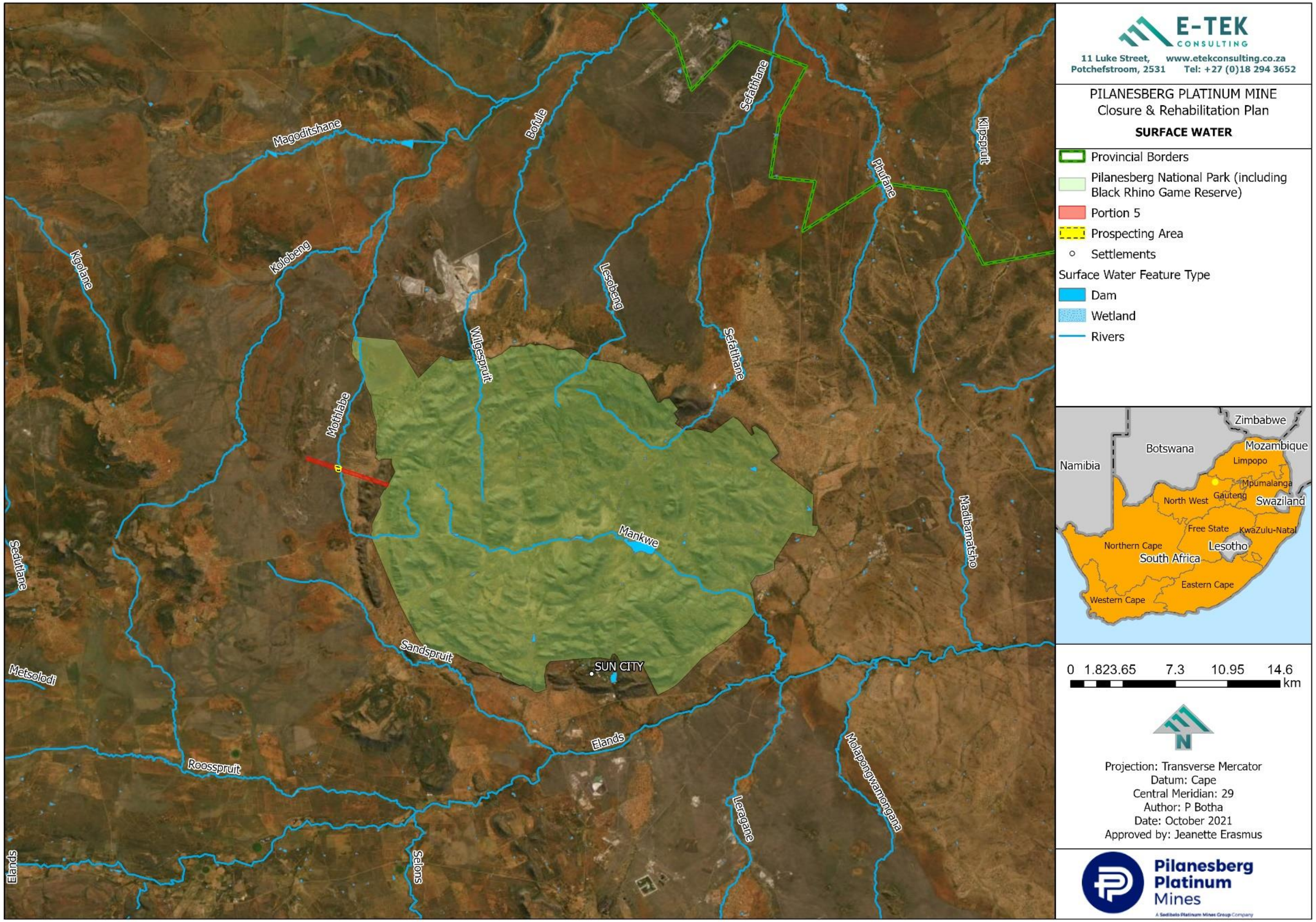

Figure 3: Ruighoek Portion 5 Proposed Prospecting Area Surface Water

4.1.1.2. Groundwater

Groundwater is defined as water found beneath the ground surface between rock/soil pores and/or fractures (IUCN, 2016). The permeable layer (including the rock/soil pores and/or fractures) which transports the groundwater are referred to as aquifers (Monroe, Wicander, & Hazlett, 2007).

Groundwater is usually found between 13 and 35 meters below ground level (mbgl). The groundwater flow slopes away from the Pilanesberg Complex and therefore correlates with the contours of the area with regards to “flowing” downhill. Fluoride concentrations have been found to be elevated in boreholes within the surrounding area, this is however attributed to the fluoride-bearing volcanic rocks associated with the Pilanesberg Complex (GreenMind, 2016).

4.1.1.3. Biomonitoring

Biomonitoring can be defined as biologically orientated measurements with the aim of protecting, preserving, and correcting the biological integrity of natural systems. Biological integrity is in turn defined as “the maintenance of community structure and function characteristic of a particular locale” (de Zwart, 1995).

Currently no biomonitoring is done at PPM, however, it is included as part of the action plan in the 2012 EMP regarding maintenance and aftercare of final landforms and rehabilitated areas. Therefore, it is recommended that this be included in future updates of this plan.

4.1.2. Climate and Climate Change

Reed and Stringer (2015) defines climate as “a statistical description of the weather, taking into account variables including temperature, wind speed and direction, and rainfall, over a long time period”.

The area is located within the Highveld Climatic Zone and receives most of its precipitation in the summer months during thunderstorms. The thunderstorms are usually short but high intensity and occur every three to four days. Temperatures within the area are generally mild with frost occurring in the winter months. The annual average temperature is approximately 20ºC (SLR, 2012). Average annual rainfall is noted at approximately 690mm (Climate-Data.Org, 2021).

Different models have been used to predict the increase in temperature, and studies that have used these models have indicated that the annual mean surface temperature could increase by 2 to 6 ºC by 2050. The rise in temperature will possibly lead to changes in the hydrological cycle (thus changes in evapotranspiration, precipitation, soil moisture and runoff) and possibly cause the inland areas of large continents to experience further drying (Verstraete & Schwartz, 1991; Ragab & Prudhomme, 2002).

The above mentioned should be considered as operations move closer to the closure and rehabilitation phase as this will affect the success of the rehabilitation activities with regards to vegetation establishment, growth and sustainability thereof.

4.1.3. Geology and Soils

4.1.3.1. Regional

Geology

PPM is located on the Western Limb of the BIC. The Bushveld Complex holds most of the world's chromium, platinum (Merensky Reef and UG2 are two layers found in the Bushveld Complex containing platinum), vanadium and refractory minerals. It has three components, namely the Rustenburg Layered Suite, Lebowa Granite Suite and the Rooiberg Group. Rocks in the Complex consist of volcanic rocks as well as basaltic magmas which created a large chamber underground. After the intrusion of basalt, another rock intruded the primary rocks, namely granite. The Complex was then covered by sedimentary rocks which have been eroded to expose the present-day geologic formations of the Complex (McCarthy & Rubidge, 2005).

4.1.3.2. Local

Geology

The geology of the Pilanesberg formation, located east of the prospecting rights area, has high variability with regards to geology. However, within the prospecting rights area, rocks are mostly comprised of surface deposits with an area comprising of leuconorite, anorthosite, pyroxenite and chromatite immediately east (refer to Figure 4).

Basaltic rocks usually weather into basic (alkaline) soils with a higher clay content, while granite rocks weather into more acidic sandy soils with a low clay content (Van Oudtshoorn, 2015).

Soils

The soils found within and around the proposed prospecting rights area include one or more of the following soil types: vertic, melanic, red structured diagnostic horizons and undifferentiated soils (refer to Figure 5) (the outcome of the high-level study conducted in 2021 should be included once it becomes available).

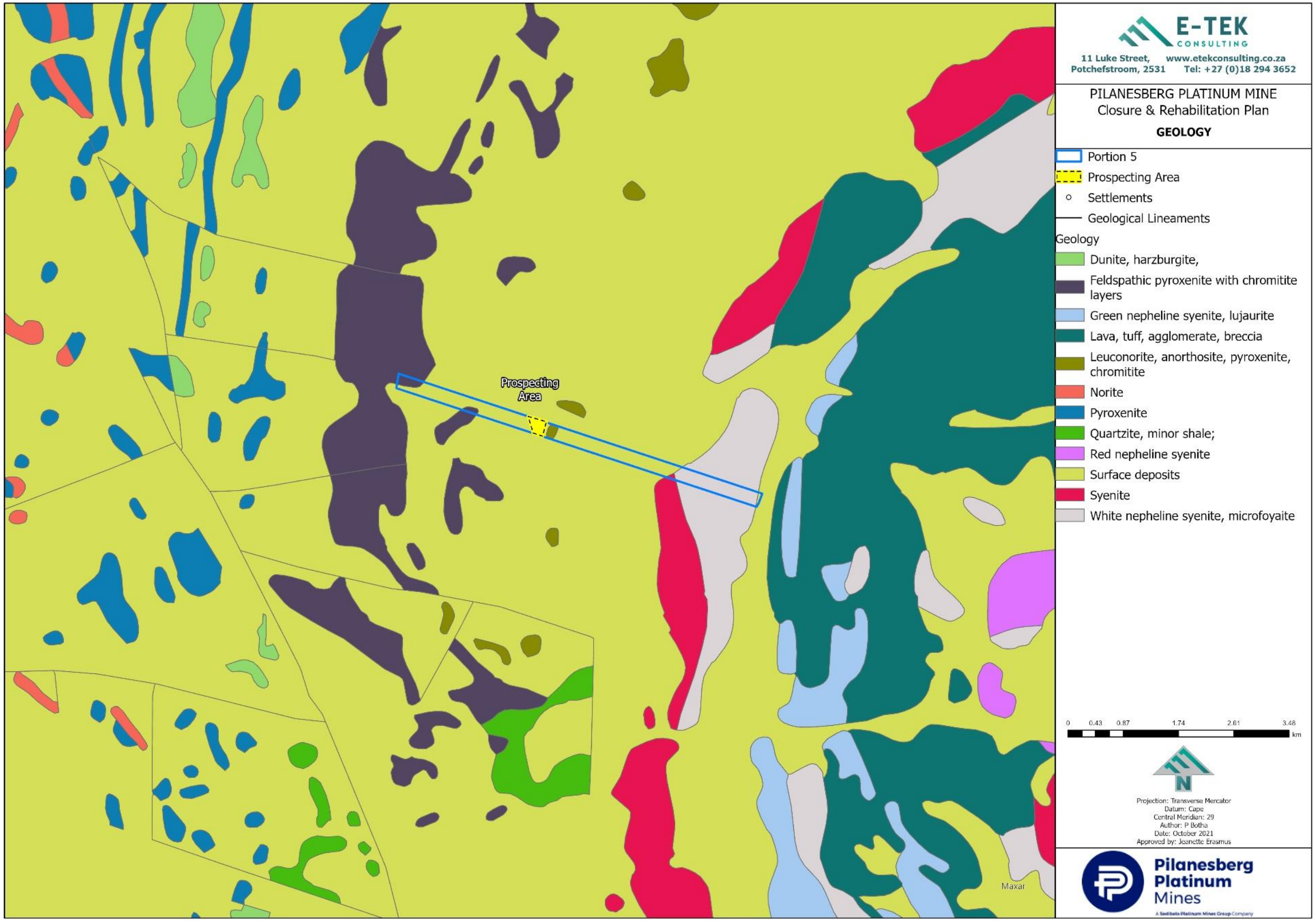

Figure 4: Ruighoek Portion 5 Proposed Prospecting Area Geology

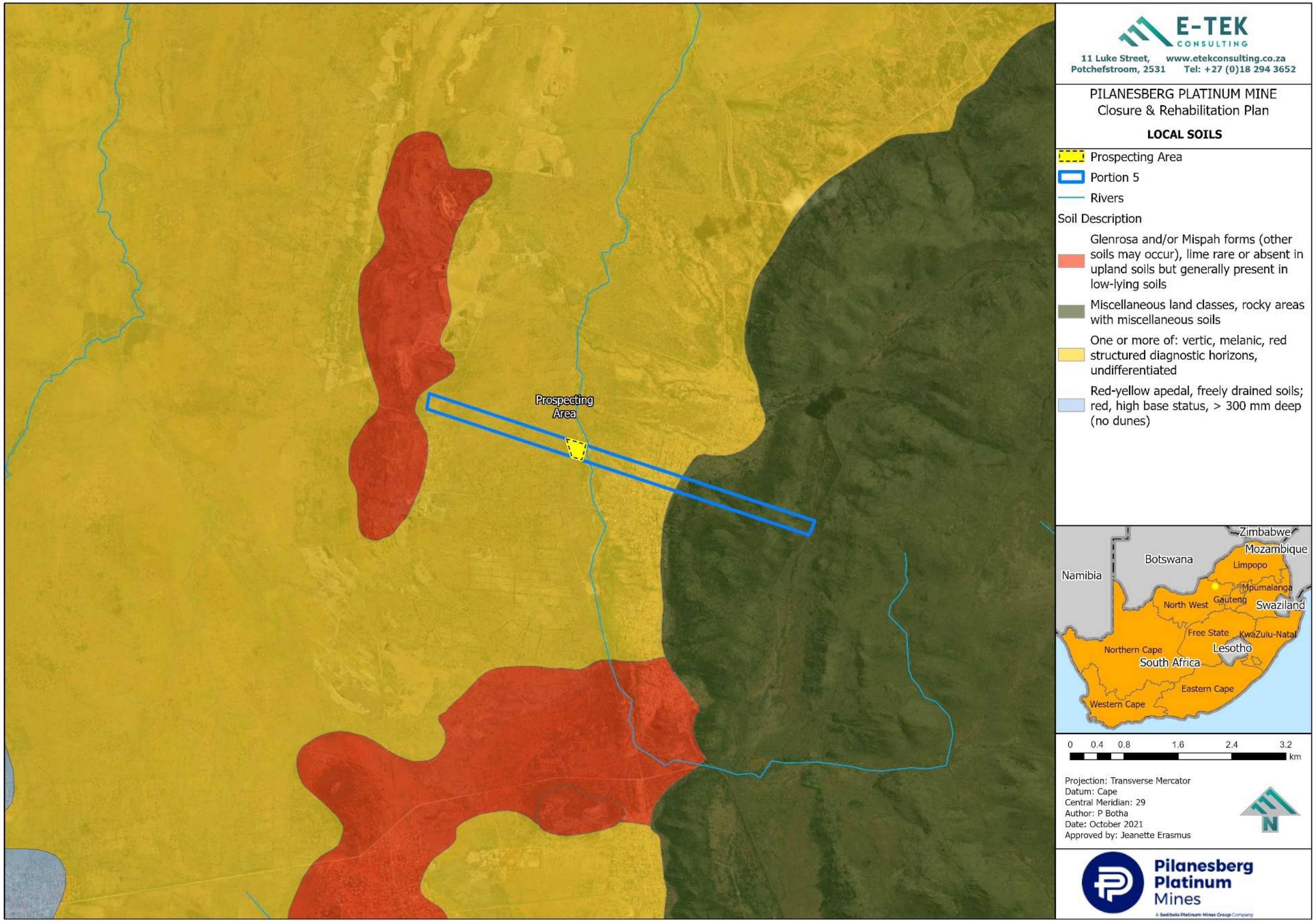

Figure 5: Ruighoek Portion 5 Proposed Prospecting Soils

4.1.4. Land Capability and Usage

Soil types within an area highly influences the specific land capability of an area. A soil classification study was done during the compilation of the 2012 EMP where the land capability of within the PPM mining rights area was determined to be a mixture of wetland, arable land, grazing land and wilderness (SLR, 2012).

4.1.1. Biodiversity

4.1.1.1. Regional

Two biomes are found within the North West Province, namely the savanna biome and the grassland biome.

Bioregions in the area includes the Eastern Kalahari Bushveld Bioregion, Dry Highveld Grassland Bioregion, Mesic Highveld Grassland Bioregion and the Central Bushveld Region (Mucina & Rutherford, 2006).

Studies of land use patterns indicate that roughly 35% of the North West province's natural ecosystems have been converted into other land use types with cultivated lands as the most extensive land use impacting the natural ecosystems. Areas are also being degraded at a rapid rate and within 180 years there will be no natural vegetated areas left in the province (Department for Rural, Environment and Agricultural Development, 2015). It is therefore important to study and determine the impact of mining on the biodiversity prior to disturbances.

4.1.1.2. Local

The proposed prospecting rights area falls within the Central Bushveld Region within the Savanna biome. The proposed prospecting rights area is adjacent to the Pilanesberg Nature Reserve. The vegetation unit located within this area is the Pilanesberg Mountain Bushveld. This unit is characterised by broad-leaved deciduous bushveld which includes a mixture of trees, shrubs and grasses. Several different species of *Grewia* are found within the area as well as *Combretum* and *Rhus* species (Mucina & Rutherford, 2006).

According to the 2012 EMP, twenty-one (21) mammal species, fifty-three (53) bird species, fifteen (15) reptile and amphibian species, and sixty eight (68) invertebrate species (including insects, scorpions, myriapoda and spiders species) were found in the Pilanesberg Platinum Mines mining rights area, thus it can be assumed to also occur within the proposed prospecting rights area.

A detailed study of the proposed prospecting rights area is therefore recommended for future planning in terms of disturbance (the outcome of the high-level study conducted in 2021 should be included once it becomes available).

4.1.2. Air Quality

4.1.2.1. Regional

Particulate matter is the main pollutant of concern which may affect human health negatively. Exposure to elevated levels of particulate matter (PM10) can lead to cardiovascular and respiratory problems and have been correlated with a reduction in life expectancy (Aneja, Isherwood, & Morgan, 2012)

The total suspended particulate (TSP) matter as well as “particles with an equivalent aerodynamic diameter less than 10 µm (PM_{10})” can be released into the atmosphere due to mining activities. This can lead to increased mortality rates in addition to decreasing the visibility and impacting plants and animals in the area (Andrade, da Luz, Campos, & de Lima, 2016). It is, therefore, important to monitor the particulate matter being released to be able to make predictions and to mitigate the negative impacts (Chaulya, et al., 2003).

4.1.2.2. Local

According to the 2012 EMP, several sources of air pollution are found within the surrounding areas of Pilanesberg Platinum Mines, including “mining operations, vehicle tailpipe emissions (due to the vehicle activity along routes within the area), domestic fuel burning (related to neighbouring communities/settlements), biomass burning (veld fires in agricultural areas within the region), and various miscellaneous fugitive dust sources such as agricultural activities, wind erosion of open areas, and vehicle entrainment of dust along unpaved roads”.

It is therefore recommended that, as more information becomes available on the proposed prospecting rights area, it be included in future updates of this plan.

4.1.3. Topography, Visual Environment and Heritage

The area where the Ruighoek Portion 5 proposed prospecting rights area is located, is characterised by a combination of isolated koppies and flatter areas. East of the proposed prospecting area is the Pilanesberg National Park with mountainous areas varying between 1330 m and 1534 m above mean sea level (amsl).

4.2. SOCIO-ECONOMIC ENVIRONMENT

All socio-economic aspects should be considered with closure in mind. PPM should be aware of the impacts of closure on the socio-economic environment and should plan ahead, investigate sustainable options post-closure and limit dependency on the mine.

4.2.1. Population, Demography & Settlement Patterns

The North West Province population accounted for approximately 6.9% of South Africa's population in 2020. The North West Province also showed an increase in population growth due to the migration from poorer areas to areas which are closer to mining areas (Statistics SA, 2020).

Statistics South Africa (Stats SA) will be conducting a population count in 2022 whereby data collection will start on 3 February 2022 (Stats SA, 2021). This data is to be incorporated within the next update of the SoER.

4.2.2. Socio-economics

4.2.2.1. COVID-19 Pandemic

The novel coronavirus disease 2019 (COVID-19) was first discovered in November 2019 within China. As the virus spread rapidly over the globe, the World Health Organisation (WHO) declared COVID-19 as a global pandemic on 11 March 2020. On 1 March 2020, South Africa recorded its first case whereafter a national state of disaster was declared and gazetted on 15 March 2020 with several restrictions being put in place. On 26 March 2020, a nationwide lockdown level 5 was enforced bringing most economic activities to a standstill. Since then, the lockdown levels varied with the current level at the time of compilation of this document being on an adjusted level 1.

When the pandemic started, the South African economy was already under considerable strain. Economic growth decreased from 3% in 2010 to 1.5% in 2019 with unemployment reaching 29.1% by the third quarter of 2019. The pandemic has since led to lower incomes for all households and a decrease in the Gross Domestic Product (GDP) (Chitiga-Mabugu, Henseler, Mabugu, & Maisonnave, 2021).

The specific impact, on mining globally, is still largely uncertain mostly due to the different mitigation measures implemented within the different countries. However, mining was brought to a temporary halt in South Africa in 2020 (Jowitt, 2020). Legislated limits on the number of staff were imposed on 26 March 2020 and intra-provincial travel restrictions also posed limitations within the mining sector.

4.2.2.2. Economy and Education

According to the North West Province Economic Data Report Q4 of 2020/2021, the province is a large and significant local economy in the South African economic context. North West mining Gross Value Added by Region (GVA-R) contributes approximately 33,8% to the total industries GVA (Current prices) in the province, 24,4% to national mining GDP, 14.0% to North West formal employment and 32,7% to national mining employment (North West Development Corporation, 2021).

The North West Province's economy is highly dependent on Platinum mining in the area with construction, agriculture and manufacturing to a lesser extent. The mining sector also supplies higher wages compared to other industries, employment is, however still relatively low due to parts of the population that still live in "homeland" regions where employment is scarce and there has been significant migration towards platinum rich areas (Trade & Industrial Policy Strategies (TIPS), 2016).

With regards to employment within the North West Province, the total employment decreased by 1,4 million, the number of unemployed persons increased by 7,5% (507 000), while the number of persons who were not economically active increased by 9,5% (1,5 million) compared to the data in 2019 (North West Development Corporation, 2021).

4.2.3. Health and Wellness

4.2.3.1. Overall

The life expectancy in South Africa for 2020 was estimated at 62.5 years for men and 68.5 years for woman with the infant mortality rate being 23.6 per 1000 live births. In South Africa, the overall HIV prevalence rate is estimated at 13.0% of the population, the total number is approximately 7.8 million people in 2020. Adults (aged between 15-49 years) living with HIV is estimated at 18.7% of the population (Statistics SA, 2020).

In the North West Province specifically, the leading causes of death include HIV, tuberculosis (TB), lower respiratory infections, diarrhoeal diseases and hypertensive heart disease. The North West Province has a high percentage (75.4%) of people infected with both HIV and TB with the cure rate of TB being only 65.8% "which puts the NW province as one of the bottom two poorest performing amongst other provinces" (North West Provincial AIDS Council, 2016).

4.2.3.2. COVID-19 Pandemic

COVID-19 had an immense impact on the health system of South Africa, however with the roll-out of the current vaccination program, the number of daily cases may decrease further within the future.

With regards to the total number of COVID-19 cases, the North West Province had, at the time of compilation of this plan, 149 848 registered cases. Deaths due to COVID-19 amounted to 19 426 in North West and total recoveries amounted to 896 321 on 6 October 2021 (National Department of Health, 2021).

5. CLOSURE VISION AND UNDERLYING PRINCIPLES

Regulations Reference: (d)(ii)	This Section describes the Closure vision, objectives and targets, which take into account the local environmental and socio-economic context, regulatory and corporate requirements as well as stakeholder expectations, where applicable for this plan.

5.1. METHODOLOGY

"The aims of the closure plan are set out through its underlying vision, principals and objectives" as in the International Council on Mining and Metals (ICMM) Integrated Mine Closure Good Practice Guide (2nd ed.).

The ICMM's Integrated Mine Closure Good Practice Guide (2nd ed.) further states that "while the closure vision provides direction for closure, and the principals offer a general framework, the closure objectives provide concrete, site-specific, and typically measurable statements.

Both the closure vision and closure objectives should be informed by the knowledge base, particularly the mine's zone of influence (ZoI), socio-economic and environmental context, stakeholder relationships, country-specific requirements and other external drivers. These factors should lead to a closure vision and closure objectives that are aligned with the characteristics of the corporation and the mine and appropriate to the socio-economic setting".

The aforementioned should therefore be considered when formulating the closure vision and closure objectives and targets for the Ruighoek 169JP Portion 5 prospecting right.

5.2. CLOSURE VISION

The Closure Vision identified during the 2016 Preliminary Closure Planning Process (2016) is as follows:

> ***"To work together with our communities, stakeholders and shareholders to create a safe healthy and secure environment enabling us to unlock value and thereby leaving a positive legacy."***

5.3. CLOSURE OBJECTIVES AND TARGETS

This closure plan is prepared in terms of GNR 1147 of the National Environmental Management Act, 1998 (Act No. 107 of 1998). The following **principles for sustainability** as set out in this Act were considered and can be used as a guideline with mine closure in mind:

(4)(a)(i) "That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;

(4)(a)(ii) That pollution and degradation of the environment are avoided or, where these cannot be altogether avoided are minimised and remedied;

(4)(a)(iii) That the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or when it cannot be altogether avoided; is minimised and remedied;

(4)(a)(iv) That waste is avoided; or, where it cannot be altogether avoided; minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;

(4)(a)(v) That the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;

(4)(a)(vi) That the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;

(4)(a)(vii) That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions;

(4)(a)(viii) That negative impact on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied;

(4)(b) Environmental management is integrated acknowledging that all elements of the environment are linked and interrelated, and it takes into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option;

(4)(c) Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person particularly vulnerable and disadvantaged persons;

(4)(d) Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination;

(4)(e) Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle;

(4)(f) The participation of all interested and affected parties in environmental governance must be promoted and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured;

(4)(g) Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes all forms of knowledge, including traditional and ordinary knowledge;

(4)(h) Community well-being and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means;

(4)(i) The social, economic and environmental impacts of activities, including costs and benefits are considered, assessed and evaluated, and decisions are appropriate in the light of such consideration and assessment;

(4)(j) The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected;

(4)(k) Decisions are taken in an open and transparent manner, and access is provided to information in accordance with the law;

(4)(l) There is intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment;

(4)(m) Actual or potential conflicts of interest between organs of state should be resolved through conflict resolution procedures;

(4)(n) Global and international responsibilities relating to the environment must be discharged in the national interest;

(4)(o) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as people's common heritage;

(4)(p) The costs of remedying pollution, environmental degradation and consequent adverse, health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects are paid for by those responsible for harming the environment;

(4)(q) The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted; and

(4)(r) Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure".

It is also important to take section 43(3)(d) of the MPRDA (Act 28 of 2002) into account as it includes the following **objectives for closure:**

- "Rehabilitate disturbed areas, excluding the tailings dam and return water dam, to their pre-mining land capability and use potentials. The rehabilitation of disturbed land will be to the extent that it is within compliance of current national environmental quality objectives;
- Limit the short- and longer-term impacts of pollution on surface and ground water and related biodiversity;
- Control the further generation of dust;
- Minimize the visual impact of the permanent features at the mine e.g. tailings dam;
- Ensure that people and animals are not harmed by falling off or into hazardous excavations or steep slopes, the management objectives for these are to minimize safety risks to the public and livestock;
- Limit the impact on staff whose positions become redundant upon closure of the mine;
- Keep relevant authorities informed of the progress of the decommissioning phase;
- Submit monitoring data to the relevant authorities; and
- Build and maintain meaningful relations with all stakeholders (I&AP's)".

6. POST-MINING LAND USE/S

Regulations Reference: (e), (e)(i) & (e)(ii)	This Section describes the proposed final post-mining land use which is appropriate, feasible and possible of implementation for the overall project and per infrastructure or activity. It also gives a description of the methodology used to identify the final post-mining land use, including the requirements of the operations stakeholders, where applicable for this plan.

6.1. METHODOLOGY

It should be noted that the planned post-mining land use has already been identified for the current scenario at the time of compilation of this plan. This may change as the mine progresses and should be reviewed with each subsequent update of this plan.

In order to identify a post-mining land use, NEMA (Act No. 107 of 1998): Financial Provisioning Regulations, 2015 (No. R. 1147), is stating that you should have:

- “A proposed final post-mining land use which is appropriate, feasible and possible for implementation;
- Descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders; and
- A map of the proposed final post-mining land use (aligned to the EIA specialist studies)”.

The post-mining land use will be influenced by a few aspects, as described throughout this plan and can be improved through a typical tool, such as conducting a SWOT Analysis session (strength, weakness, opportunity, threat) between the mine owner and the landowner. Thereafter they will be better able to work together towards planning for mine closure and the post-mining land use.

It will assist in understanding both the internal strengths and weaknesses of the mine, and the external opportunities and threats posed by the environment.

The closure plan should be directed at exploiting the major strengths and opportunities, while avoiding or overcoming the threats and weaknesses.

6.2. PROPOSED POST-MINING LAND USE/S

The 2016 Preliminary Closure Plan indicated, through a SWOT analysis, that the most likely post-mining land use is a Wilderness Area (this is aligned to the current proposed post-mining land use for this area) (refer to Figure 6).

Once the mining right has been issued for this area, the following may be considered for future planning:

- Incorporation of the Wilderness Area in the Heritage Park Corridor; and
- Making land productive post-closure;

The above-mentioned includes the potential beneficial post-closure use of specific infrastructure as well, however, the transfer of liability should be put in writing.

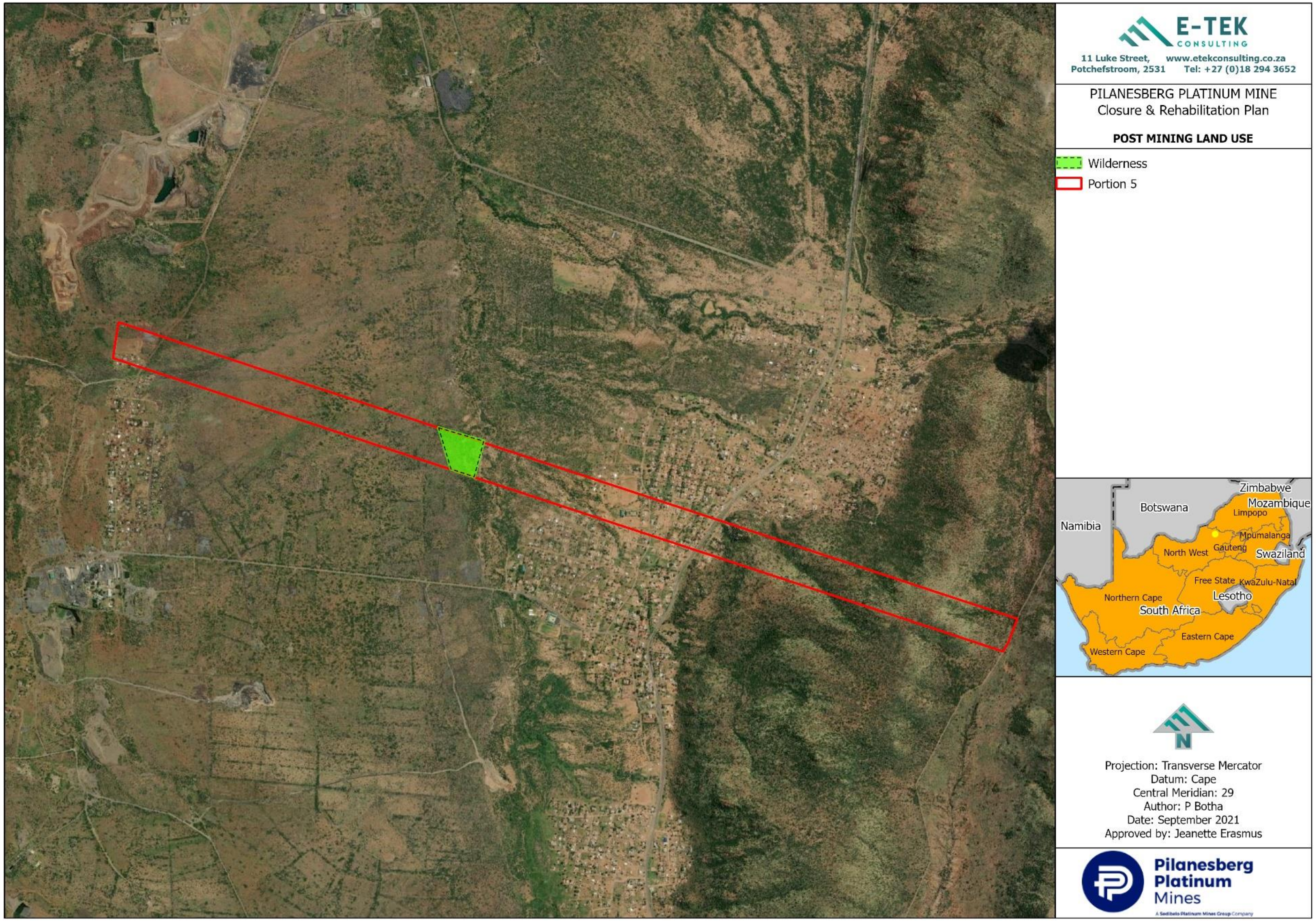

Figure 6: Proposed Post-mining Land use for Ruighoek Portion 5 Proposed Prospecting Area

7. DESIGN PRINCIPLES, CLOSURE ACTIVITIES AND TECHNICAL SOLUTIONS

Regulations Reference: **(d), (d)(iii), (d)(iv), (d)(v), (d)(vi), (d)(vii)** **(f), (f)(i), (f)(ii)** **(i)** **(j)**	**This section describes the design principles, closure activities and technical solutions for all areas, infrastructure, activities and aspects, both within the mine lease area and off of the mine lease area associated with mining, for which the mine has the responsibility to implement closure actions.** **Alternative closure and post closure options are described, where practicable, within which the operation is located, as well as the preferred closure action within the context of the risks and impacts that are being mitigated.** **Any potential gaps in the plan are linked to an auditable action plan and schedule to address the gaps. Therefore, associated ongoing research is highlighted, as well as all assumptions made to develop closure actions (in absence of detailed knowledge of onsite conditions, potential impacts, material availability, stakeholder requirements and other factors for which information may be lacking). The gap analysis can be used to identify and define any additional work that is needed to reduce the level of uncertainty for any applicable closure aspect.** **It also deals with the definition and motivation of the closure and post closure period, taking cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient to demonstrate that relinquishment criteria have been achieved.**

7.1. CLOSURE CRITERIA METHODOLOGY

Closure Criteria was compiled to list the design principles, closure activities and technical solutions for all current closure components. Refer to Table 6 for the Closure Criteria, this should be read in conjunction with the costing sheets.

This document excludes Infrastructural, Mining, Bio-physical and Socio-economic aspects, that were already included in the previous EMPs and only includes the aspects for the proposed and current trenching and drilling.

Separate Rehabilitation plans and/ or Concurrent rehabilitation plans were not compiled, and all assumptions and actions are captured in this section, as well as the applicable appendices.

The Bio-physical and Socio-economic aspects do not currently have any possible cost implications. Should there be any additional cost implications, it should be included in the Closure Criteria sheets in future.

No additional monitoring is required in terms of the expansion project, only 5 years Post-closure Care and Maintenance is included.

In order to reduce Socio-economic risks and the impact of closure on local communities, socio-economic aspects and related risks should be managed throughout the operational phase.

The Closure Criteria were based on the following:

- Comprehensive understanding of the site conditions;
- Technical reports; and
- Knowledge and experience of similar projects.

Table 6: General aspects: Rehabilitation and Closure Criteria

MINING ASPECTS		
CLOSURE COMPONENTS	**REHABILITATION AND CLOSURE CRITERIA**	**ASSUMPTIONS / NOTES**
General Surfaces	Boreholes • Cap and seal boreholes • Rehabilitate disturbed footprints Trenches • Fill voids • Shape and level area (making the area free-draining) • Establish vegetation	• Rehabilitation depends on the relevant end land use • Nine (9) boreholes are planned to be between 20 - 150 m deep • Five (5) trenches of approximately 100 m long will be dug to establish the sub-outcrop position of the PGM reefs. The trenches will be approximately 1.5 m deep and 1 m wide
Post Closure Monitoring & Maintenance	Care and Maintenance: • Allowance made for a five (5) year period	As per the current site-wide commitments the following aspects are already included in previous closure liabilities and EMPs: • Surface water monitoring • Groundwater monitoring • Vegetation, biodiversity and ecological function monitoring • Air quality

7.2. ALTERNATIVE CLOSURE AND POST CLOSURE OPTIONS

The potential alternative closure options are dependent on the applicable Statutory and Corporate related requirements, as outlined in Section 3 of this document, and includes current Mine lease agreements and expectations from the landowner, as well as the approved closure commitments stipulated in the EMP.

It is important to note that the specific sections below will also influence any closure and post closure alternatives to be considered:

- Section 4: the environment in which the project is located;
- Section 6: the feasible and practical post-mining land uses;
- Section 8: the risks associated with such an alternative option (a cost-benefit analysis may also be needed in future if there are any alternatives being considered); and
- Section 9: the expectations from external stakeholders, if any (other than the landowner or Government).

8. RISK ASSESSMENT

Regulations Reference: (c), (c)(i), (c)(ii), (c)(iii), (c)(iv) & (c)(v)	**This Section describes the findings of the environmental risk assessment, leading to the most appropriate closure strategy.** **It also deals with the risk assessment methodology, identification of indicators that are most sensitive to potential risks and the monitoring of such risks.** **The conceptual closure strategies are described to avoid, manage and mitigate the impacts and risk. Reassessment of the risks are done to determine whether, after the implementation of the closure strategy, the latent or residual risk has been avoided and / or how it has resulted in avoidance, rehabilitation and management of impacts and whether this is acceptable to the mining operation and stakeholders.**

All potential risks, associated with the closure of the Portion 5 of Ruighoek 169 JP, were identified, only focussing on the proposed prospecting rights area.

The following information was considered as part of the process to compile the worksheets:

- Legislative / statutory and corporate requirements;
- Existing mine closure objectives, closure visions and land use opportunities post-closure;
- Mine closure options and scenarios;
- The baseline information which describes the current state of the environment (SOE);
- Existing mine closure plans and previously identified impacts; and
- Stakeholder engagement outcomes

8.1. CLOSURE RISK MATRIX

The identified risks were captured in the worksheets that reflect all the respective risks for each applicable closure component.

These risks were individually evaluated in terms of a risk matrix and ranked for the closure scenarios before and after implementation of the mitigation measures / rehabilitation and closure criteria. Refer to Appendix B for the Anglo-American Risk Matrix and Closure Risk Assessment. The following tables are explaining the risk matrix and methodology used.

The identified risks were rated according to “probability / likelihood” and “consequence of occurrence” as described in the table below.

Table 7: Criteria to Determine Probability

PROBABILITY / LIKELIHOOD		
ALMOST CERTAIN 1yr	**5**	The unwanted event has occurred frequently: Occurs in order of one or more times per year & is likely to reoccur within 1 year.
LIKELY 3yrs	**4**	The unwanted event has occurred infrequently; Occurs in order of less than once per year & is likely to reoccur within 3 years.
POSSIBLE 10yrs	**3**	The unwanted event has happened at some time; Or could happen within 10 years.
UNLIKELY 30yrs	**2**	The unwanted event has happened at some time; Or could happen within 30 years.
RARE >30yrs	**1**	The unwanted event has never been known to occur; Or it is highly unlikely that it will occur within 30 years.

To determine the possible consequence, different criteria were used for each of the following disciplines or areas of responsibility to mitigate risks and impacts:

- Safety;
- Occupational Health;
- Environment;
- Financial;
- Legal and Regulatory;
- Social / Community; and
- Reputation

Table 8: Criteria to Determine the Consequence of Safety Impacts

CONSEQUENCE FOR SAFETY	
1 INSIGNIFICANT	First aid case.
2 MINOR	Medical treatment case.
3 MODERATE	Lost time injury.
4 HIGH	Permanent disability or single fatality.
5 MAJOR	Numerous permanent disabilities or multiple fatalities.

Table 9: Criteria to Determine the Consequence of Health Impacts

CONSEQUENCE FOR OCCUPATIONAL HEALTH	
1 INSIGNIFICANT	Exposure to health hazard resulting in temporary discomfort.
2 MINOR	Exposure to health hazard resulting in symptoms requiring medical intervention and full recovery (no loss time).
3 MODERATE	Exposure to health hazards/ agents (over the occupational exposure limit) resulting in reversible impact on health (with lost time) or permanent change with no disability or loss of quality of life.
4 HIGH	Exposure to health hazards/ agents (significantly over the occupational exposure limit) resulting in irreversible impact on health with loss of quality of life or single fatality.
5 MAJOR	Exposure to health hazards/ agents (significantly over the occupational exposure limit) resulting in irreversible impact on health with loss of quality of life of a numerous group/ population or multiple fatalities.

Table 10: Criteria to Determine the Consequence of Environmental Impacts

CONSEQUENCE FOR ENVIRONMENT	
1 INSIGNIFICANT	Lasting days or less. Limited to small area (metres). Receptor of low significance/ sensitivity (industrial area).
2 MINOR	Lasting weeks. Reduced area (hundreds of metres). No environmentally sensitive species/ habitat).
3 MODERATE	Lasting months. Impact on an extended area (kilometres). Area with some environmental sensitivity (scarce/ valuable environment).
4 HIGH	Lasting years. Impact on sub-basin. Environmentally sensitive environment/ receptor (endangered species/ habitats).
5 MAJOR	Permanent impact. Effects a whole basin or region. Highly sensitive environment (endangered species, wetlands, protected habitats).

Table 11: Criteria to Determine the Consequence of Financial Impacts

CONSEQUENCE FOR FINANCIAL	
1 INSIGNIFICANT	No disruption to operation/ Less than 1% of current liability estimate.
2 MINOR	Brief disruption to operation/ 1% to less than 3% of current liability estimate.
3 MODERATE	Partial shutdown of operation / 3% to less than 10% of current liability estimate.
4 HIGH	Partial loss of operation / 10% to less than 30% of current liability estimate.
5 MAJOR	Substantial or total loss of operation / 30% or higher of current liability estimate.

Table 12: Criteria to Determine the Consequence of Legal and Regulatory Impacts

CONSEQUENCE FOR LEGAL & REGULATORY	
1 INSIGNIFICANT	Technical non-compliance. No warning received. No regulatory reporting required.
2 MINOR	Breach of regulatory requirements. Report/involvement of authority. Attracts administrative fine.
3 MODERATE	Minor breach of law. Report/investigation by authority. Attracts compensation/ penalties/ enforcement action.
4 HIGH	Breach of the law. May attract criminal prosecution, penalties/ enforcement action. Individual licence temporarily revoked.
5 MAJOR	Significant breach of the law. Individual or company lawsuits. Permit to operate substantially modified or withdrawn.

Table 13: Criteria to Determine the Consequence of Social/Community Impacts

CONSEQUENCE FOR SOCIAL / COMMUNITY	
1 INSIGNIFICANT	Minor disturbance of culture/ social structures.
2 MINOR	Some impacts on local population, mostly repairable. Single stakeholder complaint in reporting period.
3 MODERATE	Ongoing social issues. Isolated complaints from community members/ stakeholders.
4 HIGH	Significant social impacts. Organized community protests threatening continuity of operations.
5 MAJOR	Major widespread social impacts. Community reaction affecting business continuity. “License to operate” under jeopardy.

Table 14: Criteria to Determine the Consequence of Reputational Impacts

CONSEQUENCE FOR REPUTATION	
1 INSIGNIFICANT	Minor impact. Awareness/ concern from specific individuals.
2 MINOR	Limited impact. Concern/ complaints from certain groups/ organizations (e.g. NGOs).
3 MODERATE	Local impact. Public concern/ adverse publicity localised within neighbouring communities.
4 HIGH	Suspected reputational damage. Local/ regional public concern and reactions.
5 MAJOR	Noticeable reputational damage. National/ international public attention and repercussions.

The risk rating matrix was coupled to the criteria discussed in the above tables for probability / likelihood and consequence. The matrix was applied, taking into consideration the site-specific risks, in accordance with the area of assessment. The classification of the identified risks was presented in terms of the following risk ratings and risk levels:

Table 15: Risk Ratings and Levels

RISK RATING	RISK LEVEL
21 to 25	H - High
13 to 20	S - Significant
6 to 12	M - Medium
1 to 5	L - Low

8.2. RISK ASSESSMENT SUMMARY

Refer to Appendix B for the comprehensive Closure Risk Assessment sheets, indicating all sensitive receptors and risk specific closure strategies.

No risks were indicated with **medium**, **significant or high** rankings post-mitigation, as Pilanesberg Platinum Mines is providing for the necessary closure criteria / mitigation measures, as well as ongoing monitoring and maintenance in the current mining rights area.

9. SOCIAL CLOSURE PLANNING AND CLOSURE CONSULTATION

Regulations Reference: (b)(iii)	**This Section describes the stakeholder issues and comments that have informed the plan, where applicable.**

Stakeholder engagement aims to achieve comprehensive consideration and understanding of the views of the various stakeholders to the closure planning process. Stakeholder engagement will ensure that the views, concerns, and proposals of those affected by, or having an interest in the mining operations of the company are addressed.

No formal stakeholder engagements took place as part of this closure planning process. Consultations have been done as part of previous EIA/EMP processes. All future stakeholder issues, concerns and comments should further inform the update of this Closure plan.

10. WORK BREAKDOWN STRUCTURE AND CLOSURE SCHEDULE

Regulations Reference: **(g), (g)(i), (g)(ii), (g)(iii)** **&** **(h), (h)(i), (h)(ii), (h)(iii)**	**This Section describes the schedule of actions for final rehabilitation, decommissioning and closure and link with the current mine plan where possible. All assumptions and schedule drivers are described.** **The spatial map or schedule is linked with Appendix 3 of GNR1147 and shows the planned spatial progression throughout the operations.** **The organisational capacity, structure and responsibilities to implement the plan are indicated, where applicable. If necessary to build closure competence, the required training and capacity building are described in this section.**

A gap analysis should be done as part of the site wide Closure Criteria. The gap analysis includes an auditable action plan and schedule to address the gaps. These aspects, are linked to a Work Breakdown Structure that captures the following:

- The specific **action** requiring additional or further investigation;
- **Priority Level**, indicating the timeframe linked to it (e.g. Immediate, within next financial year or only long term – 10 years before closure);
- A specific **Responsible Person** is linked to each of these actions (e.g. Environmental Manager or Processing); and
- **Completion Status**, e.g. to indicate whether the specific action should still be initiated, if it is in progress or completed.

The closure schedule should be refined with the update of this closure plan.

11. CLOSURE COST ESTIMATION

Regulations Reference: (k), (k)(i), (k)(ii), (k)(iii)	This section describes the closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether ongoing or once-off, are realistically estimated and incorporated into the estimates. Cost estimates for operations, or components of operations that are more than 30 years from closure will be prepared as conceptual estimates with an accuracy of ± 50 percent. Cost estimates will have an accuracy of ± 70 percent for operations, or components of operations, 30 or less years (but more than ten years) from closure and ± 80 percent for operations, or components of operations ten or less years (but more than five years) from closure. Operations with 5 or less years will have an accuracy of ± 90 percent. Motivation must be provided to indicate the accuracy in the reported number and as accuracy improves, what actions resulted in an improvement in accuracy. The closure cost estimation includes an explanation of the closure cost methodology, auditable calculations of costs per activity or infrastructure and cost assumptions. The closure cost estimate must be updated annually during the operation's life to reflect known developments, including changes from the annual review of the closure strategy assumptions and inputs, scope changes, the effect of a further year's inflation, new regulatory requirements and any other material developments.

11.1. CLOSURE COST ESTIMATION PROCEDURE AND METHODOLOGY

11.1.1. Liability Model Methodology

The approach followed to determine the financial provision required for Appendix 4 of GNR 1147 Final Rehabilitation, Decommissioning and Mine Closure Plan is as follows:

- The costing model used was developed to address all requirements set out in GNR 1147 – Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations and is aligned with all closure components identified;

- The costing model provides the following output:
  - Executive Summary (Summary of all closure components and associated costs where applicable); and
  - Closure Components (Breakdown of the five main closure components).
- The following information is captured for each closure component where applicable:
  - Reference Map (Reference map number representing the associated closure component);
  - GEO Reference (Reference number for each closure component as represented on the reference map);
  - Cost Component (Name of closure component captured);
  - Quantity (Quantity per component captured);
  - Unit (Unit of measurement);
  - Unit Rate (Rate assigned from the rate code aligned to the activity);
  - Liable Value (Presentation of the total amount liable for per component); and
  - Notes (Captures any assumptions or dedicated information).

11.1.2. Assessment Methodology

The approach followed with the determination of the closure costs could be summarized as follows:

- Review of available information, identification of activities that would need to be decommissioned or rehabilitated at closure;
- Gathering of relevant data which forms the basis of the calculation;
- All proposed activities were assigned with a reference number which can be referenced directly to the costing model;
- The following facilities form part of the financial provision calculation:
  - Proposed and current trenching and drilling.
- A reference map was created indicating the position of the proposed activities in relation to the existing infrastructure (Appendix A);
- Closure criteria were developed as part of the liability assessment (Table 6);
- Compilation of a Bill of Quantities capturing the quantities and actions relating to the

closure of the different closure aspects (in Microsoft excel format – Appendix C); and
- Unit rates from E-TEK's database were updated to be aligned with the current market-related rates acquired from local civil- and demolition contractors.

11.2. AUDITABLE CALCULATIONS OF COSTS

Refer to Appendix C (Closure Liability Model) for the detail cost breakdown per closure component.

11.3. ASSUMPTIONS FOR THE CLOSURE COST ESTIMATION

The following general and site-specific cost assumptions and qualifications are described below:

- The closure costs were determined and presented in terms of E-TEK's understanding of the currently applicable requirements of GNR 1147;
- Currency of estimate: South African Rands (ZAR);
- Based on the output required a 1–10-year closure forecast was calculated including a LoM cost based on the following timelines:
    - Year 1 – Premature Closure (FY2021); and
    - Year 2 – 10 Closure Forecast (FY2022 – FY2030).
- The proposed prospecting activities are proposed to commence in Y2022 whereby rehabilitation will commence immediately and also be complete in Y2022;
- Post closure care and maintenance will continue for a 5-year period post rehabilitation;
- Quantities and volumes calculated as part of the closure forecast were obtained from the relevant information and associated drawings;
- Costing was based on current value and no allowance was made for future value escalation as per the legislative requirements;
- It was accepted that all information used to support the costing supplied by PPM and specialists was accurate and true; this report only addresses the decommissioning and reclamation costs, equating to an outside (third party) contractor establishing on-site and conducting reclamation-related work. Other components such as staffing of the site after decommissioning, the infrastructure and support services (e.g. power supply, etc.) for the staff as well as workforce matters such as separation packages, re- training /re-skilling, etc. are outside the scope of this report;
- Based on the above, dedicated contractors would be commissioned to conduct the rehabilitation activities on the site. This would inter alia require establishment and

overhead costs for the contractors and hence, the allowance for P&Gs in the cost estimate;

- Allowance has also been made for third party contractors and consultants to conduct post-closure care and maintenance work as well as compliance monitoring;
- The financial provision calculated represents the financial requirements to implement the closure criteria identified and agreed upon as part of the closure plan; and
- Weighted percentages for P&Gs and Contingencies have been applied, Value-Added Tax (VAT) is also included:
  - P&G's – 25% Overall Allowance;
  - Contingencies – 10% Overall Allowance; and
  - VAT – 15% Overall Allowance.

12. MONITORING, AUDITS AND REPORTING

Regulations Reference: **(d)(v)** **&** **(l), (l)(i), (l)(ii), (l)(iii)**	**This section takes cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient to demonstrate that relinquishment criteria have been achieved.** **The monitoring, auditing and reporting requirements (which relates to the risk assessment, legal requirements and knowledge gaps as a minimum) include:** **A schedule outlining internal, external and legislated audits of the plan for the year, including the person responsible for undertaking the audit(s); the planned date of audit and frequency of audit as well as an explanation of the approach that will be taken to address and close out audit results and schedule.** • **A schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders, where necessary.** • **A monitoring plan which outlines parameters to be monitored, frequency of monitoring and period of monitoring.** • **An explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities.**

The monitoring plan and applicable Key Performance Indicators (KPIs) should be included in the update of this closure plan and with the compilation and support of the Rehabilitation Plan.

12.1. DEMONSTRATION OF REHABILITATION PERFORMANCE

No additional monitoring is required in terms of the proposed prospecting rights project, only five years Post-closure Care and Maintenance is included. It is envisaged that a five-year demonstration period will be required to confirm the success of rehabilitation.

Following the completion of earthworks and vegetation establishment, a visual inspection will be undertaken to inform corrective action required if needed. Thereafter ongoing monitoring and corrective actions are envisaged at the time of compiling this plan.

Figure 7 illustrates the overview of the process for the Rehabilitation Plan roll out and performance monitoring, starting with the baseline site performance assessment, towards the final site performance assessment. It is described in the sections below.

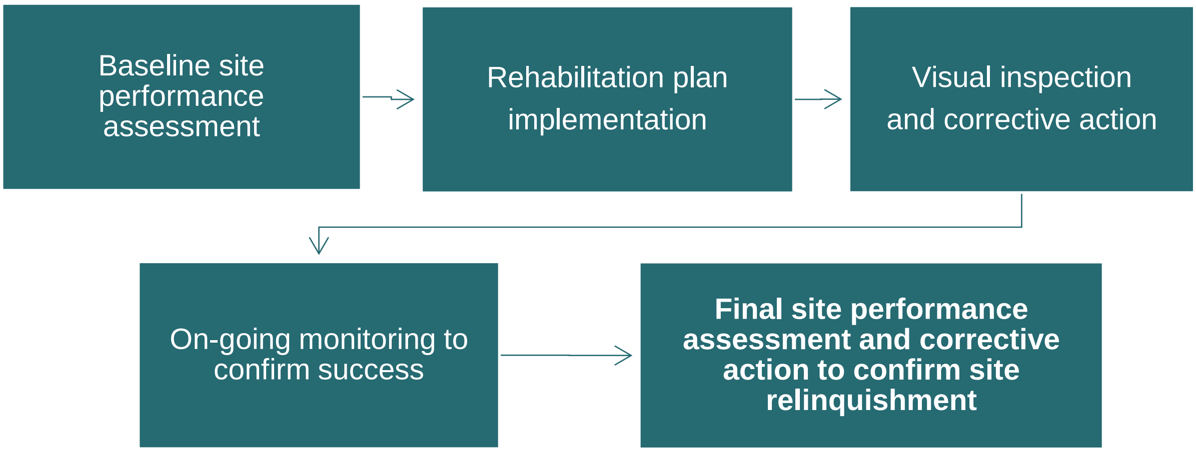

Figure 7: Illustration of the Rehabilitation Plan roll out and performance monitoring.

12.1.1. Baseline Environmental Site Performance Assessment

A baseline site performance assessment (largely based on existing information and supplemented by a dedicated site walkover) has to be conducted prior to rehabilitation implementation.

The aim of the environmental site performance assessment is to establish the status quo/baseline and knowledge base against which results of monitoring conducted after rehabilitation will be measured. Additionally, this will support the environmental permitting for decommissioning of the site in terms of the provisions of NEMA.

12.1.2. Monitoring and Corrective Action

The rehabilitation performance/progress should be documented by an independent consultant appointed by PPM and indicated in a dedicated annual rehabilitation performance report, until relinquishment criteria have been achieved. The report should reflect on the outcome of monitoring undertaken, rehabilitation performance and corrective action required.

The monitoring objectives, network, sampling routine and analysis for specific bio-physical closure aspects should always be refined with each update of this plan.

12.1.3. Final Site Performance Assessment

Following completion of rehabilitation and/or the demonstration period of five years a final performance assessment should be undertaken to document the success of rehabilitation and the corrective action undertaken. The final site performance assessment will be used to document the success of rehabilitation.

12.2. MONITORING AND MANAGEMENT OF IMPACTS

No additional requirements form part of this document and the monitoring and management actions should be aligned to the existing protocols / mitigations measures as applicable for the larger area of operations.

12.3. PROPOSED POST-CLOSURE MONITORING AND PROGRAMMES

The objective of monitoring programmes is to assess to what extent the closure criteria is being achieved during rehabilitation and closure and to identify corrective actions in situations where the closure criteria is not being achieved or the progress towards achievement is not satisfactory. These programmes are thus directly aligned with the criteria. The programmes shall comprise the following and it is the responsibility of a suitably qualified and experienced person to ensure that these requirements are adhered to:

- Ensure that relevant financial resources are made available;
- Documented procedures are in place which provide step by step instructions on how monitoring should be undertaken;
- Appoint appropriately qualified specialists to undertake the monitoring in a timeous manner to ensure work can be carried out to acceptable standards;
- Make use of appropriately calibrated equipment and where samples require analysis, they shall be preserved according to laboratory specifications;
- Make use of an independent and accredited laboratory to analyse samples and/or internal laboratory results shall periodically be checked by independent and accredited laboratories;
- Interpret monitoring data and trends of the data, and communicate to all relevant internal and external stakeholders, taking into consideration requirements of any licences; and
- Maintain monitoring records for at least 50 years post monitoring events.

13. CONCLUSION

Regulations Reference: (m)(i)	• **This Section includes the motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps, where applicable.**

Refining the closure planning process for PPM is an on-going process and therefore the Rehabilitation, Decommissioning and Mine Closure Plan should be seen as a working document which is based on the best, and most recent available information. It is important to note that any deviation from the current Rehabilitation and Closure criteria, which is used for costing purposes, may have a significant impact on future liability estimates.

The broader site-wide PPM Rehabilitation, Decommissioning and Mine Closure Plan and all its supporting documentation (Appendices) are the product of a dynamic approach and should therefore be reviewed regularly to ensure that all aspects and associated costs are taken into consideration. Furthermore, it is important that all the information be incorporated into all mining strategies, planning and operational processes. This will ensure that the objectives set out within the plan are reached and will also provide potential opportunities to reduce closure costs.

Notwithstanding the assumptions made and certain gaps that remain, if the closure measures are implemented as envisaged, the reflected costs provide a good indication of the closure liability estimates and should provide a good basis for making the required financial provision. The biophysical and physical closure costs calculated are applicable to closure situations as well as concurrent rehabilitation during the operational phase (if and when applicable).

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APPENDICES TO BE REFERENCED

APPENDIX A: PROPOSED PROSPECTING RIGHTS AREA LAYOUT & REFERENCE MAP

APPENDIX B: CLOSURE RISK ASSESSMENT

APPENDIX C: CLOSURE COST ESTIMATION

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