APPENDIX H: SPECIALIST STUDIES
BIODIVERSITY ASSESSMENT

SCIENTIFIC TERRESTRIAL SERVICES

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BIODIVERSITY ASSESSMENT AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE DEVELOPMENT OF SURFACE INFRASTRUCTURE AT THE MARULA PLATINUM MINE, LIMPOPO PROVINCE

Prepared for

SLR Consulting Ltd.

January 2022

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Report reference: STS 200060

EXECUTIVE SUMMARY

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the Environmental Impact Assessment (EIA) and Environmental Authorisation (EA) process for the proposed surface infrastructure development on the existing Marula Platinum Mine, located approximately 30 km northwest of the town of Burgersfort, Limpopo Province, henceforth referred to as the "study area".

The proposed infrastructure development activities include upgrading and/or the construction of the following infrastructure: ventilation shafts with associated infrastructure, water pipelines and powerlines, a new TSF pipeline, a product stockpile, a compressed airline, and upgrades to the existing change house.

During the field assessment, five habitat units were identified within the study area, namely:

1) Degraded Bushveld;
2) Encroached Habitat;
3) Rocky Habitat (comprising of two subunits, i.e., Rocky Outcrops and Rocky Riverine Habitat);
4) Watercourse Habitat; and
5) Transformed Habitat.

Species diversity and habitat integrity:

Overall, the habitat within the study area was degraded and not representative of the reference vegetation type, i.e., the Sekhukhune Plains Bushveld. Some places consisted of highly modified and transformed areas, in which vegetation was scarce. Many of the transformed areas (typical of those found close to high-intensity mining operations and housing infrastructure) supported a high abundance of alien and invasive plant (AIP) species. However, the surrounding untransformed, and undeveloped regions did not support high densities of AIPs but were not particularly species rich. Furthermore, the highly fragmented nature of the study area limits the potential for recolonisation of many species, particularly fauna.

The Degraded Bushveld has a moderately low sensitivity. This habitat unit was dominated by *Dichrostachys cineria*. In general, the habitat unit was largely species-poor and had a poorly represented grassy layer. Due to its proximity close to existing mining infrastructure and housing, this habitat unit has been exposed to several anthropogenic activities, including dumping, vehicle movements and livestock grazing, which has resulted in subpar habitat conditions, decreased habitat integrity and a low species diversity. As the habitat unit is degraded in nature, the remaining vegetation is not representative of the reference vegetation type for the area. Little habitat is provided for extensive native floral species diversity and community structure within this habitat unit.

The Encroached Habitat scored a sensitivity of moderately low. The overall species richness of this habitat unit was low. Woody encroachment and overgrazing within the habitat unit is largely evident with *D. cinerea, Vachellia nilotia subsp. kraussiana* and ***Terminalia sericea*** as the major encroaching species. Forb and grass species were less dominant within the habitat unit with areas of bare soil scattered throughout. This habitat unit is no longer representative of the reference vegetation type, namely the Sekhukhune Plains Bushveld, which is moderately species rich.

Both subunits, namely Rocky Outcrops and Rocky Riverine subunits, of the Rocky Habitat unit have a sensitivity of moderately high. Both subunits support typical rocky floral communities. However, they are distinguished from each other based on the dominant rock type that is present within each of the subunits as well as the slightly different floral communities that each support. In particular, the Rocky Outcrop subunit displayed a moderate diversity of floral species and has an overall moderately high level of ecological functioning. Examples of floral species that were encountered within this habitat include *Aloe cryptopoda, Scadoxus puniceus, Gloriosa superba,* and several tree species including *Vangauria infausta* and ***Terminalia sericea.*** The habitat unit did not support AIP species. The Rocky Riverine subunit displayed a moderate diversity of floral species and has an overall moderately high level of ecological functioning, especially given its location next to the Mogompane River. Examples of

floral species that were encountered within this habitat include *A. cryptopoda, Kleinia stapeliiformis, Euphorbia hirta, Eucphrobia tirucalli and Tinnea rhodesiana.*

The Watercourse Habitat scored a moderately high sensitivity. This habitat unit consisted of small sections in which the proposed powerlines and water pipelines are to be developed. The vegetation of the watercourse habitat is moderately intact; however, several alien and invasive plant (AIP) species have encroached into the sections of the watercourse within the study area. During the time of assessment, the watercourses were dry.

The Transformed habitat was of low sensitivity. This habitat unit is largely transformed consisting of pavements, informal housing, or mining infrastructure. These areas are chiefly dominated by AIP species, specifically along the roadsides where clearing of vegetation has recently occurred. Many of the gardens surrounding the informal houses also support AIP tree species, that have been historically planted as ornamentals (e.g. *Thevetia peruviana*, Yellow oleander). As such, no important habitat is provided for native floral species diversity or community structure within this habitat unit.

From a faunal perspective the high degree of human activity and the degraded nature of the vegetation is likely to only support common species who are able to survive in such areas. During the assessment, a species poor faunal assemblage with low abundances was observed which is characteristic of human modified landscapes. Furthermore, historic and current persecution of the on-site fauna has impacted on the suitability of the faunal habitat observed resulting in moderately low and low faunal sensitivities for the study area.

Conservation significance of the study area:

From a conservation perspective, the proposed development will impact on local and regional floral habitat of conservation concern as it will result in the loss of an Ecological Support Area (ESA) 1 and 2, the remaining extent of the endangered Sekhukhune Plains Bushveld (i.e. the reference state) threatened ecosystem.

Species of Conservation Concern (SCC):

The Online EIA Screening Tool for the study area indicated that the Plant Species Theme is of high sensitivity, and identified Sensitive species 374, Sensitive species 275, Sensitive species 163, *Polygala sekhukhuniensis, Searsia batophylla, Asparagus fourei,* and *Asparagus sekukuniensis* as the floral species triggering this sensitivity. The Animal Species Theme was of medium sensitivity, and identified *Aroegas fuscus* (Brown false shieldback), *Dasymys robertsii* (Robert's shaggy rat), and *Sagittarius serpentarius* (Secrutary Bird) as potentially being located within the study area. With both floral and faunal habitat integrity and diversity decreased because of various anthropogenic pressures, the conditions to support a diversity of floral and faunal SCC is sub-optimal.

No nationally threatened SCC (i.e., Red Data Listed plants), as defined in Section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), were recorded during the site assessment. However, *Searsia batrophylla* has the potential to occur within the Watercourse Habitat Unit. A protected tree, namely *Boscia albitrunca*, as defined under The National Forest Act, 1998 (Act No. 84 of 1998, amended 2001) (NFA) was recorded within the Degraded Bushveld Habitat. As this habitat unit neighbours many of the other habitat units, there is a chance that such a species is also present within these habitat units. Two provincially protected plant species, namely *Aloe cryptopoda* and *Scadoxus puniceus,* which are listed in Schedule 12 (Protected Plants) of the Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA) was also observed in the study area, particularly within the Degraded Bushveld, Rocky Habitat, and the Watercourse Habitat Units. Permits will be required should any of the protected species be removed, destroyed, or relocated with the Department of Environment, Forestry and Fisheries (DEFF) and the Limpopo Economic Development, Environmental and Tourism (LEDET). If a walkdown of the footprint area is conducted prior to construction activities commencing, where these species are rescued and relocated (if encountered), the anticipated impact on their populations will be minimal.

No faunal SCC were recorded within the proposed footprint areas. Only a single avian SCC *Falco biarmicus* (Lanner Falcon) is anticipated to utilise the study area intermittently while foraging. The surrounding areas are for the most part equally degraded with high human activity, as such there is a low chance that other faunal SCC would utilise the footprint areas persistently.

Concluding Remarks:

Following the ecological assessment of the biodiversity within the proposed infrastructure sites, the impacts associated with the proposed development activities were determined. Perceived impacts on the floral and faunal habitat, diversity and SCC are considered to range from medium to insignificant impacts prior to the implementation of mitigation measures. With mitigation measures implemented, the impacts are expected to decrease.

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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Part A: Background Information

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Report author: S. L. Daniels
Report reviewer: N. Cloete (Pr.Sci.Nat)
Report Reference: STS 200060

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on terrestrial biodiversity in terms of Government Notice 648 as promulgated in Government Gazette 45421 of 2019 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/Notes
2.1	**Assessment must be undertaken by a suitably qualified SACNASP registered specialist**	**Part A – C:** Cover Page **Part A:** Appendix E
2.2	**Description of the preferred development site, including the following aspects-**	
2.2.1	*A description of the ecological drivers/processes of the system and how the proposed development will impact these;*	**Part B:** Section 2.1.2 **Part C:** Section 3
2.2.2	*Ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the proposed development site;*	**Part B:** Section 2.1.2 **Part C:** Section 3
2.2.3	*The ecological corridors that the development would impede including migration and movement of flora and fauna;*	**Part A:** Section 3 (desktop analysis) **Part B**: Section 2.1.1 (flora) **Part C:** Section 3 (fauna)
2.2.4	*The description of any significant landscape features (including rare or important flora/faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Areas (FEPA) sub catchments;*	**Part A:** Section 3 **Part B:** Section 2 **Part C:** Section 3.2 – 3.7
2.2.5	*A description of terrestrial biodiversity and ecosystems on the proposed development 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.*	**Part A**: Section 3 (desktop analysis) **Part B**: Section 2 (flora) **Part C:** Section 3 (fauna)
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.**	Not Applicable
2.4	**The Terrestrial Biodiversity Impact Assessment must be based on the results of a site inspection undertaken on the preferred development site and must identify:**	
2.5	**Terrestrial Critical Biodiversity Areas (CBAs), including:** *2.5.1 The reasons why an area has been identified as a CBA;* *2.5.2 An indication of whether or not the development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;* *2.5.3 The impact on species composition and structure of vegetation with an indication of the extent of clearing activities;* *2.5.4 The impact on ecosystem threat status;* *2.5.5 The impact on explicit subtypes in the vegetation;* *2.5.6 The impact on overall species and ecosystem diversity of the site; and* *2.5.7 The impact on populations of species of special concern in the CBA.*	**Part A**: Section 3 (desktop analysis) **Part B**: Section 2 **Part C:** Section 3
2.6	**Terrestrial Ecological Support Areas, including;** *2.6.1 The impact on the ecological processes that operate within or across the site;* *2.6.2 The extent the development will impact on the functionality of the ESA; and* *2.6.3 Loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridor or introducing barriers that impede migration and movement of flora and fauna.*	

2.7	**Protected Areas as defined by the National Environmental Management:** Protected Areas Act, 2004 (Act No. 57 of 2004) including an opinion on whether the proposed development aligns with the objectives/purpose of the Protected Area and the zoning as per the Protected Area Management Plan.	**Part A**: Section 3 (desktop analysis)
2.8	**Priority Areas for Protected Area Expansion, including:** The way in which in which the development will compromise or contribute to the expansion of the protected area network.	**Part A**: Section 3 (desktop analysis)
2.9	Strategic Water Source Areas (SWSA) including: *2.9.1 The impact(s) on the terrestrial habitat of a Strategic Water Source Area; and* 2.9.2 *The impacts of the development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses)*	**Part A**: Section 3 (desktop analysis)
2.10	Freshwater Ecosystem Priority Area (FEPA) sub catchments, including the impacts of the development on habitat condition and/or species in the FEPA sub catchment.	**Assessed separately in the Freshwater Biodiversity Assessments (SAS 220156, 2020)
2.11	Indigenous Forests, including: *2.11.1 Impact on the ecological integrity of the forest;* *2.11.2 Extent of natural or near natural indigenous forest area lost.*	Not Applicable
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	**Part A:** Appendix E
3.2	A signed statement of independence by the specialist.	**Part A:** Appendix E
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	**Part B:** Section 1.4 **Part C:** Section 1.2
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	**Part A**: Appendix C **Part B:** Section 1.5 **Part B:** Appendix A **Part C:** Section 1.2 **Part C:** Appendix A
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	**Part B:** Section 1.4 **Part C:** Section 2
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	**Part B:** Section 3 **Part C:** Section 4
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.	**Part B:** Section 3 & 4 **Part C:** Section 5
3.8	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	**Part B:** Section 4.4 **Part C:** Section 5.4
3.9	A motivation must be provided if there were development footprints identified as per paragraph 2.3 in this table were not considered stating reasons why.	**Part B:** Section 3 & 4
3.10	A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, and any conditions to which the statement is subjected.	**Part B:** Section 5 **Part C:** Section 6

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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), and the associated Alien and Invasive Plant (AIP) Species Regulations, 2014].

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); after Low and Rebelo (1998).	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.
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 National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Alien and Invasive Species (A&IS) Regulations, 2016.
Least Threatened	Least threatened ecosystems are still largely intact.
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).
RDL (Red Data listed) 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 (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.

LIST OF ACRONYMS

AICP	Alien and Invasive Control Plans
AIP	Alien and Invasive Plants
BAP	Biodiversity Actions Plan
BGIS	Biodiversity Geographic Information Systems
BMP	Biodiversity Management Plan
BotSoc	Botanical Society of South Africa
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CEM	Certificate in Environmental Law for Environmental Managers
DEFF	Department of Environment, Forestry and Fisheries
DMR	Department of Mineral Resources
E-GIS	Environmental Geographical Information Systems
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GIS	Geographic Information System
GPS	Global Positioning System
GSSA	Grassland Society of South Africa
Ha	Hectare
HDPE	High-density polyethylene
IAIAsa	International Affiliation for Impact Assessments South Africa Group
IBA	Important Bird Area
IEM	Integrated Environmental Management
IUCN	International Union for the Conservation of Nature
LEDET	Limpopo Economic Development, Environmental and Tourism
LEMA	Limpopo Environmental Management Act, 2003 (Act No.7 of 2003)
MAMSL	Meters Above Mean Sea Level
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
MPRDA	Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Rights Area
NBA	National Biodiversity Assessment
NFA	The National Forest Act, 1998 (Act No. 84 of 1998, amended 2001)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
NL	Not Listed
NOMR	New Order Mining Right
NPAES	National Protected Areas Expansion Strategy
POSA	Plants of southern Africa
PPP	Public Participation Process
PRECIS	Pretoria Computer Information Systems
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
SAAB	South Africa Association of Botanists
SABAP 2	Southern African Bird Atlas 2
SACAD	South Africa Conservation Areas Database
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Area Database
STS	Scientific Terrestrial Services CC
SWSA	Strategic Water Source Areas
TOPS	Threatened or Protected species (in terms of NEMBA)
WSA	Water Source Areas

1 INTRODUCTION

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the Basic Assessment (BA) (EIA) and Environmental Authorisation (EA) process for the proposed surface infrastructure development on the existing Marula Platinum Mine, located approximately 30 km northwest of the town of Burgersfort, Limpopo Province.

The project is located in the Greater Tubatse local Municipality which is an administrative area in the Sekhukhune District Municipality of the Limpopo Province. The R37 runs approximately 4 km east of the mine. The proposed infrastructure development consists of waterlines, powerlines, an ore stockpile and two ventilation shafts with associated refrigeration infrastructure (see project description in section 1.1), hereafter collectively referred to as the "study area". The location and extent of the "study area", within the mining rights area (MRA) of the mine, referred to as the "MRA", is indicated in Figures 1 & 2.

The purpose of this report (Part A) is to define the biodiversity of the study area from a desktop conservation database perspective. It is the objective of this desktop assessment to provide detailed information to guide the fieldwork components (discussed in Parts B and C) to ensure that all relevant ecological aspects are considered prior to performing the field assessments. This report is not a standalone report and should be considered together with the outcome of the biodiversity assessments (floral assessment in Part B and the faunal assessment in Part C).

1.1 Project Description

Marula Platinum Mine now proposes to change their approved layout by establishing additional surface infrastructure, which will require an amendment to Marulas' approved EMPr. The proposed additional surface infrastructure comprises the following (Refer to Figure 3 for a detailed map of the proposed development layout):

- The establishment of two additional ventilation shafts;
- The upgrade to refrigeration and ventilation infrastructure at existing ventilation shafts;
- The establishment of additional water pipelines to support the additional ventilation shafts;
- The expansion and establishment of additional power supply and distribution infrastructure in support of the establishment of additional ventilation shaft and upgrades to existing ventilation shafts);
- The establishment of a product stockpile within the existing footprint of the Concentrator Plant;

- The establishment of an additional pipeline to the approved Tailings Storage Facility (TSF); and
- Structural upgrades of the existing change house and compressed airline at the Clapham Shaft Complex.

Ventilation shafts and upgrades to refrigeration infrastructure

Marula proposes to establish two new additional ventilation shafts within their existing MRA. An upcast and downcast shaft is proposed. The downcast shafts are used to draw clean air into the underground mine workings, whilst the upcast shaft will vent the "dirty/used" air to the surface. There are also existing ventilation shafts on Driekop 253 KT (Ventilation Shaft 6) and Winnarshoek 250 KT (Ventilation Shaft 5). Ventilation Shaft 7 (located on Winnarshoek 250 KT) was approved as part of the Merensky Reef project but is not constructed to date. An overview of these activities is summarised in the table below.

Aspect	Detail	
Proposed establishment of new ventilation shafts - Driekop Shaft	Name	Ventilation Shaft 9.
	Location	Driekop 253 KT (Portion 0)
	Footprint	Within approved footprint of Driekop Shaft 6.
	Technology	Upcast shaft.
	Refrigeration or ventilation infrastructure	Establishment of a new ventilation shaft with surface main fans and electrical rooms.
Proposed establishment of new ventilation shafts - Clapham Shaft	Name	Ventilation Shaft 8.
	Location	Winnarshoek 250 KT (Portion 0)
	Footprint	Approximately 0.5 ha.
	Technology	Downcast shaft.
	Refrigeration or ventilation infrastructure	Establishment of a new bulk air cooler. Establishment of refrigeration plant and condenser cooling towers.
Proposed changes and upgrades at existing infrastructure - Driekop Shaft	Name	Ventilation Shaft 6
	Refrigeration or ventilation infrastructure	Establishment of a new bulk air cooler. Establishment of a refrigeration plant and condenser cooling towers.
	Location of infrastructure	Driekop 253 KT (Portion 0)
	Footprint	Within the existing, approved footprint of the Driekop VS 6 shaft area.
Proposed changes and upgrades at existing infrastructure - Clapham Shaft	Name	Ventilation Shaft 5
	Refrigeration or ventilation infrastructure	Establishment of a new bulk air cooler.
	Location of infrastructure	Winnarshoek 250 KT (Portion 0)
	Footprint	Within the existing, approved footprint of the Clapham VS 5 shaft area.
	Name	Ventilation Shaft 7 (Approved but not constructed)

Aspect	Detail	
	Refrigeration or ventilation infrastructure	Establishment of surface main fans and electrical rooms.
	Location of infrastructure	Winnarshoek 250 KT (Portion 0)
	Footprint	Approximately 1.8 ha.

Upgrades of existing services and infrastructure:

Water supply and distribution

Water supply: Raw water required for the proposed project will be sourced from the existing on-site Lebalelo Raw Water Dam (Plant Dam). Marula has sufficient capacity and volume to accommodate the proposed project water requirements and as such no changes are anticipated to the existing water reticulation storage capacities (Plant Dam) or supply demand.

Distribution: The proposed project will require the establishment of pipelines from the Plant Dam to the new ventilation shafts (Driekop Ventilation Shaft 9 and Clapham Ventilation Shaft 8). The proposed HDPE pipelines will have a diameter of approximately 150 mm (0.15 cm) and will be below ground. The proposed pipeline to the Clapham Ventilation Shaft 8 will be approximately 2.1 km in length with a throughput of 24 l/s. The proposed Driekop Ventilation Shaft 9 pipeline will be approximately 5.2 km in length with a throughput of 24 l/s. The water supply pipeline will be fed into the plant room and subsequently through to the cooling tower. The establishment of the proposed Driekop water supply pipeline will have a total area of disturbance of 5 250 m^2/ 0.525 Ha. The establishment of the proposed Clapham water supply pipeline will have a total area of disturbance of 13 000 m^2 / 1.3 Ha.

Wastewater: Wastewater which contains an elevated salt concentration will emanate from the refrigeration process. This wastewater will be pumped into a surface sump (with approximate dimension of 2 m by 2 m). A return pipeline of approximately 50 mm will carry this wastewater back to the Concentrator Plant. The return pipeline will be located within the same below ground trench as the water supply pipeline to the ventilation shafts and will thus not result in any additional land clearance.

Power supply and transmission

Supply: Power is currently supplied to the mine by a consumer Eskom substation which is comprised of 2 x 20 MVA transformers. The power demand is expected to exceed the output from the 2 x 20 MVA transformer in 2025. In addition, the power requirements for the establishment of the new Clapham Ventilation Shaft 8 will need to be accommodated. Marula therefore proposes to increase the existing Eskom yard capacity to 60 MVA by the

addition of a 40 MVA transformer. The running load will be 54 MVA. Existing power supply infrastructure is sufficient to support the project components at the remaining ventilation shafts.

Distribution: A new 33 kV overhead transmission line will be established from the on-site Eskom yard to the Clapham Ventilation Shaft 8. A new 33 kV overhead transmission line will also be established from the Driekop Shaft Complex to the new Driekop Ventilation Shaft 9, to supply the new ventilation shaft with power. The new 33 kV overhead transmission line will then be fed into a new step-down transformer located at the Clapham and Driekop ventilation shafts. The 33 kV will be stepped down to 11 kV and then fed into the plant room and ventilation fans. The lengths of the Clapham Ventilation Shaft 8 and the Driekop Ventilation Shaft 9 will be 3.8 km and 3.3 km, respectively.

Disturbance to watercourses: Watercourses within the proposed project area include the Tshwenyane, Mogompane, Motse Rivers and an unnamed tributary of the Moopetsi River (with riparian vegetation), as well as numerous non-perennial and ephemeral drainage lines. The proposed power distribution lines and tower bases will be located within 32 m the existing watercourses. A water use license (WUL) will need to be applied for due to this disturbance, however this will be undertaken separately from this Basic Assessment process.

Establishment of a product stockpile

To alleviate storage capacity constraints experienced with their current operations, Marula proposes the establishment of an additional product stockpile. The additional product stockpile will reach a maximum capacity of 200 000 tons and will be located within the existing, disturbed footprint of the Concentrator Plant. The proposed location of the product stockpile is disturbed but unlined. The product material is like the mine's existing tailings and is considered low grade ore. The 2015 geochemical waste assessment undertaken by Golder (Golder, 2015) detailed that the tailings material is classified as a Type 3 waste. The results of the assessment indicated that NO_3 leachate concentrations exceeded the TCT0 threshold in two of the tailing composites. The material was reported to require a Class C liner. Marula will further investigate the liner requirements for the proposed stockpile as part of their WUL application which will be undertaken as a separate process.

TSF pipeline

To increase the operational efficiency at the mine, an additional tailings conveyance pipeline is proposed. The proposed additional pipeline will follow the existing overland pipeline route

which runs from the Concentrator Plant to the Phase 2 TSF. The additional pipeline will be 4 km in length with an internal diameter of 243 mm and comprised of HDPE lined steel.

Upgrade to existing change house (including lamp room) and compressed airline

The current change house and lamp room at the Clapham Shaft Complex has reached its current capacity. An upgrade of the change house (and lamp rooms) is now proposed to accommodate an increase of the labour force for 600 people. The actual construction timeline is expected to begin in 2024 / 2025. In addition to the upgrade of the Clapham change house, the existing 400 NB compressed air ring main from compressor house to Clapham UG mine will be upgraded from 400 NB to 600 NB. No change to the pipeline pressure is anticipated. The structural upgrades of the change house and compressed air ring main will be undertaken within the existing and disturbed Clapham Shaft Complex footprint and no additional land clearance will be required.

TSF contamination plume remediation

Marula is investigating various methods of managing the contamination plume emanating from the existing Tailings Dam facility. The investigation of remediation measures is still in a feasibility phase due to budget constraints, as such there are no specific measures available. However, the approved EMPr requires an amendment to accommodate for the inclusion of management measures which are deemed feasible by Marula. The TSF contamination plume component is therefore only administrative at this stage.

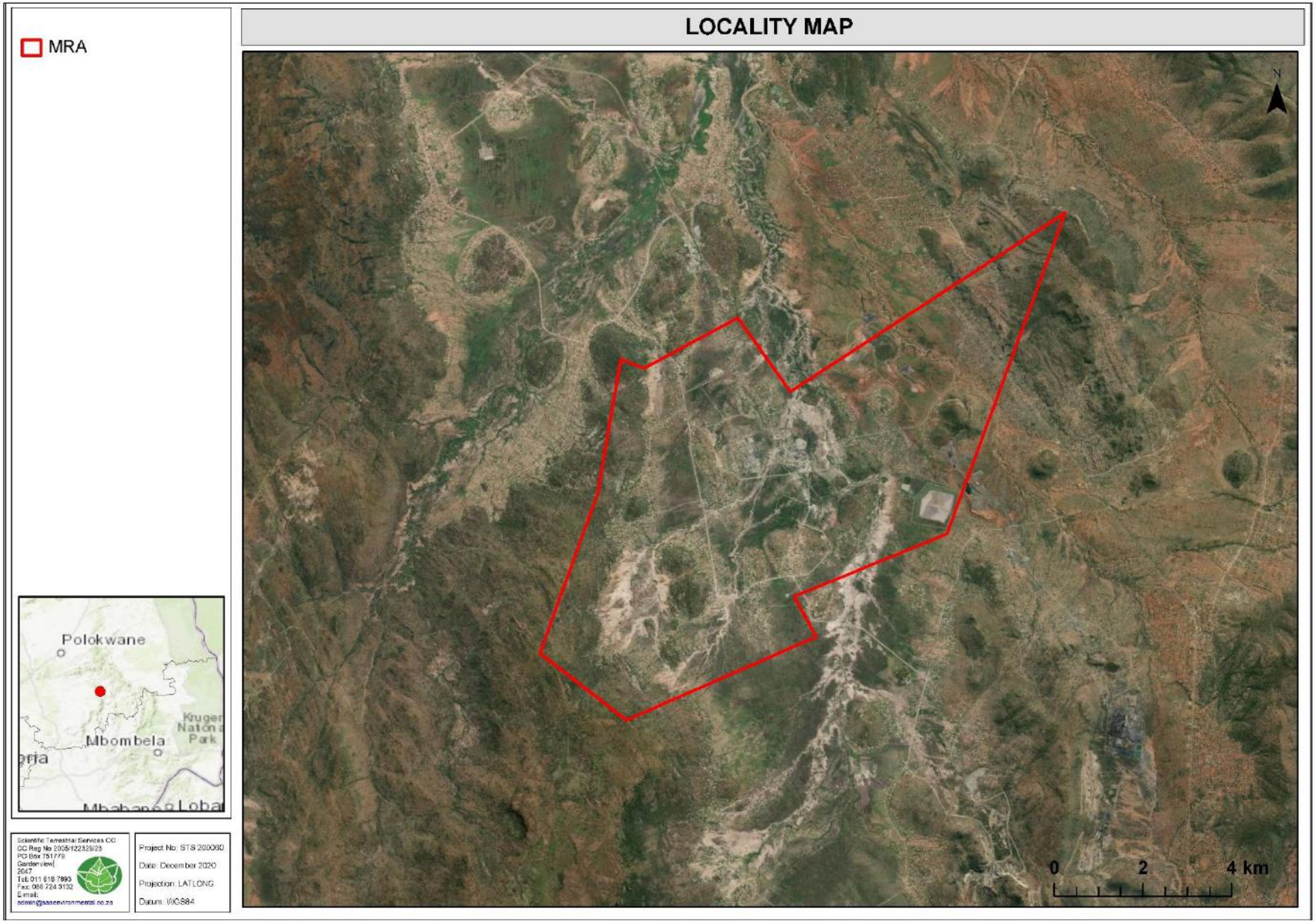

Figure 1: Digital satellite image depicting the MRA in relation to surrounding area.

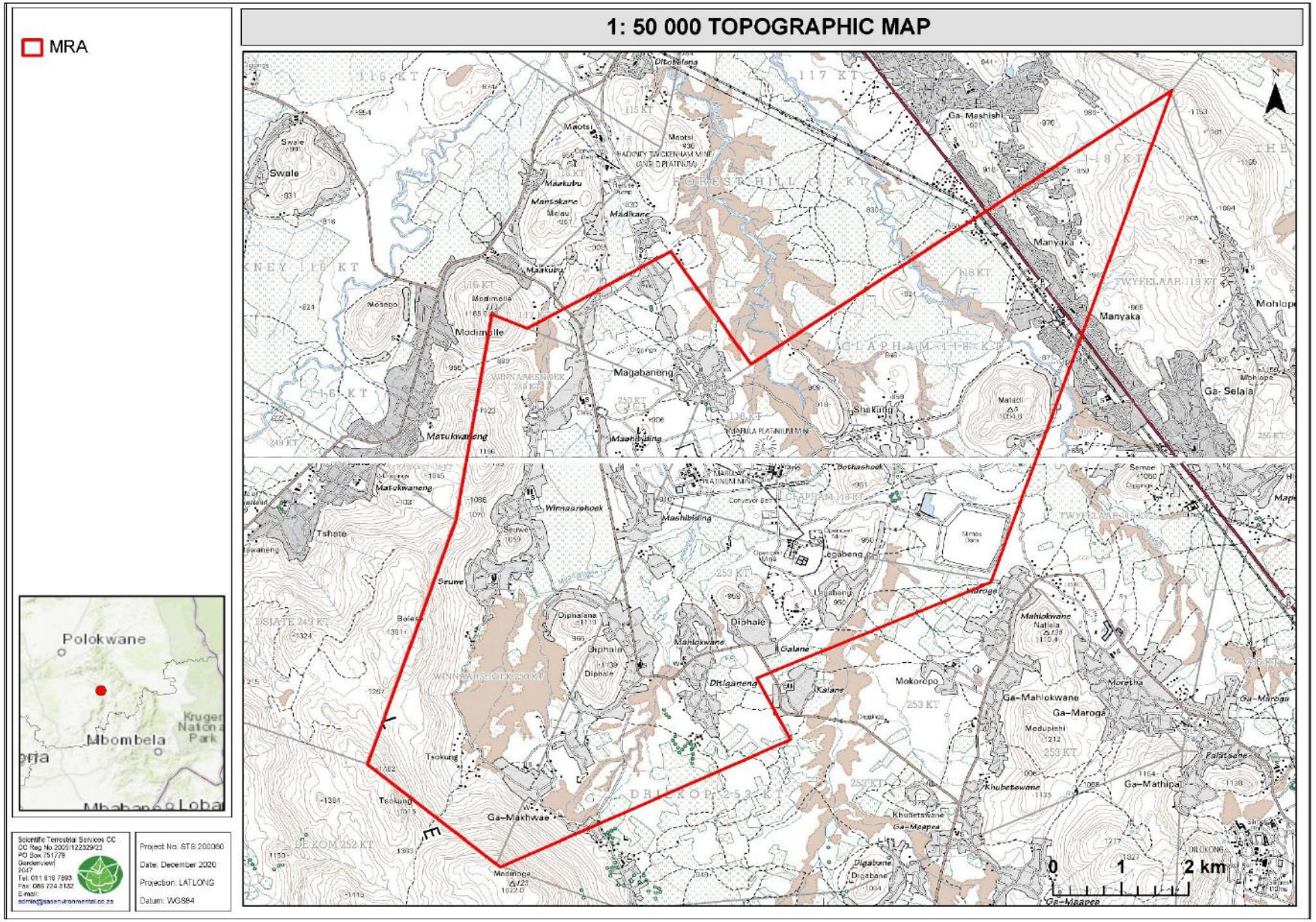

Figure 2: The MRA depicted on a 1:50 000 topographical map in relation to the surrounding area.

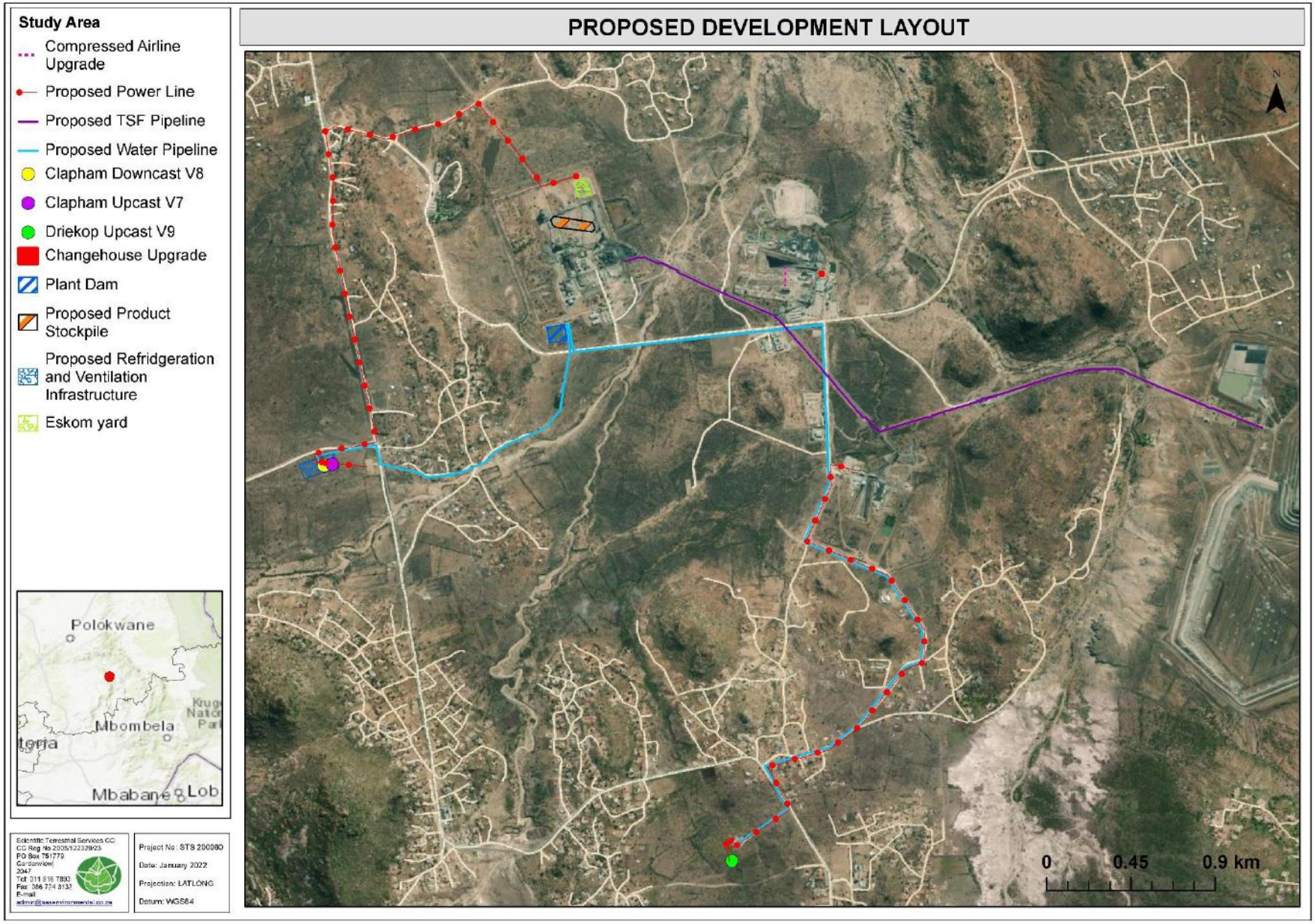

Figure 3: Proposed infrastructure development layout (i.e., study area) within the existing Marula Platinum Mine.

1.2 Scope of Work

Specific outcomes in terms of Part A of the report are as follows:

- To compile a desktop assessment with all relevant information as presented by 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 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 E);
- To outline the legislative requirements that were considered for the assessment (Appendix B of this report); and
- To provide the methodologies followed relating to the impact assessment and development of the mitigation measures (Appendix C) that were applied in the floral and faunal assessments (Part B and Part C).

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The biodiversity desktop assessment is confined to the study area and does not include detailed results of the MRA or adjacent properties, although ecologically important or sensitive areas according to the desktop databases of the surrounding areas have been included on the relevant maps;
- 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 actual site characteristics within the study area at the scale required to inform an environmental process. However, this information is useful as background information to the study and, based on the desktop results, sufficient decision making can take place with regards to the proposed infrastructure development if considered together with the ground-truthed results of the biodiversity assessments (Part B and C); and
- The field assessment was undertaken during late spring (18-19 November 2020). The field assessment aimed to determine the ecological status of the study area, and to "ground-truth" the results of the desktop assessment.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996[1];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- Government Notice 648 as promulgated in Government Gazette 45421 of 2019 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);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Forest Act, 1998 (Act No. 84 of 1998, amended 2001) (NFA);
- Government Notice R598 Alien and Invasive Species Regulations as published in the Government Gazette 37885 dated 1 September 2014 as it relates to the National Environmental Management Biodiversity Act, 1998 (Act No. 107 of 1998);
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA).
- Government Notice 536 List of Protected Tree Species as published in the Government Gazette 41887 dated 7 September 2018 as it relates to the NFA;
- The Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA); and
- The Limpopo Environmental Management Act, 2003 (Act No.7 of 2003) (LEMA).

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

2 ASSESSMENT 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 includes [2]:

[1] 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 not the acts amending it are allocated act numbers.

[2] Datasets obtained from:

- The National Protected Areas Expansion Strategy (NPAES) focus areas for Protected Area Expansion, 2009 (Formally and Informally Protected Areas):
- South African Conservation Areas Database, Quarter 2 (SACAD, 2020);
- The South African Protected Areas Database, Quarter 2 (SAPAD, 2020);
- The Limpopo Conservation Plan version 2 (2013),
- Mucina and Rutherford, 2012 and 2018:
  - Biomes, Bioregions and Vegetation Type(s);
- The National Threatened Ecosystems (2011);
- The National Biodiversity Assessment (NBA, 2018);
- Important Bird and Biodiversity Areas (IBAs) (2015), in conjunction with the South African Bird Atlas Project (SABAP2); and
- The International Union for Conservation of Nature (IUCN).

The field assessment took place during late spring (18-19 November 2020) to determine the ecological status of the study area and to "ground-truth" the results of the desktop assessment. Results of the field assessment a presented in Parts B and C.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study Area based on National and Provincial Datasets

The following section contains data accessed as part of the desktop assessment and are presented as a "dashboard" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for improved assimilation of results by the reader to take place. Where required, further discussion and interpretation are provided.

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

Table 1: Summary of the biodiversity characteristics associated with the study area [Quarter Degree Squares (QDS) 2430AC and 2430CA].

<table>
<tr><th colspan="2">DETAILS OF THE STUDY AREA IN TERMS OF MUCINA & RUTHERFORD (2012 AND 2018)</th><th colspan="2">DESCRIPTION OF THE VEGETATION TYPE RELEVANT TO THE STUDY AREA (MUCINA & RUTHERFORD 2006)</th></tr>
<tr><td>Biome</td><td>The study area is situated within the Savanna Biome.</td><td rowspan="2">Distribution</td><td rowspan="2">Limpopo and Mpumalanga Provinces: Lowland area from Burgersfort and the lower basin of the Steelpoort River in the south, northwards through the plains of the Motse River basin to Jobskop and Legwareng (south of the Strydpoort Mountains). Continues up the basin of the Olifants River to around Tswaing and the valleys of the Lepellane and Mohlaletsi Rivers.</td></tr>
<tr><td>Bioregion</td><td>The proposed study area is situated within the Central Bushveld Bioregion.</td></tr>
<tr><td>Vegetation Type</td><td>The proposed study area falls within the Sekhukhune Plains Bushveld (SVcb 27).</td><td rowspan="3">Climate</td><td>Summer rainfall with very dry winters</td></tr>
<tr><td colspan="2">CONSERVATION DETAILS PERTAINING TO THE STUDY AREA (VARIOUS DATABASES)</td><td>
<table>
<tr><th>MAP (mm)</th><th>MAT (°C)</th><th>MFD (days)</th><th>MAPE (mm)</th><th>MASMS (%)</th></tr>
<tr><td>518</td><td>19</td><td>4</td><td>2084</td><td>79</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">National Threatened Ecosystems (2011)</td><td rowspan="2">According to the National Threatened Ecosystem Dataset, the sections of the study area is located within an ecosystem that is considered Endangered, namely the Sekhukhune Plains Bushveld.

None of the three proposed ventilation shafts, nor the proposed ore stockpile are located within the remnants of the endangered ecosystem. Only the proposed water pipelines and power line routes are located within remnants of the endangered ecosystem.

Endangered (EN) ecosystems have lost significant habitat or have experienced significant deterioration in condition, with loss of structure and function. Further loss or deterioration should be avoided. 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><td>Altitude (m)</td><td>700–1 100</td></tr>
<tr><td>Conservation</td><td>Vulnerable according to Mucina and Rutherford (2006) but the status has been changed to Endangered according to the updated National Biodiversity Assessment (2018). Target 19%. Nearly 2% statutorily conserved in Potlake, Bewaarkloof and Wolkberg Caves Nature Reserves. Approximately 25% of this area has been transformed and is mainly under dry-land subsistence cultivation. A small area is under pressure from chrome and platinum mining activities and the associated urbanisation. Depending on commodities, this threat could increase in the future. There is a high level of degradation of much of the remaining vegetation by unsustainable harvesting and utilisation. Erosion widespread at usually high to very high levels with donga formation. Alien Agave species, Caesalpinia decapetala, Lantana camara, Melia azeda-rach, Nicotiana glauca, Opuntia species, Verbesina encelioides and Xanthium strumarium are widespread but scattered.</td></tr>
<tr><td>National Biodiversity Assessment (2018) Figure 4</td><td>The study area falls within the remaining extent of the Sekhukhune Plains Bushveld (Endangered), which is currently poorly protected.

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 Protected Areas Act, 2003 (Act No. 57 of 2003), and compared with the biodiversity target for that ecosystem type.</td><td>Vegetation & landscape features (Dominant Floral Taxa in Appendix B)</td><td>Mainly semi-arid plains and open valleys between chains of hills and small mountains running parallel to the escarpment. Predominantly short, open to closed thornveld with an abundance of Aloe species and other succulents. Heavily degraded in places and overexploited by man for cultivation, mining, and urbanisation. Both man-made and natural erosion dongas occur in areas containing clays rich in heavy metals. Encroachment by indigenous microphyllous (fine-leaved) trees and invasion by alien species is common throughout the area.</td></tr>
</table>

	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 iv. If less than 5% it is Hardly Protected.	**Geology and Soils**	Complex geology, with rocks mainly mafic and ultramafic intrusive rocks of the main to lower zones of the Rustenberg Layered Suite on the eastern lobe of the Bushveld Igneous Complex (Vaalian). The zones (subsuites) are dominated by concentric belts of norite, gabbro, anorthosite and pyroxenite, with localised protrusions of magnetite, chromatite, serpentinised harzburgite, olivine diorite, shale, dolomite and quartzite. Most of the area consists of red apedal soils. Deep, loamy Valsrivier soils are characteristic of the plains and shallow Glenrosa soils are found on the low-lying, rocky hills. Patches of erodable black, melanic structured horizons are common around small mountains. Some Steendal soils are underlain by gypsum. Land types mainly Ae, Ib, Ea and Ia.
SAPAD (2020, Q2); SACAD (2020, Q2); NPAES (2009) Figure 5	According to the National Protected Areas Expansion Strategy (NPAES, 2009) database, the study area falls within 10 km of the North East Escarpment Focus Area. The South African Protected Area Database (SAPAD, 2020)[3] and the South African Conservation Areas Database (SACAD, 2020)[4] do not indicate that any protected or conservation areas fall within 10 km of the study area.		
IBA (2015)	The study area is not located within an Important Bird and Biodiversity Area (IBA, 2015), nor is it located within 10 km of an IBA.		
NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL (2020)			
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.		**Plant Species**	For the Plant Species theme, the entire study area is within an area that has a **High sensitivity**. Sensitive species identified by the Screening tool include: Sensitive species 374, Sensitive species 275, Sensitive species 163, *Polygala sekhukhuniensis, Searsia batophylla, Asparagus fourei,* and *Asparagus sekukuniensis*.
		Animal Species	For the Animal Species theme, a **medium sensitivity** was reported for the study area. Sensitive species identified by the Screening tool include: *Aroegas fuscus* (Brown false shieldback), *Dasymys robertsii* (Robert's shaggy rat), and *Sagittarius serpentarius* (Secrutary Bird).
		Terrestrial Sensitivity	The Terrestrial Sensitivity for the study area has a very **high sensitivity**. Triggered features include: CBA1, CBA2, ESA1, and ESA2.

[3] **SAPAD (2020):** The definition of protected areas follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the "System of Protected Areas", which consists of the following kinds of protected areas - 1. Special nature reserves; 2. National parks; 3. Nature reserves; 4. Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003); 5. World heritage sites declared in terms of the World Heritage Convention Act; 6. Marine protected areas declared in terms of the Marine Living Resources Act; 7. Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998); and 8. Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970).

[4] **SACAD (2020):** The types of conservation areas that are currently included in the database are the following: 1. Biosphere reserves, 2. Ramsar sites, 3. Stewardship agreements (other than nature reserves and protected environments), 4. Botanical gardens, 5. Transfrontier conservation areas, 6. Transfrontier parks, 7. Military conservation areas and 8. Conservancies.

LIMPOPO CONSERVATION PLAN V2 (2013)			
Ecological Support Areas 1 **Figure 6**	Parts of the powerlines and waterlines transverse areas considered to be ESA 1. ESA 1 are in a largely natural state. Land management recommendations: Implement appropriate zoning and land management guidelines to avoid impacting on ecological processes. Avoid intensification of land use and fragmentation of natural landscapes. Incompatible land use: Urban land use including Residential (including golf estates, rural residential, and resorts). Business, Mining and Industrial: Infrastructure (roads, powerlines, pipelines).	**Ecological Support Areas 2** **Figure 6**	Parts of the powerlines and waterlines, the compressed airline, change house as well as three ventilation shafts (and associated infrastructure) are located within an ESA 2. ESA 2 areas are no longer intact but potentially retain significant importance from a process perspective (e.g., maintaining landscape connectivity). Land management recommendations: Maintain current land-use. Avoid any intensification of the current land-use which may result in additional impact on ecological processes. Incompatible land-use: any land-use activity that results in additional impacts on ecological functioning mostly associated with the intensification of and use in the area.
Flora	A Key location for a key vegetation community intersects the study area. The entire extent of the study area is located within an area identified as important for Red Data Species.		
MINING & BIODIVERSITY GUIDELINES			
High Biodiversity Importance **Figure 7**	The study area is located within areas identified as **Highest Biodiversity Importance** and **High Biodiversity Importance,** according to the Mining and Biodiversity Guidelines (2012). Small sections of the powerlines and waterlines throughout the study area transverse areas of High Biodiversity Importance. **Areas of Highest Biodiversity Importance** Risk for mining: Highest risk for mining. Implications for mining: EIA's and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licenses, and environmental authorisations. If confirmed, the risk of fatal flaws is high. **Areas of High Biodiversity Importance** Risk for mining: High risk for mining. Implications for mining: These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, for maintaining important ecosystem services for communities or the country. An EIA should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on spatial biodiversity.		
STRATEGIC WATER SOURCE AREA (SWSA) 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	The study area is not within 10 km of a Strategic Water Source Area.		

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.

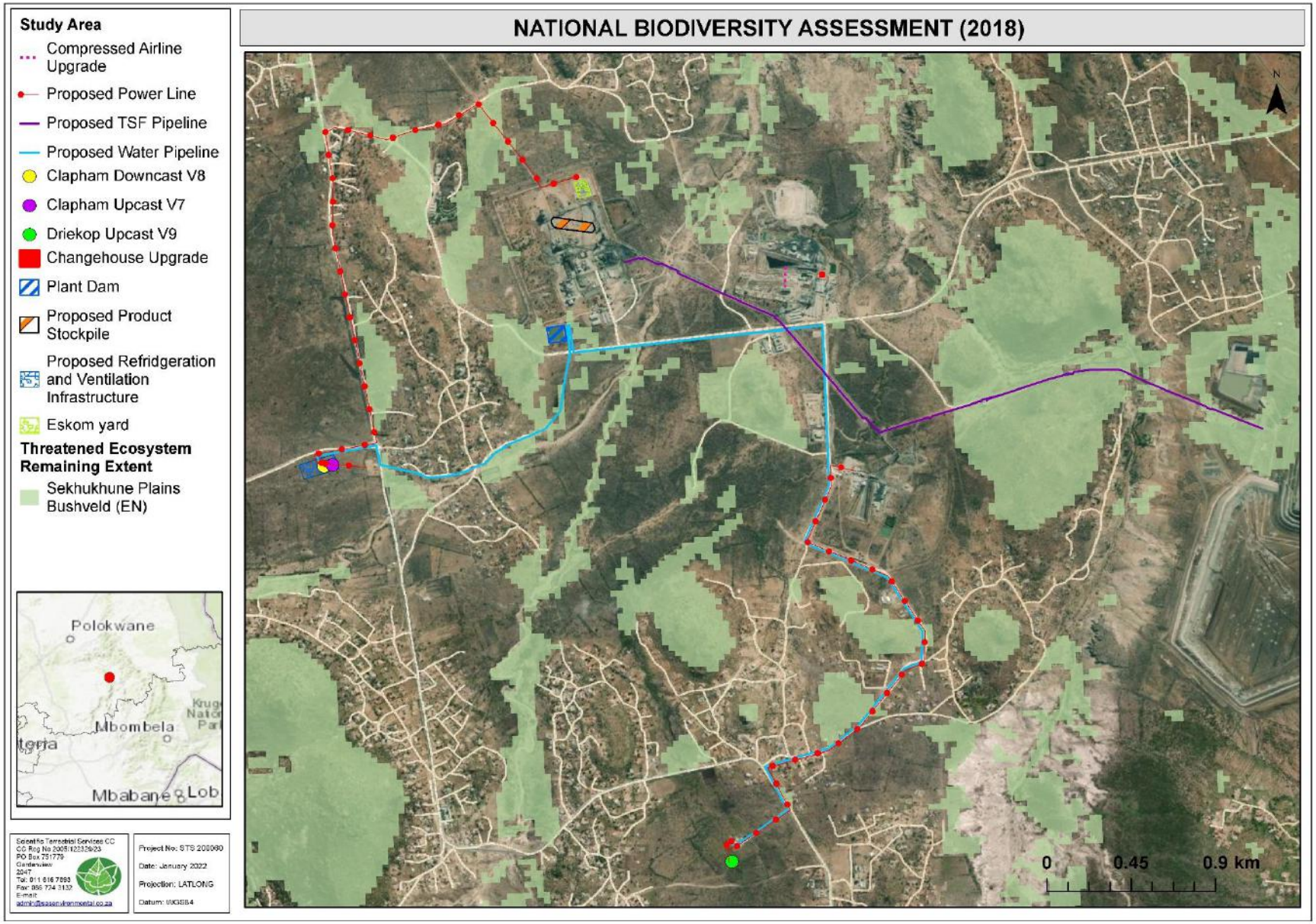

Figure 4: The remaining extent of the Makhado Sweet Thornveld (LC), according to the National Biodiversity Assessment (NBA, 2018).

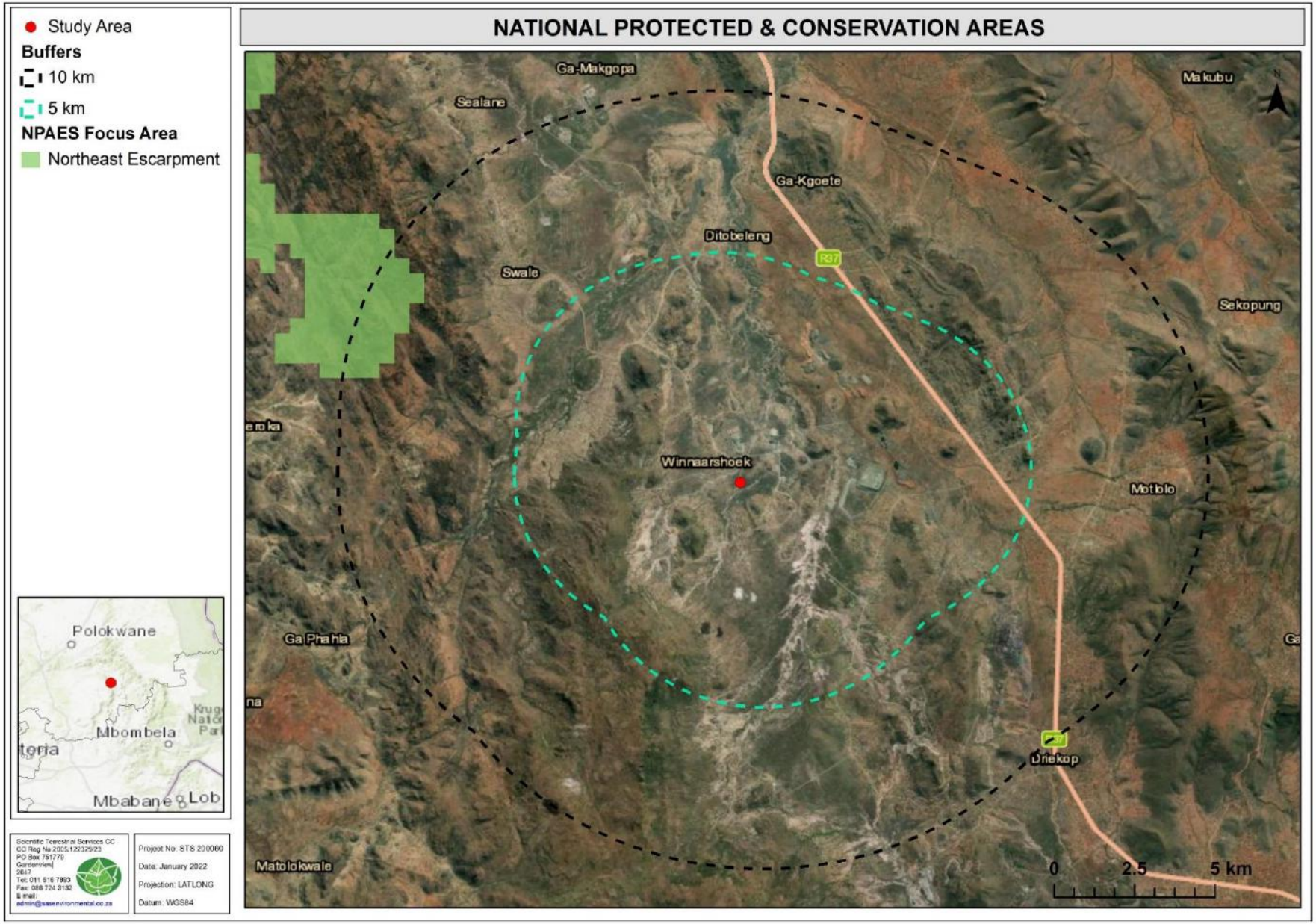

Figure 5: Protected Areas within 10 km of the study area (NPAES, 2009).

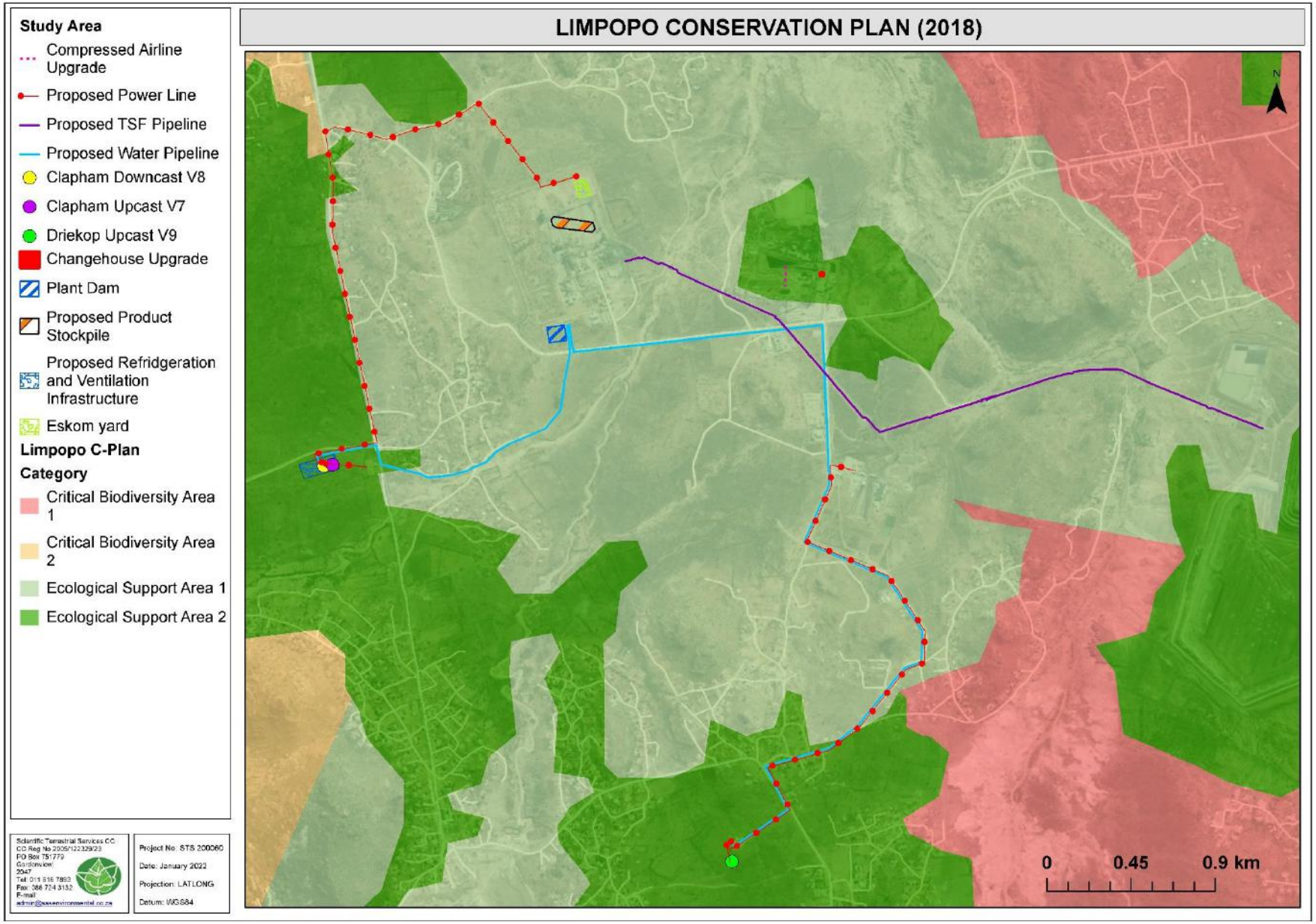

Figure 6: Importance of the study area according to the Limpopo Conservation Plan Version 2 (2013).

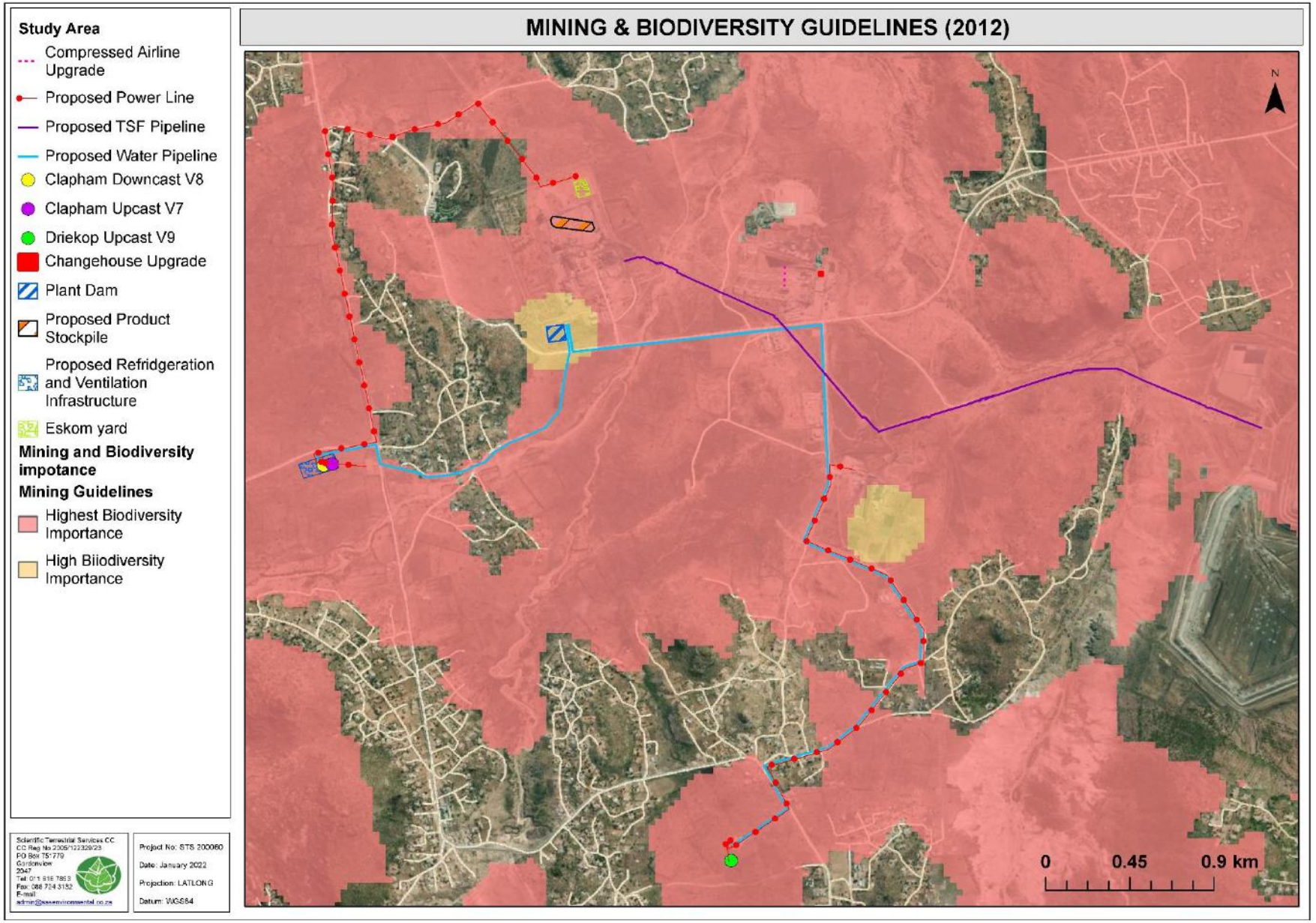

Figure 7: Importance of the study according to the Mining and Biodiversity Guidelines (2012).

4 STRUCTURE OF THE BIODIVERSITY REPORT

Part A of this report served to introduce the study area, as well as the general approach to the study. Part A also presents the results of general desktop information reviewed as part of the study including the information generated by the relevant authorities as well as the context of the site in relation to the surrounding anthropogenic activities and ecological character.

Part B presents the results of the floral field assessment, data analyses and discussion of the results. Part B then presents the results of the impact assessment where the impacts on floral ecology and biodiversity are discussed.

Part C presents the results of the faunal field assessment, data analyses and discussion of the results. Part C then presents the results of the impact assessment where the impacts on faunal ecology and biodiversity are discussed.

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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.

Although STS CC exercises due care and diligence in rendering services and preparing documents, STS CC accepts no liability and the client, by receiving this document, indemnifies STS CC and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by STS CC and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must refer to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX B: Legislative Requirements

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 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.

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations (GN R326 as amended in 2017 and well as listing notices 1, 2 and 3 (GN R327, R325 and R324 of 2017), 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 Environmental Impact Assessment process depending on the nature of the activity and scale of the impact.

The National Environmental Management Biodiversity Act, 2004 (Act No. 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.

The National Forest Act, 1998 (Act No. 10 of 1998), as amended in September 2011 (NFA)

According to the department of Department of Environment, Forestry and Fisheries (DEFF) (previously the Department of Agriculture, Forestry and Fisheries (DAFF)) ©2019 website (https://www.daff.gov.za/daffweb3/):
"In terms of the National Forests Act of 1998 certain tree species (types of trees) can be identified and declared as protected. The Department of Water Affairs and Forestry followed an objective, scientific and participative process to arrive at the new list of protected tree species, enacted in 2004. All trees occurring in natural forests are also protected in terms of the Act. Protective actions take place within the framework of the Act as well as national policy and guidelines. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilisation."

Applicable sections of the NFA pertaining to the proposed project include the below:
Section 12:
Declaration of trees as protected

1) The Minister may declare-
    a. particular tree,
    b. a particular group of trees,
    c. a particular woodland; or
    d. trees belonging to a particular species,
    to be a protected tree, group of trees, woodland or species.
2) The Minister may make such a declaration only if he or she is of the opinion that the tree, group of trees, woodland or species is not already adequately protected in terms of other legislation.
3) In exercising a discretion in terms of this section, the Minister must consider the principles set out in section 3(3) of the NFA.

Section 15(1):
No person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence granted by the Minister or in terms of an exemption from the provisions of this subsection published by the Minister in the Gazette.

Contravention of this declaration is regarded as a first category offence that may result in a person who is found guilty of being sentenced to a fine or imprisonment for a period up to three years, or both a fine and imprisonment.

Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 1003 Alien Invasive Species List as published in the Government Gazette 43726 of 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)

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 unauthorised 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 minimise 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, 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.

The Conservation of Agricultural Resources Act, 1983 (Act No. 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 construction and operation, phases.

Limpopo Environmental Management Act (Act No. 7 of 2003) (LEMA)

The objectives of this Act are:

- to manage and protect the environment in the Province;
- to secure ecologically sustainable development and responsible use of natural resources in the
- Province;
- generally, to contribute to the progressive realisation of the fundamental rights contained in section 24 of the Constitution of the Republic of South Africa Act, 1996 (Act No. 108 of 1996), and
- to give effect to international agreements effecting environmental management which are binding on the Province.

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).

The Minerals and Petroleum Resource Development Act, 2002 (Act No. 28 of 2002) (MPRDA)

The obtaining of a New Order Mining Right (NOMR) is governed by the MPRDA. The MPRDA requires the applicant to apply to the Department of Mineral Resources (DMR) for a NOMR which triggers a process of compliance with the various applicable sections of the MPRDA. The NOMR process requires environmental authorisation in terms of the MPRDA Regulations and specifically requires the preparation of a Scoping Report, an Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP), and a Public Participation Process (PPP).

APPENDIX C: Impact Assessment Methodology

SLR METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Note: Part A provides the definition for determining impact consequence (combining intensity, spatial scale, and duration) and impact significance (the overall rating of the impact). Impact consequence and significance is determined from Part B and C. The interpretation of the impact significance is given in Part D.

The method to be used for assessing risks/impacts is outlined in the sections below.

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilisation against the 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. A 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.

***VH = very high, H = high, M= medium, L= low and VL= very low and + denotes a positive impact.**

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[5] 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 construction and operation.

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

APPENDIX D: Vegetation Types

Sekhukhune Plains Bushveld (SVcb 27)

Remarks: This semi-arid bushveld is a disturbed and degraded system with many erosion dongas. However, much of the erosion can be attributed to inherent edaphic properties. The unit is situated in the Sekhukhuneland CE (Van Wyk & Smith 2001). Several endemic taxa of this unit still require formal description (Siebert et al. 2001). It is related to SVcb 28 Sekhukhune Mountain Bushveld, SVcb 23 Polokwane Plateau Bushveld and SVcb 15 Springbokvlakte Thornveld in terms of floristic diversity, species richness and vegetation structure (Breebaart & Deutschländer 1997, Siebert et al. 2002b).

Table D1: Dominant & typical floristic species of the Sekhukhune Plains Bushveld (Mucina & Rutherford, 2012)

Group	Species
Woody Species	
Tall Trees	*Vachellia erioloba*, *Philenoptera violacea*
Small trees	*Senegalia mellifera* subsp. *detinens* (d), *Vachellia. nilotica* (d), *Vachellia. tortilis* subsp. *heteracantha* (d), *Boscia foetida* subsp. *rehmanniana* (d), *Vachellia grandicornuta*, *Albizia anthelmintica*, *Balanites maughamii*, *Combretum imberbe*, *Commiphora glandulosa*, *Maerua angolensis*, *Markhamia zanzibarica*, *Mystroxylon aethiopicum* subsp. *schlechteri*, *Ptaeroxylon obliquum*, *Schotia brachypetala*, *Ziziphus mucronata*.
Tall shrubs	*Searsia engleri* (d), *Cadaba termitaria*, *Dichrostachys cinerea*, *Ehretia rigida* subsp. *rigida*, *Grewia bicolor*, *Karomia speciosa*, *Maerua decumbens*, *Rhigozum brevispinosum*, *R. obovatum*, *Tinnea rhodesiana*, *Triaspis glaucophylla*.
Low shrubs	*Felicia clavipilosa* subsp. *transvaalensis* (d), *Seddera suffruticosa* (d), *Lasiosiphon polycephalus*, *Gossypium herbaceum* subsp. *africanum*, *Jamesbrittenia atropurpurea*, *Jatropha latifolia* var. *latifolia*, *Lantana rugosa*, *Melhania rehmannii*, *Justicia divaricata*, *Myrothamnus flabellifolius*, *Pechuel-Loeschea leubnitziae*, *Plinthus rehmannii*.
Succulent Shrubs	*Aloe cryptopoda* (d), *Euphorbia enormis* (d), *Kleinia longiflora* (d), *Aloe castanea*, *A. globuligemma.*
Succulents	
Succulent climbers	*Cynanchum viminale*.
Succulent trees	*Euphorbia tirucalli* (d).
Herbaceous species	
Herbaceous climbers	*Coccinia rehmannii*, *Decorsea schlechteri.*
Herbs	*Ocimum filamentosum* (d), *Phyllanthus maderaspatensis* (d), *Blepharis integrifolia*, *Corchorus asplenifolius*, *Hibiscus praeteritus*, *Ipomoea magnusiana*.
Geophytic Herbs	*Drimia altissima*, *Sansevieria pearsonii*
Graminoids	
Grasses	*Cenchrus ciliaris* (d), *Enneapogon cenchroides* (d), *Panicum maximum* (d), *Urochloa mosambicensis* (d), *Aristida adscensionis*, *A. congesta*, *Eragrostis barbinodis*, *Paspalum distichum*, *Schmidtia pappophoroides*, *Stipagrostis hirtigluma* subsp. *patula*, *Tragus berteronianus.*

***(d) – Dominant species for the vegetation type**

APPENDIX E: Details, Expertise And Curriculum Vitae of Specialists

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

Samantha-Leigh Daniels	PhD Candidate Plant Science (University of Pretoria)
Daryl van der Merwe	MSc (Conservation Biology) (University of Cape Town)
Christien Steyn	MSc Plant Science (University of Pretoria)
Christopher Hooton	BTech Nature Conservation (Tshwane University of Technology)
Kim Marais	BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
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

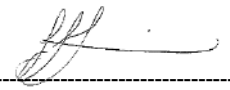
Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Nelanie Cloete		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Cell:	084 311 4878
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	Nelanie@sasenvgroup.co.za		
Qualifications	MSc Environmental Management (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)		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Kim Marais		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Cell:	071 413 2245
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	kim@sasenvgroup.co.za		
Qualifications	BSc (Hons) Zoology (University of the Witwatersrand) BSc (Zoology and Conservation) (University of the Witwatersrand)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Member of South African Wetland Forum		

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 -

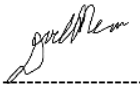
- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity 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, Daryl van der Merwe, 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, Christien Steyn, 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

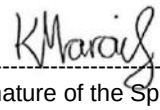
I, Christopher Hooton, declare that -

- 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, Kim Marais, 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

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

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 DARYL VAN DER MERWE

PERSONAL DETAILS

Position in Company	Field Biologist
Joined SAS Environmental Group of Companies	2019

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Environmental Observation Network (SAEON)

EDUCATION

Qualifications

MSc (Conservation Biology) (University of Cape Town)	2019
BSc (Hons) Plant Science (Ecology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Faunal assessments
- Invertebrate assessments
- Invertebrate monitoring
- Avifaunal Assessments
- Alien and Invasive Control Plan (AICP)
- Ecological Scans
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting

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 the EMPR and WUL conditions

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

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, Eastern Cape, Western Cape, Northern Cape, Free State
Africa - Zimbabwe, Sierra Leone

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

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTIEN STEYN

PERSONAL DETAILS

Position in Company	Floral Ecologist
Joined SAS Environmental Group of Companies	2018

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Association of Botanists (SAAB)
Member of the Botanical Society of South Africa (BotSoc)

EDUCATION

Qualifications

MSc (Plant Science) (University of Pretoria)	2017
BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Free State

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Terrestrial Ecological and Biodiversity Scoping Assessments
- Terrestrial Ecological and Biodiversity Screening Assessments
- Floral Assessments
- Input into Terrestrial Rehabilitation Plan design with the focus on the re-establishment of vegetation
- Floral Rescue and Relocation Plans
- Alien and Invasive Control Plan (AICP)
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Desktop Studies, Mapping and Background Information Research

Training

- Alien and Invasive Plant Identification and awareness

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

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 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

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BIODIVERSITY ASSESSMENT AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE DEVELOPMENT OF SURFACE INFRASTRUCTURE AT THE MARULA PLATINUM MINE, LIMPOPO PROVINCE

Prepared for

SLR Consulting Ltd.

January 2022

Part B: Floral Assessment

Prepared by: Scientific Terrestrial Services CC
Report author: S. L Daniels
Report reviewers: N. Cloete (Pr. Sci. Nat)
C. Steyn
Report reference: STS 200060

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LIST OF ACRONYMS

AICP	Alien and Invasive Control Plans
AIP	Alien and Invasive Plants
BAP	Biodiversity Actions Plan
BGIS	Biodiversity Geographic Information Systems
BMP	Biodiversity Management Plan
BotSoc	Botanical Society of South Africa
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CEM	Certificate in Environmental Law for Environmental Managers
DEFF	Department of Environment, Forestry and Fisheries
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
E-GIS	Environmental Geographical Information Systems
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GIS	Geographic Information System
GPS	Global Positioning System
GSSA	Grassland Society of South Africa
Ha	Hectare
IEM	Integrated Environmental Management
IUCN	International Union for the Conservation of Nature
LEDET	Limpopo Economic Development, Environmental and Tourism
LEMA	Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003)
MRA	Mining Rights Area
NBA	National Biodiversity Assessment
NFA	The National Forest Act, 1998 (Act No. 84 of 1998, amended 2001)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
NL	Not Listed
NWA	National Water Act, 1998 (Act No. 36 of 1998)
POSA	Plants of southern Africa
PRECIS	Pretoria Computer Information Systems
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
STS	Scientific Terrestrial Services CC
TOPS	Threatened or Protected species (in terms of NEMBA)

GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson *et* al. (2011), Hui and Richardson (2017), Wilson *et* al. (2017) and Skowno et al. (2019), 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), and the associated Alien and Invasive Species Regulations, 2014].

Alien species (syn. exotic species; non-native)	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.
Biodiversity Management Plan	A plan aimed at ensuring the long-term survival in nature of an indigenous species, a migratory species or an ecosystem, published in terms of the Biodiversity Act. Norms and standards to guide the development of Biodiversity Management Plans for Species have been developed. At the time of writing, norms and standards for Biodiversity Management Plans for Ecosystems were in the process of being developed.
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); after Low and Rebelo (1998).	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.
Casual species	Those alien species that do not form self-replacing populations in the invaded region and whose persistence depends on repeated introductions of propagules (Richardson et al. 2000; Pyšek et al. 2004). The term is generally used for plants.
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.
Critically Endangered (CR) (IUCN Red List category)	**Applied to both species/taxa and ecosystems**: 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. Critically Endangered ecosystem types are considered to be at an extremely high risk of collapse. Most of the ecosystem type has been severely or moderately modified from its natural state. The ecosystem type is likely to have lost much of its natural structure and functioning, and species associated with the ecosystem may have been lost. Critically endangered species are those considered to be at extremely high risk of extinction.
Degradation	The many human-caused processes that drive the decline or loss in biodiversity, ecosystem functions or ecosystem services in any terrestrial and associated aquatic ecosystems.
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.
Driver (ecological)	A driver is any natural or human-induced factor that directly or indirectly causes a change in ecosystem. A direct driver clearly influences ecosystem processes, where

	an indirect driver influences ecosystem processes through altering one or more direct drivers.
Endangered (EN) (Red List category)	**Applied to both species/taxa and ecosystems**: 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. Endangered ecosystem types are at a very high risk of collapse. Endangered species are those considered to be at very high risk of extinction.
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.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
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 National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Alien and Invasive Species (A&IS) Regulations, 2014.
Least Threatened	Least threatened ecosystems are still largely intact.
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 List (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 (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project. These are species and subspecies that are important for South Africa's conservation decision-making processes.
Threatened ecosystem	An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, based on an analysis of ecosystem threat status. A threatened ecosystem has lost or is losing vital aspects of its structure, function or composition. The Biodiversity Act allows the Minister of Environmental Affairs or a provincial MEC for Environmental Affairs to publish a list of threatened ecosystems. To date, threatened ecosystems have been listed only in the terrestrial environment. In cases where no list has yet been published by the Minister, such as for all aquatic ecosystems, the ecosystem threat status assessment in the NBA can be used as an interim list in planning and decision making. Also see Ecosystem threat status.
Threatened species	A species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment (Red List), using a standard set of

	criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.
Vulnerable (VU) (Red List category)	**Applied to both species/taxa and ecosystems**: 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. An ecosystem type is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for VU and is then considered to be at a high risk of collapse.
Weeds	A plant is a weed '*if, in any specified geographical area, its populations grow entirely or predominantly in situations markedly disturbed by man (without, of course, being deliberately cultivated plants*)' (Baker 1965); in cultural terms, weeds are plants (**not necessarily alien**) that grow in sites where they are not wanted and that have detectable economic or environmental impacts (Pyšek et al. 2004).

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on terrestrial biodiversity in terms of Government Notice 648 as promulgated in Government Gazette 45421 of 2019 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) (NEMA).

No.	Requirements	Section in report/Notes
2.1	**Assessment must be undertaken by a suitably qualified SACNASP registered specialist**	**Part A – C:** Cover Page **Part A:** Appendix E
2.2	**Description of the preferred development site, including the following aspects-**	
2.2.1	*A description of the ecological drivers/processes of the system and how the proposed development will impact these;*	**Part B:** Section 2.1.2 **Part C:** Section 3
2.2.2	*Ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the proposed development site;*	**Part B:** Section 2.1.2 **Part C:** Section 3
2.2.3	*The ecological corridors that the development would impede including migration and movement of flora and fauna;*	**Part A:** Section 3 (desktop analysis) **Part B**: Section 2.1.1 (flora) **Part C:** Section 3 (fauna)
2.2.4	*The description of any significant landscape features (including rare or important flora/faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Areas (FEPA) sub catchments;*	**Part A:** Section 3 **Part B:** Section 2 **Part C:** Section 3.2 – 3.7
2.2.5	*A description of terrestrial biodiversity and ecosystems on the proposed development 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.*	**Part A**: Section 3 (desktop analysis) **Part B**: Section 2 (flora) **Part C:** Section 3 (fauna)
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.**	Not Applicable
2.4	**The Terrestrial Biodiversity Impact Assessment must be based on the results of a site inspection undertaken on the preferred development site and must identify:**	
2.5	**Terrestrial Critical Biodiversity Areas (CBAs), including:** *2.5.1 The reasons why an area has been identified as a CBA;* *2.5.2 An indication of whether or not the development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;* *2.5.3 The impact on species composition and structure of vegetation with an indication of the extent of clearing activities;* *2.5.4 The impact on ecosystem threat status;* *2.5.5 The impact on explicit subtypes in the vegetation;* *2.5.6 The impact on overall species and ecosystem diversity of the site; and* *2.5.7 The impact on populations of species of special concern in the CBA.*	**Part A**: Section 3 (desktop analysis) **Part B**: Section 2 **Part C:** Section 3
2.6	**Terrestrial Ecological Support Areas, including;** *2.6.1 The impact on the ecological processes that operate within or across the site;* *2.6.2 The extent the development will impact on the functionality of the ESA; and* 2.6.3 *Loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridor or*	

	introducing barriers that impede migration and movement of flora and fauna.	
2.7	**Protected Areas as defined by the National Environmental Management:** Protected Areas Act, 2004 (Act No. 57 of 2004) including an opinion on whether the proposed development aligns with the objectives/purpose of the Protected Area and the zoning as per the Protected Area Management Plan.	**Part A**: Section 3 (desktop analysis)
2.8	**Priority Areas for Protected Area Expansion, including:** The way in which in which the development will compromise or contribute to the expansion of the protected area network.	**Part A**: Section 3 (desktop analysis)
2.9	Strategic Water Source Areas (SWSA) including: *2.9.1 The impact(s) on the terrestrial habitat of a Strategic Water Source Area; and* 2.9.2 *The impacts of the development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses)*	**Part A**: Section 3 (desktop analysis)
2.10	Freshwater Ecosystem Priority Area (FEPA) sub catchments, including the impacts of the development on habitat condition and/or species in the FEPA sub catchment.	**Assessed separately in the Freshwater Biodiversity Assessments (SAS 220156, 2020)
2.11	Indigenous Forests, including: *2.11.1 Impact on the ecological integrity of the forest;* *2.11.2 Extent of natural or near natural indigenous forest area lost.*	Not Applicable
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	**Part A:** Appendix E
3.2	A signed statement of independence by the specialist.	**Part A:** Appendix E
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	**Part B:** Section 1.4 **Part C:** Section 1.2
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	**Part A**: Appendix C **Part B:** Section 1.5 **Part B:** Appendix A **Part C:** Section 1.2
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	**Part B:** Section 1.4 **Part C:** Section 2
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	**Part B:** Section 3 **Part C:** Section 4
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.	**Part B:** Section 3 & 4 **Part C:** Section 5
3.8	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	**Part B:** Section 4.4 **Part C:** Section 5.4
3.9	A motivation must be provided if there were development footprints identified as per paragraph 2.3 in this table were not considered stating reasons why.	**Part B:** Section 3 & 4
3.10	A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, and any conditions to which the statement is subjected.	**Part B:** Section 5 **Part C:** Section 6

1 INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the Basic Assessment (BA) and Environmental Authorisation (EA) process for the proposed surface infrastructure development on the existing Marula Platinum Mine, located approximately 30 km northwest of the town of Burgersfort, Limpopo Province.

The study area is in the Greater Tubatse Local Municipality which is an administrative area in the Sekhukhune District Municipality of the Limpopo Province. The R37 runs approximately 4 km east of the mine. The proposed development activities include upgrading and/or the construction of the following infrastructure: ventilation shafts with associated infrastructure, water pipelines and powerlines, a new TSF pipeline, a product stock ore pile, a compressed airline, and upgrades to the existing change house (see project description in section 1.2 of Part A). Collectively, these activities are hereafter referred to as the "study area" (Figure 1). For a detailed Project description of all proposed development activities, please refer to Part A.

The purpose of this report is to define the floral ecology of the study area, to identify areas of increased Ecological Importance and Sensitivity (EIS), as well as the mapping of such areas, and to describe the Present Ecological State (PES) of the study area. The primary objective of the floral assessment is not to compile 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 species of conservation concern (SCC) and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).

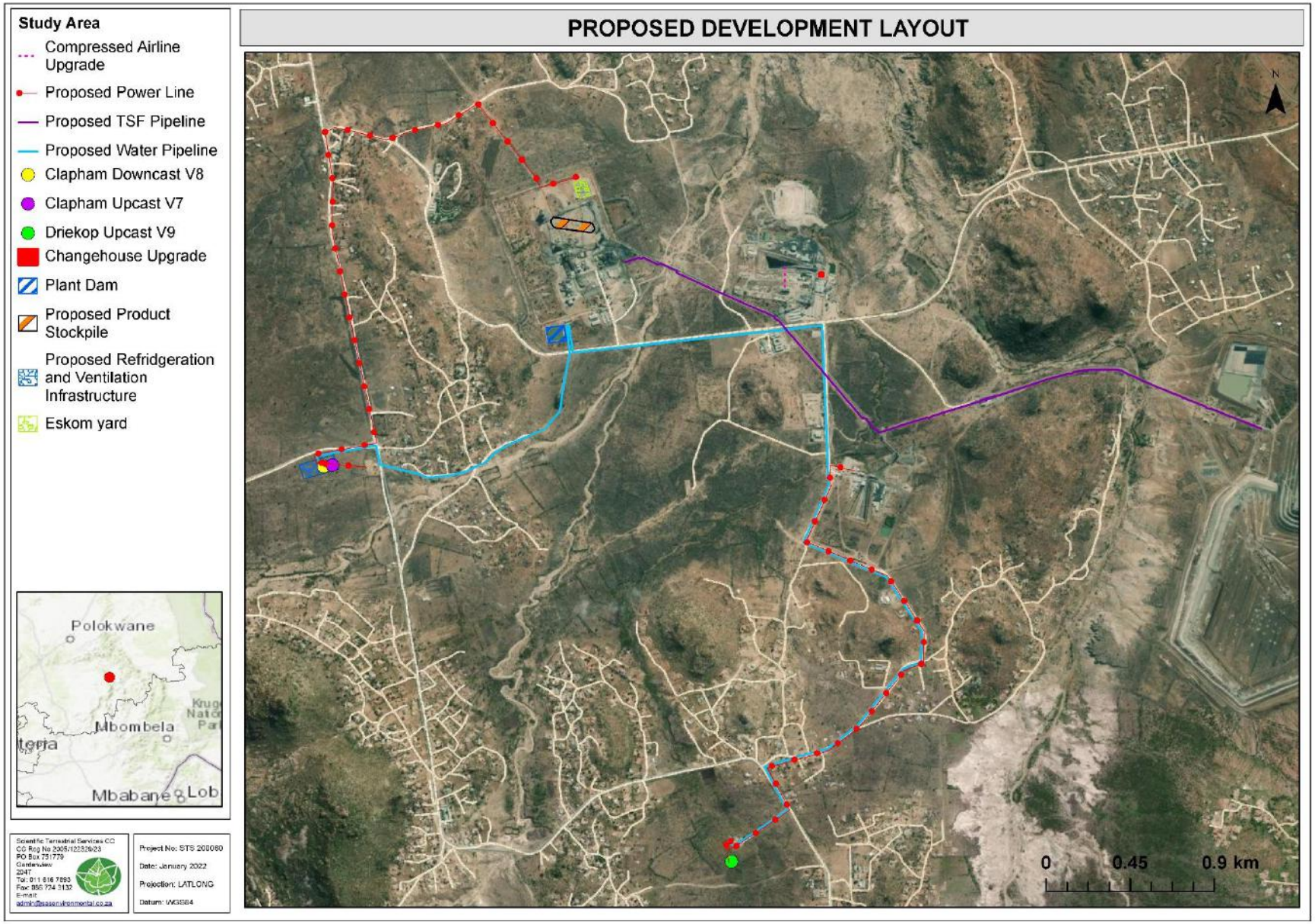


Figure 1: Proposed infrastructure development layout within the Marula Platinum Mine.

1.2 Scope of Work

Specific outcomes in terms of the report are as follows:

- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To provide inventories of floral species as encountered within the study area;
- To identify and consider all sensitive landscapes such as indigenous forests, rocky ridges, wetlands and/ or any other special features such as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs);
- To conduct a Red Data Listed (RDL) floral species assessment as well as an assessment of other SCC, including the potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed development within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements, to allow regional and national biodiversity targets to be met, and the provision of ecological services in the local area is sustained.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The floral assessment is confined to the study area and includes the sites earmarked for development as well as an 80 m buffer around the proposed linear infrastructure (i.e., 40 m either side of pipelines / powerlines etc.,). The assessment does not include the entire Mining Rights Area (MRA) nor the neighbouring and adjacent properties. The entire study area and immediate surroundings were, however, included in the desktop analysis of which the results are presented in **Part A: Section 3**;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities have been accurately assessed and considered. Relevant online sources and background information were further assessed to improve on the overall understanding of the study area's ecology;
- Sampling, by its nature, means that not all individuals are assessed and identified. Some species and taxa associated with the study area may have been missed during the assessment; and

- The data presented in this report are based on one site visit, undertaken on the 18-19th of November 2020 (late spring). A more accurate assessment would require that assessments take place in all seasons of the year. Following the site visit, new infrastructure has been proposed by the client which was not part of the original design. Thus, small portions of the study area, specifically the proposed TSF pipeline has not been thoroughly investigated. However, on-site data was augmented with all available desktop data. Together with project experience in the area, the findings of this assessment are considered an accurate reflection of the ecological characteristics of the study area.

An on-site visual investigation of the assessment areas was conducted on the 18th to the 19th of November 2020 to confirm the assumptions made during the consultation of the background maps and to determine whether the sensitivity of the terrestrial biodiversity associated with the assessment areas confirms the results of the online National Web-based Environmental Screening Tool.

1.4 General Approach

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 in the area and background research done prior to the site visit. This allows representative recordings of floral communities and optimal detection of SCC (refer to the methodology description in **Appendix A**).

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

- To guide the selection of appropriate sample sites, background data and digital satellite images were consulted before going to 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 mining project);
- All relevant resources and datasets as presented by the South African National Biodiversity Institute's (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/), including the Limpopo Conservation Plan v2 (2013) and the online National Web-based Environmental

Screening Tool, were consulted to gain background information on the physical habitat and potential floral diversity associated with the assessment areas;

- Based on the broad habitat units delineated before going to site and the pre-identified points of interest, which is updated based on on-site observations and access constraints, 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 each vegetation community that is representative of typical vegetation structure of that community, as well as photos of all detected SCC.

Additional information on the method of assessment is provided in **Appendix A** of this report.

1.5 Definitions, descriptions, and taxon nomenclature

Scientific nomenclature for plant species in this report follows that of the SANBI's Red List of South African Plants Online, as it relates to the Botanical Database of Southern Africa (BODATSA). For alien species, the definitions of Richardson et al. (2011) are used. Vegetation structure is described as per Edwards (1983) (refer to Figure A1).

1.6 Sensitivity Mapping

All the ecological features of the assessment areas were considered, and sensitive areas were assessed and projected onto satellite imagery. The sensitivity map should assist the Environmental Assessment Practitioner (EAP) / proponent as to the suitability of the proposed development within the assessment areas.

2 RESULTS OF FLORAL ASSESSMENT

The study area falls within the Sekhukhune Plains Bushveld vegetation type (listed as vulnerable in Mucina and Rutherford, 2006), i.e., the reference state. Mucina and Rutherford (2006) describe the Sekhukhune Plains Bushveld as having mainly semi-arid plains and open valleys between chains of hills and small mountains running parallel to the escarpment. It is heavily degraded in places and overexploited by man for cultivation, mining, and urbanisation. As such it is often prone to severe encroachment by indigenous microphyllous (fine-leaved) trees and invasion by alien species is common throughout the area.

Overall, the habitat within the study area was degraded and not representative of the reference vegetation type. Some places consisted of highly modified and transformed areas, in which vegetation was scarce. Many of the transformed areas (typical of those found close to high-intensity mining operations and housing infrastructure) supported a high abundance of alien and invasive plant (AIP) species. However, the surrounding untransformed, and undeveloped regions did not support high densities of AIPs but were not particularly species rich. The biodiversity of the study area can thus be defined under five broad habitat units, namely Degraded Bushveld, Encroached Habitat, Rocky Habitat (which encompassed two subunits, namely Rocky Outcrops and Rocky Riverine Habitat), Watercourse Habitat and Transformed Habitat (Figures 2 - 4). These habitat units were distinguished based on species composition, vegetation structure, ecological function, biophysical nature of the environment and habitat condition.

The five broad habitat units include:

1) **Degraded Bushveld**: This habitat unit was relatively species poor, with a poorly represented grass layer throughout. The woody component included species such as *Dichrostachys cinerea, Ziziphus mucronata*, and *Boscia albitrunca*. The Ventilation Shafts (and associated infrastructure), as well as parts of the proposed water and power lines were located within this habitat unit;
2) **Encroached Habitat**: Located in the northern section of the proposed power line, this habitat unit is characterised by encroached bushveld[1]. The main encroaching species included *Dichrostachys cinerea, Vachellia nilotica* subsp. *kraussiana* and *Terminalia sericea*;

[1] According to the DEA's 2019 report on indigenous bush encroachment, "Bush encroachment entails increases in the abundance of indigenous woody vegetation in the grassland and savanna biomes...". (*Towards a policy on indigenous bush encroachment in South Africa (2019), Department of Environmental Affairs, Pretoria, South Africa*)

3) **Rocky Habitat**: This habitat unit consisted of two subunits, namely Rocky Outcrops and Rocky Riverine Habitat:
    - The Rocky Outcrop Subunit comprised of a moderately diverse species composition typical of rocky areas; and
    - The Rocky Riverine Habitat, although supporting a species composition typical of rocky areas, supported a floral community different to that of the Rocky Outcrop Subunit. This habitat subunit bordered but was not located within the Mogompane River.
4) **Watercourse Habitat**: This habitat consisted of the watercourses[2] that transverse the proposed powerlines and pipelines in several sections throughout the study area. These watercourses were all dry at the time of assessment. Please also refer to the Watercourse Assessment for further details on watercourses associated with the study area and MRA (SAS 220156, 2020);
5) **Transformed Habitat**: This habitat unit includes the road along which the proposed water and powerlines will be located, as well as built-up areas located next to the roads which include informal residential development and mining-related developments. Due to anthropogenic influences, these areas have an altered physical environment and are scarcely vegetated. The vegetation that is present within these areas includes AIP species.

2.1 Floral Ecological Discussion

To present a more complete overview of the ecological condition of the vegetation communities associated with the study area, the below section addresses the ecological drivers, functions and corridors that contribute to the current species composition and veld condition. Specific details pertaining to habitat integrity, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity, are provided in more detail in sections 2.2 – 2.7.

[2] In terms of the definition contained within the National Water Act, 1998 (Act No. 36 of 1998) (NWA), 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.

2.1.1 Corridors on site

Despite both the mining infrastructure and informal housing that surround the study area, there is still a reasonable degree of undeveloped areas within the study area that provide corridors for dispersal, although they are somewhat fragmented. Much of the study area, and its associated habitat units, support species compositions that are fairly degraded in nature, the capacity of the study area to provide dispersal corridors is moderate. This is particularly relevant within the undeveloped and untransformed areas that surround the informal housing and mining infrastructure found throughout the study area. Within parts of the study area where mining operations and housing are prominent, i.e., within the Transformed Habitat Unit, a lack of connective corridors were identified.

2.1.2 Ecological drivers / processes / functioning

Fire and herbivory are recognised as some of the most important drivers of the savanna biome (O'Connor et al. 2014). However, due to the location of the study area, being surrounded by both an active mining area and informal housing, these important ecological drivers (especially fire) are largely absent from the study area. A lack of fire, which functions to maintain the development and structure of these productive communities, is particularly evident throughout all the habitat units. Naturally occurring herbivores are largely absent from the study area, however, herbivory is still present within the system, albeit herbivory from domestic animals (e.g., sheep, goat, and cattle). This has resulted in parts of the veld being heavily overgrazed, which is particularly evident in parts of the Degraded Bushveld Habitat unit.

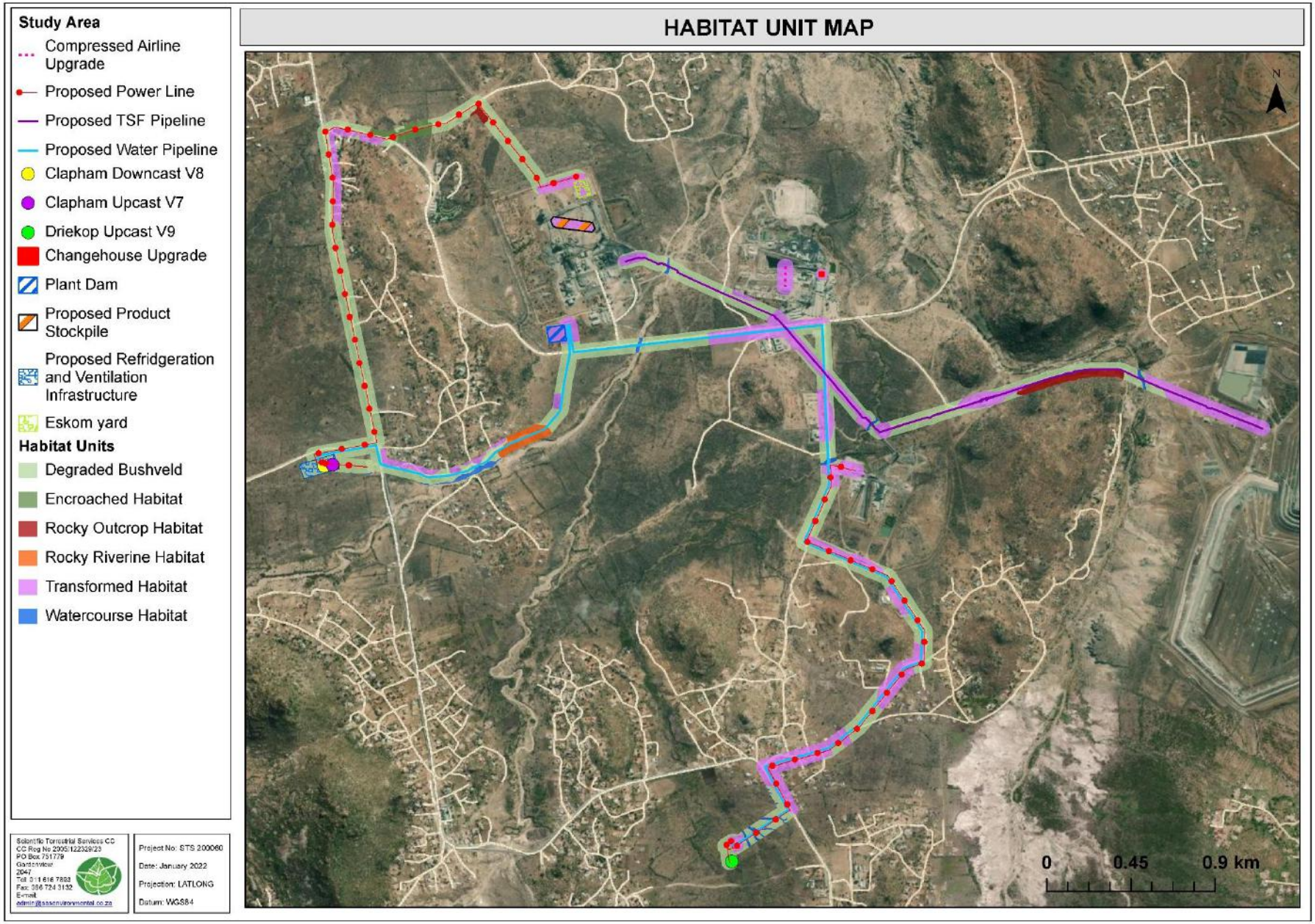


Figure 2: Conceptual illustration of the habitat units associated with the study area as identified during the field assessment.

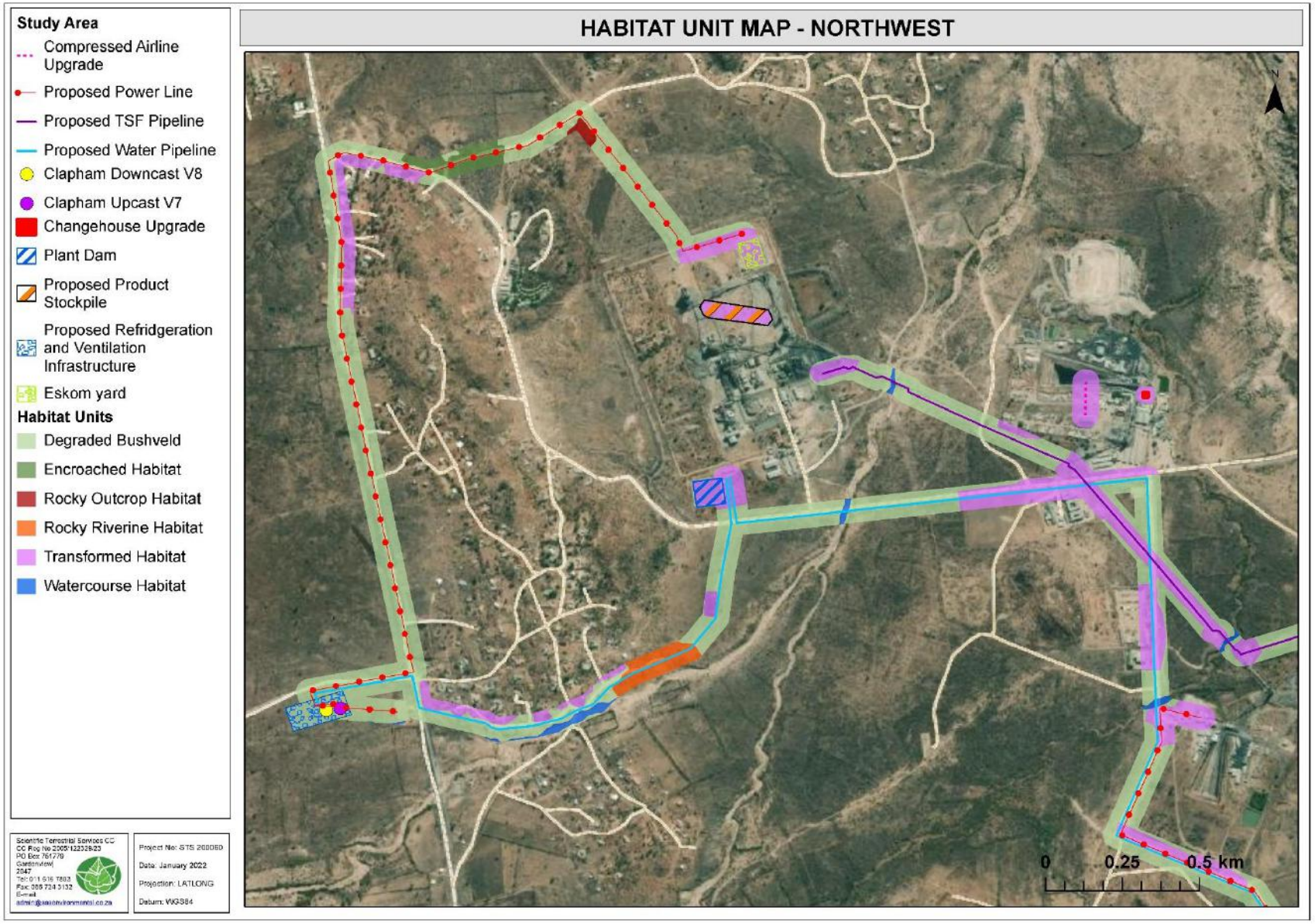


Figure 3: Conceptual illustration of the habitat units associated with the northwestern section of the study area as identified during the field assessment.

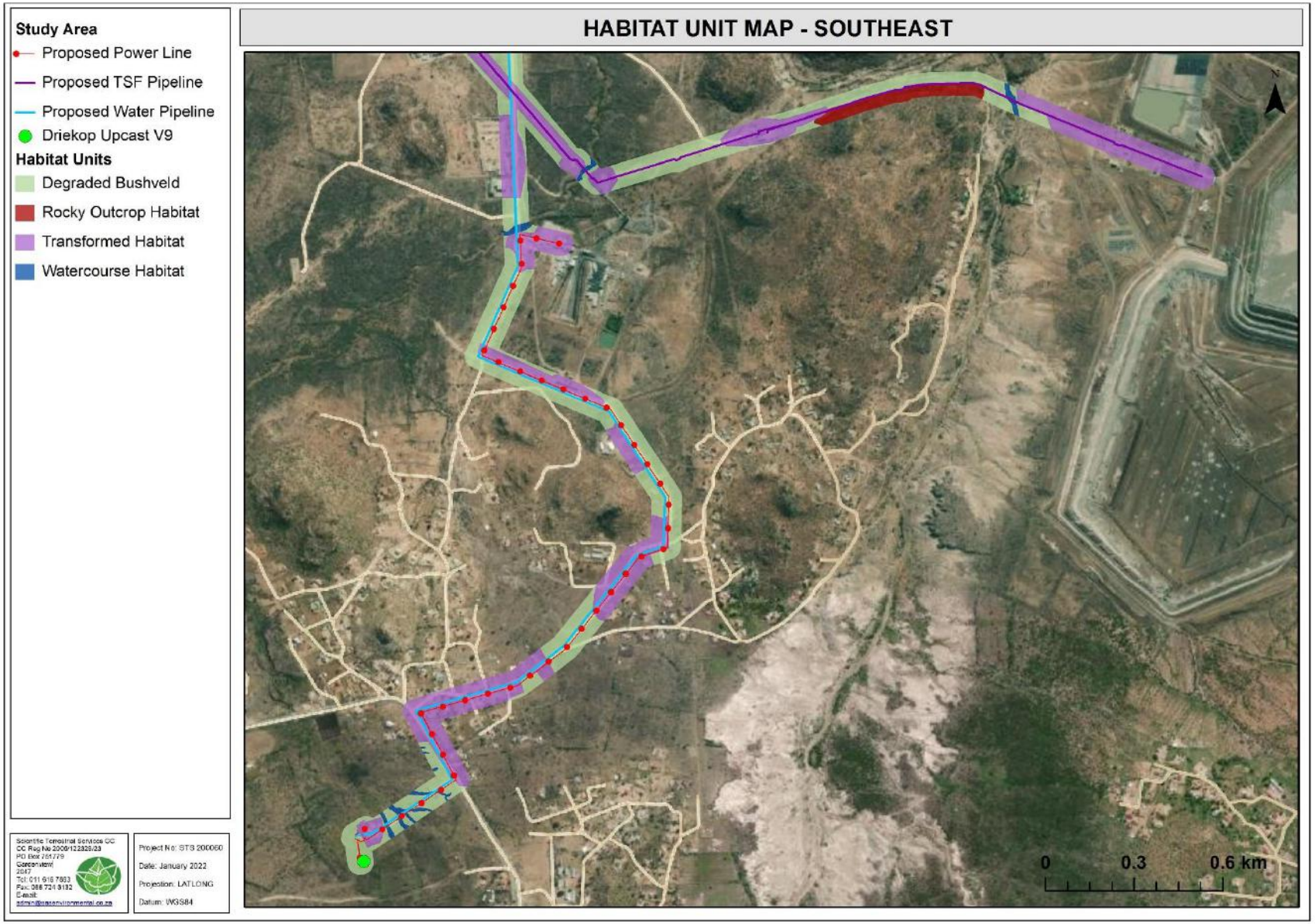


Figure 4: Conceptual illustration of the habitat units associated with the southeastern section of the study area as identified during the field assessment.

2.2 Degraded Bushveld

VARIOUS VEGETATION COMMUNITIES & THE DIFFERENT VEGETATION STRUCTURES ASSOCIATED WITH THE DEGRADED BUSHVELD HABITAT UNIT
Proposed infrastructure located within habitat unit: Parts of the proposed water and power lines as well as the ventilation shafts (and the associated refrigeration infrastructure). This habitat unit was dominated by *Dichrostachys cinerea* throughout the study area. In general, the habitat unit was largely species poor and had a poorly represented grassy layer. Due to its proximity close to existing mining infrastructure and housing. This habitat unit has been exposed to several anthropogenic activities, including dumping, vehicle movements and livestock grazing, which has resulted in subpar habitat conditions, decreased habitat integrity and a low species diversity. As the habitat unit is degraded in nature, the remaining vegetation is not representative of the reference vegetation type for the area. Little habitat is provided for extensive native floral species diversity and community structure within this habitat unit.
VEGETATION STRUCTURE AND DOMINANT SPECIES

The vegetation structure of the **Degraded Bushveld** can be described as **a species-poor and *Dichrostchys*-dominated Bushveld.** The low species diversity recorded within the habitat unit is attributed to the disturbed nature of the area. Graminoids were largely absent, with large amounts of bare ground present throughout the habitat unit. Forbs were under-represented, likely attributed to the degree of browsing throughout the habitat. Representative forbs included *Aptosimum lineare, Senna italica* subsp. *arachoides* and *Abutilon angulatum.* The woody layer was poorly represented and dominated by *Dichrostchys cinerea*. Other woody species found within this habitat unit, albeit infrequently, included *Vachellia nilotica* subsp. *kraussiana, Boscia albitrunca, and Gossypium herbaceum* subsp. *africanum.* The protected species, *Aloe cryptopoda*, was located within in this habitat unit. AIPs were not prominent within the habitat unit, however, the occasional AIP found included *Argemone ochroleuca* and *Senna didymobotrya.* Refer to Appendix C for a list of species recorded within this habitat unit
SELECTED EXAMPLES OF FLORA RECORDED WITHIN THE DICHROSTACHYS BUSHVELD HABITAT UNIT
  
From left to right: *Aptosimum lineare, Senna italica* subsp. *arachoides, and Vachellia nilotica*

Species of Conservation Concern	Activities associated with the development of the surrounding infrastructure and long-term fragmentation from surrounding species sources has destroyed suitable habitat for the establishment and persistence of SCC on the site. Dispersal corridors throughout this habitat unit are moderately fragmented because of the surrounding mining and housing development. As such, the fragmented dispersal corridors on site, together with a decrease in many dispersal agents, have further reduced the potential of SCC re-establishment and persistence. Habitat for floral species within the degraded landscape has been modified to the extent where the likelihood of SCC establishment is low. No threatened SCC (i.e., Red Data Listed plants), as defined in Section 56 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), were recorded during the site assessment. No suitable habitat for viable populations of threatened species is available within this habitat unit. According to the National Web-Based Online Screening Tool, seven species were identified as having the potential to be located within the study area (see Appendix B), however, none of these were recorded during the site assessment and the Degraded Habitat no longer provides suitable conditions to support such species – especially not viable populations. A protected species as per Schedule 12 (Protected Plants) of the Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA), namely *Aloe cryptopoda*, was observed in this habitat unit. Permits from the Limpopo Economic Development, Environmental and Tourism (LEDET) will be required to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place. Additionally, the National Forest Act, 1998 (Act No. 84 of 1998, amended 2001) (NFA) protected species, *Boscia albitrunca,* was observed within this habitat unit albeit not very abundantly. Permits will have to be obtained from the Department of Environment, forest, and Fisheries (DEFF) for the individuals of *Boscia albitrunca* that will have to be removed for construction to proceed. Refer to Appendix B for a list of species assessed as part of the SCC assessment.

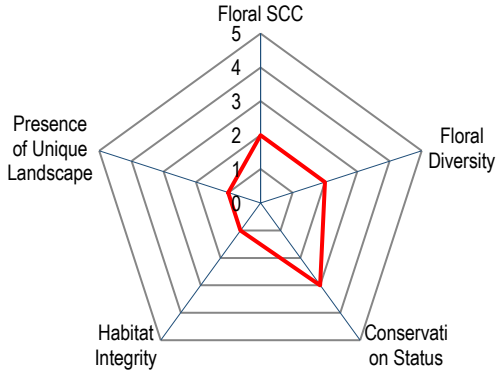
BUSINESS CASE

This habitat unit has a **moderately low habitat sensitivity** from a floral ecological and resource management perspective. The moderately low sensitivity of the unit is attributed to the degraded nature (arising from dumping, vehicle movements and livestock grazing) of the area which has led to a decrease in habitat integrity and ecological functionality.

The habitat unit is located within both an ESA 1 and ESA 2 as per the Limpopo Conservation Plan (Version 2, 2013). These areas are regarded as important for supporting ecological processes and functioning. However, given that the vegetation in this unit is largely in a degraded state, it is anticipated to provide limited ecologically functionality. As such this unit is not considered representative of an ESA any longer. The habitat unit is situated within areas classified as Highest Biodiversity Importance, with a small section of the habitat unit located within an area of High Biodiversity Importance according to the Mining and Biodiversity Guidelines (2012). However, given that no significant biodiversity features were confirmed for this habitat unit, the assigned High, and Highest Biodiversity Areas as per the Mining and Biodiversity Guidelines were not conformed for this habitat unit.

The combination of a lack of suitable habitat for floral SCC, fragmented dispersal corridors and the presence of a large amount of *D. cinerea* within the habitat unit denotes that the proposed development within the already disturbed habitat unit is unlikely to have a significant impact on the floral communities present. During construction and post-development, habitat suitable for establishment and proliferation of AIP species is likely to be created. It is thus recommended that AIPs be monitored and controlled. Removal of AIP species to a registered waste facility as well as the implementation of AIP control and maintenance measures at the onset of construction will limit the spread of AIP species to surrounding natural habitat, and subsequently, limit the footprint area for which AIP control management will have to be implemented during the operational and decommissioning and closure activities.

Moderately Low Habitat Sensitivity



2.3 Encroached Habitat

VARIOUS VEGETATION COMMUNITIES & THE DIFFERENT VEGETATION STRUCTURES ASSOCIATED WITH THE ENCROACHED HABITAT

Proposed infrastructure located within habitat unit: Northern section of the proposed power line.

The overall species richness of this habitat unit was low. Woody encroachment and overgrazing within the habitat unit is largely evident with *Dichrostachys cinerea, Vachellia nilotia* subsp. *kraussiana* and *Terminalia sericea* as the major encroaching species. Forb and grass species were less dominant within the habitat unit with areas of bare soil scattered throughout. This habitat unit is no longer representative of the reference vegetation type, namely the Sekhukhune Plains Bushveld, which is moderately species rich.

Vegetation Structure and Dominant Species

The vegetation structure can be described as **encroached, thorny bushveld.** Vegetation cover, aside from encroaching woody species, throughout the habitat, was low. The species richness of the habitat unit was moderately low. Graminoids were largely absent in this habitat unit, with bare soils being particularly dominant throughout. The forb layer was also underrepresented, with the most common forb species being *Aptosimum lineare.*

The unit is heavily encroached by *Dichrostachys cinerea, Vachellia nilotica* subsp. *kraussiana* and *Terminalia sericea.* Other woody species included G*ossypium herbaceum* subsp*. africanum* and the occasional *Ziziphus mucronata.* Although not particularly invaded by AIP species, this habitat unit did support moderately large stands of *Agave sisalana* (NEMBA Category 2).

Refer to Appendix C for a list of species recorded within this habitat unit.

Selected examples of flora recorded within the Encroached Habitat

From left to right: *Dichrostachys cinerea*, G*ossypium herbaceum* subsp*. africanum and Agave sisalana*

Species of Conservation Concern	No nationally threatened SCC (i.e., Red Data Listed plants), as defined in NEMBA Section 56, were recorded during the site assessment. This habitat unit is heavily encroached, and the veld condition is not optimal to support threatened species known for the region. No Specially Protected or Protected species as listed in Schedule 11 (Specially Protected) or Schedule 12 (Protected Plants) of the LEMA were observed in this habitat unit. No NFA protected species were observed within this habitat unit, however, given that the protected tree species, *Boscia albitrunca,* was located within the neighbouring Degraded Bushveld Habitat, there is a chance that this species could establish within this habitat unit. It is advised that a walkdown of the footprint areas be conducted before the commencement of any development and all protected species marked for relocation (where feasible) or removal. Permits will have to be obtained from DEFF for potential individuals of *Boscia albitrunca* that may require removal for construction to proceed. No species from the list provided in the National Web Based Online Screening Tool were recorded within this habitat unit and due to a lack of suitable conditions, none of these species are anticipated to be present within this habitat unit. Refer to Appendix B for a list of species assessed as part of the SCC assessment.

Business case

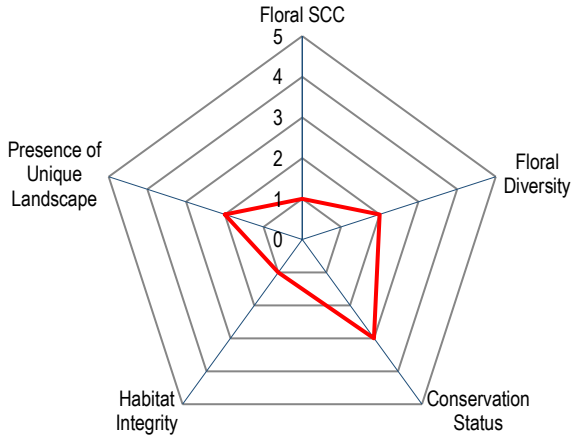
Impact Summary:

This habitat unit is of **moderately low sensitivity** from a floral ecological and resource management perspective. The vegetation unit is heavily encroached and overgrazed and floral diversity low. The habitat unit is classified as High Biodiversity Importance according to the Mining and Biodiversity Guidelines (2013) and is considered as an ESA 2 as per the Limpopo Conservation Plan (Version 2, 2013). However, the habitat unit is not considered unique in the landscape given its encroached nature with the vegetation communities therein no longer representative of the reference state (habitat unit located outside of the remnants of the Sekhukhune Plains Bushveld). The Encroached Habitat can still function as an ESA 2, but no significant biodiversity features were present to confirm the area as High Biodiversity Importance as per the Mining and Biodiversity Guidelines (2012). No Floral SCC or protected tree species, as per the NFA, were located within this habitat unit. Given the nature of the habitat unit, and the large degree of grazing and encroachment, it is unlikely that any SCC or NFA protected species will establish within the habitat unit.

The loss of the habitat unit from the area is therefore not considered unacceptable, as the loss of the habitat unit is unlikely to impact upon national and provincial biodiversity and conservation targets.

This habitat unit falls within the area earmarked for the development parts of the northern powerline. The combination of a lack of suitable habitat for other floral SCC and the extent of bush encroachment within the habitat unit has resulted in the degradation of the available habitat. The proposed development is not deemed likely to have significant negative impacts on the encroached floral assemblages. It is however advised that during and post-construction activities, procedures to reduce and control bush encroachment (that result from the proposed activities) within the surrounding area be implemented, particularly that of *V. nilotica* subsp. *k*raussiana*, D. cinerea* and *T. sericea*.

Moderately Low Habitat Sensitivity



2.4 Rocky Habitat

VARIOUS VEGETATION COMMUNITIES AND THE DIFFERENT VEGETATION STRUCTURES ASSOCIATED WITH THE ROCKY HABITAT UNIT	
Proposed infrastructure located within the habitat unit: Proposed water and power lines and the TSF pipeline. This Habitat unit consists of two subunits, namely Rocky Outcrops and Rocky Riverine Habitat. These areas support typical rocky floral communities. However, they are distinguished from each other based on the dominant rock type that is present within each of the subunits as well as the slightly different floral communities that each support. In particular, the Rocky Outcrop subunit displayed a moderate diversity of floral species and has an overall moderately high level of ecological functioning. Examples of floral species that were encountered within this habitat include *Aloe cryptopoda, Scadoxus puniceus, Gloriosa superba,* and several tree species including *Vangauria infausta* and *Terminalia sericea.* The habitat unit did not support AIP species. The Rocky Riverine subunit displayed a moderately high diversity of floral species and has an overall moderately high level of ecological functioning, especially given its location next to the Mogompane River. Examples of floral species that were encountered within this habitat include *Aloe cryptopoda, Kleinia stapeliiformis, Euphorbia hirta, Eucphrobia tirucalli* and *Tinnea rhodesiana.* Although this habitat unit supports a moderately rich indigenous species diversity, two AIP species were identified within this habitat unit, namely *Agave sisalana* (NEMBA Category 2) and *Opuntia Ficus-indica* (NEMBA Category 1b*).* Refer to Appendix C for a list of species recorded within this Habitat unit.	
Rocky Outcrops	**Rocky Riverine Habitat**
	

<table>
<tr><th>Selected examples of flora recorded within the Rocky Outcrop Subunit</th><th>Selected examples of flora recorded within the Rocky Riverine subunit</th></tr>
<tr><td>  
Left to right: Scadoxus puniceus; Gloriosa superba</td><td>  
Left to right: Eucphrobia tirucalli; Kleinia stapeliiformis</td></tr>
<tr><td>Species of Conservation Concern</td><td colspan="2">No threatened SCC (i.e., Red Data Listed plants), as defined in Section 56 of the NEMBA, were recorded during the site assessment. However, from the POC assessment, this habitat unit provides suitable conditions for several SCC that were not encountered during the site assessment:

- Asparagus fourei (POC = Medium; Status = VU);
- Asparagus sekhuhhuniensis (POC = Medium; Status = EN);
- Euphorbia barnardii (POC = Medium; Status = EN);
- Gladiolus sekukuniensis (POC = Medium, Status = VU);
- Searsia batrophylla (POC = Medium, Status = VU);
- Vachellia sekhuhhuniensis (POC = Medium; Status = CR);

A protected species as per Schedule 12 (Protected Plants) of the LEMA, namely Aloe cryptopoda, was observed in habitat subunits. Additionally, Scadoxus puniceus, another protected species as per Schedule 12 (Protected Plants) of LEMA was present within the Rocky outcrop subunit. Permits from the LEDET will be required to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place. No NFA protected species were observed within either of the habitat subunit. However, given that the protected tree species, Boscia albitrunca, was located within the neighbouring Degraded Bushveld Habitat, there is a chance that this species could establish within this habitat unit. It is advised that a walkdown of the site be conducted before the commencement of any development and all protected species marked. Permits will have to be obtained from the DEFF for potential individuals of Boscia albitrunca that may require removal for construction to proceed.

According to the National Web Based Online Screening Tool, seven species were identified as having the potential to be located within the study area, namely Sensitive species 374, Sensitive species 275, Sensitive species 163, Polygala sekhukhuniensis, Searsia batophylla, Asparagus fourei, and Asparagus sekukuniensis. None of these species were identified during the field assessment, however the POC assessment indicated that Polygala sekhukhuniensis, Searsia batophylla, Asparagus fourei, and Asparagus sekukuniensis (all Red Data Listed SCC) scored a POC of medium.

Refer to Appendix B for a list of species assessed as part of the SCC assessment.</td></tr>
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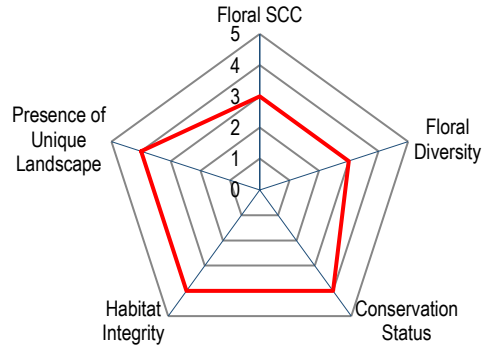
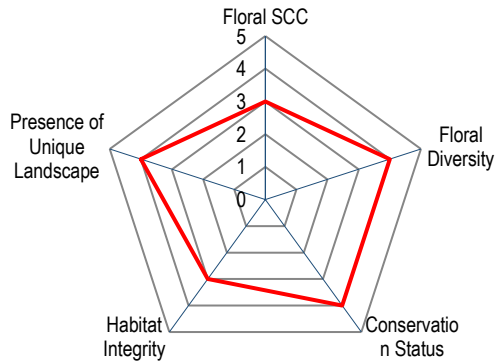
Business case

Rocky Outcrops Subunit Sensitivity: Moderately High Habitat



Rocky Riverine Subunit Sensitivity: Moderately High Habitat



Impact summary

This habitat unit (including both subunits) is of a **moderately high sensitivity** from a floral ecological and resource management perspective. The habitat is considered natural and in a good condition with both habitat subunits having experienced few impacts (i.e. very little grazing and dumping has occurred within these habitats). The Rocky Outcrops provide unique habitat and support two floral species protected under Schedule 12 (Protected Plants) of LEMA. Furthermore, these rocky outcrops support an array of floral species that are not located within the surrounding habitat units (i.e. the Degraded Bushveld and the Transformed Habitat). The Rocky Riverine Habitat is unique given its proximately to the Mogompane River. This subunit supported one species protected under Schedule 12 (Protected Plants) of LEMA. This habitat provides unique habitat for floral species that are typical of rocky areas, albeit somewhat different to the Rocky Outcrop subunit, and that is not represented within the surrounding habitat units.

The proposed infrastructure area will not directly impact on the Rocky Outcrop Habitat provided that the development of the proposed water and powerlines is restricted to areas right next to the road servitude, and thus avoiding development within the outcrops themselves. This is achievable given that the rocky outcrops are not located on both sides of the existing roads. If development were to occur on the opposite side of the road to the Rocky Outcrops, the negative impacts thereof can be minimized.

The proposed infrastructure will directly impact on floral species associated with the Rocky Riverine Habitat. This subunit is located alongside the Mogompane River. As such, this habitat unit provides unique habitat that is characterised by rocky areas. The proposed water and power lines will directly impact on the sensitive Rocky Riverine subunit as well as on various floral species, including one SCC. It is recommended that the proposed pipelines be realigned to exclude impacting on the Rocky Riverine habitat. Both Habitat subunits are located within an ESA 1. Given the sensitivity of the subunits and the unique habitat these areas provide, their presence within an ESA 1 area is confirmed. Furthermore, the rocky outcrop within the northern part of the study area falls within the remnants of the threatened ecosystem.

As construction within the Rocky Habitat may provide suitable habitat for the proliferation of AIP species, it is suggested that a management and control plan be implemented to ensure the spread of such species does not occur during and post construction. If the proposed layout is authorised, it will be necessary to conduct a thorough walkdown of both the Rocky Outcrop and the Rocky Riverine subunits within the footprint area, as well as within a 10 m buffer around the footprint area, where all protected floral species are marked for relocation to suitable habitat outside the direct footprint. The SCC walkdown should occur in the flowering season of the species to ensure adequate detection and identification of the species. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation.

2.5 Watercourse Habitat

VARIOUS VEGETATION COMMUNITIES & THE DIFFERENT VEGETATION STRUCTURES ASSOCIATED WITH THE WATERCOURSE HABITAT	
Proposed infrastructure located within habitat unit: Proposed water and power lines. This habitat unit consisted of small sections throughout the study area in which the proposed powerlines and water & TSF pipelines are to be developed. The Watercourse Habitat comprise several features, including rivers, tributaries, ephemeral, and non-perennial drainage lines. The watercourses that traverse the proposed infrastructure include Tswhenyane River (northern section of the water lines, running through an existing bridge), the Unnamed Tributary of the Moopetsi River (eastern section of the water line, running through an existing bridge), and non-perennial drainage lines (southern section of the water and power lines). The Mogompane River and the Unnamed tributary of the Motse River fall within the buffer areas surrounding the powerlines and water lines, but not in the proposed footprint of these infrastructure. The rivers and tributaries within the MRA are characterised by weakly developed and moderately degraded riparian[3] habitat. As these systems receive very little rain, water flows only occur after adequate rain events. Water, therefore, does not accumulate long enough for distinct riparian vegetation to develop and, as such, the riparian vegetation included a species composition similar to that of the surrounding bushveld vegetation. However, in several sections the vegetation structure did in fact differ from surrounding vegetation in that the woody component was denser. It should be noted that several upstream sections of the rivers have severe erosion and bank incision, owing to exposed soils and bare areas in such places, where little or no vegetation was present (i.e., the riparian vegetation is not continuous along these systems). The unnamed tributaries, on the other hand, are characterised by a more continuous vegetation layer that and in several areas have been overgrown / encroached upon by woody species, potentially attenuating flow during rain events (refer to the Watercourse Assessment: SAS 220156, 2020). For the non-perennial and ephemeral drainage lines, no distinct change in vegetation structure or species composition could be discerned. No riparian vegetation can thus be associated with these systems. The drainage lines were largely characterised by a lack of graminoid cover (though this could be due to season of study) with woody species occurring sporadically along, or within, the drainage lines.	
Vegetation Structure and Dominant Species	
The vegetation structure can be defined as **open, comprising of both a woody layer and a shrub layer**. Floral diversity was intermediate within this habitat unit. Much of the woody and shrub layers included species found throughout the Degraded Bushveld habitat; however, within the riparian habitat the structure of the vegetation differed from that of the surrounding vegetation. The intermediate diversity of floral species can be attributed to most of the watercourses within this region being dry for large parts of the year, as well as the presence of severe erosion and bank incision in some upstream sections, thus resulting in exposed bare soils in such places. Examples of floral species that were encountered within this habitat include *Aloe cryptopoda, Carissa bispinossa, Eucphrobia tirucalli, Tinnea rhodesiana* and several tree species including *Dichrostachys cinerea* and *Terminalia sericea.*	 Dense stands of *Dichrostachys cinerea* along sections of the Watercourse Habitat.

[3] National Water Act, 1998 (Act 36 of 1998) (NWA): "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 land areas

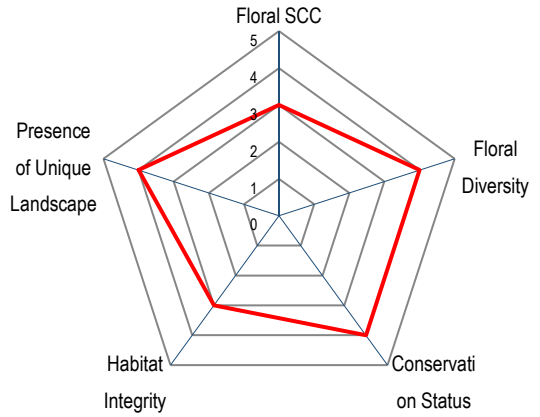
Several AIP species have encroached into sections of the watercourse within the study area. This can be related to its proximity to anthropogenic activities (e.g., informal housing and mining-related operations), and overgrazing impacts from domestic cattle and goats. The habitat is naturally more susceptible to erosion due to erosive soils. Refer to Appendix C for a list of species recorded within this habitat unit.	 Sections of the Watercourse Habitat with noticeably less dense woody cover that can be attributed to erosion and bank incision.

Selected examples of flora recorded within the Watercourse Habitat



Left: *Carissa bispinossa;* **Middle**:*Euphorbia tirucalli;* **Right**: *Gomphocarpus fruiticosus*

Species of Conservation Concern	No nationally threatened SCC (i.e., Red Data Listed plants), as defined in NEMBA Section 56, were recorded during the site assessment. However, it should be noted that this habitat unit is suitable to support *Searsia batophylla* (VU). As such, a walkthrough of the footprint area will be required before any construction commences, and any threatened SCC marked and suitably rescued and relocated to suitable habitat outside of the development footprint. A protected species, *Aloe crytopoda*, as per Schedule 12 (Protected Plants) of the LEMA were observed in this habitat unit for which permits from the LEDET will be required before individuals of this species can be removed, cut, or destroyed prior to any vegetation clearing taking place. No NFA protected species were observed within this habitat unit. Refer to Appendix B for a list of species assessed as part of the SCC assessment.

Business case	
Impact Summary: This habitat unit is of **moderately high** sensitivity from a floral perspective. The Watercourse Habitat is connected to surrounding areas, and as such impacts at a single point in the system can have a significant downstream impact, particularly during high rainfall events. The habitat unit is classified as High Biodiversity Importance according to the Mining and Biodiversity Guidelines (2013) and is transverses both an ESA 1 and ESA 2 as per the Limpopo Conservation Plan (Version 2, 2013). Given the habitat units ecological functionality within the ecosystem, its presence as an ESA is confirmed. It is therefore considered an important feature in the landscape, serving as an ecological corridor benefiting both fauna and flora within the region. The proposed development of the powerlines and water and TSF pipelines will directly impact on the Watercourse Habitat within the study area, given that the associated infrastructure transverses the watercourse habitat in several places. For the powerlines it is essential that surface infrastructure be placed outside of the Watercourse Habitat. . No Floral SCC (i.e. Red Data Listed plants) were identified during the field assessment, however, the habitat provides suitable conditions to support the SCC, *Searsia batrophylla*. One protected species, *Aloe crytopoda*, as per Schedule 12 (Protected Plants) of the LEMA was observed in this habitat unit. Permits from the LEDET will be required to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place. No NFA protected species were observed within either of the habitat subunits. This habitat unit did support several AIP species. Thus, it is recommended that ongoing alien control be implemented throughout the construction and post-construction phases of the development. Removal of AIP species to a registered waste facility and implementation of AIP control and maintenance measures at the onset of construction and after construction will limit the spread of AIP species to surrounding natural habitat, especially Watercourse Habitat further downstream. Activities that are planned within the delineated Watercourse Habitat or the zones of regulation, as identified in the Watercourse Assessment, will require authorisation from the Department of Water and Sanitation (DWS). Stormwater management and erosion control will be essential to prevent siltation of Watercourse Habitat.	**Watercourse habitat Sensitivity: Moderately High Habitat** 

2.6 Transformed Habitat

VARIOUS VEGETATION COMMUNITIES & THE DIFFERENT VEGETATION STRUCTURES ASSOCIATED WITH THE TRANSFORMED HABITAT

Proposed infrastructure located within habitat unit: Proposed water and power lines, compressed air infrastructure, proposed conveyors, change house, and the proposed product stockpile.

The remaining areas were all identified as Transformed Habitat based on the anthropogenically transformed nature of these areas. This habitat unit is largely transformed consisting of pavements, informal housing, or mining infrastructure. These areas are chiefly dominated by AIP species, specifically along the roadsides where clearing of vegetation has recently occurred. Many of the gardens surrounding the informal houses also support AIP tree species, which have been historically planted as ornamentals (e.g. *Thevetia peruviana*, Yellow oleander). As such, no important habitat is provided for native floral species diversity or community structure within this habitat unit.

Vegetation Structure and Dominant Species

No clear vegetation structure can be defined within this habitat unit. The habitat unit consists largely of AIP species, particularly along the roadsides and within the transformed areas surrounding and within mining-related infrastructure.

Characteristic AIP species located within this habitat unit included *Agave sisalana* (NEMBA Category 2), *Thevetia peruviana* (NEMBA Category 1b), *Ricinus communis* (NEMBA Category 2), *Senna didymobotrya* (NEMBA Category 1b), *Amaranthus thunbergia* (Not Listed, NL), and *Zinnia peruviana* (NL).

Typical indigenous species present throughout the habitat unit included *Gomphocarpus fruticosus*, *Lagerra decurrens* and *Vachellia nilotica* subsp. *kraussiana.*

Refer to Appendix C for a list of species recorded within this habitat unit.

Selected examples of flora recorded within the Transformed Habitat

Left: *Zinnia peruviana;* **Middle***: Senna didymobotrya;* **Right***: Argemone mexicana*

Species of Conservation Concern	No nationally threatened SCC (i.e. Red Data Listed plants), as defined in NEMBA Section 56, were recorded during the site assessment. This habitat unit was encroached, and the veld condition is not optimal to support threatened species known for the region. No Specially Protected or Protected species as listed in Schedule 11 (Specially Protected) or Schedule 12 (Protected Plants) of the LEMA were observed in this habitat unit. No NFA protected species were observed within this habitat unit and it is unlikely that any will be present within the habitat unit. Refer to Appendix B for a list of species assessed as part of the SCC assessment.

Business case

Impact Summary:

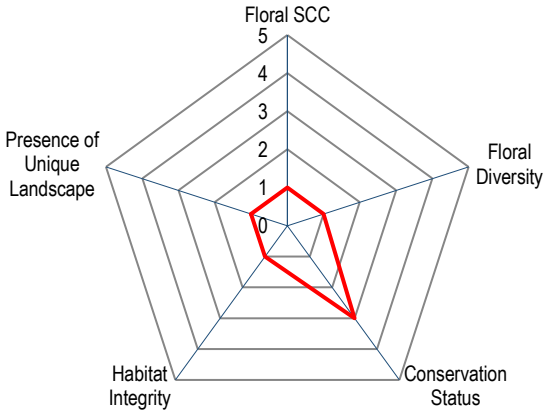
This habitat unit is of low sensitivity from a floral ecological and resource management perspective. The vegetation unit is heavily encroached and overgrazed and floral diversity low. The habitat unit is classified as High Biodiversity Importance according to the Mining and Biodiversity Guidelines (2012) and is considered as an ESA 2 as per the Limpopo Conservation Plan (Version 2, 2013). However, due to the extent of habitat modification, the vegetation communities do not confirm the presence of ESAs and important biodiversity features. Although it is located within an endangered ecosystem (National Threatened Ecosystems, 2011, and NBA, 2018), namely the Sekhukhune Plains Bushveld, these areas are no longer deemed representative of the reference vegetation type.

No Floral SCC (i.e. Red Data Listed plants), provincially protected (as defined by LEMA) or protected tree species (as per the NFA) were located within this habitat unit. Given the built-up nature of the habitat unit, and the large degree of transformation, it is unlikely that any SCC or NFA protected species will establish within the habitat unit.

The habitat unit is not considered unique in the landscape, given its transformed and modified nature. The loss of the habitat unit from the area is therefore not considered unacceptable and is unlikely to impact upon national biodiversity and conservation targets.

Due to the transformed nature of this habitat unit, the proposed development within the habitat unit is not deemed likely to have negative impacts on indigenous floral communities due to only alien-dominated floral assemblages being present. Given that the habitat unit is already dominated by several alien species and that construction activities are likely to provide habitat for the further proliferation of AIP species, it is recommended that AIP management and control plan be implemented to control the spread of such species. Removal of AIP species to a registered waste facility as well as the implementation of AIP control and maintenance measures at the onset of construction as well as after construction will limit the spread of AIP species to surrounding natural habitat.

Low Habitat Sensitivity



2.7 Sources of Habitat Degradation

Human activities and/ or climatic variation can gradually, or rapidly, lead to the deterioration of the conditions of land, which impacts on habitat integrity and tends to reduce floral diversity. The cost and effort it will take to restore habitat integrity of an area is positively correlated with the extent to which the veld has been degraded. Determining whether the vegetation of an area has been degraded includes the evaluation of three main indicators (Van Oudtshoorn, 2015), including:

- Lack of vegetation and/or diversity;
- Bush encroachment; and
- Alien and invasive plant species.

The above-listed indicators of habitat degradation are discussed in the below sections. Within the study area, the primary causes of habitat degradation include historic earth-moving activities and grazing pressures.

2.7.1 Lack of vegetation and/or diversity

A lack of vegetation occurred within several habitat units, particularly the Degraded Bushveld, the Encroached Habitat, and the Transformed Habitat. The lack of vegetation across these habitat units is attributed to overgrazing and a lack of a natural fire regime within the study area. Specifically, overgrazing can lead to species loss, as well as reductions in biomass and functional diversity. As such, within the study area, overgrazing has led to a lower species richness than what would be expected from the reference vegetation type (i.e. the Sekhukhune Plains Bushveld), as well as a reduction in biomass.

2.7.2 Bush encroachment

According to the Department of Environmental Affairs' (DEA's) 2019 report on indigenous bush encroachment[4] (now the DEFF), "Bush encroachment entails increases in the abundance of indigenous woody vegetation in the grassland and savanna biomes…". The result of bush encroachment includes alterations to the structure and functioning of ecosystems, with these changes becoming increasingly irreversible as the fundamental nature of the ecosystems change. As such, bush encroachment also negatively impacts on the value of ecosystems delivered.

[4] Towards a policy on indigenous bush encroachment in South Africa (2019), Department of Environmental Affairs, Pretoria, South Africa.

Bush encroachment was observed within the study area, particularly with the Encroached Habitat Unit. Within this habitat unit, the main bush encroachers included *Dichrostachys cinerea, Vachellia nilotica* subsp. *kraussiana,* and *Terminalia sericea* (Figure 5).

Avoiding or reversing bush encroachment is possible with rangeland management; however, in cases where bush encroachment has passed the tipping point where the encroacher species account for more than 40% - 50% of vegetation cover, it is recommended that bush encroachment be cleared or thinned either manually or mechanically. The guidance of a suitably qualified person should be sought.

Figure 5: Bush encroachment evident within the Encroached Habitat Unit. Main encroaches included *Dichrostachys cinerea, Vachellia nilotica* subsp. *kraussiana* and *Terminalia sericea.*

Current policy and legislation do not deal specifically with bush encroachment. The Conservation of Agricultural Resource Act, 1983 (Act No. 43 of 1983) (CARA) encourages the maintenance of rangelands, but if clearing occurs within an important biodiversity area (e.g. within a CBA or ESA) or if it will affect listed species, it can require authorisation under NEMBA or the NFA. The encroached Habitat Unit is located within an ESA; however, it is no longer representative of an ESA nor does it provide the associated ecological functionality that such areas provide. Although this habitat unit is heavily encroached, it should be noted that the NFA protected tree species, *Boscia albitrunca*, has the potential to be located within the Encroached habitat unit.

2.7.3 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[5]. Many introduced species are beneficial, e.g. almost all agriculture and forestry

[5] Government Notice 864 Alien Invasive Species List as published in the Government Gazette 40166 of 2016, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004).

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).

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, which were gazetted on 1 August 2014 and became law on 1 October 2014. AIPs 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 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 "*must ensure that the specimens of the species do not spread outside of the land or the area specified in the permit*"); 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 controlled if they occur in protected areas or riparian zones.

Duty of care related to listed invasive species are referred to in NEMBA Section 73[6]. 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 DEFF - i.e. the Working for Water programme (van Wilgen, 2020). Managing AIPs early on will reduce clearing costs in the long run.

[6] 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.

Site Results

Of the AIPs recorded during the field assessment, 13 species are listed under NEMBA Category 1b, two species were listed under NEMBA category 2, one species was listed under NEMBA category 3 (Table 1). Four species were not listed (Table 1) but *Zinnia peruvinana* is a recognised problem plant that should be controlled as soon as it becomes evident that these species are impacting on the indigenous floral communities.

The Transformed Habitat, although barely vegetated, supported the most AIP species of all the habitat units. It is advised that an Alien and Invasive Species Management and Control Plan be implemented throughout all phases of construction within all habitat units, particularly within the Transformed Habitat, to limit the spread of AIP species into the surrounding habitat.

Table 1: Dominant alien floral species identified during the field assessment with their invasive status as per NEMBA: Alien and Invasive Species Lists, GN R1003 of 2020.

Scientific name (Common name, origin)	NEMBA Category	Degraded Bushveld	Encroached Habitat	Rocky Outcrop Subunit	Rocky Riverine Subunit	Transformed Habitat	Watercourse Habitat
Trees and shrubs							
**Callistemon rigidus* (Stiff Bottlebrush, Australia)	3					x	
**Jacaranda mimosifolia* (Jacaranda, South America)	1b					x	
**Lantana camara* (Common Lantana, American tropics)	1b					x	x
**Melia azedarch* (Syringa, Indomalaya and Australasia)	1b					x	
**Ricinus communis* (Castor bean, Africa)	2	x				x	
**Senna didymobotrya* (Peanut butter cassia, Africa)	1b					x	x
**Thevetia peruviana* (Yellow Oleander, Central America)	1b					x	
**Tipuana tipu* (Yellow Bells, South America)	1b	x				x	
Forbs							
**Argemone Mexicana* (Mexican prickly poppy), Mexico	1b	x					
**Argemone ochroleuca* (Mexican poppy, Mexico)	1b	x				x	x
**Ciclospermum leptophyllum* (Marsh parsley, Australia)	NL	x	x			x	
**Flaveria bidentis* (Smelters bush, South America)	1b	x				x	
**Gomphrena cetosoides* (Globe Amaranth flower, Central America)	NL	x				x	
**Hibiscus trionum* (Flower-of-an-hour, Old World tropics)	NL	x					

Scientific name (Common name, origin)	NEMBA Category	Degraded Bushveld	Encroached Habitat	Rocky Outcrop Subunit	Rocky Riverine Subunit	Transformed Habitat	Watercourse Habitat
**Solanum elaeagnifolium* (Silverleaf nightshade, North and Central America)	1b	x				x	
**Vinca major* (Greater periwinkle, Mediterranean)	1b				x		
**Xanthium strumarium* (Large cocklebur, North Amercia)	1b	x				x	x
**Zinnia peruviana* (Peruvian zinnia, Peru)	NL	x		x			x
Succulents							
**Agave sisalana* (Sisal, Mexico)	2	x	x	x		x	x
**Opuntia ficus-indica* (Prickly Pear, Mexico)	1b	x	x			x	x

3 SENSITIVITY MAPPING

The National Web-Based Online Screening Tool identified the study area to be in a **high sensitivity** area for the Plant Species Theme. The Terrestrial Biodiversity Theme was identified as having a **very high sensitivity**. Based on the ground-truthed results of the site visit, Table 2 below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Figures 6 – 8 conceptually illustrate the areas considered to be of varying ecological sensitivity and how they will be impacted by the proposed infrastructure development. The areas are depicted according to their sensitivity in terms of the presence or potential for floral SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity (compared to a reference type).

Table 2: A summary of the sensitivity of each habitat unit and implications for development.

Sensitivity	Habitat Unit	Development Implications
Moderately High Sensitivity	**Rocky Habitat (encompassing the Rocky Outcrop subunit and the Rocky Riverine Subunit) & Watercourse Habitat**	Conservation Objective for areas of Moderately High Sensitivity**:** Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance. Areas of moderately high sensitivity include those areas, particularly the Rocky Habitat and the watercourse Habitat, where the floral diversity was intermediate to moderately high, the habitat was largely intact and where features of conservation significance were present, including the below list: - Confirmed presence of protected plant species according to Schedule 12 (Protected Plants) of the Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA), namely *Aloe cryptopoda* and *Scadoxus puniceus* within the Rocky Habitat*;* - Areas confirmed to be ESA 1 within both the Rocky and Watercourse Habitat; and - Watercourses are legally protected within the National Water Act, 1998 (Act No. 36 of 1998) (NWA). **Development options:** Development within these habitat subunits is likely to result in the loss of floral habitat, protected floral species (as per Schedule 12 of LEMA), and species diversity. Two protected species as identified by LEMA were recorded within the Rocky Habitat and it is anticipated that more are present. Both the Rocky Habitat subunits and parts of the Watercourse Habitat Unit are situated within an ESA 1, which is important for ecological functioning. Furthermore, given the location of the Rocky Riverine Subunit near the Mogompane River, the ecological functioning of this habitat unit is of particular importance, particularly those associated with the edge effects of the river system. As far as is possible, development should be avoided within the Rocky Riverine Subunit and if feasible, other layout options for water and power lines should be sought for the development that transverses this subunit. Should this not be feasible due to definite locations for the powerline and water line routes, strict rehabilitation measures must be implemented to restore the habitat back to its pre-development state or improved state. Development around the Rocky Outcrop subunit can be minimised provided that the development of the proposed water and powerlines are restricted to next to the existing servitude, opposite the Rocky outcrops and thus avoiding development of the outcrops themselves. This is achievable given that the rocky outcrops are not located on both sides of the existing roads, and thus if construction were to take place on the opposite side of the road, the negative impacts on these rocky outcrops can be minimised. Development around the watercourse habitat should be avoided as far as is possible and the zones of regulations from the Freshwater Report taken into consideration (SAS 220156). AIP management plan will need to be implemented if development is approved as AIP species can easily spread downstream and impact on habitat outside of the development footprint. Furthermore, edge effects of the associated watercourse system should be managed.

Sensitivity	Habitat Unit	Development Implications
Moderately Low Sensitivity	**Degraded Bushveld & Encroached Habitat**	<u>Conservation Objective for areas of Moderately Low Sensitivity</u>**:** Optimise the development potential while improving the biodiversity integrity of the surrounding natural habitat and managing edge effects. These floral communities are of moderately low importance and significance from a floral resource management perspective. This is due to historic anthropogenic activities (e.g., dumping) and current grazing pressures which have altered the floral species composition significantly from the reference state (i.e. the Sekhukhune Plains Bushveld). Decreased habitat integrity and bush encroachment have resulted in low potential for SCC to be present. Despite the moderately low floral richness within the Degraded Bushveld Habitat, a protected species as per Schedule 12 (Protected Plants) of the Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA), namely *Aloe cryptopoda*, was observed in this habitat unit. Permits from the Limpopo Economic Development, Environmental and Tourism LEDET will be required to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place. Additionally, the NFA protected species, *Boscia albitrunca,* was observed within this habitat unit albeit not very abundantly. Permits will have to be obtained from the Department of Environment, forest, and Fisheries (DEFF) for the individuals of *Boscia albitrunca* that will have to be removed for construction to proceed. **Development options:** In its current modified state, these areas are not deemed important to support indigenous floral communities; however, where these areas fall outside of the approved development footprint, but within the powerline and water line servitudes, they should be managed as ecological support areas to reach a functioning ecological condition, e.g., control bush encroachment. As such, development within these areas can be optimised, but edge effects should be strictly managed.
Low Sensitivity	**Transformed Habitat**	<u>Conservation Objective for areas of Low Sensitivity</u>**:** Optimise development potential. This habitat unit is of low ecological importance and sensitivity and development related activities are unlikely to have any significant impact on the floral community. The Transformed Habitat has experienced large degrees of modification and provides little habitat for indigenous floral species. Much of the habitat unit is dominated by a lack of vegetation but where vegetation is present, AIP species dominate. As such, AIP control must take place to improve possible function of the area and to control edge effects. **Development options:** The habitat within the Transformed Habitat unit has been notably degraded from a floral species perspective. Anthropogenic activities over the years has led to a decreased habitat integrity and low species diversity. Human disturbance and presence within this habitat have led to the proliferation of AIPs and the subsequent loss of floral diversity. It is highly recommended that an AIP control and management plan be implemented during all phases of construction of the water line and power servitudes to limit the spread of AIP species to the surrounding areas.

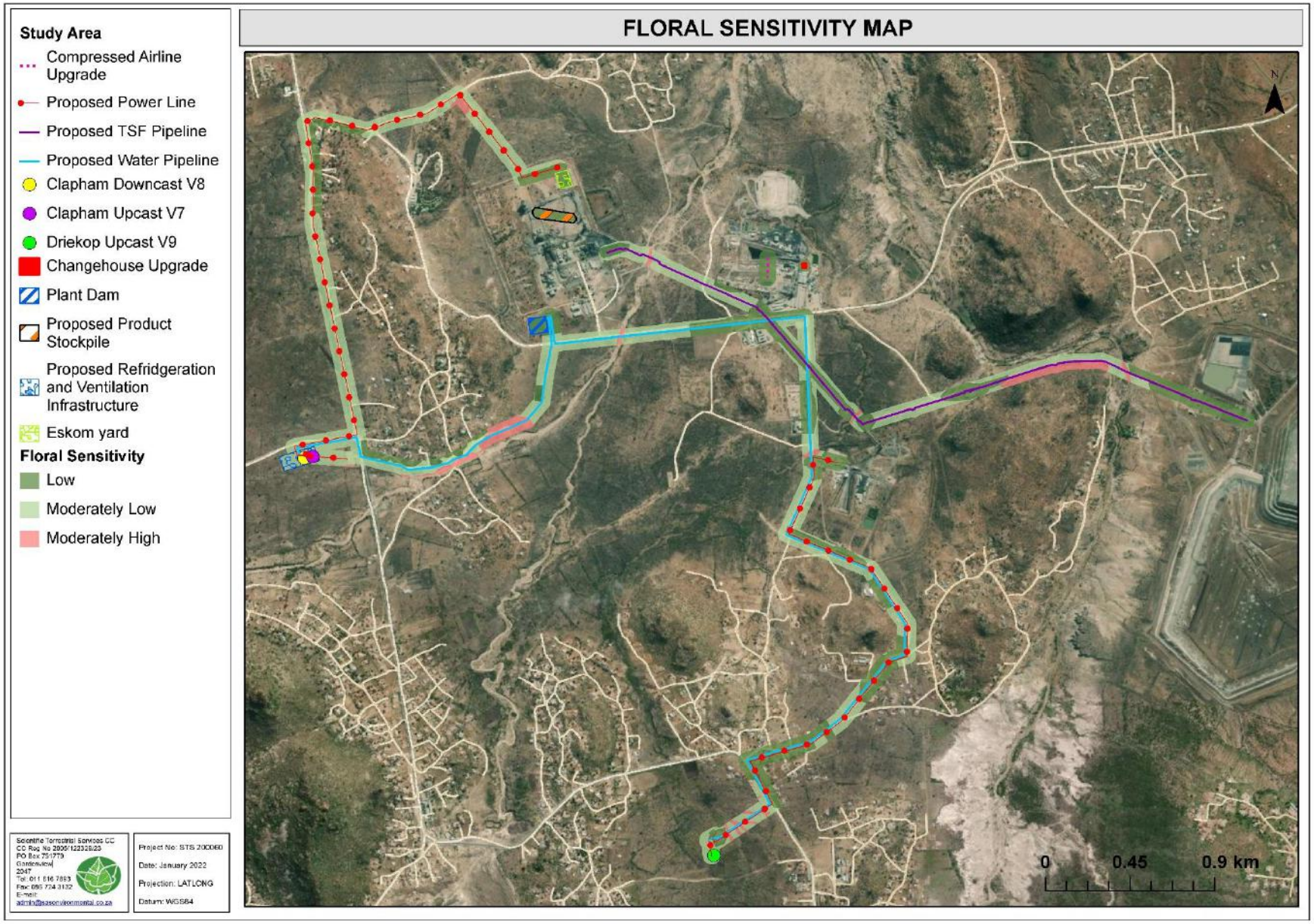


Figure 6: Conceptual illustration of the habitat sensitivity associated with the study area as identified during the field assessment.

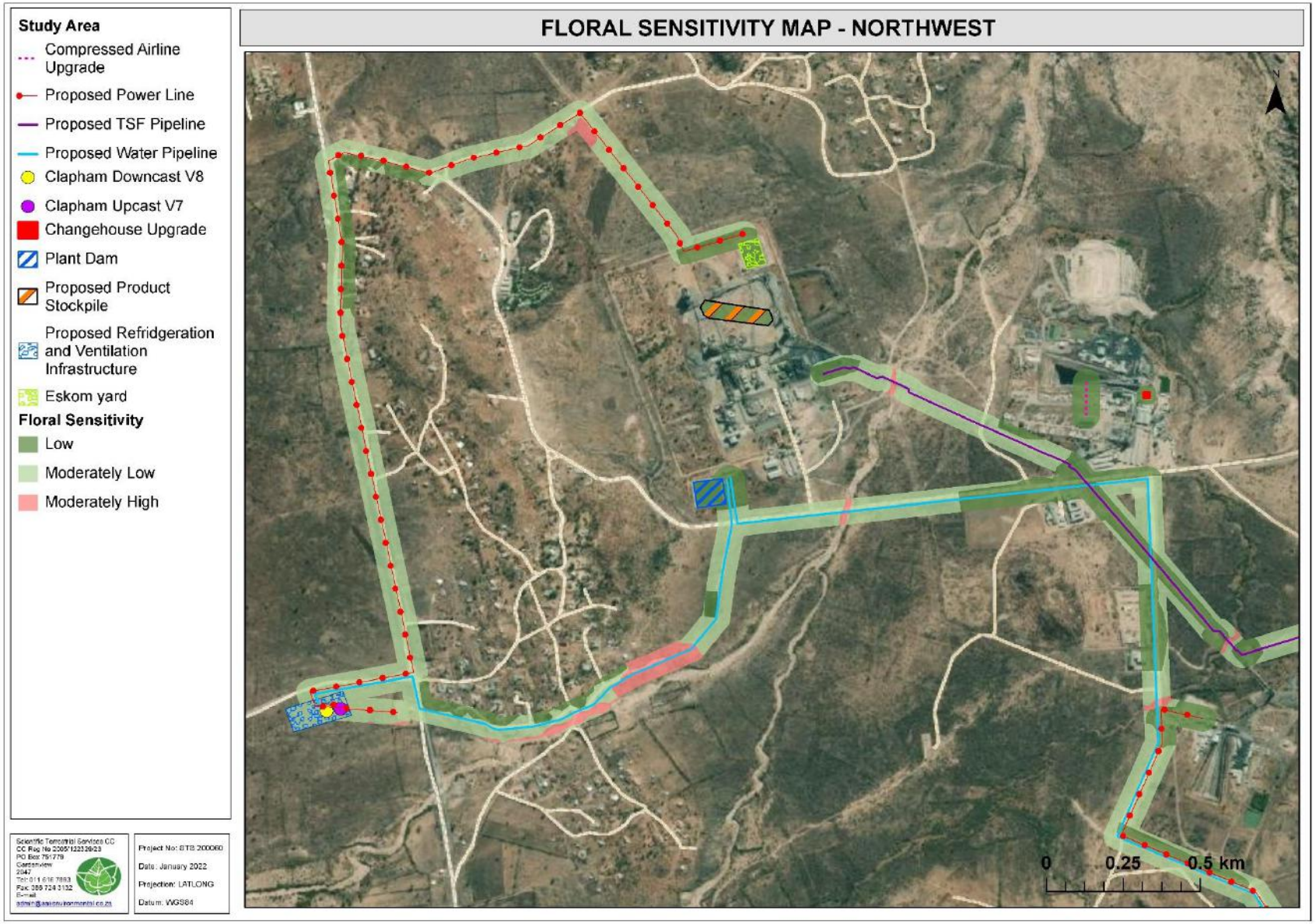


Figure 7: Conceptual illustration of the habitat sensitivity associated with the northwestern section of the study area as identified during the field assessment.

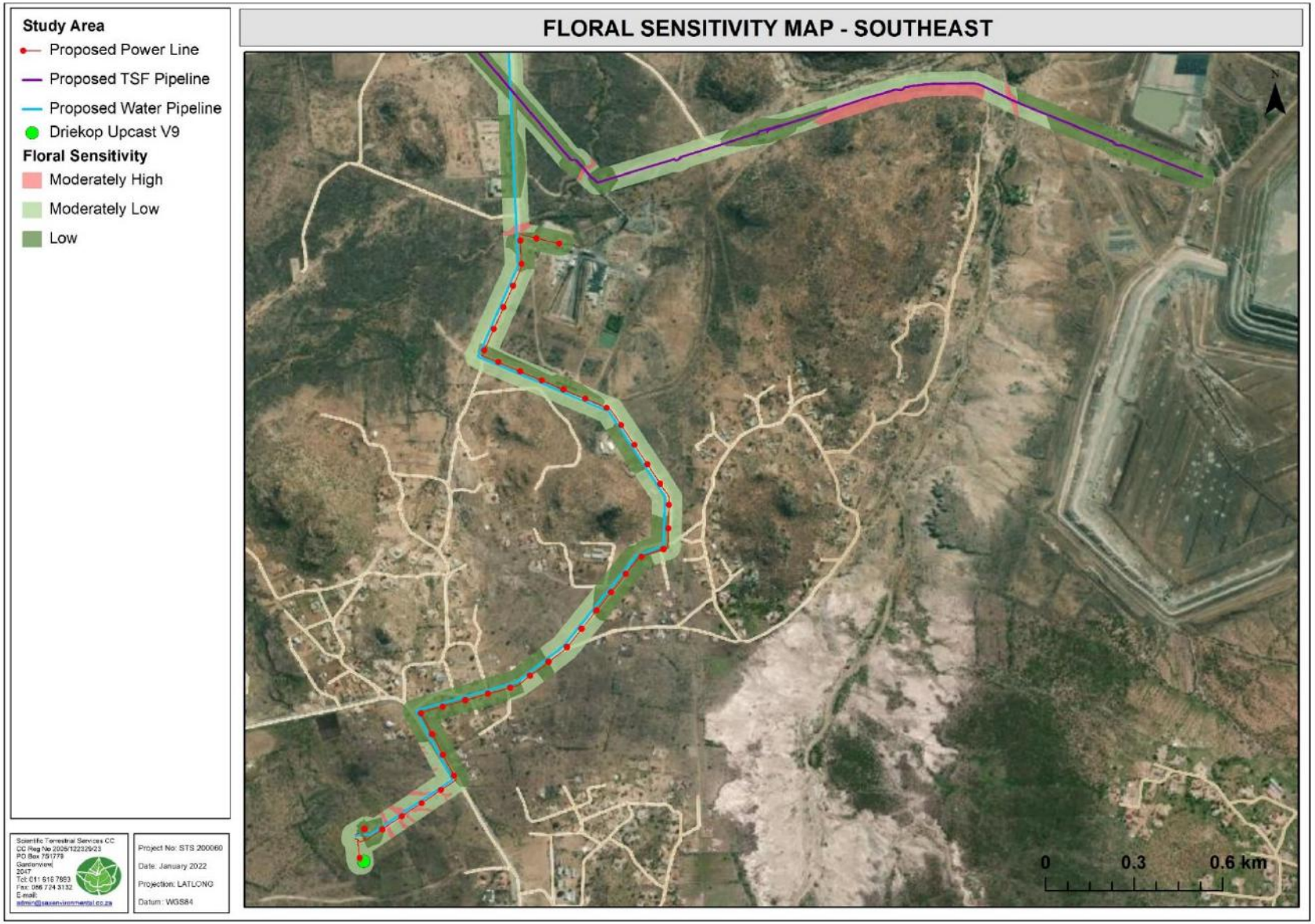


Figure 8: Conceptual illustration of the habitat sensitivity associated with the southeastern section of the study area as identified during the field assessment.

4 IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts arising from the proposed infrastructure development for the study area. The proposed development activities include upgrading and/or the construction of the following infrastructure: ventilation shafts with associated infrastructure, water pipelines and powerlines, a new TSF pipeline, a product stock ore pile, a compressed airline, and upgrades to the existing change house.

An impact discussion and assessment of all potential Planning Phase (Pre-construction and Planning), Construction, Decommissioning & Closure Phases impacts are provided in Section 4.2 and 4.3. All mitigatory measures required to minimise the perceived impacts are presented in Section 4.4.

4.1 Activities and Aspect Register

The table below indicates the perceived risks to floral species associated with the activities pertaining to the proposed infrastructure development at Marula Mine.

Table 3: Activities and Aspects likely to impact on the floral resources of the study area.

ACTIVITIES AND ASPECTS REGISTER	Wate, TSF and Power line	Stockpile and Shafts
Planning Phase (Pre-Construction and Planning)	**Applicable**	**Applicable**
- Potential failure to relocate, where feasible, all floral SCC, protected species according to LEMA or NFA protected trees species to suitable habitat outside the development footprint (i.e. in the Rocky Habitat and the Degraded Bushveld Habitat). - **Impact**: Loss of floral SCC, protected species as per LEMA and NFA within the development footprint areas in the study area.	X	X
- Potential inadequate design of stormwater management and erosion control, resulting in increased risk of erosion and loss of topsoil; - **Impact**: Loss of favourable floral habitat beyond the authorised footprint, leading to a decline in floral diversity.	X	X
- Inconsiderate planning of infrastructure placement and design within the Rocky Habitat (especially within the Rocky Riverine Subunit), leading to the loss of intact floral habitat, as well as unnecessary edge effect impacts on areas outside of the proposed development footprint. - **Impact:** Degradation and modification of the receiving environment, loss of floral habitat.	X	X
- Potential failure to design and implement an Alien and Invasive Plant (AIP) Management/Control plan before the commencement of construction activities, resulting in the spread of AIPs from the development footprint to surrounding natural habitat. - **Impact:** Spreads of AIPs, leading to potential loss of floral species diversity from surrounding natural habitat.	X	X
Construction and Operational (Mining) Phases	**Applicable**	**Applicable**
- Site clearing and the removal of vegetation. - **Impact:** Loss of floral habitat, diversity and potentially occurring floral SCC.	X	X
- Potential failure to monitor the success of relocated floral SCC. - **Impact:** Loss of SCC individuals.	X	X
- Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the further transformation of adjacent natural habitat such as open bushveld that surround the greater study area. - **Impact:** Loss of favourable floral habitat outside of the direct development footprint, including a decrease in species diversity and a potential loss of floral SCC.	X	X
- Dumping of construction material within areas where no construction is planned, thereby leading to further habitat disturbance - allowing the establishment and spread of AIPs. - **Impact:** Loss of favourable floral habitat, diversity and SCC as AIPs outcome and replace these species.	X	X
- Failure to rehabilitate bare areas or disturbed sites as soon as they become available, potentially resulting in loss of viable soils, increased erosion risks and/or the proliferation of AIPs. - **Impact:** Long-term loss of favourable habitat for the establishment of floral species. Loss of floral diversity and SCC.	X	X
- Overexploitation through the removal and/or collection of important or sensitive floral SCC beyond the direct footprint area due to increased presence of workers on site. The study area supports two	X	X

ACTIVITIES AND ASPECTS REGISTER	Wate, TSF and Power line	Stockpile and Shafts
provincially protected species, *Aloe cryptopoda* and *Scadoxus puniceus*, as well as a NFA protected tree species, *Boscia albitrunca*, that are not anticipated to be restricted to the footprint area. - **Impact:** Local loss of floral SCC individuals beyond the footprint areas.		
- Additional pressure on floral habitat by increased human movement associated with the proposed mining activities, including increased vehicular movement, contributing to: • Overexploitation through the removal and/or collection of important or sensitive floral SCC beyond the direct footprint area; • Increased introduction and spread of AIPs; and • Increased risk of fire frequency. - **Impact:** Loss of sensitive floral habitat and the potential loss of floral SCC.	X	X
- Potentially poorly managed edge effects: • Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to ongoing proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the floral habitat; and • Compaction of soils outside of the study area due to indiscriminate driving of construction vehicles through natural vegetation. - **Impact:** Loss of floral habitat, diversity and SCC within the direct footprint of the proposed development. Loss of surrounding floral diversity and floral SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.	X	X
- Potential failure to • Implement a Biodiversity Management Plan (BMP); and • Initiate the rehabilitation plan and monitoring of alien floral communities during the operational phase. - **Impact:** Permanent transformation of floral habitat and long-term degradation of floral habitat within the region.	X	X
- Excavation and compaction of soils leading to increased runoff and sedimentation of surrounding Watercourses. - **Impact:** Loss of favourable floral habitat and decline in diversity.	X	
- Dust generated during construction and operational activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants[7] 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.	X	X
- Decreased ecoservice provision & decreased ability to support biodiversity by ESA due to vegetation and soil disturbance. - **Impact: L**oss or alteration of ESA Habitat and associated ecological functionality.	X	X
Operational Phases / Decommissioning & Closure		
- Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the footprint area. - **Impact:** Ongoing or permanent **l**oss of floral habitat, diversity and potentially occurring SCC.	X	X

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

ACTIVITIES AND ASPECTS REGISTER	Wate, TSF and Power line	Stockpile and Shafts
- Rehabilitation of currently degraded habitat and management of bush encroached areas. - **Impact (positive):** Some ecological functioning will be restored that has been lost due to habitat degradation.	X	X
- Potentially ineffective rehabilitation of exposed and impacted areas potentially leading to a shift in vegetation type. - **Impact:** Permanent loss of floral habitat, diversity and SCC, and a higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity (such as the Rocky habitat and Watercourse Habitat within ESA 1 and ESA 2).	X	X
- Potential poor management and failure to monitor rehabilitation efforts, leading to: • Landscapes left fragmented, resulting in reduced dispersal capabilities of floral species and a decrease in floral diversity; • Compacted soils and increased AIP cover limiting the re-establishment of natural vegetation; • Increased risk of erosion in areas left disturbed. - **Impact:** Long-term (or permanent) loss of floral habitat, diversity, and SCC.		X

4.2 Floral Impact Assessment Results

The below table indicates the perceived risks to the floral ecology associated with all phases of the proposed development. The table also 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. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

Table 4: Impact on the floral habitat, diversity and SCC from the proposed Powerlines and Water and TSF pipelines during the pre-construction phase, the construction phase, and the operational and maintenance phase of the proposed linear development.

Infrastructure	UNMANAGED						MANAGED					
	Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
PRE-CONSTRUCTION PHASE												
Impact of floral Habitat and Diversity												
Powerline	M	L	M	L	H	**Medium**	L	L	L	L	M	**Low**
Water & TSF Pipelines	H	H	M	L	H	**Medium**	M	H	L	L	M	**Low**
Impact on Floral SCC												
Powerline	L	L	M	L	H	**Medium**	VL	L	L	L	M	**Low**
Water & TSF Pipelines	H	H	4	L	H	**Medium**	VH	H	M	L	M	**Low**
CONSTRUCTION PHASE												
Impact of floral Habitat and Diversity												
Powerline	M	L	M	L	H	**Medium**	L	L	L	L	M	**Low**
Water & TSF Pipelines	VH	H	M	L	VH	**Medium**	H	H	L	L	H	**Medium**
Impact on Floral SCC												
Powerline	L	L	M	L	H	**Medium**	VL	L	L	L	M	**Low**
Water & TSF Pipelines	VH	H	M	L	H	**Medium**	H	H	M	L	M	**Low**
OPERATIONAL AND MAINTENANCE PHASE												
Impact of floral Habitat and Diversity												
Powerline	L	L	L	L	H	**Medium**	VL	L	VL	L	M	**Low**

Water & TSF Pipelines	M	H	M	L	H	**Medium**	L	H	L	L	M	**Low**
Impact on Floral SCC												
Powerline	VL	L	L	L	H	**Medium**	VL	L	VL	L	M	**Low**
Water & TSF Pipelines	H	H	M	L	H	**Medium**	M	H	L	L	M	**Low**
DECOMMISSIONING AND CLOSURE PHASE												
Impact of floral Habitat and Diversity												
Powerline	L	M	M	M	H	**Medium**	VL	M	L	L	M	**Low**
Water & TSF Pipelines	L	VL	VL	L	L	**Low**	VL	VL	VL	VL	VL	**INSIGNIFICANT**
Impact on Floral SCC												
Powerline	H	M	M	M	H	**Medium**	M	M	L	L	M	**Low**
Water & TSF Pipelines	VL	VL	VL	L	L	**Low**	VL	VL	VL	VL	VL	**INSIGNIFICANT**

Table 5: Impact on the floral habitat, diversity and SCC from the proposed Ventilation shafts and product stockpile during the preconstruction and planning phase, the construction phase and the decommissioning and closure phase of the mine.

Infrastructure	UNMANAGED						MANAGED					
	Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
PRE-CONSTRUCTION AND PLANNING PHASE												
Impact of floral Habitat and Diversity												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	M	M	M	M	H	**Medium**	L	M	L	L	M	**Low**
Product Stockpile	M	VL	L	L	L	**Low**	L	VL	VL	VL	VL	**INSIGNIFICANT**
Impact on Floral SCC												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	H	M	M	M	H	**Medium**	M	M	L	M	M	**Low**
Product Stockpile	L	VL	L	L	L	**Low**	VL	VL	1	VL	VL	**INSIGNIFICANT**
CONSTRUCTION AND OPERATIONAL PHASE												
Impact of floral Habitat and Diversity												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	M	M	M	M	H	**Medium**	L	M	L	L	M	**Low**
Product Stockpile	M	VL	L	L	L	**Low**	L	VL	VL	VL	VL	**INSIGNIFICANT**

Impact on Floral SCC												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	H	M	M	M	H	**Medium**	M	M	L	M	M	**Low**
Product Stockpile	L	VL	L	L	L	**Low**	VL	VL	VL	VL	VL	**INSIGNIFICANT**
DECOMMISSIONING AND CLOSURE PHASE												
Impact of floral Habitat and Diversity												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	L	M	M	M	H	**Medium**	VL	M	L	L	M	**Low**
Product Stockpile	L	VL	VL	L	L	**Low**	VL	VL	VL	VL	VL	**INSIGNIFICANT**
Impact on Floral SCC												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	H	M	M	M	H	**Medium**	M	M	L	L	M	**Low**
Product Stockpile	VL	VL	VL	L	L	**Low**	VL	VL	VL	VL	VL	**INSIGNIFICANT**

4.3 Impact Discussion

Prior to mitigation measures implemented, the impact of the proposed development on the floral ecology of the study area is anticipated to be moderately unfavourable for the development of the ventilation shafts, conveyors, airline and changeroom upgrade as well as the water & TSF pipelines, and the powerlines. However, the impact associated with the development of the stockpiles is anticipated to be less detrimental.

With mitigation measures implemented, the direct and indirect impacts on the floral ecology for the study area may be reduced to medium to low levels during both the construction and operational phases where the development of the ventilation shafts and associated refrigeration infrastructure, conveyors, airline and changeroom upgrade as well as the water lines and powerlines are associated. In contrast, with mitigation measures in place, the development of the stockpiles is anticipated to be insignificant during the construction and operational phases of the development due to placement within already transformed habitat.

The impact on floral SCC varies slightly between the proposed infrastructure but without any mitigation measures implemented, the impact on floral SCC is anticipated to be Medium for the development of the ventilation shafts, conveyors, airline, changeroom upgrade, water and TSF pipelines and the powerlines. The impact significance can be reduced to Low levels if species are adequately rescued and relocated prior to the commencement of vegetation clearance. The impact on floral SCC for the stockpiles prior to mitigation is anticipated to be low, whereas with the implementation of mitigation measures is anticipated to be insignificant.

As part of the rehabilitation actions, disturbed areas (as a result of construction and / or operational activities) that are not within the development footprint must be rehabilitated appropriately and AIP establishment controlled within such areas.

4.3.1 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 infrastructure development. The proposed development will result in the clearance of vegetation, which will lead to a loss of floral habitat and diversity within the study area.

The development of the proposed water and TSF pipelines and the power lines will result in the greatest impact in terms of size of the habitat impacted during construction; however, the reference vegetation type is well represented within the greater region. As such a significant loss of the associated degraded floral communities is not anticipated. However, the proposed

water and powerlines do transverse a sensitive habitat, namely a Rocky Habitat subunit (i.e., the Rocky Riverine subunit) as well as the Watercourse Habitat. The development of the proposed water and within this area is deemed likely to impact of the floral habitat and diversity that is located within this area. If the powerlines are constructed at heights greater than the height of the Rocky Outcrops, impacts on the floral communities within this habitat subunit can be greatly decreased. Although, the proposed development of the water and powerlines will lead to a 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 proposed development of the ventilation shafts (and associated refrigeration structures), conveyors, airline and changeroom upgrade is not anticipated to be significant due to the small size thereof. The area identified for the development of the shafts is also no longer considered to be a good representation of the Sekhukhune Plains Bushveld vegetation type. A lack of important ecological processes (such as fire) within these areas has led to a degraded system. Given the degree of degradation and overgrazing within the area identified for development of the ventilation shafts, the area is not anticipated to provide suitable habitat for other indigenous species. As such, a significant loss of floral communities is not anticipated with the specified development, nor is it likely to impact floral communities at a larger local and regional (provincial) level.

The proposed locations of the product stockpiles will receive the smallest impact in terms of size of the habitat lost. This habitat unit is no longer considered to be a good representation of the Sekhukhune Plains Bushveld vegetation type, particularly as it is located within an already transformed area. As such, a significant loss of floral communities is not anticipated for the development of the stockpile. Development of the stockpile is further unlikely to impact floral communities at a larger local and regional (provincial) level.

4.3.2 Impacts on Floral SCC

Placement of the development infrastructure is likely to have an unfavourable impact on protected floral species (LEMA) such as *Aloe crypotpoda* (within the Degraded Bushveld and Rocky Habitat Units) and *Scadoxus puniceus* (within the Rocky Outcrop Subunit), specifically along the routes identified for the proposed water and powerlines.

The study area is not associated with a high diversity of SCC or protected floral species according to LEMA and the NFA, nor were a high abundance of individuals observed. However, the loss of *Aloe crypotpoda, Scadoxus puniceus* and *Boscia albitrunca* individuals is considered definite, especially along the routes identified for the development of the water

and TSF pipelines and the powerlines. Impacts on SCC from the proposed powerline can be greatly reduced if vegetation clearing is kept only to areas where infrastructure will be erected and vegetation in between these structures be maintained.

Activities which are likely to negatively affect the flora of conservation concern within and around the study area include, but are not limited to, the following:

- Placement of infrastructure (water and TSF pipelines) within sensitive floral habitat (particularly within the Watercourse Habitat and Degraded Bushveld Habitat Units) or habitat favoured by the recorded protected floral species. Sensitive habitats are likely to be affected regardless of alternative routes as Watercourse Habitat in particular will still be traversed;
- Irreversible destruction of favourable floral habitat during construction and operational activities; and
- Poorly managed AIP proliferation with subsequent displacement of floral SCC.

A walkdown of the footprint area prior to construction activities should be conducted. Should these species or any other floral SCC or protected species as per the LEMA and the NFA be encountered during any phase of the proposed development, these species should be rescued and relocated by a suitably qualified specialist and either relocated to suitable habitat within the study area outside of the development footprint or moved to registered nurseries such as the Agricultural Research Council (ARC) or the South African National Biodiversity Institute (SANBI). Any other floral SCC encountered during the construction phase of the proposed development should also be relocated by a suitably qualified specialist and, where required, the necessary permits should be applied for.

4.3.3 Impact on CBAs, ESAs, Threatened Vegetation and Protected Areas

The proposed development will not impact on any CBAs, or protected areas (within 3 km of the study area). However, the proposed development will impact on ESAs as well as a threatened ecosystem, namely the Sekhukhune Plains Bushveld, which is endangered. ESAs are important features in the greater landscape and provide unique conditions for flora and important ecological functionality within the ecosystem. The current layout of the proposed development transverses mostly ESA 1 areas, although ESA 2 areas are also affected. Due to their ecological importance, it is recommended that impacts to ESAs be avoided or minimised as far as possible and kept to approved areas only.

Although the study area falls within an endangered ecosystem, much of the proposed development does not fall within the fragmented remnants of the vegetation unit. Where

development does fall within such remnants (i.e., parts of both the powerlines and water lines), it is recommended that the development, and associated vegetation clearing, be kept to what is absolutely necessary and kept within the approved areas only.

4.3.4 Probable Residual Impacts

Even with extensive mitigation and rehabilitation, residual impacts on the receiving floral ecological environment are still likely. Although rehabilitation during the closure and decommissioning of the mine is planned, it is still unlikely to result in the complete restoration of the receiving environment to the vegetative reference state. Rehabilitation, if suitably undertaken, will however result in a suitable vegetation cover of indigenous species known from the area, thereby minimising long term residual impacts. Rehabilitation efforts however may be hindered as a result of land use activities associated with the neighbouring communities, notably increased grazing and use of natural resources in the rehabilitated areas. The following points highlight the key residual impacts that have been identified:

- Continued AIP proliferation;
- Potential continued loss of protected floral species and suitable habitat; and
- Bush encroachment limiting floral species establishment in the rehabilitated areas as well as the remaining surrounding areas.

4.3.5 Cumulative Impacts

Currently, the current greatest threat to the floral ecology that are likely to contribute to cumulative impacts on the floral communities within the surrounding areas are bush encroachment, overgrazing, and the continued proliferation of AIP species, resulting in the overall loss of native floral communities within the local area.

4.4 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed development 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 6: A summary of the mitigatory requirements for floral resources.

Project phase	Planning Phase
Impact Summary	Loss of floral habitat, species 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 incorporating the sensitivity of the biodiversity report as well as other specialist studies; and
- Prior to the commencement of construction activities, an AIP Management/Control Plan should be compiled for implementation:
  - Removal of AIPs should preferably commence during the pre-construction phase and continue throughout the construction and operational phases. AIPs should be cleared within the study area before any vegetation clearing activities commence, thereby ensuring that no AIP propagules are spread with construction rubble, or soils contaminated with AIP seeds during the construction phase; and
  - An AIP Management/Control Plan should be implemented by a qualified professional. No use of uncertified chemicals may be used for chemical control of AIPs. Only trained personnel are to use chemical and mechanical control methods of AIPs. Chemical control may not be used within the Watercourse Habitat.
Floral SCC
- Species protected under NFA and Schedule 12 of the Limpopo Environmental Management Act, 2003 (Act No 7 of 2003) were recorded on site. Suitable habitat for such species is present, especially in the within the Degraded Bushveld and Rocky Habitats. A walkdown of the footprint area is required before construction activities commence where anticipated floral SCC/protected species are searched and marked (if encountered); and
- If SCC/protected species are encountered and will be affected by the construction activities, these species must be marked and where possible, relocated to suitable habitat surrounding the disturbance footprint. Suitable habitat is available in nearby surrounding locations. A licence from the Department of Environment, Forestry and Fisheries (DEFF) is required for the removal of NFA protected tree species (*Boscia albutruncia*). For the removal, destruction, or relocation of protected flora in terms of the LEMA (Schedules 11 and 12), a license is required from the Department of Economic. Development, Environment & Tourism (LEDET).	

Project phase	Construction and Operational Phases
Impact Summary	Loss of floral habitat, species and SCC
Proposed mitigation and management measures:	

Development footprint
• The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management);
• Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved development footprint.
• Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal;
• No collection of indigenous floral species must be allowed by construction personnel, especially with regards to floral SCC (if encountered);
• Care should be taken during the construction and operation activities to limit edge effects on the surrounding habitats. This can be achieved by:
  - Demarcating all footprint areas during construction activities;
  - Rubble is to be disposed of on the existing waste rock dump (WRD) whilst cleared alien invasive plant species are to be taken to a registered waste disposal facility;
  - All soils outside of the operational area that have been compacted as a result of construction activities should be ripped and profiled and reseeded;
  - 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 development footprint areas (refer to section 2.7.3 of this report); and
  - No dumping of waste is allowed on site. Rcoek material and any rubble removed as a result of the construction activities should be disposed of on the WRD. No temporary dump sites should be allowed in areas with natural vegetation. Waste disposal containers and bins should be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility.
• If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral 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 recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil; and
- Upon completion of construction activities, where bare / disturbed areas remain that are not part of the everyday operations/functions of the mine, these areas are to be revegetated with indigenous species.

Alien Vegetation
- Edge effects arising from the proposed development, such as erosion and alien plant 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 (2014) (section 2.7.3 of this report);
- Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the construction and operational phase of the development, and a 30 m buffer surrounding the study area should be regularly checked for AIP proliferation and to prevent spread into surrounding natural areas; 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 construction personnel; and
- Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC outside of the proposed development footprint area.

Fire
- No illicit fires must be allowed during the construction of the proposed development.

Rehabilitation
- Rehabilitation of natural vegetation should proceed in accordance with the rehabilitation plan. The rehabilitation plan should consider all phases of the project indicating rehabilitation actions to be undertaken during and once construction has been completed, ongoing rehabilitation/monitoring during the operational phase of the project as well as rehabilitation actions to be undertaken after operations have ceased;
- Any natural areas beyond the direct footprint, which have been affected by the construction or operational activities, must be rehabilitated using indigenous species;
- Floral monitoring should be done annually during operational activities. Please also refer to the monitoring guidelines in section 4.5;
- Areas that have been disturbed as a result of mining activities must be rehabilitated as soon possible. 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 construction activities falling outside of the project area should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas.

Project phase	Decommissioning & Closure Phase
Impact Summary	Loss of floral habitat, species and SCC

Proposed mitigation and management measures:

Development footprint
- No additional habitat outside of the footprint areas is to be disturbed during the closure phase;
- No vehicles are allowed to indiscriminately drive through sensitive habitat and natural areas; and
- No dumping of litter must be allowed on-site.

Alien Vegetation
- Edge effects such as erosion and alien plant 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 (2014) (section 2.7.3 of this report);
- Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the closure phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas; 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
- 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 and closure phase of the proposed development; and

• Edge effect 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 development footprint.
Rehabilitation
• All infrastructure and footprint areas should be rehabilitated in accordance with the rehabilitation plan; • 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; • Edge effects such as erosion and AIP proliferation, which may affect adjacent or downstream sensitive habitat, need to be strictly managed adjacent to the footprint areas and as part of the rehabilitation phase; • Ongoing alien and invasive vegetation monitoring and clearance should take place throughout the rehabilitation phase of the project; • Due to the impacts on ESA 1, ESA 2 and an endangered ecosystem, rehabilitation must be to the pre-mined condition. Where possible, vegetation condition should be improved through bush encroachment and AIP management; and • Monitoring of rescued and relocated floral SCC should continue during the Decommissioning & Closure Phase until it is evident that the species have successfully established. Where possible, these species should be reintroduced into rehabilitation sites.

4.5 Floral Monitoring

A floral monitoring plan must be designed and implemented throughout all phases of the proposed mining project, 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 operational 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 project and action must be taken to mitigate impacts as soon as negative effects from mining activities become apparent; and
- The method of monitoring must be designed to be subjective and repeatable to ensure consistent results.

5 CONCLUSION

STS was appointed to conduct a Faunal and Floral Ecological Assessment as part of the EIA and Authorisation process for the proposed surface infrastructure development on the existing Marula Platinum Mine, located approximately 30 km northwest of the town of Burgersfort, Limpopo Province, henceforth referred to as the “study area”.

The study is located within the MRA of the Marula Platinum Mine. During the field assessment, five broad habitat units were identified within the study area, namely Degraded Bushveld, Encroached Habitat, Rocky Habitat (encompassing two smaller subunits, namely Rocky Outcrops and Rocky Riverine subunits), Watercourse Habitat and Transformed Habitat. The Degraded Bushveld and Encroached Habitat were of moderately low sensitivity. The Degraded Bushveld supported a relatively low species richness and is degraded largely due to dumping and overgrazing within the habitat unit. The Encroached Habitat was encroached, with the main encroaching species being *Dichrostachys cinerea, Vachellia nilotica* and *Terminalia sericea*. The Rocky Habitat, which consisted of two subunits (i.e. Rocky Outcrops and Rocky Riverine Habitat) and the Watercourse Habitat were of moderately high sensitivity. These habitat units were scored this sensitivity as the area provides unique habitat for floral species. The Transformed Habitat is of low sensitivity and is not deemed important to support floral communities given the transformed state and level of AIP proliferation within the habitat unit. Impacts from the proposed development on these habitat units will be of low significance.

No SANBI Red Data Listed species were observed during the field assessment. However, an NFA species was encountered within the study area, namely *Boscia albutruncia* (within the Degraded Bushveld Habitat). Furthermore, two protected species, *Aloe crytopoda* and *Scadoxus puniceus*, as per Schedule 12 of the Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) were identified within the Degraded Bushveld, Watercourse Habitat and within the Rocky Habitat. It is recommended that a summer season walkdown be undertaken and all potentially occurring protected floral species within the final development footprint be marked by means of GPS. Permits from LEDET and DEFF should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place.

The proposed infrastructure area will impact on two habitat units namely, the Rocky Habitat (including both subunits) as well as the Watercourse Habitat. As such, the following recommendations are proposed: development of the proposed water and powerlines should be restricted to areas right next to the road servitude, avoiding development within the outcrops themselves. This is achievable given that the rocky outcrops are not located on both sides of the existing roads. If development were to occur on the opposite side of the road to

the Rocky Outcrops, the negative impacts thereof can be minimised. The proposed water and power lines will directly impact on the sensitive Rocky Riverine subunit as well as on various floral species, including one SCC. It is recommended that the proposed power and water and TSF pipeline path which overlaps the Rocky Riverine Habitat should be realigned to exclude this moderately sensitive habitat. Development within the watercourse habitat should be avoided where possible. Activities that are planned within the delineated Watercourse Habitat or the zones of regulation, as identified in the Watercourse Assessment, will require authorisation from the Department of Water and Sanitation (DWS). Stormwater management and erosion control will be essential to prevent siltation of Watercourse Habitat.

Following the biodiversity assessment within the study area, the impacts associated with the proposed development activities were determined. The impacts arising from the proposed development are predominantly medium. With mitigation measures fully implemented, it is the opinion of the specialist that all impacts can be effectively reduced to low and insignificant levels.

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: 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[8]:

- **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;

[8] 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

- 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 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 (GN 255 of 2015) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA), were taken into consideration for the Limpopo Province.

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

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.

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. In order 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 A1: 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 A1 below:

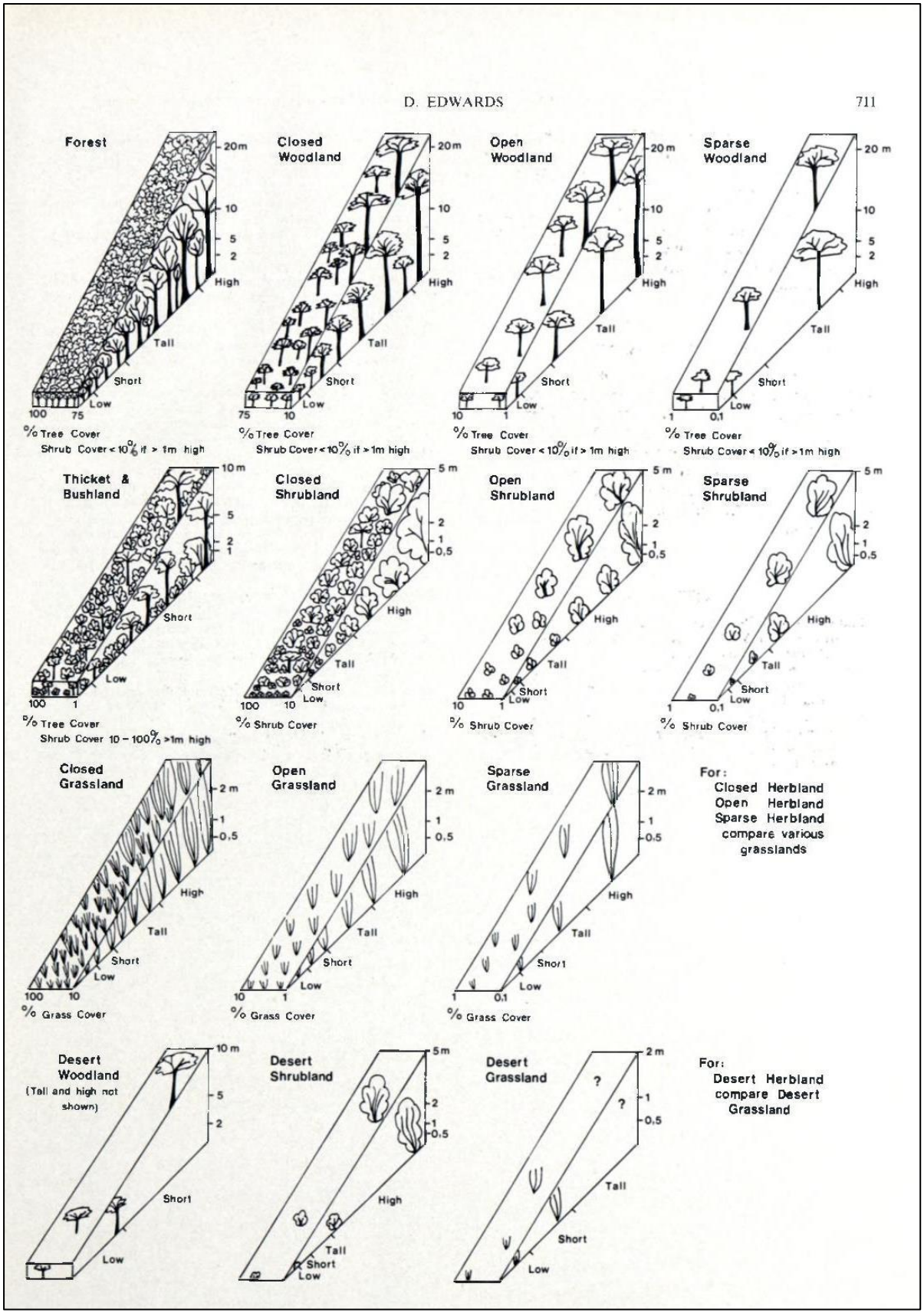

Figure A1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.

APPENDIX B: 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 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 (EOO) <500 km^2, OR
  - Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy (AOO), 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.

Table B1: National red listed plant species recorded in the surrounding areas within the QDS 2430AC and 2430CA. Data obtained from the new Plants of southern Africa (new POSA) online catalogue. Data is obtained from the Botanical Database of Southern Africa (BODATSA), which contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).

Family	Scientific name	National Red List status	Habitat Description	POC
Acanthaceae	*Dicliptera fruticosa*	NT	Range: Strydpoort Mountains to Ohrigstad Major Habitats: Sekhukhune Mountain Bushveld, Ohrigstad Mountain Bushveld, Poung Dolomite Mountain Bushveld, Sekhukhune Plains Bushveld, Gravelotte Rocky Bushveld Description: Savanna and open woodland, shady areas on rocky magnetite and dolomite slopes. Population trend: Decreasing	Low
Anacardiaceae	*Searsia batophylla*	VU	Range: Sekhukhuneland Major Habitats: Sekhukhune Mountain Bushveld, Sekhukhune Plains Bushveld, Ohrigstad Mountain Bushveld Description: Dry bushveld, in low-lying areas and along watercourses, 650-975 m Population trend: Unknown	Medium
Asparagaceae	*Asparagus fourei*	VU	Range: Sekhukhuneland, Burgersfort to Penge Major Habitats: Sekhukhune Mountain Bushveld, Sekhukhune Plains Bushveld, Poung Dolomite Mountain Bushveld Description: Mixed bushveld, on rocky, dolomite outcrops Population trend: Stable	Medium
Asparagaceae	*Asparagus sekukuniensis*	EN	Range: Leolo Mountains, Sekhukhuneland Major Habitats: Sekhukhune Mountain Bushveld, Sekhukhune Plains Bushveld Description Bushveld, on rocky slopes Population trend: Decreasing	Medium

Euphorbiaceae	*Euphorbia barnardii*	EN	Range: Sekhukhuneland, from the Strydpoort Mountains southwards along the Leolo Mountains to Steelpoort Major Habitats: Sekhukhune Mountain Bushveld, Sekhukhune Plains Bushveld, Ohrigstad Mountain Bushveld Description: Savanna and closed woodland, rocky slopes and summits, mainly norite outcrops, with one subpopulation on banded ironstone. At most sites, the habitat has been degraded to a shrubby, succulent-dominated vegetation with low grass and tree cover. Population trend: Decreasing	Medium
Fabaceae	*Vachellia sekhukhuniensis*	CR	Range: North-eastern boundary of Sekhukhuneland Major Habitats: Ohrigstad Mountain Bushveld Description: Open woodlands and wooded grassland on quartzite ridges Population trend: Decreasing	Medium
Iridaceae	*Gladiolus sekukuniensis*	VU	Range: Leolo and Strydpoort Mountains Major Habitats: Sekhukhune Mountain Bushveld, Sekhukhune Plains Bushveld, Ohrigstad Mountain Bushveld Description: Banded ironstone in soil containing lumps of calcrete, or on norite. Population trend: Stable	Medium
Polygalaceae	*Polygala sekhukhuniensis*	VU	Range: Sekhukhuneland Major Habitats: Sekhukhune Mountain Bushveld, Sekhukhune Plains Bushveld Description: Sparsely vegetated heavy metal rich soils on lower slopes and valley bottoms Population trend: Decreasing	Low

CR= Critically Endangered**, EN=** Endangered**, EW =** Extinct in the Wild**, NT =** Near Threatened**, VU=** Vulnerable**, P=** Protected, **POC** = Probability of Occurrence

Table B2: TOPS plant list for the Limpopo Province.

SCIENTIFIC NAME	HABITAT	DISTRIBUTION / RANGE	NATIONAL RED LIST STATUS	POC
Bowiea volubilis subsp. volubilis	Low and medium altitudes, usually along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screes. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm.	Eastern Cape to Limpopo Province. Widespread elsewhere in southern and eastern Africa.	VU	Low
Brackenridgea zanguebarica	In South Africa: stony, light grey and shallow sandy loam in woodland, also on the southern aspect of dry mountain bushveld.	One known subpopulation in South Africa occurs in the Thengwe district in Venda. Also occurs in Zimbabwe, Mozambique and northwards to Tanzania.	CR	Low
Dioscorea sylvatica	Wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs.	Western Cape, Eastern Cape, KwaZulu-Natal, Free State, Gauteng, Mpumalanga, Limpopo Province, Swaziland, Zimbabwe and Zambia.	VU	Low

SCIENTIFIC NAME	HABITAT	DISTRIBUTION / RANGE	NATIONAL RED LIST STATUS	POC
Drimia sanguinea	Open veld and scrubby woodland in a variety of soil types.	Northern Cape and across to Limpopo and Mpumalanga Provinces, Namibia, Botswana and Zimbabwe.	NT	Medium
Encephalartos brevifoliolatus	Short grassland in open protea savanna.	Formerly occurred near the Blyde River Canyon Nature Reserve	EW	Low
Encephalartos cupidus	Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests.	Extinct throughout most of the range in Limpopo and Mpumalanga, presently restricted to a small area in northern Mpumalanga.	CR	Low
Encephalartos dolomiticus	Grassland, in shallow soils on dolomite ridges.	Sekhukhuneland.	CR	Low
Encephalartos dyerianus	Open grassland and shrubland on the slopes of low granite hills.	Phalaborwa.	CR	Low
Encephalartos eugene-maraisii	Sandstone hills and rocky ridges in open grassland and savanna.	Waterberg.	EN	Medium
Encephalartos hirsutus	Exposed quartzite cliffs in mountain bushveld.	Soutpansberg Mountains.	CR	Low
Encephalartos inopinus	Shallow soils on steep, rocky slopes and gorges, restricted to dolomite.	Steelpoort and Olifants River valleys.	CR	Low
Encephalartos nubimontanus	Steep cliffs in low open woodland.	Formerly occurred in the Mountains north of Penge.	EW	Low
Encephalartos transvenosus	Tall grassveld and mixed bushveld, mainly on steep rocky slopes facing southeast in the mistbelt zone.	Limpopo Drakensberg Escarpment and Soutpansberg.	LC	Low
Euphorbia groenewaldii	Gentle, northwest-facing slopes of small granite hills and ridges between bands of schist or in gritty red sandy loam soil, 1100-1500 m.	East of Polokwane. Polokwane Plateau Bushveld, Mamabolo Mountain Bushveld	CR	Medium
Harpagophytum procumbens	Well drained sandy habitats in open savanna and woodlands.	Within South Africa this species occurs in the Northern Cape, North West, Free State, and Limpopo Provinces and the largest populations are found in the communally owned areas of the North West Province and the north eastern parts of the Northern Cape.	LC	Medium
Harpagophytum zeyheri subsp. *zeyheri*	On Kalahari sand in dry open woodland.	Gauteng, Limpopo, Mpumalanga, North West.	LC	Low
Mondia whitei	Mainly swamp forest in South Africa and occasionally in riverine and coastal forest, further north it is found in Afromontane forest. It is currently restricted to lower elevations, although historically it was recorded in higher altitude midlands forest.	From Guinea-Bissau through tropical Africa to KwaZulu-Natal.	EN	Low
Prunus africana	Evergreen forests near the coast, inland mistbelt forests and afromontane forests up to 2100 m.	Widespread in Africa from the southern Cape, through KwaZulu-Natal, Swaziland and northwards in to Zimbabwe and central Africa and the islands of Madagascar and Comoros.	VU	Low
Siphonochilus aethiopicus	Tall open or closed woodland, wooded grassland or bushveld.	Sporadically from the Letaba catchment in the Limpopo Lowveld to	CR	Low

SCIENTIFIC NAME	HABITAT	DISTRIBUTION / RANGE	NATIONAL RED LIST STATUS	POC
		Swaziland. Extinct in KwaZulu-Natal. Widespread elsewhere in Africa.		
Warburgia salutaris	Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets.	North-eastern KwaZulu-Natal, Mpumalanga and Limpopo Province. Also occurs in Swaziland, Mozambique and Zimbabwe and Malawi.	EN	Low

CR= Critically Endangered**, EN=** Endangered**, EW =** Extinct in the Wild**, LC = Least Concern; NT =** Near Threatened**, VU=** Vulnerable**, P=** Protected, POC = Probability of Occurrence

Table B3: NFA plant list for species with a known distribution range falling within the study area[9].

SCIENTIFIC NAME	HABITAT & DISTRIBUTION[10] & [11]	NATIONAL RED LIST STATUS	POC
Boscia albitrunca	Habitat mainly includes dry, open woodland and bushveld, mostly in hot, arid, semi-desert areas, often on termitaria. The vast distribution range covers Botswana, Limpopo, Gauteng, North-West, Swaziland, the Free State, Northern Cape and KwaZulu-Natal. It also extends into Zambia, Zimbabwe, and Mozambique.	LC	Confirmed
Combretum imberbe	The leadwood can be found in all the bushveld regions and in mixed forest in southern Africa. Preferred habitat includes open bushveld, mixed woodland, rivers or dry watercourses and often on alluvial soils. It is widespread in Lowveld areas and grows along streams and rivers. Combretum imberbe is widespread in northern Namibia. It is also found in Mpumalanga, Limpopo, North-West Province, Mozambique, and into tropical Africa.	LC	High
Balanites maughanii	The plants can be found in small colonies in the bushveld, sand forest, on sandstone outcrops, along riverbanks, near springs and around pans.	LC	Low
Catha edulis	Khat is found in woodlands and on rocky outcrops. It is scattered in KwaZulu-Natal and Eastern Cape, mostly from the mistbelt, moving inland. It is also found in the Western Cape, Mpumalanga, Swaziland, Mozambique and through to tropical Africa and the Arab countries.	LC	Low
Elaeodendron transvaalense	Savanna or bushveld, from open woodland to thickets, often on termite mounds.	NT	Low
Sclerocarya birrea* subsp. *caffra	The Marula is widespread in Africa from Ethiopia in the north to KwaZulu-Natal in the south. In South Africa it is more dominant in the Baphalaborwa area in Limpopo. It occurs naturally in various types of woodland, on sandy soil or occasionally sandy loam.	LC	High
Philenoptera violacea	Alluvial flats in bushveld	LC	Low
Pittosporum viridiflorum	*Pittosporum viridiflorum* is widely distributed in the eastern half of South Africa, occuring from the Western Cape up into tropical Africa and beyond to Arabia and India. It grows over a wide range of altitudes and varies in form from one location to another. *Pittosporum viridiflorum* grows in tall forest and in scrub on the forest margin, kloofs and on stream banks.	LC	Low
Prunus africana	*Prunus africana* is confined to evergreen forests from near the coast to the mist belt and montane forests in KwaZulu-Natal, Eastern Cape, Swaziland, Mpumalanga, Zimbabwe, and tropical Africa. This It is a moderately fast-growing tree which is sensitive to heavy frost, preferring areas where there is regular rain; it will tolerate moderate frosts.	VU	Low

[9] https://www.thetreeapp.co.za/team/
[10] http://pza.sanbi.org/
[11] http://redlist.sanbi.org/index.php

SCIENTIFIC NAME	HABITAT & DISTRIBUTION[10] & [11]	NATIONAL RED LIST STATUS	POC
Vachellia erioloba	Found in dry woodland, bushveld, grassland, and watercourses in arid areas usually on stony or sandy soil. Widespread in the arid northern provinces of South Africa, also Namibia, Botswana, Zimbabwe, southern Angola, and south-western Zambia.	LC	Medium

CR= Critically Endangered**, EN=** Endangered**, EW =** Extinct in the Wild**, LC = Least Concern; NT =** Near Threatened**, VU=** Vulnerable**, P=** Protected, POC = Probability of Occurrence

APPENDIX C: Floral Species List

Table C1: Dominant woody floral species encountered during the field assessment. Alien species identified during the field assessment are indicated with an asterisk (*).

Scientific name	Degraded Bushveld	Encroached Habitat	Rocky Outcrop Subunit	Rocky Riverine Subunit	Transformed Habitat	Watercourse Habitat
Trees and shrubs						
**Callistemon rigidus*					x	
**Jacaranda mimosifolia*					x	
**Lantana camara*					x	x
**Melia azedarch*					x	
**Ricinus communis*	x				x	
**Senna didymobotrya*					x	x
**Thevetia peruviana*					x	
**Tipuana tipu*	x				x	
Bauhinia galpinii		x			x	
Boscia albitrunca	x					
Carissa bispinosa		x	x			x
Celtis africana						x
Dichrostachys cinerea	x	x			x	x
Diospyros lycoides			x	x		x
Englerophytum magalies montanum				x		
Gossypium herbaceum	x	x				
Grewia flavescens			x	x		
Gymnosporia buxifolia			x	x		x
Terminalia sericea	x	x	x	x		x
Vachellia nilotica	x	x	x	x	x	
Vangauria infausta			x	x		
Ziziphus mucronata	x	x				x
Forbs						
Aptosimum lineare	x	x	x	x		x
**Argemone mexicana*	x					
**Argemone ochroleuca*	x				x	x
**Ciclospermum leptophyllum*	x	x			x	
**Flaveria bidens*	x				x	
**Gomphrena cetosoides*	x				x	
**Hibiscus trionum*	x					
**Solanum elaegnifolium*	x				x	
**Vinca major (NEMBA Category 1b)*				x		
**Xanthium strumarium*	x				x	x
**Zinnia peruviana*	x		x			x
Abutilon angultatum	x					

Asparagus suaveolens	x	x				x
Chamaecrista mimosoides	x					
Commicarpus pentandrus	x	x	x	x	x	
Euphorbia hirta	x				x	
Geigeria burkei subsp. Burkei	x	x	x	x		
Gloriosa superba			x			
Gomphocarpus fruticosus	x		x			x
Indigophera holubii	x				x	
Jatropha erythropoda			x	x		
Kleinia longiflora			x			
Ledebouria marginata			x	x		x
Leonotis nepetifolia var. nepetifolia	x				x	
Plantago laceoloata	x				x	
Scadoxus puniceus			x			
Senna italica subsp. arachoides	x		x	x		
Solanum lichtensteinii	x	x			x	
Tapinanthus oleifolius	x					
Tinnea rhodesiana			x	x		
Tribulus terrestris	x				x	
Succulents						
**Opuntia cf ficus-indica*	x	x			x	x
**Agave sisalana*	x	x	x		x	x
Aloe Cryptopoda	x		x	x		x
Eucphrobia tirucalli	x		x	x		x
Euphorbia griseola subsp. Griseola			x			
Kleinia stapeliiformis			x			
Sarcostemma viminale			x	x		
Graminoids						
Cynodon dactylon	x	x			x	
Eragrosis capensis			x	x		
Eragrostis rigidior	x				x	
Heteropogon contortus	x				x	
Hyparrhenia hirta		x			x	x
Melinis repens	x	x	x	x	x	
Panicum maximum	x					
Paspalum distichum	x				x	
Themeda triandra	x	x			x	x
Urochloa mosambicensis	x	x			x	

APPENDIX H: SPECIALIST STUDIES
TERRESTRIAL BIODIVERSITY ASSESSMENT PART C: FAUNAL ASSESSMENT

SCIENTIFIC TERRESTRIAL SERVICES

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BIODIVERSITY ASSESSMENT AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE DEVELOPMENT OF SURFACE INFRASTRUCTURE AT THE MARULA PLATINUM MINE, LIMPOPO PROVINCE

Prepared for

SLR Consulting Ltd.

January 2022

Part C: Faunal Assessment

Prepared by: Scientific Terrestrial Services CC
Report author: D. van der Merwe
Report reviewers: C. Hooton
K. Marais (Pr. Sci. Nat)
Report reference: STS 200060

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on terrestrial biodiversity in terms of Government Notice 648 as promulgated in Government Gazette 45421 of 2019 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/Notes
2.1	**Assessment must be undertaken by a suitably qualified SACNASP registered specialist**	**Part A**: Cover Page; and Appendix E
2.2	**Description of the preferred development site, including the following aspects-**	
2.2.1	*A description of the ecological drivers/processes of the system and how the proposed development will impact these;*	**Part C**: Section 3
2.2.2	*Ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the proposed development site;*	**Part C**: Section 3
2.2.3	*The ecological corridors that the development would impede including migration and movement of flora and fauna;*	**Part C**: Section 3
2.2.4	*The description of any significant landscape features (including rare or important flora/faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Areas (FEPA) sub catchments;*	**Part C**: Section 3
2.2.5	*A description of terrestrial biodiversity and ecosystems on the proposed development 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.*	**Part A**: Section 3 (desktop analysis) **Part B**: Section 3 (flora) **Part C**: Section 3 (fauna)
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.**	Nonapplicable. Entire subject property falls within a very high terrestrial sensitivity. **Part B:** Section 4
2.4	**The Terrestrial Biodiversity Impact Assessment must be based on the results of a site inspection undertaken on the preferred development site and must identify:**	
2.5	**Terrestrial Critical Biodiversity Areas (CBAs), including:** *2.5.1 The reasons why an area has been identified as a CBA;* *2.5.2 An indication of whether or not the development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;* *2.5.3 The impact on species composition and structure of vegetation with an indication of the extent of clearing activities;* *2.5.4 The impact on ecosystem threat status;* *2.5.5 The impact on explicit subtypes in the vegetation;* *2.5.6 The impact on overall species and ecosystem diversity of the site; and* *2.5.7 The impact on populations of species of special concern in the CBA.*	**Part A**: Section 3 (desktop analysis) **Part B**: Section 3 **Part C**: Section 3
2.6	**Terrestrial Ecological Support Areas, including;** *2.6.1 The impact on the ecological processes that operate within or across the site;* *2.6.2 The extent the development will impact on the functionality of the ESA; and* *2.6.3 Loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridor or introducing barriers that impede migration and movement of flora and fauna.*	
2.7	**Protected Areas as defined by the National Environmental Management:** Protected Areas Act, 2004 (Act No. 57 of 2004) including an opinion on whether the proposed development aligns with the objectives/purpose of the Protected Area and the zoning as per the Protected Area Management Plan.	**Part A**: Section 3 (desktop analysis) **Part B**: Section 3

2.8	**Priority Areas for Protected Area Expansion, including:** The way in which in which the development will compromise or contribute to the expansion of the protected area network.	**Part A**: Section 3 (desktop analysis) **Part B**: Section 3
2.9	Strategic Water Source Areas (SWSA) including: *2.9.1 The impact(s) on the terrestrial habitat of a Strategic Water Source Area; and* 2.9.2 *The impacts of the development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses)*	Addressed in the Freshwater Assessment (SAS 220156, 2020)
2.10	Freshwater Ecosystem Priority Area (FEPA) sub catchments, including the impacts of the development on habitat condition and/or species in the FEPA sub catchment.	Addressed in the Freshwater Assessment (SAS 220156, 2020)
2.11	Indigenous Forests, including: *2.11.1 Impact on the ecological integrity of the forest;* *2.11.2 Extent of natural or near natural indigenous forest area lost.*	Not Applicable
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	**Part A:** Appendix E
3.2	A signed statement of independence by the specialist.	**Part A:** Appendix E
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	**Part B:** Section 2.1
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	**Part A**: Section Appendix C
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	**Part C:** Section 1.3
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	**Part C:** Section 4
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.	**Part C:** Section 5
3.8	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	**Part C:** Section 5.4
3.9	A motivation must be provided if there were development footprints identified as per paragraph 2.3 in this table were not considered stating reasons why.	**Part C:** Section 4
3.10	A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, and any conditions to which the statement is subjected.	**Part C:** Section 5.3 **Part C:** Section 6

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ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CR	Critically Endangered
DEFF	Department: Environment, Forestry and Fisheries
EAP	Environmental Assessment Practitioner
EIS	Ecological Importance and Sensitivity
EN	Endangered
EW	Extinct in the Wild
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IEM	Integrated Environmental Management
IIE	Independent Institute of Education (Pty) Ltd
IUCN	International Union for Conservation of Nature and Natural Resources
LEMA	Limpopo Environmental Management Act, 2003 (Act No.7 of 2003)
LC	Least Concern
NT	Near Threatened
NYBA	Not yet been assessed
MAMSL	Meters Above Mean Sea Level
P	Protected
PES	Present Ecological State
POC	Probability of Occurrence
PRECIS	Pretoria Computerised Information System
QDS	Quarter Degree Square
RDL	Red Data Listed
RE	Regionally Extinct
SABAP 2	Southern African Bird Atlas Project 2
SANBI	South Africa National Biodiversity Institute
SP	Specially Protected
STS	Scientific Terrestrial Services
SCC	Species of Conservation Concern
TOPS	Threatened or Protected Species
VU	Vulnerable

GLOSSARY OF TERMS

Alien and Invasive species	A species that is not an indigenous species; or 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.
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.
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.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Least Threatened	Least threatened ecosystems are still largely intact.
Red Data listed (RDL) species	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 (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the Basic Assessment (BAR) for Environmental Authorisation (EA) of the proposed surface infrastructure development on the existing Marula Platinum Mine, located approximately 30 km northwest of the town of Burgersfort, Limpopo Province.

The study area is in the Greater Tubatse Local Municipality which is an administrative area in the Sekhukhune District Municipality of the Limpopo Province. The R37 runs approximately 4 km east of the mine. The proposed development activities include upgrading and/or the construction of the following infrastructure: ventilation shafts with associated infrastructure, water pipelines and powerlines, a new TSF pipeline, a product stock ore pile, a compressed airline, and upgrades to the existing change house. The location and extent of the study area is indicated in Figure 1. For a detailed Project description of all proposed development activities, please refer to section 1.2 of Part A.

The purpose of this report is to define the faunal ecology of the study area as well as mapping and defining areas of increased Ecological Importance and Sensitivity (EIS) and to define the Present Ecological State (PES) of the study area. The objective of this study is:

- To provide inventories of faunal species as encountered within the study area;
- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/ or any other special features;
- To conduct a Red Data Listed (RDL) species assessment as well as an assessment of other Species of Conservation Concern (SCC), including potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed development activities associated within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management;
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- This assessment was limited to the study area only and did not consider the entire Mining Right Area;
- Following the site visit, new infrastructure has been proposed by the client which was not part of the original design. Thus, small portions of the study area, specifically portions of the proposed TSF pipeline have not been thoroughly investigated. However, it is the opinion of the ecologist that through on-site observations of the area and its surroundings sufficient information has been captured to accurately discuss these localities;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the footprint area may therefore have been missed during the assessment; and
- A field assessment was undertaken from the 18-19th of November 2020 (summer season), to determine the faunal ecological status of the study area, and to “ground-truth” the results of the desktop assessment (presented in Section A). A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data and specialist experience in the area, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

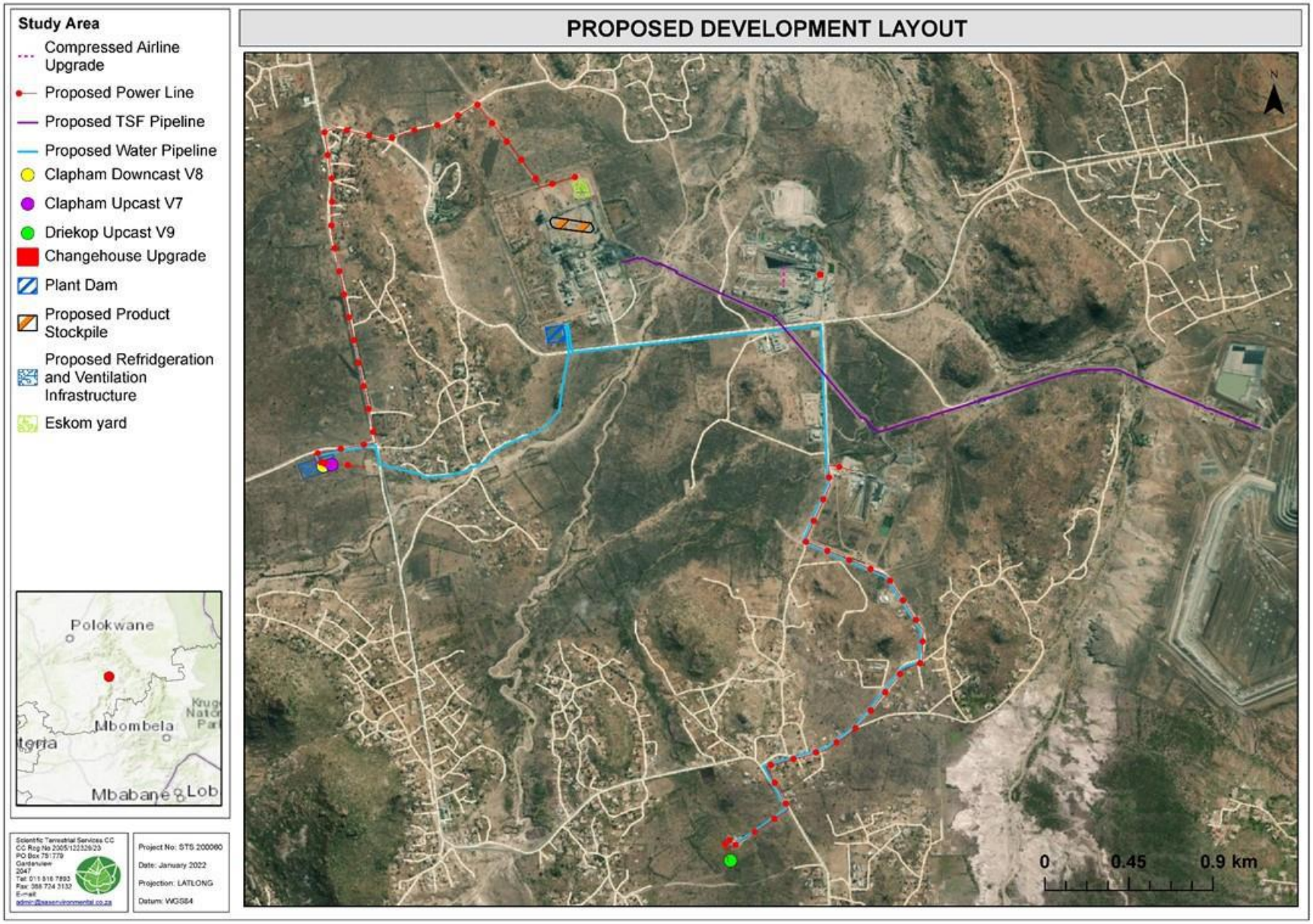


Figure 1: Conceptual illustration of the proposed infrastructure development within the study area in relation to the existing Marula Platinum Mine.

2. ASSESSMENT APPROACH

The field assessment was undertaken on the 18-19th November 2020 (summer season), to determine the faunal ecological status of the study area. A reconnaissance 'walkabout' was initially undertaken to determine the general habitat types found throughout the study area, following this, specific study sites were selected that were considered to be representative of the habitats found within the study area, with special emphasis being placed on areas that may potentially support faunal SCC. Sites were investigated on foot in order to identify the occurrence of fauna within the study area. Sherman and camera traps were used to increase the likelihood of capturing and observing mammal species, notably nocturnal and reclusive mammals.

A detailed explanation of the method of assessment is provided in Appendix A of this report. The faunal categories covered in this assessment are mammals, avifauna, reptiles, amphibians, general invertebrates and arachnids. For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to Appendix C of Part A of the study.

2.1 General approach

In order to accurately determine the PES of the study area and capture comprehensive data with respect to faunal taxa, the following methodology were applied:

- Maps and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. An initial visual on-site assessment of the study area was made in order to confirm the assumptions made during consultation of the digital satellite imagery;
- A literature review with respect to habitats, vegetation types and species distribution was conducted. For a detailed description of the vegetation types and habitats associated with the study area, please refer to Part B report;
- Relevant databases considered during the assessment of the study area included the Important Bird and Biodiversity Areas (IBA, 2015), South African Bird Atlas Project 2 (SABAP2), International Union for Conservation of Nature (IUCN), the Northern Cape Critical Biodiversity Area (CBA) Map (2016) and the National Biodiversity Assessment (NBA, 2018);
- Specific methodologies for the assessment, in terms of field work and data analysis of faunal ecological assemblages are presented in Appendix A of this report; and

- For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to Appendix C of Part A.

2.2 Sensitivity Mapping

All the ecological features associated with the study area were considered, and sensitive areas were assessed. In addition, identified locations of protected species were marked by means of Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery and/or topographic maps. The sensitivity map should guide the final design and layout of the proposed development activities. Please refer to Section 4 of this report for further details.

3. FAUNAL ASSESSMENT RESULTS

3.1 Faunal Habitat

Four habitat units are associated with the proposed developments. These habitat units are discussed briefly in terms of faunal utilisation and importance below. For a more detailed description and discussion of these habitat units please refer to the Part B: Floral Report. Figure 2 provides a visual representation of the various habitats within the study area.

Degraded Bushveld: This habitat unit was relatively species poor, with a poorly represented grass layer throughout. The woody component included species such as *Dichrostachys cineria, Ziziphus mucronata*, and *Boscia albitrunca*. The two Clapham Ventilation Shafts (the approved Clapham Vent Shaft and the proposed Clapham Vent Shaft), the Driekop Ventilation Shaft together with their proposed refrigeration infrastructure as well as parts of the proposed water and power lines proposed were located within this habitat unit. The unit is the most well represented within the study area and because of its low floral diversity provides lowered forage availability for fauna, especially for grazers as the forb, herb and grass layer are poorly developed and heavily grazed. Nevertheless, within the study area this unit is anticipated to host the greatest assemblage of fauna (predominantly as a result of the extent of this habitat compared to the other habitat types);

Encroached Habitat: Located in the northern section of the proposed power line, this habitat unit is characterised by encroached bushveld. The main encroaching species included *Dichrostachys cinerea, Vachellia nilotica* and *Terminalia Sericea*. This unit comprises a small highly fragmented unit and is not anticipated to host a diverse assemblage of fauna or one

that is different from the surrounding habitat due to the degree of fragmentation and degradation that has occurred here;

Rocky Habitat: This habitat unit consisted of two subunits, namely Rocky Outcrops and Rocky Riverine Habitat:

- The Rocky Outcrop sub-unit comprises a fairly diverse species composition typical of rocky areas; and
- The Rocky Riverine Habitat, although supporting a species composition typical of rocky areas, supported a floral community different to that of the Rocky Outcrop sub-unit. This habitat unit consisted of flat, white-grey rocks as opposed to the rich red rocks of the Rocky Outcrops. This habitat sub-unit bordered the Mogompane River.

Fauna favouring rocky habitat, such as arachnids and reptiles will find suitable shelter within these habitats. Forage for species inhabiting this location will be limiting and thus will be heavily competed for due to the small area which they overlay and highly fragmented nature of the units.

Watercourse Habitat: This habitat unit consisted of the watercourses that traverse the proposed infrastructure throughout the study area (i.e., mostly the powerlines and the water and TSF pipelines). These watercourses were all dry at the time of assessment and are expected to be dry for the vast majority of the year (thus can be considered ephemeral watercourses). As they are only expected to flow during times of high rainfall, they do not sustain a wet response for a suitable period of time to facilitate habitat capable of supporting water dependant amphibian or insect species. In some cases, the structure of vegetation along the watercourses was denser and taller than the adjacent degraded bushveld unit which would be favoured by avian species., however, in most cases the watercourses were badly eroded and vegetation structure and species composition hardly changed or were more degraded than the surrounding areas, reducing shelter and resources for fauna within this unit.

Transformed Habitat: This habitat unit includes the road along which the proposed water and TSF pipelines and powerlines will be located, as well as built-up areas located next to the roads which include informal residential development and mining related developments. Due to anthropogenic influences, these areas have an altered physical environment and are scarcely vegetated. The vegetation that is present within these areas include a dominance of AIP and garden ornamental species. Avifaunal diversity appeared highest in this unit as the gardens and fruit trees within the human settlements increased foraging and habitat suitability. Insects and reptiles will also use this resource, however, an intermediate diversity for these classes is anticipated due to the transformed state of these locations.

Figure 2 below provides a visual representation of the above-mentioned habitat units while Sections 3.2 - 3.5 provide a dashboard report of the findings of each faunal class.

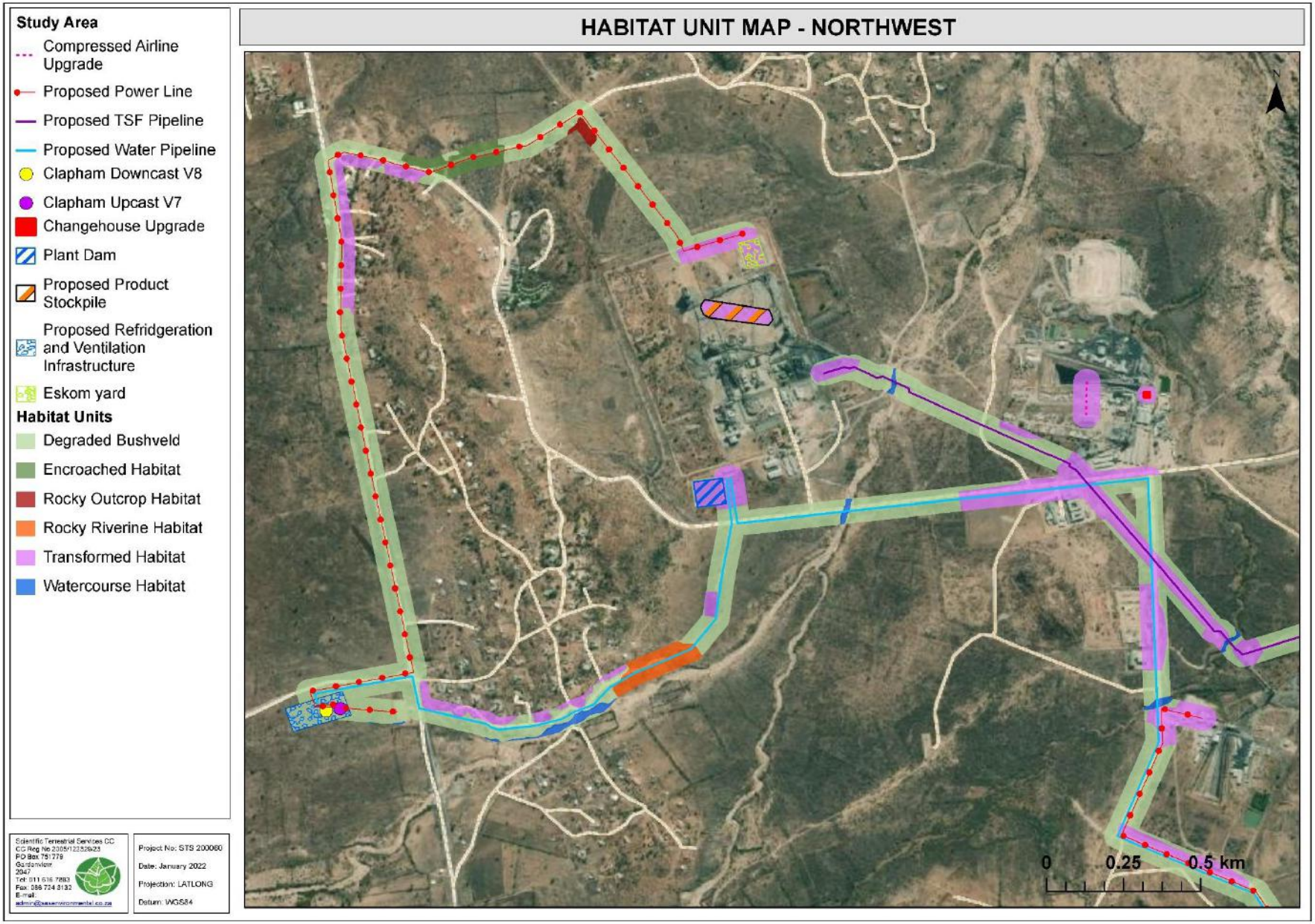


Figure 2: Habitat units associated with the north-western portions of the study area as identified during the 2020 assessment.

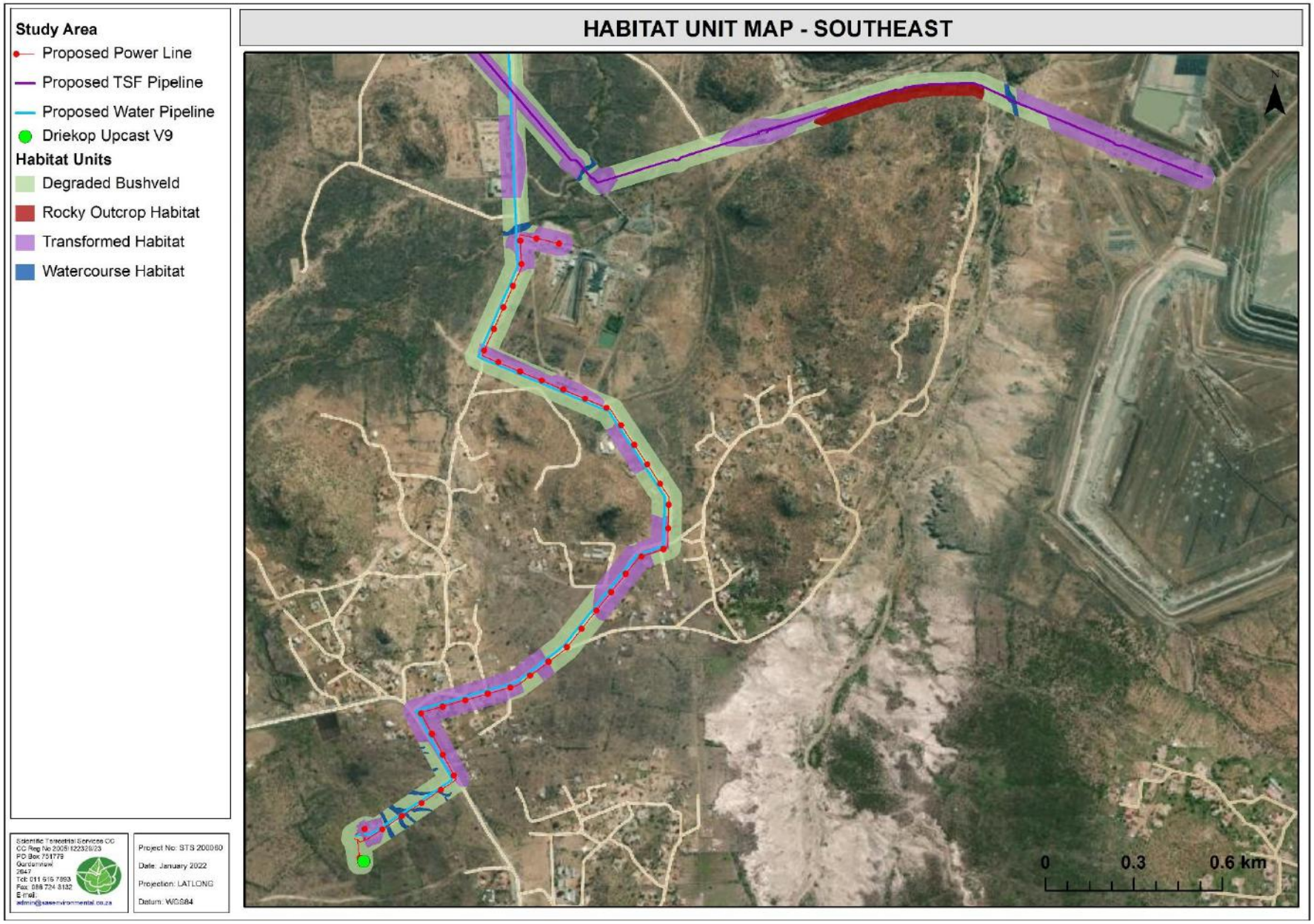


Figure 3: Habitat units associated with the south-eastern portion of the study area as identified during the 2020 assessment.

3.2 Mammals

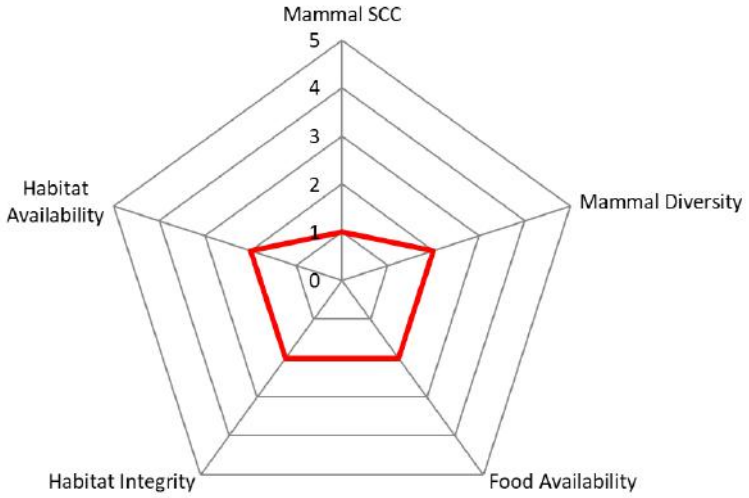
Table 1: Field assessment results pertaining to mammal species within the study area.

Mammal Habitat Sensitivity	Moderately low	Photographs:

Photograph Notes:

Top: Left and Right – Domestic animals are ubiquitous within the study area resulting in a heavily grazed study area where resource competition is high. **Bottom:** Left – General indication of heavily grazed graminoid and shrub layer reducing forage for primary consumers. Right – *Herpestes sanguineus* (Slender Mongoose) observed within the Rocky Riverine Habitat.

Mammal Sensitivity Graph:



Mammal SCC	During the field assessment, no mammal SCC were observed. None of the proposed infrastructure is located within habitat that is deemed favourable or suitable for mammal SCC. The National Web Based Screening Tool indicated that *Dasymys robertsii* (Robert's Shaggy Rat), a Vulnerable species may occur within the study area. The absence of surface water areas and wetland renders the habitat unsuitable for the species.

Mammal Discussion	Long term habitat disturbance and, in many instances, habitat loss has led to a notable decrease in mammal species diversity and abundance. Existing mining activities, continued human presence in the areas and probable persecution from snaring activities has further led to a loss of diversity throughout the proposed infrastructure development sites. The resultant mining activities and habitat disturbance has led to a loss of habitat connectivity and food resources, resulting in a loss of habitat suitability and overall integrity. Only common mammal species adept at surviving in disturbed habitats in close proximity to rural housing may occur within the area. Given the localities of the various infrastructure development sites, which are to be placed between and along existing infrastructure and rural households, it is unlikely that in the long term these areas will serve as suitable habitats or areas of refuge or importance for mammal species. The area is largely transformed rural residential areas, where hunting with dogs and trapping utilising snares is frequent, and mammal population numbers have decreased. Sightings of common mammals are rare within the study area and restricted to the mountainous regions to the west where trapping no longer occurs (communication with community members). Furthermore, high populations of domestic dogs and cats in the area further reduce the potential for any mammal SCC. Whilst on site signs of *Lepus saxatilis* (Scrub Hare) were noted while a single indigenous mammal, *Galerella sanguinea* (Slender Mongoose), was observed. These species are adept at surviving within disturbed habitats and are often noted within areas adjacent to communities.
Business Case and Conclusion	The overall mammal species diversity for the proposed development sites is deemed to be moderately low. Loss of mammal species abundance and diversity is a result of the high pressures from the activities of humans within the broader locality around the study area and the probable persecution (hunting/snaring) of mammals by the local communities. The proposed developments are unlikely to contribute further to the loss of species diversity and abundance, and although the developments will lead to the loss of habitat within the study area, the small size and already disturbed nature of the sites is not likely to impact mammal species populations in the region. The development will further not lead to any loss of habitat connectivity nor will they impact upon any mammal migrations or corridors of movement as it predominantly adjacent existing roads or infrastructure.

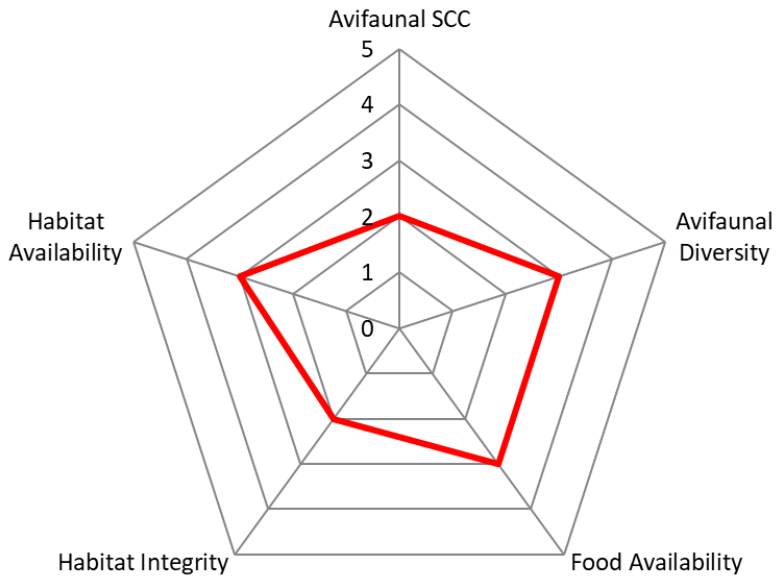
3.3 Avifauna

Table 2: Field assessment results pertaining to avifaunal species within the study area.

Avifaunal Habitat Sensitivity	Intermediate

Photograph Notes:
Images: Top: Left to right – *Chrysococcyx caprius* (Diederik Cuckoo), *Crithagra sulphurate* (Brimestome Canary) and *Erythropygia paena* (Kalahari scrub robin). **Bottom:** Left – *Plecopasser mahali* (White-browed Sparrow-Weaver). Right – *Colius striatus* (Speckled Mousebird).

Avifaunal Sensitivity Graph:



Photographs:

Avifaunal SCC	During the field assessment an individual *Gyps coprotheres* (Cape Vulture) was noted soaring to the east of the study area. *Falco biarmicus* (Lanner Falcon) have a high reporting rate within the area and will likely utilize some of the transformed habitat to hunt should an opportunity present itself. Due to the degraded nature of the habitat and limited food resources it is unlikely that further avifaunal SCC will inhabit the proposed development sites. Due to the low levels of applicable food resources, it is further unlikely that any avifaunal SCC will forage in the proposed infrastructure development sites. *Sagittarius serpentarius* (Secretarybird) was flagged by the national web based Screening Tool, however, the encroached/dense habitat and high abundance of humans and their associated activities within the study area will not be suitable for this species.
Avifaunal Discussion	Avifaunal diversity is considered intermediate, largely restricted to small common species with a low abundance of birds of prey. Within the study area it was also evident that the human settlements (within the Transformed Habitat) attracted more bird species than the adjacent Degraded Bushveld. This is predominantly due to the increased structure and the presence of fruiting trees within the household gardens foraging opportunities for avifauna, increasing both abundance and diversity of birds. The Degraded Bushveld was homogenous in its structure with a species poor floral assemblage and heavily grazed forb, herb and graminoid layer reducing its favourability to most avifaunal

	species, the limited food resources are likely to be a key driver in limiting avifaunal abundance herein. The Rocky Habitat and Encroached Habitat comprised of small portions within the study area, however, the greater structural diversity, floral diversity and shelter, specifically within the Rocky Outcrop sub-unit, did appear to be favoured by many avifaunal species. The overall disturbed nature of the habitats, transformation of suitable habitat and surrounding existing mining activities has led to notable decrease in habitat integrity.
Business Case and Conclusion	The overall avifaunal species diversity for the proposed infrastructure development sites is deemed to be intermediate. Historic habitat disturbance due to human settlement and the adjacent community related agricultural activities and subsequently the development of the mine has had a significant impact on avifaunal species abundance within the proposed development areas. The proposed infrastructure developments are unlikely to contribute further to the loss of avifaunal species diversity and abundance, and although the developments will lead to the loss of habitat within some of the footprint areas, the small size and already disturbed nature of the sites is not likely to impact avifaunal species populations in the region. The development will further not lead to any loss of habitat connectivity nor will they impact upon migration routes, important foraging areas or corridors of movement.

3.4 Herpetofauna

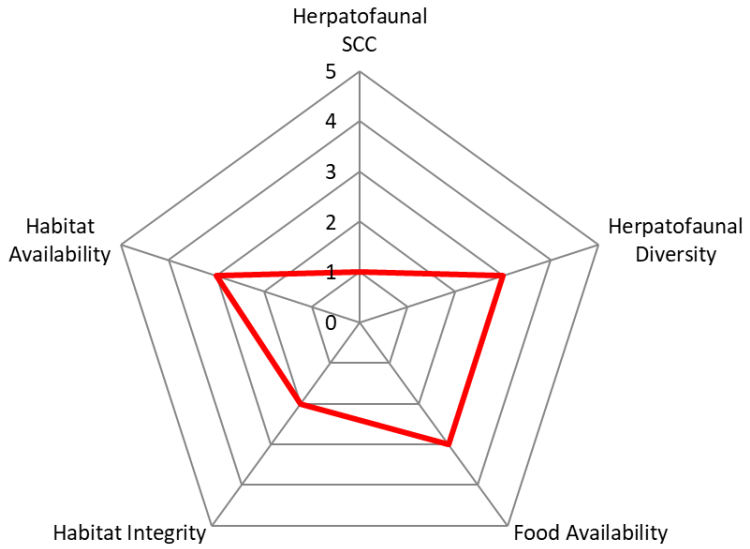
Table 3: Field assessment results pertaining to reptile and amphibian species within the study area.

Herpetofauna Habitat Sensitivity	Moderately low

Photograph Notes:

Image: *Trachylepis punctatissima* (Speckled Rock Skink) observed adjacent to the Clapham Vent shaft within the Degraded Bushveld.

Herpetofauna Sensitivity Graph:



Photographs:

Herpetofauna Discussion

Herpetofauna diversity and abundances appeared low during the field assessment as only rock skinks were observed. It is anticipated that an intermediate diversity of reptiles will inhabit the area while a low diversity of amphibians is likely due to the arid nature of the region. Reptile and amphibian species are notoriously hard to detect, owing to their secretive nature. The degraded state of the various habitat units corroborated the lower than anticipated diversity levels. Very few amphibians are expected to occur within the proposed infrastructure development sites, owing to the lack of surface water or areas of increased soil moisture needed to sustain amphibians. The habitat units further had limited food resources due to the moderately low abundance levels of insects and small mammals, however, very little rain had fallen prior to the field assessment which likely limited the invertebrate abundance. Though this may change after rainfall periods, the change is not expected to be significant enough to lead to notable increases in reptilian or amphibian diversity and abundances. Smaller reptile species may permanently inhabit the proposed sites, however larger predatory snakes and species that require more niche habitat (rocky outcrops, wetlands etc) are unlikely to permanently reside within the proposed study area If they are observed, it will likely be as they are passing through to other more suitable areas of habitat or whilst foraging as persecution within Degraded and Transformed Habitat is likely high.

Herpetofauna SCC	No amphibian or reptile SCC were observed during the assessment, nor are any expected to occur within the proposed development sites due to the unsuitable habitat available within the footprint areas. A cautionary note regarding *Python natalensis* (Southern African Python) which local community members have claimed to see - it is anticipated that should this species occur here it would be under severe threat as a result of human wildlife conflict.
Business Case and Conclusion	Overall, the herpetofauna sensitivity is deemed to be intermediate at most, owing to the decreased levels of suitable habitat for amphibians and the general degraded and disturbed nature of the surrounding habitat as well as high human activity within the study area. Few amphibian species are expected to occur within the study area due to insufficient habitat, whilst only common and widely occurring reptiles will likely utilise the habitats. The proposed infrastructure developments are unlikely to contribute further to the loss of herpetofauna diversity and abundance, and although the developments will lead to the loss of habitat within the footprint areas, the small size and already disturbed nature of the sites is not likely to impact on species populations in the region. The development will further not lead to any loss of habitat connectivity nor will the developments impact upon migration routes, important foraging locations or corridors of movement.

3.5 Invertebrates

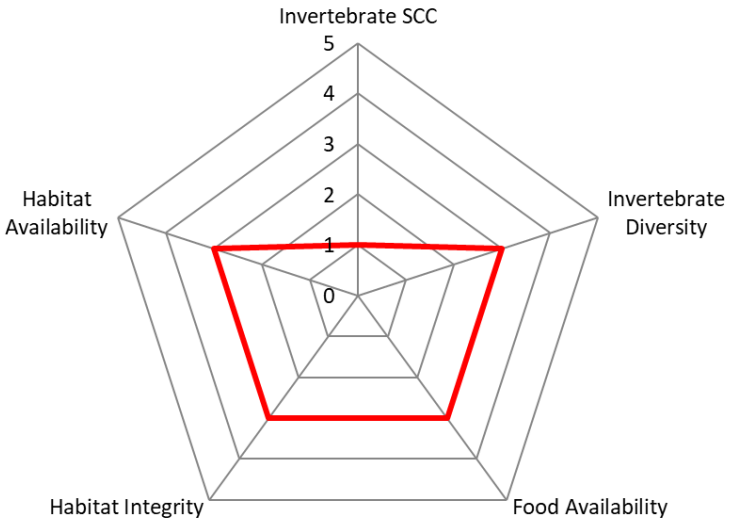
Table 4: Field assessment results pertaining to insect species within the study area.

Insect Habitat Sensitivity	Intermediate

Photograph Notes:

Image: Top: Left to right – Remains of a Milkweed Locust (*Phymateus* sp.), *Mylabris oculata* (CMR Bean Beetle), Leaf Beetle (*Antipus* sp.) and the web of a spider (Lycosidae).

Insect Sensitivity Graph:



Photographs:

Invertebrate Discussion

Invertebrate diversity and abundance across the various project development areas were intermediate and moderately low respectively. Habitat degradation and transformation coupled with high human activity is considered to be a major factor contributing to this lowered diversity. The degraded habitat and reduced floral species composition limits insect diversity as suitable food resources are not readily available. The resources that are available are severely competed for by the domestic animals within the study area and overgrazing was aparrent. The decreased abundance and diversity of insects directly impacts on arachnid species populations, as insects form the base food resource for arachnid species. It is probable the diversity and abundance will increase after good rains are received, this was taken into account for the diversity scoring. As such, it is likely that the areas between mine infrastructure and households will have an increased insect abundance and diversity, and concurrently an increased arachnid diversity and abundance, as habitat and food resources are more readily available and accessible in these locations.

Invertebrate SCC	During the field assessment no invertebrate SCC were observed nor, given the disturbed and sub-optimal condition of the available habitat, are any expected to occur within the study area. Furthermore, it must be noted that the Limpopo State of the Environment Report (SoER) (2004) makes no provision for arachnid species within its protected species lists. *Aroegas fuscus* (Brown False Shielback), an endangered species was flagged by the national web based Screening Tool, however, the species is found at elevations above 1200m in grassland and thus the site, which occurs below 1000m in bushveld habitat is not considered suitable.
Business Case and Conclusion	Overall, the invertebrate sensitivity is deemed to be intermediate. The degraded habitats combined with limited niche habitat, reduced surface water availability and food resources is not conducive to supporting high diversities of invertebrate species. Given the low abundance and intermediate diversity observed and degraded state of the habitat units, it is unlikely that the proposed developments will lead to further invertebrate diversity and abundance declines in the region. The proposed infrastructure developments will further not lead to any loss of habitat connectivity or niche areas of habitat, nor will the developments impact upon corridors of movement.

3.6 Faunal Species of Conservational Concern Assessment

During field assessments, it is not always feasible to identify or observe all species within an area, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, and to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) method is used, utilising known distribution and on-site habitat to determine the probability of faunal SCC occurrence within the study area.

Species listed in Appendix B whose known distribution ranges and habitat preferences include the study area were taken into consideration. Following the assessment of the SCC which are known to occur within the region, comparisons were drawn between these species space and habitat requirements and that which is available within the study area. Taking into consideration the degraded and isolated state of the habitat units within the study areas, few faunal SCC are expected to occur within or rely upon these areas for continued survival.

Table 7 below lists all species as per Appendix B, those Specially Protected by Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA) or within any South African Atlas Red-List and TOPS that are considered to have a Medium or High POC and may occur within the study area. Due to the habitat units associated with the study area the likelihood for faunal SCCs occurring within the study area is deemed to be low. Should any faunal SCC in Appendix B of this report, be encountered within the active mining area and be at risk from the activities a biodiversity specialist must be consulted, in order to advise on the best way forward. For mitigation on how to appropriately manage and treat potential SCC present in the study area refer to Section 5.2.

Table 5: Faunal SCC that may occur within the subject property due to suitable habitat. A full list of POC calculations is presented in Appendix A

Scientific and Common Name	Habitat Description	Red List (Global) Status	Regional Status	POC (%)
AVIFAUNA				
Falco biarmicus (Lanner Falcon)	**Range**: Southern Europe and the Arabian Peninsula with most of its range within Africa. **Major habitats**: Forest, Savanna, shrubland, Grassland, Rocky areas (inland cliffs and mountains) and desert. Favours open grassland, agricultural areas or cleared woodland near cliffs. **Description**: Inhabits a wide variety of habitats and may illustrate crepuscular behaviour. Mostly resident with some birds migrating to west Africa. **Food:**. Birds, small mammals, insects and reptiles. **Available habitat with the study area:** Margins of the Degraded and Transformed Habitat units.	LC	VU	**70**

Should any faunal SCC as listed in Appendix C of this report be encountered during the course of the study area activities, all operations must be stopped immediately, and a biodiversity specialist must be consulted, in order to advise on the best way forward.

4. SENSITIVITY MAPPING

Figure 3 below conceptually illustrates the faunal ecological sensitivity for the various areas. The areas are depicted according to their sensitivity in terms of the presence or potential for faunal SCC, habitat integrity, levels of disturbance and overall levels of diversity. Table 6 below presents the sensitivity of each habitat along with an associated conservation objective and implications for the proposed activities.

Table 6: A summary of the sensitivity of each habitat unit and implications for the proposed activities.

Habitat Unit	Sensitivity	Development Implications
Degraded Bushveld **Encroached Habitat** **Rocky Habitat and** **Watercourse Habitat**	**MODERATELY LOW** Optimise development potential while improving biodiversity intactness of surrounding natural habitat and managing edge effects.	The habitat integrity of these areas is considered moderately low and has been degraded as a result of historic agricultural activities, erosion, existing human settlements and existing mining. Only one faunal SCC (Lanner Falcon) may utilise the Degraded Bushveld and habitat adjacent to it for foraging purposes, however it is not likely to be reliant on the available habitat for breeding. As such, the development will not reduce breeding productivity or potential of the SCC. Development within these habitat units is not expected to have a significant negative impact on the local or regional ecology of the area, provided mitigation measures are adhered to.
Transformed Habitat	**Low** Optimise development potential.	The habitat within these areas is deemed of low sensitivity as a result of its altered state and lack of suitable habitat for most faunal classes. Development within these areas is unlikely to lead to high impact to faunal habitat or species diversity, provided mitigation measures are implemented, as discussed in Section 5.

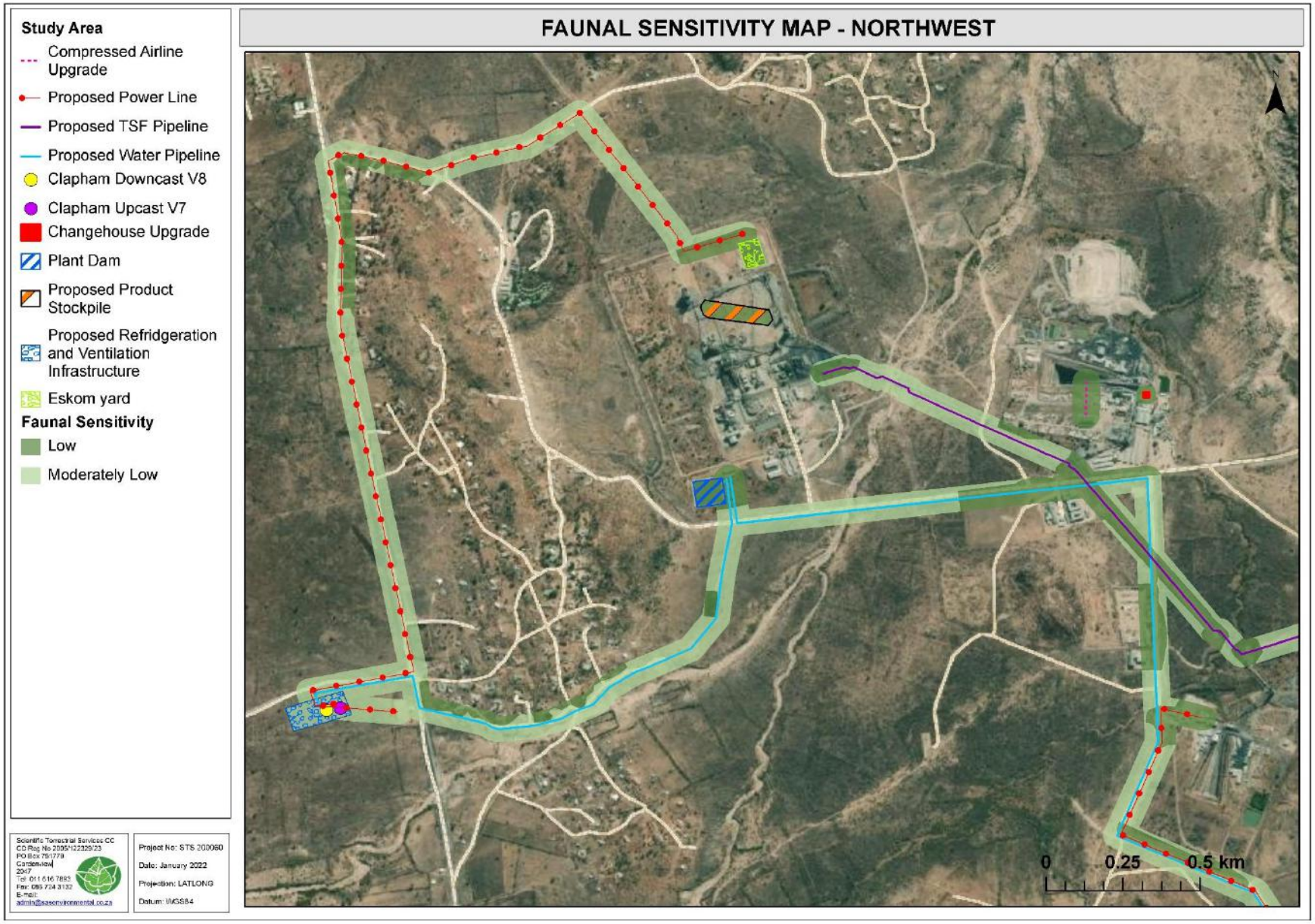


Figure 4: Habitat sensitivity map for the north-western portion of the study area.

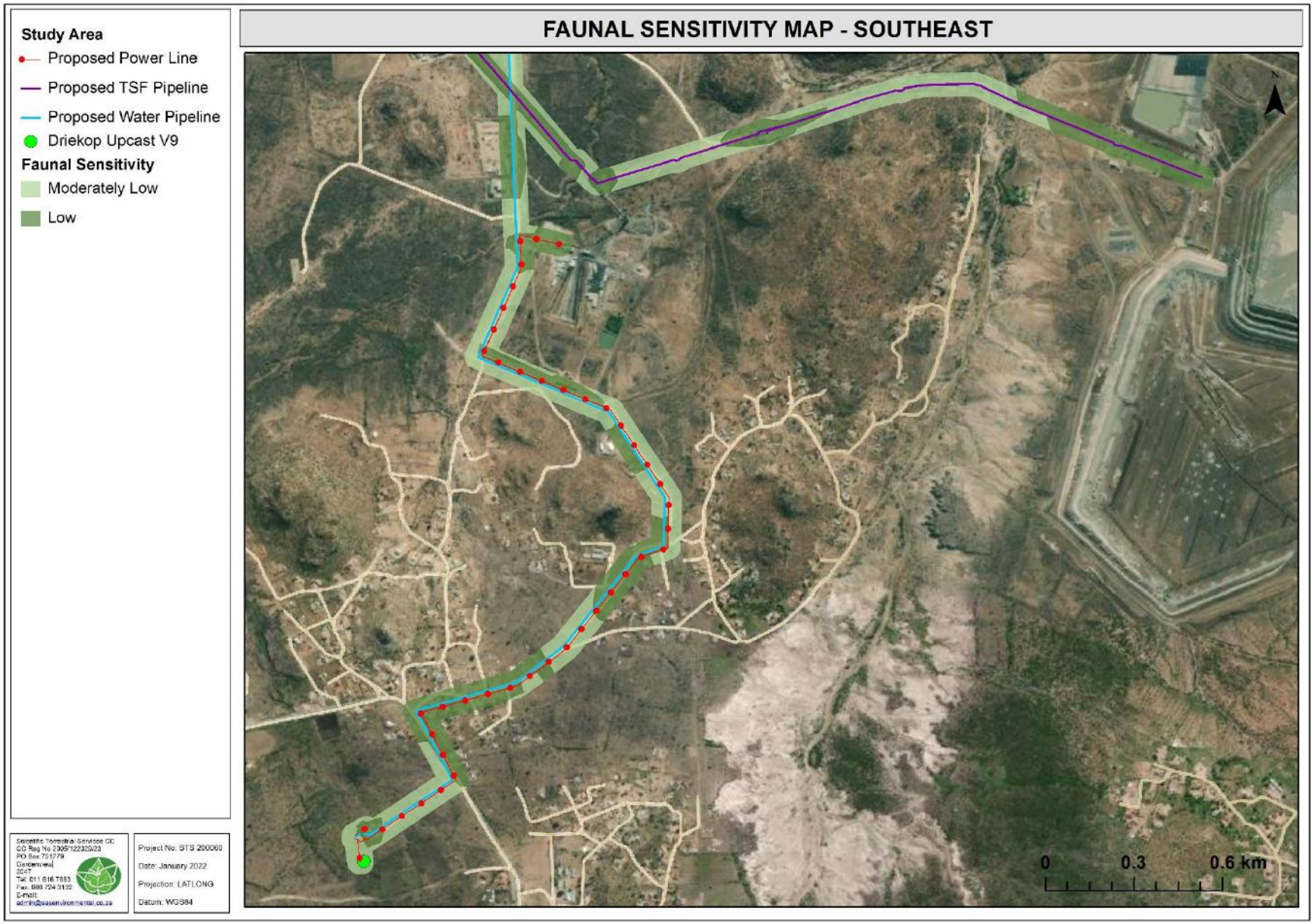


Figure 5: Habitat sensitivity map for the Clapham Vent Shafts portions of the study area.

5. IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts arising from the proposed infrastructure development for the study area.

An impact discussion and assessment of all potential pre-construction, construction, operational and maintenance phase impacts are provided in Section 5.2 and 5.3. All mitigatory measures required to minimise the perceived impacts are presented in Section 5.4.

Proposed Activity Description:

The proposed development activities include upgrading and/or the construction of the following infrastructure: ventilation shafts with associated infrastructure, water pipelines and powerlines, a new TSF pipeline, a product stock ore pile, a compressed airline, and upgrades to the existing change house.

5.1 Activities and Aspect Register

The table below indicates the perceived risks to faunal species associated with the activities pertaining to the proposed infrastructure developments at the existing Marula Platinum Mine within the study area.

Table 7: Aspects and activities register considering faunal resources during the pre-construction and planning phases.

ACTIVITIES AND ASPECTS REGISTER
Pre-Construction Phase
- Inconsiderate planning of infrastructure placement and design, leading to unnecessary edge effect impacts on areas outside of the proposed development footprint. - **Impact:** Degradation and modification of the receiving environment, loss of faunal habitat.
- Potential failure to implement the required mitigation measures before and at the commencement of construction activities: • Potential failure to have a Rehabilitation Plan and anti-collision measures (for bird strikes) developed before the commencement of the development. - **Impact**: Long-term or permanent degradation and modification of the receiving environment, loss of SCC and fauna habitat.
- Potential inadequate design of electricity pylons and powerlines increasing the possibility of birds being electrocuted by or colliding with infrastructure. - **Impact:** Long-term collision and electrocution risks to SCC species leading to a reduction in SCC diversity.
- Potential failure to design and implement an Alien and Invasive Plant (AIP) Management/Control plan before the commencement of construction activities, resulting in the spread of AIPs from the development footprint to surrounding natural habitat. - **Impact:** Spreads of AIPs, leading to potential loss of faunal habitat.
Construction Phase
- Site clearing and the removal of vegetation. - Uncontrolled and unplanned site clearing and the removal of vegetation and destruction of avifaunal habitat and forage.

ACTIVITIES AND ASPECTS REGISTER
- **Impact:** Loss of faunal habitat, diversity and abundance.
- Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native plant species, including the further transformation of adjacent natural habitat (especially within the Watercourse Habitat). - **Impact:** Loss of habitat within and outside of the direct development footprints, including a decrease in species diversity.
- Potential failure to implement a rehabilitation and an alien floral control plan after the construction phase. - **Impact:** Potentially leading to permanent transformation of avifaunal habitat and long-term degradation of important avifaunal habitat within the region.
- Dumping of construction material within areas where no construction is planned, thereby leading to further habitat disturbance - allowing the establishment and spread of AIPs. - **Impact:** Loss of faunal habitat, diversity and species abundance.
- Potentially poorly managed edge effects: • Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to ongoing proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the faunal habitat; and • Compaction of soils outside of the study area due to indiscriminate driving of construction vehicles through natural vegetation. - **Impact:** Loss of faunal habitat and species diversity within the direct footprint of the proposed development. Loss of surrounding faunal diversity and habitat through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.
- Increased risk of collisions with the project infrastructure and/or electrocution while perching on the pylons or powerlines. - **Impact:** Local loss of avifaunal SCC abundance and diversity.
- Ensure erosion preventative measures are considered along the water and TSF pipeline locations to reduce to faunal habitat loss as the area is prone to high erosion. - **Impact:** Loss of faunal and floral habitat.
- Possible increased fire frequency during construction. - **Impact:** Loss or alteration of faunal habitat and species diversity.
- Potential failure to concurrently rehabilitate bare or disturbed sites as soon as the construction activities have occurred will potentially result in loss of viable soils, increasing erosion risk and/or permitting the proliferation of AIPs. - **Impact:** Long-term loss of favourable habitat for faunal species. Loss of faunal diversity and potential SCC which will disperse into the surrounding area in search of favourable habitat.
Operational and Maintenance Phases
- Ineffective rehabilitation of exposed and impacted areas potentially leading to vegetation succession and a possible reduction of faunal diversity and exclusion of all 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 avifaunal habitat of increased sensitivity. Further reduction of available habitat in the long-term, compounding the limiting factors to faunal assemblages.
- Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the footprint area. - **Impact:** Ongoing or permanent **l**oss of remaining faunal habitat, species diversity and exclusion of SCC.
- Potential poor management and failure to monitor rehabilitation efforts, leading to: • Landscapes being left fragmented, resulting in reduced migration capabilities of avifaunal species, isolation of avifaunal populations and a decrease in avifaunal diversity; • Compacted soils limiting the re-establishment of natural vegetation; and • Increased risk of erosion in areas left disturbed. - **Impact:** Long-term (or permanent) loss of avifaunal habitat, diversity and SCC.
- Increased risk of collisions with the project infrastructure and/or electrocution while perching on the pylons or powerlines. - **Impact:** Local loss of avifaunal SCC abundance and diversity.
- Increased risk of collisions with the project infrastructure and/or electrocution while perching on the pylons or powerlines. - **Impact:** Local loss of avifaunal SCC abundance and diversity.

ACTIVITIES AND ASPECTS REGISTER
- On-going disturbance during operational phase may lead to erosion and sedimentation of surrounding habitats. - **Impact:** Degradation of favourable habitat and limited potential for faunal habitat and species re-establishment.

5.2 Faunal Impact Assessment Results

The below table indicates the perceived risks to the faunal ecology associated with all phases of the proposed infrastructure development. The table also 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. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

Table 8: Impact on the faunal habitat, diversity, and SCC associated with the Ventilation Shafts (and their associated refrigeration infrastructure) and the Ore Stockpile.

Habitat Unit	UNMANAGED						MANAGED					
	Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
PRE-CONSTRUCTION AND PLANNING PHASE												
Impact of faunal Habitat and Diversity												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	L	L	VL	VL	M	**Very Low**	VL	L	VL	VL	L	**INSIGNIFICANT**
Product Stockpile	L	L	VL	VL	M	**Very Low**	VL	L	VL	VL	L	**INSIGNIFICANT**
Impact on faunal SCC												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	L	L	VL	VL	M	**Very Low**	VL	L	VL	VL	L	**INSIGNIFICANT**
Product Stockpile	L	L	VL	VL	M	**Very Low**	VL	L	VL	VL	L	**INSIGNIFICANT**
CONSTRUCTION PHASE												
Impact of faunal Habitat and Diversity												
Shafts (including ventilation and associated refrigeration infrastructure), airline	M	L	VL	VL	H	**Very Low**	L	L	VL	VL	M	**Very Low**

and changeroom upgrade												
Product Stockpile	L	L	VL	VL	M	**Very Low**	VL	L	VL	VL	L	**INSIGNIFICANT**
Impact on faunal SCC												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	M	L	VL	VL	H	**Very Low**	L	L	VL	VL	M	**Very Low**
Product Stockpile	L	L	VL	VL	M	**Very Low**	VL	L	VL	VL	L	**INSIGNIFICANT**
DECOMMISSIONING AND CLOSURE PHASE												
Impact of faunal Habitat and Diversity												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	L	VH	VL	VL	VH	**Very Low**	L	H	VL	VL	H	**Very Low**
Product Stockpile	L	H	VL	VL	L	**INSIGNIFICANT**	VL	H	VL	VL	VL	**INSIGNIFICANT**
Impact on faunal SCC												
Shafts (including ventilation and associated refrigeration infrastructure), airline and changeroom upgrade	L	VH	VL	VL	H	**Very Low**	L	H	VL	VL	M	**Very Low**
Product Stockpile	L	H	VL	VL	L	**INSIGNIFICANT**	VL	H	VL	VL	VL	**INSIGNIFICANT**

Table 9: Impact on the faunal habitat, diversity, and SCC associated with the Powerlines and water and TSF Pipelines.

Habitat Unit	UNMANAGED						MANAGED					
	Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
PRE-CONSTRUCTION PHASE												
Impact of faunal Habitat and Diversity												
Powerlines	M	L	L	L	M	**Very Low**	L	L	L	L	L	**Very Low**
Water and TSF Pipelines	M	L	L	L	M	**Very Low**	VL	L	L	L	L	**Very Low**
Impact on faunal SCC												
Powerlines	M	L	L	L	M	**Very Low**	L	L	L	L	L	**Very Low**
Water and TSF Pipelines	L	L	L	L	M	**Very Low**	VL	L	L	L	L	**Very Low**
CONSTRUCTION PHASE												
Impact of faunal Habitat and Diversity												
Powerlines	M	L	L	L	VH	**Low**	L	L	L	L	H	**Low**
Water and TSF Pipelines	M	L	L	L	VH	**Low**	L	L	L	L	H	**Low**
Impact on faunal SCC												
Powerlines	M	L	L	L	H	**Low**	L	L	L	L	M	**Very Low**
Water and TSF Pipelines	L	L	L	L	M	**Low**	L	L	L	L	L	**Very Low**

OPERATIONAL AND MAINTENANCE PHASE												
Impact of faunal Habitat and Diversity												
Powerlines	M	VH	L	L	VH	**Low**	L	H	L	L	H	**Low**
Water and TSF Pipelines	M	VH	L	L	M	**Very Low**	L	H	L	L	L	**Very Low**
Impact on faunal SCC												
Powerlines	M	VH	L	L	VH	**Low**	L	H	L	L	M	**Very Low**
Water and TSF Pipelines	M	VH	L	L	M	Very Low	L	H	L	L	L	Very Low
DECOMMISSIONING AND CLOSURE PHASE												
Impact of faunal Habitat and Diversity												
Powerlines	L	VH	VL	VL	VH	**Very Low**	L	H	VL	VL	H	**Very Low**
Water and TSF Pipelines	L	H	VL	VL	L	**INSIGNIFICANT**	VL	H	VL	VL	VL	**INSIGNIFICANT**
Impact on faunal SCC												
Powerlines	L	VH	VL	VL	H	**Very Low**	L	H	VL	VL	M	**Very Low**
Water and TSF Pipelines	L	H	VL	VL	L	**INSIGNIFICANT**	VL	H	VL	VL	VL	**INSIGNIFICANT**

5.3 Impact Discussion

The perceived impact significance of the proposed infrastructure development (prior to mitigation) on faunal habitat, diversity and SCC ranges from low to insignificant. The relatively decreased scoring prior to mitigation measures is largely based on the fact that the sites are of small size, already in varying stages of habitat degradation and located within or immediately adjacent to existing mining activities or surface infrastructure. Although the sites are already degraded, there remains the opportunity to further reduce environmental impact risks by implementing the recommended mitigation measures. Through implementing mitigation measures not only will the overall impact significance decrease, the effort, time and financial input costs for rehabilitation and AIP control will be reduced.

5.3.1 Impact on Faunal Habitat and Diversity

The various proposed infrastructure developments will result in the clearance of vegetation within the Vent Shafts and associated refrigeration infrastructure areas and to a limited extent along the proposed powerline and water and TSF pipeline routes. The habitat within these sites has already been disturbed and degraded to varying degrees, providing limited habitat to faunal species. Although these developments will lead to loss of habitat in these sites, it is not expected to be significant to faunal species nor, should the provided mitigation be implemented, have a significant impact to faunal species diversity or abundance in the region. All edge effects are to be monitored to ensure that the surrounding natural habitat is not impacted upon, thereby ensuring no further impacts to faunal species diversity and habitat occurs. Particular attention should be made to Watercourse Habitat areas as the potential for AIP is high in this habitat. Impacts anticipated to occur to faunal habitat and diversity within the study area range from low to very low prior to mitigation implementation. With mitigation measures full implemented the impacts can be reduced in most cases to lower impacts significance, low and very low impact scores. Impacts anticipated from the linear (powerlines and water and TSF pipelines) infrastructure will incur slightly higher impacts as the extent over which these infrastructures occur is greater than the remaining activities, though these impacts are predominantly envisaged to occur during the construction phase, with operational phase impacts decreasing..

5.3.2 Impacts on Faunal SCC

Only a single SCC is anticipated to utilize the site while foraging, namely: *Falco biarmicus* (Lanner Falcon). This species is considered to be Vulnerable on a regional scale due to transformation of grassland habitat through urbanisation, agriculture and afforestation and the corresponding decreases in its preferred prey and foraging opportunities. The proposed

activities are mostly linear and occur adjacent to existing disturbances or along roads and thus will not result in the large scale alteration of suitable habitat. Impacts to this SCC are largely low and very low prior to the implementation of mitigation measures while with mitigation measures in place it is anticipated that the impacts can largely be reduced to mostly very low and insignificant levels. A single SCC *Gyps coprotheres* (Cape Vulture) was seen soaring above the region to the east of the study site, however, onsite characters and disturbances do no provide suitable habitat for this species within the study area. The degraded state of the habitat both within the sites as well as in the surrounding areas and the adjacent mining activities preclude most faunal SCC from these sites. However, best construction and operation practices must still be employed alongside the recommended mitigation measures to ensure no further habitat degradation occurs. This is important to assist in future rehabilitation activities, increasing the potential that SCC may in the future be able to recolonise these areas post mine closure.

5.3.3 Probable Residual Impacts

Even with extensive mitigation and rehabilitation, residual impacts on the receiving faunal ecological environment are still likely. Although rehabilitation during the closure and decommissioning of the mine is planned, it is still unlikely to result in the complete restoration of the receiving environment to that of the reference state. Rehabilitation, if suitably undertaken, will however result in a suitable vegetation cover of indigenous plant species which will provide habitat for fauna and allow for the recolonisation of the rehabilitated areas. Rehabilitation efforts however may be hindered as a result of land use activities associated with the neighbouring communities, notably increased grazing and use of natural resources in the rehabilitated areas. The following points highlight the key residual impacts that have been identified:

- Edge effects such as further habitat fragmentation and AIP proliferation (particularly in Watercourse Habitat); 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.

5.3.4 Cumulative Impacts

The local area has already been subjected to extensive impacts as a result of historic agriculture, housing and the existing mining activities, with most of the proposed activities occurring along existing infrastructure and in already degraded habitat of a small extent. The development will nonetheless lead to common faunal species being displaced from some of the proposed sites into the adjacent habitats. This may lead to increased competition for space

and food resources, however, given the small abundance and 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 in the surrounding areas, displacing faunal species further as indigenous floral species (faunal habitat and food resources) are displaced and lost.

5.4 Integrated Impact Mitigation

The table below highlights the additional general mitigation measures that are applicable to the project, in addition to those mentioned in the impact table, in order to suitably manage and mitigate the ecological impacts that are associated with the proposed infrastructure development within the study area.

Table 10: A summary of the mitigatory requirements for faunal resources.

Project phase	*Planning Phase*
Impact Summary	*Loss of faunal habitat and species diversity*
Management Measures	***Proposed mitigation and management measures:***
	Faunal Habitat and Diversity - At all times, ensure that sound environmental management is in place during the planning phase; - Minimise loss of indigenous vegetation where possible through refining the final development footprint, optimising the design within habitat of lowered ecological importance and sensitivity; and - Design of infrastructure should be environmentally sound and all construction equipment to be utilised must be a good working condition, and all possible precautions taken to prevent potential spills and /or leaks.
Project phase	*Construction Phase*
Impact Summary	*Loss of faunal habitat and species diversity*
Management Measures	***Proposed mitigation and management measures:***
	Development footprint - The development footprint should be demarcated, and it should be ensured that no development related activities take place outside of the demarcated footprint; - Faunal habitat beyond the demarcated area should not be altered; - Construction equipment should be restricted to travelling only on designated roadways to limit the ecological footprint of the development activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal; - No dumping of litter or cleared vegetation on site should be allowed. As such it is advised vegetation cuttings (especially AIP) to be carefully collected and disposed of at a separate waste facility; - All rubble waste generated is to be disposed of on the existing waste rock dump (WRD); - No illicit fires must be allowed during the construction phase of the proposed development. - If any pollutant spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line and faunal recolonization. In the event of a breakdown, maintenance of vehicles must take place with care, and the collection of spillages should be practised preventing the ingress of hydrocarbons into the topsoil; - Anti-collision devices should be installed along the entire length of the powerline. These must be Eskom approved anti-collision devices that are durable as the area is prone to strong winds. Anti-collision devices must be installed as soon as the wires are strung. The devices must be installed 5m apart and alternate between a light and dark colour in order to increase the visibility of the wires.

	- Any structures which may act as perching sites for birds should be installed with anti-perching spikes; - Excavated topsoil must be stored with associated native vegetation debris for subsequent use in rehabilitation; - An AIP control plan must be developed for the site and must include ongoing alien and invasive plant monitoring and clearing/control throughout all phases of the development; - 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 comply with legal standards; - During the site-pegging phase of surface infrastructure, should any faunal SCC (albeit considered unlikely) be observed, all activities should be halted and a suitably qualified specialist is to be contact to advise on the best way forward; - Edge effect control needs to be implemented to ensure no further degradation and potential loss of faunal habitat outside of the proposed project footprint areas occurs; and - Smaller species such as scorpions and reptiles are likely to be less mobile during the colder periods of the year, as such should any be observed in the footprint sites during clearing and operational activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Construction personnel are to be educated about these species and the need for their conservation. Smaller scorpion species and harmless reptiles should be carefully relocated by a suitably nominated construction person or staff member. For larger venomous snakes, a suitably trained official or specialist should be contacted to affect the relocation of the species, should it not move off on its own.
Project phase	*Operational Phase*
Impact Summary	*Loss of faunal habitat and species diversity*
	Development footprint - All vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the development activities; - No litter or cleared plant material should be dumped or allowed to remain on-site. As such it is advised that vegetation cuttings to be carefully collected and disposed of at a separate waste facility; - Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the operational phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas which may alter the suitability of the habitat to avifaunal species; - Disturbed areas and areas of bare soil resulting from construction or operation activities that do not form part of the immediate active mine area 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; - No hunting/trapping or collecting of faunal species is allowed; 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 comply with legal standards.
Project phase	Decommissioning & Closure Phase
Impact Summary	*Loss of faunal habitat and species diversity*
	Development footprint - No additional habitat outside of the footprint areas is to be disturbed during the closure phase; - All edge effects are to be managed and remediated immediately - Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the operational phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas

6. CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct a faunal assessment as part of the Basic Assessment (BA) for the Environmental Authorisation (EA) process for the proposed

surface infrastructure development on the existing Marula Platinum Mine, located approximately 30 km northwest of the town of Burgersfort, Limpopo Province. During the field assessment it was noted that the majority of the study area had undergone degradation as a result of human settlements, historic agriculture and/or mining leaving few, highly fragmented, natural portions interspersed within the study area.

Following the field assessment, four faunal habitats were noted, namely the Degraded Bushveld, Encroached Habitat, Rocky Habitat and Transformed Habitat. These habitat units have all been subjected to varying degrees of impact and as a result support a limited diversity of faunal species. The Rocky Habitat are considered the most natural, however, these units comprise of small portions of the study area and are not anticipated to host significantly different assemblages of fauna as they are highly fragmented within the locality. The proposed activities will also, for the most part, occur adjacent to existing roads and infrastructure or where previous disturbances have already altered the vegetation reducing the potential to destroy sensitive habitat.

No faunal SCC were recorded within the proposed footprint areas, and only a single species (Lanner Falcon) is expected to occur therein where foraging is likely. A single Cape Vulture was also noted flying a few kilometres to the east of the study area, however, the surrounding areas are for the most part degraded, and thus this opportunistic feeder will only utilise the study area should a carcass of a domestic animal present itself, otherwise the habitat is not considered suitable for this species. Due to the degraded nature of the study area there is a low chance that further faunal SCC would even utilise the footprint areas periodically.

Perceived impacts to faunal species and faunal habitat are deemed to have very low to low significance levels prior to mitigation. With mitigation measures implemented, the impacts are expected to decrease to low and insignificant levels in almost all cases. Impacts are largely of lower significance as the proposed activities are not anticipated to transform or destroy sensitive areas or large portions of habitat and are not likely to result in changes to the faunal diversity or abundances within the study area.

The objective of this study was to provide sufficient information on the faunal ecology of the area, together with other studies on the physical and socio-cultural environment, in order for the Environmental Assessment Practitioner (EAP) and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. It is the opinion of the ecologist that this study provides the relevant information required in order to implement 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: 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 anthropogenic activities adjacent to the sites will 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, calls, dung and other notable field signs. Due to the short duration, limited size and disturbed nature of the environment, camera and Sherman traps were not employed. Specific attention was paid to mammal SCC as listed by the International Union for the Conservation of Nature (IUCN), the Limpopo province and NEMBA.

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 in the study area. Field surveys were undertaken utilising direct 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 IUCN.

Reptiles

Reptiles were identified during the field survey. Suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected and all reptiles 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 IUCN.

Amphibians

Identifying amphibian species is done by the use of 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 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 the survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by the 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 scorpions.

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 contribute 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 utilization of the study area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table A1: 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 ar surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat un 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 B: Faunal SCC

Faunal Species of Conservation Concern

Table B1: Red Data Mammal species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Diceros bicornis	Black Rhinoceros	CR	CR
Neamblysomus julianae	Juliana's golden mole	CR	VU
Loxodonta africana	African elephant	VU	VU
Lycaon pictus	African wild dog	EN	EN
Amblysomus gunningi	Gunning's golden mole	VU	EN
Lutra maculicollis	Spotted-necked otter	VU	LC
Acinonyx jubatus	Cheetah	VU	VU
Felis lybica	African Wild Cat	VU	NYBA
Panthera leo	Lion	VU	VU
Ceratotherium simum	White rhinoceros	NT	NT

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN.

Table B2: Red Data Bird species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Gyps coprotheres	Cape Vulture	T	VU
Ciconia nigra	Black Stork	T	LC
Falco naumanni	Lesser Kestrel	T	LC
Certhilauda chuana	Short-clawed Lark	T	LC
Pterocles gutturalis	Yellow throated Sandgrouse	T	LC
Anthropoides paradiseus	Blue Crane	T	VU
Gyps africanus	White backed Vultures	T	EN
Ardeotis kori	Kori Bustard	T	LC
Scotopelia peli	Pel's Fishing Owl	T	LC
Bucorvus leadbeateri	Southern Ground Hornbill	T	VU
Buphagus erythrorhynchus	Red-billed Oxpecker	T	LC
Terathopius ecaudatus	Bateleur	T	NT
Polemaetus bellicosus	Martial Eagle	T	NT
Aquila rapax	Tawny Eagle	T	LC
Torgos tracheliotos	Lappet faced Vulture	T	VU
Trigonoceps occipitalis	White headed Vulture	T	VU
Buphagus africanus	Yellow billed Oxpecker	T	LC
Stephanoaetus coronatus	Crowned hawk Eagle	T	NT

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province

Table B3: Red Data Amphibian species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Breviceps sylvestris	Transvaal forest rain frog	VU	EN
Ptychadena uzungwensis		P	LC
Leptopelis bocagii		P	LC
Hemisus guineensis	Guinea Snout-burrower	P	LC

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Table B4: Red Data Reptile species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Homoroselaps dorsalis	Striped Harlequin snake	R	NT
Xenocalamus transvaalensis	Transvaal Quill-snout snake	R	DD
Lamprophis swazicus	Swazi Rock Snake	R	NT
Python natalensis	African Python	VU	NYBA
Lygodactylus methueni	Methuen's Dwarf Gecko	VU	VU
Crocodylus niloticus	Nile Crocodile	VU	LC
Lycophidion variegatum	Variegated Wolf snake	P	NYBA
Psammophis jallae	Jalla's Sand snake	P	NYBA

R = Rare, DD = Data Deficient, LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Table B5: Red Data Invertebrates species mentioned in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Taurhina splendens	Splendid fruit chafer *	T	NYBA
Charaxes marieps	Marieps Charaxes butterfly *	T	NYBA
Trichostetha fasicularis	Protea beetle *	T	NYBA
Ischnestoma ficqui	Fruit eating beetles *	T	NYBA

R = Rare, DD = Data Deficient, LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province. * Very little detailed or general information exists on terrestrial invertebrates in the Limpopo Province, thus in general there is very little consolidated information regarding invertebrates (Limpopo SOER, 2004).

South African Bird Atlas Project 2 list

Table B6: Avifaunal Species for the pentads 2425_3000, 2430_3000 and **2430_3005 within the QDS 2430AC and 2430CA.**

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2425_3000	http://sabap2.adu.org.za/coverage/pentad/2425_3000
2430_3000	http://sabap2.adu.org.za/coverage/pentad/2430_3000
2430_3005	http://sabap2.adu.org.za/coverage/pentad/2430_3005

APPENDIX C: Faunal Species List

Table C1: Mammal species recorded (*) or expected to occur in site.

Scientific Name	Common Name	Threat Status
Lepus saxatilis	Scrub hare	LC
Sylvicapra grimmia	Common Duiker	LC
**Galerella sanguinea*	Slender Mongoose	LC
Genetta genetta	Small-spotted Genet	LC

LC = Least Concern

Table C2: Avifaunal species recorded (*) or expected to occur on site.

Scientific name	Common Name	Threat Status
**Uraeginthus angolensis*	Blue Waxbill	LC
**Oena capensis*	Namaqua Dove	LC
Erythropygia paena	Kalahari Scrub Robin	LC
**Tchagra australis*	Brown-crowned Tchagra	LC
Granatina granatina	Violet-eared Waxbill	LC
Cinnyris talatala	White-bellied Sunbird	LC
Sylvia subcaerulea	Chestnut-vented Tit-babbler	LC
Crithagra sulphurata	Brimstone Canary	LC
Trisholaema leucomelas	Acacia Pied Barbet	LC
Milvus parasitus	Yellow-billed Kite	LC
Corvus albus	Pied Crow	LC
Plocepasser mahali	White-browed Sparrow-weaver	LC
Colius striatus	Speckled Mousebird	LC
Acridotheres tristis	Common Myna	LC
**Passer melanurus*	Cape Sparrow	LC
**Streptopelia capicola*	Cape Turtle Dove	LC
**Motacilla capensis*	Cape Wagtail	LC
**Lanius collaris*	Common Fiscal	LC
**Pycnonotus tricolor*	Dark-capped Bulbul	LC
Numida meleagris	Helmeted Guineafowl	LC
Passer domesticus	House Sparrow	LC
**Streptopelia senegalensis*	Laughing Dove	LC
Chrysococcyx caprius	Diederik Cuckoo	LC
Dicrurus adsimilis	Fork-tailed Drongo	LC
Corythaixoides concolor	Grey Go-away-bird	LC
**Pternistis natalensis*	Natal Spurfowl	LC

*Species observed on site, LC = Least Concern

Table C3: Amphibian species previously recorded by SAFAP for the QDS (2430AC and 2430AC).

Scientific name	Common Name	Threat Status
Sclerophrys garmani	Toad	Least Concern
Sclerophrys gutturalis	Toad	Least Concern
Poyntonophrynus fenoulheti	Fenoulhet's Toad	Least Concern
Sclerophrys capensis	Raucous Toad	Least Concern
Breviceps adspersus	Bushveld rain frog	Least Concern
Kassina senegalensis	Bubbling Kassina	Least Concern
Chiromantis xerampelina	Foam Nest Tree Frog	Least Concern
Hyperolius marmoratus	Marbled Reed Frog	Least Concern
Hyperolius pusilus	Water Lily Reed Frog	Least Concern
Ptychadena oxyrhynchus	South African Sharp Nosed Frog	Least Concern
Ptychadena porosissima	Striped Grass Froh	Least Concern
Phrynobatrachus mababiensis	Mababe Puddle Frog	Least Concern
Phrynomantis bifasciatus	Banded Rubber Frog	Least Concern
Ptychadena anchietae	Plain Grass Frog	Least Concern
Pyxicephalus edulis	African Bull Frog	Least Concern
Tomopterna natalensis	Natal Sand Frog	Least Concern
Ptychadena mossambica	Broad banded Grass Frog	Least Concern
Tomopterna cryptotis	Tremelo Sand Frog	Least Concern

LC = Least Concern

Table C4: Reptile species recorded (*) or expected to occur on site.

Scientific name	Common Name	Threat Status
Trachylepis varia	Variable Skink	NYBA
**Trachylepis margaritifer*	Rainbow Skink	LC
**Trachylepis punctatissima*	Speckled Rock Skink	LC
Pachydactylus panctatus	Speckled Gecko	NYBA
Matobosaurus Validus	Common Plated Lizard	NYBA

*Species observed on site, LC = Least Concern

Table C5: Insect species recorded (*) or expected to occur on site.

Scientific Name	Common Name	Threat Status
Dischista rufa	Savannah Fruit Chafer	NYBA
Antipus sp.	Leaf Beetle	NA
Trinervitermes sp.	Snouted harvester termites	NA
Conocephalus caudatis	Meadow Katydid	NYBA
**Musca domestica*	House Fly	NYBA
Spialia sp.	Sandman	NA
Creoleon sp.	Large Grassland Antlion	NA
Amblysterna natalensis	Jewel beetle	NYBA
Acmaeodera sp	Jewel beetle	NA
Mylabris sp	Blister Beetle	NA
**Acrotylus* sp	Burrowing Grasshoppers	NA
Lycus sp.	Net-winged Beetle	NA
Garreta sp	Dung Beetle	NA
**Danaus chrysippus*	African Monarch	LC
Sonchia sternalis	Four-spot Leaf Beetle	NYBA
Leucocelis amethustina	Amethyst Fruit Chafer	NYBA

Scientific Name	Common Name	Threat Status
Eupezus natalensis	Tree Darkling Beetle	NYBA
Gymnopleurus humanus	Small Green Dung Beetle	NYBA
Anomalipus elephas	Large Armoured Darkling Beetle	NYBA
**Alcimus* sp.	Robber Fly	NA
Kheper nigroaeneus	Large Copper Dung Beetle	NYBA
Protostrophus sp	Bearded Weevils	NA
Pachylomerus femoralis	Flattened Giant Dung Beetle	NYBA
Thermophilum homoplatum	Two-spotted Ground Beetle	NYBA
Macrotoma palmata	Large Brown Longhorn	NYBA
**Anoplolepis custodiens*	Pugnacious Ant	NYBA

*Species observed on site, LC = Least Concern, NYBA = Not Yet Been Assessed

Table C6: Arachnid species expected to occur on site.

Scientific Name	Common Name	Threat Status
Argiope lobate	Black-lobed Garden Orb-web Spider	NYBA
Thomisus sp	NA	NYBA
Agelena sp.	NA	NYBA
Miturgidae	NA	NYBA
Euryopis sp.	NA	NYBA
Lycosidae	NA	NYBA

NYBA = Not Yet Been Assessed

APPENDIX H: SPECIALIST STUDIES
WATERCOURSE ECOLOGICAL ASSESSMENT

SCIENTIFIC AQUATIC SERVICES

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WATERCOURSE ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL AND WATER USE AUTHORISATION PROCESSES FOR VENTILATION SHAFTS AT MARULA PLATINUM MINE, LIMPOPO PROVINCE

Prepared for

SLR Consulting (Africa) (Pty) Ltd

December 2020

Revised: January 2022

Prepared by: Scientific Aquatic Services
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Report reference: SAS 220156
Date: December 2020
Revised: January 2022

EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a watercourse ecological assessment as part of the Environmental and Water Use Authorisation processes for the proposed ventilation shafts and associated infrastructure (surface main fans, electrical rooms and bulk air cooler), as well as powerlines, pipelines and product stockpile at Marula Platinum Mine, Limpopo Province.

The Tshwenyane, Mogompane, Motse Rivers and an unnamed tributary of the Moopetsi River (with riparian vegetation), along with numerous non-perennial and ephemeral drainage lines without riparian characteristics and an artificial wetland in the vicinity of the proposed mining infrastructure were identified during this study. A number of the proposed project components directly cross the Tshwenyane River and an unnamed tributary of the Moopetsi River. Both watercourses are deemed to have a largely modified ecological state due to the historical and current small-scale agricultural activities, utilisation of the rivers and their tributaries for domestic purposes by local communities, and the presence of mining activities within the area of focus.

The results of the SLR Risk Assessment indicates that if, mitigation is not implemented the impact significance will be low. According to the results of the DWS Risk Assessment, assuming strict implementation of mitigation measures takes place, the impact significance of activities such as site preparation activities are anticipated to be of 'Low' impact significance, due to the nature and extent of the activities and non-perennial, ephemeral nature of the watercourses.

Based on the above outcomes and taking into account the mostly localised nature of the impacts associated with the proposed ventilation shafts and related mining activities it is the opinion of the ecologist that the proposed project may be considered for authorisation, provided that the mitigation measures stipulated in this report are implemented.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a watercourse ecological assessment as part of the Environmental and Water Use Authorisation processes for the proposed ventilation shafts and associated infrastructure, hereafter collectively referred to as the "focus area") at Marula Platinum Mine, Limpopo Province.

The purpose of this report is to define the ecology of the Focus Area in terms of watercourse characteristics, including mapping of the watercourses, discussion of key ecological drivers and definition of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS), as well as the socio-cultural and ecological service provision of the watercourses utilising current industry "best practice" assessment methods, in order to ascertain what, if any, impact the proposed mining related activities will have on the watercourses related to the Focus Area. Additionally, this report aims to define the Recommended Management Objectives (RMO) and Recommended Ecological Category (REC) for the watercourses. It is a further objective of this study to provide detailed information when considering the proposed mining related activities in the vicinity of the watercourses, to ensure the ongoing functioning of the ecosystem, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.

The assessment took the following approach:

- A desktop study was conducted, in which possible watercourses were identified for on-site investigation, and relevant national and provincial databases were consulted (Section 4);
- A single field assessment took place in November 2020, in order to ground-truth the identified watercourses within the Focus Area and associated investigation area (defined as 500 m from

the Focus Area in accordance with GN509 as it relates to the National Water Act (NWA), 1998 (Act No. 36 of 1998). A number of watercourses were identified within the Focus Area, and were classified according to the Ollis *et al.* (2013) classification system;

- The characteristics of the watercourses were defined including the PES, EIS, REC, RMO and BAS (Section 5); and
- The results obtained were used to assess the impacts of the proposed development footprint on the watercourses in the Focus Area (Section 6). In this regard, only the proposed powerlines, pipelines, ventilation shafts and associated infrastructure were assessed, as the remaining proposed project components are not likely to affect the watercourses as they are situated within existing disturbed areas.

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

Table A: Summary of results of the field assessment as discussed in Section 5.

HGM Unit	PES	Ecoservices	EIS	REC / RMO / BAS
Unnamed tributary of the Moopetsi River	D	Intermediate	Moderate	D / D / Maintain
Tshwenyane River	D	Intermediate	Moderate	D / D / Maintain
Non-perennial and ephemeral drainage lines without riparian vegetation	N/A	Low	Moderate	N/A

Cleared sites and compacted ground from mining infrastructure and roads have stormwater runoff impacts, where the removal of vegetation and hardening of surfaces increases the impacts created by seasonal rainfall events. Mining vent infrastructure and toxic residue on roads (left behind from vehicles) may leave stormwater water runoff impaired in terms of physical-chemical parameters causing impacts on the immediate and downstream users. Disturbances within the landscape and watercourse channels have also encouraged a high rate of bush encroachment and alien invasive plant proliferation. The watercourses within the focus area are of moderate EIS which suggests the site's ecological state, at minimum be maintained. In order to achieve this or an improved ecological state, mitigation measures should be strictly implemented.

Table B: Summary of the DWS Risk Assessment applied to the proposed overhead transmission powerlines.

No.	Phases	Activity	Aspect	Impact	Risk Rating
1	**Planning phase of 33kV overhead transmission powerlines**	Planning and site preparation prior to construction activities associated with the construction of the powerlines.	Potentially inadequate or unsuitable design of infrastructure leading to changes to watercourse characteristics	Tower bases constructed within 32 m of watercourses may lead to erosion and sedimentation of riparian resources, arising from increased runoff due to cleared areas, thus leading to loss of riparian habitat; and *The alteration to stream flow patterns due to support structures placed in the channel.	L
2	**Construction Phase of 33kV overhead transmission powerlines**	Site preparation prior to construction activities including placement of contractor laydown areas and storage facilities.	*Disturbance/ compaction of soils from heavy construction vehicles and laydown facilities; *Removal of vegetation at powerline tower locations; and *Oil contamination from construction vehicles.	*Stormwater runoff from the reduced infiltration, flood water discharge, and velocity increases from hardened surfaces causing erosion of the landscape and channel banks, and subsequent sedimentation of the channel bed. Sedimentation can lead to suffocation of vegetation, destroying sensitive freshwater habitats; *Decreased ecoservice provision (e.g., flood attenuation, sediment trapping and nutrient and toxicant assimilation); *Proliferation of alien vegetation as a result of disturbances;	L
3		Construction of the powerline towers in close proximity to and within watercourses	*Excavation, removing and stockpiling soil (topsoil) for tower cavity; and *Infilling base structure/ cavity with concrete mixture.	*Earthworks within watercourse, leading to loss of habitat, disturbance of soils and loss of ecoservices such as biodiversity maintenance, flood attenuation, nutrient assimilation; *Cement that enters a watercourse will raise the pH (resulting in high alkalinity), which can be toxic to aquatic life, changing the riparian ecology; and *Stockpiling of sediment adjacent to riparian areas and runoff from stockpiles can lead to changes in riparian habitat.	L
4			Clearing and levelling of land for the installation of the powerlines, including infilling and levelling of the watercourse, and removal of riparian vegetation.	*Construction can cause unnatural concentration of flow, unnatural ponding occurs due to a lack of runoff potential, changing the water retention and distribution in the landscape.	L
5		Infrastructure Transportation and Storage	Potential for indiscriminate movement of vehicles through the riparian zone.	*Disturbances of soils leading to increased alien vegetation proliferation, and in turn to further altered riparian habitat;	L

6			Potential placement of contractor laydown areas, and/or potential indiscriminate storage of powerline infrastructure and construction equipment within the riparian zone and/or Zone Of Regulation ZOR.	*Altered runoff patterns, leading to increased erosion and sedimentation of instream and riparian habitat. *Impacts on surface water quality due to pollution.	L
7	**Operational Phase of 33kV overhead transmission powerlines**	*Long term operation of the powerlines; *Potential increased traffic adjacent to the affected reaches of the associated Rivers (Eskom service vehicles). *Potential indiscriminate movement of maintenance vehicles within riparian zone and ZOR.	*Maintenance of power line infrastructure in the vicinity of the riparian zone; and *Cleared and hardened surfaces and natural erodibility of the soil.	*Erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, leading to loss of riparian habitat of watercourses downgradient from the powerline towers; *Altered water quality as a result of increased availability of pollutants.	L

Table C: Summary of the DWS Risk Assessment applied to the proposed water pipelines.

No.	Phases	Activity	Aspect	Impact	Risk Rating
1	Pre-construction phase of pipelines	Planning and site preparation prior to construction activities associated with the construction of the pipelines.	Potentially inadequate or unsuitable design of infrastructure leading to changes to watercourse characteristics	*Pipelines constructed within 32 m of watercourses will have consequences on the natural buffer zone of the watercourses, leading to erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, thus leading to loss of riparian habitat.	L
2	Construction Phase of pipelines	Site preparation prior to construction activities including placement of contractor laydown areas and storage facilities.	*Removal of vegetation a site clearing at the water pipeline locations; *Disturbance/ compaction of soils from heavy construction vehicles; *Oil contamination from construction vehicles.	*Stormwater runoff; and *Increased proliferation of alien vegetation as a result of disturbances.	L
3		Installation of HDPE water supply and wastewater pipelines	Trenching along existing road in close proximity to watercourse, as well as through watercourses, stockpiling, and backfilling soil for pipeline installment.	*Removing sediment will have a direct loss on habitat at removal site; *Stockpiling of sediment adjacent to riparian areas and runoff from stockpiles can lead to changes in riparian habitat; *Backfilling trench; and *Construction edge effects.	L
4	Operational Phase of pipelines	Operation of the pipelines	Cleared and hardened areas and natural erodibility of the soil.	*Erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, leading to loss of riparian habitat of watercourses downgradient form the pipelines.	L
5			Potential leakage of water from the pipeline.	*Possible incision and alteration of the hydroperiod of the watercourse system.	L

Table D: Summary of the DWS Risk Assessment applied to the proposed ventilation shafts.

No.	Phases	Activity	Aspect	Impact	Risk Rating
1	Pre-construction phase of ventilation shafts	Planning and site preparation prior to construction activities associated with the construction of the Ventilation shafts.	Potentially inadequate or unsuitable design of infrastructure leading to changes to watercourse characteristics	*Vents constructed within 32 m of watercourses will have consequences on the natural buffer zone of the watercourses, leading to erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, thus leading to loss of riparian habitat.	L
2	Construction Phase of ventilation shafts	Site preparation prior to construction activities including placement of contractor laydown areas and storage facilities.	*Removal of vegetation or site clearing at the water pipeline locations; *Disturbance/ compaction of soils from heavy construction vehicles; *Oil contamination from construction vehicles.	*Exposure of soils can result in erosion; *Stormwater runoff from the reduced infiltration, flood water discharge, and velocity increases from hardened surfaces causing erosion of the landscape and channel banks, and subsequent sedimentation; *Increased proliferation of alien vegetation as a result of disturbances; and *Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles can infiltrate soils and runoff into surrounding watercourses, impacting watercourse water quality, habitat, and biota downgradient of the contamination site.	L
3		Establishment of new ventilation shaft, surface main fans, electrical rooms, and bulk air cooler.	Removing and stockpiling soil for vent shaft; *Infilling base cavity with concrete mixture; Land elevation changes; soil compaction.	*Removing sediment will have a direct loss on habitat at removal site; *Stockpiling of sediment adjacent to riparian areas and runoff from stockpiles can lead to changes in riparian habitat; *Construction edge effects; *Cement that enters a watercourse will raise the pH (resulting in high alkalinity), which can be toxic to aquatic life, changing the riparian ecology; *Construction can cause unnatural concentration of flow, unnatural ponding occurs due to a lack of runoff potential, changing the water retention and distribution in the landscape; or *In steep areas the high energy of water leaving the site can reach critical levels leading to erosion.	L
4	Operational Phase of ventilation shafts	Operation of the new ventilation shafts, surface main fans, electrical rooms, and bulk air cooler	Cleared and hardened areas and natural erodibility of the soil; and * Leakage of wastewater, which will emanate from the refrigeration process at ventilation shafts, into surrounding environment	*Erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, leading to loss of riparian habitat of watercourses downgradient from the ventilation shafts; and wastewater that enters the surrounding environment can have water quality impacts.	L

Table E: Summary of the SLR Consulting Impact Assessment applied to the proposed powerlines.

Construction Phase	Management	Intensity / Severity	Duration	Extent / Spatial	Probability of exposure	Consequence	Significance
Construction	Unmanaged	L	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL
Operations	Unmanaged	L	M	VL	H	L	L
	Managed	VL	L	VL	M	VL	VL
Closure and post closure	Unmanaged	L	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL

Table F: Summary of the SLR Consulting Impact Assessment applied to the proposed water pipelines.

Construction Phase	Management	Intensity / Severity	Duration	Extent / Spatial	Probability of exposure	Consequence	Significance
Construction	Unmanaged	L	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL
Operations	Unmanaged	L	M	VL	H	L	L
	Managed	VL	L	VL	M	VL	VL
Closure and post closure	Unmanaged	M	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL

Table G: Summary of the SLR Consulting Impact Assessment applied to the proposed ventilation shafts and associated infrastructure.

Construction Phase	Management	Intensity / Severity	Duration	Extent / Spatial	Probability of exposure	Consequence	Significance
Construction	Unmanaged	L	L	VL	H	L	L
	Managed	VL	L	VL	M	VL	VL
Operations	Unmanaged	L	M	VL	H	L	L
	Managed	VL	L	VL	M	VL	VL
Closure and post closure	Unmanaged	M	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL

Based on the findings of the freshwater ecological assessment provided in Section 5 of this report, and the results of the impacts and risk assessments as provided in Section 6, it is the opinion of the ecologist that the proposed ventilation shafts and related powerlines, pipelines and product stockpile pose a low risk to the integrity of the watercourses associated with the proposed activities. Strict implementation of mitigation measures will keep the significance of risks low, therefore ensuring low impacts to receiving watercourses found in the downstream catchment. Additionally, mitigated areas that have recovered should in turn restore the capacity of the landscape to support livestock farming/grazing within the catchment, further supporting provisional services of the watercourses.

Adherence to cogent, well-conceived and ecologically sensitive site development plans, the mitigation measures provided in this report as well as general good construction practice and ongoing management, maintenance and monitoring, are essential if the significance of perceived impacts is to be reduced to limit further degradation to the freshwater environment. This is particularly important given the highly erodible nature of the soil in the area of focus.

Based on the above outcomes, and taking into account the mostly localised nature of the impacts associated with the proposed ventilation shafts and related infrastructure and powerlines and pipelines, and product stockpile it is the opinion of the ecologist that the proposed project may be considered for authorisation, provided that the mitigation measures stipulated in this report are implemented.

DOCUMENT GUIDE

The following table indicates the requirements for Specialist Studies as per Appendix 6 of Government Notice 326 of 2017, amendments to the Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998), promulgated in Government Notice 40772 of 2017.

No.	Requirements	Section in report
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist.	Cover Page and Appendix G
2.2	Description of the preferred development site, including the following aspects-	Section 4 and 5
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
2.2.2	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 4: Table 1
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 4.1
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 4 and 5
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 7
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Yes, with implementation of the proposed mitigation measures.
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
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 5
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);	Section 6

	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 over abstraction 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 unchanneled 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); e. Fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f. Loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g., waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc).	
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 G
3.2	A signed statement of independence by the specialist;	Appendix G
3.3	The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 5.2
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 3, Appendix C and Appendix D
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 6
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 6 and 7
3.8	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol;	Section 6
3.9	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 6
3.10	A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being 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 6
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 per paragraph 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.	Section 6
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, animals 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 (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Ephemeral:	Ephemeral systems flow for less time than they are dry. Flow or flood for short periods of most years in a five-year period, in response to unpredictable high rainfall events. Support a series of pools in parts of the channel.
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.
Non-perennial:	Systems which flow intermittently, for at least nine months of the year. Flow is absent for between 1%-25% of the year.
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 according to the International Union for Conservation of Nature (IUCN) Classification.
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.
BAR	Basic Assessment Report
BAS	Best Attainable State
BGIS	Biodiversity Geographic Information Systems
CSIR	Council of Scientific and Industrial Research
CVB	Channelled Valley Bottom
DHSWS	Department of Human Settlements, Water and Sanitation
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EPL	Ecosystem Protection Level
ES	Ecological Sensitivity
ESA	Ecological Support Area
ETS	Ecosystem Threat Status
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
Ha	Hectares
HGM	Hydrogeomorphic
IAIA	International Association of Impact Assessors
IUCN	International Union for Conservation of Nature
IWUL	Integrated Water Use Licence
LaRSSA	Land Rehabilitation Society of South Africa
mm	Millimetre
m.a.m.s.l	Metres above mean sea level
MAP	Mean Annual Precipitation
MPRDA	Mineral and Petroleum Resources Development Act
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NEMWA	National Environmental Management: Waste Act
NFEPA	National Freshwater Ecosystem Priority Areas
NOMR	New Order Mining Right
NWA	National Water Act
PCD	Pollution Control Dam
PES	Present Ecological State
PPP	Public Participation Process
REC	Recommended Ecological Category
RHP	River Health Program
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SAIAB	South Africa Institute of Aquatic Biodiversity
SAIIAE	South Africa Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SASSO	South African Soil Surveyors Association
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups

WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WULA	Water Use License Application
ZOR	Zone Of Regulation

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a watercourse ecological assessment as part of the Environmental and Water Use Authorisation processes for the proposed ventilation shafts and associated infrastructure (surface main fans, electrical rooms, and bulk air cooler), as well as powerlines, pipelines and product stockpile at Marula Platinum Mine, Limpopo Province. The proposed development footprint will henceforth be referred to as the “Focus Area”.

In order to identify all possible watercourses that may potentially be impacted by the proposed project, a 500 m “zone of investigation” around the Focus Area, in accordance with Regulation 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e., the 500 m zone of investigation around the Focus Area - will henceforth be referred to as the “investigation area” (Figure 1 and 2).

The purpose of this report is to define the ecology of the Focus Area in terms of watercourse characteristics, including mapping of the watercourses, discuss key ecological drivers and to define the Present Ecological State (PES) and the socio-cultural and ecological service provision of the watercourses utilising current industry “best practice” assessment methods, in order to ascertain what, if any, impact the proposed mining related activities will have on the watercourses associated with the Focus Area. Additionally, this report aims to define the Recommended Management Objectives (RMO) and Recommended Ecological Category (REC) for the watercourses. It is a further objective of this study to provide detailed information when considering the proposed mining related activities in the vicinity of the watercourses, to ensure the ongoing functioning of the ecosystem, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.

This report, after consideration and a description of the ecological integrity of the Focus Area, must guide the Environmental Assessment Practitioner (EAP) and relevant authorities, by means of a reasoned opinion and recommendations, as to the viability of the proposed mining related activities from a watercourse management point of view.

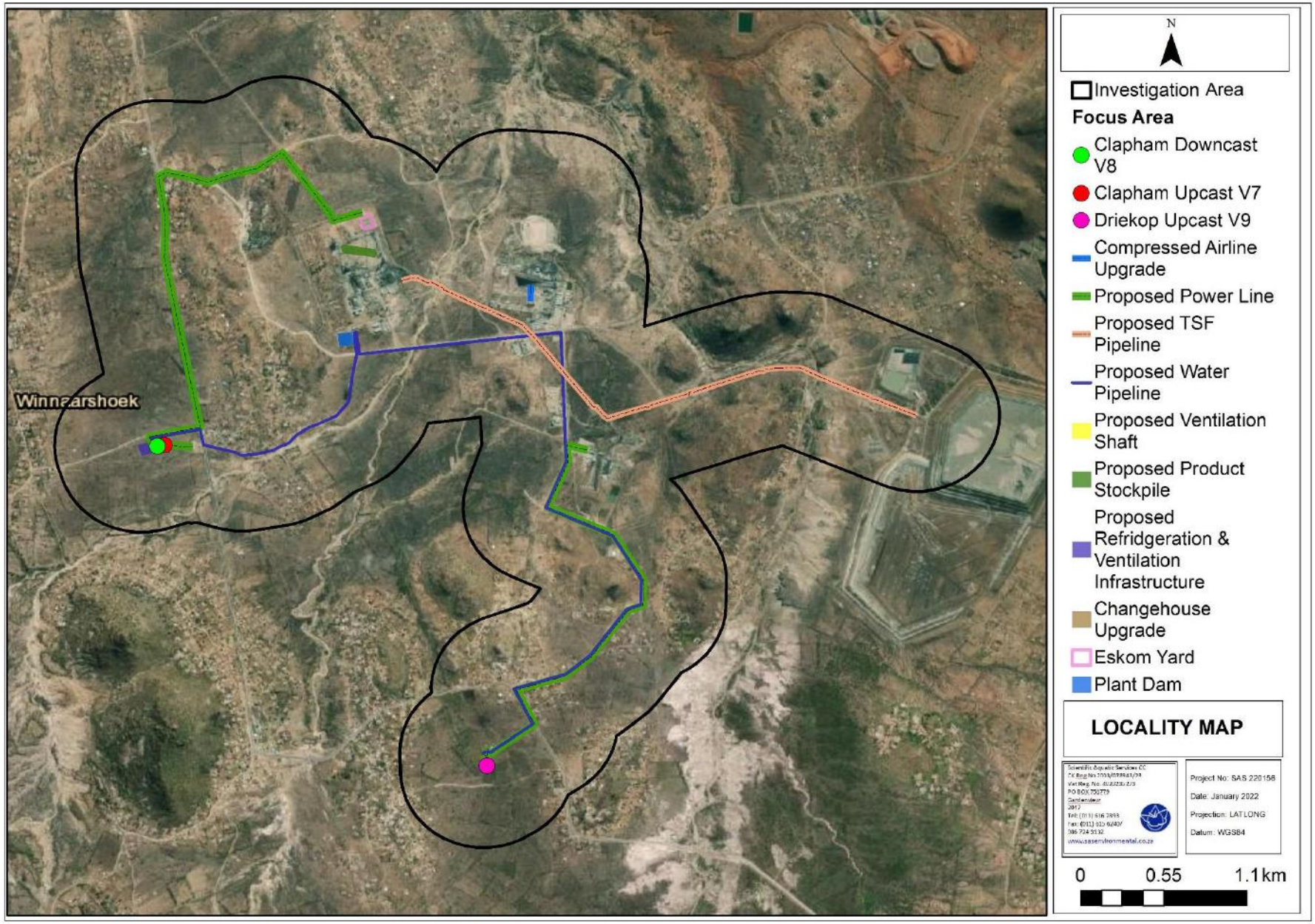


Figure 1: A digital satellite image depicting the location of the Focus Area and investigation area in relation to the surrounding area.

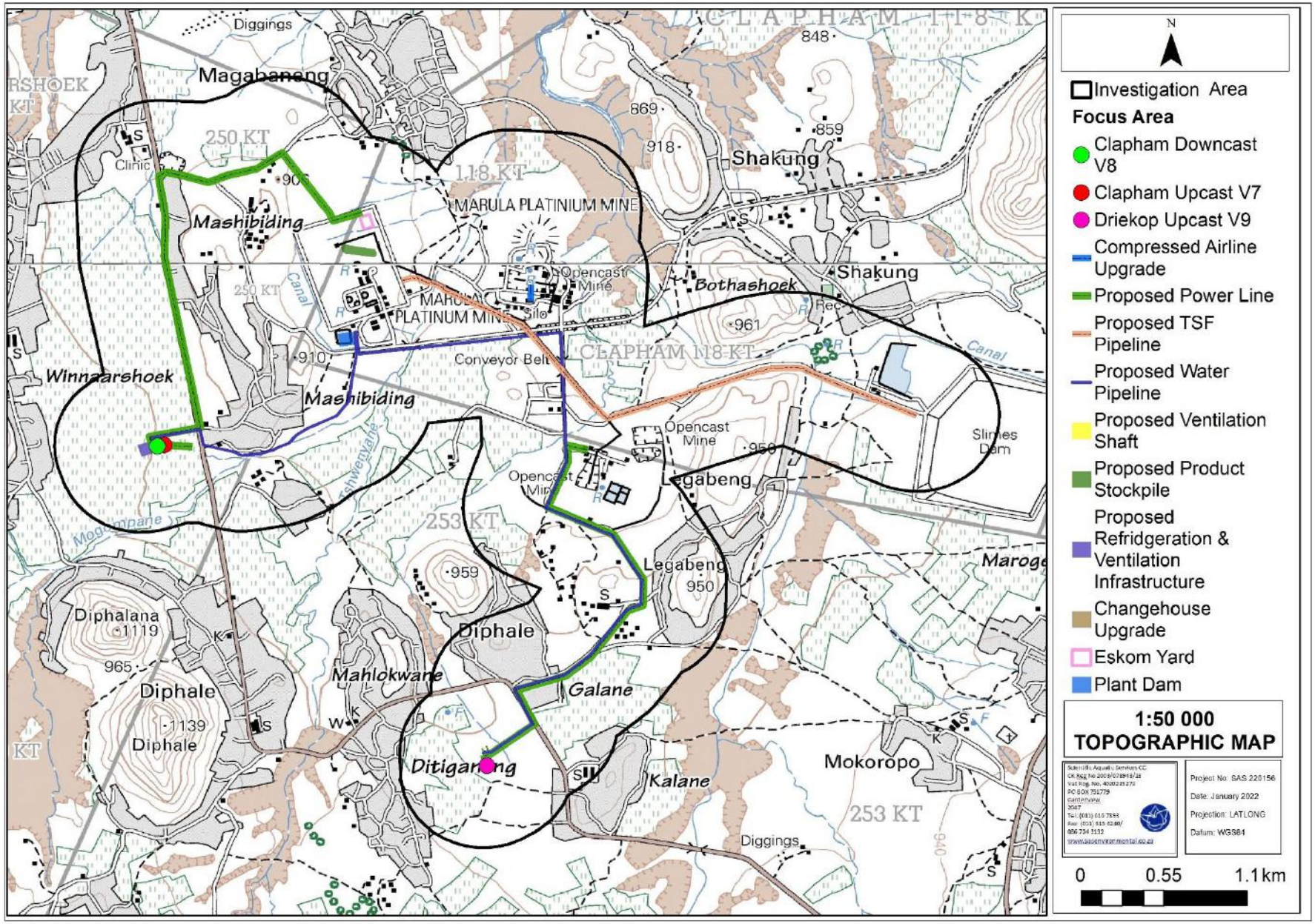


Figure 2: The Focus Area and investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area.

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, National Biodiversity Assessment (NBA) (2018), Limpopo Conservation Plan (2013) and the Mining and Biodiversity Guidelines (2013) was undertaken to aid in defining the PES of the watercourses;
- All watercourses 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 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 watercourses;
- The watercourse 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 EIS of the watercourses were determined according to the method described by Rountree & Kotze, (2013);
- The PES of the watercourses was assessed according to the resource directed measures guideline as advocated by Kleynhans *et al* (2008);
- The watercourses were mapped according to the ecological sensitivity of each hydrogeomorphic unit in relation to the Focus Area. In addition to the watercourse boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;
- Allocation of a suitable Recommended Management Objective (RMO), Recommended Ecological Category (REC) and Best Attainable State (BAS) to the watercourses based on the results obtained from the PES and EIS assessments;
- The impact assessment was undertaken according to a pre-defined impact assessment methodology specifically designed to address risks to biodiversity; and

[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). At present, the Department is known as the Department of Human Settlements, Water and Sanitation (DHSWS). 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.

- To present management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact on the receiving environment.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The determination of the watercourse boundaries and the assessment thereof, is confined to the Focus Area. The watercourses within 500m of the Focus Area were delineated in fulfilment of Regulation GN509 of 2016 as it relates to the National Water Act using various desktop methods including use of topographic maps, historical and current digital satellite imagery, and aerial photographs. The general surroundings were, however, considered in the desktop assessment of the Focus Area;
- 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 actual site characteristics within the Focus Area at the scale required to inform the Environmental Impact Assessment (EIA) process. However, this information is considered to be useful as background information to the study and, based on the results of the site investigation in conjunction with desktop results, informed decision making can take place with regards to the proposed development activities;
- Use was made of aerial photographs, digital satellite imagery as well as provincial and national wetland databases to identify areas of interest prior to the field survey. Any additional wetland areas, watercourses and drainage lines noted during the field survey were also assessed and added to the number of survey points. Although all possible measures were undertaken to ensure all watercourses were assessed and delineated, some smaller non-perennial/ ephemeral features may have been overlooked; However, if the sensitivity map is consulted during the planning phases of the mine expansion, the majority of watercourse/riparian habitat considered to be of increased EIS will be safeguarded;
- 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 watercourse will need to be surveyed and pegged according to surveying principles and with survey equipment. If more accurate assessments are required the riparian zones and non-perennial/ ephemeral drainage line features will need to be surveyed and pegged according to surveying principles. The delineations are however deemed sufficiently accurate to ensure that the riparian

resources are adequately protected if the management and mitigation measures of this report are adhered to and adequate buffers are implemented;

- Aquatic habitats, wetlands and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the watercourse boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. It is, however, expected that the watercourses within the Focus Area have been accurately assessed and considered, based on the field observations undertaken in terms of the watercourse ecology.

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);
- Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998);
- 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);
- 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 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Environmental Management: Biodiversity Act, 2014 (Alien and Invasive Species Regulations, 2014);
- The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)*;* and
- Limpopo Environmental Management Act, 2003, (Act No. 7 of 2003) (LEMA).

[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.

2 PROJECT DESCRIPTION

The Marula Platinum Mine (hereafter 'Marula') is situated along the western side of the R37, near Burgersfort, and falls within the Tubatse Local Municipality (LM), within the Sekhukune District Municipality (DM) in the Limpopo Province. The Focus Area is approximately 3.2 km south of the town of Ga-Kgoete and approximately 11 km north from the town of Driekop.

Marula now proposes to change their approved layout by establishing additional surface infrastructure, which will require an amendment to Marulas' approved EMPr. The proposed additional surface infrastructure comprises the following:

- The establishment of two additional ventilation shafts.
- The upgrade to refrigeration and ventilation infrastructure at existing ventilation shafts.
- The establishment of additional water pipelines to support the additional ventilation shafts.
- The expansion and establishment of additional power supply and distribution infrastructure in support of the establishment of additional ventilation shaft and upgrades to existing ventilation shafts).
- The establishment of a product stockpile within the existing footprint of the Concentrator Plant.
- The establishment of an additional pipeline to the approved Tailings Storage Facility (TSF).
- Structural upgrades of the existing change house and compressed airline at the Clapham Shaft Complex.

2.1 Ventilation shafts and upgrades to refrigeration infrastructure

Marula proposes to establish two new additional ventilation shafts within their existing MRA. An upcast and downcast shaft is proposed. The downcast shafts are used to draw clean air into the underground mine workings, whilst the upcast shaft will vent the "dirty/used" air to the surface. There are also existing ventilation shafts on Driekop 253 KT (Ventilation Shaft 6) and Winnarshoek 250 KT (Ventilation Shaft 5). Ventilation Shaft 7 (located on Winnarshoek 250 KT) was approved as part of the Merensky Reef project but is not constructed to date. An overview of these activities is summarised in Tables 1 and 2 below.

Table 1: Proposed ventilation infrastructure

Aspect	Detail	
Proposed establishment of new ventilation shafts - Driekop Shaft	Name	Ventilation Shaft 9.
	Location	Driekop 253 KT (Portion 0)
	Footprint	Within approved footprint of Driekop Shaft 6.
	Technology	Upcast shaft.
	Refrigeration or ventilation infrastructure	Establishment of a new ventilation shaft with surface main fans and electrical rooms.
Proposed establishment of new ventilation shafts - Clapham Shaft	Name	Ventilation Shaft 8.
	Location	Winnarshoek 250 KT (Portion 0)
	Footprint	Approximately 0.5 ha.
	Technology	Downcast shaft.
	Refrigeration or ventilation infrastructure	Establishment of a new bulk air cooler. Establishment of refrigeration plant and condenser cooling towers.

Table 2: Proposed upgrades of ventilation and refrigeration infrastructure

Aspect	Detail	
Proposed changes and upgrades at existing infrastructure - Driekop Shaft	Name	Ventilation Shaft 6
	Refrigeration or ventilation infrastructure	Establishment of a new bulk air cooler. Establishment of a refrigeration plant and condenser cooling towers.
	Location of infrastructure	Driekop 253 KT (Portion 0)
	Footprint	Within the existing, approved footprint of the Driekop VS 6 shaft area.
Proposed changes and upgrades at existing infrastructure - Clapham Shaft	Name	Ventilation Shaft 5
	Refrigeration or ventilation infrastructure	Establishment of a new bulk air cooler.
	Location of infrastructure	Winnarshoek 250 KT (Portion 0)
	Footprint	Within the existing, approved footprint of the Clapham VS 5 shaft area.
	Name	Ventilation Shaft 7 (Approved but not constructed)
	Refrigeration or ventilation infrastructure	Establishment of surface main fans and electrical rooms.
	Location of infrastructure	Winnarshoek 250 KT (Portion 0)
	Footprint	Approximately 1.8 ha.

2.2 Upgrades of existing services and infrastructure

Water supply and distribution

Water supply: Raw water required for the proposed project will be sourced from the existing on-site Lebalelo Raw Water Dam (Plant Dam). Marula has sufficient capacity and volume to accommodate the proposed project water requirements and as such no changes are anticipated to the existing water reticulation storage capacities (Plant Dam) or supply demand.

Distribution: The proposed project will require the establishment of pipelines from the Plant Dam to the new ventilation shafts (Driekop Ventilation Shaft 9 and Clapham Ventilation Shaft 8). The proposed HDPE pipelines will have a diameter of approximately 150 mm (0.15 cm) and will be below ground. The proposed pipeline to the Clapham Ventilation Shaft 8 will be approximately 2.1 km in length with a throughput of 24 l/s. The proposed Driekop Ventilation Shaft 9 pipeline will be approximately 5.2 km in length with a throughput of 24 l/s. The water supply pipeline will be fed into the plant room and subsequently through to the cooling tower. The establishment of the proposed Driekop water supply pipeline will have a total area of disturbance of 5 250 m^2/ 0.525 Ha. The establishment of the proposed Clapham water supply pipeline will have a total area of disturbance of 13 000 m^2 / 1.3 Ha.

Wastewater: Wastewater which contains an elevated salt concentration will emanate from the refrigeration process. This wastewater will be pumped into a surface sump (with approximate dimension of 2 m by 2 m). A return pipeline of approximately 50 mm will carry this wastewater back to the Concentrator Plant. The return pipeline will be located within the same below ground trench as the water supply pipeline to the ventilation shafts and will thus not result in any additional land clearance.

Power supply and transmission

Supply: Power is currently supplied to the mine by a consumer Eskom substation which is comprised of 2 x 20 MVA transformers. The power demand is expected to exceed the output from the 2 x 20 MVA transformer in 2025. In addition, the power requirements for the establishment of the new Clapham Ventilation Shaft 8 will need to be accommodated. Marula therefore proposes to increase the existing Eskom yard capacity to 60 MVA by the addition of a 40 MVA transformer. The running load will be 54 MVA. Existing power supply infrastructure is sufficient to support the project components at the remaining ventilation shafts.

Distribution: A new 33 kV overhead transmission line will be established from the on-site Eskom yard to the Clapham Ventilation Shaft 8. A new 33 kV overhead transmission line will also be established from the Driekop Shaft Complex to the new Driekop Ventilation Shaft 9, to supply the new ventilation shaft with power. The new 33 kV overhead transmission line will then be fed into a new step-down transformer located at the Clapham and Driekop ventilation shafts. The 33 kV will be stepped down to 11 kV and then fed into the plant room and ventilation fans. The lengths of the Clapham Ventilation Shaft 8 and the Driekop Ventilation Shaft 9 will be 3.8 km and 3.3 km, respectively.

Disturbance to watercourses: Watercourses within the proposed project area include the Tshwenyane, Mogompane, Motse Rivers and an unnamed tributary of the Moopetsi River (with riparian vegetation), as well as numerous non-perennial and ephemeral drainage lines. The proposed power distribution lines and tower bases will be located within 32 m the existing watercourses. A water use license (WUL) will need to be applied for due to this disturbance, however this will be undertaken separately from this Basic Assessment process.

2.3 Establishment of a product stockpile

In order to alleviate storage capacity constraints experienced with their current operations, Marula proposes the establishment of an additional product stockpile. The additional product stockpile will reach a maximum capacity of 200 000 tons and will be located within the existing, disturbed footprint of the Concentrator Plant. The proposed location of the product stockpile is disturbed but unlined. The product material is similar to the mine's existing tailings and is considered low grade ore. The 2015 geochemical waste assessment undertaken by Golder (Golder, 2015) detailed that the tailings material is classified as a Type 3 waste. The results of the assessment indicated that NO_3 leachate concentrations exceeded the TCT0 threshold in two of the tailing composites. The material was reported to require a Class C liner. Marula will further investigate the liner requirements for the proposed stockpile as part of their WUL application which will be undertaken as a separate process.

Figure 3: Conceptual design of the proposed product stockpile

2.4 TSF pipeline

To increase the operational efficiency at the mine, an additional tailings conveyance pipeline is proposed. The proposed additional pipeline will follow the existing overland pipeline route which runs from the Concentrator Plant to the Phase 2 TSF. The additional pipeline will be 4 km in length with an internal diameter of 243 mm and comprised of HDPE lined steel.

The proposed alignment is shown in **Error! Reference source not found.** and detailed as follows:

Start point	S24° 30' 3.762" E30° 4' 21.895"
Middle point	S24° 30' 30.037" E30° 5' 16.393"
End point	S24° 30' 32.641" E30° 6' 12.020"

2.5 Upgrade to existing change house (including lamp room) and compressed airline

The current change house and lamp room at the Clapham Shaft Complex has reached its current capacity. An upgrade of the change house (and lamp rooms) is now proposed to accommodate an increase of the labour force for 600 people. The actual construction timeline

is expected to begin in 2024 / 2025. In addition to the upgrade of the Clapham change house, the existing 400 NB compressed air ring main from compressor house to Clapham UG mine will be upgraded from 400 NB to 600 NB. No change to the pipeline pressure is anticipated. The structural upgrades of the change house and compressed air ring main will be undertaken within the existing and disturbed Clapham Shaft Complex footprint and no additional land clearance will be required.

2.6 TSF contamination plume remediation

Marula is investigating various methods of managing the contamination plume emanating from the existing Tailings Dam facility. The investigation of remediation measures is still in a feasibility phase due to budget constraints, as such there are no specific measures available. However, the approved EMPr requires an amendment to accommodate for the inclusion of management measures which are deemed feasible by Marula. The TSF contamination plume component is therefore only administrative at this stage.

3 ASSESSMENT APPROACH

3.1 Watercourse Field Verification

For the purposes of this investigation, the following definitions as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

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 a watercourse.

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".

Regulated Area of a watercourse as defined by Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act (Act No. 36 of 1998) (NWA):

(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 or dam;
(b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m 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."

A field assessment was undertaken in November 2020 to conduct a watercourse delineation and ecological assessment. The delineation of the identified watercourses took place, as far as possible, according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

- Landscape position;
- 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.

In addition to the delineation process, a detailed assessment of the delineated watercourses was undertaken, at which time factors affecting the integrity of the watercourses were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the watercourses. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

3.2 Sensitivity Mapping

The watercourses associated with the Focus Area were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project the watercourses onto digital satellite imagery and topographic maps. The sensitivity map

presented in Section 5.4 should guide the design and layout of the proposed project components.

3.3 Risk Assessment and Recommendations

Following the completion of the assessment, a pre-determined impact assessment method and the DWS risk assessment matrix were undertaken (please refer to Appendix D for the methods of approach) and recommendations were developed to address and mitigate impacts associated with the proposed project components. These recommendations also include general 'best practice' management measures, which apply to the proposed mining associated activities 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 operation including planning, construction and operation. The detailed site-specific mitigation measures are outlined in Section 6 of this report.

4 RESULTS OF THE DESKTOP ANALYSIS

4.1 Analyses of Relevant Databases

The following section contains data accessed as part of the desktop assessment and are presented as a "dashboard style" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place.

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 Focus Area's actual site characteristics at the scale required to inform the environmental authorisation and/or water use licencing processes. Given these limitations, this information is considered useful as background information to the study. 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. Thus, this data was used as a guideline to inform the watercourse assessment and to focus on areas and aspects of increased conservation importance during the site assessment.

Table 3: Desktop data relating to the character of watercourses associated with the Focus Area and surrounding region.

Aquatic ecoregion and sub-regions in which the Focus Area is located		Detail of the Focus Area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
Ecoregion	Eastern Bankenveld	Wetland Vegetation Type	The Focus Area is located within an Upstream Management Catchment which is required to prevent the downstream degradation of Freshwater Ecosystem Priority Areas (FEPAs) and Fish Support Areas (FSAs).
Catchment	Olifants – North		
Quaternary Catchment	B71E		
WMA	Olifants	NFEPA Wetlands (Figures 3)	According to the NFEPA Database there are three artificial unchanneled valley-bottom wetlands in heavily or critically modified condition (WETCON= Z3) within the investigation area. These were identified during the site assessment and were found to be impoundments related to mining infrastructure.
subWMA	Middle Olifants	Wetland Vegetation Type	The Focus Area is situated within the Central Bushveld Group 7 Wetland Vegetation Type, considered least threatened as provided by Mbona *et al.* (2015).
Dominant characteristics of the Eastern Bankenveld Ecoregion Level 2 (9.03) (Kleynhans *et al.,* 2007)			
Dominant primary terrain morphology	Closed Hills, Mountains; moderate and high relief, Low mountains	NFEPA Rivers (Figures 3)	The Moopetsi River is situated approximately 1 km east of the Focus Area. According to the NFEPA Database the river is largely modified (RIVCON= D) and the PES 1999 considers the river to be moderately modified (Class= C).
Dominant primary vegetation types	Mixed Bushveld		
Altitude (m a.m.s.l)	500 to 2300		
MAP (mm)	400 to 700		
Coefficient of Variation (% of MAP)	20 to 34		
Rainfall concentration index	55 to 64	Detail of the Focus Area in terms of the Limpopo Conservation Plan (2013)	
Rainfall seasonality	Early summer	Ecological Support Areas (Figure 5)	According to the Limpopo Conservation Plan, the majority of the Focus Area falls within an area classified as an Ecological Support Area 1. Small portions to the west and a portion of the south of the Focus Area fall within an area classified as an Ecological Support Area 2. Ecological Support Areas are areas that are not essential for meeting biodiversity targets but play an important role in supporting the functioning of Priority Areas or Critical Biodiversity Areas and are often vital for delivering ecosystem services.
Mean annual temp. (°C)	14 to 22		
Winter temperature (July) (°C)	2 – 20		
Summer temperature (Feb) (°C)	12 – 30		
Median annual simulated runoff (mm)	20 to 150		
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 4)			
According to the NBA 2018: SAIIAE The Moopetsi River is situated approximately 1 km east of the Focus Area and considered largely modified (RIVCON= D) (PES 1999 Class is considered to be moderately modified (C) and the PES 2018 Class is considered to be seriously modified (E)). The Moopetsi is critically endangered (Ecosystem Threat Status) and is poorly protected (Ecosystem Protection Level). Furthermore, two dams and a number of reservoirs are indicated to be within the investigation area.			
National web based environmental screening tool (2020)			
The screening tool is intended for pre-screening of sensitivities in the landscape to be assessed within the EIA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas. The Focus Area does not fall within one of the sensitivity categories screened by the tool.			
Importance of the Focus Area according to the Mining and Biodiversity Guidelines (2013) (Figure 7).			
The majority of the Focus Area falls within an area considered to be of Highest Biodiversity Importance. Highest Biodiversity Importance areas include areas where mining is not legally prohibited, but where there is a very high risk that due to their potential biodiversity significance and importance to ecosystem services (e.g. water flow regulation and water provisioning) that mining projects will be significantly constrained or may not receive necessary authorisations. A small portion of the Focus Area falls within an area considered to be of High Biodiversity Importance. High biodiversity importance areas may limit mining options. Mining should be tightly controlled as these areas are important for conserving biodiversity, for supporting or buffering the biodiversity priority areas, for maintaining important ecosystem services for particular communities or the country as a whole.			

CVB = Channelled Valley Bottom; DWS = Department of Water and Sanitation; EI = Ecological Importance; EPL = Ecosystem Protection Level; ES = Ecological Sensitivity; ESA = Ecological Support Area; ETS = Ecosystem Threat Status; FEPA = Freshwater Ecosystem Priority 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; PES = Present Ecological State; SAIIAE = South Africa Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area

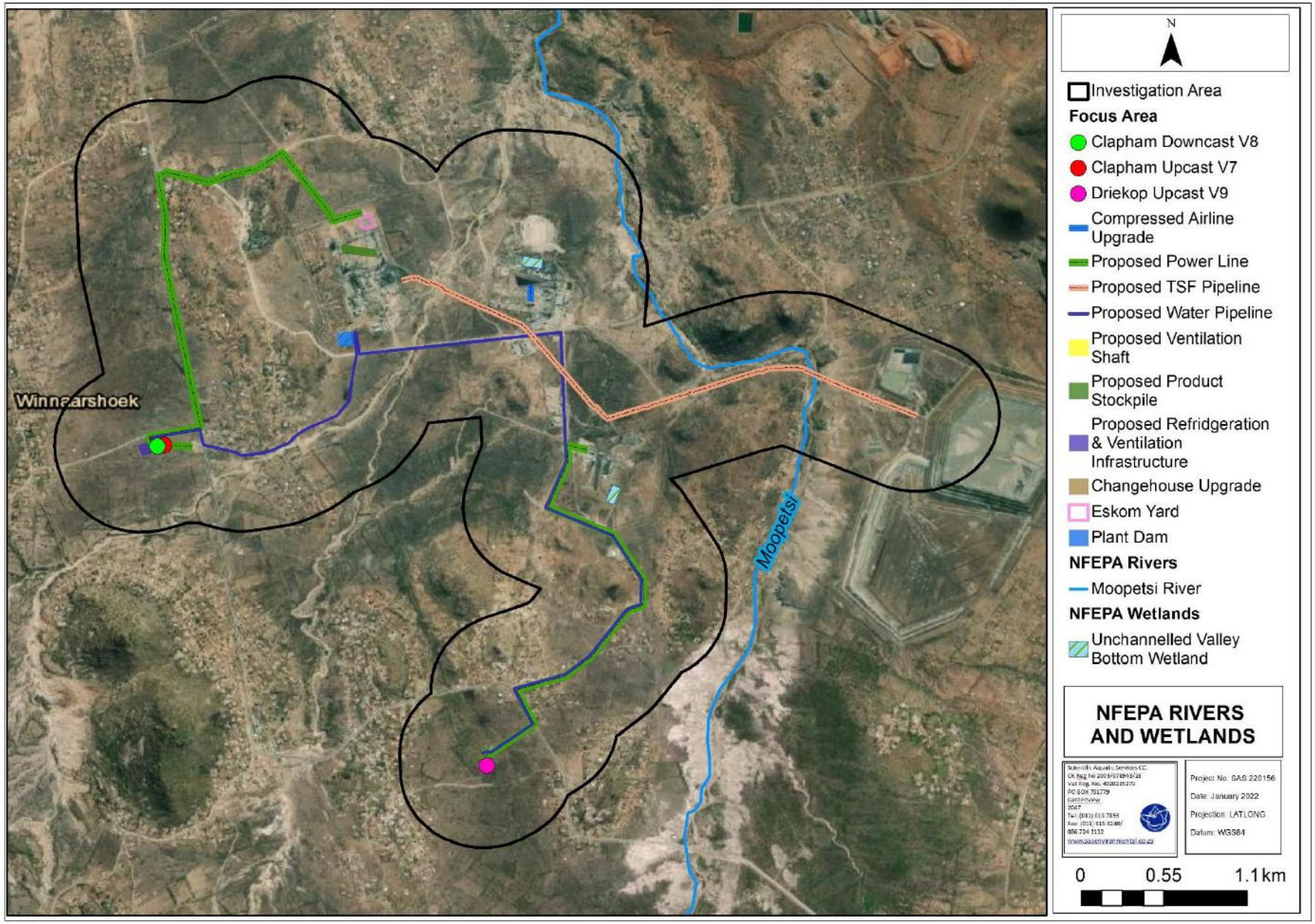


Figure 4: The Moopetsi River and artificial wetland features associated with the Focus Area and investigation area as indicated by NFEPA (2011).

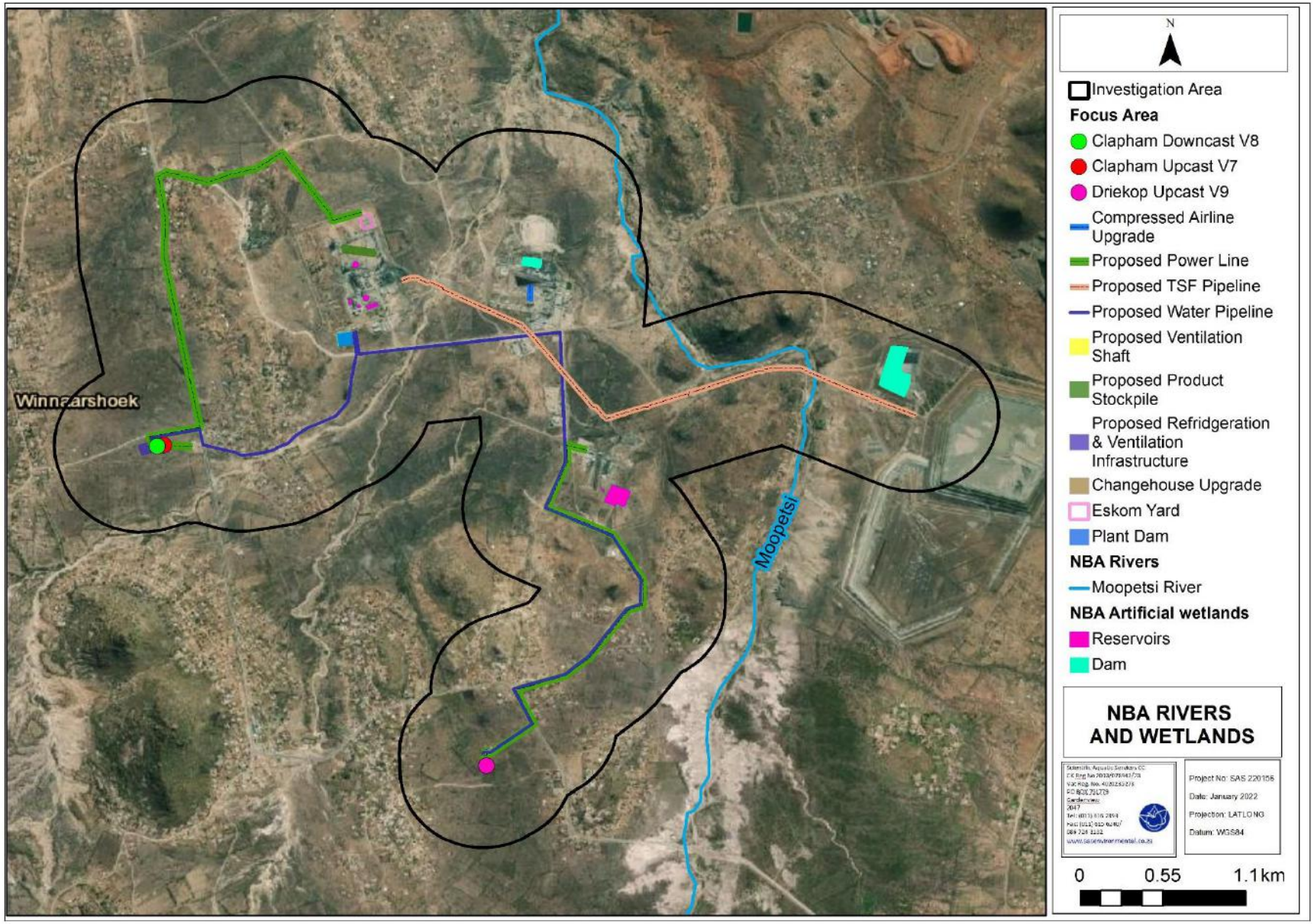


Figure 5: Wetland and river features associated with the Focus Area and investigation area, according to the National Biodiversity Assessment: South African Inventory of Inland Aquatic Ecosystems (NBA: SAIIAE, 2018).

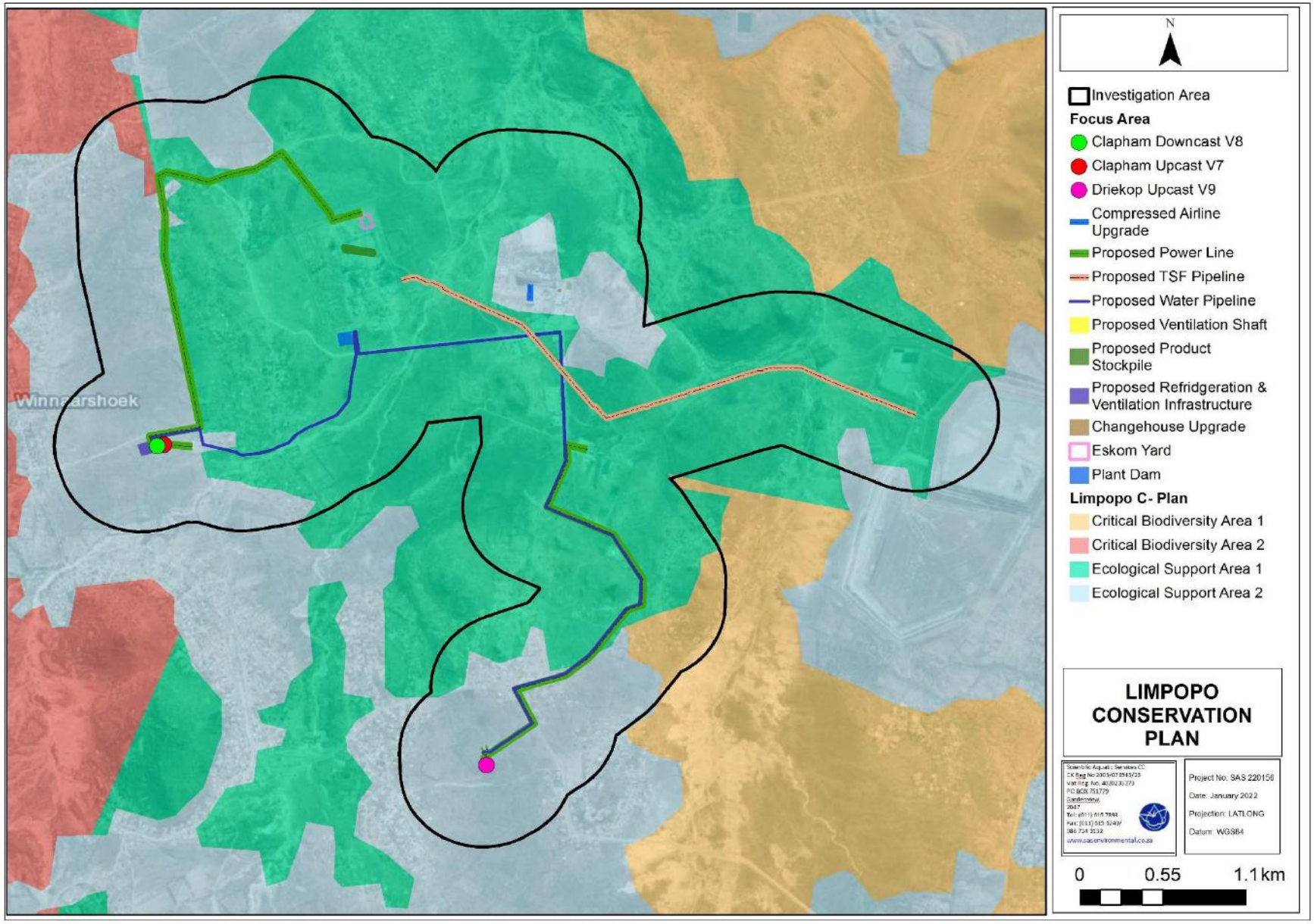


Figure 6: Critical Biodiversity Areas and Ecological Support Areas associated with the Focus Area according to the Limpopo Conservation Plan V2 (2013).

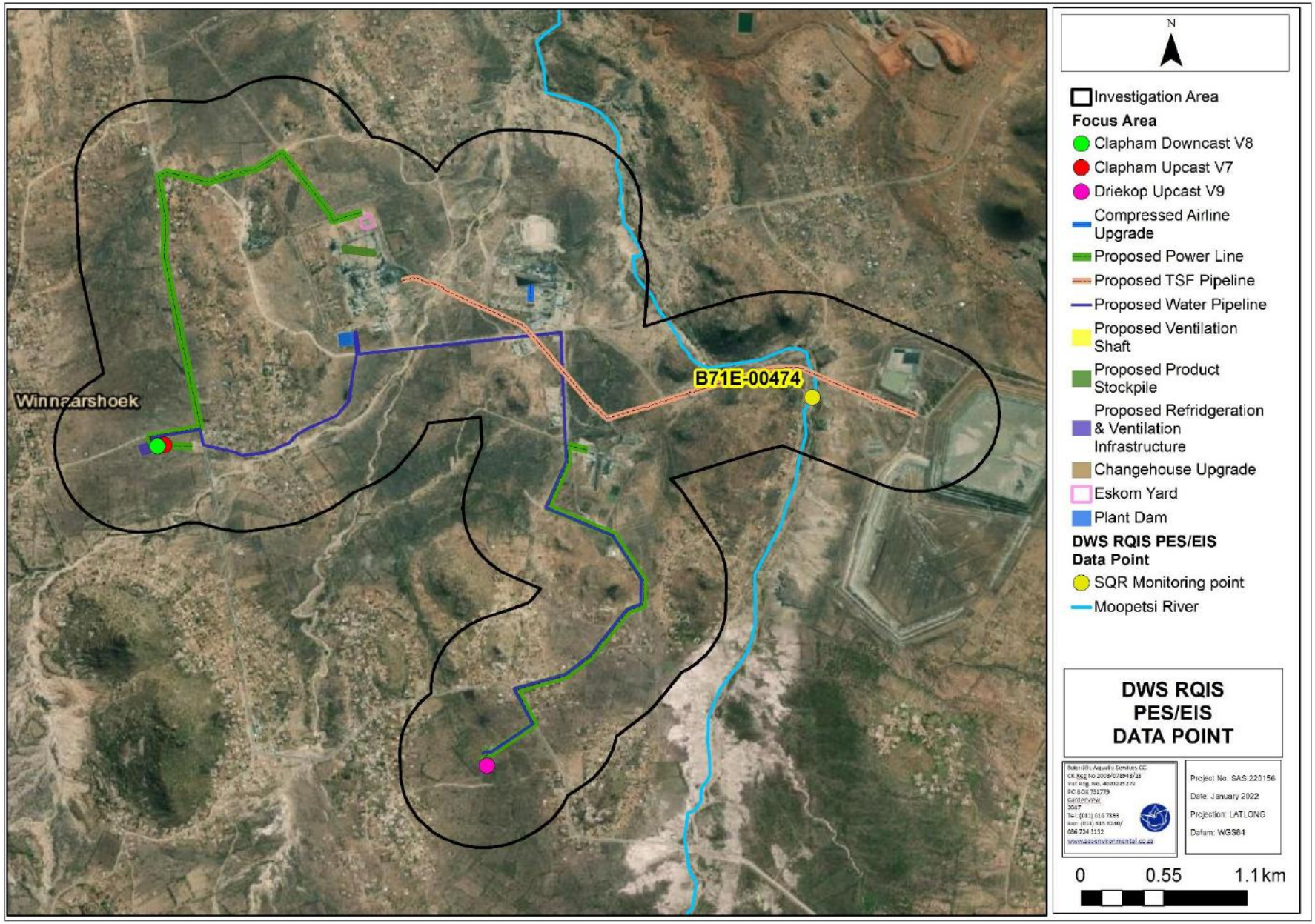


Figure 7: Relevant Sub-Quaternary Catchment Reach (SQR) associated with the Focus Area and investigation area.

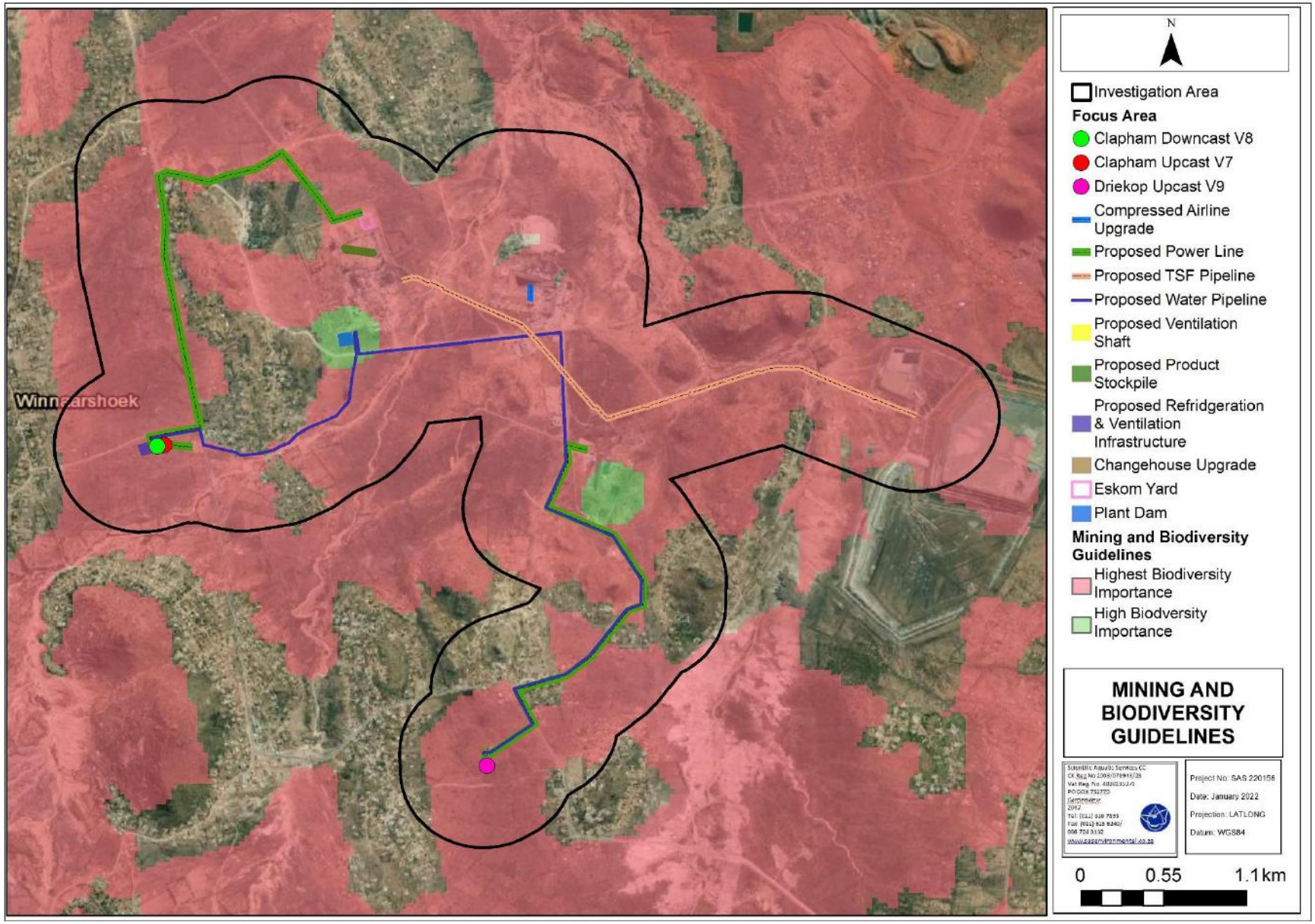


Figure 8: Biodiversity importance associated with the Focus Area according to Mining and Biodiversity guidelines (2013).

4.2 Ecological status of sub-quaternary catchments [Department of Water and Sanitation (DWS) Resource Quality Services (RQS) PES/EIS database]

The PES/EIS database, as developed by the DWS RQS department, was utilised to obtain additional background information on the project area. The information from this database is based on information at a sub-quaternary catchment reach (subquat reach) level, with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of information such as SA RHP sites, Ecological Water Requirement (EWR) sites and Hydro Water Management System (WMS) sites.

Key information on background conditions of the reach of the Moopetsi River associated with the Focus Area, as contained in this database and pertaining to the Present Ecological State (PES), ecological importance and ecological sensitivity for the sub-quaternary catchment reach (SQR) Moopetsi River (B71E-00474) is tabulated in Table 2. Based on the PES/EIS database no fish species or macro-invertebrate species have been recorded for the Moopetsi River at B71E-00474.

Table 4: Summary of the ecological status of the sub-quaternary catchment (SQ) reach Moopetsi River (B71E-00474) based on the DWS RQS PES/EIS database.

Synopsis (SQ reach Moopetsi River (B71E-00474))					
PES[1] category median	**Mean EI[2] class**	**Mean ES[3] class**	**Length**	**Stream order**	**Default EC[4]**
E (Seriously Modified)	Low	Low	25,11	1	D
PES details					
Instream habitat continuity MOD		Large	**Riparian/wetland zone MOD**		Serious
RIP/wetland zone continuity MOD		Large	**Potential flow MOD activities**		Moderate
Potential instream habitat MOD activities		Serious	**Potential physico-chemical MOD activities**		Serious
EI details					
Fish spp/SQ		na	**Fish average confidence**		na
Fish representivity per secondary class		na	**Fish rarity per secondary class**		na
Invertebrate taxa/SQ		na	**Invertebrate average confidence**		na
Invertebrate representivity per secondary class		na	**Invertebrate rarity per secondary class**		na
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Very low	**Habitat diversity class**		High
Habitat size (length) class		Low	**Instream migration link class**		Moderate
Riparian-wetland zone migration link		Moderate	**Riparian-wetland zone habitat integrity class**		Low
Instream habitat integrity class		Low	**Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m**		High

Riparian-wetland natural vegetation rating based on expert rating			Low
ES details			
Fish physical-chemical sensitivity description	na	**Fish no-flow sensitivity**	na
Invertebrates physical-chemical sensitivity description	na	**Invertebrates velocity sensitivity**	na
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

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;
[2] EI = Ecological Importance;
[3] ES = Ecological Sensitivity

5 RESULTS: WATERCOURSE ASSESSMENT

5.1 Delineation

All features were delineated on a desktop level with the use of digital satellite imagery and topographical maps. Portions of the features were then verified during the field survey according to the guidelines advocated by DWA (2005) and the watercourse/riparian delineations as presented in this report are regarded as a best estimate of the temporary and riparian zone boundaries based on the site conditions present at the time of assessment. Ground-truthing of riparian boundaries focused on those areas within the investigation area of the proposed project components.

During the assessment, the following indicators were used to ascertain the boundaries of the temporary zones of the rivers with riparian characteristics and the ephemeral and non-perennial drainage lines without riparian zones:

- Terrain units were used as the primary indicator, as both soil profiles and vegetation communities have been transformed, and therefore it was difficult in many areas to discern riparian / drainage line boundaries utilising these indicators;
- Soil morphological characteristics were considered; however, the vertic soils within the study area do not show soil variations such as gleying (leaching out of iron). Therefore, this indicator was not used extensively to determine boundaries (particularly of the non-perennial and ephemeral drainage lines) as differences between terrestrial and wetland soils could not be reliably discerned using soil morphology; and
- Vegetation although transformed throughout the study area, was considered informative at many features, although in most instances degraded, the change in vegetation communities between terrestrial and riparian/wetland ecosystems was subtle (refer to photograph notes in Table 4).

5.2 Drainage System Characterisation

The Tshwenyane, Mogompane, Motse Rivers and an unnamed tributary of the Moopetsi River (with riparian vegetation), along with numerous non-perennial and ephemeral drainage lines without riparian characteristics and an artificial wetland in the vicinity of the proposed mining infrastructure were identified.

The aforementioned HGM units identified in the Focus Area were classified according to the Classification System (Ollis *et al.*, 2013) as Inland Systems, falling within the Eastern Bankenveld Aquatic Ecoregion, and within the Central Bushveld Group 7 WetVeg group,

classified by Mbona *et al.* (2015) as “Least Threatened”. At Levels 3 (Landscape Unit) and 4 (HGM Type) of the Classification System, the systems were classified as per the summary in Table 3 below.

Table 5: Characterisation at Levels 3 and 4 of the Classification System of the riparian and wetland systems identified within the proposed investigation area.

Group	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) Unit Type
Motse River	**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.	**River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water
Tshwenyane River		
Mogompane River		
Unnamed tributaries of the Moopetsi River		
Non-perennial drainage lines		
Ephemeral drainage lines		

The Moopetsi River is a major tributary, via the Matadi River, of the non-perennial Motse River, the catchment of which contributes to the Olifants River. The Mogompane River drains into the Tshwenyane, which in turn is a major tributary of the Moopetsi River. All of these rivers are non-perennial, characterized by stream bank incision particularly in areas which are heavily utilized by domestic livestock.

The ephemeral and non-perennial drainage lines may historically have possessed riparian vegetation, albeit weakly defined riparian zones. Due to impacts such as erosion (natural, but exacerbated by anthropogenic activities in the catchment), human activities such as harvesting firewood from woody species in the riparian zone and overgrazing or trampling by domestic livestock, the vegetation communities associated with these drainage lines have been extensively altered over a period of several years. At the time of assessment, no discernible riparian zones were noted, and therefore, the non-perennial and ephemeral drainage lines were not classified as riparian features in terms of the definition contained in DWAF (2008) and were thus excluded from detailed ecological assessments. Nevertheless, these systems convey water from the upgradient catchment to the downgradient watercourses, albeit intermittently, forming the headwaters of the riverine systems identified within the focus area. Based on the definition of a watercourse contained in the National Water Act, 1998 (Act No. 36 of 1998), these systems function as waterways and therefore enjoy legal protection.

The artificial wetlands identified by the NFEPA (2011) database were not assessed, as these are dams constructed specifically as part of the mining operations and were therefore not

considered relevant to this study. The artificial wetland was not identified by the NFEPA database and has been identified as a small depression-type wetland. The artificial wetland is located adjacent to a mining facility and formed when the old earthen dams associated with the mining activities were not decommissioned. Over a period of many years, water has collected within the former dams, and as there is not an efficient stormwater management system in place within the mining facility's parking / administration area, stormwater runoff collects in the "wetland", thus perpetuating the wetland conditions.

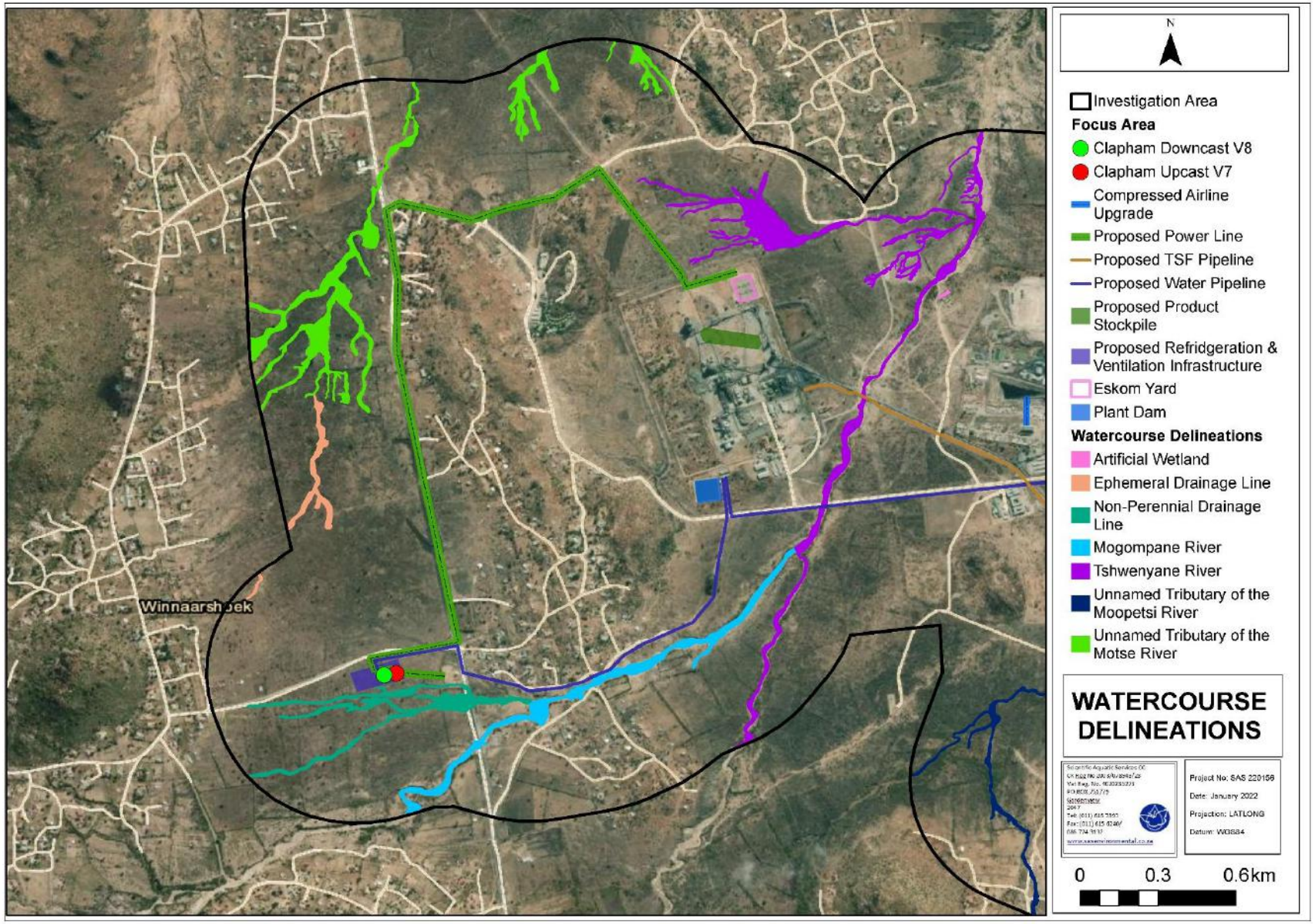


Figure 9: Location of the watercourses within the northern portion of the Focus Area, in relation to the infrastructure.

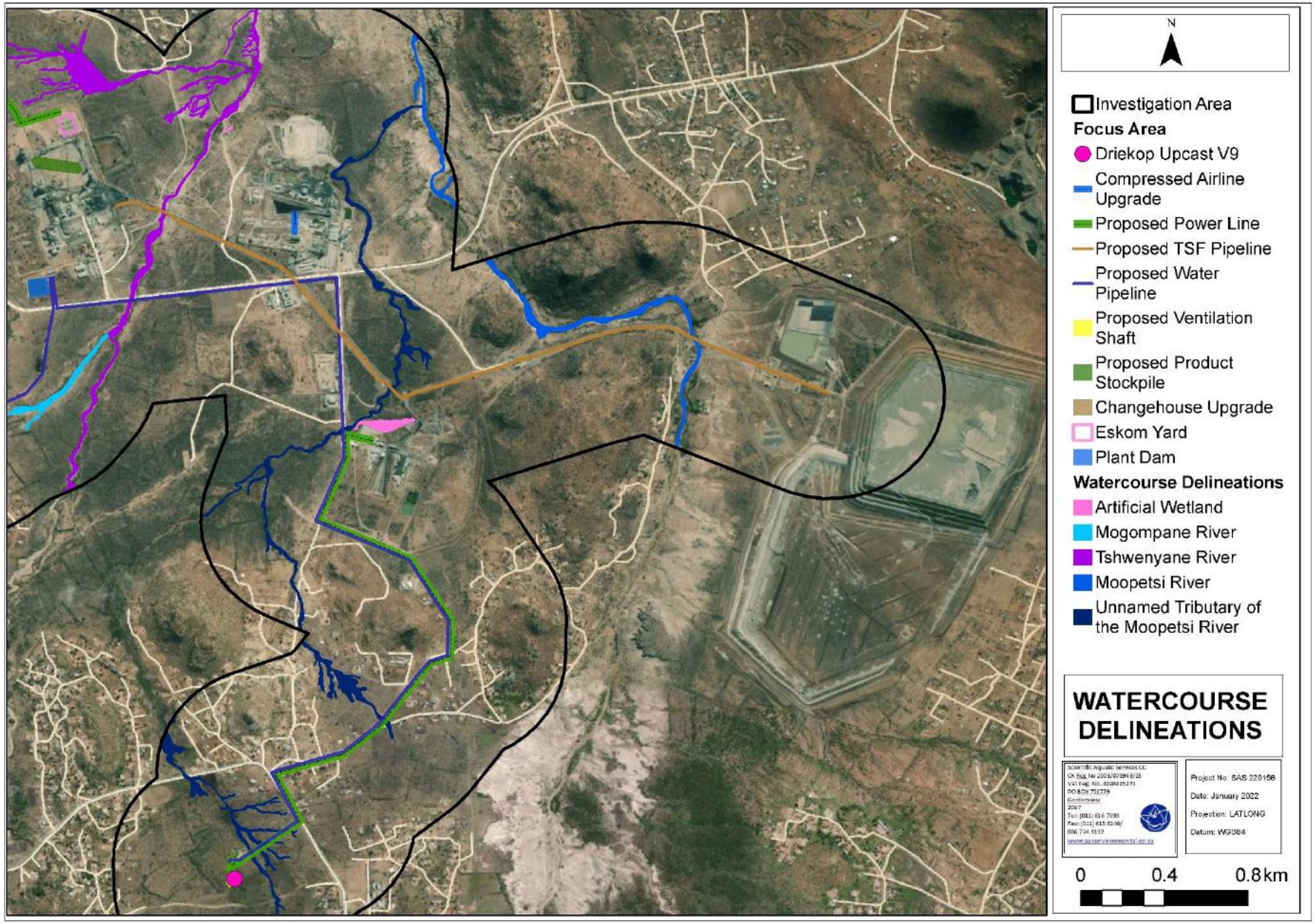


Figure 10: Location of the watercourses within the southern portion of the Focus Area, in relation to the infrastructure.

5.3 Field Verification Results

Following the site visit, various assessments were undertaken in order to determine the following:

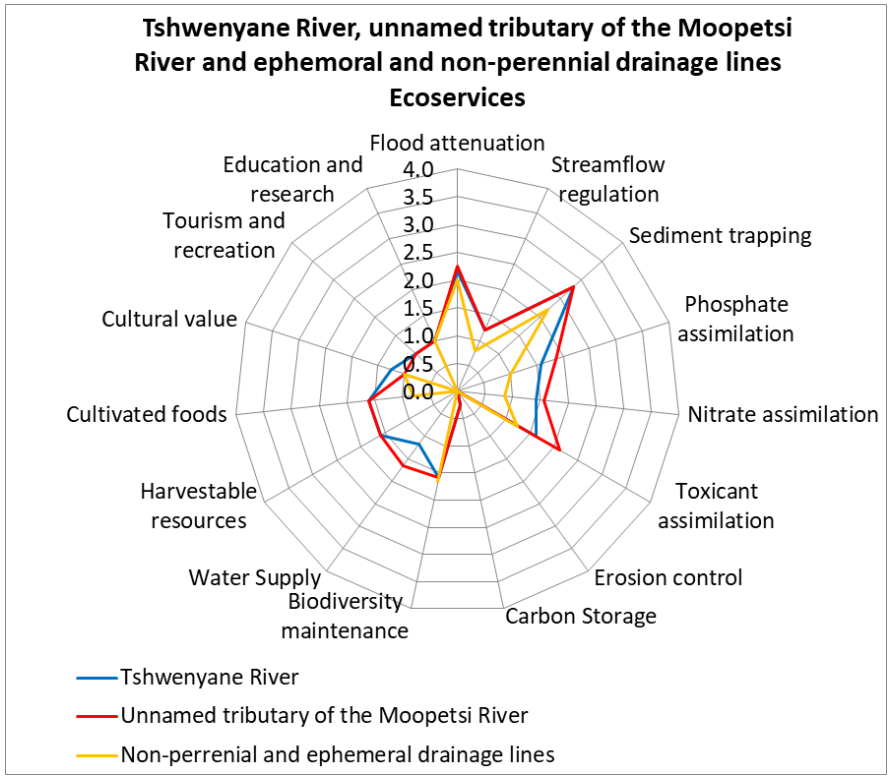
- PES, incorporating aspects such as hydrology, vegetation and geomorphology;
- Service provision of the watercourses, which incorporates aspects such as biodiversity maintenance, flood attenuation, streamflow regulation and assimilation, to name a few;
- The EIS is guided by the results obtained from the assessment of PES and service provision of the watercourses;
- An appropriate REC, RMO and BAS to guide the management of the watercourses. This is ideally assigned with the intent of enhancing the ecological integrity of the watercourse where feasible; and
- Assessment of impacts of the construction and operation of the proposed project components on the watercourse and receiving freshwater environment.

Watercourses within the 500 m investigation area were identified, however only portions located within the Focus Area were assessed and ground truthed and the potential impacts of activities such as livestock grazing, extensive erosion and clearing of natural vegetation within the greater catchment were taken into consideration during the assessment.

For the purposes of presenting a concise discussion, the Tshwenyane River, the unnamed tributary of the Moopetsi River and the non-perennial and ephemeral drainage lines, the results of the watercourse assessments are presented in one dashboard report below. The dashboard provides a summary of the ecological assessment of the watercourses in terms of relevant aspects (hydrology, geomorphology and vegetation components) associated with the watercourses. Due to the similar watercourse characteristics of the Tshwenyane River and unnamed tributary of the Moopetsi River and the fact that each of these watercourses have been subjected to the same anthropogenic impacts, the watercourses were assessed in a combined fashion. Further, the brief assessments of the ephemeral and non-perennial drainage lines were similarly combined. The details pertaining to the methodology used to assess the watercourses is contained in Appendix C.

Table 6: Summary of the assessment of the Tshwenyane River, unnamed tributary of the Moopetsi River, and ephemeral and non-perennial drainage lines.

Ecological & socio-cultural service provision graph:



Photograph notes: (Top left) The Tshwenyane River channel (with road crossing) associated with the location of the proposed water pipeline installation. (Top right) Non-perennial river channel showing vegetation presence of the Tshwenyane River. (Bottom left) Non-perennial drainage line at the proposed Clapham ventilation shaft, showing lack of riparian vegetation. (Bottom right) Non-perennial channel showing vegetation presence and degradation of the channel bank walls.

Present Ecological State

Riparian IHI PES Category:
Unnamed tributary of the Moopetsi River: D
Tshwenyane River: D

The IHI calculations for the unnamed tributary of the Moopetsi River, and the Tshwenyane River indicate that large modifications to the systems have occurred, and that the loss of natural habitat, biota and ecosystem functions is large. Historical and current small-scale agricultural activities, and the presence of mining activities within the Focus Area as well as the greater catchment area are the predominant modifiers to the systems. These factors, in conjunction with severely eroded soils within the systems, have resulted in

Watercourse characteristics:

a) Hydraulic regime

The extent to which hydrological regime and therefore related functions may have been altered as a result of in-stream placement of infrastructure such as bridge crossings is difficult to ascertain, since the watercourses are non-perennial/ ephemeral systems and very little to no flowing water was observed in any of the channels at the time of the assessment. However, it can be expected that flow patterns have been altered from their natural state as a result of infrastructure being placed within the active macro channels.

b) Water quality

There was insufficient water in the systems at the time of assessment to accurately sample water quality parameters, but that given the impacts in the catchment its likely to be impaired.

	loss of vegetation cover within the riparian zones, and where vegetation cover remains, the species composition consists primarily of alien vegetation or pioneer species. Loss of vegetation cover (in both the riparian and terrestrial ecosystems within the study area) and highly erodible soils has in turn led to severe bank incision and increased sediment inputs as a result of this are anticipated, thus altering the geomorphology of the systems.	**c) Geomorphology and sediment balance** Channels of the unnamed tributary of the Moopetsi River were shallow to deep and channel incisions were present ranging from slightly to heavily incised banks. Channels of the Tshwenyane River were wide and relatively shallow with a mixture of alluvial sand and large sections of exposed bedrock. Due to the inherent erodibility of soils in the area, erosion has occurred in and around the watercourses associated with Focus Area, although anthropogenic influences have exacerbated it. Mining related activities such as increased traffic, within both the Focus Area and catchment area likely to be responsible for further sediment inputs, particularly from the gravel roads, which will be transported to the rivers in runoff during rainfall events. As the rivers are seasonal, additional sediment inputs to the channels may result in an accumulation of sediment, leading to blockages of culverts and smothering of instream vegetation. Increased runoff during rainfall events is likely, as the extent of hardened surfaces (rooftops, roads, paved parking areas associated with mining infrastructure) due to increased development within the catchment. Whilst additional water inputs originating from such runoff may alter hydrological patterns to some extent, such alterations are unlikely to be significant. However, as the soils are prone to erosion, increased runoff, particularly if it is channelled, may lead to further erosion of riparian areas.
Ecoservice provision	**EcoService provision Category** **Unnamed tributary of the Moopetsi River: Intermediate** **Tshwenyane River: Intermediate** **Non-perennial and ephemeral drainage lines: Low** As shown by these results, the two river systems are considered to provide intermediate levels of ecological functioning and service provision. Functions which are strongly dependent on the presence of surface water and/or long periods of saturation (i.e. a permanent zone) such as streamflow regulation, toxicant assimilation and provision of water for domestic use are likely to fluctuate seasonally, given the ephemeral nature of these rivers. Functions such as flood attenuation on the other hand are more efficient when the system is not already saturated, as there is greater capacity for the reduction of flood peaks when the system is dry. Biodiversity maintenance is considered to be intermediate within both systems, primarily due to the extent of these rivers, their connectivity to natural areas and the locality within a relatively undeveloped catchment. Nevertheless, bush encroachment and proliferation of alien vegetation as a result of removal of indigenous floral species (resulting in habitat loss), alteration of the sediment and water quality regime, and the seasonal nature of these rivers all contribute to a lowered importance in terms of maintenance. The rivers were not considered to be important in terms of erosion control, considering the extensive bank erosion apparent at the time of the assessment.	**d) Habitat and biota** Although the Mining and Biodiversity Guidelines (Table 1) indicate “high biodiversity importance” throughout the Focus Area, areas around the ventilation shafts were found to be degraded. The floral community structure, composition and species throughout the Focus Area, in both terrestrial and riparian ecosystems, has been significantly transformed as a result of historical agricultural activities (commercial and small-scale subsistence crop cultivation), overgrazing by livestock such as goats and cattle, and mining activities. Loss of vegetation cover resulting primarily from overgrazing has resulted in large expanses of exposed soils, leading to severe and widespread erosion in many areas, whilst levels of bush encroachment by indigenous species such as *Dichrostachys cinerea* (Sickle bush) and proliferation of alien vegetation such as *Agave sisalana* and *Zinnia peruviana* in some areas is high. The rivers and tributaries are characterised by a weakly developed and moderately degraded riparian habitat. As these systems receive very little rain, flowing only after adequate rain events, water does not accumulate long enough for distinct riparian vegetation to develop. As such the riparian vegetation included a species composition similar to that of the surrounding bushveld vegetation. However, in several sections the vegetation structure did in fact differ from surrounding vegetation in that the woody component was denser. It should be noted that several upstream sections of the rivers have severe erosion and bank incision, owing to exposed soils and bare areas in such places, where little or no vegetation was present (i.e. the riparian vegetation is not continuous along these systems). The unnamed tributary, on the other hand, is characterised by a more continuous vegetation layer that, in several areas, have been overgrown / encroached upon by woody species, potentially attenuating flow during rain events. For the non-perennial and ephemeral drainage lines, no distinct change in vegetation structure or species composition could be discerned. No riparian vegetation can thus be linked to these systems. The drainage lines were largely characterised by a lack of graminoid cover (though this could be due to season of study and overgrazing, which is prevalent in the area) with woody species occurring sporadically along, or within, these drainage lines.

	In terms of socio-cultural service provision, the rivers are considered to be an important – albeit seasonal - source of water for the local communities. The presence of spoor along the embankments of both watercourses indicates that they are utilised by domestic livestock. The potential for provision of harvestable resources (for example, reeds) exists primarily due to the location within a relatively rural setting, although few such resources were observed. It was not possible to definitively ascertain whether any cultural value is appended to the rivers by the local communities; however, it is assumed that due to the location and numerous small settlements in the vicinity of the rivers, there may be some cultural value associated with these resources. The non-perennial and ephemeral drainage lines score low considering their low vegetation presence and attenuating traits.	**REC / RMO / BAS Category**	**Unnamed tributary of the Moopetsi River / Tshwenyane River:** **REC:D/D: Maintain** **RMO: D/D: Maintain** **BAS: Maintain** These assessments show that all riparian non-perennial and ephemeral watercourses within the study area have undergone significant levels of transformation as a result of historical and current agricultural practices, and to a slightly lesser extent as a result of mining activities. These systems are located in an area that is of moderate ecological and sensitivity importance and therefore management objectives should aim to maintain the ecological status of the watercourses. Where applicable and feasible, mitigation measures to minimise the impacts associated with Marula Platinum mining activities must be implemented in order to retain current levels of ecological integrity and functioning. It is preferable however that suitable bank erosion rehabilitation measures be implemented, particularly in sections of the Moopetsi and Tshwenyane Rivers in close proximity to mining activities and related disturbances.
EIS discussion	**EIS Category for the Tshwenyane River, the Unnamed tributary of the Moopetsi River, and the non-perennial and ephemeral drainage lines: C Moderate** These results indicate that the unnamed tributary of the Moopetsi River and the Tshwenyane River fall within EIS Category C, indicating that these watercourses are considered to be low in biodiversity support and low in ecological importance and sensitivity at a landscape level, however the private protection of the watercourses by the mine increases the ecological importance and sensitivity on a provincial and local scale.	**Possible significant impacts, business case, conclusion, and mitigation requirements:**	Human land uses, arid climatic conditions and the erosive nature of soils found within the Marula MRA infers a high vulnerability to erosion and sedimentation of identified watercourse channels. Current and historical platinum mining infrastructure and activities (roads, pipelines, powerlines, platinum mining activities and operations) and small-hold agricultural activities (livestock grazing) within the catchment, along with the possible domestic use by residents of the rural town of Galane, add to the largely modified/ degraded status of the watercourse channels identified and further exacerbate inherent erosional impacts of the landscape. Disturbances within the landscape and watercourse channels have also encouraged a high rate of bush encroachment and alien invasive plant proliferation, impacting the distribution and retention of water in the landscape. Therefore, it is highly recommended that stored indigenous vegetation removed during site preparation and construction phases and newly introduced indigenous vegetation be planted in exposed and disturbed patches in locations around activities in order to limit erosion and sediment thereof. Any areas where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible. This will ensure that watercourses are not impacted further and that ecosystem service provision is sustained in terms of retaining and distributing water in the landscape and supporting riparian habitats and biota.

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5.4 Sensitivity Mapping

5.4.1 Legislative Requirements, national and provincial guidelines pertaining to the application of 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 to be 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 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).

Legislative requirements were used to determine the extent of buffer zone required for each watercourse depending on whether a group is considered wetland/riparian habitat or not. The Tshwenyane River and unnamed tributary of the Moopetsi River, as well as the non-perennial drainage lines with riparian characteristics are defined as watercourses. If any activities involving the proposed mine ventilation shaft, associated infrastructure, and product stockpile are to take place within 100 meters or the 1:100 year flood lines, exemption in terms of Regulation GN 704 of the National Water Act, needs to be obtained. For activities relating to the water pipeline and powerline installation, GN509 of 2016 as it relates to the National Water Act will also apply and therefore a Water Use License will be required.

Table 7: 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).	General 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 21c and 21i 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 500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation, as well as General Notice no. 509 of 2016 as it relates to the National Water Act.
	Government Notice 704 Regulations as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 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 project complies 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 floodline 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 107 of 1998) EIA Regulations (2014).	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act 107 of 1998) EIA regulations, 2014 (as amended) states that: *The development of:* *(xii) Infrastructure or structures with a physical footprint of 100 square meters 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.*

The delineated watercourse and applicable zones of regulation in terms of NEMA and the National Water Act (GN704 and GN509) are conceptually depicted in Figures 9 and 10 below.

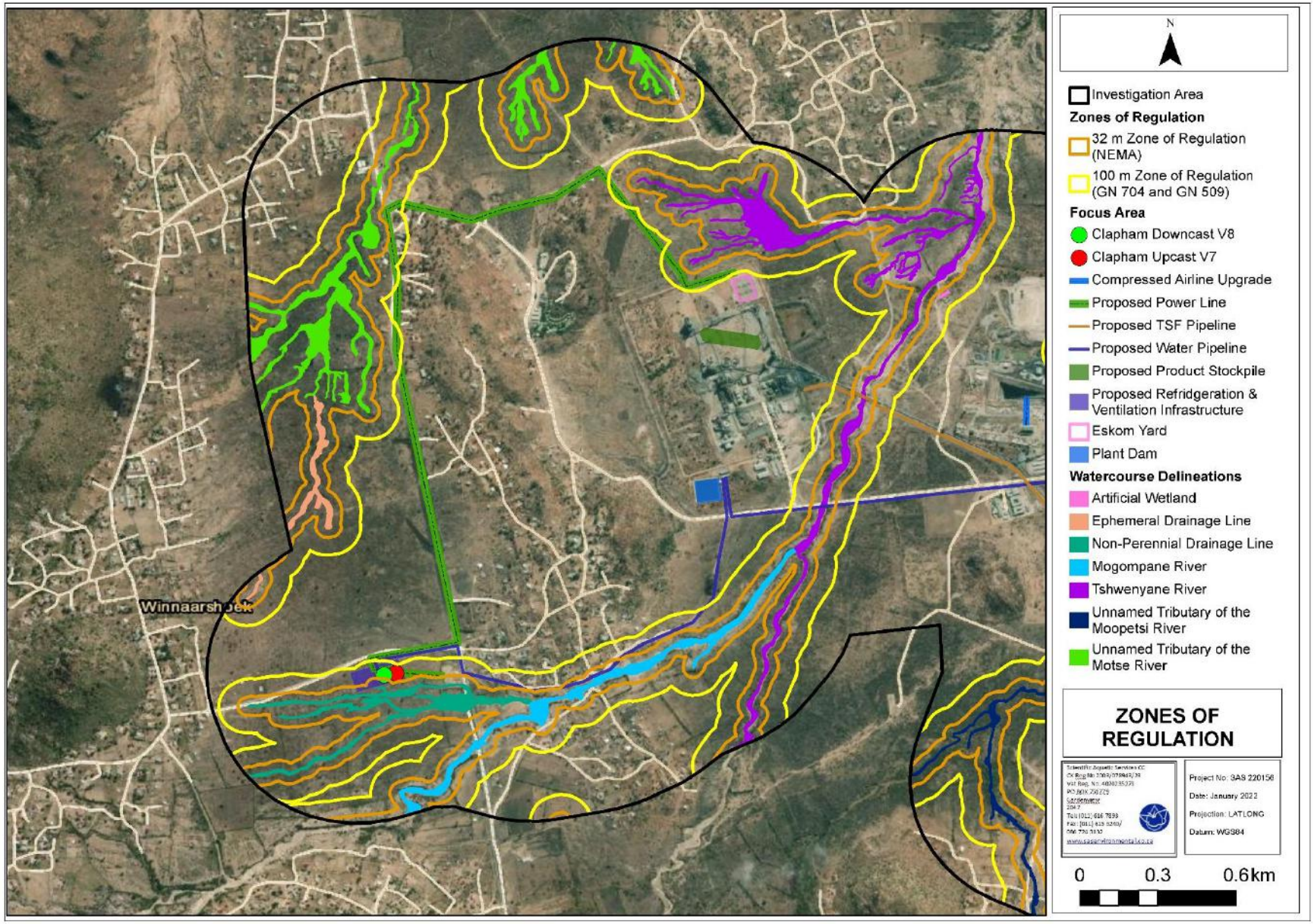

Figure 11: Conceptual presentation of the zones of regulation applicable to the western watercourses in terms of NEMA, and GN704 and GN509 as they relate to the National Water Act in relation to the watercourses.

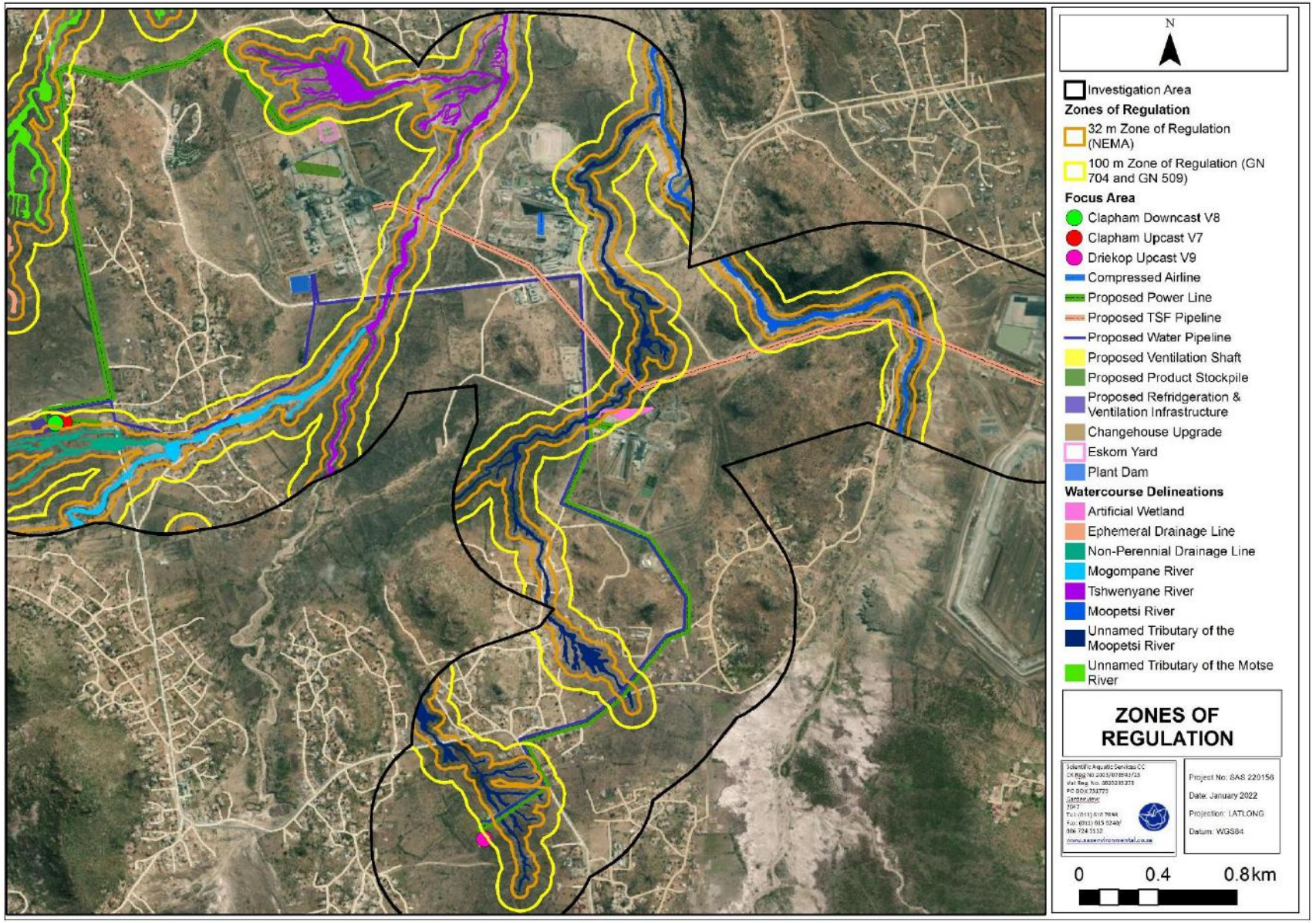

Figure 12: Conceptual presentation of the zones of regulation applicable to the eastern watercourses in terms of NEMA, and GN704 and GN509 as they relate to the National Water Act in relation to the watercourses.

6 IMPACT AND RISK ASSESSMENTS

This section presents the significance of potential impacts on the watercourses associated with the proposed project components. In addition, it indicates the required mitigatory measures needed to minimise the potential impacts of the proposed development and presents an assessment of the significance of the impacts prior and taking into consideration the available mitigatory measures and assuming that they are fully implemented. The impact significances were determined using the method provided by the Environmental Assessment Practitioner (EAP) (SLR Consulting (Pty) Ltd) and the DWS Risk Assessment Matrix (2016).

The results of the SLR Consulting Impact Assessment as presented here will be utilised in the Basic Assessment application, whilst the results of the DWS Risk Assessment will be utilised to determine the necessity for a Water Use Licence (WUL) application in consultation with the relevant competent authority. Thus, although the DWS Risk Assessment and the SLR Consulting Impact Assessment may present different scores for the same activity, this is due to differences in their methodologies (refer to Appendix D) and not due to inconsistencies in their application, and each will be judged individually for their specified purpose as discussed above.

The impact and risk assessments were based on the layout as provided by the proponent, which indicates that the proposed ventilation shafts and associated infrastructure, powerlines, and water pipelines will be constructed in close proximity to (within 32 m), and in some cases through the watercourses identified within the Focus Area.

6.1 Consideration of impacts and application of mitigation measures

Impact assessments were undertaken to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the identified watercourses. The results of the impact assessments are presented in Tables 6 to 11 below.

- The SLR Consulting Impact Assessment was applied twice, first to ascertain the impact significance in the absence of mitigation, and then to ascertain the perceived impact assessment assuming that mitigation measures are implemented;

- The DWS Risk Assessment was applied once, assuming that a high level of mitigation is implemented, thus the results of the risk assessment provided in this report present the perceived impact significance post-mitigation;
- In applying both methods, it was assumed that the mitigation hierarchy as advocated by the DEA *et al* (2013) would be followed, i.e., the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- It is assumed that appropriate mitigation measures have already been implemented for existing mining related infrastructure that does not fall within the scope of this investigation. This includes the existing concentrator plant where the proposed product stockpile is located, therefore the impacts of the proposed product stockpile on watercourses is considered minimal and no further assessment is required. Notwithstanding this, it is strongly advised that the edge effects of activities including bush encroachment, soil erosion, and alien/ weed control be strictly managed around the concentrator plant;
- At the time of this assessment, the watercourses associated with the proposed project components were deemed to be in a severely modified ecological state, and of moderate importance and sensitivity;
- Most impacts are considered to be easily detectable; however, impacts such as surface and/or groundwater contamination would entail specific monitoring to ascertain the occurrence of impacts;
- The impact assessment was applied taking into consideration the chronological order of activities;
- In the DWS Risk Assessment, the default score for legal issues (for all watercourses proposed to be traversed by linear infrastructure and that associated with Clapham Ventilation Shafts 7 and 8) is '5' since some activities, as listed in Tables 6 to 8, will be located within the 100 m ZoR in terms of GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- The activities relating to the proposed project components are all considered to be highly site specific, not of a significant extent relative to the area of the watercourses assessed, and therefore have a limited spatial extent;
- While the operation of some of the proposed project components will be a permanent activity, the construction thereof is envisioned to take no more than a few months. However, the frequency of the construction impacts may be daily during this time; and
- It is highly recommended that the proponent make provision for small-scale rehabilitation of the areas of the watercourses which may be directly impacted upon by construction activities. The area must preferably be rehabilitated to conditions as close as possible to the "natural" state, not the pre-construction state since the state

of the watercourses is deemed to be significantly altered from the reference condition. This will ensure that the ecological condition of the watercourse reaches associated with the proposed project activities are maintained and where feasible, improved.

6.1.1 Impact discussion and essential mitigation measures

There are four key ecological risks on the assessed watercourses that were assessed, namely:

- Loss of watercourse habitat and ecological structure resulting in impacts to vegetation;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the watercourses; and
- Impacts on water quality.

The outcomes of the impact assessments are summarised in the tables below, after which a discussion thereof follows.

Table 8: Summary of the DWS Risk Assessment applied to the proposed powerlines.

No.	Phases	Activity	Aspect	Impact	Risk Rating	Confidence level	Control Measures
1	**Planning phase of 33kV overhead transmission powerlines**	Planning and site preparation prior to construction activities associated with the construction of the powerlines.	Potentially inadequate or unsuitable design of infrastructure leading to changes to watercourse characteristics	Tower bases constructed within 32 m of watercourses may lead to erosion and sedimentation of riparian resources, arising from increased runoff due to cleared areas, thus leading to loss of riparian habitat; and *The alteration to stream flow patterns due to support structures placed in the channel.	**L**	**70**	*Where feasible, towers must be positioned in locations that do not fall within the NEMA 32 m zone of regulation. Should engineering constraints prevent this, no towers may be placed within the regulated zone, but not directly within watercourses; *Where possible it is recommended to construct powerlines in close proximity of existing powerlines in order to minimize the proposed powerline footprint; and *Construction must preferably take place in the dry season where no rainfall will be experienced.
2	**Construction Phase of 33kV overhead transmission powerlines**	Site preparation prior to construction activities including placement of contractor laydown areas and storage facilities.	*Disturbance/ compaction of soils from heavy construction vehicles and laydown facilities; *Removal of vegetation at powerline tower locations; and *Oil contamination from construction vehicles.	*Vehicular movement and access to the site, and the removal of riparian vegetation and associated disturbances to soils within the Focus Area could lead to: *stormwater runoff from the reduced infiltration, flood water discharge, and velocity increases from hardened surfaces causing erosion of the landscape and channel banks, and subsequent sedimentation of the channel bed. Sedimentation can lead to suffocation of vegetation, destroying sensitive freshwater habitats; *Decreased ecoservice provision (e.g. flood attenuation, sediment trapping and nutrient and toxicant assimilation); *Proliferation of alien vegetation as a result of disturbances; *Vegetation degradation, and the subsequent loss of breeding and foraging habitat for watercourse-dependent fauna; *Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles	**L**	**70**	*Edge effects of activities including bush encroachment, erosion, and alien/ weed control need to be strictly managed in these areas; *Drip trays must be located beneath any parked and leaking equipment along with lubricant/fuel absorbing media (moss type products) within the drip trays to contain spilt material and avoid groundwater pollution. **Mixing of concrete;** *Should concrete to be mixed be used, all wet and dry material should be stored within the contractor laydown areas and should be covered and contained to prevent contact with rainfall or runoff; *Concrete mixing/ batching must be undertaken on an impermeable surface to prevent soil and groundwater pollution. The following recommendations must be adhered to:

				can infiltrate soils and runoff into surrounding watercourses, impacting watercourse water quality, habitat, and biota downgradient of the contamination site.			• A washout area should be designated outside of the watercourses and associated 100m buffer and wash water should be treated on-site or discharged to a suitable sanitation system (USEPA. 2005); • Cement bags must be disposed of in the demarcated hazardous waste receptacles and the used bags must be disposed at a designated hazardous waste disposal facility; and • Spilt or excess concrete must be disposed of at a suitable landfill site. Chain of custody documentation must be kept available at site; **Disturbed and compact soils:** *Careful planning must take place to ensure a free draining landscape that allows water to drain towards the watercourses in a natural manner with specific mention of the following: • Ensure that runoff occurs in a natural diffuse manner with no unnatural concentration of flow; • Ensure that no areas of unnatural ponding occur due to a lack of runoff potential; • In steep areas ensure that energy dissipation takes place to ensure that water leaving the site does so without reaching critical levels which would lead to erosion; and • Ensure that runoff does not lead to excessive sedimentation in area; *All sediment stockpiles must be removed to a suitable landfill facility to ensure that stockpile surfaces in the area will not contribute to the contaminant land of any overland water flow;
3		Construction of the powerline towers in close proximity to and within watercourses	*Excavation, removing and stockpiling soil (topsoil) for tower cavity; and *Infilling base structure/ cavity with concrete mixture.	*Earthworks within watercourse, leading to loss of habitat, disturbance of soils and loss of ecoservices such as biodiversity maintenance, flood attenuation, nutrient assimilation; *Cement that enters a watercourse will raise the pH (resulting in high alkalinity), which can be toxic to aquatic life, changing the riparian ecology; *Stockpiling of sediment adjacent to riparian areas and runoff from stockpiles can lead to changes in riparian habitat; and *Removing sediment will have a direct loss on habitat at removal site.	**L**	**70**	
4			Clearing and levelling of land for the installation of the powerlines, including infilling and levelling of the watercourse, and removal of riparian vegetation.	*Construction can cause unnatural concentration of flow, unnatural ponding occurs due to a lack of runoff potential, changing the water retention and distribution in the landscape; or *In steep areas the high energy of water leaving the site can reach critical levels leading to erosion.	**L**	**70**	
5		Infrastructure Transportation and Storage	Potential for indiscriminate movement of vehicles through the riparian zone.	*Disturbances of soils leading to increased alien vegetation proliferation, and in turn to further altered riparian habitat; *Altered runoff patterns, leading to increased erosion and sedimentation of instream and riparian habitat; and *impacts on surface water quality due to pollution.	**L**	**70**	
6			Potential placement of contractor laydown areas, and/or potential indiscriminate storage of powerline infrastructure and construction equipment within the riparian zone and/or ZOR.		**L**	**70**	

							*Soil stockpiles may not be contaminated, and it must be ensured that the minimum surface area is taken up; The height of soil stockpiles must be in line with the existing EMPr, or an approved soil management plan if there is one in place; *No temporary stockpiling of soils is to take place within 10 m of the watercourses, should be placed on the downgradient side of the watercourses so as to prevent transport of sediment in stormwater runoff into the watercourses, and as far as practical, all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the watercourses; *Stockpiled soil must be levelled as required during construction and post-construction to avoid sedimentation from runoff, and revegetated with indigenous vegetation; and *Areas where soil has been disturbed must be suitably compacted (using handheld equipment) to minimize any erosion and subsequent sedimentation. **Vegetation**: *The time period of soil exposure must be kept to a minimum to limit the potential movement of sediments to downstream reaches of watercourses; *As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soil; *All vegetation clearing to be limited to the footprint of the proposed activity; *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; *An alien vegetation management plan must be compiled by a suitably qualified specialist, and implemented at the outset of the proposed activity, in order to minimize the risk of further proliferation

							of alien floral species in the areas surrounding the study area; *Compacted soil should be ripped, reprofiled and reseeded with indigenous vegetation following construction; and *Removed alien invasive plant material must be disposed of at a registered garden refuse site and may not be burned or mulched on site.
7	**Operational Phase of 33kV overhead transmission powerlines**	*Long term operation of the powerlines; *Potential increased traffic adjacent to the affected reaches of the associated Rivers (Eskom service vehicles); and *Potential indiscriminate movement of maintenance vehicles within riparian zone and ZOR.	*Maintenance of power line infrastructure in the vicinity of the riparian zone; and *Cleared and hardened surfaces and natural erodibility of the soil.	*Erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, leading to loss of riparian habitat of watercourses downgradient from the powerline towers; *Disturbance to soils and ongoing erosion as a result of periodic maintenance activities. *Altered water quality as a result of increased availability of pollutants.	**L**	**70**	*Stored indigenous vegetation removed during pre-construction and construction phases should be replanted in exposed and disturbed patches around the tower bases in order to limit erosion around the bases, and potential sedimentation of any adjacent watercourses; *Reprofiling of soil and revegetation of areas disturbed as a result of the construction of powerlines must take place immediately after completion of construction with indigenous vegetation and monitored during the operational phase; *Any areas where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible; and *Maintenance vehicles to stay out of watercourses where possible.

Table 9: Summary of the DWS Risk Assessment applied to the proposed water pipelines (including the TSF pipeline).

No.	Phases	Activity	Aspect	Impact	Risk Rating	Confidence level	Control Measures
1	**Pre-construction phase of pipelines**	Planning and site preparation prior to construction activities associated with the construction of the pipelines.	Potentially inadequate or unsuitable design of infrastructure leading to changes to watercourse characteristics	*Pipelines constructed within 32 m of, or over watercourses will have consequences on the natural buffer zone of the watercourses, leading to erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, thus leading to loss of riparian habitat;	L	70	*According to the assessed layout, all watercourse crossings are located within existing road servitudes. This must remain the case, as this will reduce the significance of cumulative or latent impacts on the affected watercourses.
2	**Construction Phase of pipelines**	Site preparation prior to construction activities.	*Removal of vegetation a site clearing at the water pipeline locations; *Disturbance/ compaction of soils from heavy construction vehicles; *Oil contamination from construction vehicles.	*Exposure of soil can result in erosion; *Stormwater runoff from the reduced infiltration, flood water discharge, and velocity increases from hardened surfaces causing erosion of the landscape and channel banks, and subsequent sedimentation of the channel bed. Sedimentation can lead to suffocation of vegetation, destroying sensitive freshwater habitats; and *Increased proliferation of alien vegetation as a result of disturbances; *Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles can infiltrate soils and runoff into surrounding watercourses, impacting watercourse water quality, habitat, and biota downgradient of the contamination site.	L	70	* Edge effects of activities including bush encroachment, erosion, and alien/ weed control need to be strictly managed in these areas; *Drip trays must be located beneath any parked or leaking equipment along with lubricant/fuel absorbing media (moss type products or sawdust) within the drip trays to contain spilt material and avoid groundwater pollution; Vegetation: Refer to mitigation measures pertaining to vegetation in Table 6.
3		Installation of HDPE water supply and wastewater pipelines	Trenching along existing road in close proximity to watercourses, as well as through watercourses,	*Removing sediment will have a direct loss on habitat at removal site; *Stockpiling of sediment adjacent to riparian areas and runoff from stockpiles can lead to changes in riparian habitat; *Backfilling trench; and *Construction edge effects.	L	70	***During trenching:** -It is imperative that trenching occurs in the dry season where there is minimal impact on the seasonal nature of watercourses that may be excavated; -soil must be stockpiled upgradient of the trench; -Mixing of the lower and upper layers of the excavated soil should be kept to a minimum in order to ensure the

			stockpiling, and backfilling soil for pipeline construction.				subsurface flow of water is not impacted and the underlying clay layer is reinstated; -The excavated soil must be used to backfill the trenches, immediately after installation of the pipeline; -The soil must be replaced in the same layers as which it was extracted; -The infilled trenches must be level with the surrounding area and compacted to prevent alteration to the flow patterns, formation of preferential flow paths or erosion from occurring; -The construction footprint must be limited to the width of the trench and an additional 5 m buffer (to allow for the stockpiled soil and movement of personnel and construction equipment); -The area must be rehabilitated after the completion of the construction phase, including revegetation thereof with indigenous wetland vegetation; and -The eradication of alien vegetation within the footprint area must be undertaken.
4	**Operational Phase of pipelines**	Operation of the pipelines	Cleared and hardened areas and natural erodibility of the soil.	*Erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, leading to loss of riparian habitat of watercourses downgradient form the pipelines.	**L**	**70**	*Stored indigenous vegetation removed during pre-construction and construction phases needs to be replanted in exposed and disturbed patches around the pipelines in order to limit erosion and sedimentation of any associated watercourses; *Reprofiling of soil and revegetation of areas disturbed as a result of the construction of pipelines must take place immediately after completion of construction and monitored during the operational phase; and *Any areas where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible.
5			Potential leakage of water from the pipeline.	*Possible incision and alteration of the hydroperiod of the watercourse system.	**L**	**70**	*It is recommended that the integrity of the pipeline be tested at least once every five years or more often should there be any sign of a leak; *It should be ensured that the hydrological regime of the watercourses not be impacted as a result of leaks or bursting of the pipeline, and that an emergency plan should be compiled to ensure a quick response and

							attendance to the matter in case of a leakage or bursting of the pipeline: and *Maintenance vehicles to stay out of watercourses where possible

Table 10: Summary of the DWS Risk Assessment applied to the proposed ventilation shafts and associated infrastructure.

No.	Phases	Activity	Aspect	Impact	Risk Rating		Control Measures
1	**Pre-construction phase of ventilation shafts**	Planning and site preparation prior to construction activities associated with the establishment of new ventilation shafts and associated refrigeration and ventilation infrastructure.	Potentially inadequate or unsuitable design of infrastructure leading to changes to watercourse characteristics.	*Vents constructed within 32 m of watercourses will have consequences on the natural buffer zone of the watercourses, leading to erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, potentially leading to alterations to or loss of riparian habitat.	**L**	**70**	*Although it is acknowledged that optimization of the proposed vent shaft footprints has been undertaken, should the opportunity arise for further optimization of the footprint, it is preferred that they be positioned outside the applicable Zones of Regulation (NEMA and GN704) if feasible. If this is not possible, strict enforcement of mitigation measures during all phases is essential, including undertaking construction during the dry season if at all possible.
2	**Construction Phase of ventilation shafts**	Site preparation prior to construction activities..	*Removal of vegetation a site clearing at the water pipeline locations; *Disturbance/ compaction of soils from heavy construction vehicles; *Oil contamination from construction vehicles.	*Exposure of soil can result in erosion; *stormwater runoff from the reduced infiltration, flood water discharge, and velocity increases from hardened surfaces causing erosion of the landscape and channel banks, and subsequent sedimentation of the channel bed. Sedimentation can lead to suffocation of vegetation, destroying sensitive freshwater habitats; *Increased proliferation of alien vegetation as a result of disturbances; and *Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles can infiltrate soils and runoff into surrounding watercourses, impacting watercourse water quality, habitat, and biota downgradient of the contamination site.	**L**	**70**	*Edge effects of activities including bush encroachment, erosion, and alien/ weed control need to be strictly managed in these areas; *Drip trays must be located beneath any parked and leaking equipment along with lubricant/fuel absorbing media (moss or sawdust type products) within the drip trays to contain spilt material and avoid groundwater pollution; **Mixing of concrete:** Refer to mitigation measures pertaining to Mixing concrete in Table 6. **Disturbed and compacted soils:**

3		Establishment of new ventilation shaft, surface main fans, electrical rooms, and bulk air cooler.	*Removing and stockpiling soil for vent shaft; *Infilling base cavity with concrete mixture; *Land elevation changes due to earthworks; and *soil compaction.	*Removing sediment will have a direct loss on habitat at removal site; *Stockpiling of sediment adjacent to riparian areas and runoff from stockpiles can lead to changes in riparian habitat; *Construction edge effects; *Cement that enters a watercourse will raise the pH (resulting in high alkalinity), which can be toxic to aquatic life, changing the riparian ecology; *Construction can cause unnatural concentration of flow, unnatural ponding occurs due to a lack of runoff potential, changing the water retention and distribution in the landscape; or *In steep areas the high energy of water leaving the site can reach critical levels leading to erosion.	L	70	*Careful planning must take place to ensure a free draining landscape that allows water to drain towards the watercourses in a natural manner with specific mention of the following: • Ensure that runoff occurs in a natural diffuse manner with no unnatural concentration of flow; • Ensure that no areas of unnatural ponding occur due to a lack of runoff potential; • In steep areas ensure that energy dissipation takes place to ensure that water leaving the site does so without reaching critical levels which would lead to erosion; and • Ensure that runoff does not lead to excessive sedimentation in area; **Vegetation**: Refer to mitigation measures pertaining to vegetation in Table 6.
4	**Operational Phase of ventilation shafts**	Operation of the new ventilation shafts, surface main fans, electrical rooms, and bulk air cooler	Cleared and hardened areas and natural erodibility of the soil; * Leakage of wastewater, which may emanate from the refrigeration process at ventilation shafts, into surrounding environment	*Erosion and sedimentation of riparian resources arising from increased runoff due to cleared areas, leading to loss of riparian habitat of watercourses downgradient form the ventilation shafts; and wastewater that enters the surrounding environment can have water quality impacts.	L	70	*Stored indigenous vegetation removed during pre-construction and construction phases need to be replanted in exposed and disturbed patches around the bases in order to limit erosion thereof and possible sedimentation of adjacent watercourses; *Reprofiling of soil and revegetation of areas disturbed as a result of the construction of product stockpiles must take place immediately after completion of construction with indigenous vegetation and monitored during the operational phase; *Any areas where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible; and *Maintenance vehicles to stay out of watercourses where possible

Table 11: Summary of the SLR Consulting Impact Assessment applied to the proposed powerlines.

Construction Phase	Management	Intensity / Severity	Duration	Extent / Spatial	Probability of exposure	Consequence	Significance
Construction	Unmanaged	L	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL
Operations	Unmanaged	L	M	VL	H	L	L
	Managed	VL	L	VL	M	VL	VL
Closure and post closure	Unmanaged	L	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL

Table 12: Summary of the SLR Consulting Impact Assessment applied to the proposed water pipelines (including the TSF pipeline).

Construction Phase	Management	Intensity / Severity	Duration	Extent / Spatial	Probability of exposure	Consequence	Significance
Construction	Unmanaged	L	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL
Operations	Unmanaged	L	M	VL	H	L	L
	Managed	VL	L	VL	M	VL	VL
Closure and post closure	Unmanaged	M	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL

Table 13: Summary of the SLR Consulting Impact Assessment applied to the proposed ventilation shafts and associated infrastructure.

Construction Phase	Management	Intensity / Severity	Duration	Extent / Spatial	Probability of exposure	Consequence	Significance
Construction	Unmanaged	L	L	VL	H	L	L
	Managed	VL	L	VL	M	VL	VL
Operations	Unmanaged	L	M	VL	H	L	L
	Managed	VL	L	VL	M	VL	VL
Closure and post closure	Unmanaged	M	L	VL	H	L	L
	Managed	VL	VL	VL	M	VL	VL

As illustrated in the tables above, the impact significance of the majority of the proposed activities are considered low. Mitigation measures were developed to guide the proposed activities in the vicinity of the freshwater systems. These mitigation measures are presented in Tables 6 to 8 as part of the DWS Risk Assessment.

According to the SLR Impact Assessment, the perceived impacts that may result from the proposed project components have low risk significance on the Tshwenyane River, the

unnamed tributary of the Moopetsi River and the non-perennial and ephemeral drainage lines found within the investigation area. With the implementation of mitigation measures (Tables 6 to 8), as per the DWS Risk assessment, the proposed project components pose a low risk significance to the identified watercourses.

Mitigation methods proposed for activities involving watercourses significantly contribute to keeping the risk significance low. This is owing to the already degraded landscape and the need for management measures in order to maintain its ecological state. Further, the non-perennial nature of the watercourses, where flow and wet response by riparian features are only experienced intermittently according to season, impacts to watercourses will occur seasonally too, so while impacts may occur, the period over which water flows in channels is limited and therefore no significant impacts are likely to occur downstream. Hence it is imperative that construction of the proposed project components takes place in the dry season and that stormwater runoff measures are prepared for when rainfall does occur. Nevertheless, reaches of the various watercourses that are traversed by linear infrastructure, or which are located within 50 m of other surface infrastructure such as the vent shafts, may potentially show signs of latent impacts, in particular, erosion since the soil in the area is naturally prone to erosion. This in turn may lead to incision and gully formation as already observed within the MRA, and over time may result in the modification of watercourses to the extent that they are no longer able to support riparian vegetation. Therefore, ongoing monitoring of such crossings and surface infrastructure areas is essential to detect the effects of possible latent impacts.

Additional “good practice” mitigation measures applicable to a project of this nature are provided in Appendix F of this report.

7 CONCLUSION

Human land uses, semi-arid climatic conditions and the erosive nature of soils found within the Marula MRA infers a high vulnerability to erosion and sedimentation of identified watercourse channels. Current and historical platinum mining infrastructure and activities (roads, pipelines, powerlines, platinum mining activities and operations) and small-scale agricultural activities (livestock grazing) within the catchment, along with the possible domestic use by the residents of the rural town of Galane, contribute to the largely modified/ degraded status of the watercourse channels identified and further exacerbate inherent erosional impacts of the landscape.

Cleared sites and compacted ground from mining infrastructure and roads exacerbate stormwater runoff impacts, where the removal of vegetation and hardening of surfaces increases the impacts created by seasonal rainfall events. The subsequent decrease in soil infiltration and flood water discharge leads to an increased velocity of water flowing over the land. The increased velocity of water causes incising of channel banks and beds. Sediment removed from bank erosion is then deposited further downstream, suffocating vegetation, and causing sediment accumulation within the associated channel and the loss of ecoservices such as biodiversity maintenance, flood attenuation and nutrient assimilation.

Mining infrastructure and toxic residue on roads (left behind from vehicles) may leave stormwater water runoff impaired in terms of physical-chemical parameters causing impacts on the immediate and downstream users. Disturbances within the landscape and watercourse channels have also encouraged a high rate of bush encroachment and alien invasive plant proliferation, impacting the distribution and retention of water in the landscape. Similar disturbances and impacts to vegetation and soils are afforded by the poor livestock management that currently occurs in the catchment. Overgrazing by livestock has cleared and trampled vegetation and soils, leaving soil compact and exposed and destabilizing watercourse channel banks, degrading channels further. The site is EIS Category C which suggests the site's ecological state, at minimum be maintained. In order to achieve this or an improved state mitigation measures should be strictly implemented.

The PES, EIS and contribution to ecological and socio-cultural functioning were assessed during a single site visit undertaken mid November 2020, prior to the area receiving any significant rainfall, and following prolonged dry conditions. The results of the assessment are summarised in the table below:

Table 14: Summary of results of the field assessment as discussed in Section 5.

HGM Unit	PES	Ecoservices	EIS	REC / RMO / BAS
Unnamed tributary of the Moopetsi River	D	Intermediate	Moderate	D / D / Maintain
Tshwenyane River	D	Intermediate	Moderate	D / D / Maintain
Non-perennial and ephemeral drainage lines without riparian vegetation	N/A	Low	Moderate	N/A

Adherence to cogent, well-conceived and ecologically sensitive site development plans, the mitigation measures provided in this report as well as general good construction practice and ongoing management, maintenance and monitoring, are essential if the significance of perceived impacts is to be reduced to limit further degradation to the freshwater environment. If strong adherence to existing water use license conditions and the proposed mitigation

measures takes place, impacts will remain low, especially if priority is given to mitigating potential erosion, bush encroachment and alien plant proliferation risks at the locations where the proposed pipelines and powerlines will cross the Tshwenyane River and the unnamed tributary of the Moopetsi River. It is also suggested that the same focus on management occurs at the Mogompane River and the unnamed tributary of the Motse River, which although located outside the focus area are situated within the investigation area and could be indirectly impacted by the proposed activities.

Mitigation measures will keep the significance of risks low, therefore ensuring low impacts of receiving watercourses found in the Focus Area. Additionally, mitigated areas that have recovered should in turn restore the capacity of the landscape to support livestock farming/grazing within the catchment, further supporting provisional services of the watercourses. Therefore, it is in the opinion of the specialist that the proposed product stockpile, ventilation shafts and related infrastructure, water pipelines, and powerlines are acceptable for authorisation, provided that the mitigation measures stipulated in this report are implemented.

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APPENDIX A – Terms of Use and Indemnity

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 time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right, at their sole discretion, 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

LEGISLATIVE REQUIREMENTS

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 (Act No. 107 of 1998) (NEMA)	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.
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).
The National Water Act 1998 (Act No. 36 of 1998) (NWA)	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).
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998)	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NATIONAL WATER ACT, 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.
Government Notice 704 Regulations as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)	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 project complies with Regulation GN 704 of the National Water Act which contains regulations on the 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:* *(b) 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 floodline of the aquatic resource or 100m from the edge of the resource, whichever distance is the greatest.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)	The obtaining of a New Order Mining Right (NOMR) is governed by the MPRDA. The MPRDA requires the applicant to apply to the DMR for a NOMR which triggers a process of compliance with the various applicable sections of the MPRDA. The NOMR process requires environmental authorisation in terms of the MPRDA Regulations and specifically requires the preparation of a Scoping Report, an EIA, an Environmental Management Programme (EMP), and a Public Participation Process (PPP).

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 freshwater features present or in close proximity of the proposed study 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 proposed study area.

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

The freshwater features encountered within the proposed study 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[4] (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.

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

[4] 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.

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. Index of Habitat Integrity (IHI)

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 C4 below. To assess the PES of the wetland and riparian features, the IHI for South African floodplain and channelled valley bottom wetland types (Department of Water Affairs and Forestry Resource Quality Services, 2007) was used.

Table C4: 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

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”.[5] The assessment of the ecosystem services supplied by the identified freshwater features 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;
- Maintenance of biodiversity;

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

- 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 freshwater features. 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 freshwater features.

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 freshwater resource (sections above), with the objective of either maintaining, or improving the ecological integrity of the freshwater resource 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 unacceptable (Malan and Day, 2012) and therefore, should a freshwater resource fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A freshwater resource may receive the same class for the REC as the PES if the freshwater resource 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 freshwater resource.

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

APPENDIX D – Impact 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'[6]. 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 wetlands, 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; and
- **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[7].

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, 1998 (Act No. 107 of 1998) 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.

[6] The definition has been aligned with that used in the ISO 14001 Standard.
[7] Some risks/impacts that have low significance will however still require mitigation

"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;
- Risks/Impacts were assessed for construction phase and operational phase

The SLR Consulting (Pty) Ltd methodology used in determining the significance of environmental impacts is carried out by following the below steps. The method used for the assessment of environmental issues is set out in the tables below. This assessment methodology enables the assessment of cumulative impacts, the significance of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring and the degree to which the impacts can be mitigated. Note: Part A provides the definition for determining impact consequence (combining intensity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

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)

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	VH
			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.

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[8] 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.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

[8] 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 IHI assessment applied to the Tshwenyane River and unnamed tributary of the Moopetsi River combined.

RIPARIAN IHI	
Base Flows	-2.5
Zero Flows	-2.5
Moderate Floods	3.0
Large Floods	2.5
HYDROLOGY RATING	**2.7**
Substrate Exposure (marginal)	3.0
Substrate Exposure (non-marginal)	4.0
Invasive Alien Vegetation (marginal)	4.0
Invasive Alien Vegetation (non-marginal)	4.0
Erosion (marginal)	3.0
Erosion (non-marginal)	3.0
Physico-Chemical (marginal)	1.0
Physico-Chemical (non-marginal)	1.0
Marginal	4.0
Non-marginal	4.0
BANK STRUCTURE RATING	**4.0**
Longitudinal Connectivity	1.0
Lateral Connectivity	1.0
CONNECTIVITY RATING	**1.0**
RIPARIAN IHI %	**42.3**
RIPARIAN IHI EC	**D**
RIPARIAN CONFIDENCE	**2.8**

Table E2: Presentation of the results of the Ecoservices assessment applied to the Tshwenyane River, unnamed tributary of the Moopetsi River and the non-perennial, and ephemeral drainage lines.

Ecosystem service	Tshwenyane River	Unnamed tributary of the Moopetsi River	Non-perennial and ephemeral drainage lines
Flood attenuation	2.2	2.3	2.0
Streamflow regulation	1.2	1.2	0.8
Sediment trapping	2.8	2.8	2.2
Phosphate assimilation	1.6	1.9	1.0
Nitrate assimilation	1.4	1.6	0.9
Toxicant assimilation	1.6	2.1	1.3
Erosion control	0.0	0.0	0.0
Carbon Storage	0.3	0.3	0.0
Biodiversity maintenance	1.6	1.6	1.7
Water Supply	1.2	1.7	0.0
Harvestable resources	1.6	1.6	0.0
Cultivated foods	1.6	1.6	0.8
Cultural value	1.3	1.0	1.0
Tourism and recreation	1.0	1.0	0.0
Education and research	1.0	1.0	1.0
SUM	**20.2**	**21.5**	**12.6**
Average score	**1.3**	**1.4**	**0.8**

Table E3: Presentation of the results of the EIS assessment applied to the Tshwenyane River, unnamed tributary of the Moopetsi River and the non-perennial, and ephemeral drainage lines.

	Unamed tributary of the Moopetsi River	Tshwenyane River	non-perennial, and ephemeral drainage lines	
Ecological Importance and Sensitivity	Score (0-4)	Score (0-4)	Score (0-4)	*Confidence (1-5)*
Biodiversity support	A (average)	A (average)	A (average)	(average)
	0.33	0.33	0.33	3,33
Presence of Red Data species	0	0	0	3
Populations of unique species	0	0	0	3
Migration/breeding/feeding sites	1	1	1	4
Landscape scale	B (average)	B (average)	B (average)	(average)
	1.60	1.60	1.60	4,00
Protection status of the wetland	3	3	3	4
Protection status of the vegetation type	0	0	0	4
Regional context of the ecological integrity	3	3	3	4
Size and rarity of the wetland type/s present	1	1	1	4
Diversity of habitat types	1	1	1	4
Sensitivity of the wetland	C (average)	C (average)	C (average)	(average)
	2.00	2.00	2.00	3,00
Sensitivity to changes in floods	2	2	2	3
Sensitivity to changes in low flows/dry season	2	2	2	3
Sensitivity to changes in water quality	2	2	2	3
ECOLOGICAL IMPORTANCE & SENSITIVITY	**(max of A,B or C)**	**(max of A,B or C)**	**(max of A,B or C)**	
Fill in highest score:	**C**	**C**	**C**	
Average of A, B or C	**2**	**2**	**2**	

Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.

			Unamed tributary of the Moopetsi River	Tshwenyane River	non-perennial, and ephemeral drainage lines	
Hydro-Functional Importance			Score (0-4)	Score (0-4)	Score (0-4)	*Confidence (1-5)*
Regulating & supporting benefits	**Flood attenuation**		2	2	2	4
	Streamflow regulation		0	0	0	4
	Water Quality Enhancement	***Sediment trapping***	2	2	2	4
		Phosphate assimilation	2	2	2	4
		Nitrate assimilation	2	2	2	4

		Toxicant assimilation	2	2	2	4
		Erosion control	2	2	2	4
	Carbon storage		0	0	0	4
HYDRO-FUNCTIONAL IMPORTANCE			2	2	2	4
Direct Human Benefits			Score (0-4)	Score (0-4)	Score (0-4)	Confidence (1-5)
Subsistence benefits	***Water for human use***		0	0	0	4
	Harvestable resources		0	0	0	4
	Cultivated foods		0	0	0	4
Cultural benefits	***Cultural heritage***		0	0	0	4
	Tourism and recreation		1	0	0	4
	Education and research		0	0	0	4
DIRECT HUMAN BENEFITS			0,17	0,00	0,00	4

APPENDIX F –Mitigation Measures

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

Development footprint

- All development footprint areas should remain as small as possible and should not encroach into the freshwater areas unless absolutely essential and part of the proposed development. It must be ensured that the freshwater habitat is off-limits to construction vehicles and non-essential personnel
- 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 areas and be restricted to existing roads where possible;
- Appropriate sanitary facilities must be provided for the life of the pre-construction and construction 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 and use

- 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 recollection 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 environment is already transformed to an extent as a result of alien plant invasion; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint;
- Removal of the alien and weed species encountered within the freshwater resources must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction, operational, and maintenance phases;
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - 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 wetland areas during the eradication of alien and weed species.

Disturbed and compact soils

- Sheet runoff from access roads should be slowed down by the strategic placement of berms;

- As far as possible, all construction activities should occur in the low flow season, during the drier winter months;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils;
- No stockpiling of topsoils is to take place within close proximity to the river, and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the river;
- All soils compacted as a result of construction activities as well as ongoing operational activities falling outside of project footprint areas 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;
- All soils compacted as a result of construction activities falling outside of project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all construction and rehabilitation phases to prevent loss of floral habitat;
- Rehabilitate all drainage line and riparian habitat areas to ensure that the ecology of these areas is re-instated during all phases;
- Edge effects of activities including erosion and alien/ weed control need to be strictly managed in these areas;
- As far as possible, all rehabilitation activities should occur in the low flow season, during the drier winter months.
- As much vegetation growth as possible should be promoted within the proposed development area in order to protect soils;
- All alien vegetation in the riparian zone should be removed upon completion of construction and reseeded with indigenous grasses as specified by a suitably qualified specialist (ecologist);
- All areas affected by construction should be rehabilitated upon completion of the construction phase of the development;
- Bank vegetation cover should be monitored to ensure that sufficient vegetation is present to bind the bankside soils and prevent bankside erosion and incision; and
- All alien vegetation in the footprint area as well as immediate vicinity of the proposed development activities should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

APPENDIX G – 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)

Amanda Mileson NDip Nature Conservation (UNISA)

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		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 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

SCIENTIFIC AQUATIC SERVICES (SAS)

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing Member, Group CEO, Water Resource Discipline Lead, Ecologist, Aquatic Ecologist
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust

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

COUNTRIES 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 SECTOR 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

SELECTED PROJECT EXAMPLES OUT OF OVER 3000 PROJECTS COMPLETED

PROJECT NAME	PROJECT DESCRIPTION PER DEVELOPMENT SECTOR	PROVINCE
LINEAR		
N3 De Beers Pass Route	Wetland and Aquatic Assessment	KwaZulu Natal
SANRAL N4 Upgrades	Faunal, Floral and Wetland Assessments	Mpumalanga
Gautrain Rapid Rail Ext Project	Due Diligence Feasibility Study	Gauteng
N11 Section 13x Mokopane Ring Road	Biodiversity, Aquatic And Wetland Ecological Assessment	Limpopo
SASOL Gas Pipeline	Watercourse Rehab & Management Plan	Gauteng
Bylsbridge Development	Biomonitoring Programme and Monthly ECO	Gauteng
MINING		
Tronox Namakwa Sands Mine Expansion	Floral, Faunal and Wetland Ecological Assessments	Western Cape
Brikor Limited	Wetland Rehabilitation and Water Use Licence Audits	Gauteng
Fuleni Anthracite Coal Project	Biodiversity, Wetland, Aquatic and Visual Impact Assessments	KwaZulu Natal
Leandra Colliery	Biodiversity, Wetland, Aquatic and Visual Impact Assessments	Gauteng
The Dual Project	Biodiversity, Wetland, Aquatic and Visual Impact Assessments	Limpopo
TGME Pilgrims Rest	Biodiversity, Wetland, Aquatic and Visual Impact Assessments	Mpumalanga
Barberton Mines (Fairview, Consort, Sheba)	Aquatic biomonitoring assessments	Mpumalanga
Modikwa Platinum Mine Integrated Water Management Study	Freshwater And Aquatic Ecological Assessment & Management Plan	Limpopo
Dwars River Catchment For Dwars River Environmental Forum (DREF)	Mass and Salt Load Study	Limpopo
Sibanye Stillwater Akanani Mine	Biodiversity, Wetland, Soils And Visual Impact Assessment	Limpopo

Thaba Chueu Operations	Annual Water Quality Monitoring & Biomonitoring	Mpumalanga
Samada Diamonds	Water Use Authorisation And Specialist Studies	Free State
AngloAmerican Amandebult Mine Complex	Biodiversity Assessment	Limpopo
Nkomati Nickel Mine	Biodiversity, Wetland and Aquatic Assessments	Mpumalanga
Gravenhage Mine	Watercourse Ecological Assessment & Hydropedological Study	Northern Cape
Glencore Mine Operations (Thorncliffe, Magareng and Helena)	Biodiversity External Audit & Biodiversity Management and Monitoring Plan	Limpopo
Ikwezi Mine	Freshwater Assessment, Biodiversity Monitoring, Freshwater Rehabilitation Plan & WULA	KwaZulu Natal
Welstand Colliery	Hydropedological Assessment	Mpumalanga
Kebrafield Colliery	Wetland and Hydropedological Assessments and Wetland Offset	Mpumalanga
Evander Gold Mine Tailings Storage Facility expansion	Wetland Offset and Hydropedological Assessment	Mpumalanga
INDUSTRIAL CHEMICALS		
Anchor Yeast	Freshwater Assessment	KwaZulu Natal
Sasol Sludge Plant	Wetland And Aquatic Assessment	Mpumalanga
NCP Alcohols	Freshwater Assessment	Gauteng
Enstra Paper/Blesbokspruit (SAPPI	Quarterly Biomonitoring and Toxicity Testing	Gauteng
Phesantekraal Light Industrial Development	Stormwater Management	Western Cape
INFRASTRUCTURE		
Mzimvubu Dam	Full Ecological Assessments	Eastern Cape
Vissershok Dams	WULA And Wetland Assessment	Western Cape
Tshwane WWTW	Freshwater Ecological Assessment	Gauteng
Assmang Machadorp Works	Ongoing Aquatic Biomonitoring Programme	Mpumalanga
uMkhomazi Water Project	Biodiversity Offset	KwaZulu Natal
Sishen Western Dewatering Infrastructure Project	Floral Species of Conservation Concern & Tree Marking	Northern Cape
Richards Bay Coal Terminal	Estuarine Ecological Assessment	KwaZulu Natal
Vopak Richards Bay Harbour South Dunes Precinct	Wetland Offset Initiative	KwaZulu Natal
SASOL Fine Ash Dam-6 Borrow Pit	Hydropedological And Freshwater Assessments	Mpumalanga
Kwaduzuka WWTW	Freshwater Ecological Assessment	KwaZulu Natal
New Cargo Precinct (OR Tambo Airport)	Terrestrial & Freshwater Ecological Assessments	Gauteng
COMMERCIAL & RESIDENTIAL DEVELOPMENT		
Thusaneng Housing Project	Biodiversity Study	Gauteng
Blue Hills Eco Estate	Flora, Faunal And Wetland Assessment	Gauteng
Val De Vie Estate	Integrated WULA; Watercourse Rehabilitation Plan	Western Cape

Riversands Commercial Hub – Bridge Crossings	Environmental Control Officer	Gauteng
Carlswald Valley Residential Estate	Wetland Assessment and Wetland Rehabilitation Plan	Gauteng
AM Lodge	Terrestrial Ecological Habitat Sensitivity Assessment	Limpopo
Blair Athol Estate	Freshwater & Aquatic Ecological Assessment	Gauteng
Birchleigh North Ext 4 Housing Development	Wetland and Hydropedological Assessment	Gauteng
M&T Development various mixed use development projects	Freshwater, Biodiversity and Aquatic Assessments	Gauteng
RENEWABLE ENERGY		
Century Property various mixed use development projects	Freshwater, Biodiversity and Aquatic Assessments	Gauteng
ADvTECH House various educational facility projects	Freshwater & Aquatic Assessments	Gauteng
Duhva Solar Plant	Full Ecological Assessments	Mpumalanga
Arnot Solar Plant	Full Ecological Assessments	Mpumalanga
Copperton Wind Energy Facility	Freshwater Assessment, Hydrology and WULA	Northern Cape
Haga Wind Energy Facility	Freshwater Assessment, Visual Impact Assessment and WULA	Eastern Cape
Sutherland Wind Energy Facility	Freshwater Assessment	Northern Cape
Kruisvallei Hydroelectric Facility	WULA Audit	Free State
Erasmus Park Development	Visual Impact Assessment	Gauteng
AGRICULTURE		
Brand Se Baai Abalone Farm	Biodiversity Baseline Assessment	Western Cape
Doringbaai Aquaculture Farms	Biodiversity Assessment	Western Cape
Ptn 38 Elandspruit Farm	Biodiversity Assessment	Mpumalanga
Doornkloof Farm	Freshwater & Aquatic Ecological Assessment	KwaZulu Natal
Schoeman Boerdery - Olifants River	S24G Aquatic Ecological Assessment & Landscaping Plan	Limpopo
Lourensford Wine Farm	Freshwater Verification	Western Cape
Olievenhoutbosch Solar Facility	Visual Impact Assessment	Gauteng
Houtboschkloof Farm	Freshwater Assessment & Reserve Determination	Limpopo
MUNICIPAL		
Mutsho Powerstation	Freshwater ecological assessments	Limpopo
Fisantkraal WasteWater Treatment Works	Aquatic Biomonitoring	Western Cape
Braamfonteinspruit Rehabilitation (Joburg Roads Agency)	Floral, Faunal, Freshwater and Aquatic Assessments	Gauteng
Kleinmond Cemetery	Wetland and Hydropedological Assessments	Western Cape

REFERENCES

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Jaco Kleynhans
Director: Jaco K Consulting
Tel: 013 243 7110
Email: jaco@jacokconsulting.co.za

Yours faithfully

STEPHEN VAN STADEN

SCIENTIFIC AQUATIC SERVICES (SAS)

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF

AMANDA MILESON

PERSONAL DETAILS

Position in Company	Ecologist
Date of Birth	15 February 1978
Nationality	Zimbabwean
Languages	English
Joined SAS	2013

MEMBERSHIP IN PROFESSIONAL SOCIETIES

South African Wetland Society

Gauteng Wetland Forum

EDUCATION

Qualifications

N.Dip Nature Conservation (UNISA)	2017
Advanced Diploma Nature Conservation (UNISA)	2020

Short Courses

Wetland Management: Introduction and Delineation (University of the Free State)	2018
Tools for Wetland Assessment (Rhodes University)	2017
Wetland Rehabilitation (University of the Free State)	2015

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, North West, Limpopo, Northern Cape, Eastern Cape

Zimbabwe, Zambia

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater EcoService and Status Determination

- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species Plan
- Freshwater Offset Plan

Biodiversity Assessments

- Biodiversity EcoScan
- Biodiversity Offset Plan

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF TIA KEIGHLEY

PERSONAL DETAILS

Position in Company	Junior Field Ecologist: Wetland Ecology
Date of Birth	09 July 1992
Nationality	South African
Languages	English
Joined SAS	2020

EDUCATION

Qualifications

BSc Masters Water Resource Science (Rhodes University)	2017
BSc Honours Environmental Science (Rhodes University)	2018
BSc Environmental Science and Zoology (Rhodes University)	2017
Tools for Wetland Assessment (Rhodes University)	2014

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater EcoService and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans