FAUNAL AND FLORAL ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR A PROPOSED COAL MINE ON THE REMAINING EXTENT OF THE FARM THE DUEL 186 MT, LIMPOPO PROVINCE

Prepared for

Jacana Environmentals CC

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Section B: Floral Assessment

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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;
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
Biosphere Reserve	Areas identified either on terrestrial or marine ecosystems (or both) that are internationally recognized under the framework of UNESCO's Man and Biosphere (MAB) programme. Spatial zonation of a Biosphere Reserve: • **Core zone/s** - these are areas that must have a legal/long term protection status in terms of national laws; • **Buffer zone/s** – these areas usually surround or adjoin the core zones; and • **Transition zone** – is the area which contains diversity of sustainable activities.
CBA (Critical Biodiversity Area)	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.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
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.
Invasive species	Means any species whose establishment and spread outside of its natural distribution range; they threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and may result in economic or environmental harm or harm to human health
Least Threatened	Least threatened ecosystems are still largely intact.
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.

ACRONYMS

AIP	Alien and Invasive Plants
BGIS	Biodiversity Geographic Information Systems
CR	Critically Endangered
DAFF	Department: Agriculture, 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
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature and Natural Resources
LEDET	Limpopo Department of Economic Development and Tourism
LEMA	Limpopo Environmental Management Act
MRA	Mining Right area
NFA	National Forest Act
NT	Near Threatened
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
SANBI	South Africa National Biodiversity Institute
SP	Specially Protected
STS	Scientific Terrestrial Services
SCC	Species of Conservation Concern
TOPS	Threatened or Protected Species
VBR	Vhembe Biosphere Reserve
VU	Vulnerable

DOCUMENT GUIDE

The Document Guide below is for reference to the procedural requirements for environmental authorisation applications in accordance to GN267 of 24 March 2017, as it pertains to NEMA.

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Section A: Appendix E
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Section A: Appendix E
b)	A declaration that the specialist is independent	Section A: Appendix E
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
cA)	An indication of the quality and age of base data used for the specialist report	Section 2 and Section A: 3
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix A
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 3 and 4
g)	An identification of any areas to be avoided, including buffers	Section 4
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 4
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.3
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 5
k)	Any mitigation measures for inclusion in the EMPr	Section 5
l)	Any conditions for inclusion in the environmental authorisation	Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 5 and 6; Section A: Executive Summary
(iA)	Regarding the acceptability of the proposed activity or activities	Section 5 and 6; Section A: Executive Summary
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 5 and 6; Section A: Executive Summary
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

1 INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Assessment and Authorisation process for a proposed coal mine on the remaining extent of the farm The Duel 186 MT, Limpopo Province, hereafter referred to as “study area” (Section A: Figure 1 - 2). The N1 between Musina, west from the study area, meets the R525 regional road that reaches the village of Tshipise, north of the study area. The Nzhelele Nature Reserve is situated west of the study area. The land coverage in the vicinity and within the study area is mixed between rural settlement, hunting and ecotourism. Some of the properties in the area are also focused on mixed farming, with a mixture of livestock, game and irrigated agriculture. Hunting, game trading and eco-tourism is an established socio-economic driver in the area. There are a number of properties utilised for trophy (for local and foreign tourists) and biltong hunting with ecotourism spin-off activities.

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 in relation to the proposed project footprint, and to describe the Present Ecological State (PES) of the study area. It is the objective of this study:

- To provide inventories of floral 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 the potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed development activities 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.

This report, after consideration and description of the ecological integrity of the study area, must guide the proponent, authorities and Environmental Assessment Practitioner (EAP), by means of recommendations, as to the significance of botanical impacts associated with the

proposed development as well as to define the suitability of the study area for the intended land use, which in this case is the proposed mining development, from a floral ecological point of view.

1.2 Project Description[1]

Subiflex (Pty) Ltd holds a Prospecting Right on the farms Lotsieus 176 MT, Kranspoort 180 MT, Nairobi 181 MT and The Duel 186 MT. The proposed project is for the mining of coal on the Remaining Extent of The Duel 186 MT (i.e. the study area) using a combination of underground (long-wall methodology[2]) and open cast (conventional drill and blast operation with truck and shovel, load and haul) mining methods. The expected life of mine (LoM) is 24 years.

Mining of the Open Pit (Figure 1) will form part of the first operations, whereas underground mining is planned to commence from year 10, continuing for five years. Selected positions within the Open Pit will be used to gain access for underground mine activities, and upon completion, all access points will be closed. The Open Pit will be rehabilitated.

The proposed infrastructure to be developed includes (Figure 1):

- Coal Handling Processing Plant;
- Overburden Waste Dump;
- Temporary Discard Dump;
- Haul roads and Access roads;
- Pollution Control Dams;
- Raw water storage facility and distribution systems; and
- Auxiliary infrastructure including a workshop and store, office and change house, electrical power supply and security fencing.

The final discard material from the plant will be disposed of in the mined-out open pit. If the pit is unavailable due to existing mining activities, the discard material will be placed on an interim surface discard dump, from where it will be reclaimed and dumped into the mined-out open pit towards the end of the mine life as part of the rehabilitation of the mining site.

[1] 05-03-2015 The Duel Coal Project BID final approved.

[2] "Long-wall mining recovers and extracts a high percentage of the coal and can be very costly. It involves the full extraction of coal from a section of the seam or face using mechanical shearers (WCI, 2009)." Shongwe Bonisile Nolwando Master's Thesis (2018): The Impact of Coal Mining on the Environment and Community Quality of Life: A Case Study Investigation of the Impacts and Conflicts Associated with Coal Mining in the Mpumalanga Province, South Africa.

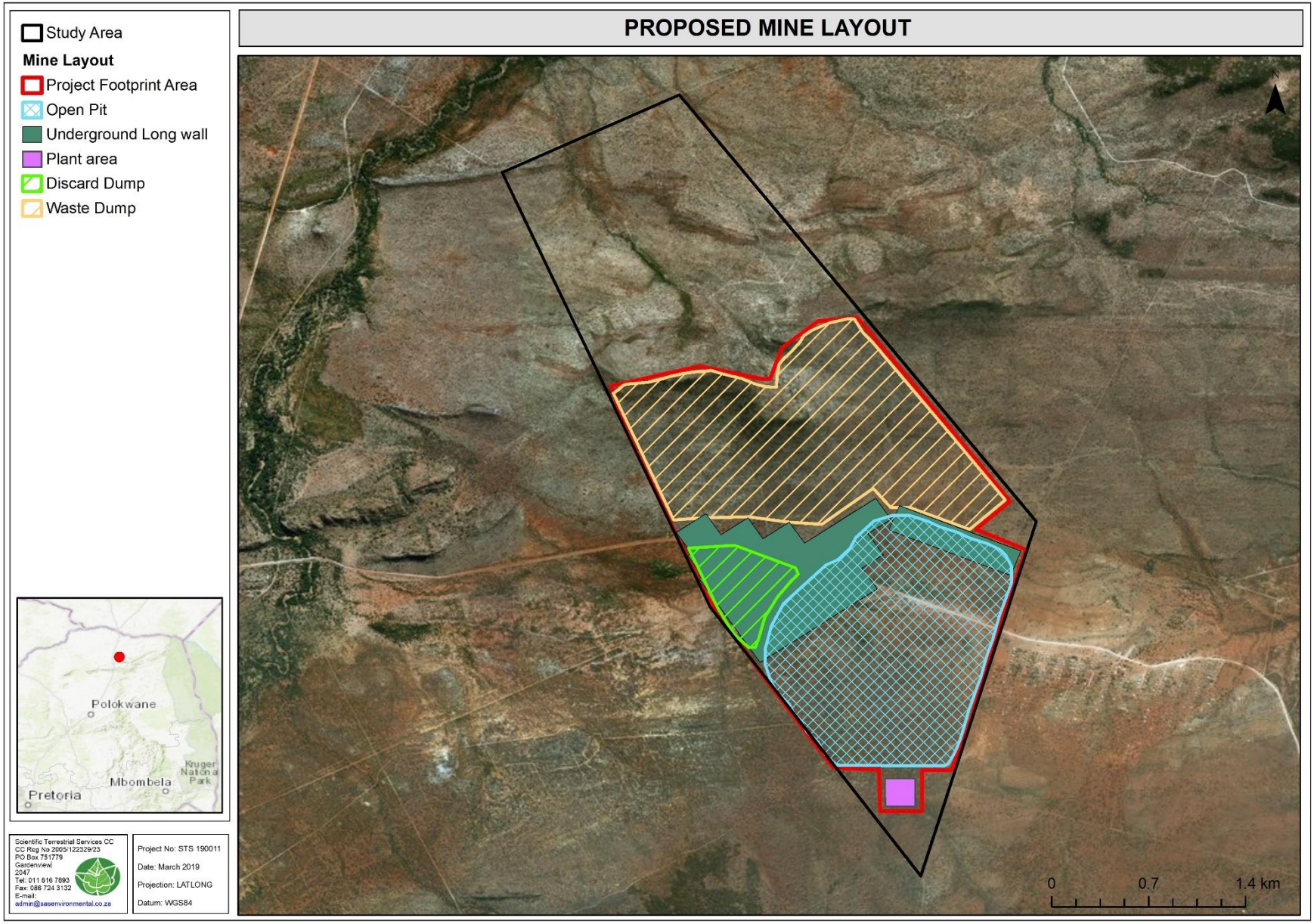


Figure 1: The proposed mine layout for the study area.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- Scientific Aquatic Services (SAS) have previously undertaken floral ecological studies within the study area (SAS 214206, 2016. Floral Assessment as part of the Environmental Assessment and Authorisation Process for a proposed coal mine on the remaining extent of the farm The Duel 186 Mt, Limpopo Province. Prepared for: Jacana Environmentals CC). The aim of the current study was to re-assess the floral component for the "The Duel" project and to update, where and if required, the results of the previous studies;
- The floral assessment of this study is confined to the study area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment;
- 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 communities and populations had 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;
- Sampling by its nature means that not all individuals are assessed and identified. Some species and taxa within the study area may, therefore, have been missed during the assessment. This is particularly relevant within arid regions where many floral species only respond to a good rain event, e.g. many bulbous plants only emerge and flower after sufficient rains; and
- The previous field assessment took place in February 2015. As part of the assessment update, a second field investigation was undertaken from the 26th to the 28th of February 2019, to determine the ecological status of the study area, and to "ground-truth" the results of the desktop assessment and to to ensure that all information previously presented remains valid.

2 GENERAL SITE SURVEY

Initial field assessments were undertaken during February 2015, in order to determine the ecological status of the study area. To provide updated information of the floral ecology associated with the study area, a second field assessment was undertaken from the 26th to the 28th of February 2019.

For the field assessment of 2015 (SAS 214206, 2016), 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 representative of the habitats found within the area. In this regard, special emphasis was placed on areas that may potentially support floral SCC – particularly within the areas where infrastructure is proposed. Sites were investigated on foot in order to identify the occurrence of the dominant plant species and habitat diversities.

For the 2019 field assessment, a similar approach was undertaken where the habitat units identified during the 2015 assessments were reassessed on foot, with the focus on infrastructure areas and areas with potential gaps.

In order to accurately determine the ecological state of the study area and to capture comprehensive data with respect to floral ecology, the following methodology was followed:

- Maps and digital satellite imagery were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. The results of these analyses were then used to focus the field work on specific areas of concern and to identify areas where target specific investigations were required;
- Historical data and previous specialist studies were available for the study area and were utilised as background information to this report[3]; and
- All relevant information as presented by SANBI's Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org), including the Limpopo Conservation Plan v.2 (2013), to gain background information on the physical habitat and potential floral and faunal biodiversity associated with the study area. Databases that have been updated since the initial 2015 field assessments were included in the background research, i.e. the 2018 Vegetation Map of South Africa, Lesotho and Swaziland (the latest update of the map of the National Vegetation Map Project and follows version

[3] SAS 214206, 2016. Floral Assessment as part of the Environmental Assessment and Authorisation process for a proposed coal mine on the remaining extent of the farm The Duel 186 MT, Limpopo Province.

VEGMAP 2012), the South Africa Protected Areas Database (SAPAD, 2018 Q4), the South Africa Conservation Areas Database (SACAD, 2018 Q4).

A detailed explanation of the method of assessment is provided in **Appendix A** of this report. For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to **Section A, Appendix D**.

2.1 Sensitivity Mapping

All the ecological features of the study area were considered, and sensitive areas were assessed. In addition, identified locations of protected species were marked by means of a Global Positioning System (GPS). Not all localities of protected species were recorded as this is not included in the scope of work; however, the recorded localities are sufficient for the determination of the habitat sensitivity of the study area.

A Geographic Information System (GIS) was used to project the above-mentioned features onto satellite imagery and/or topographic maps. The sensitivity map should guide the final design and layout of the proposed development activities.

3 FLORAL DESCRIPTION

3.1 Results of the Floral Assessment

The study area falls within the Savanna biome (Mucina and Rutherford, 2006) and is situated within the Central Bushveld Bioregion, as well as the Mopane Bioregion (Mucina & Rutherford, 2006) (Figure 2). Moreover, the study area falls within two vegetation types namely, *Musina Mopane Bushveld* and *Soutpansberg Mountain Bushveld* vegetation types (Mucina & Rutherford, 2012 and 2018 data sets). The characteristics of these vegetation types are provided in Section A.

The field assessment confirmed that the vegetation within the study area is representative of both the Musina Mopane Bushveld and Soutpansberg Mountain Bushveld vegetation types - thus considered representative of the reference states. However, the study area falls within the ecotone of these two vegetation types, thereby owing to several shared species between the Musina Mopane Bushveld and Soutpansberg Mountain Bushveld within the study area. Furthermore, several freshwater features are present within the study area and consist of a species composition similar to the two overarching vegetation types.

Three broad habitat units were thus identified within the study area, i.e. Soutpansberg Mountain Bushveld, Freshwater Habitat, and Mopane Bushveld. Their sensitivities are described within the below sections and their location in relation to the study area and proposed mining infrastructure depicted in Figure 3 – 4.

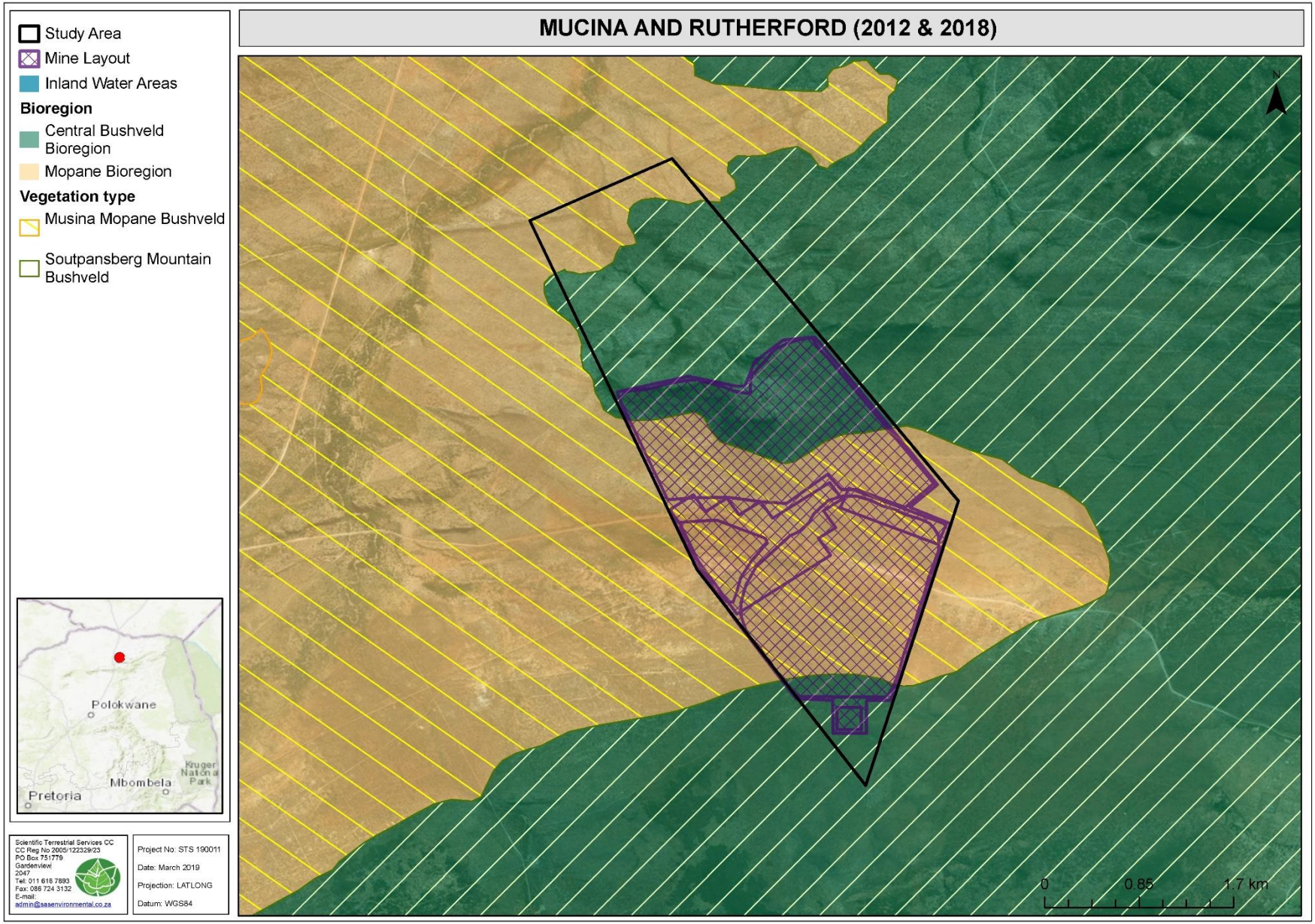


Figure 2: Bioregions and vegetation types associated with the study area (Mucina and Rutherford, 2012 and 2018 data sets).

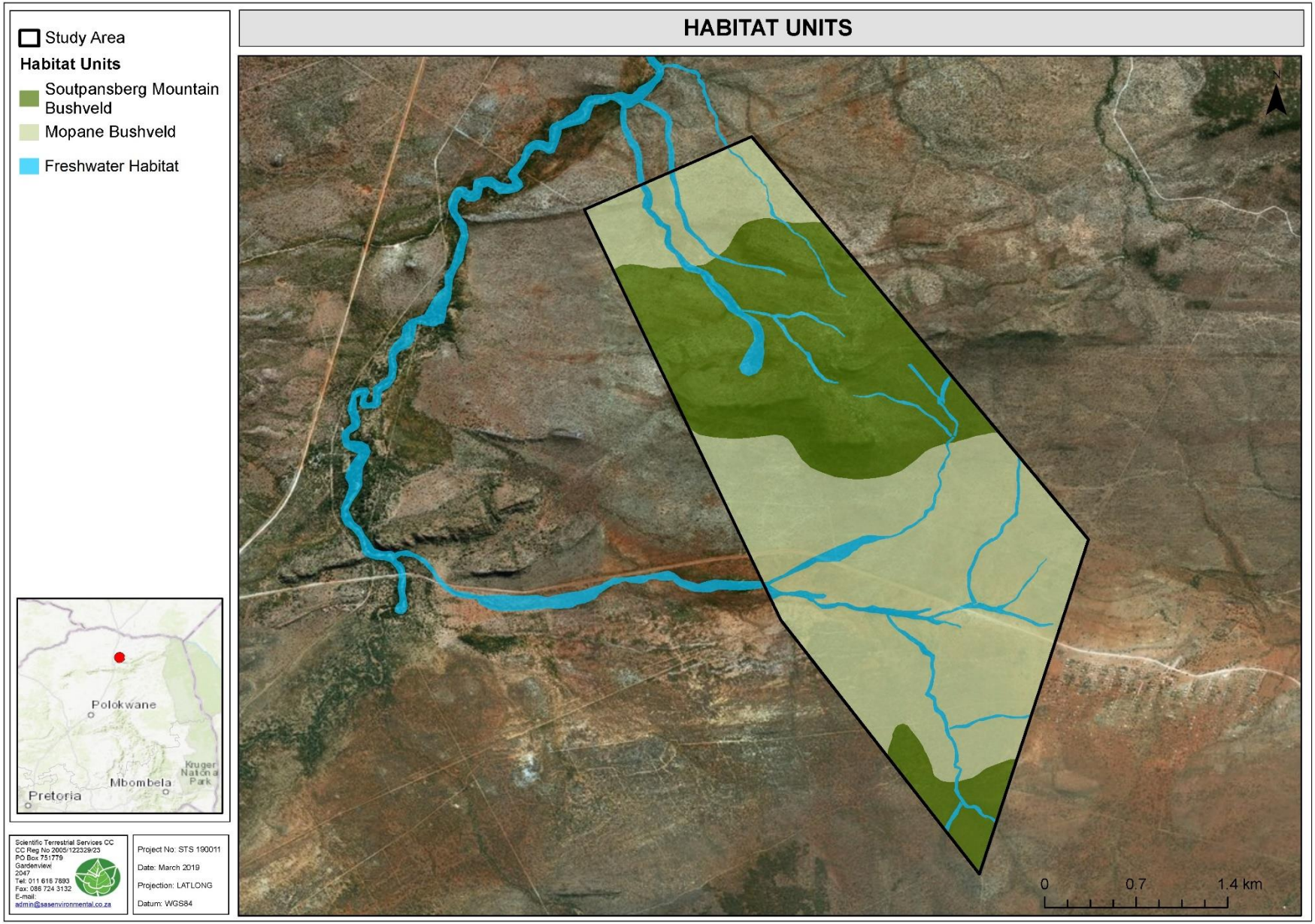


Figure 3: Conceptual illustration of the habitat units within the study area.

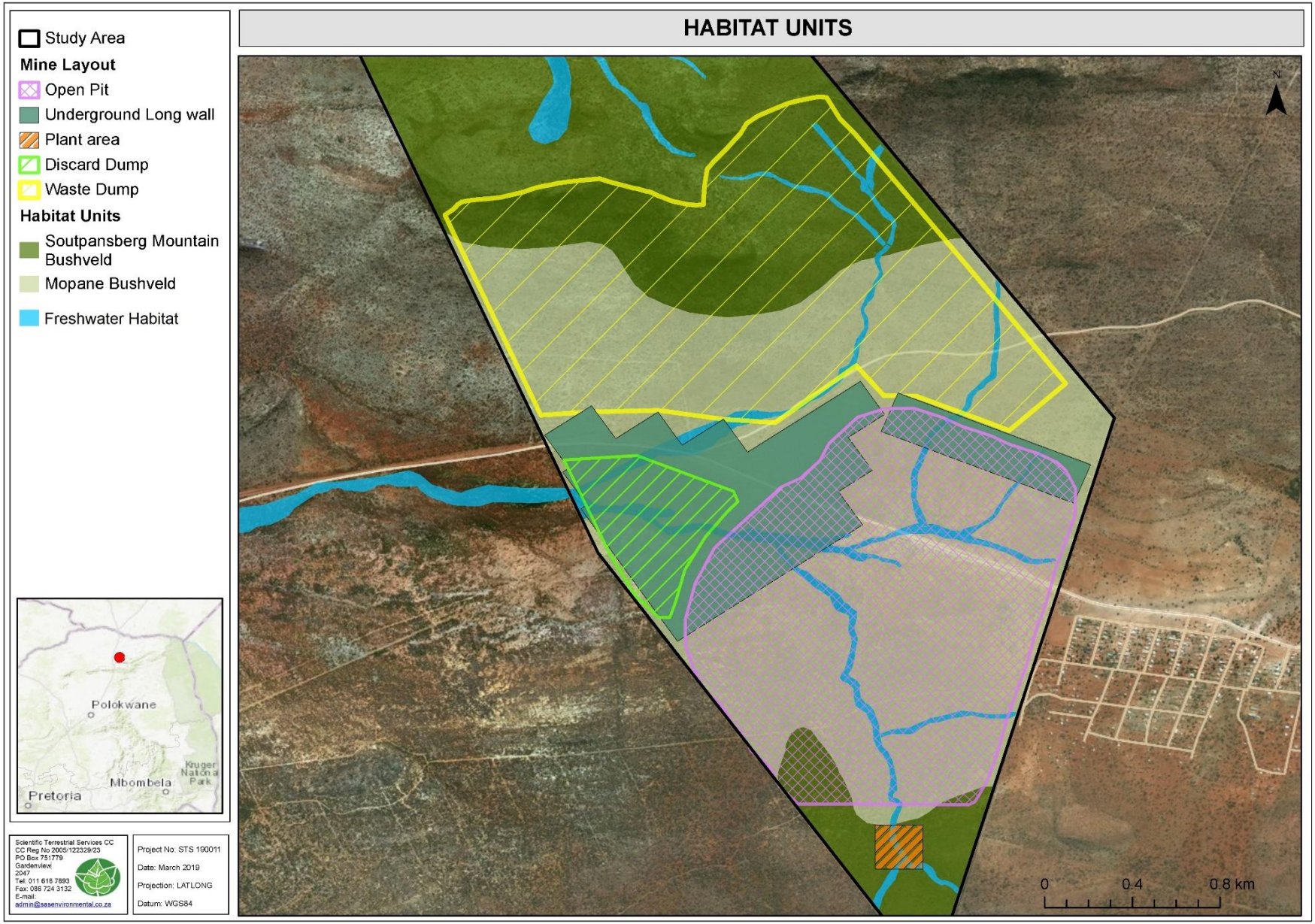


Figure 4: Conceptual illustration of the habitat units within the study area in relation to the proposed mine layout.

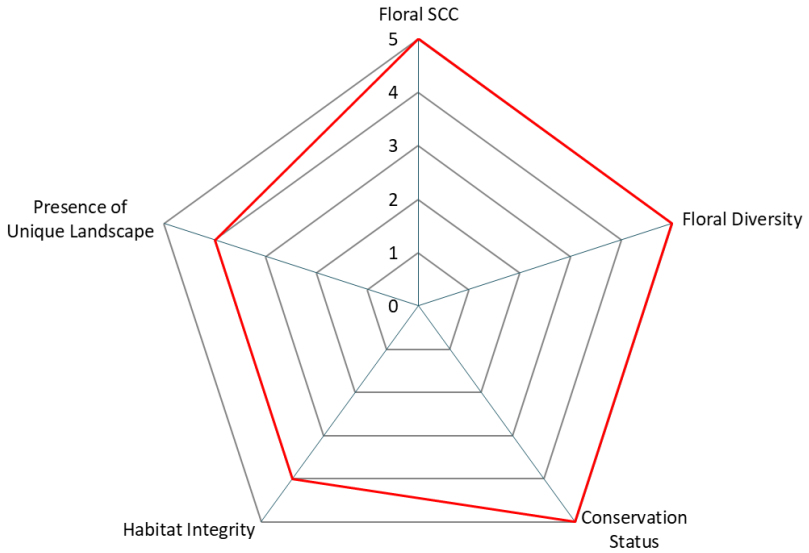
3.1.1 Habitat Unit 1: Soutpansberg Mountain Bushveld

Floral Habitat Sensitivity	High

Habitat Unit Description:

The Soutpansberg Mountain Bushveld habitat unit occurs in sections in the central and extreme southern portions of the study area. This habitat unit was typically associated with steeper, undulating ridges within the study area. The lower slopes are more commonly associated with a tall, dense grass layer and typical mountain bushveld tree species such as *Commiphora glandulosa*, *Commiphora viminea*, *Sclerocarya birrea* subsp *caffra*, *Senegalia senegal* var. *leiorhachis* and *Terminalia prunioides*. At higher elevations the habitat varied between large rock outcrops along the northern and top sections of the ridge, with densely vegetated kloof habitat found along the southern edges of the ridge where the slopes are much steeper. Within the kloof habitat, shaded conditions have given rise to a tall grass-dominated understory vegetation, whereas forb diversity was markedly lower.

Floral Habitat Sensitivity Graph:



Steep, undulating hills and ridges within the central section of the study area.

Several rock outcrops occur throughout this habitat unit but was most prominent at higher elevations (left). The along the southern, steeper slopes, densely vegetated kloof habitat occurs (right).

Floral Species of Conservation Concern (SCC)	Several floral species of conservation concern (SCC) occur within this habitat unit, most of which are tree species protected under the National Forest Act, 1998 (Act 84 of 1998, as amended in September 2011) (NFA): A*dansonia digitata* (Baobab tree), *Boscia albitrunca* (Shepherd's Tree), *Combretum imberbe* (Leadwood), *Philenoptera violacea* (Apple-leaf) and *Sclerocarya birrea* subsp. *caffra* (Marula tree). One species protected under the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Lists of Species that are Threatened or Protected (TOPS), namely *Adenium multiflorum*, is present in this habitat unit. *Adenium multiflorum* and *Adansonia digitata* are also protected under the Limpopo Environmental Management Act, 2003 (Act 7 of 2003) (LEMA). Under the LEMA, all species of the Orchidaceae family are protected, of which one was encountered within this habitat unit: *Ansellia africana* (Leopard Orchid). - Based on the floral SCC Potential of Occurrence (POC) assessment (section 3.6), several Red Data Listed (RDL) floral species are likely occurring within the Soutpansberg Mountain Bushveld habitat unit due to suitable available habitat; however, they were not recorded during the field assessment. These species include the forb species *Ceropegia cimiciodora* (Vulnerable (VU)), *Tylophora coddii* (Rare), but also the woody species *Elaeodendron transvaalense* (NT) and *Warburgia salutaris* (Endangered (EN)).
Floral Diversity	Floral diversity of this habitat unit is high, with woody species forming the dominant vegetation throughout. A well-developed grass and forb layer also persist throughout the habitat unit. Vegetation is considered representative of the reference vegetation type (Mucina and Rutherford, 2006). Within the woody layer the dominant tree species included *Adansonia digitata* (NFA), *Combretum apiculatum* subsp. *apiculatum*, *Commiphora marlothii*, *Commiphora neglecta*, Comm*iphora viminea*, *Croton gratissimus*, *Dombeya rotundifolia*, *Gyrocarpus americanus* subsp. *africanus*, *Lannea schweinfurthii* var. *stuhlmannii, Peltophorum africanum*, *Kirkia acuminata*, *Schotia brachypetala, Senegalia ataxacantha,* to name a few. A diverse shrub layer was interspersed between the taller tree species, but also common on the rock outcrops, including species such as Anis*otes rogersii, Barleria affinis, Grewia bicolor, Grewia flava, Grewia flavescens, Indigofera circinnata, Myrothamnus flabellifolius* (DDT) and *Tinnea rhodesiana*. - The woody layer was most representative of the Arid Mountain Bushveld; one of five vegetation variations present within the reference state. Though less prominent than the woody layer, the forb layer was well-developed and included common species shared with the adjacent Mopane Bushveld habitat unit, e.g. *Blepharis diversispina, Commelina africana* and *Commelina erecta*, but several species unique to the habitat unit was present such as *Cardiospermum corundum, Cordylostigma virgatum* and *Merremia pinnata*. Several species characteristic of the rocky nature of this habitat unit occured at higher elevations, i.e. *Barleria affinis, Cyphostemma sandersonii, Pellaea calomelanos, Scadoxus multiflorus* subsp *multiflorus* and *Xerophyta retinervis*. Succulent species included *Kalanchoe sexangularis* and *Kleinia fulgens*. Species such as *Cynodon dactylon, Diheteropogon amplectens, Elionurus muticus, Heteropogon contortus, Loudetia simplex, Stipagrostis hirtigluma, Schmidtia pappophoroides* and *Tragus berteronianus* dominated the graminoid layer.  *Barleria affinis* (left) and *Commiphora marlothii* (right)  *Croton gratissimus* (left) and *Myrothamnus flabellifolius* (DDT) (right)  *Scadoxus multiflorus* subsp. *multiflorus* (left) and *Xerophyta retinervis* (right)

<table>
<tr>
<td>Conservation Status of Vegetation Type/Ecosystem</td>
<td>The species composition of this habitat unit is representative of the vegetation type in which it occurs, and the vegetation type is considered to be Vulnerable (Mucina & Rutherford, 2006).

The Soutpansberg Mountain Bushveld habitat unit falls within Critical Biodiversity Areas (CBAs) 1 and 2, of which the mine infrastructure areas are located in a CBA 1 (Limpopo Conservation Plan v.2, 2013). Mining is not considered a compatible land-use for a CBA 1 and net loss of intact habitat or intensification of land use should be avoided (Limpopo C-Plan Technical Report[4]). Moreover, the entire study area falls within Habitat of Threatened / Rare Species, considered important for Red Data floral Species (Limpopo C-Plan). Based on the largely intact and untransformed nature of this habitat unit, it is highly likely that Red Data floral Species are present within this habitat unit – refer also o section 3.3 of this report.

Portions of the southern section of the Soutpansberg Mountain Bushveld habitat unit that is located within the central portion of the study area, as well as the southern-most portion of the study area, falls within an area considered to be of Highest Biodiversity Importance (Mining and Biodiversity Guidelines, 2013). These 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, mining projects will be significantly constrained or may not receive the necessary authorisations.

Finally, the study area is located within a transitional zone of the Vhembe Biosphere Reserve (refer to Section A) and thus do not enjoy any legal protection; however, these areas are to be used in a sustainable manner due to the international recognition of the biodiversity importance of Biosphere Reserves.</td>
<td>Presence of Unique Landscapes
This habitat unit is unique due to the micro-habitat that is provided by rock outcrops. Furthermore, the topography gives rise to variations in the climatic and physical characteristics of the environment, thereby providing unique growing conditions at different elevations and aspects – especially within the central section of the study area where the ridge is more pronounced.
Habitat integrity/Alien and Invasive species
The vegetation composition in these areas is typical of the Soutpansberg Mountain Bushveld vegetation type. Alien species diversity and abundance was generally low, with species such as Zinnia peruviana, Opuntia ficus-indica, Cereus jamacaru and Tagetes minuta encountered in isolated patches. The habitat unit has high ecological functionality and overall high levels of habitat integrity and is in a relatively undisturbed condition.</td>
</tr>
<tr>
<td colspan="3"><u>Business Case, Conclusion and Mitigation Requirements:</u>
The Soutpansberg Mountain Bushveld habitat unit is considered of high ecological importance and sensitivity, and any impacts from the proposed mining activities and associated infrastructure are anticipated to be significant. The clearing of vegetation and site preparation associated with the northern portions of the proposed Interim Waste Dump and the Plant area in the extreme southern portion of the study area will have a significant impact on preferred floral habitat. Most notably for NFA- and LEMA-protected floral species, as well as for species specifically associated with the micro-habitat within the rock outcrops and aspect-specific habitat within the south-facing kloofs.

It is recommended that mining-related activities should be reconsidered within the Soutpansberg Mountain Bushveld as far as possible and feasible. However, were the proposed activities to proceed, the following recommendations are made to minimise the impact on floral species:
• The footprint areas of all surface infrastructure must be minimised to what is absolutely essential;
• Proposed infrastructure located within steep slopes of ridges or hills should be restricted to the lower slopes due to the high risk of erosion and the consequential need for extensive rehabilitation activities later down the line;
• An Alien and Invasive Plant (AIP) Control Plan and Erosion Control Plan must be developed and implemented during all phases of development to lower the risk of erosion and the potential proliferation of AIPs within the study area;
• Due to several floral SCC being recorded within this habitat unit, permits should be obtained from LEDET and DAFF to remove, cut or destroy any protected species before construction of infrastructure takes place. Consequently, before any construction activities can occur a detailed walk down of the area must take place, preferably within their flowering or fruiting season, during which all protected species, or species of conservation concern, should be marked.</td>
</tr>
</table>

[4] Desmet, P. G., Holness, S., Skowno, A. & Egan, V.T. (2013). Limpopo Conservation Plan v.2: Technical Report. Contract Number EDET/2216/2012. Report for Limpopo Department of Economic Development, Environment & Tourism (LEDET) by ECOSOL GIS.

3.1.2 Habitat Unit 2: Mopane Bushveld Habitat Unit

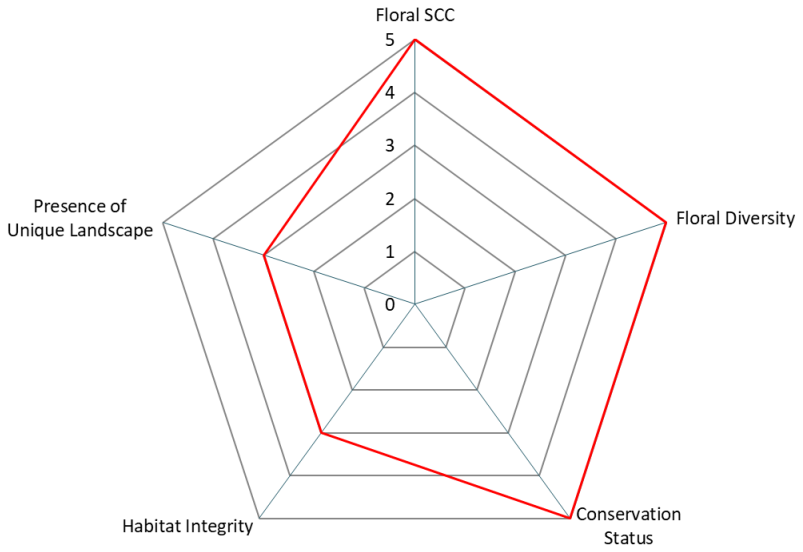
Floral Habitat Sensitivity	Moderately high

Habitat Unit Description:

The Mopane Bushveld habitat unit covered the far northern portion of the study area, as well as the central portions, and was encountered in the lower-lying sections of the study area associated with deep red soils. Generally, the Mopane Bushveld is associated with scattered woody vegetation and stretches of bare red soils (typical of the vegetation type). In areas where the Soutpansberg Mountain Bushveld is transitioning into Mopane Bushveld, this habitat unit tends to be more floristically diverse with a denser woody and grass layer.

Sections of this habitat unit have been transformed by road construction and edge effects associated with close anthropogenic activities, although not to such a degree that it is unrecognisable as Mopane Bushveld.

Floral Habitat Sensitivity Graph



Open Mopane veld within the northern and central sections of the study area.

Rocky Mopane veld within the southern portion of the study area where the vegetation is transitioning to Soutpansberg Mountain Bushveld.

Floral Species of Conservation Concern (SCC)	Several floral species of conservation concern (SCC) occur within this habitat unit, most of which are tree species protected under the NFA, i.e. A*dansonia digitata* (Baobab tree), *Boscia albitrunca* (Shepherd's Tree), *Combretum imberbe* (Leadwood) and *Sclerocarya birrea* subsp. *caffra* (Marula tree). One TOPS listed species, namely *Adenium multiflorum*, is present in this habitat unit. *Adenium multiflorum* and *Adansonia digitata* are also protected under the LEMA. *Aloe litoralis*, (LEMA protected) was encountered within the extreme southern extent of the Mopane Bushveld within the study area. Furthermore, the LEMA lists all species of the genera *Huernia, Orbea* and *Stapelia* as Schedule 12 protected plants - several species falling within these genera have a distribution range coinciding with that of the study area and are likely occurring within the study area. - Based on the POC assessment (section 3.3), only TOPS, NFA and LEMA protected floral species have a high probability of occurring within this habitat unit, no SANBI RDL floral SCC are expected to be present within this habitat unit.
Floral Diversity	According to Mucina and Rutherford (2006), the Musina Mopane Bushveld vegetation unit is the most diverse mopaneveld type in South Africa. This, together with the study area falling within the ecotone of the Musina Mopane Bushveld and Soutpansberg Mountain Bushveld vegetation types as defined in the Mucina and Rutherford 2018 database, is the reason for the high floristic diversity within this habitat unit. The woody layer of this habitat unit was dominated by *Colophospermum mopane, Combretum apiculatum* subsp. *apiculatum, Commiphora viminea, Kirkia acuminata, Sterculia rogersii* and *Terminalia prunioides,* with *Adansonia digitata* (NFA protected) interspersed throughout the habitat unit. The shrub layer was characterised by *Commiphora pyracanthoides*, *Grewia bicolor*, *Grewia flava*, *Grewia occidentalis*, *Rhigozum zambesiacum* and *Ximenia americana*. While the herbaceous layer was poorly represented, which is typical of this vegetation type, a diverse range of forbs were present, including *Aptosimum lineare*, *Corchorus asplenifolius*, *Justicia odora*, *Ledebouria leptophylla*, *Limeum sulcatum* var. *sulcatum*, *Pavonia burchellii* and *Sedera capensis*. The graminoid layer was dominated by *Cynodon dactylon, Enneapogon cenchroides, Enteropogon macrostachyus. Eragrostis lehmanniana, Eragrostis pallens, Hyparrhenia hirta, Schmidtia pappophoroides* and *Themeda triandra*. The vegetation composition is typical of the Musina Mopane Bushveld vegetation type.  *Aptosimum lineare* (left) and *Kyphocarpa angustifolia* (right)  *Portulaca collina* (left) and *Sedera capensis* (right)  *Orbivestus cinerascens* (left) and *Colophospermum mopane* (right)

<table>
<tr>
<td rowspan="2">Conservation Status of Vegetation Type/Ecosystem</td>
<td rowspan="2">The species composition of this habitat unit is also representative of the vegetation type in which it occurs, and the vegetation type is considered Least Threatened (Mucina & Rutherford, 2006).

The section of the Mopane Bushveld habitat unit where mining infrastructure is proposed falls within a CBA 1 area (Limpopo Conservation Plan v.2, 2013). Mining is not considered a compatible land-use for a CBA 1 area, and net loss of intact habitat or intensification of land use should be avoided (Limpopo C-Plan Technical Report[5]). Similarly, the section of the Mopane Bushveld habitat unit where mining infrastructure is proposed falls within an area considered to be of Highest Biodiversity Importance (Mining and Biodiversity Guidelines, 2013). These 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, mining projects will be significantly constrained or may not receive the necessary authorisations.

Moreover, as already mentioned, the entire study area falls within Habitat of Threatened / Rare Species, considered important for Red Data floral Species (Limpopo C-Plan). Based on the largely intact and untransformed nature of this habitat unit, it is highly likely that Red Data floral Species are present within this habitat unit – also refer to section 3.3 of this report.

Finally, the study area is located within a transitional zone of the Vhembe Biosphere Reserve (refer to Section A) and thus not enjoy any legal protection; however, these areas are to be used in a sustainable manner due to the international recognition of the biodiversity importance of Biosphere Reserves.</td>
<td>Habitat integrity/Alien and Invasive species</td>
</tr>
<tr>
<td>The Mopane Bushveld habitat unit has a moderate to high ecological functionality and levels of habitat integrity and is in a relatively undisturbed condition. Thus, the ecological sensitivity and conservation value of the less transformed areas of the habitat unit is of increased ecological significance.
As already mentioned, the more transformed areas of the habitat unit, while not as ecologically intact, are still moderately representative of the reference vegetation type that they are situated in and is of limited extent.</td>
</tr>
<tr>
<td colspan="2"></td>
<td>Presence of Unique Landscapes</td>
</tr>
<tr>
<td colspan="2"></td>
<td>The Mopane Bushveld vegetation type is well represented in the study area as well as in the surrounding region.</td>
</tr>
<tr>
<td colspan="3">Business Case, Conclusion and Mitigation Requirements:

The Mopane Bushveld habitat unit is considered to be of moderately high ecological importance and sensitivity. Impacts associated with vegetation clearing will be of highest significance for the proposed Open Pit. The Open Pit, together with the proposed Interim Discard Dump, southern portion of the proposed Interim Waste Dump and the Plant area, will lead to significant loss of preferred floral habitat and diversity associated with the Mopane Bushveld within the study area. This is mainly due to the fact that the proposed mine layout extends across the majority of the Mopane Bushveld habitat unit within the study area.

Were the proposed activities to proceed, the following recommendations are made to minimise the impact of floral ecology associated with the Mopane Bushveld habitat unit:
• The footprint areas of all surface infrastructure must be minimised to what is essential;
• Any disturbance of sensitive floral habitat and species of conservation concern must be actively avoided;
• An Alien and Invasive Plant (AIP) Control Plan and Erosion Control Plan must be developed and implemented during all phases of development, to lower the risk of erosion and the increase in proliferation of AIPs within the MRA; and
• Due to floral SCC being recorded within this habitat unit, permits should be obtained from LEDET and DAFF to remove, cut or destroy any protected species before construction of infrastructure takes place. Consequently, before any construction activities can occur a detailed walk down of the area must take place, preferably within their flowering or fruiting season (refer to section 3.6), during which all protected species should be marked.</td>
</tr>
</table>

[5] Desmet, P. G., Holness, S., Skowno, A. & Egan, V.T. (2013). Limpopo Conservation Plan v.2: Technical Report. Contract Number EDET/2216/2012. Report for Limpopo Department of Economic Development, Environment & Tourism (LEDET) by ECOSOL GIS.

3.1.3 Habitat Unit 3: Freshwater Habitat Unit

Floral Habitat Sensitivity	Moderately High

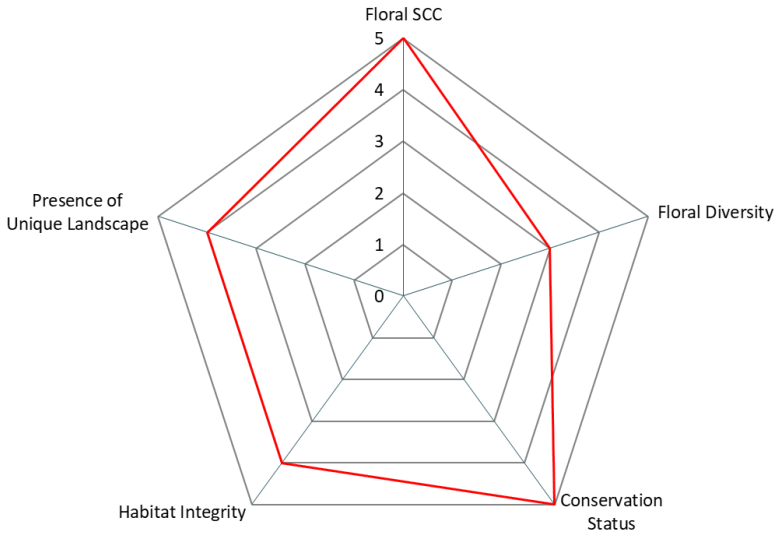
Habitat Unit Description:

Several types of watercourses are present within the study area, i.e. the Mutamba River and several drainage lines, some of which have true riparian vegetation associated therewith. These were delineated and are discussed in detail in the freshwater assessment report (Section D: SAS 219046 – Freshwater and Aquatic Assessment, 2019).

The river assessed (Mutamba River) was defined as a perennial system containing riparian habitat due to the presence of alluvial soil as well as the presence of vegetation, with a composition and physical structure, distinct from adjacent areas. The Mutamba River falls outside of the MRA and study area.

Within the study area, drainage lines were present that are associated with true riparian vegetation. However, several smaller drainage lines were also observed, most of which do not hold surface water for periods long enough for the formation of hydromorphic soil that would support vegetation adapted to life in saturated soils and lead to the formation of wetlands or the establishment of true riparian areas.

Floral Habitat Sensitivity Graph



Ephemeral drainage line with associated true riparian habitat.

Typical views of the smaller ephemeral drainage lines where true riparian vegetation did not establish.

<table>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="2">In terms of RDL and protected floral species, two species protected under the NFA, namely Sclerocarya birrea subsp caffra and Combretum imberbe are present in this habitat unit especially within the thickets associated with the riparian zones and the ephemeral systems. Aloe litoralis, (LEMA protected) was encountered in this habitat unit within the extreme southern extent of the study area.</td></tr>
<tr><td>Floral Diversity</td><td colspan="2">The Freshwater Habitat within the study area is less floristically diverse than the adjacent habitat units, which can be attributed to the unique soil conditions associated with the Freshwater Habitat. The ephemeral drainage lines and riparian areas stretch across the study area and across both the Musina Mopane Bushveld and Soutpansberg Mountain Bushveld; thus, common and widespread species associated with these two overarching habitat units are shared with the Freshwater Habitat unit, e.g. Colophospermum mopane, Grewia flavescens, Senegalia nigrescens, Terminalia prunioides and Ziziphus mucronata.

In terms of distinct watercourse vegetation, the riparian zone of the Mutamba River (outside of study area) was defined by the presence of large Combretum imberbe, Spirostachys africana, Ficus salicifolia and F. craterostoma trees.

Within the study area, the permanent zones of the riparian systems were characterized by Phragmites mauritianum, Brachiaria deflexa, Cyperus sexangularis and Typha capensis, though not all of these species were present at the different riparian zones within the study area.

The ephemeral drainage lines were also associated with distinct species, although these species are not necessarily associated with moisturer-rich conditions. The vegetation around the majority of ephemeral drainage lines was characterised by Combretum imberbe, Salvadora australis, Vachellia grandicornuta, Ziziphus mucronata and Spirostachys africana, which can form dense belts along the banks of these features.

 
Combretum imberbe (left), Salvadora australis (middle), Brachiaria deflexa (right)</td></tr>
<tr><td rowspan="4">Conservation Status of Vegetation Type/Ecosystem</td><td rowspan="4">Sections of the Freshwater Habitat form part of the Vulnerable Soutpansberg Mountain Bushveld vegetation type (Mucina & Rutherford, 2006).

The section of the Freshwater Habitat where mining infrastructure is proposed falls within a CBA 1 area (Limpopo Conservation Plan v.2, 2013). Mining is not considered a compatible land-use for a CBA 1 area, and net loss of intact habitat or intensification of land use should be avoided (Limpopo C-Plan Technical Report). Similarly, the section of the Freshwater Habitat where mining infrastructure is proposed falls within an area considered to be of Highest Biodiversity Importance (Mining and Biodiversity Guidelines, 2013). These 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, mining projects will be significantly constrained or may not receive the necessary authorisations.

As mentioned previously, the entire study area, including the Freshwater Habitat, falls within the transitional zone of the Vhembe Biosphere Reserve.

This habitat unit, comprising of true watercourses (SAS, 2019) enjoy protection under the National Water Act, 1998 (Act 36 of 1998) (NWA).</td><td>Habitat integrity/Alien and Invasive species</td></tr>
<tr><td>The riparian zones and ephemeral drainage lines are characterised by high ecological functionality and overall high levels of habitat integrity.</td></tr>
<tr><td>Presence of Unique Landscapes</td></tr>
<tr><td>The Freshwater Habitat provides a niche habitat for several floral species and thus provides unique habitat that is not available in the adjacent habitat units.</td></tr>
</table>

Business Case, Conclusion and Mitigation Requirements:	This habitat unit is considered to be of moderately high ecological sensitivity and importance from a floral perspective. As such, any impacts on the freshwater systems associated with the study area are likely to be significant on a local and regional scale. With the current proposed mine layout, all freshwater systems that fall within the project footprint area will be negatively impacted. In addition, downstream impacts on floral ecology are likely to emanate from the mining impacts on the Freshwater Habitat Unit, including reduced recharge, sedimentation resulting from erosion as well as AIP proliferation along the Freshwater Habitat Unit, thus further altering floral community structure. It is recommended that no mining-related activities should take place within the Freshwater Habitat Unit and associated buffer zones as defined by NEMA (32 metres), GN704 of the NWA (100 metres), particularly because the impacts will not remain localised and has a high potential to impact on downstream systems. However, were the proposed activities to proceed, the following recommendations are made to minimise the impact on floral species: • All possible steps must be taken to ensure that infrastructure does not encroach unnecessarily so to prevent negative impacts due to sedimentation and/or impacts on water quality of the Freshwater Habitat Unit and associated buffers. It is recommended that the Freshwater Habitat Unit and associated buffer zones beyond the immovable footprint areas must be designated as No-Go areas; • To minimise the need for additional vegetation clearance, existing access roads are to be used to gain access to the proposed infrastructure as far as possible; • There is considerable potential for impacts on floral ecology both within the study area as well as downstream thereof, due to the potential for reduced recharge and an increase in sediment load to the Freshwater Habitat Unit. Thus, all affected riparian vegetation and watercourse systems, including areas downstream of the mine, must be monitored for moisture stress and all potentially affected riparian zones should be monitored for changes in riparian vegetation structure. • Erosion control measures are to be implemented to mitigate downslope sedimentation of the Freshwater Habitat Unit and the hindrance of revegetation/ rehabilitation activities; • An AIP control plan must be designed and implemented in order to monitor and control alien floral recruitment along the Freshwater Habitat Unit as watercourses are corridors along which AIPs can spread, thus leading to further downstream impacts to floral ecology; and • Before any construction activities can occur a detailed walk down of the area must take place, preferably within their flowering season (refer to section 3.5), during which all protected species should be marked, for which permits should be obtained from DAFF and LEDET to remove, cut or destroy any protected species before construction of infrastructure takes place.

3.2 Floral Species of Conservation Concern Assessment

Threatened/protected species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is a threatened species. Furthermore, SCC are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare and Declining.

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species, was undertaken. The complete PRECIS (Pretoria Computer Information Systems) floral Red Data Listed (RDL) lists for the grid reference 2230CC, and 2230CA (Appendix B) was acquired from SANBI (South African National Biodiversity Institute). Also taken into consideration was:

- 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);
- List of Schedule 11 (Specially protected) and Schedule 12 (Protected plants) under the Limpopo Environmental Management Act, 2003 (Act 7 of 2003); and
- List of Protected Tree Species (GN 809 of 2014) under the National Forest Act (Act 84 of 1998).

From the SCC assessment (Table 1), several of the RDL floral species listed for the QDS 2230CC and 2230CA have a high probability of occurring within the study area, especially within the Soutpansberg Mountain Bushveld habitat unit. Floral SCC that were recorded within the study area and that are associated with the habitat units identified on site are also listed in the below table.

**The occurrence records of the floral SCC as recorded during the field assessment of 2019 are depicted in Figures 5 however, it should be noted that marking the occurrences of all SCC within the study area was not part of the scope of work and that the depicted occurrences are merely a guideline to indicate that the species are present and, in most cases, the species were present in higher abundances than what is depicted on the maps (refer to additional information on species abundance in Table 1). Species' occurrences on the maps are based on several transects followed within the various habitat units, but additionally includes random recordings of species as encountered during the field assessment.*

Before any construction activities can take place, a detailed walk-down of the area is necessary, during which all SCC should be marked and either considered for rescue and relocation or, if planning to destroy or move these species, permits would be required from relevant authorities (see table below and Appendix B).

Table 1: Floral SCC with a high probability of occurrence score (POC) within the QDS 2230CC and 2230CA, with information on floral species encountered on site. Refer to Appendix B for the full list of SCC and their POC scores.

SCIENTIFIC NAME	HABITAT & DISTRIBUTION / RANGE	TOPS THREAT STATUS	NATIONAL RED LIST STATUS	POC (%)
SANBI Red and Orange Listed Species				
Legal requirements: A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7 of NEMBA.				
Ceropegia cimiciodora	It occurs in a Savanna habitat, in turf and sandy loam soils. - High probability of occurring, especially in **Soutpansberg Mountain Bushveld** habitat unit. Not recorded during assessment.	-	VU	80
Tylophora coddii	It occurs in a terrestrial savannah habitat, in rock crevices, 1000 – 1600 m. ➢ High probability of occurring, especially in **Soutpansberg Mountain Bushveld** habitat unit. Not recorded during assessment.	-	Rare	70
Warburgia salutaris	It occurs in a terrestrial forest and savannah habitat, in coastal, riverine, dune and montane forest, as well as open woodland and thickets. ➢ Suitable habitat available within the **Soutpansberg Mountain Bushveld** habitat unit. Not recorded during assessment.	-	EN	60
Elaeodendron transvaalense	It occurs in a terrestrial Savanna or bushveld habitat, from open woodland to thickets, often on termite mounds. Declining due to heavy exploitation for the muthi market. ➢ Suitable habitat available within the **Soutpansberg Mountain Bushveld** habitat unit. Not recorded during assessment.	-	NT	60
TOPS plant list for the Limpopo Province				
Legal requirements: Any restricted activity for which a permit is required includes international import/ export/ re-export, gathering/ plucking/ collecting, conveying / moving/ translocation, growing/ breeding/ propagating, selling/ buying/ receiving/ giving/ donating, as well as nursery possession.				
Drimia sanguinea	Open veld and scrubby woodland in a variety of soil types. ➢ Suitable habitat available within the **Mopane Bushveld** habitat unit. Not recorded during assessment.	P	NT	73
Harpagophytum procumbens	Well drained sandy habitats in open savanna and woodlands. ➢ Suitable habitat available within the **Mopane Bushveld** habitat unit. Not recorded during assessment.	P	LC	67
Harpagophytum zeyheri subsp. *zeyheri*	On Kalahari sand in dry open woodland. ➢ Suitable habitat available within the **Mopane Bushveld** habitat unit. Not recorded during assessment.	P	LC	67

SCIENTIFIC NAME	HABITAT & DISTRIBUTION / RANGE	TOPS THREAT STATUS	NATIONAL RED LIST STATUS	POC (%)
List of Protected Tree Species (GN 809 of 2014) under the NFA				
Legal requirements: In terms of this act, protected tree species may not be cut, disturbed, damaged or destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the DAFF a delegated authority. Applications for such activities should be made to the responsible official in each province. Each application is evaluated on merit (including field assessments) before a decision is taken whether or not to issue a licence (with or without conditions). Such decisions must be in line with national policy and guidelines.				
Adansonia digitata	It is restricted to hot, dry woodland on stony, well-drained soils, in frost-free areas that receive low rainfall. In South Africa, it is found only in the warm parts of the Limpopo Province. ➢ Scattered throughout the **Mopane Bushveld** and **Soutpansberg Mountain Bushveld** habitat units.	-	LC	100
Boscia albitrunca	Habitat mainly includes dry, open woodland and bushveld, mostly in hot, arid, semi-desert areas, often on termitaria. ➢ Abundant throughout the **Mopane Bushveld** and **Soutpansberg Mountain Bushveld** habitat units.	-	LC	100
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. ➢ Restricted distribution in the study area – mainly found within the **Freshwater Habitat Unit** at low abundances.	-	LC	100
Philenoptera violacea	Found in savanna and wooded grassland and frequently along rivers. Large specimens found near water. *Philenoptera violacea* is distributed in three provinces of South Africa: Limpopo, Mpumalanga and KwaZulu-Natal. In Limpopo, it is found in the northern part of the province. ➢ Occurs in low abundances; only individual found within the **Soutpansberg Mountain Bushveld**. Suitable habitat also available within the **Freshwater Habitat Unit.**	-	LC	100
Sclerocarya birrea subsp. *caffra*	It occurs naturally in various types of woodland, on sandy soil or occasionally sandy loam. ➢ Common throughout, but more so within the **Soutpansberg Mountain Bushveld**.	-	LC	100
Schedule 12 (Protected) plants under the LEMA				
Legal requirements: If individuals or communities of these species will be disturbed by construction/operational activities, they must be relocated to suitable, similar habitat in close proximity to where they were removed from, but outside the disturbance footprint after obtaining the relevant permits from the Limpopo Department of Economic Development, Environment and Tourism (LEDET).				
Adenium multiflorum	Widespread in eastern South Africa, including KwaZulu-Natal, Mpumalanga and Limpopo provinces, extending northwards into east and west tropical Africa. It grows in arid woodland. ➢ Low abundance within the **Mopane Bushveld** and **Soutpansberg Mountain Bushveld** habitat units.	-	LC	100

SCIENTIFIC NAME	HABITAT & DISTRIBUTION / RANGE	TOPS THREAT STATUS	NATIONAL RED LIST STATUS	POC (%)
Aloe littoralis	Occurs in Mopani veld and dry open woodland. - Several individuals recorded within the **Mopane Bushveld** and within the **Freshwater Habitat Unit.** Low abundances of this species were recorded; however, suitable habitat is available throughout the **Mopane Bushveld** habitat unit.	-	LC	100
Ansellia africana	In hot dry mixed deciduous woodlands at medium to low altitudes, in riverine vegetation and miombo woodlands near rivers, on *Hyphaene*, *Adansonia*, *Colophospermum*, *Ficus*, *Brachystegia*, *Parinari*, *Terminalia*, *Uapaca* and *Albizia* spp., also sometimes on rocks in shade, rarely in forest 0-2200 m. ➢ One individual recorded within the south-facing slopes of the **Soutpansberg Mountain Bushveld**. More species are expected to be present within this habitat unit.	-	LC	100
All species of *Huernia*	*Huernia zebrina* subsp. *insigniflora* has a distribution range that falls within the study area. ➢ Suitable habitat available within the **Mopane Bushveld** and **Soutpansberg Mountain Bushveld** habitat unit. Not recorded during assessment.	-	-	73
All species of *Orbea*	The genus is distributed widely throughout Africa. Unlike most of the other stapeliad genera in southern Africa, which have their highest degree of diversification on the border between the winter-rainfall area and the dry karroid regions, *Orbea* has its highest diversification along the eastern escarpment, with a peak in the Soutpansberg and Blouberg areas. ➢ Suitable habitat available within the **Mopane Bushveld** and **Soutpansberg Mountain Bushveld** habitat unit. Not recorded during assessment.	-	-	73
All species of *Stapelia*	*Stapelia gettliffei* and *Stapelia kwebensis* have a distribution range that falls within the study area. ➢ Suitable habitat available within the **Mopane Bushveld** and **Soutpansberg Mountain Bushveld** habitat unit. Not recorded during assessment.	-	-	73

EN = Endangered; LC = Least Concern; NT = Near Threatened; P = Protected; VU= Vulnerable.

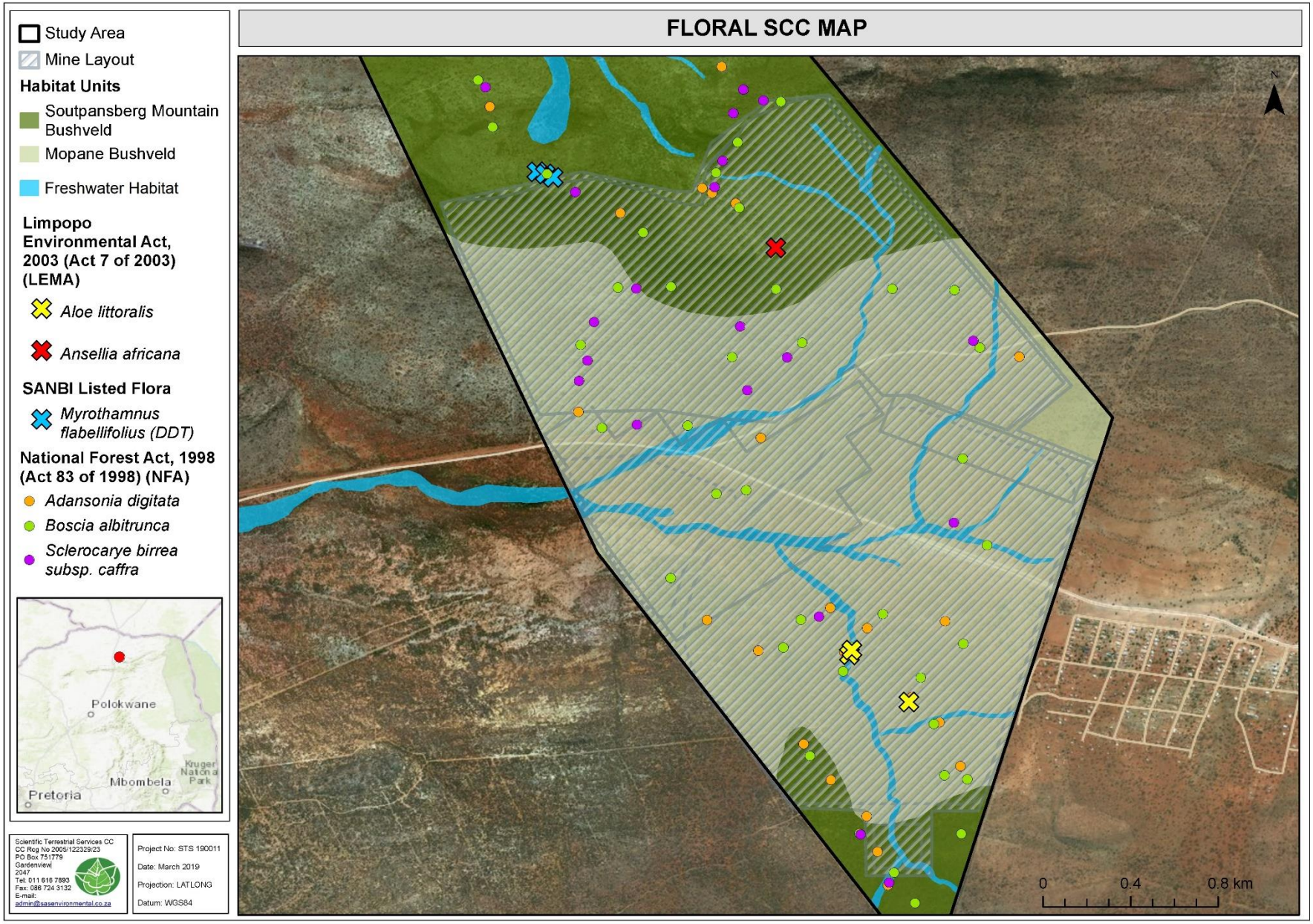


Figure 5: Floral SCC that was found on site in relation to the infrastructure areas.

3.3 Alien and Invasive Plant (AIP) Species

Alien and invasive floral species are floral species of exotic origin which are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural “check” mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

Alien vegetation invasion causes degradation of the ecological integrity of an area, causing (Bromilow, 2001):

- A decline in species diversity;
- Local extinction of indigenous species;
- Ecological imbalance;
- Decreased productivity of grazing pastures; and
- Increased agricultural input costs.

Alien and Invasive Plant (AIP) species’ proliferation within the study area was low to very low and limited to isolated patches of disturbance around roads and closer to human settlements adjacent to the study area. It is important that all AIPs located in the study area be removed on a regular basis as part of maintenance activities as stipulated within the NEMBA: Alien and Invasive Species Regulations, GN R864 of 2016. Removal and control of AIPs should take place throughout the pre-construction, construction, operational, and rehabilitation/ maintenance phases.

During the floral assessment, dominant alien and invasive plant species were identified and are listed in the table below.

Table 2: Alien and invasive plant species within the study area.

Species	English name	Origin	Category*	Habitat Unit
Trees/ shrubs				
Cereus jamacaru	Queen of the night	South America	1b	Soutpansberg Mountain Bushveld
Datura ferox	Large thorn-apple	Eurasia	1b	Soutpansberg Mountain Bushveld
Opuntia ficus-indica	Prickly pear	Mexico	1b	Soutpansberg Mountain Bushveld
Solanum mauritianum	Bugweed	South America	1b	Soutpansberg Mountain Bushveld
Solanum nigrum	European black nightshade	Eurasia	N/A	Mopane Bushveld
Forbs				
Bidens pilosa	Common blackjack	South America	N/A	Soutpansberg Mountain Bushveld & Mopane Bushveld
Mollugo nudicaulis	-	Central Africa	N/A	Mopane Bushveld
Schkuhria pinnata	dwarf Mexican marigold	South America	N/A	Soutpansberg Mountain Bushveld & Mopane Bushveld
Tagetes minuta	Tall khaki weed	South America	N/A	Soutpansberg Mountain Bushveld & Mopane Bushveld
Zinnia peruviana	Redstar zinnia	South America	N/A	Soutpansberg Mountain Bushveld & Mopane Bushveld

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: 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.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.

3.4 Medicinal Plant Species

Medicinal plant species are not necessarily indigenous species, with many of them regarded as alien invasive weeds. The medicinal species are all commonly occurring species and are not confined to the study area.

The table below presents a list of plant species with traditional medicinal value, plant parts traditionally used and their main applications, which were identified during the field assessment.

Table 3: Dominant traditional medicinal floral species identified during the field assessment. Medicinal applications and application methods are also presented (van Wyk, Oudtshoorn, Gericke, 2009). Where information was not available in van Wyk et al. (2009), other sources were used to gather information, including SANBI's PlantZAfrica website (http://pza.sanbi.org/).

Species	Name	Plant parts used	Medicinal uses
Asclepias fruticosa	Milkweed	Leaves, sometimes roots	Used as snuff to treat headaches and tuberculosis.
Adansonia digitata (NFA)	Baobab	Leaves, fruit, bark, roots	Leaves rich in vitamin C, sugars, potassium tartrate, and calcium. The fibrous bark is used to make items such as mats and ropes, fishing nets, fishing lines, sacks as well as clothing.
Adenium multiflorum (LEMA)	Impala lily	Bark and trunk	Used for fish poison and arrow poison. The poison is prepared from latex in the bark and fleshy parts of the trunk. Despite the toxicity, it is used in medicinal applications and as magic potions.
Boscia albitrunca (NFA)	Shepherd's tree	Bark, roots, leaves	The root is pounded to make porridge. It is commonly used as a substitute for coffee or chicory. The root is also used to make a beer and to treat haemorrhoids. The leaves are nutritious and are often browsed by cattle. An infusion of the leaves is used to treat eye infections in cattle.
Combretum imberbe (NFA)	Leadwood	Leaves, bark, roots and flowers	Smoke from burning leaves used to relieve coughs, colds and chest complaints. Flowers used as a cough mixture. Leaves believed to have magical powers. For treatment of diarrhoea and stomach pains, root decoctions are used. A combination of roots and leaves taken against bilharzia.
Commiphora edulis	Rough leaved corkwood	Gum	Gum boiled in water to form a soap for washing clothes.
Corchorus asplenifolius	Geel varingblaartjie	Entire plant	Used in traditional medicine with other plants, as an aphrodisiac and to treat impotence. A powder of the root that is rubbed into a skin incision has been recorded to cure the effects of snakebites.[6]
Dichrostachys cinerea	Sickle bush	Root and often stems bark, leaves and pods	Root infusions have been used to treat body pain, backache, toothache, elephantiasis, syphilis, leprosy and as a styptic, diuretic, purgative and aphrodisiac.
Datura stramonium	Thornapple	Leaves and rarely the green fruit.	Generally, as asthma treatment and pain reduction.
Dombeya rotundifolia	Wild pear	Mainly bark, sometimes roots	Infusions are used orally or as enemas to treat internal ulcers, haemorrhoids, diarrhoea and stomach problems.
Hilliardiella oligocephala	Groenamara	Leaves and twigs	Infusions are taken as stomach bitters to treat abdominal pain and colic.
Philenoptera violacea (NFA)	Apple leaf	Mostly roots	Most parts of the plant are used to treat diarrhoea. The roots are used for gastro-intestinal problems; powdered root-bark is used to treat colds and snakebite. Root infusions are commonly used as part of a hookworm remedy.
Olea europaea subsp *africana*	Wild olive	Dried leaves, sometimes stem and bark	The main use of the plant is as a hypotensive to lower blood pressure and to enhance renal function.

[6] Van der Walt, R. (2009). Wild Flowers of the Limpopo Valley Including Mapungubwe National Park. Retha van der Walt.

Species	Name	Plant parts used	Medicinal uses
Spirostachys africana	Tamboti	Latex, bark	A drop of the fresh latex is applied to a painful tooth as painkiller. The bark is used to treat stomach pains, but large dosages will cause damage to the internal organs.
Schotia brachypetala	Weeping boer bean	Bark and roots	Used to treat heartburn and hangovers. Bark and root mixtures are used to strengthen the body and purify the blood, to treat nervous heart conditions and diarrhoea, as well as for facial saunas.
Sclerocarya birrea subsp. *caffra* (NFA)	Marula	Bark, roots and leaves	Diarrhoea, dysentery and unspecific stomach problems are treated with the bark. Also used as a general tonic, in combatting fever and in the treatment of malaria.
Tagetes minuta	Tall khaki bush	Leaves, flowers	The repellent properties of essential oil have been known for a long time and were found to be effective in preventing sheep from becoming infected with blow-fly larvae. Many gardeners use warm water extracts of the fresh plant to keep roses and other garden plants free from insects and fungal diseases. The essential oil is used in perfumery and as a flavourant in food, beverages and tobacco.
Ziziphus mucronata	Buffalo thorn	Roots, bark or leaves used separately or in combination.	Warm bark infusions (sometimes together with roots or leaves added) are used as expectorants (also as emetics) in cough and chest problems, while root infusions are a popular remedy for diarrhoea and dysentery. Decoctions of roots and leaves (or chewed leaves) are applied externally to boils, sores and glandular swellings, to promote healing and as an analgesic.

A moderate to a high diversity of medicinal species is present, and it is highly likely that the local communities rely on these medicinal species as relatively few medical facilities are present in the local area. In addition, five medicinal tree species are protected under the NFA, namely *Adansonia digitata, Boscia albitrunca*, *Combretum imberbe, Philenoptera violacea* and *Sclerocarya birrea* subsp *caffra*. Another medicinal species, namely *Adenium multiflorum,* is protected under the NEMBA TOPS list. *Adenium multiflorum* and *Adansonia digitata* are also protected under the Limpopo Environmental Management Act, 2003 (Act 7 of 2003).

Thus, any detrimental impact on the medicinal species associated with the study area is likely to have a significant impact on surrounding communities relying on such species for medicinal use.

4 SENSITIVITY MAPPING

The figures below conceptually illustrate the areas considered to be of increased ecological sensitivity with the proposed infrastructure layout overlaid. 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. The table below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

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

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Soutpansberg Mountain Bushveld	**High**	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.	The Soutpansberg Mountain Bushveld habitat unit has general high ecological functionality and overall high levels of habitat integrity and is in a largely undisturbed condition. The species composition of this habitat unit is also representative of the vegetation type in which it occurs, and the vegetation type is considered to be Vulnerable. Furthermore, this habitat unit contains several floral SCC. Thus, this habitat unit is highly sensitive.
Mopane Bushveld	**Moderately High**	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	The Mopane Bushveld habitat unit has general moderate to high ecological functionality and levels of habitat integrity and is in a relatively undisturbed condition. The species composition of this habitat unit is also representative of the vegetation type in which it occurs, and the vegetation type is considered Least Threatened. Furthermore, this habitat unit contains several floral SCC. Thus, this habitat unit is of moderately high sensitivity.
Freshwater Habitat Unit	**Moderately High**	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	The riparian zones and ephemeral drainage lines are characterised by high ecological functionality and overall high levels of habitat integrity. The Freshwater Habitat Unit provides niche habitat for several floral species and thus provides unique habitat that is not available in the adjacent habitat units. Moreover, floral SCC is present within this habitat unit. Thus, this habitat unit is considered to be of moderately high sensitivity. As such, any impacts on riparian zones and ephemeral drainage lines systems associated with the study area are likely to be significant on a local and regional scale.

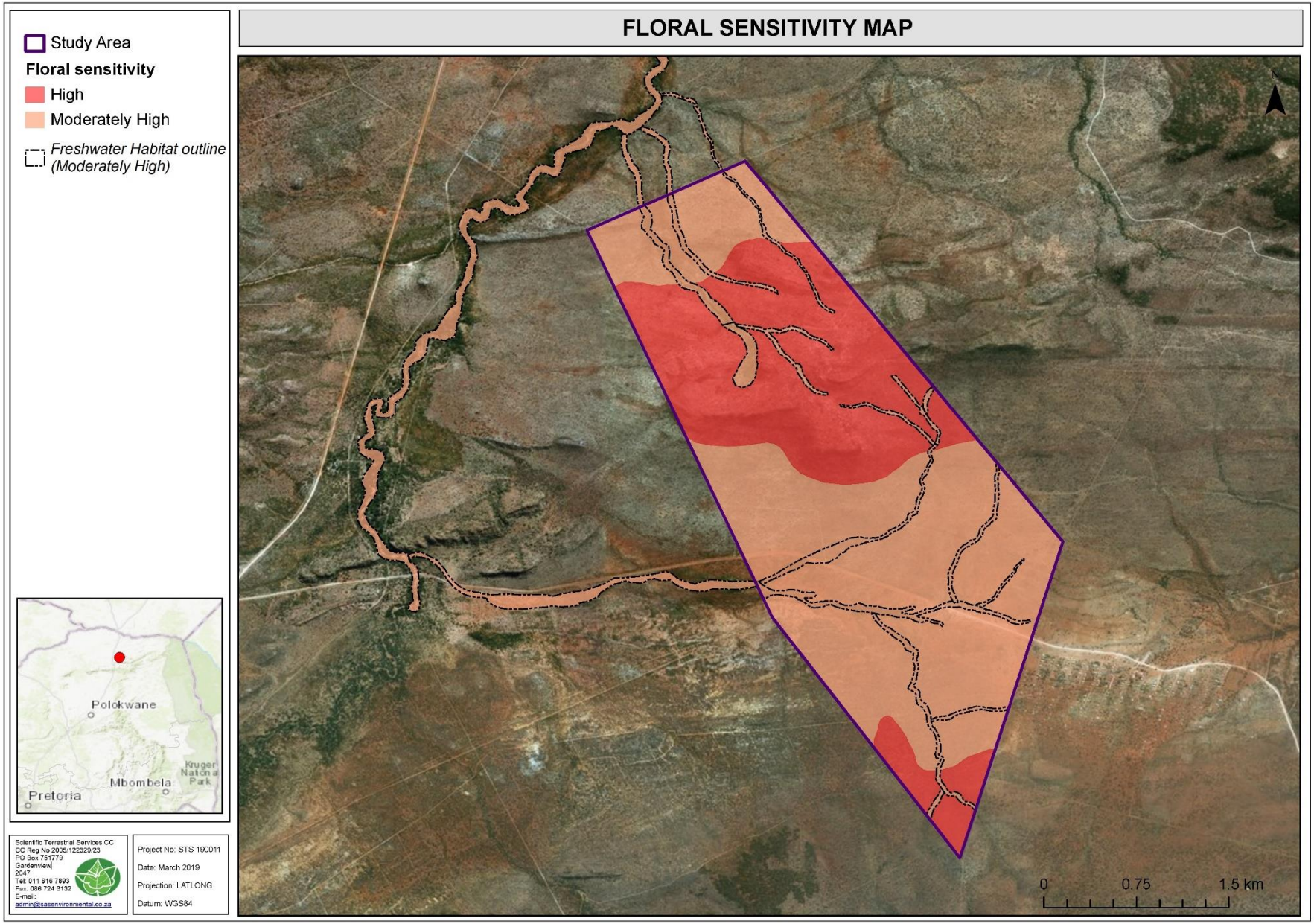


Figure 6: Sensitivity map for the study area.

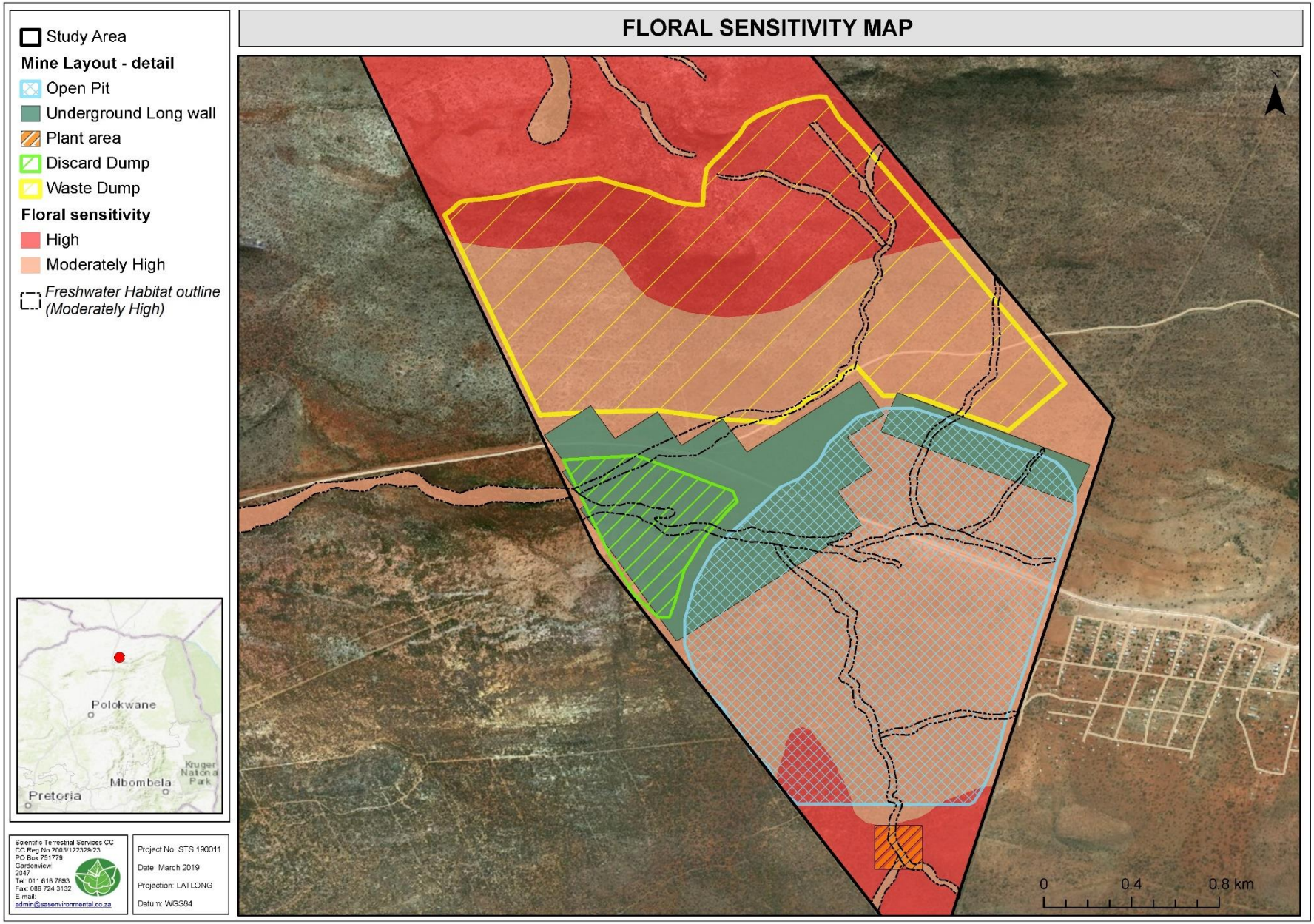


Figure 7: Sensitivity map for the study area zoomed in on the proposed mining-related infrastructure.

5 FLORAL IMPACT ASSESSMENT

The impact assessment was undertaken on all aspects of floral ecology deemed likely to be affected by the proposed coal mining project. The sections below present the results of the findings per identified risk/impact for the floral ecology of the study area.

5.1 Impact 1: Impact on Floral Habitat

The data gathered during the baseline floral ecological assessment indicate that the Soutpansberg Mountain Bushveld habitat unit is of high sensitivity, with the Mopane Bushveld and Freshwater Habitat Units of moderately high sensitivity – in terms of ecological functioning and floral habitat integrity.

Placement of infrastructure and mining activities within intact floral habitat in areas such as the Soutpansberg Mountain Bushveld and Freshwater Habitat Units is highly likely to have a detrimental impact on local and regional floral habitat conservation. The Mopane Bushveld is well-represented within the region and impacts on floral ecology associated with this habitat unit is more likely to be restricted to the study area and immediate surrounding areas – no regional loss of floral habitat anticipated.

The study area is associated with Critical Biodiversity Areas (Limpopo C-Plan Version 2) and vegetation types which are classified as vulnerable. Furthermore, the baseline floral assessment confirmed the presence and habitat integrity of these areas. Approximately 55% of the study area is also situated in an area of Highest Biodiversity Importance according to the Mining and Biodiversity Guideline (2013) database. Floral habitat is therefore of moderately high conservation importance.

Activities which are likely to negatively affect the floral habitat integrity of the study area includes, but are not limited to, the following:

- Placement of mining infrastructure within sensitive floral habitat;
- Destruction of floral habitat during construction and operational activities;
- Dust generated by mining activities;
- Alien floral invasion and erosion in disturbed areas;
- Dewatering and pollution of watercourses leading to altered riparian and freshwater floral habitat; and
- Increased human populations in the surrounding area leading to greater pressure on natural floral habitat.

The above activities are highly likely to have a significant impact on floral habitat within and around the study area as the physical destruction of floral habitat will be unavoidable within this sensitive area. The following tables provide an indication of the anticipated impact significance pre- and post-mitigation.

Activities and aspect registry

Pre-Construction	Construction	Operational	Decommissioning & Closure
Potential poor planning of infrastructure placement and design in sensitive floral habitat units.	Site clearing and the removal of vegetation leading to a loss of sensitive floral habitat.	On-going disturbance of soils due to operational activities leading to altered floral habitat.	Ineffective rehabilitation of exposed and impacted areas leading to altered runoff pattern flow and timing, pit voids and permanent losses of floral habitat.
Potential poor planning of infrastructure leading to excessively large footprints leading to increase direct impacts and impacts associated with loss of recharge and other edge effect mechanisms	Loss of floral biodiversity through invasion of alien species in disturbed areas.	Increased introduction and proliferation of alien plant species and further transformation of natural habitat.	Potential ineffective rehabilitation will lead to the proliferation of alien and invasive plant species and further floral habitat and species loss
Potential failure to initiate the development of a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the pre-construction phase.	Erosion as a result of mining development and storm water runoff leading to a loss of floral habitat.	Risk of contamination and contamination from all operational facilities may pollute the receiving environment leading to altered floral habitat.	Bare soil areas, if not rehabilitated will lead to increased runoff, erosion and the sedimentation of downslope habitats
	Movement of construction vehicles and access road construction through sensitive floral habitat.	Seepage affecting soils and the groundwater regime leading to altered floral habitat	On-going risk of contamination from mining facilities beyond closure leading to permanent impact on floral habitat.
	Construction of open pits, topsoil stockpiles, overburden dumps and other surface infrastructure leading to a loss of sensitive floral habitat.	Additional pressure on floral habitat by increased human populations associated with the proposed mine leading to a loss of floral habitat.	On-going seepage and runoff may affect the groundwater regime beyond closure.
	Compaction of soils reducing the efficiency of floral re-establishment	Potential failure to implement a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the operational phase.	Potential failure to implement a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the decommissioning and closure phase.
	Potential failure to implement a biodiversity action plan, rehabilitation plan and alien floral control plan during the construction phase.	Dust generation during operational activities leading to a loss of floral habitat.	

Pre-Construction	Construction	Operational	Decommissioning & Closure
	Increased fire frequency during construction leading to a loss of sensitive floral habitat	Increased fire frequency during operation leading to a loss of sensitive floral habitat	
	Dust generation during construction leading to a loss of floral habitat.		

Table 5: Impact on Floral Habitat associated with the study area.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	5	4	5	9	14	126 (Very High)
Operational phase	5	4	5	4	5	9	14	126 (Very High)
Decommissioning and Closure Phase	5	4	4	3	5	9	12	108 (High)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	4	3	4	9	11	99 (Medium-High)
Operational phase	4	4	3	3	4	8	10	80 (Medium-High)
Decommissioning and Closure Phase	4	4	3	3	4	8	10	80 (Medium-High)

5.2 Impact 2: Impact on Floral Diversity

The Soutpansberg Mountain Bushveld has the highest floral species diversity within the study area, followed by the Mopane Bushveld that is also floristically diverse. The Freshwater Habitat Unit has a moderate diversity of floral species.

The Soutpansberg Mountain Bushveld and Freshwater Habitat areas are of high sensitivity in terms of ecological functioning and floral habitat integrity and considered unique within the landscape. Therefore, placement of infrastructure, construction of the mine and mining activities within intact floral habitat in areas such as the Soutpansberg Mountain Bushveld and Freshwater Habitat areas are highly likely to have a detrimental impact on local and regional floral diversity.

The Mopane Bushveld is well-represented within the region and mining impacts on species diversity is not anticipated to extend to a regional scale. However, the floral diversity within the study area is higher than what can be expected for the reference vegetation type due to the section of the Mopane Bushveld within the study area falling within the ecotone of the *Musina Mopane Bushveld* and *Soutpansberg Mountain Bushveld* vegetation types. Furthermore, the majority of the proposed mine layout falls within this habitat unit and will, therefore, have a significant impact on the floral species diversity associated with the Mopane Bushveld within the study area.

Activities which are likely to negatively affect the floral diversity of the study area includes, but are not limited to, the following:

- Placement of mining infrastructure within sensitive floral habitat;
- Destruction of floral habitat during construction and operational activities;
- Dust generated by mining activities leading to altered floral species diversity;
- Alien floral invasion and erosion in disturbed areas;
- Loss of recharge and pollution of watercourses leading to altered riparian floral communities; and
- Alteration of hydrology and runoff patterns.

The above activities are highly likely to have a significant impact on floral diversity within and around the study area as the alteration of floral diversity will be highly likely within this sensitive area. The following tables provide an indication of the anticipated impact significance pre- and post-mitigation.

Activities and aspect registry

Pre-Construction	Construction	Operational	Decommissioning & Closure
Potential poor planning of infrastructure placement and design in sensitive floral habitat units	Site clearing and the removal of vegetation leading to a loss of floral diversity	On-going disturbance of soils due to operational activities leading to altered floral diversity	Ineffective rehabilitation of exposed and impacted areas leading to altered runoff pattern flow and timing, pit voids and permanent losses of floral species diversity.
Potential failure to initiate a biodiversity action plan, rehabilitation plan and alien floral control plan during the pre-construction phase.	Loss of floral biodiversity through the invasion of alien species in disturbed areas	Increased introduction and proliferation of alien plant species and further transformation of floral diversity	On-going risk of contamination from mining facilities beyond closure leading to permanent impact on floral diversity.
	Erosion as a result of mining development and stormwater runoff leading to a loss of floral diversity.	Risk of contamination and contamination from all operational facilities may pollute receiving environment leading to altered floral diversity	On-going seepage and runoff may affect the groundwater regime beyond closure
	Movement of construction vehicles and access road construction through sensitive floral habitat.	Seepage affecting soils and the groundwater regime leading to altered floral diversity	Potential failure to implement a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the decommissioning and closure phase.
	Construction of open pits, topsoil stockpiles, overburden dumps and other surface infrastructure leading to a loss floral diversity.	Additional pressure on floral diversity by increased human populations associated with the proposed mine	
	Compaction of soils reducing the efficiency of floral re-establishment	Potential failure to implement a biodiversity action plan, rehabilitation plan and alien floral control plan during the operational phase.	
	Potential failure to implement a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the construction phase.	Dust generation during operational activities leading to a loss of floral diversity	
	Increased fire frequency during construction leading to a loss of floral diversity	Increased fire frequency during operation leading to a loss of floral diversity	
	Dust generation during construction leading to a loss of floral diversity.		

Table 6: Impact on Floral Diversity associated with the study area.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	5	4	5	9	14	126 (Very High)
Operational phase	5	4	5	4	5	9	14	126 (Very High)
Decommissioning and Closure Phase	5	4	4	3	5	9	1\2	108 (High)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	4	3	4	9	11	99 (Medium-High)
Operational phase	4	4	3	3	4	8	10	80 (Medium-High)
Decommissioning and Closure Phase	3	4	3	3	3	7	9	63 (Medium-Low)

5.3 Impact 3: Impact on Floral Species of Conservation Concern

Placement of infrastructure, construction of the mine and mining activities are highly likely to have an unfavourable impact on medicinal species and floral species of conservation concern such as *Adansonia digitata, Boscia albitrunca, Combretum imberbe, Philenoptera violacea* and *Sclerocarya birrea* subsp. *caffra,* among others. Furthermore, the study area is highly likely to provide habitat and play host to additional protected species. A high diversity of medicinal species was also encountered which are important to the rural communities residing in and around the study area.

The impact to floral SCC will not be limited to any specific habitat unit as all three habitat units within the study area had an abundance of floral SCC present – with the highest diversity of floral SCC recorded within the Soutpansberg Mountain Bushveld. All three habitat units are also expected to harbour several floral SCC that was not recorded during the field assessment.

The study area is rich in floral SCC, and the proposed mining activities will lead to the loss of many individuals within the study area. Rescue and relocation of all floral SCC are not deemed possible or feasible and, consequently, the impact of mining activities will be significant on a local and regional scale.

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 mining infrastructure within sensitive floral habitat;
- Destruction of floral habitat during construction and operational activities;

- Dust generated by mining activities leading to altered floral species diversity;
- Alien floral invasion and erosion in disturbed areas;
- Increased harvesting pressure on protected and medicinal floral communities; and
- Loss of recharge and pollution of watercourses leading to altered riparian floral communities.

The above activities are highly likely to have a significant negative impact on species of conservation concern within and around the study area. The following tables provide an indication of the anticipated impact significance pre- and post-mitigation.

Activities and aspect registry

Pre-Construction	Construction	Operational	Decommissioning & Closure
Potential poor planning of infrastructure placement and design in sensitive floral habitat units	Site clearing and the removal of vegetation leading to a loss of sensitive and medicinal species	On-going disturbance of soils due to operational activities leading to a loss of sensitive and medicinal species	Ineffective rehabilitation of exposed and impacted areas leading to altered runoff pattern flow and timing, pit voids and permanent losses of threatened floral species.
Potential failure to initiate a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the pre-construction phase.	Loss of sensitive and medicinal species through the invasion of alien species in disturbed areas	Increased introduction and proliferation of alien plant species and further transformation of floral diversity	On-going risk of contamination from mining facilities beyond closure leading to permanent impact on sensitive and medicinal species
	Erosion as a result of mining development and stormwater runoff leading to a loss of sensitive and medicinal species	Risk of contamination and contamination from all operational facilities may pollute receiving environment leading to altered floral diversity	On-going seepage and runoff may affect the groundwater regime beyond closure
	Movement of construction vehicles and access road construction through sensitive floral habitat.	Seepage affecting soils and the groundwater regime leading to a loss of sensitive and medicinal species	Potential failure to implement a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the decommissioning and closure phase.
	Construction of open pits, topsoil stockpiles, overburden dumps and other surface infrastructure leading to a loss of sensitive and medicinal species.	Additional pressure on sensitive and medicinal species by increased human populations associated with the proposed mine	

Pre-Construction	Construction	Operational	Decommissioning & Closure
	Compaction of soils reducing the efficiency of floral re-establishment	Potential failure to implement a biodiversity action plan, rehabilitation plan and alien floral control plan during the operational phase.	
	Potential failure to implement a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the construction phase.	Dust generation during operational activities leading to a loss of sensitive and medicinal species	
	Increased fire frequency during construction leading to a loss of sensitive and medicinal species	Increased fire frequency during operation leading to a loss of sensitive and medicinal species	
	Dust generation during construction leading to a loss of sensitive and medicinal species		

Table 7: Impact on Floral SCC associated with the study area.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	5	4	5	9	14	126 (Very High)
Operational phase	5	4	5	4	5	9	14	126 (Very High)
Decommissioning and Closure Phase	5	4	4	3	5	9	12	108 (High)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	4	3	5	9	12	108 (High)
Operational phase	3	4	2	2	4	7	8	56 (Medium-Low)
Decommissioning and Closure Phase	3	4	3	3	3	7	9	63 (Medium-Low)

5.4 Impact Assessment Summary

From the results of the floral impact assessment, it is evident that prior to mitigation all impacts on the receiving floral environment are very high in the construction and operational phase and high in the decommissioning and closure phases. Mitigation measures available will have

limited ability to minimise the impacts on the receiving floral environment. Thus, with mitigation measures implemented, impacts on the receiving floral environment are medium-high to high in the construction and operational phase and medium-low to medium-high in the decommissioning and closure phases.

Table 8: Summary of impact significance on floral resources.

Construction Phase		
Impact	**Unmanaged**	**Managed**
1: Impact on habitat for floral species	Very High	Medium-High
2: Impact on floral diversity	Very High	Medium-High
3: Impact on species of conservation concern	Very High	High
Operational Phase		
Impact	**Unmanaged**	**Managed**
1: Impact on habitat for floral species	Very High	Medium-High
2: Impact on floral diversity	Very High	Medium-High
3: Impact on species of conservation concern	Very High	Medium Low
Decommissioning and Closure Phase		
Impact	**Unmanaged**	**Managed**
1: Impact on habitat for floral species	High	Medium-High
2: Impact on floral diversity	High	Medium Low
3: Impact on species of conservation concern	High	Medium Low
Summary	**Very High**	**Medium-High**

5.5 Floral Impact Mitigation

5.5.1 Mitigation measures

Based on the findings of the floral ecological assessment, several recommendations are made to minimise the impact on the floral ecology of the area, should the proposed mining project proceed:

- Any disturbance of sensitive floral habitat and species of conservation concern must be avoided as far as possible;
- If any mining activities are to be authorised, it is strongly recommended that the surface footprint of the proposed mine be reduced to the minimum;
- The footprint and daily operation of surface infrastructure must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding sensitive floral habitat. The significance of the impact on the ecology of the area will be largely linked to the degree to which this can be implemented;
- Sensitive floral habitat and associated buffer zones beyond the immovable footprint areas must be designated as No-Go areas, and no mining vehicles, personnel, or any other mining-related activities are to encroach upon these areas;

- An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on flora throughout all mining phases;
- Adequate stormwater management must be incorporated into the design of the proposed development throughout all phases in order to prevent erosion of topsoil and the loss of floral habitat. In this regard, special mention is made of:
    - Sheet runoff from cleared areas, paved surfaces and access roads need to be curtailed;
    - Runoff from paved surfaces should be slowed down by the strategic placement of berms; and
    - All overburden stockpiles and waste stockpiles must have berms and/catchment paddocks at their toe to contain runoff of the facilities;
- All affected riparian and freshwater systems, including areas downstream of the mine, must be monitored for moisture stress and monitor all potentially affected riparian zones for changes in riparian vegetation structure;
- An alien floral control plan must be designed and implemented in order to monitor and control alien floral recruitment in disturbed areas. Furthermore, it is strongly recommended that alien floral control is implemented by the mine in the wider study area. The alien floral control plan must be implemented for a period of 5 years after decommissioning and closure;
- No collection of firewood, SCC/Protected or medicinal floral species must be allowed by mining personnel;
- No illicit fires must be allowed during any phases of the proposed mining development;
- Concurrent/progressive rehabilitation must be implemented at all times and disturbed areas must be rehabilitated as soon as possible. This will not only reduce the total disturbance footprint, but will also reduce the overall rehabilitation effort and cost;
- A nursery must be developed in conjunction with a suitably qualified specialist where indigenous/endemic plant species including medicinal plants must be propagated with focus on rehabilitation;
- Rehabilitation trials must be continuously undertaken from the commencement of construction in order to determine the efficiency of rehabilitation methods and the suitability of flora propagated in the nursery for rehabilitation;
- The nursery plan and rehabilitation plan must be continuously updated in accordance with the trial results in order to ensure that optimal rehabilitation measures are employed;

- Rehabilitation efforts must be implemented for a period of at least 5 years after decommissioning and closure;
- A floral SCC relocation, monitoring and management plan must be designed and implemented by a suitably qualified specialist and should address all species which can be successfully rescued and relocated; and
- During the surveying and site-pegging phase of surface infrastructure, all SCC/protected species which will be affected by surface infrastructure must be marked and where possible, relocated to suitable habitat surrounding the disturbance footprint. If relocation is impossible or any of the protected species are destroyed, 3 plants for every protected plant destroyed must be propagated in the nursery. The relevant permits must be applied for as indicated in the baseline floral assessment.

5.5.2 Probable Latent Impacts

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

- Destruction of ecologically intact, irreplaceable floral habitat;
- Permanent loss of niche floral habitat;
- Permanent loss of floral habitat earmarked for conservation;
- Permanent loss of and altered floral species diversity;
- Alien and invasive plant species proliferation;
- Permanent loss of SCC/protected floral species and suitable habitat; and
- Disturbed areas are highly unlikely to be rehabilitated to pre-development conditions of ecological functioning and significant loss of floral habitat, species diversity and SCC/protected floral species will most likely be permanent.

5.5.3 Floral monitoring

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

- Permanent monitoring plots must be established in areas surrounding the surface infrastructure and rehabilitated areas. These plots must be designed to accurately monitor the following parameters on an annual basis:
  - Measurements of crown and basal cover;
  - Species diversity;

- Species abundance;
- Impact of dust on flora;
- Recruitment of indigenous species;
- Alien vs. Indigenous plant ratio;
- Recruitment of alien and invasive species;
- Erosion levels and the efficacy of erosion control measures;
- Vegetation community structure including species composition and diversity which should be compared to pre-development conditions.

➢ Monitoring of rehabilitation trials in light of the above parameters must also take place throughout all phases of the proposed mining development and for a period of 5 years after decommissioning and closure;

➢ The rehabilitation plan must be continuously updated in accordance with the monitoring results in order to ensure that optimal rehabilitation measures are employed;

➢ Results of the monitoring activities must be taken into account during all phases of the proposed mining development and action must be taken to mitigate impacts as soon as negative effects from mining-related activities become apparent; and

➢ The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.

6 CONCLUSION

Scientific Terrestrial Services (STS) was to conduct a faunal and floral ecological assessment as part of the Environmental Assessment and Authorisation process for a proposed coal mine on the remaining extent of the farm The Duel 186 MT, Limpopo Province.

The findings of the field assessment were largely in agreement with the field assessment results of the 2015 assessment. The main differences between the two assessments included:

- Updated databases and additional databases utilised during the desktop assessment;
- The habitat units were adjusted based on 2019 field assessment results;
- Habitat diversity and sensitivity of the Mopane Bushveld habitat unit increased due to updated floral species lists, updated POC of floral SCC assessment and updated floral habitat sensitivity rankings (Appendix B, Table B1);
- The list of floral SCC that was recorded on site was added to, with several additional potential floral SCC also assessed as part of the POC assessment. Several of the floral SCC recorded on site were mapped for a visual representation of their relative extent throughout the study area.

The results of the floral report indicate that the study area is of increased sensitivity due to the intact, and largely undisturbed, nature of the vegetation that is representative of the vegetation types for the area. Moreover, the study area is floristically diverse, and a broad range of floral SCC are present, some at relatively high abundances. The ecological sensitivity of the habitat units varies between moderately high (Mopane Bushveld and Freshwater Habitat Units) and High (Soutpansberg Mountain Bushveld Habitat Unit).

The perceived impact significance of the proposed mining activities prior to mitigation affecting floral habitat, diversity and SCC are very high to high, particularly in the construction and operational phases of mining. If effective mitigation takes place, some of the impacts may be reduced to a mostly medium high significance rating in the construction and operational phases while impacts in the decommissioning and closure phase is medium low, largely since severe impacts would have already taken place leaving little to still impact. Impact mitigation is thus expected to be limited in its ability to minimise the impacts on the receiving floral environment. It is thus deemed essential that a cogently developed, documented and managed biodiversity management plan be implemented and maintained throughout the life of the proposed mine. Moreover, the study area falls within the Vhembe Biosphere Reserve and, albeit within the transitional zone thereof, the area should aim to both conserve the

uniquely biodiverse environment, while simultaneously supporting and promoting sustainable development – of which mining is not deemed a compatible land use (Limpopo C-Plan).

The objective of this study was to provide sufficient information on the floral 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. The needs for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure economic development of the country. It is the opinion of the ecologists 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: Floral method of Assessment

Floral Species of Conservational Concern Assessment

Prior to the field visit, a record of floral SCC and their habitat requirements was acquired from SANBI for the Quarter Degree Square in which the study area is situated, as well as relevant regional, provincial and national lists. 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 was determined using the following calculations wherein the distribution range for the species, specific habitat requirements and level of habitat disturbance were considered. The accuracy of the calculation is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Each factor contributes an equal value to the calculation.

Distribution						
	Outside of known distribution range					**Inside known distribution range**
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat availability						
	No habitat available					**Habitat available**
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat disturbance						
	0	**Very low**	**Low**	**Moderate**	**High**	**Very high**
Site score						
EVC 1 score	5	4	3	2	1	0

[Distribution + Habitat availability + Habitat disturbance] / 15 x 100 = POC%

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;
- **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 optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX B: Floral SCC

The POC of each of the species listed below was calculated (table below).

Table C1: PRECIS plant list for the QDS 2230CC and 2230CA (Raimondo et al., 2009; SANBI, www.sanbi.org).

FAMILY	SPECIES	THREAT STATUS	HABITAT	POC (%)
Apocynaceae	*Ceropegia cimiciodora Oberm.*	VU	Distributed in KwaZulu-Natal and Limpopo Province, ranges from Soutpansberg, Swaziland and northern KwaZulu-Natal. It occurs in a Savanna habitat, in turf and sandy loam soils.	80%
Apocynaceae	*Tylophora coddii Bullock*	Rare	Distributed in the Limpopo Province, ranges from the southern end of Wylie's Poort to the Blouberg. It occurs in a terrestrial savannah habitat, in rock crevices, 1000 – 1600 m.	70%
Aquifoliaceae	*Ilex mitis (L.) Radlk. var. mitis*	Declining	Distributed in Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West and Western Cape Province, widespread from Table Mountain in the Western Cape to Ethiopia and also Madagascar. It occurs in a terrestrial Albany Thicket, Forest, Fynbos, Grassland, Indian Ocean Coastal Belt and Savanna habitat, along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes.	5%
Canellaceae	*Warburgia salutaris (G.Bertol.) Chiov. .*	EN	Distributed in KwaZulu-Natal, Limpopo and Mpumalanga Province, also occurs in Swaziland, Mozambique, Zimbabwe and Malawi. It occurs in a terrestrial forest and savannah habitat, in coastal, riverine, dune and montane forest, as well as open woodland and thickets.	60%
Celastraceae	*Elaeodendron croceum (Thunb.) DC.*	Declining	Distributed in Eastern Cape, KwaZulu-Natal, Limpopo and Mpumalanga Province, as well as in Zimbabwe. It occurs in a terrestrial forest habitat, in the margins of coastal and montane forests.	6%
Celastraceae	*Elaeodendron transvaalense (Burtt Davy) R.H.Archer*	NT	Distributed in KwaZulu-Natal, Limpopo, Mpumalanga and North West Province. It occurs in a terrestrial Savanna or bushveld habitat, from open woodland to thickets, often on termite mounds. Declining due to heavy exploitation for the muthi market.	60%
Cornaceae	*Curtisia dentata (Burm.f.) C.A.Sm.*	NT	Distributed in Eastern Cape, Free State, KwaZulu-Natal, Limpopo and Mpumalanga Province, ranges from Cape Peninsula to the Zimbabwe-Mozambique highlands. It occurs in a terrestrial forest habitat, in evergreen forest from coast to an altitude of 1800 m.	35%
Cyatheaceae	*Alsophila capensis (L.f.) J.Sm.*	Declining	Distributed in Eastern Cape, KwaZulu-Natal, Limpopo and Mpumalanga Province, as well as in Zimbabwe, Mozambique, Malawi and southern Tanzania. It occurs in a terrestrial forest, near waterfalls, streams and permanently moist seepages.	20%
Lauraceae	*Cryptocarya transvaalensis Burtt Davy .*	Declining	Distributed in Limpopo and Mpumalanga Province, occurs along the eastern Escarpment, from Swaziland to the Wolkberg Mountains and also the Soutpansberg Mountains, and northwards to tropical Africa. It occurs in a terrestrial forest, limited to Afromontane forests up to an altitude of 1700 m.	0%
Mesembryanthemaceae	*Khadia borealis L.Bolus*	Rare	Distributed in the Limpopo Province, in the Soutpansberg summit, from Lejuma to Mavhode. It occurs in a terrestrial grassland, in dry grasslands or savannah, in crevices of quartzitic rocks.	0%
Myrsinaceae	*Rapanea melanophloeos (L.) Mez*	Declining	Distributed in Eastern Cape, Free State, KwaZulu-Natal, Limpopo and Mpumalanga Province, ranges from Cape Peninsula to Malawi. It occurs in a terrestrial forest, coastal, swamp and mountain forest, on forest margins and bush clumps, often in damp areas from coast to mountains.	5%
Orchidaceae	*Disa extinctoria Rchb.f.*	NT	Distributed in Limpopo and Mpumalanga Province, ranges from Swaziland to Tzaneen. It occurs in a terrestrial grassland,	0%

FAMILY	SPECIES	THREAT STATUS	HABITAT	POC (%)
			crest of the escarpment in damp grassland and swamps, from an altitude of 1000 – 1300 m.	
Orchidaceae	*Mystacidium brayboniae Summerh.*	NT	Distributed in the Limpopo Province, in the Soutpansberg Mountains. It occurs in a terrestrial forest, in most, high altitude mistbelt forests and woodlands.	0%
Passifloraceae	*Adenia gummifera (Harv.) Harms var. gummifera*	Declining	Distributed in Eastern Cape, KwaZulu-Natal, Limpopo and Mpumalanga Province, widespread in eastern Africa, from Somalia to Kei River mouth in the Eastern Cape, South Africa. It occurs in a terrestrial forest and savannah habitat, in forested ravines, forest patched and forest margins, forest scrub, miombo woodland, savannah, dune forest, on stony slopes, termitaria and littoral bush, from an altitude of 0 – 1800 m.	46%
Rhizophoraceae	*Cassipourea malosana (Baker) Alston*	Declining	Distributed in Eastern Cape, KwaZulu-Natal, Limpopo and Mpumalanga Province, ranges from Port St Johns district in the Eastern Cape to the Limpopo province and northwards to Ethiopia. It occurs in a terrestrial forest, in the understorey of Afromontane forest or in thickets on rocky outcrops in Mpumalanga, also in coastal and midland forests in KwaZulu-Natal.	0%
Rosaceae	*Prunus africana (Hook.f.) Kalkman*	VU	Distributed in Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga and North West Province, 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.	0%
Rubiaceae	*Vangueria soutpansbergensis N.Hahn*	Rare	Distributed in the Limpopo Province, in the Soutpansberg Mountains. It occurs in a terrestrial savannah, mixed woodlands on rocky slopes, only found growing on soils derived from quartzite, from an altitude of 1440m.	0%

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

Table C2: TOPS plant list for the Limpopo Province.

SCIENTIFIC NAME	HABITAT	DISTRIBUTION / RANGE	TOPS THREAT STATUS	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	VU	45
Brackenridgea zanguebarica	**In South Africa**: stony, light grey and shallow sandy loam in woodland, 655 m, 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	CR	0
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	VU	45
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.	P	NT	73
Encephalartos brevifoliolatus	Short grassland in open protea savanna.	Formerly occurred near the Blyde River Canyon Nature Reserve	CR	EW	0

SCIENTIFIC NAME	HABITAT	DISTRIBUTION / RANGE	TOPS THREAT STATUS	NATIONAL RED LIST STATUS	POC (%)
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	CR	0
Encephalartos dolomiticus	Grassland, in shallow soils on dolomite ridges.	Sekhukhuneland.	CR	CR	0
Encephalartos dyerianus	Open grassland and shrubland on the slopes of low granite hills.	Phalaborwa.	CR	CR	0
Encephalartos eugene-maraisii	Sandstone hills and rocky ridges in open grassland and savanna.	Waterberg.	EN	EN	27
Encephalartos hirsutus	Exposed quartzite cliffs in mountain bushveld.	Soutpansberg Mountains.	CR	CR	45
Encephalartos inopinus	Shallow soils on steep, rocky slopes and gorges, restricted to dolomite.	Steelpoort and Olifants River valleys.	CR	CR	0
Encephalartos nubimontanus	Steep cliffs in low open woodland.	Formerly occurred in the Mountains north of Penge.	CR	EW	0
Encephalartos transvenosus	Tall grassveld and mixed bushveld, mainly on steep rocky slopes facing southeast in the mistbelt zone.	Limpopo Drakensberg Escarpment and Soutpansberg.	P	LC	20
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	CR	CR	0
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.	P	LC	67
Harpagophytum zeyheri subsp. *zeyheri*	On Kalahari sand in dry open woodland.	Gauteng, Limpopo, Mpumalanga, North West.	P	LC	67
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	EN	0
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	VU	20
Siphonochilus aethiopicus	Tall open or closed woodland, wooded grassland or bushveld.	Sporadically from the Letaba catchment in the Limpopo Lowveld to Swaziland. Extinct in KwaZulu-Natal. Widespread elsewhere in Africa.	CR	CR	20
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	EN	33

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

APPENDIX C: Floral Species List

The tables below list the dominant floral species found within the various habitat units during the site assessment of 2015 and 2019.

Table D1: Dominant Woody species encountered during the field assessment of 2015 and 2019, including trees, shrubs and dwarf shrubs. Species names in blue were only found during the 2015 field assessment but are believed to be present within the study area despite not encountered during the 2019 assessment. Alien species are indicated with an asterisk (*) and protected species are in bold font.

Scientific name	Soutpansberg Mountain Bushveld	Freshwater Habitat	Mopane Bushveld
**Datura stramonium* (1b)	x		
**Solanum mauritianum* (1b)	x		
**Solanum nigrum*			x
Abutilon fruticosum			x
***Adansonia digitata* (NFA)**	x		x
***Adenium multiflorum* (LEMA)**	x		x
Anisotes rogersii	x	x	x
Asparagus falcatus			x
Asparagus laricinus			x
Balanites pedicellaris subsp. *pedicellaris*	x	x	x
Barleria affinis	x		
Barleria sinensis			x
Berchemia zeyheri	x		
Blepharis subvolubilis subsp. subvolubilis	x		x
***Boscia albitrunca* (NFA)**	x		x
Boscia foetida subsp. *rehmanniana*			x
Burkia africana			x
Carissa bispinosa	x		x
Colophospermum mopane (encroaching into the Soutpansber Mountain Bushveld habitat unit)	x	x	x
Combretum apiculatum subsp. *apiculatum*	x		x
Combretum molle	x		
Commiphora africana			x
Commiphora edulis	x		
Commiphora glandulosa	x		x
***Combretum imberbe* (NFA)**	x	x	
Commiphora mollis	x		
Commiphora marlothii	x		
Commiphora neglecta			x
Commiphora pyracanthoides			x
Commiphora viminea	x		x
Croton gratissimus	x		
Dichrostachys cinerea	x		x
Diplorhynchus condylocarpon	x		
Diospyros lycioides	x		
Dombeya rotundifolia	x		
Entandrophragma caudatum	x		
Euclea crispa	x		
Ficus salicifolia		x	
Ficus craterostoma		x	
Gardenia volkensii	x		x
Grewia bicolor	x		x
Grewia flava	x		x

Scientific name	Soutpansberg Mountain Bushveld	Freshwater Habitat	Mopane Bushveld
Grewia flavescens	x	x	x
Grewia occidentalis	x		x
Grewia villosa			x
Gymnosporia buxifolia	x		x
Gyrocarpus americanus subsp. *africanus*	x		
Indigofera circinnata			x
Justicia odora			x
Kirkia acuminata	x		x
Lannea schweinfurthii var. *stuhlmannii*	x		x
Lantana rugosa	x		x
Lycium sp.			x
Maerua sp.			x
Megalochlamys revoluta subsp. *cognata*			x
Melhania acuminata			x
***Myrothamnus flabellifolius* (DDT)**	x		
Olea europaea subsp. *africana*	x		
Orbivestus cinerascens			x
Ozoroa paniculosa	x		
Pavetta lanceolata			x
Peltophorum africanum	x		
Philenoptera violacea (NFA)	x		
Psiadia punctulata			x
Rhigozum zambesiacum			x
Salvadora australis		x	
***Sclerocarya birrea* subsp *caffra* (NFA)**	x	x	x
Schotia brachypetala	x	x	
Senegalia ataxacantha	x		
Senegalia nigrescens	x	x	x
Senegalia senegal var. leiorhachis	x		x
Sesamothamnus lugardii	x		x
Solanum delagoense			x
***Spirostachys africana* (NFA)**		x	
Sterculia rogersii	x		x
Strychnos spinosa	x		
Strychnos madagascariensis	x		
Terminalia prunioides	x	x	x
Terminalia sericea	x		x
Tinnea rhodesiana	x		x
Tinospora fragosa	x		
Vachellia grandicornuta		x	
Vachellia karroo	x		x
Vachellia tortilis subsp. *heteracantha*			x
Waltheria indica	x		
Ximenia americana			x
Ximenia caffra			x
Ziziphus mucronata	x	x	x

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: 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.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.

Table D2: Dominant Forb species encountered during the field assessment of 2015 and 2019. Species names in blue were only found during the 2015 field assessment but are believed to be present within the study area despite not encountered during the 2019 assessment. Alien species are indicated with an asterisk (*) and protected species are in bold font.

Scientific name	Soutpansberg Mountain Bushveld	Freshwater Habitat	Mopane Bushveld
**Bidens pilosa*	x		x
**Mollugo nudicaulis*			x
**Schkuhria pinnata*			x
**Tagetes minuta*	x		x
**Zinnia peruviana*	x		x
Aptosimum lineare			x
Asclepias fruticosa	x		
Asparagus falcatus	x		
Becium filamentosum			x
Blepharis diversispina	x		
Boerhavia coccinea var coccinea			x
Cardiospermum corindum	x		
Ceratotheca triloba			x
Commelina africana	x	x	x
Commelina erecta	x	x	
Commicarpus plumbagineus var plumbagineus		x	
Corchorus asplenifolius			x
Cordylostigma virgatum	x		
Cyphostemma sandersonii	x		
Euphorbia neopolycnemoides			x
Evolvulus alsinoides			x
Gerbera ambigua		x	
Helichrysum nudifolium		x	
Hermannia depressa	x		
Hibiscus engleri			x
Hilliardiella oligocephala	x		x
Indigofera holubii			x
Ipomoea crassipes	x		
Justicia odora	x		
Justicia protracta subsp. rhodesiana			x
Kyphocarpa angustifolia			x
Laggera decurrens			x
Ledebouria leptophylla			x
Ledebouria marginata			x
Ledebouria sp.			x
Limeum sulcatum var. *sulcatum*			x
Merremia pinnata	x		
Pavonia burchellii			x
Pellaea calomelanos	x		
Portulaca collina			x
Portulaca kermesina			x
Rhynchosia minima var. minima	x	x	x
Scadoxus multiflorus subsp *multiflorus*	x		
Seddera capensis	x		x

Scientific name	Soutpansberg Mountain Bushveld	Freshwater Habitat	Mopane Bushveld
Senecio oxyriifolius	x		
Tribulus terrestris			x
Tribulus zeyheri subsp. *zeyheri*			x
Tricliceras glanduliferum			x
Xerophyta retinervis	x		

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: 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.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.

Table D3: Dominant Succulent species encountered during the field assessment of 2015 and 2019. Species names in blue were only found during the 2015 field assessment but are believed to be present within the study area despite not encountered during the 2019 assessment. Alien species are indicated with an asterisk (*) and protected species are in bold font.

Scientific name	Soutpansberg Mountain Bushveld	Freshwater Habitat	Mopane Bushveld
**Cereus jamacaru* (1b)	x		
**Opuntia ficus-indica* (1b)	x		
Aloe arborescens	x		
***Aloe littoralis* (LEMA)**		x	x
Euphorbia cooperi			x
Kalanchoe sexangularis	x		
Kleinia fulgens	x		

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: 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.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.

Table D4: Dominant Graminoid species encountered during the field assessment of 2015 and 2019, including both grass and sedge species. Species names in blue were only found during the 2015 field assessment but are believed to be present within the study area despite not encountered during the 2019 assessment. Alien species are indicated with an asterisk (*) and protected species are in bold font.

Scientific name	Soutpansberg Mountain Bushveld	Freshwater Habitat	Mopane Bushveld
Aristdia congesta subsp *barbicollis*	x		x
Aristida congesta subsp *congesta*	x	x	x
Artistida bipartita	x		
Brachiaria deflexa		x	x
Bothriochloa insculpta		x	
Cenchrus ciliarus	x		x
Cymbopogon plurinodes	x		
Cymbopogon pospischilii			x
Cynodon dactylon	x	x	
Cyperus sexangularis (sedge)		x	
Cyperus rupestris (sedge)		x	
Digitaria eriantha subsp. *eriantha*			x
Digitaria natalensis		x	
Diheteropogon amplectens	x		
Elionurus muticus	x		x
Enneapogon cenchroides	x		x
Enteropogon macrostachyus			x
Eragrostis capensis		x	x
Eragrostis chloromelas	x	x	x
Eragrostis curvula	x	x	x
Eragrostis lehmanniana		x	x
Eragrostis pallens	x		x
Eragrostis superba	x		
Heteropogon contortus	x		x
Hyparrhenia hirta	x	x	
Hyparrhenia tamba		x	
Imperata cylindrica		x	
Kyllinga alba (sedge)			x
Loudetia simplex	x		x
Melinis nerviglumis	x		
Melinis repens	x		x
Oropetium capense			x
Panicum coloratum			x
Panicum maximum	x	x	x
Phragmites mauritianum		x	
Schmidtia pappophoroides	x		x
Setaria sphacelata		x	
Sporobolus nitens		x	
Sporobolus pyramidalis		x	
Tetrapogon tenellus		x	x
Themeda triandra	x	x	x
Tragus berteronianus	x		x
Tristachya leucothrix	x		
Typha capensis (monoecious, perennial marsh herb)		x	
Urochloa mosambicensis		x	x

1a: Category 1a – Invasive species that require compulsory control.

1b: Category 1b – Invasive species that require control by means of an invasive species management programme.

2: 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.

3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.