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**BIODIVERSITY ASSESSMENT AS PART OF THE
INTEGRATED ENVIRONMENTAL AUTHORISATION
PROCESS FOR KUDUMANE MANGANESE RESOURCES
EXPANSION PROJECT, NEAR HOTAZEL IN THE
NORTHERN CAPE PROVINCE**

Prepared for

SRK Consulting (South Africa) (Pty) Ltd.

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Part B: Floral Assessment

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SAS Environmental Group of Companies

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DOCUMENT GUIDE

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

No.	SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS	Section in report/Notes
Theme-Specific Requirements as per Government Notice No. 320 Terrestrial Biodiversity Theme – Very High Sensitivity Rating as per Screening Tool Output		
2	Terrestrial Biodiversity Specialist Assessment	
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	Part A – C: Cover Page Part A: Appendix E
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Part A: Section 1
2.3	The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:	
2.3.1	A description of the ecological drivers or processes of the system and how the proposed development will impact these;	Part B: Section 3 (flora) Part C: Section 3 (fauna)
2.3.2	Ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site;	Part B: Section 3 (flora) Part C: Section 3 (fauna)
2.3.3	The ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	Part A: Section 3 (desktop analysis) Part B: Section 3 (flora) Part C: Section 3 (fauna)
2.3.4	The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Area (FEPA) sub catchments;	Part A: Section 3 (desktop analysis) Part B: Section 3.2 – 3.3 (flora) Part C: Section 3.2 – 3.5 (fauna) <i>*For descriptions on the presence of FEPAs, please refer to the Freshwater Biodiversity Assessment (SAS 202196, 2021)</i>
2.3.5	A description of terrestrial biodiversity and ecosystems on the preferred site, including: <ul style="list-style-type: none"> a) main vegetation types; b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified; c) ecological connectivity, habitat fragmentation, ecological processes and fine scale habitats; and d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified; 	Part A: Section 3 (desktop analysis) Part B: Section 3 (flora) Part C: Section 3 (fauna)
2.3.6	The assessment must identify any alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	Not Applicable.
2.3.7	The assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:	
2.3.7.1	Terrestrial Critical Biodiversity Areas (CBAs), including: <ul style="list-style-type: none"> a) the reasons why an area has been identified as a CBA; b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation; 	Part A: Section 3 (desktop analysis) Part B: Section 3.2, 5.2.3 Part C: Section 3, 4 & 5



No.	SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS	Section in report/Notes
	<ul style="list-style-type: none"> c) <i>the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);</i> d) <i>the impact on ecosystem threat status;</i> e) <i>the impact on explicit subtypes in the vegetation;</i> f) <i>the impact on overall species and ecosystem diversity of the site; and</i> g) <i>the impact on any changes to threat status of populations of species of conservation concern in the CBA;</i> 	
2.3.7.2	Terrestrial Ecological Support Areas (ESAs), including: <ul style="list-style-type: none"> a) <i>the impact on the ecological processes that operate within or across the site;</i> b) <i>the extent the proposed development will impact on the functionality of the ESA; and</i> c) <i>loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;</i> 	
2.3.7.3	Protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including- <ul style="list-style-type: none"> a) <i>an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;</i> 	Part A: Section 3 (desktop analysis) However, not applicable as no protected areas or areas of conservation concern are within 10 km of the proposed project,
2.3.7.4	Priority areas for protected area expansion, including- <ul style="list-style-type: none"> a) <i>the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;</i> 	Part A: Section 3 (desktop analysis)
2.3.7.5	SWSAs including: <ul style="list-style-type: none"> a) <i>the impact(s) on the terrestrial habitat of a SWSA; and</i> b) <i>the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);</i> 	Not Applicable to this report
2.3.7.6	FEPA sub catchments, including- <ul style="list-style-type: none"> a) <i>the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;</i> 	Not Applicable to this report
2.3.7.7	Indigenous forests, including: <ul style="list-style-type: none"> a) <i>impact on the ecological integrity of the forest; and</i> b) <i>percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.</i> 	Not Applicable to this report
2.4	The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.	
	Part B: Results of the Floral Assessment as well as conclusions on Terrestrial Biodiversity as it relates to vegetation communities. Part C: Results of the Faunal Assessment as well as conclusions on Terrestrial Biodiversity as it relates to faunal communities.	
3	Terrestrial Biodiversity Specialist Assessment Report	
3.1	The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Part A: Appendix E
3.1.2	A signed statement of independence by the specialist;	Part A: Appendix E
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Part B: Section 1.3 (flora) Part C: Section 1.3 (fauna)
3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Part A: Appendix C Part B: Section 2 (flora) Part B: Appendix A (flora)



No.	SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS	Section in report/Notes
		Part C: Section 2 (fauna) Part C: Appendix A (fauna)
3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Part B: Section 1.3 (flora) Part C: Section 1.3 (fauna)
3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Part B: Section 4 (flora) Part C: Section 4 (fauna)
	<p>Impact Assessment Requirements</p> <p>3.1.7 Additional environmental impacts expected from the proposed development;</p> <p>3.1.8 Any direct, indirect and cumulative impacts of the proposed development;</p> <p>3.1.9 The degree to which impacts and risks can be mitigated;</p> <p>3.1.10 The degree to which the impacts and risks can be reversed;</p> <p>3.1.11 The degree to which the impacts and risks can cause loss of irreplaceable resources;</p> <p>3.1.12 Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);</p>	Part B: Section 5 (flora) Part C: Section 5 (fauna)
3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a “low” terrestrial biodiversity sensitivity and that were not considered appropriate;	Not Applicable to this report
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Part A: Executive summary Part B: Section 6 (flora) Part C: Section 6 (fauna)
3.1.15	Any conditions to which this statement is subjected.	Part B: Section 5.1 (flora) Part C: Section 5.1 (fauna)
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.	Not Applicable to this report
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	Not Applicable to this report



LIST OF ACRONYMS

AIP	Alien and Invasive Plant
BAP	Biodiversity Action Plan
BGIS	Biodiversity Geographic Information Systems
BODATSA	Botanical Database of Southern Africa
CBA	Critical Biodiversity Area
CR	Critically Endangered
DENC	Department of Environment and Nature Conservation
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
EN	Endangered
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
ECO	Environmental Control Officer
E-GIS	Environmental Geographical Information Systems
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EMPrs	Environmental Management Programmes
EW	Extinct in the Wild
GN	General Notice
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectares
IEA	Integrated Environmental Authorisation
IUCN	International Union for Conservation of Nature
KMR	Kudumane Manganese Resources [Pty] Ltd
LC	Least Concern
MRAs	Mining Right Areas
NBA	National Biodiversity Assessment
NEMBA	National Environmental Management: Biodiversity Act, 2004 [Act No.10 of 2004]
NFA	National Forest Act, 1998 [Act No. 84 of 1998]
NWA	National Water Act, 1998 [Act No. 36 of 1998]
NCNCA	Northern Cape Nature Conservation Act, 2009 [Act No. 9 of 2009]
POSA	Plants of Southern Africa
PCDs	Pollution Control Dams
POC	Potential of Occurrence
PES	Present Ecological State
QDS	Quarter Degree Square
QDS	Quarter Degree Square
RDL	Red Data Listed
RoM	Run of Mine
STS	Scientific Terrestrial Services
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
TOPS	Threatened or Protected Species
TOPS	Threatened or Protected Species
VU	Vulnerable
WML	Waste Management Licence
WRDs	Waste Rock Dumps
WULA	Water Use Licence Application



GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson *et al.* (2011), Hui and Richardson (2017), Wilson *et al.* (2017) and Skowno *et al.* (2019), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), and the associated Alien and Invasive Species Regulations, 2020].

Alien species (syn. exotic species; non-native)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Biodiversity priority areas	<p>Features in the landscape or seascape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. They include the following categories, most of which are identified based on systematic biodiversity planning principles and methods: Protected Areas, Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas and Ecological Support Areas, Freshwater Ecosystem Priority Areas, high water yield areas, flagship free-flowing rivers, priority estuaries, study areas for land-based protected area expansion, and study areas for offshore protection. Marine ecosystem priority areas and coastal ecosystem priority areas have yet to be identified but will be included in future.</p> <p>The different categories <i>are not mutually exclusive</i> and, in some cases, overlap, often because a particular area or site is important for more than one reason. They should be <i>complementary</i>, with overlaps <i>reinforcing the importance</i> of an area.</p>
Biological diversity or Biodiversity (as per the definition in NEMBA ¹)	The variability among living organisms from all sources including, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.
Biome - as per Mucina and Rutherford (2006); after Low and Rebelo (1998).	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate, and major large-scale disturbance factors (such as fires).
Bioregion (as per the definition in NEMBA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act;
Critical Biodiversity Area (CBA)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Critically Endangered (CR) (IUCN ² Red List category)	Applied to both species/taxa and ecosystems: A species is CR when the best available evidence indicates that it meets at least one of the five IUCN criteria for CR, indicating that the species is facing an extremely high risk of extinction. CR ecosystem types are at an extremely high risk of collapse. Most of the ecosystem type has been severely or moderately modified from its natural state. The ecosystem type is likely to have lost much of its natural structure and functioning, and species associated with the ecosystem may have been lost. CR species are those considered to be at extremely high risk of extinction.
Degradation	The many human-caused processes that drive the decline or loss in biodiversity, ecosystem functions or ecosystem services in any terrestrial and associated aquatic ecosystems.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
Driver (ecological)	A driver is any natural or human-induced factor that directly or indirectly causes a change in ecosystem. A direct driver clearly influences ecosystem processes, where

¹ The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)

² International Union for Conservation of Nature (IUCN)



	indirect driver influences ecosystem processes through altering one or more direct drivers.
Endangered (EN) (IUCN Red List category)	Applied to both species/taxa and ecosystems: A species is EN when the best available evidence indicates that it meets at least one of the five IUCN criteria for EN, indicating that the species is facing a very high risk of extinction. EN ecosystem types are at a very high risk of collapse. EN species are those considered to be at very high risk of extinction.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g., southern Africa), national (South Africa), provincial, regional, or even within a particular mountain range.
Ground-Truth	To check the accuracy of remotely sensed data (i.e., the desktop databases used in Part A) by means of in-situ, “on the ground” observations.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
Indigenous vegetation (as per the definition in NEMA ³)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.
Listed alien species	All alien species that are regulated in South Africa under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Alien and Invasive Species Regulations, 2020.
Least Threatened	Least threatened ecosystems are still largely intact.
Native species (syn. indigenous species)	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g., species are still native if they increase their range as a result of watered gardens but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
Red Data Listed (RDL) species	According to the Red List of South African plants (http://redlist.sanbi.org/) and the IUCN, organisms that fall into the Extinct in the Wild (EW), CR, EN, Vulnerable (VU) categories of ecological status.
Species of Conservation Concern (SCC)	The term SCC in the context of this report refers to all RDL and IUCN listed threatened species as well as protected species of relevance to the project.
Threatened ecosystem	An ecosystem that has been classified as CR, EN or VU, based on an analysis of ecosystem threat status. A threatened ecosystem has lost or is losing vital aspects of its structure, function, or composition. The NEMBA allows the Minister of Environmental Affairs or a provincial MEC for Environmental Affairs to publish a list of threatened ecosystems. To date, threatened ecosystems have been listed only in the terrestrial environment. In cases where no list has yet been published by the Minister, such as for all aquatic ecosystems, the ecosystem threat status assessment in the National Biodiversity Assessment (NBA) can be used as an interim list in planning and decision making.
Threatened species	A species that has been classified as CR, EN or VU, based on a conservation assessment (Red List), using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.
Vulnerable (VU) (Red List category)	Applied to both species/taxa and ecosystems: A species is VU when the best available evidence indicates that it meets at least one of the five IUCN criteria for VU, indicating that the species is facing a high risk of extinction. An ecosystem type is VU when the best available evidence indicates that it meets any of the criteria A to E for VU and is then considered to be at a high risk of collapse.

³ National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)



1 INTRODUCTION

Scientific Terrestrial Services CC (STS) was appointed to conduct a Biodiversity Assessment as part of the Integrated Environmental Authorisation (IEA) process for the Kudumane Manganese Resources (Pty) Ltd (KMR) Expansion Project, near Hotazel in the Northern Cape Province. It is the intention of KMR to expand its existing operations and construct additional infrastructure to improve production capacity.

KMR is in the John Taolo Gaetsewe District Municipality in the Northern Cape, approximately three (3) km south-west of the town of Hotazel, approximately 60 km north of the town of Kathu, and approximately 45 km north of Sishen Airport. KMR currently holds two Mining Rights which will collectively be referred to as the Mining Right Areas (MRAs):

- Mining Right NC/30/5/1/2/2/0268 MR: covering the farms York A 279 and Telele 312 (hereafter referred to as “York” and “Telele”, respectively); and
- Mining Right NC/ 30/5/1/2/2/10053 MR: over the farms Devon 277, Hotazel 280 and Kipling 271 (hereafter referred to as “Devon”, “Hotazel”, and “Kipling”, respectively).

The MRAs are depicted in **Part A - Figures 1 & 2**.

The purpose of this report is to define the floral ecology associated with the proposed KMR Expansion Activities, to identify areas of increased Ecological Importance and Sensitivity (EIS), as well as the mapping of such areas, and to describe the Present Ecological State (PES) of the proposed KMR Expansion Activities. The primary objective of the floral assessment is not to compile an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in the area of interest, to optimise the detection of Species of Conservation Concern (SCC) and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).

1.1 Project Description

KMR is an established opencast manganese mine and intends to expand its current operations to extend the life of its operation and improve production capacity through the inclusion of key mining-related activities and infrastructure within their approved MRAs. The infrastructure and activities associated with the proposed KMR Expansion Project require a new Environmental Authorisation (EA), the amendment of the mine’s existing Environmental Management Programmes (EMPrs), a Waste Management Licence (WML) and a Water Use Licence Application (WULA) to authorise the below listed **key infrastructure**:



- A new Opencast Pit mine on Kipling;
- Expansion of the Hotazel and York Opencast Pits to allow for the mining of KMRs boundary pillar associated with each pit; and
- Two attenuation dams within the Ga-Mogara River, to allow for the expansion of the York and Hotazel Opencast Pits. An Options Analysis was undertaken by SRK to determine the best approach for KMR to extend the open-pit mining operations in a westerly direction beyond the 1:100-year floodline (The extension of the pits is restricted by a drainage channel of the Ga-Mogara River on the western side). Option-1/Scenario 1 was determined to be the best and most cost-effective option and includes the construction of dams along the river course to attenuate the flow before reaching the open pit areas. In this option, there are no diversion channels. The report states: *“The capture and attenuation of the flowing upstream ponds is technically a good option and if the ponds overflow, the open pit operation can be suspended until the storm has abated. The mitigation measure will be to monitor upstream flows and give sufficient time to evacuate the pit. If the water flows into the pit, then the pit can be pumped dry and mining can commence.”*.

The above key infrastructure will have **secondary infrastructure** and activities associated with them, including Waste Rock Dumps (WRDs), Run of Mine (RoM) Stockpiles, Pollution Control Dams (PCDs), Haul Road Expansion and additional, smaller surface infrastructure such as offices, parking etc. A comprehensive description of the proposed project activities is provided in **Part A (Section 1.1: Figures 3 – 7)**.

The above activities are depicted in Figures 1 – 5 below as they are proposed to take place within each farm portion.

This report, after consideration and the description of the ecological integrity of the proposed KMR Expansion Activities, must guide the Environmental Assessment Practitioner (EAP), the regulatory authorities and the developing proponent, by means of the presentation of the floral results and recommendations as to the ecological viability of the proposed KMR Expansion Activities.



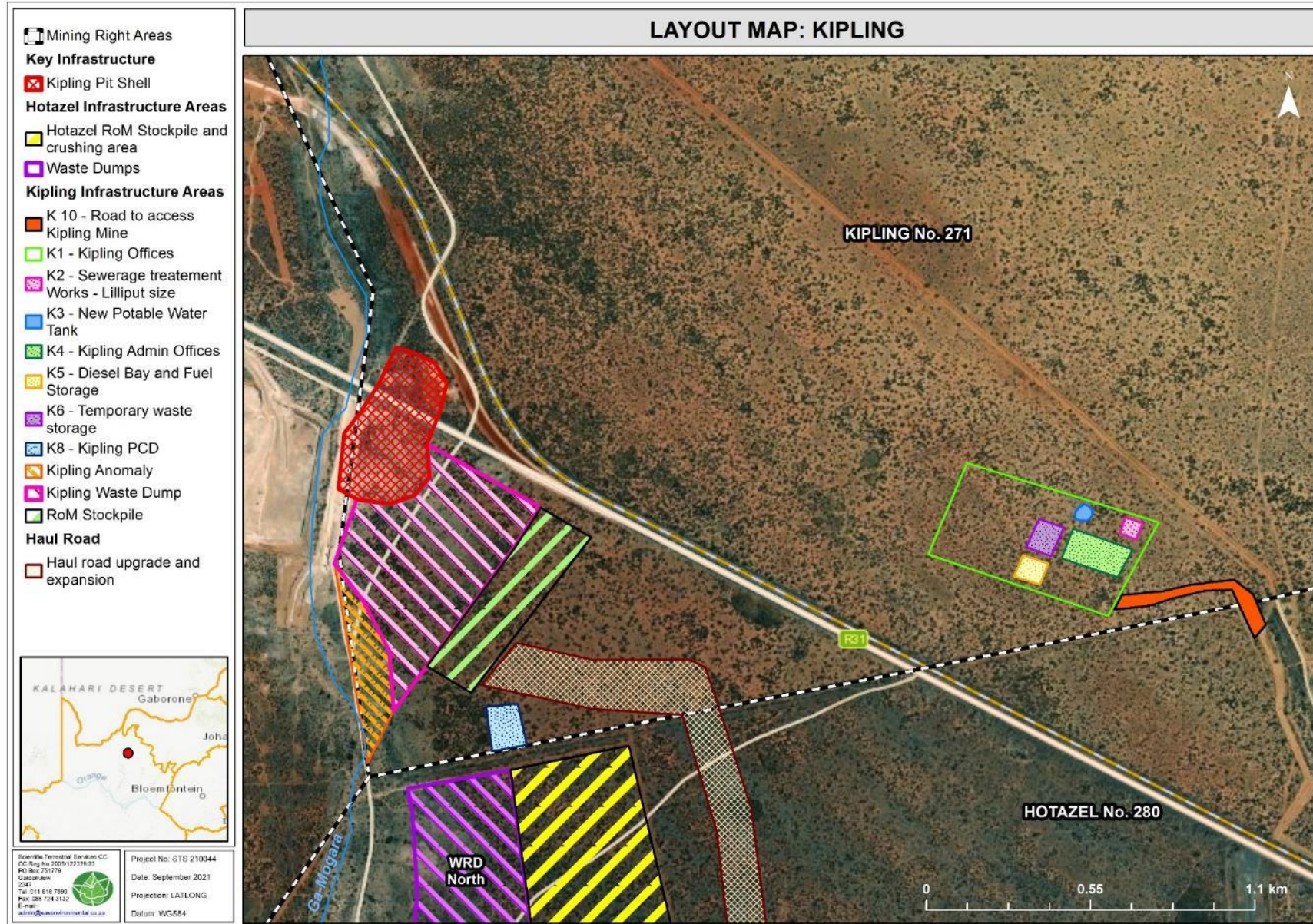


Figure 1: Proposed KMR Expansion Activities associated with the farm Kipling.



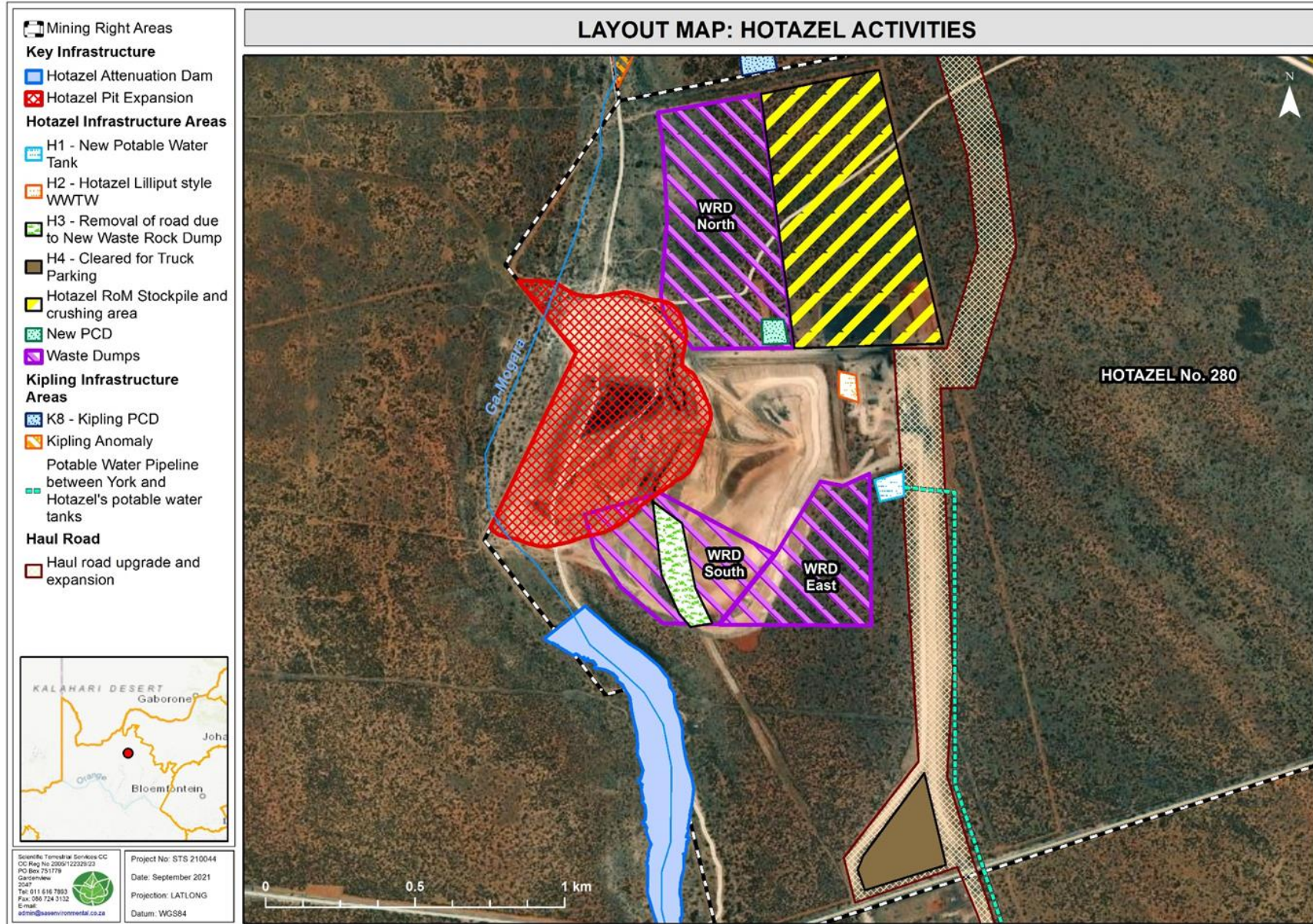


Figure 2: Proposed KMR Expansion Activities associated with the farm Hotazel.



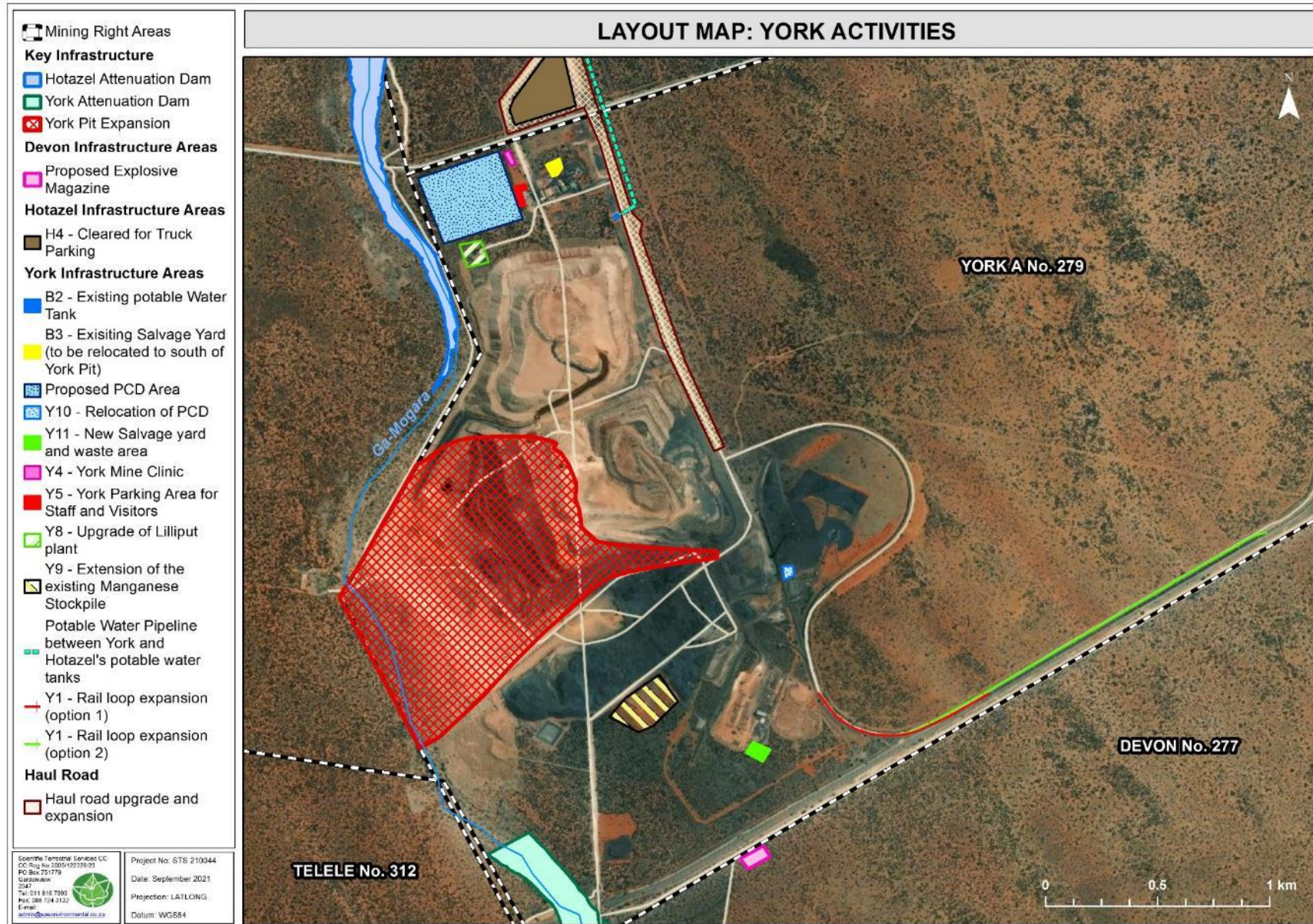


Figure 3: Proposed KMR Expansion Activities associated with the farm York.



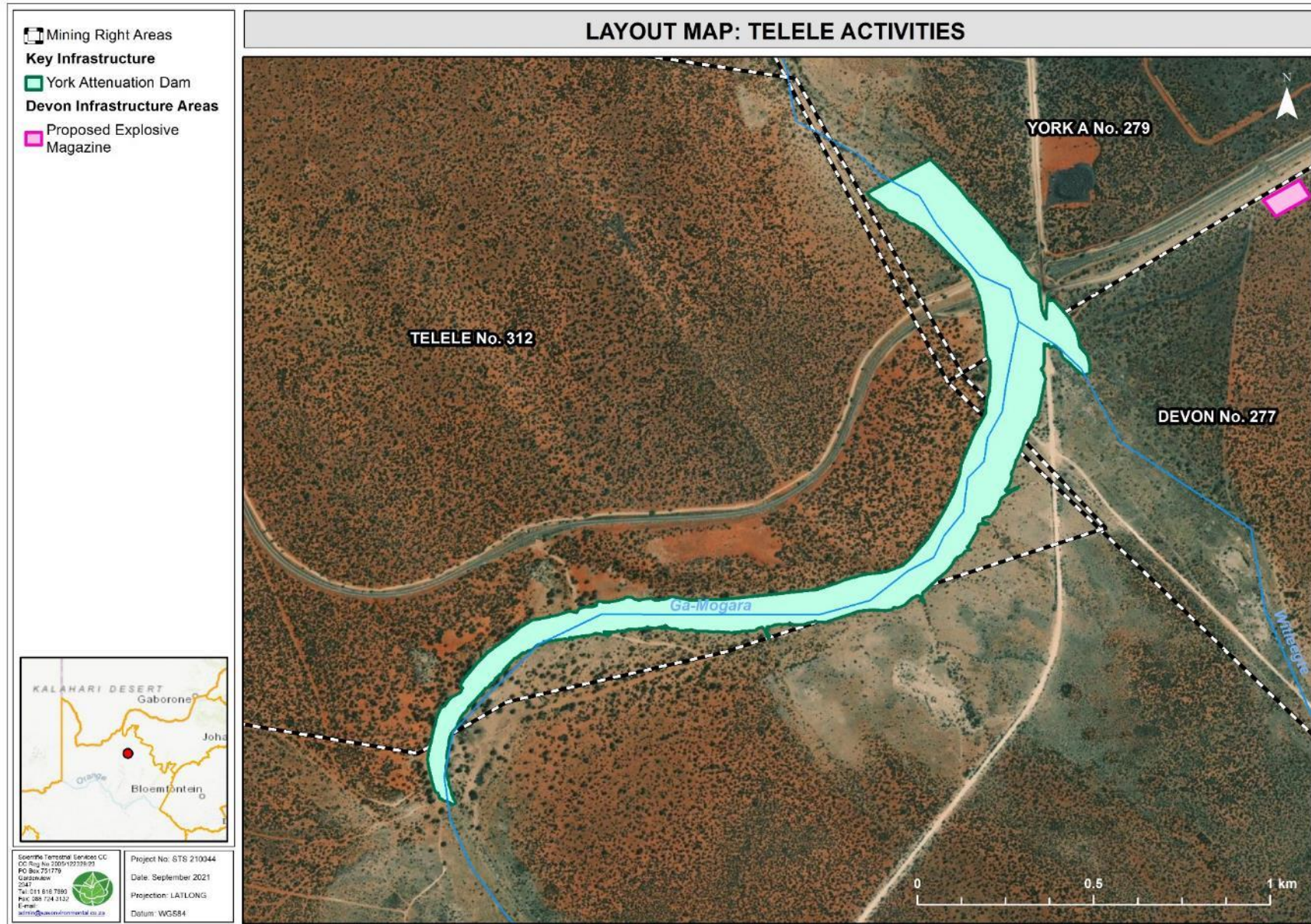


Figure 4: Proposed KMR Expansion Activities associated with the farm Telele.



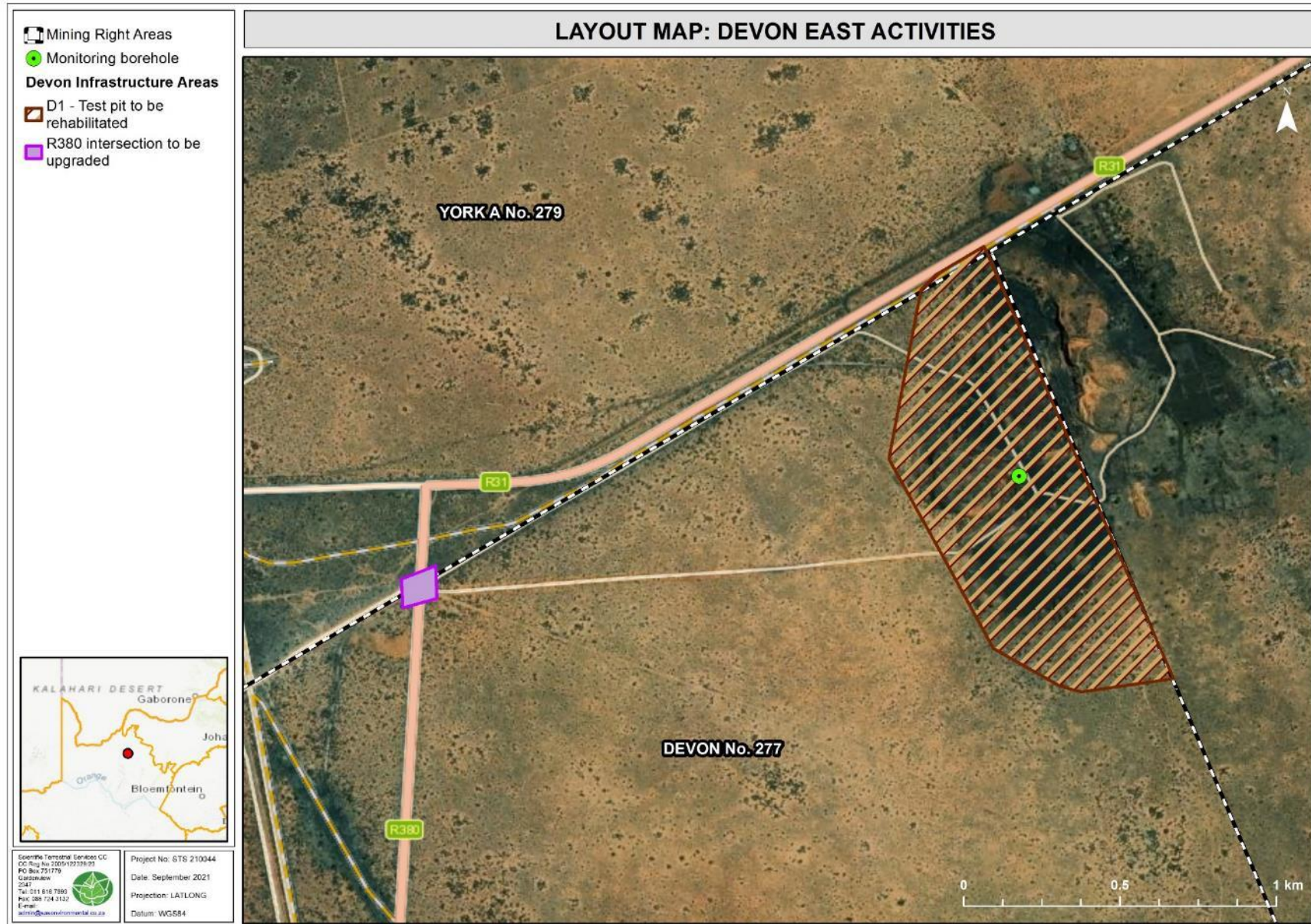


Figure 5: Proposed KMR Expansion Activities associated with the farm Devon (East).



1.2 Scope of Work

Specific outcomes in terms of the report are as follows:

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

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The floral assessment is confined to the proposed KMR Expansion Activities and does not include the full extent of the MRAs nor the neighbouring and adjacent properties. The proposed KMR Expansion Activities and immediate surroundings were, however, included in the desktop analysis of which the results are presented in **Part A: Section 3**;
- Sampling by its nature means that not all individuals are assessed and identified. With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. The field assessment took place during winter (20th – 23rd of July 2021) and thus falls outside of the flowering season of several species within the region, particularly graminoids and geophytes which either go dormant during winter or lack the diagnostic characteristics to make confident identification to species level. A more comprehensive assessment would require that assessments take place in all seasons of the year. To account for seasonal limitations, on-site data was



significantly augmented with all available desktop data and background research of previous studies conducted for the KMR:

- **NCC Environmental Services (Pty) Ltd. 2019a.** Annual Biodiversity Assessment for Kudumane Manganese Resources Farm York 279 and Farm Hotazel 280. Northern Cape Province. Prepared for: Kudumane Manganese Resources. July 2018.
- **NCC Environmental Services (Pty) Ltd. 2019b.** Annual Biodiversity Assessment and Biodiversity Action Plan Kudumane Manganese Resources Farm York 279 and Farm Hotazel 280 Northern Cape Province. Prepared for: Kudumane Manganese Resources. November 2019.
- **Eco-Pulse & EMS. 2019a.** River and Buffer Zone Revegetation Plan for the Kudumane Manganese Resources Mine in Hotazel, Northern Cape. Final Report. Unpublished specialist Report prepared by Eco-Pulse Consulting cc and Ecological Management Services cc for Kudumane Manganese Resources (Pty) Ltd. September 2019.
- **Eco-Pulse & EMS. 2019b.** Kudumane Manganese Resources Mine near Hotazel, Northern Cape: Alien Invasive Plant Eradication and Control Programme. Final Report. Specialist Report prepared by Eco-Pulse Consulting cc and Ecological Management Services cc for Kudumane Manganese Resources (Pty) Ltd. Report No. EP460-02. October 2019.
- **Phillips, R. and Mshengu, T., 2018.** Kalagadi Manganese Mining Right Amendment, Hotazel, Northern Cape. J38048. Ecological Assessment. September 2018.
- **Ecological Management Services (EMS). 2015.** Draft Biodiversity Offset investigation for the Kudumane Manganese Mine, Hotazel Northern Cape. April 2015.
- **Ecological Management Services (EMS). 2014.** Biodiversity Assessment for the Proposed Kudumane Manganese Mine, Hotazel, Northern Cape. May 2014.
- **Ecological Management Services (EMS). 2012.** Biodiversity Action Plan for the proposed Kudumane Manganese Mine near Hotazel in the Northern Cape. October 2012.
- **Ecological Management Services (EMS). 2009.** Ecological survey for the proposed Manganese Mine, near Hotazel, Northern Cape.



- The Department of Forestry, Fisheries, and the Environment's (DFFE) Screening Tool provides names of sensitive species likely to be present within the study area and its surrounds. Within the screening tool outcome, the names of some species are not provided. These species are rather assigned a number keeping them unidentifiable (e.g., Sensitive species 1). This procedure is followed because of the vulnerability of the species to threats such as illegal harvesting and overexploitation. According to the best practise guidelines provided by South African National Biodiversity Institute (SANBI), the identity of sensitive species **may not appear** in the final EIA report **nor any of the specialist reports** released into the public domain. However, the conservation threat status of such species has been provided.

2 ASSESSMENT APPROACH

An on-site visual investigation of the assessment areas was conducted during winter (20th – 23rd of July 2021) to confirm and ground-truth the assumptions made during the consultation of the background maps and to determine whether the sensitivity of the terrestrial biodiversity associated with the assessment areas confirms the results of the online National Web-based Environmental Screening Tool ("Screening Tool" hereafter).

2.1 General Approach

The vegetation surveys are based on the subjective sampling method, which is a technique where the specialist chooses specific sample sites within the area of interest based on their professional experience in the area and background research done prior to the site visit. This allows representative recordings of floral communities and optimal detection of SCC (refer to the methodology description in **Appendix A**).

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

- To guide the selection of appropriate sample sites, background data and digital satellite images were consulted before going to site, during which broad habitats, vegetation types and potentially sensitive sites were identified. The results of these analyses were then used to focus the fieldwork on specific areas of concern and to identify areas where targeted investigations were required (e.g., for SCC detection and within the direct footprint of the proposed mining project);



- All relevant resources and datasets as presented by the South African National Biodiversity Institute's (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (<http://bgis.sanbi.org>) and the Environmental Geographical Information Systems (E-GIS) website (<https://egis.environment.gov.za/>), including the Northern Cape Critical Biodiversity Area (CBA) Map (2016) and the Screening Tool, were consulted to gain background information on the physical habitat and potential floral diversity associated with the assessment areas;
- Based on the broad habitat units delineated before going to site and the pre-identified points of interest, which is updated based on on-site observations and access constraints, the selected sample areas were surveyed on foot, following subjective transects, to identify the occurrence of the dominant plant species and habitat diversities, but also to detect SCC which tend to be sparsely distributed. A buffer zone was applied around the infrastructure areas to ensure a larger site is assessed to detect possible edge effects that may arise from the proposed activities; and
- Photographs were taken of each vegetation community that is representative of typical vegetation structure of that community, as well as photos of all detected SCC (except for sensitive species as identified by the DFFE's Screening Tool⁴).

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

2.2 Definitions, descriptions, and taxon nomenclature

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

2.3 Sensitivity Mapping

All the ecological features of the assessment areas were considered, and sensitive areas were assessed and delineated using a Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery. The sensitivity map should assist the Environmental Assessment Practitioner (EAP) / proponent as to the suitability of the proposed development within the assessment areas.

⁴ The identity of sensitive species **may not appear** in the final EIA report **nor any of the specialist reports** released into the public domain.



3 RESULTS OF FLORAL ASSESSMENT

3.1 Broad-scale vegetation characteristics

The proposed KMR Expansion Activities is located within the Kathu Bushveld and Gordonia Duneveld vegetation types (Mucina and Rutherford, 2006), which was used as the reference states in this assessment.

Most of the proposed KMR Expansion Activities are in the remaining extent of the Gordonia Duneveld, a vegetation type that is of Least Concern (LC) in terms of its conservation status but has a protection level of Moderately Protected (Skowno et al., 2019). Mucina and Rutherford (2006) describe the Gordonia Duneveld as “Parallel dunes about 3–8 m above the plains. Open shrubland with ridges of grassland dominated by *Stipagrostis amabilis* on the dune crests and *Vachellia haematoxylon* on the dune slopes, also with *Senegalia mellifera* on lower slopes and *Rhigozum trichotomum* in the interdune straaaten.”.

The York Attenuation Dam, test pit to be rehabilitated, the R380 intersection upgrade and the eastern section of the Kipling Offices are within the Kathu Bushveld vegetation type which is currently considered of LC and Poorly Protected (Skowno et al., 2019). Mucina and Rutherford (2006) describe the Kathu Bushveld as “Medium-tall tree layer with *Vachellia erioloba* in places, but mostly open and including *Boscia albitrunca* as the prominent trees. Shrub layer generally most important with, for example, *Senegalia mellifera*, *Diospyros lycioides* and *Lycium hirsutum*. Grass layer is variable in cover.”.

3.2 Ground-truthed vegetation characteristics

Due to variations in naming of habitat units used by different authors (NCC Environmental Services, Eco-Pulse, EMS, and Phillips & Mshengu, 2018) for the vegetation types associated with the MRAs, the habitat units defined and discussed in this report did not attempt to follow the same naming convention as previous studies. The information provided by the previous studies listed in Section 1.3 of this report was, however, considered when describing the habitat units and assigning sensitivities.

Based on the results of the field investigation of July 2021 by STS, three broad habitat units were distinguished for the proposed KMR Expansion Activities:



- **Ga-Mogara Habitat Unit.** The Ga-Mogara habitat refers to the vegetation communities associated with the Ga-Mogara River⁵ – conforming to the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998) (NWA) – as delineated by the Freshwater Ecologist (SAS 202196, 2021). The Ga-Mogara Habitat is considered degraded from a floral perspective in most sections associated with the proposed KMR Expansion Activities, with alien vegetation prolific in some sections and impacts from overgrazing and mining pressures more evident in others. The Ga-Mogara Habitat encompasses the channel and banks of the Ga-Mogara River;
- **Savannah Habitat Unit.** This habitat unit includes vegetation communities that are typical of the Savannah biome (i.e., characterised by a grassy ground layer and a distinct upper layer of woody plants) and elements of the two reference vegetation types are present within this habitat unit. The Savannah Habitat was divided into three subunits based on variances in species composition, habitat condition, vegetation structure, and/or soil types, namely the Degraded Thornveld, Karoid Shrubland and Mixed Thornveld; and
- **Transformed Habitat Unit.** This habitat is currently transformed in nature due largely to mining activities or mining-related infrastructure.

For a breakdown of the floral communities, habitat characteristics and conservation sensitivities associated with the above-mentioned habitat units, refer to Section 3.2.1 – 3.2.3. Figures 5 – 10 depict the habitat units associated with the proposed KMR Expansion Activities.

⁵ Please note that for the purposes of this report the spelling “Gamagara River” and the spelling “Ga-Mogara River” as used in the DWS RQIS database, is to be considered synonyms and may be used interchangeably.



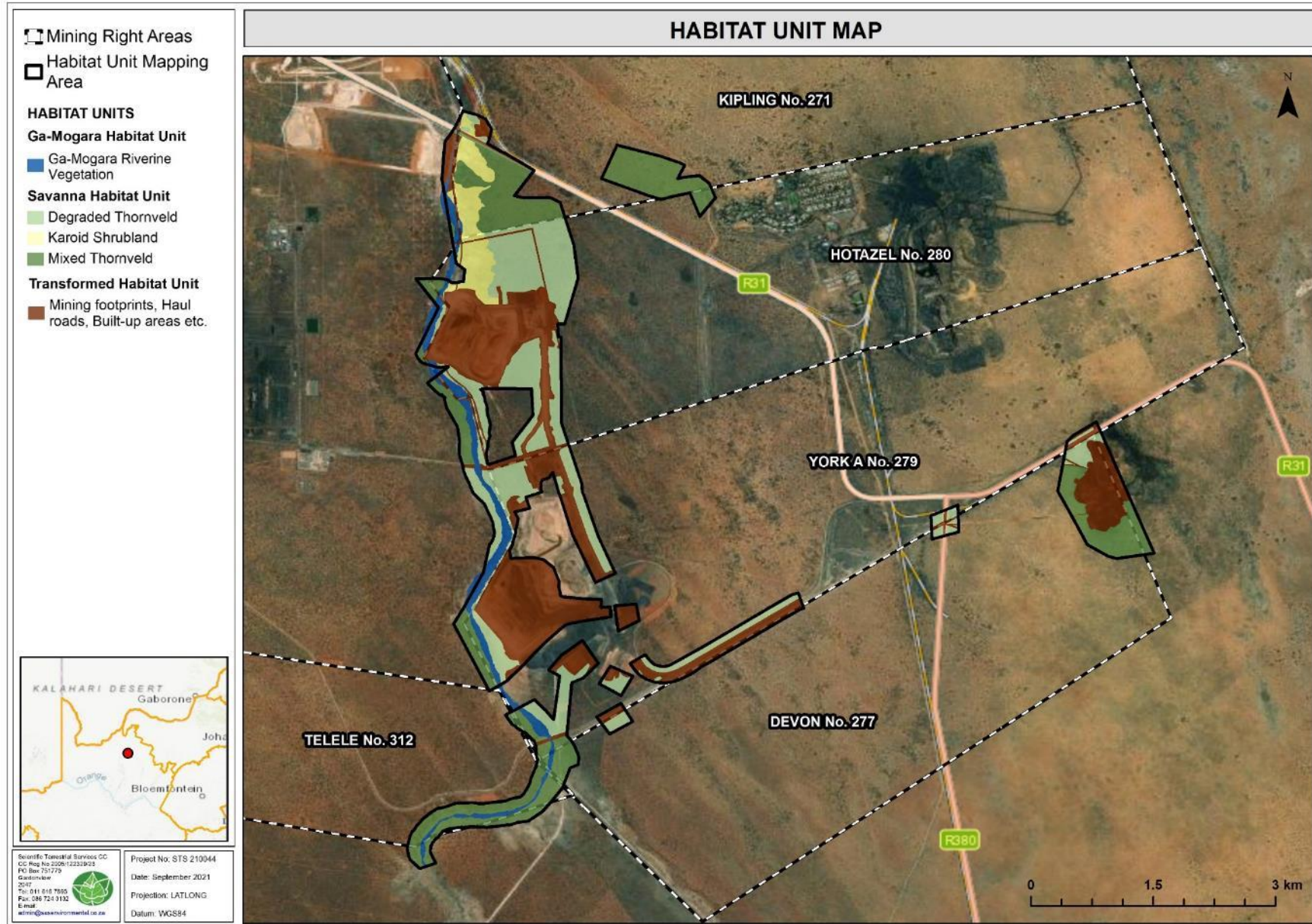


Figure 6: Conceptual illustration of the habitat units associated with the MRAs.



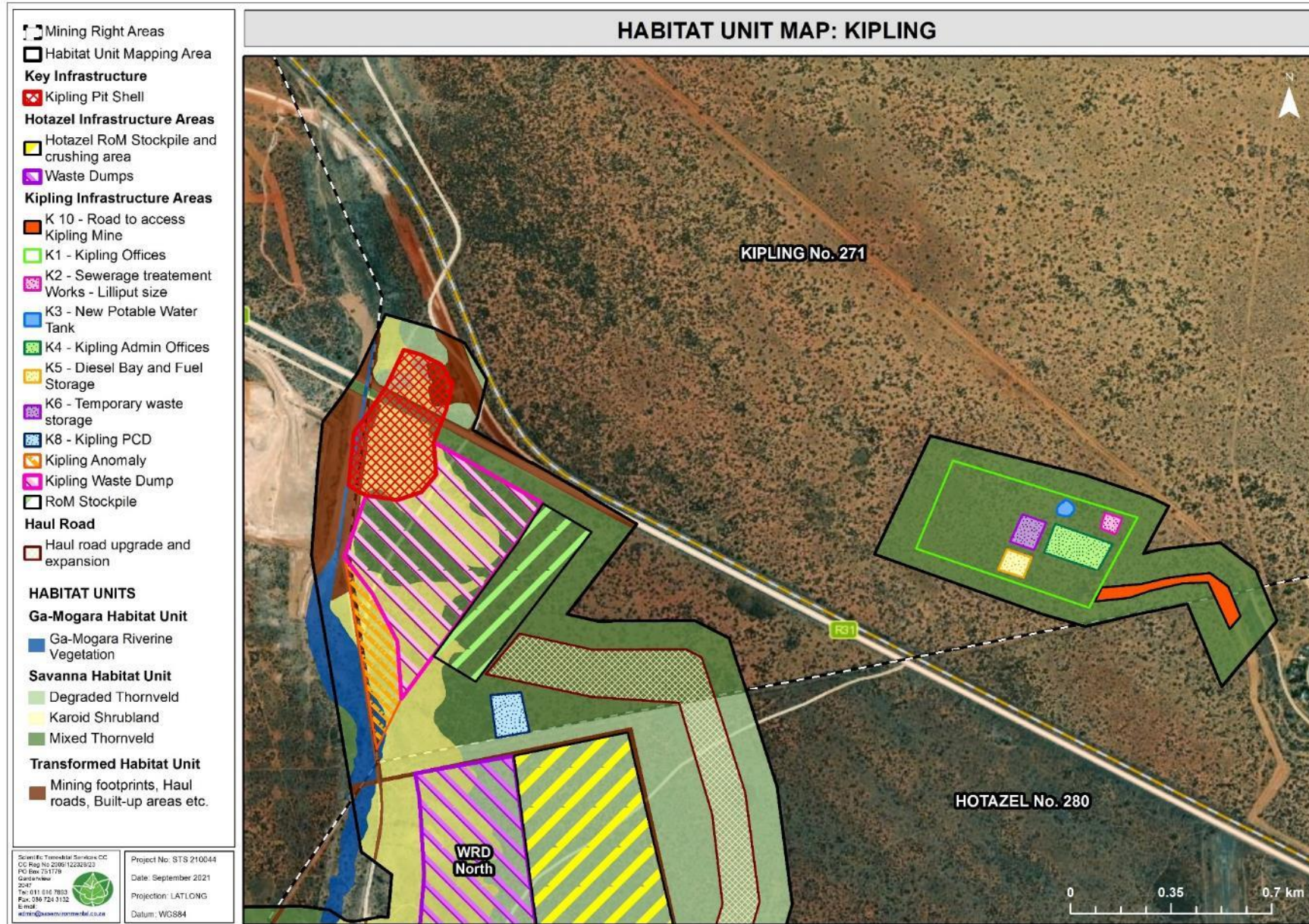


Figure 7: Conceptual illustration of the habitat units and proposed KMR Expansion Activities associated with Kipling.



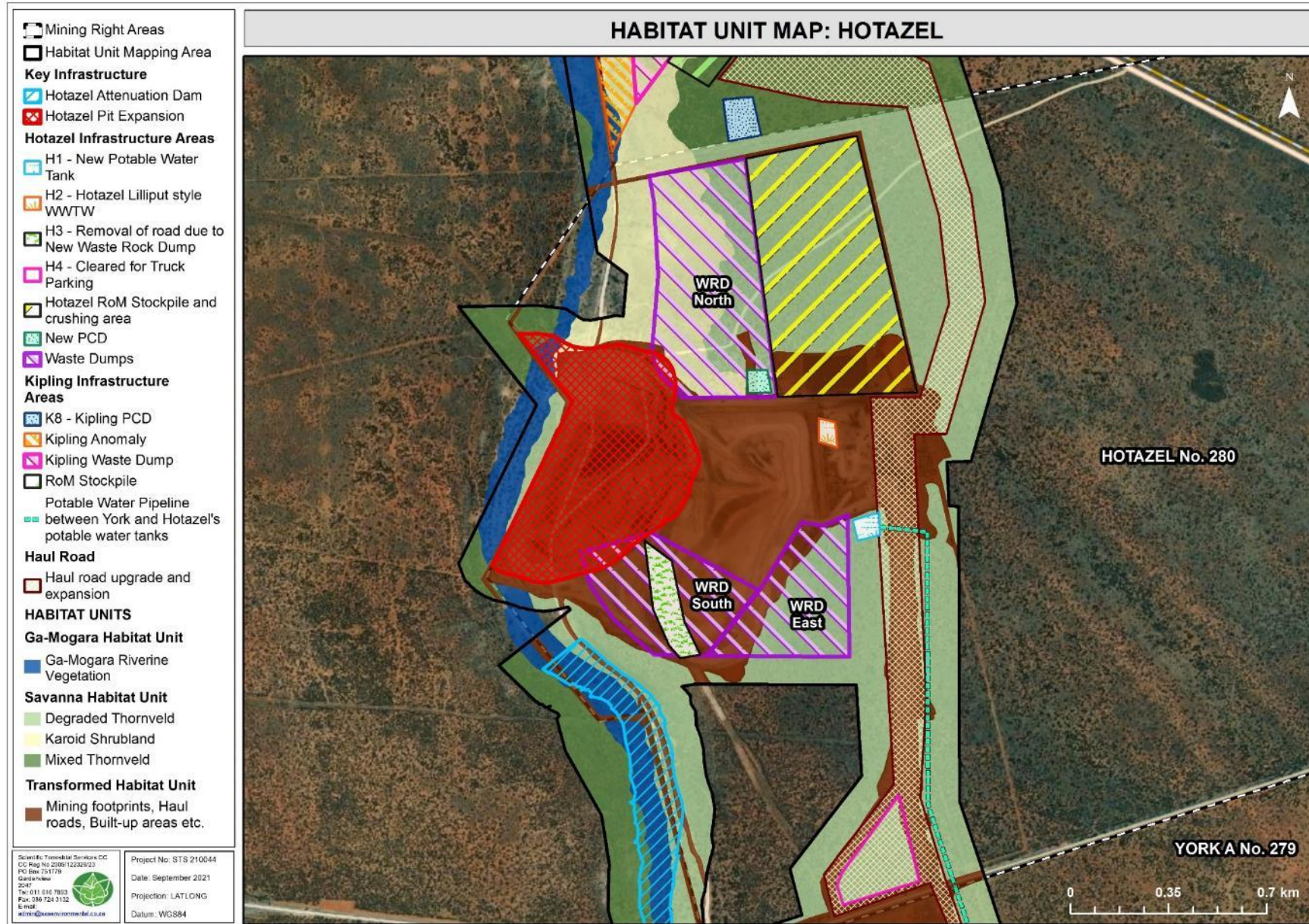


Figure 8: Conceptual illustration of the habitat units and proposed KMR Expansion Activities associated with Hotazel.



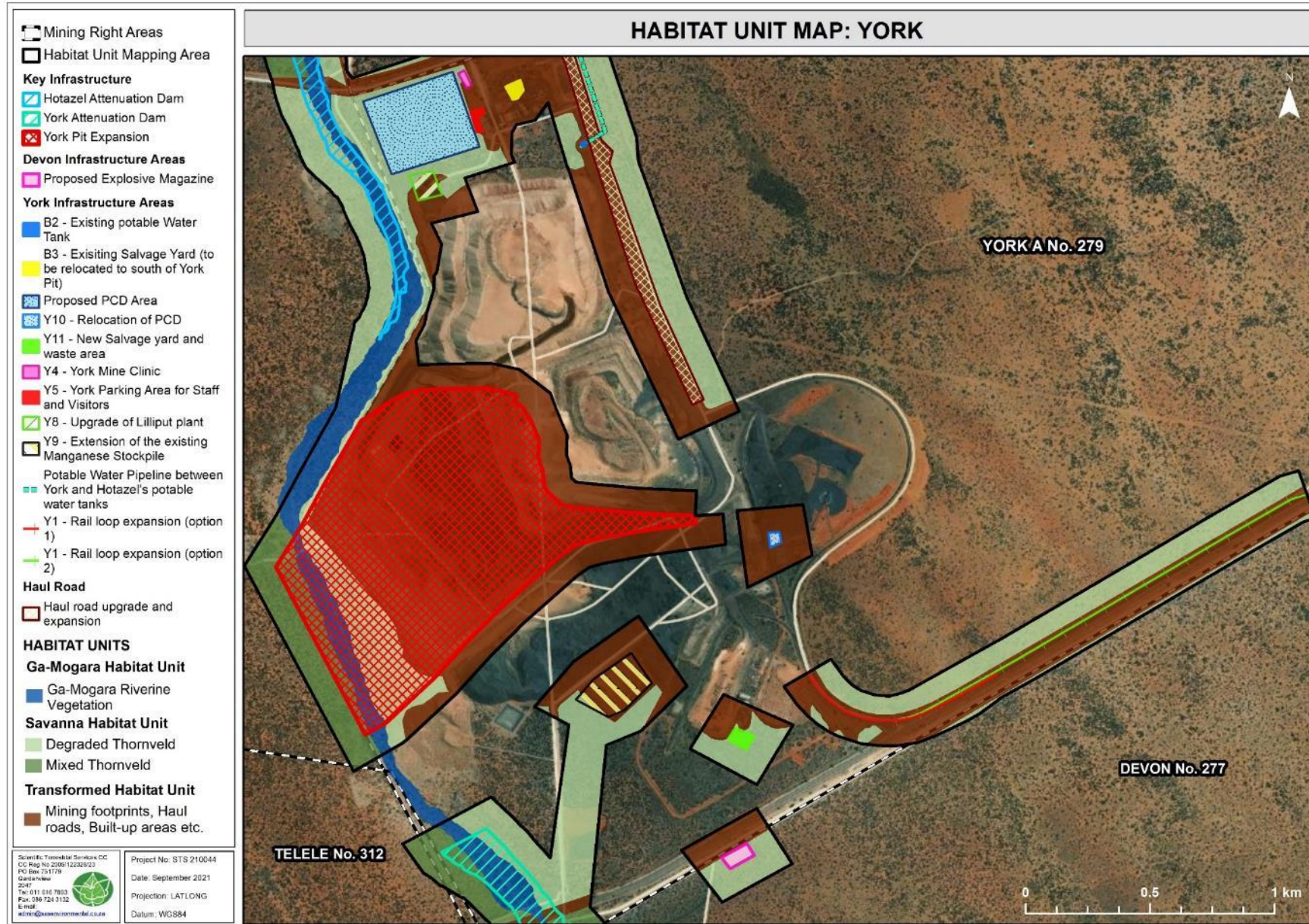


Figure 9: Conceptual illustration of the habitat units and proposed KMR Expansion Activities associated with York.



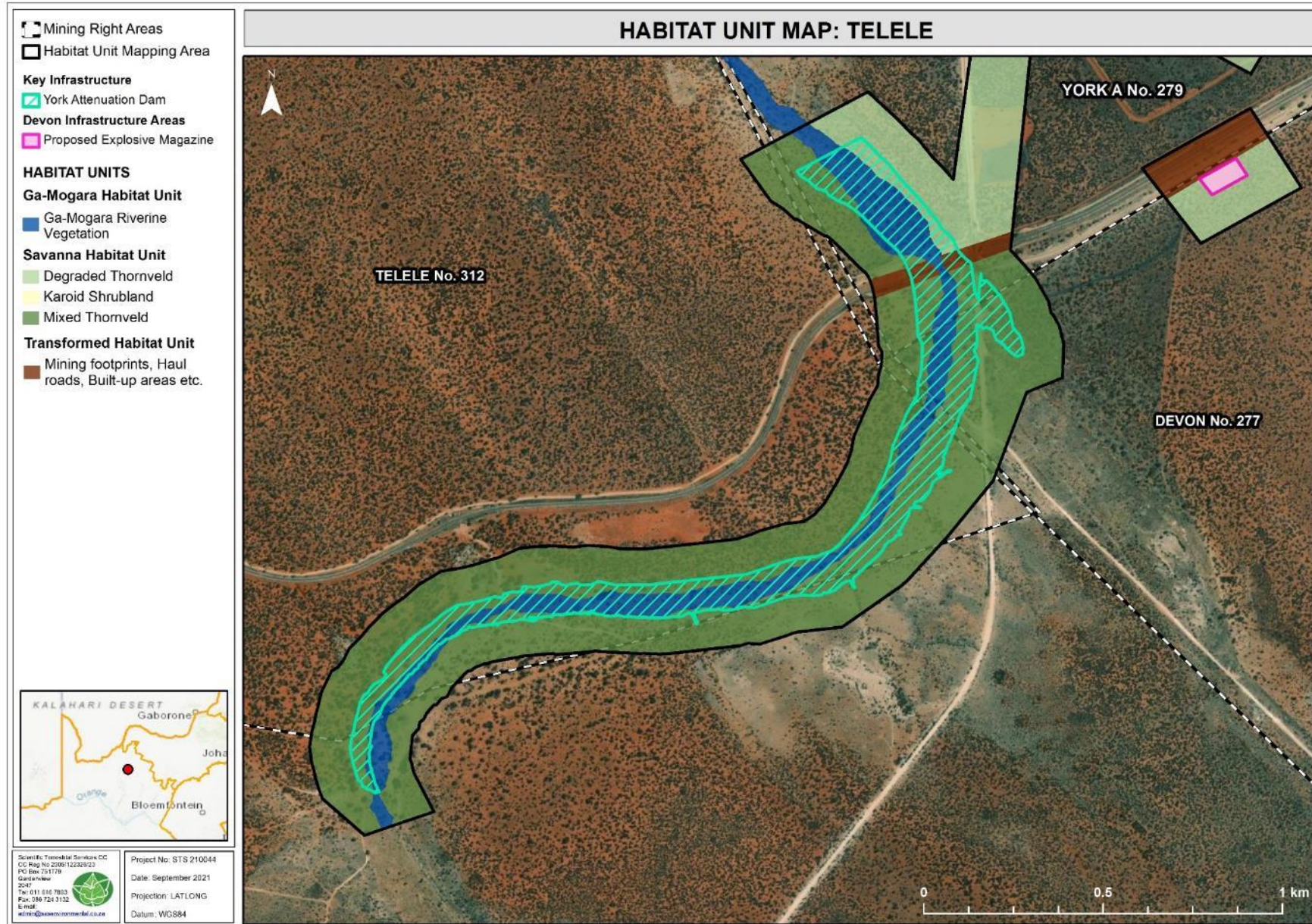


Figure 10: Conceptual illustration of the habitat units and proposed KMR Expansion Activities associated with Telele.



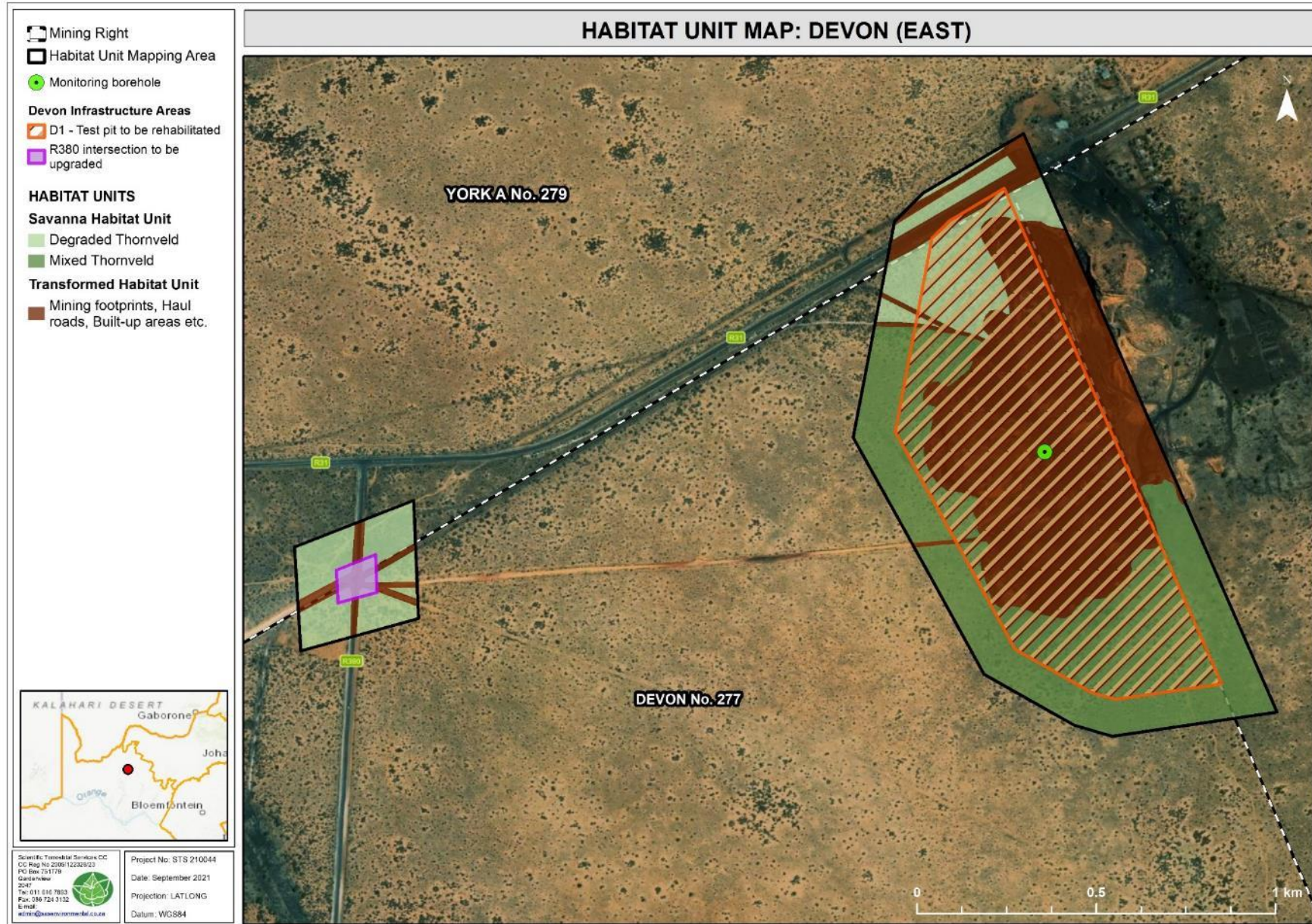





Figure 11: Conceptual illustration of the habitat units and proposed KMR Expansion Activities associated with Devon (eastern section).



3.2.1 Ga-Mogara Habitat Unit

HABITAT OVERVIEW	
<p>Vegetation structure (as per Diagram A1 in Appendix A)</p>	<p>The vegetation structure varies between either short-to-medium, dense grassland in the river channel to a short-to-tall, sparse woodland with a well-developed grass layer along the riverbanks (photo (a) below). The riverine vegetation in its natural condition comprises an almost continuous graminoid-dominated layer where woody species are sparsely scattered (mainly <i>Vachellia erioloba</i>, <i>Ziziphus mucronata</i>, <i>Lycium hirsutum</i>); however, the vegetation structure of the Ga-Mogara Habitat Unit takes on a short-to-tall thicket in most of its extent associated with the proposed KMR Expansion Activities due to the invasive <i>Prosopis glandulosa</i> which has formed dense stands (Photos b and c below).</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>a)</p> </div> <div style="text-align: center;">  <p>b)</p> <p>Dense <i>Prosopis</i> stands in the river channel</p> </div> <div style="text-align: center;">  <p>c)</p> </div> </div> <p>The Ga-Mogara River is an ephemeral (or episodic) system which means that the river is most often dry but should flow for brief periods after heavy rainfall. The Ga-Mogara River, however, has been without significant surface flows for a prolonged period due to, inter alia, the episodic nature of the river, the upstream dewatering and swallet formation by mine workings of the Sishen Iron Ore Mine (more detail provided in the below section on Habitat Integrity), as well as prolonged dry conditions for the region. Even with the heavy and abnormal rainfall earlier this year, this part of the Ga-Mogara river didn't have any flow (communication with mine officials). Due to the lack of conditions more suitable for riparian vegetation, the floral communities of the Ga-Mogara Habitat Unit largely comprise of terrestrial species (limited discernible difference between terrestrial and riparian vegetation).</p> <p>Despite the dry conditions of the Ga-Mogara River, the topography of the river still allows for water to collect in the channel during rainfall events and although this water drains away rapidly as a result of the coarse, sandy, alluvial soils, the vegetation structure is different to that observed for the surrounding terrestrial habitat, i.e., more dense assemblages of grass species (characteristic of dry and/or ephemeral river systems).</p>
<p>Habitat Integrity</p>	<p>The greater extent of the Ga-Mogara River, including the section of the Ga-Mogara Habitat Unit associated with the proposed KMR Expansion Activities, have been altered throughout the years due to impacts not only along the sections associated with KMR (i.e., local impacts), but also from historic and ongoing mining and agricultural activities along the greater extent of the river (i.e., regional impacts), resulting in degradation of floral communities along this ephemeral river.</p> <p>Within the immediate vicinity of the proposed KMR Expansion Activities (local scale impacts), direct impacts to the Ga-Mogara Habitat include agricultural practices, edge effects from adjacent mining activities (increased sediment loads from dust deposition), the realignment of the Ga-Mogara River channel (on</p>



the remaining extent of the farms Gloria 266 northwest of Kipling 271 as well as the farms Kipling 271 and Umtu 281 ⁶), as well as alien and invasive plant (AIP) proliferation (especially that of *Prosopis glandulosa*). A portion of the mining footprint which includes both soil stockpiles and overburden has encroached into the eastern margin of the Ga-Mogara river resulting in habitat lost to infilling (Eco-Pulse & EMS, 2019a). Other modifiers of the system include small areas of localised erosion and bank incision, as well as (haul)road and bridge crossings. See example photos below.



Left: The Opencast Pit on York in close proximity to the Ga-Mogara Habitat Unit, contributing to sediment loads to the system from dust deposition. **Right:** Several rail and bridge crossings are associated with the Ga-Mogara Habitat unit.

Within the greater river system (resulting in regional scale impacts), one of the more significant impacts stem from dewatering activities of the Sishen Iron Ore Mine as well as the formation of swallets south of the Sishen Iron Ore Mine (GCS 2011; PHD 2007), which have contributed to an almost complete loss of surface flow: “As a result of the surface flow in the Gamagara River being captured in recent years mainly by the large N-S structural feature [i.e., the swallets] that crosses the river near the old golf club, surface flow in the downstream sections of the Gamagara River has virtually ceased.”. The dewatering and swallet formation have further resulted in higher transmission losses in the river, though this impact has been recorded to decrease in intensity with downstream distance from impact. More important to the vegetation communities of the Ga-Mogara Habitat Unit, the invasion by *Prosopis glandulosa* also has far-reaching impacts. AIP invasion is discussed in more detail in **Section 3.3.2**.

The above-mentioned impacts on the Ga-Mogara River have placed cumulative pressures on the systems and resulted in the current desiccated condition of the river and loss of integrity of the Ga-Mogara Habitat from a floral perspective.

SPECIES OVERVIEW

Apart from the Transformed Habitat Unit, the Ga-Mogara Habitat Unit generally comprised lower species diversities than the other natural habitat units assessed. The floral diversity is especially low in sections where the river has been more severely impacted by either agricultural practices or where AIPs were recorded as dominant. Where less habitat disturbances are present, the floral species diversity is higher and the vegetation denser (especially within the graminoid layer). As beforementioned, the prolonged dry periods and very little surface water flow in the Ga-Mogara River, the vegetation communities associated with this habitat unit are largely terrestrial in nature, with only a select few species considered restricted/unique to the Ga-Mogara Habitat, such as the forb *Cullen tomentosum*, and the graminoid *Cyperus margaritaceus*.

The graminoids component included *Aristida stipitata*, *Cenchrus ciliaris*, *Chloris virgata*, *Cynodon dactylon* (dominant in several sections), *Cyperus margaritaceus*, *Enneapogon cenchroides*, *Eragrostis echinochloidea*, *Eragrostis trichophora* and *Schmidtia kalahariensis*. All these graminoid species are also present in the adjacent terrestrial habitat. The forbs were scattered, not

⁶ SLR Consulting (Africa) (Pty) Ltd. (2016). Integrated Storm Water Management Plan SWMP in support of WULA. SLR Project No.: 710.14003.00015. Report No.: Doc. no.1 Revision No.0, January 2017.



abundantly distributed, and overall, poorly represented within the Ga-Mogara Habitat Unit. Species recorded on site included species not necessarily associated with watercourses, namely *Amellus tridactylus*, *Arctotis leiocarpa*, *Citrullus naudinianus*, *Geigeria ornativa*, *Nerine laticoma* and *Sesamum triphyllum*. Only *Cullen tomentosum* is considered a species more typical of watercourses than terrestrial habitat. The alien forbs *Bidens pilosa*, *Schkuhria pinnata* and *Tagetes minuta* were irregularly distributed – being abundant in some sections, but absent in others. The woody component included scattered trees, shrubs and dwarf shrubs, none of which are restricted to the Ga-Mogara Habitat Unit. Typically seen are *Vachellia erioloba*, *Lycium hirsutum*, *Melolobium cf. microphyllum* and *Ziziphus mucronata*. The alien tree *Prosopis glandulosa* has significantly proliferated within several sections of the Ga-Mogara Habitat Unit.

Refer to **Appendix B – Table B1** for a list of species recorded within this Habitat Unit by STS and **Appendix B – Table B2** for the list of species recorded for the relevant Quarter Degree Square (QDS) and as presented in the previous studies conducted by EMS.

SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right: *Nerine laticoma*, *Cullen tomentosum* (close-up), *Cullen tomentosum* (growth form), *Arctotis leiocarpa*, *Chrysocoma ciliata*, *Bidens pilosa*

SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC.)

<p>Presence of Unique Landscapes</p>	<p>The Screening Tool outcome indicates that the Ga-Mogara Habitat Unit occurs in a Very High Sensitivity area which was triggered by the presence of an Ecological Support Area (ESA) (Holness and Oosthuysen, 2016). According to the Northern Cape CBA Map Reasons database the triggering biodiversity and ecological features associated with the ESA includes the presence of all Rivers (i.e., the Ga-Mogara River) and Landscape Structural Elements such as dolerite dykes (Holness and Oosthuizen, 2016).</p> <p>The Ga-Mogara Habitat is therefore considered an important ecological corridor and is of conservation significance. Much of the Ga-Mogara Habitat is degraded from a floral perspective and lacks a species composition distinctly unique from the surrounding terrestrial habitat. However, the river system cannot be considered on a localised scale alone (being a connected system) and thus as a whole it is regarded a unique feature in the landscape as an ESA and further enjoys protection under the NWA and NEMA as a watercourse.</p> <p>The Very High Sensitivity of the Screening Tool outcome is confirmed for the Ga-Mogara Habitat Unit.</p>
<p>Species of Conservation Concern</p>	<p>As part of the SCC assessment, the following classes were considered:</p> <ul style="list-style-type: none"> - Threatened species. In terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA), threatened species are Red Data Listed (RDL) species falling into the following categories of ecological status: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected in terms of the NEMBA Threatened or Protected Species (TOPS) Regulations (General Notice (GN) R152 of 2007, as amended). Removal, translocation and/or destruction of these species require authorisation from the DFFE. - Protected Species. Species that do not necessarily fall in the above categories of ecological status, but that are deemed important from a provincial biodiversity perspective, e.g., Protected Species [Schedule 2, Section 50(1)] and Specially Protected Species [Schedule 1, Section 49(1)] under the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA) for which restricted activities may not occur without permits. The List of Protected Tree Species (GN No. 536) as published in the Government Gazette 41887 dated 7 September 2018 as it relates to the National Forest Act, 1998 (Act No. 84 of 1998) (NFA) was also considered for the SCC assessment.



	<p>No threatened species were recorded within the Ga-Mogara Habitat and from a floral perspective the habitat is not suitable to sustain threatened species. Screening Tool outcome further indicated the Plant Species Theme to be of low sensitivity, thus from a database perspective no threatened species are known from the area. The area is, however, known to be poorly sampled and a Probability of Occurrence (POC) assessment was undertaken for threatened species known from the QDS 2722BB, 2722BD, 2723AA, and 2723AC (refer to Appendix A for the method of assessment). No threatened species were found to be associated with the assessed QDS's, and thus the low sensitivity for the Plant Species Theme is supported within the Ga-Mogara Habitat Unit.</p> <p>Nationally protected tree species associated with the Ga-Mogara Habitat included several large individuals of <i>Vachellia erioloba</i> (Camel Thorn). These individuals were pod-bearing, which means that they are old specimens. <i>Boscia albitrunca</i> (Shephard's tree) was noted in the EMS reports, but not recorded on site. The <i>Boscia albitrunca</i> becomes more prominent southwards towards Kathu.</p> <p>Provincially protected species were associated with the Ga-Mogara Habitat, namely <i>Nerine laticoma</i> (confirmed on site) and <i>Gymnosporia buxifolia</i> (potentially occurring) – both species are listed under Schedule 2 of the NCNCA. These species are not currently threatened, and their conservation status is LC. Their distributions are also not restricted to this habitat unit, nor to the local or regional areas.</p> <p>Permits from the Department of Environment and Nature Conservation (DENC) and authorisations from the DFFE should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place. Refer to Appendix C for the complete floral SCC assessment results.</p>
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CONCLUDING REMARKS

Impacting infrastructure: The **Key Infrastructure** will impact on the Ga-Mogara Habitat. The proposed Opencast Pits will expand into the Ga-Mogara River and hence the need for the two attenuation dams to trap and store potential flood waters.

Vegetation Importance	Notes of Concern
<p>The Ga-Mogara Habitat is important from a habitat conservation perspective (presence of an ESA) and a resource management perspective (e.g., provision of movement corridors), especially given the semi-arid setting of the proposed KMR Expansion Activities. All previous studies of KMR have assigned a high sensitivity to the Ga-Mogara despite all compounding impacts to the system and general degradation of the floral component. The main reason for this is the nature of the habitat, i.e., ephemeral rivers are important in the landscape to support ecological processes and serve as movement corridors (both applicable in dry and wetter seasons). Within the assessed areas the importance of the Ga-Mogara Habitat as a movement corridor is not highly functional for faunal species as there is adequate movement for these species in adjacent terrestrial areas which are not in such a close proximity to mining activities. With the proposed attenuation dams the potential of the Ga-Mogara Habitat to serve as a movement corridor will be further decreased since transport of nutrients and plant propagules with surface flows during rain events will be intercepted.</p> <p>From a floral perspective, further dewatering of the groundwater table could pose a risk to keystone species such as <i>Vachellia erioloba</i> – a nationally protected tree important for floral and faunal ecology in the area. Mature individuals have especially deep root systems to reach the groundwater table in the dry seasons; however, only the younger species are able to extend their root system deeper. Older species no longer direct energy towards root growth.</p>	<p>The currently proposed KMR Expansion Activities conflict with the Targets of the Biodiversity Action Plans (BAP) (Ecological Management Services. 2012; Ecological Management Services. 2015; NCC Environmental Services (Pty) Ltd. 2019b):</p> <ol style="list-style-type: none"> 1) The vegetation condition of the Ga-Mogara Habitat is to be improved and ecosystem functioning should be re-established where these have been disturbed/altered/diminished. 2) Promote habitat connectivity by reducing fragmentation of the Ga-Mogara Habitat and linking this system with other areas of important biodiversity areas. 3) Ensure that no significant impacts are caused to any water resources or courses. 4) The York Attenuation Dam is located in the proposed offset area (Ecological Management Services. 2015). <p>The proposed Kipling Pit Shell expansion will impact on the Ga-Mogara River diversion of Mokala Mine.</p>



Key considerations

- Given the existing impacts to the greater Ga-Mogara River system, it is highly advised that no further impact to the system take place and that as per the recommendations of the BAPs, the improvement of current vegetation condition and ecosystem functioning be strived for. If authorised, the River and Buffer Zone Revegetation Plan (Eco-Pulse & EMS, 2019a) must be updated to reflect additional impacts to the system. Based on the data that was made available to the specialists at the time of writing this report, no rehabilitation has been recommended for the Ga-Mogara Habitat that will be impacted by the proposed pit expansions. As such, a rehabilitation plan must be drawn up, and approved, if the proposed activities in the Ga-Mogara Habitat receives authorisation.
- If the proposed KMR Expansion Activities are authorised, it is recommended that stormwater management and erosion control measures must be implemented to limit sediment runoff into the Ga-Mogara Habitat. Refer also to the Freshwater Ecological assessment (SAS 202196, 2021) with regards to mitigation measures for the proposed activities in the Ga-Mogara Habitat, as well as important recommendations regarding the zones of regulation.
- AIP control within any watercourse is essential, particularly that of *Prosopis glandulosa* (refer also to section 3.3.2). If the proposed project is authorised, the Alien Invasive Plant Eradication and Control Programme as proposed by Eco-Pulse & EMS (2019) must be revised and should include the proposed expansion activities. To minimise the rehabilitation and alien control costs post decommissioning, it is recommended that ongoing alien control be implemented throughout the mining process as this will limit the spread of such species to the surrounding areas, especially regarding downstream habitat of the Ga-Mogara Habitat. Engagement with neighbouring landowners should be considered for an integrated AIP management plan to ensure long-term success of AIP control along the Ga-Mogara River.
- The vegetation surrounding the proposed mine layout should be maintained and rehabilitated where it is degraded to allow these stretches of vegetation to serve as a buffer against potential edge effect impacts from the proposed mining activities. This will also allow for less fragmented habitat and thus improve movement corridors.



3.2.2 Savannah Habitat Unit

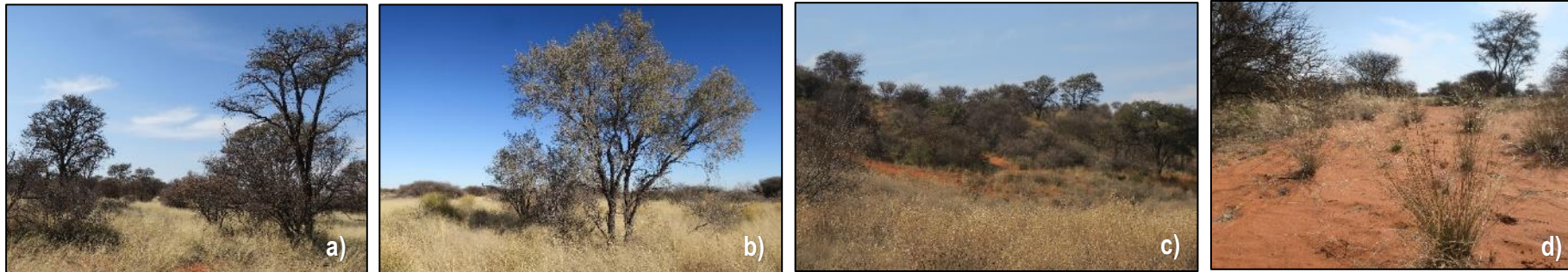
HABITAT DESCRIPTION

The Savannah Habitat includes three subunits that vary in vegetation structure, soil type and/or habitat integrity – namely the Degraded Thornveld, Karoid Shrubland and Mixed Thornveld. Species composition invariably differ between these habitat subunits, but most species are, however, shared among them. Due to the similarities in species composition as well as general vegetation structure conforming to the definition of a savanna, the grouping of the subunits under one broad unit is justified.

The habitat subunits are discussed in more detail in the below sections of this table.

Mixed Thornveld

The vegetation structure of the Mixed Thornveld subunit was variable throughout the assessed areas but can largely be described as an open tree savanna, which is characteristic of the Kathu Bushveld reference state (photos a and b below). Elements of the Gordonia Duneveld was also present with, e.g., low parallel dunes on the plains (photo c below), though these were more often not a prominent feature in the assessed areas. More formally, and as per Diagram A1 in Appendix A, the vegetation structure varied between **tall-to-high, open woodland** with a well-defined tree layer occurring on the characteristic red, wind-blown aeolian kalahari sands, with other sections better described as **tall, open shrubland** with some variances in tree/shrub height occurring based on the abundance and/or presence of taller tree species such as *Vachellia erioloba* and *Terminalia sericea*. Refer to the photos below for examples of vegetation structure variances throughout the site.



Vegetation structure generally an open tree savanna, with a medium to tall tree canopy. Dominant trees varied between sites, with *Vachellia erioloba* dominant in some sections (photo a), and the smaller *Vachellia haematoxylon* (photo b) more prominent in other. Photos a and b depict a characteristic vegetation structure of the Kathu Bushveld reference vegetation type, with photo c depicting the dunes more characteristic of the Gordonia Duneveld reference vegetation type. The grass layer also varied from continuous in some sections to more sparsely occurring in others (photo d and e).

On Kipling and Telele (along the Ga-Mogara River), as well as the assessed sections that encroached onto the neighbouring Kalagadi Mine, the woody component is characteristic of an open tree savanna and included scattered, tall *Vachellia erioloba* trees with the low tree layer occupied mainly by *Senegalia mellifera* subsp. *detinens* (almost encroaching in some areas). Other characteristic woody species included *Grewia flava*, *Lycium hirsutum*, *Vachellia haematoxylon* and *Ziziphus mucronata*. The sections of this habitat subunit within Devon and York and the more northerly sections of Kipling, comprised less tall tree species and the lower trees and/or taller shrubs formed the prominent woody component. The tall tree layer was typically very sparse, with smaller trees such as *Senegalia mellifera* subsp. *detinens* and *Ziziphus mucronata* more abundant. Shrubs such as *Grewia flava*, *Lasiosiphon polycephalus*, *Lycium cinereum*, *Rhigozum trichotomum*, *Roepera lichtensteiniana* and *Vachellia hebeclada* subsp. *hebeclada* were well represented throughout.

The graminoid component was well represented (good diversity of species) in this habitat subunit (throughout), albeit not a continuous cover of graminoids. This fragmented graminoid cover is characteristic and expected of this semi-arid environment. Denser and more continuous grass stands will be present during wetter seasons. The grass species best represented in this habitat subunit included *Aristida congesta* subsp. *barbicollis*, *Aristida congesta* subsp. *congesta*, *Enneapogon cenchroides*, *Eragrostis echinochloidea*, *Eragrostis lehmanniana*, *Eragrostis pallens*, *Pogonarthria squarrosa*, *Stipagrostis* cf. *ciliata*, *Stipagrostis uniplumis*, *Schmidtia pappophoroides* and *Schmidtia kalahariensis*. The forb component was poorly represented and can be attributed to the season of assessment.



Refer to **Tables B1 and B2 (Appendix B)** for an indication of herbaceous species associated with the Savanna Habitat.

Floristically this habitat subunit matched the anticipated species diversities with habitat integrity largely intact. Much of the Mixed Thornveld subunit is connected to a larger expanse of habitat where very few anthropogenic activities have occurred, thus resulting in minimally modified ecological processes and drivers. Fire and herbivory have been altered due to management practices, including fencing off farm portions, but not to the extent that floral communities are notably being adversely affected. Habitat integrity levels were higher for sites further away from mining activities. External factors placing pressure on floral communities included grazing pressures, woody species encroachment in some sections, and the loss of natural ecological processes (fire and herbivory) required to maintain a healthy savanna ecosystem.

Karoid Shrubland	Degraded Thornveld
<p>The Karoid Shrubland comprises short, open shrubland (as per Diagram A1 in Appendix A) and differed significantly in structure from the other subunits of the Savanna Habitat. The tree layer was largely absent and the presence of calcrete soils have resulted in a prominent and well-represented dwarf (karoid) shrub layer. Species such as <i>Aptosimum lineare</i>, <i>Barleria rigida</i>, <i>Cadaba aphylla</i>, <i>Caroxylon (Salsola) cf. patentipilosa</i>, <i>Eriocephalus</i> sp., <i>Justicia australis</i> and <i>Pentzia calcarea</i> were better represented in this habitat subunit than in the others. The grass species <i>Enneapogon desvauxii</i> was far more prominent in this subunit than in the other Savanna Habitat subunits.</p> <p>One of the aspects that mostly separates this habitat subunit from the others is the shallow soils with the flat, low-lying calcrete outcrops (refer to below photos). It is these shallow soils that result in the dominance of dwarf (or karoid) shrubs. Tree species with deeper root systems will struggle to adequately establish in these soils. Similarly, with the graminoid layer, species such as <i>Enneapogon desvauxii</i>, <i>Stipagrostis obtusa</i> and <i>Aristida congesta</i> subsp. <i>congesta</i> favour these shallower soils more so than the deeper sandy soils found in the majority of the KMR areas. Forbs were largely absent at the time of assessment due to seasonal constraints, but species noted during the site assessment included <i>Dicoma capensis</i>, <i>Dimorphotheca zeyheri</i>, <i>Geigeria ornativa</i>, <i>Helichrysum zeyheri</i>, <i>Melolobium</i> cf. <i>microphyllum</i> and <i>Trianthema parvifolia</i>.</p> <div data-bbox="212 1002 1093 1326"> </div> <p>This habitat subunit stretches over both the farm Kipling and Hotazel. The section within Hotazel has been subjected to various mining-related impacts and edge effects which have</p>	<p>The Degraded Thornveld subunit includes open-to-closed, tall shrubland (as per Diagram A1 in Appendix A) and is largely characterised by vegetation that has been degraded either through overgrazing or being subjected to mining edge effects. The resultant vegetation structure includes areas with a particularly low presence of graminoids (many bare soil patches), with some sections severely encroached by <i>Senegalia mellifera</i> subsp. <i>detinens</i> and <i>Rhigozum trichotomum</i>.</p> <div data-bbox="1137 603 2018 895"> </div> <p>Although the woody component was well represented in this habitat subunit, the encroaching nature of these species are resulting in the loss of indigenous floral diversity by pushing out these species and occupying habitat where additional species could have established following dispersal events. The lack of a well-represented graminoid layer excludes many grazing herbivores that play a key role in tree-grass coexistence and hence the increase in woody encroacher species in many of the sections where grass cover is low.</p> <p>Where this habitat subunit occurs along mining activities it is subjected to edge effects and with it being fenced off from the surrounding natural habitats, the natural ecological processes have been severely altered. The resulting vegetation communities are thus degraded, encroached and often associated with an increased presence of AIPs or weedy herbaceous species.</p> <p>Habitat integrity is largely diminished in this subunit.</p>



resulted in the habitat becoming encroached and the vegetation communities degraded. The section within the Kipling farm, which is less disturbed, was in a better condition with the habitat retaining moderately high levels of integrity (as seen in the above photos).

Species diversity for the habitat subunit was moderate. For a more comprehensive list of species associated with the Savanna Habitat, refer to **Tables B1 and B2 (Appendix B)**.



SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC)

Presence of Unique Landscapes

According to the Screening Tool, the Terrestrial Biodiversity Theme associated with the proposed KMR Expansion Activities largely fall in a **Low Sensitivity area**, with a significant stretch mapped as **Very High Sensitivity** areas. The triggered sensitivity features include an ESA that surrounds the Ga-Mogara Habitat Unit. According to the Northern Cape CBA Map Reasons database the triggering biodiversity and ecological features associated with the ESA includes the presence of the Kathu Bushveld, Gordonias Duneveld vegetation types, as well as the conservation areas (i.e., the Griqualand West Centre (GWC)) (Holness and Oosthuizen, 2016). Neither of these vegetation types are considered endemic, nor are they listed as being threatened. Habitat indicative of the GWC is not present within this habitat unit and as such no unique habitat related to the centre of endemism is likely to be available. The Savanna Habitat Unit is a fair representation of these two reference vegetation types, albeit an ecotonal representative; however, these vegetation types are currently still wide-spread and not under threat, thus the Very High Sensitivity is not supported.

Species of Conservation Concern

As mentioned before, as part of the SCC assessment, the following classes were considered **Threatened species** as well as both nationally and provincially **protected species**. As for the Ga-Mogara Habitat, no threatened species were recorded within the Savanna Habitat Unit, supporting the Screening Tool's low sensitivity outcome for the Plant Species Theme. Within the sections where the characteristic red aeolian sands were present, the NEMBA TOPS protected species *Harpagophytum procumbens* (LC) was confirmed on site (also a Schedule 1 protected species under the NCNCA – see sections below). Though not currently threatened, the destruction/removal/relocation of this species is regulated by the DFFE and permits would need to be obtained before any vegetation clearance can take place.

Several nationally protected tree species were associated with the Savanna habitat, particularly with the Mixed Thornveld subunit. *Vachellia erioloba* (Camel Thorn) was recorded throughout the assessed areas but was markedly more abundant in sections of Kipling (north of the R380). The protected *Vachellia haematoxylon* (Grey Camel Thorn) was also recorded throughout but in greater abundances than *Vachellia erioloba*. Within the northern sections of Devon, Kipling north of the R380, and the habitat on the neighbouring Kalagadi mine west of the farm Hotazel were associated with increased abundances of *Vachellia haematoxylon*. *Vachellia erioloba* is a more widespread species (below photo – left three), although its slow growth makes the tree sensitive to habitat loss. The *Vachellia haematoxylon* species are more restricted in its distribution range and is a Kalahari endemic (below photos – right three). Loss of habitat has a higher possibility to negative impact on *Vachellia haematoxylon* if these species are not either rescued and relocated, or offset.



From left to right: Distribution map of *Vachellia erioloba*, adult *Vachellia erioloba*, characteristic thorns of *Vachellia erioloba*, distribution map for *V. haematoxylon*, adult *V. haematoxylon*, characteristic thorn and leaves of *V. haematoxylon*.



	<p>Provincially protected species were associated with the Savanna Habitat Unit, although only <i>Harpagophytum procumbens</i> (Schedule 1), <i>Nerine laticoma</i> (Schedule 2), <i>Ruschia griquensis</i> (Schedule 2) and <i>Trianthena parvifolia</i> (Schedule 2) was confirmed on site; mostly recorded within the Mixed Thornveld subunits. Species that were not recorded on site but that obtained a high POC score for this habitat unit included Schedule 2 species: <i>Plinthus sericeus</i>, <i>Raphionacme velutina</i> (recorded by Todd (2018) within the area), <i>Gymnosporia buxifolia</i> (recorded by Todd (2018) within the area), <i>Babiana hypogaea</i> (well-known from the area), <i>Moraea pallida</i>, and <i>Jamesbrittenia atropurpurea</i> subsp. <i>atropurpurea</i> (recorded by Todd (2018) within the area). None of these species have a restricted distribution range or are currently considered threatened. They are all known from both the local and regional areas.</p> <p>Permits from DENC and authorisations from the DFFE should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place. Refer to Appendix C for the complete floral SCC assessment results.</p>
CONCLUDING REMARKS	
<p>Impacting infrastructure: Both the Key Infrastructure and several of the Secondary Infrastructure will impact on the Savanna Habitat Unit. Of higher significance is the proposed placement of the proposed Opencast Pits, WRDs, ROM stockpiles, and Ancillary Infrastructure (offices, parking etc) in the Mixed Thornveld subunit and the more intact sections of the Karoid Shrubland. The Degraded Thornveld subunit will be impacted by both Key and Secondary Infrastructure, but the impact on floral communities will be less severe.</p>	
Vegetation Importance	Notes of Concern
<p>The Savanna Habitat is of moderately low to moderately high importance from a floral ecological perspective, depending on the extent of habitat degradation and proximity to existing mining activities. The previous studies have indicated various sensitivities for the KMR MRAs, ranging from low to high. The currently proposed KMR Expansion Activities are largely within areas previously delineated to have a low to medium sensitivity, with very few destructive activities proposed for higher sensitivity areas. These sensitivities largely align with the findings of STS; however, sensitivities are further discussed and mapped in Section 4 of this report.</p> <p>The Degraded Thornveld has lost most of its habitat integrity and the natural ecological processes and drivers required to sustain a healthy savanna system have been altered and/or removed. This habitat subunit is of decreased importance and infrastructure placement in this subunit will have minimal adverse impacts on floral ecology for the region (given that mitigation measures are adhered to and edge effects managed). The Karoid Shrubland and Mixed Thornveld is mostly of Intermediate importance as these comprise vegetation that is still in a natural condition and where little habitat disturbances are present. The sections of the Mixed Thornveld on Kilping (north of the R380) and the sections on Kalagadi Mine west of the farm Hotazel, are of increased importance as they all form part of less fragmented habitat with a moderate to high abundance of protected species (nationally and provincially). Mining edge effects have largely (to entirely) been excluded from these sections and thus the vegetation communities can support a larger diversity floral and faunal species.</p>	<p>Taking into consideration the Targets of the BAP and Offset Investigation (Ecological Management Services. 2012; Ecological Management Services. 2015; NCC Environmental Services (Pty) Ltd. 2019b):</p> <ol style="list-style-type: none"> 1) The proposed rehabilitation of old workings on Devon must aim to achieve the targets set forth in the 2012 BAP: a) Maintain the existing area of “<i>Acacia haematoxylon</i> Savannah”, preserving the character, biodiversity value and local distinctiveness of the vegetation type; and b) Restore and improve the condition of existing “<i>Acacia haematoxylon</i> Savannah” in the area. 2) The Kipling offices are in an area previously considered as a potential offset area. It is recommended that alternative locations for the offices be considered, where possible.




Key considerations

- Sections on Kipling are associated with numerous, older specimens of *Vachellia erioloba* trees. These trees are protected under the NFA and cannot be “rescued” during construction or mining activities. The very hard wood and deep tap root system makes translocation of adult specimens unsuitable (Root/shoot ratio about 40%. Roots extend about 1.2 times further than the crown area). Due to the wide extent and morphology of the tree’s root system, transplanting of trees usually involves substantial removal of roots. The whole transplanting process in particular for large trees is an engineering feat and requires substantial involvement of resources and time. The taproot of *Vachellia erioloba* species can descend to 60 m, providing access to deep ground water. The excavation of individuals will undoubtedly result in damage to the root and will result in unsuccessful translocation. As such, it is highly recommended that clearance to these species be avoided at all costs. If this is not possible, their numbers should be offset with at minimal a 1:3 ratio and the areas where these species will be planted cannot be in an area earmarked for future mining.
- Similar to the above, the loss of *Vachellia haematoxylon* individuals is highly undesirable due to the restricted distribution range of this Kalahari endemic. Offsetting loss of these individuals must be pursued where avoidance or rescue and relocation is not possible. The old mine workings to be rehabilitated on Devon is within an area where *Vachellia haematoxylon* is abundant. The rehabilitation of this area must incorporate the planting of these species.
- As per the recommendation of the Closure and Rehabilitation plans for Kudumane Manganese Mine, rehabilitation of available areas should occur concurrently and must aim to achieve the pre-mined state (where feasible). As such, the mining footprint must be kept to a minimal and as close to existing infrastructure as possible. This will prevent further habitat fragmentation and thus reduce the chances or rate of habitat loss due to edge effect impacts, thereby lowering rehabilitation requirements.
- Poor vegetation management has resulted in bush encroachment and the presence of AIPs. These must be managed across the KMR MRAs with a particular focus on areas surrounding anthropogenic activities. The ongoing spread and intensification of AIPs and bush encroachment must be prevented and managed. The AIP management plan set up by Eco-Pulse & EMS (2019b) is adequate but will need an amendment to include new expansion activities and should reflect the updated NEMBA Legislation of alien and invasive species.



3.2.3 Transformed Habitat Unit

REFERENCE PHOTOS	
	
<p>Typical vegetation and landscape features associated with the Transformed Habitat Unit</p>	
HABITAT OVERVIEW	
Vegetation structure and condition	No real vegetation structure could be defined for this habitat unit due to large sections being transformed or heavily degraded.
Habitat Integrity and Species overview	Due to modification of habitat and vegetation clearing associated with mining activities, the habitat integrity of this habitat unit is diminished. The habitat is largely devoid of vegetation apart from some pioneer species such as the grasses <i>Enneapogon cenchroides</i> and <i>Pogonarthria squarrosa</i> establishing on bare patches. AIPs were recorded in this habitat unit, but numbers were generally low.
SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC)	
Presence of Unique Landscapes	<p>Within areas identified as an ESA and a Centre of Endemism:</p> <ul style="list-style-type: none"> - Small section of this habitat unit is located within ESAs. However, given the level of transformation that this habitat has experienced, it is no longer considered to be representative of an ESA. The floral communities are indicative of disturbed habitat and do not have the complement of species that would render this habitat unit a representative of the ESA in which it occurs, especially as the Northern Cape CBA reason map references the nearby Gamagara River and associated wetland systems. - Habitat indicative of the GWC is not present within this habitat unit and as such no unique habitat related to the centre of endemism is likely to be available. <p>Given the above, no unique habitat was identified within this habitat unit and the results of this assessment do not align with the Very High Sensitivity outcome of the Screening Tool.</p>
Species of Conservation Concern	No SCC were recorded in this habitat unit and the level of habitat degradation is not suitable for the establishment of SCC, especially not of more sensitive endemics and RDL species. The Screening Tool further indicates the areas to be of Low Sensitivity, thus further supporting the lack of SCC for this habitat unit.
CONCLUDING REMARKS	
<p>This habitat unit is not considered important from a floral ecological importance and resource management perspective.</p> <p>Key considerations:</p> <ul style="list-style-type: none"> - The habitat is severely degraded and no longer represents the original state, nor is it suitable to sustain viable populations of floral SCC. The infrastructure proposed within this habitat unit is unlikely to disrupt any significant ecological processes or impede any ecological corridors (from a purely floral perspective). - In terms of the Screening Tool outcome, these areas match the Low Sensitivity assigned to the Plant Species Theme. - Due to the area already being exposed to disturbances and edge effect impacts from overgrazing and mining activities, this habitat unit is associated with, and further susceptible to, AIP proliferation and bush encroachment. If the proposed KMR Expansion Activities are authorised, it will be important to implement measures that will limit edge effect impacts on the surrounding areas. 	



3.3 Alien and Invasive Plant (AIP) Species

South Africa is home to an estimated 759 naturalised or invasive terrestrial plant species (Richardson et al., 2020), with 327 plant species, most of which are invasive, listed in national legislation⁷. Many introduced species are beneficial, e.g., almost all agriculture and forestry production are based on alien species, with alien species also widely used in industries such as horticulture. However, some of these species manage to “escape” from their original locations, spread and become invasive. Although only a small proportion of introduced species become invasive (~0.1–10%), those that do proceed to impact negatively on biodiversity and the services that South Africa’s diverse natural ecosystems provide (from ecotourism to harvesting food, cut flowers, and medicinal products) (van Wilgen and Wilson, 2018).

3.3.1 Legal Context

South Africa has released several Acts legislating the control of alien species. Currently, invasive species are controlled by the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) – Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 September 2020. AIPs defined in terms of NEMBA are assigned a category and listed within the NEMBA List of Alien and Invasive Species (2020) in accordance with Section 70(1)(a) of the NEMBA:

- **Category 1a** species are those targeted for urgent national eradication;
- **Category 1b** species must be controlled as part of a national management programme, and cannot be traded or otherwise allowed to spread;
- **Category 2** species are the same as category 1b species, except that permits can be issued for their usage (e.g., invasive tree species can still be used in commercial forestry, providing a permit is issued that specifies where they may be grown and that permit holders “*Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3*”); and

⁷ Government Notice number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004).



- **Category 3** are listed invasive species that can be kept without permits, although they may not be traded or further propagated, and must be considered a Category 1b species if they occur in riparian zones.

Duty of care related to listed invasive species are referred to in NEMBA Section 73⁸. The motivation for this duty of care is both environmentally and economically driven. Management of alien species in South Africa is estimated to cost at least ZAR 2 billion (US\$142 million) each year - this being the amount currently spent by the national government's DFFE - i.e., the Working for Water programme (van Wilgen, 2020). Managing AIPs early on will reduce clearing costs in the long run.

3.3.2 Site Results

The assessed areas for the proposed KMR Expansion Activities had low diversity of AIPs. The density of most of the AIPs were low; however, within the Ga-Mogara Habitat and some sections associated with the Transformed Habitat, the AIP abundance was medium-high. Most of the species recorded on site (including those recorded during previous assessments) are listed category invaders for which control is required.

Table 1 below lists the AIPs associated with the KMR MRAs. The existing AIP control plan (Eco-Pulse & EMS, 2019b) is sufficient but would need to be revised to include the new sections of the proposed KMR Expansion Activities. Additional species recorded on-site during the 2021 assessments would also need to be considered in the revised Eco-Pulse & EMS (2019b) AIP control plan.

⁸ Section 73(2): A person who is the owner of land on which a listed invasive species occurs must-

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



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

Scientific name (Common Name)	Origin	NEMBA Category	Environmental Impacts ⁹
<i>Alternanthera pungens</i>	South America	Not Listed	More an agronomic weed than a natural habitat weed.
<i>Argemone mexicana</i> (Yellow-flowered Mexican poppy)	Mexico	1b	It is prolific in disturbed sites and competes with agricultural crops and indigenous species. This plant contaminates crop seed. Spiny fruits and leaf tips can adhere to the wool of sheep. The seeds are poisonous to humans and livestock.
<i>Argemone ochroleuca</i> (White-flowered Mexican poppy)	Mexico	1b	Prolific in disturbed sites and competes with agricultural crops and indigenous species. This plant contaminates crop seed, and the spiny fruits and leaf tips can adhere to the wool of sheep. The seeds and parts of the plant are poisonous to humans and livestock.
<i>Atriplex nummularia</i> (Old Man Salt Bush)	Australia	2	Competes with and has the potential to replace and reduce indigenous species.
<i>Bidens pilosa</i> (Common Blackjack)	South and Central America	Not Listed	<i>Bidens pilosa</i> is an aggressive weed that grows forming dense stands that outcompete and displace crop and native vegetation. Under favourable conditions, <i>B. pilosa</i> may grow three times faster than similar plant species.
<i>Cylindropuntia imbricata</i> (Imbricate cactus, Imbricate prickly pear)	North and Central America (southern United States & Mexico)	1b	Competes with and replaces indigenous species. Dense infestations reduce the grazing potential and hence the carrying capacity of the land. Thickets restrict access of domestic and wild animals. The very spiny cladodes adhere to passing animals and the barbed spines can penetrate their skin and feet causing severe injuries. Spines become entangled in sheep's wool and cause downgrading of the wool. All these factors combine to cause the drastic devaluation of agricultural land.
<i>Datura ferox</i> (Large thorn apple)	Tropical America	1b	It competes with indigenous species.
<i>Opuntia ficus-indica</i> (Mission prickly pear, Sweet prickly pear)	Central America (Mexico)	1b	Competes with and replaces indigenous species. Dense infestations reduce the grazing potential of the land and restrict access by domestic and wild animals. The spiny cladodes can cause injuries to animals and during the fruiting season the minute spines (glochids) on the fruits can be highly irritative and can result in animals being unable to feed. Dense infestations can cause drastic devaluation of agricultural and conservation land.
<i>Opuntia humifusa</i> (Large-flowered prickly pear, Creeping prickly pear)	North and Central America (south-western United States and Mexico)	1b	
<i>Pennisetum setaceum</i> (Fountain Grass)	North Africa	1b	Forms stands along road verges and in other disturbed sites with the potential to spread into adjacent natural veld.
<i>Prosopis glandulosa</i> (Honey mesquite)	North and Central America	3 in Northern Cape 1b in watercourses	<i>Prosopis</i> trees are extravagant users of readily available groundwater and dense stands could seriously affect the hydrology of the ecosystems they invade. Dense stands compete with and replace indigenous woody and grassland species. Dense stands produce few pods and thus replace natural pasturage without providing pods in return. Dense

⁹ Data sourced from the Invasive Species South Africa (ISSA) website: <http://invasives.org.za/>

Scientific name (Common Name)	Origin	NEMBA Category	Environmental Impacts ⁹
			stands are virtually impenetrable, restricting the movement of domestic and wild animals and causing injuries
<i>Prosopis velutina</i> (Velvet mesquite)	Southern Arizona, USA, and northern Sonora, Mexico	3 in Northern Cape 1b in watercourses	<i>P. velutina</i> , like other <i>Prosopis</i> species, is thought to have negative effects on water availability, but the exact effects of this species on the level of water tables have yet to be fully elucidated. Observing invasions of <i>P. velutina</i> in its native USA, Browning et al. (2012) noted that tree and shrub abundance has increased in many grasslands, causing changes in ecosystem carbon and nitrogen pools, related to patterns of woody plant distribution.
<i>Schkuhria pinnata</i> (Mexican marigold)	Central America	Not Listed	No real environmental threat identified as yet.
<i>Tagetes minuta</i> (Khaki weed)	South America	Not Listed	No real environmental threat identified as yet. The pioneer species, however, notably forms dense stands in disturbed areas and has the potential to occupy new niches before native species do.

4 SENSITIVITY MAPPING

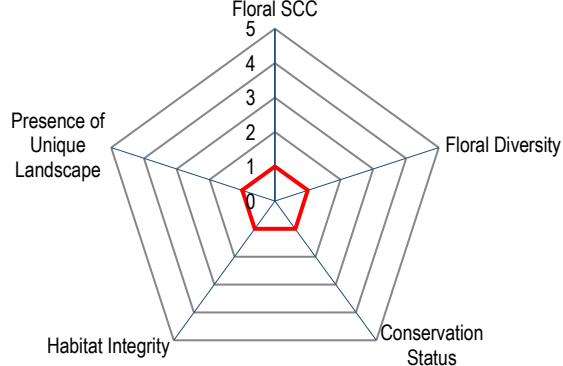
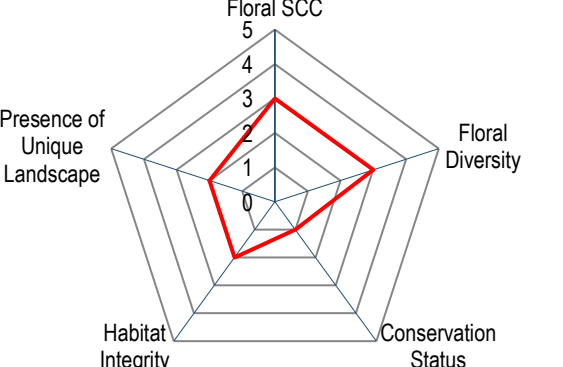
The National Web-based Screening Tool identified the entire KMR MRAs to be in a **low sensitivity** area for the Plant Species Theme (i.e., areas where no threatened flora are known or expected to occur). The low sensitivity for the Plant Species Theme was confirmed during the ground-truthing of the assessed areas.

The section surrounding the Ga-Mogara River was identified as a **very high sensitivity** area for the Terrestrial Biodiversity Theme (triggering features include an ESA). Although mining activities have transformed sections of this ESA, the ESA was confirmed on site and supported the high sensitivity assigned by the Screening Tool outcome.

Based on the ground-truthed results of the site visit, Table 2 below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development. These sensitivities differ from the Screening Tool sensitivities as they consider different aspects, such as the presence or potential for floral SCC (both threatened species as well as protected species), habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity (compared to a reference type). Figures 11 - 16 conceptually illustrates the areas considered to be of varying ecological sensitivity and how they will be impacted by the proposed infrastructure development.



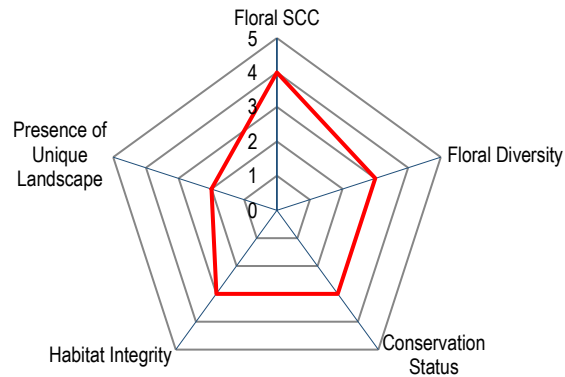
Table 2: A summary of the sensitivity of each habitat unit and implications for development.

Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
<p style="text-align: center;">Low</p> 	<p>Optimise development potential.</p>	<p>Transformed Habitat Unit</p>	<ul style="list-style-type: none"> - Indigenous floral diversity and abundance low to largely absent. - Where vegetation is present, the floral communities are homogenous and / or AIP species common. - No habitat of conservation concern is associated with these sections.
<p style="text-align: center;">Moderately Low</p> 	<p>Optimise development potential.</p>	<p>Degraded Thornveld Karoid Shrubland (where degraded)</p>	<ul style="list-style-type: none"> - Vegetation notably degraded with woody species severely encroaching and/or graminoid component almost entirely absent. - Floral SCC recorded in these areas were restricted to woody species protected under the NFA and the NCNCA. - Several provincially protected floral species are likely occurring in these sections, although poor habitat conditions are likely to prevent future expansion of their populations.



Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
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Intermediate

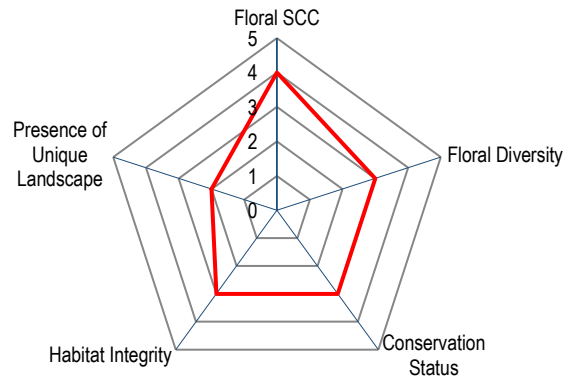


Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.

Mixed Thornveld
Karoid Shrubland

- Habitat representative of the reference states but limited unique features such as ESAs associated with these sections.
- Floral SCC include a moderate representation of nationally (NFA) protected tree species and a moderately low representation of provincially (NCNCA) protected floral species.
- Bush encroachment evident in some sections.
- AIPs very few or entirely absent.

Moderately High



Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.

Ga-Mogara
Habitat Unit

- Habitat within an ESA, thus of conservation significance.
- Movement and dispersal corridor.
- Floral SCC are present in this habitat unit.



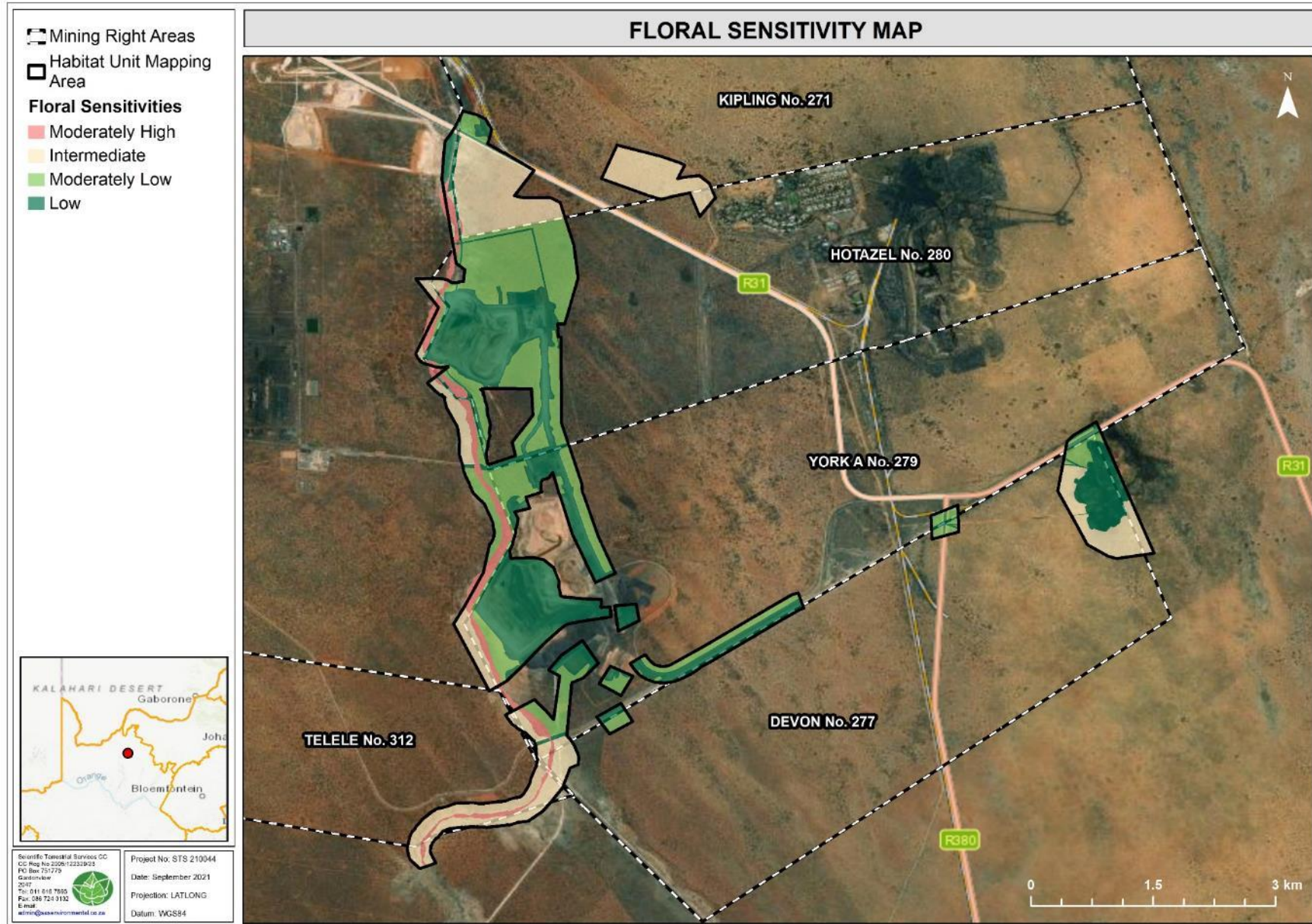


Figure 12: Conceptual illustration of the habitat sensitivities associated with the MRAs.



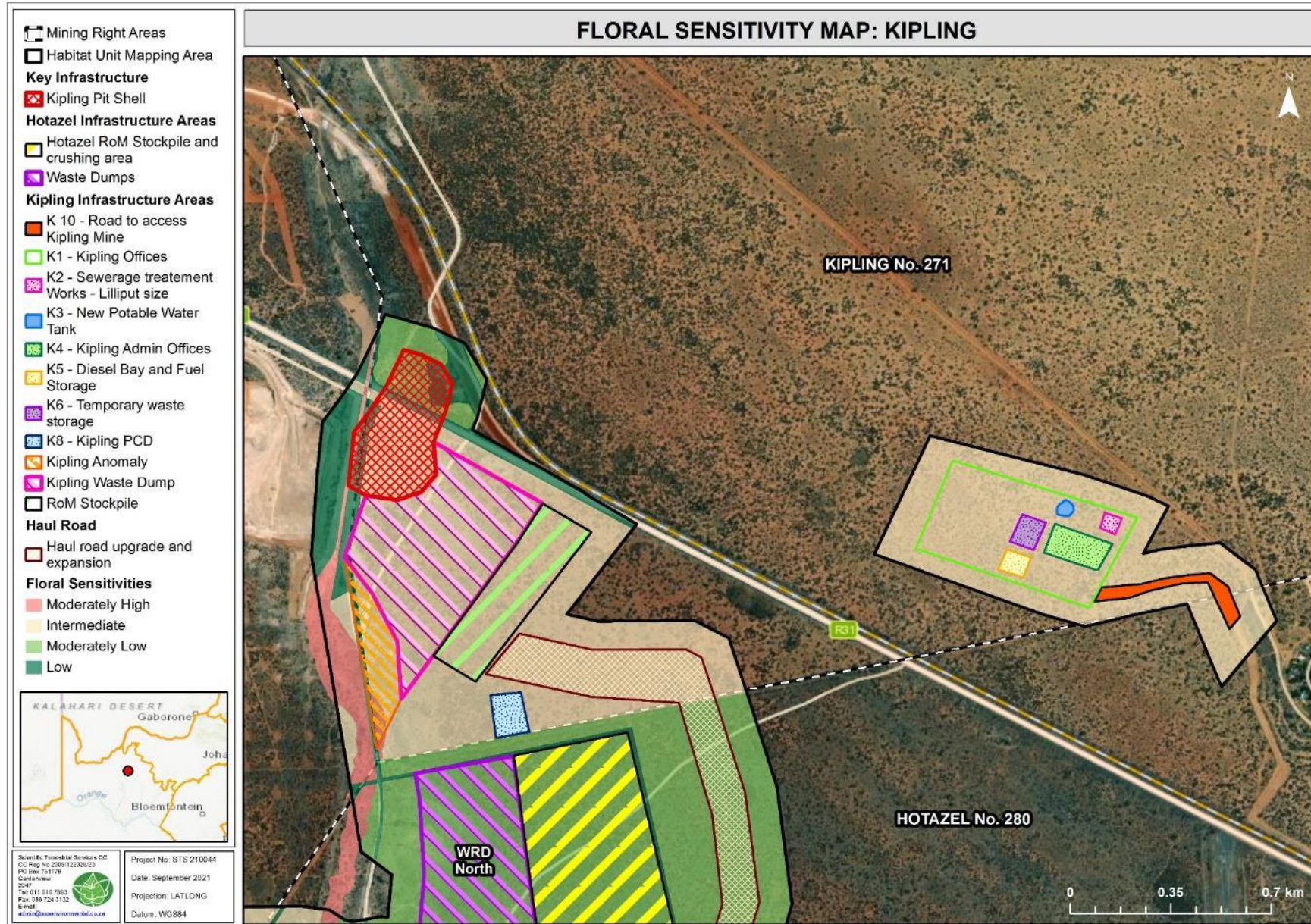


Figure 13: Conceptual illustration of the habitat sensitivities and proposed KMR Expansion Activities associated with Kipling.



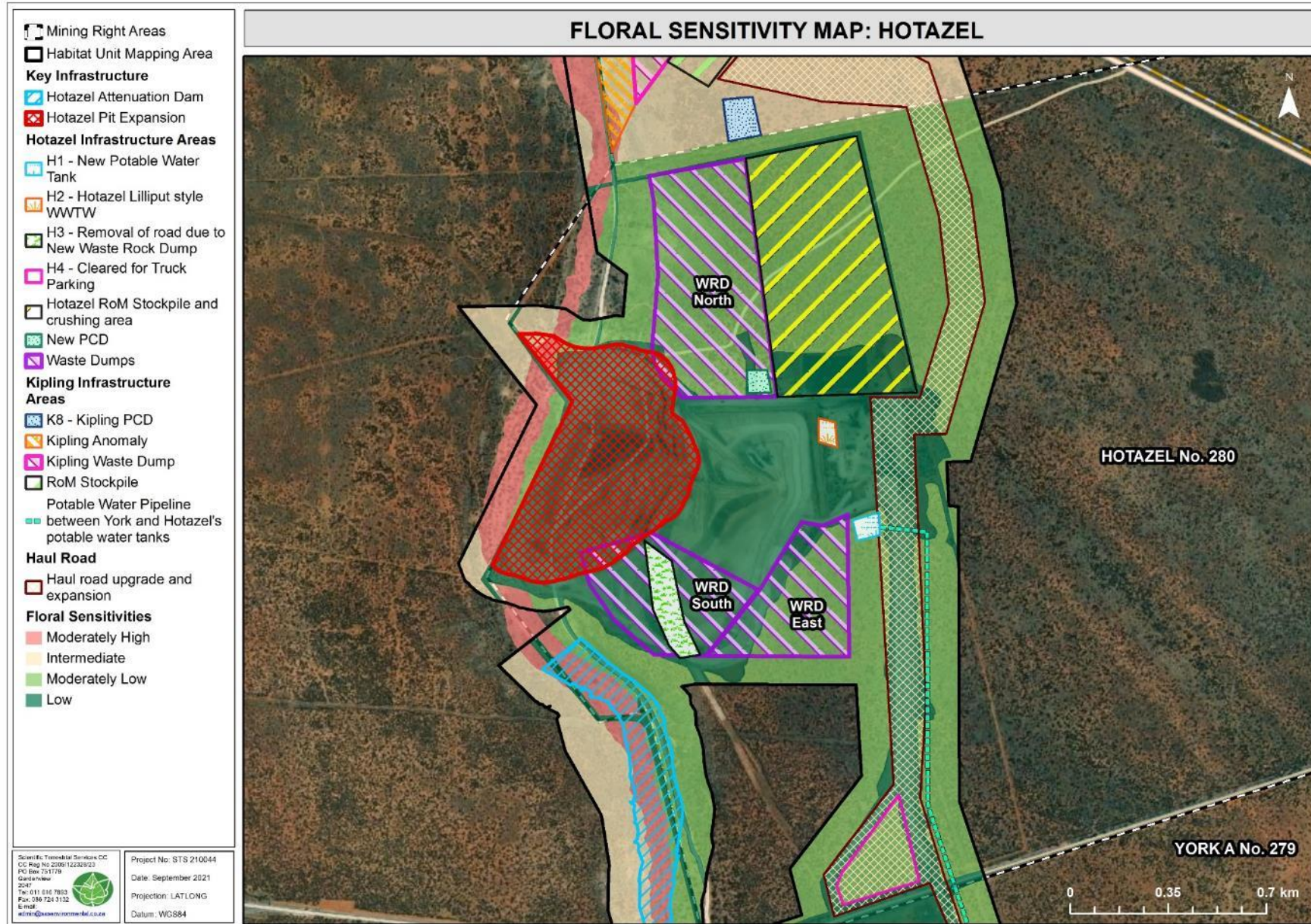


Figure 14: Conceptual illustration of the habitat sensitivities and proposed KMR Expansion Activities associated with Hotazel.



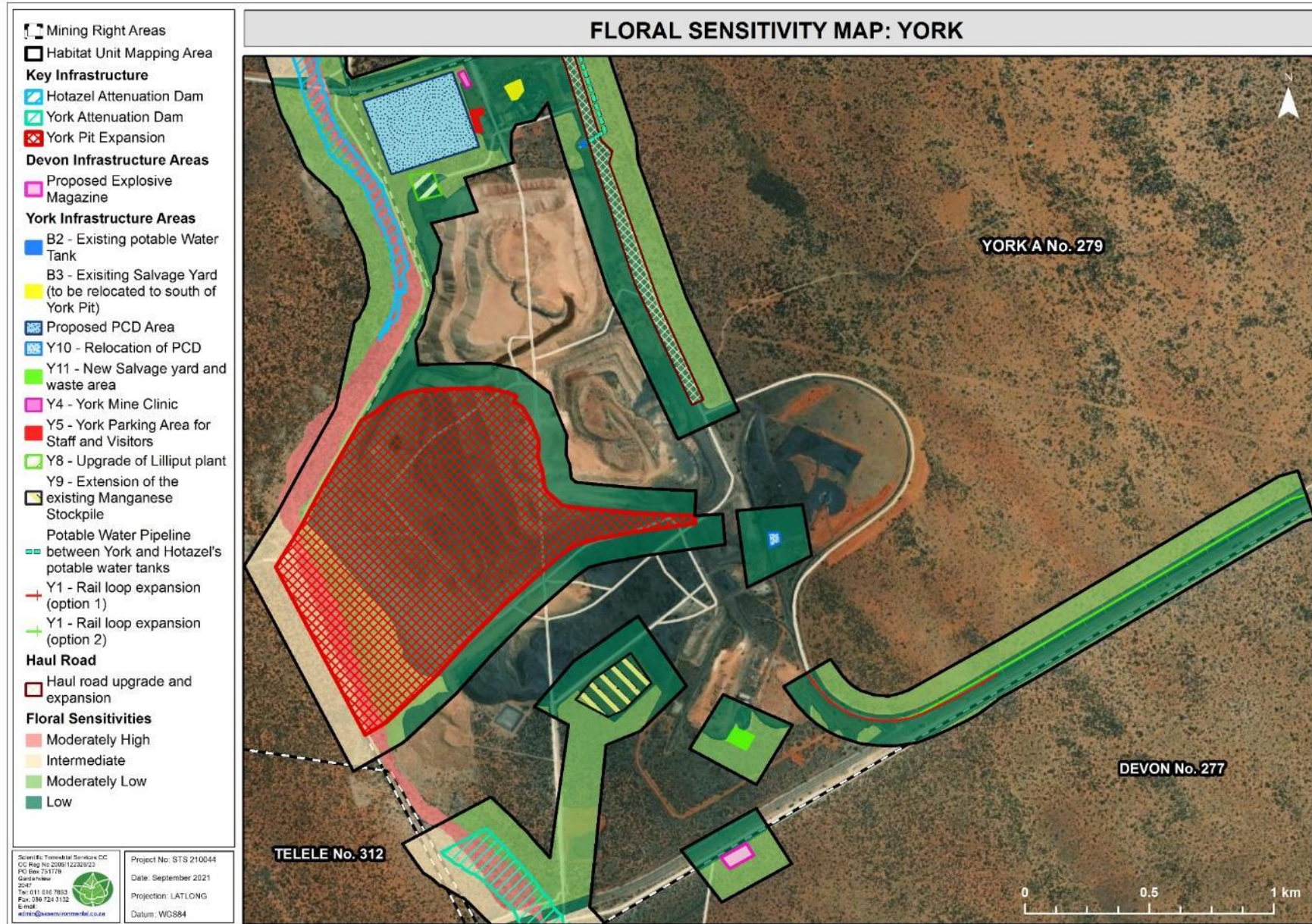


Figure 15: Conceptual illustration of the habitat sensitivities and proposed KMR Expansion Activities associated with York.



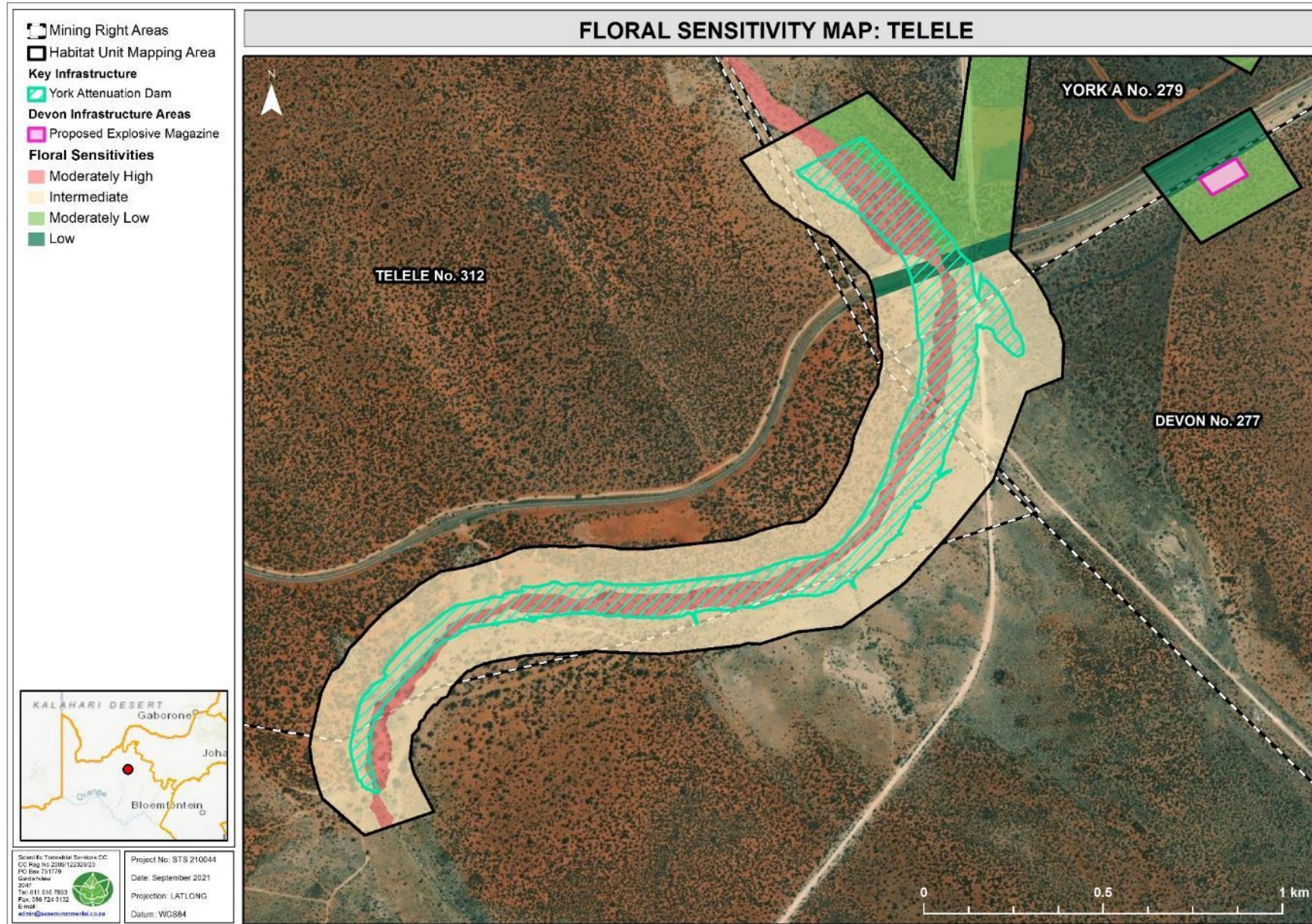


Figure 16: Conceptual illustration of the habitat sensitivities and proposed KMR Expansion Activities associated with Telele.



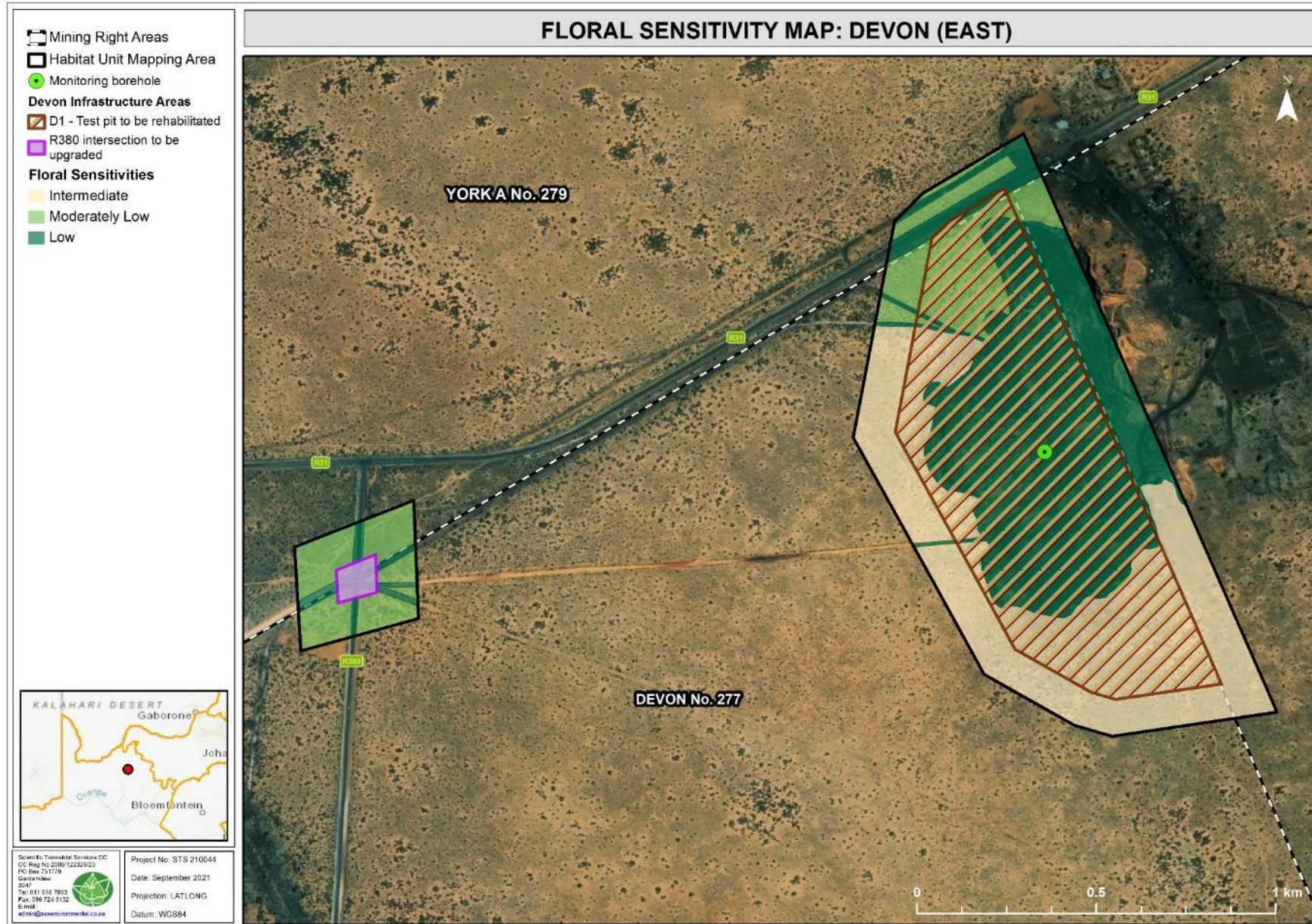


Figure 17: Conceptual illustration of the habitat sensitivities and proposed KMR Expansion Activities associated with Devon (Eastern section).



5 IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts arising from the proposed KMR Expansion Activities.

An impact discussion (5.2) and assessment (5.1) of all potential Pre-construction, Construction, Operational and Maintenance, and Decommissioning / Rehabilitation Phase impacts are provided in the below sections. All mitigatory measures required to minimise the perceived impacts are presented within the impact assessment tables (as presented in Section 5.1).

The objective for Kudumane Manganese Mine is to implement concurrent rehabilitation, taking advantage of resources available during the operational phase of the mine (available personnel and equipment), while minimising the need for double handling of backfill material where possible, reducing the potential for contamination and reducing the final closure liability. However, it should be noted that the closure plans state that WRDs will be permanent features and rehabilitation will only aim to slope and stabilise the dumps.

Decommissioning and closure activities, as identified in the EIAR/EMPr (SLR, 2014) are listed below:

- Backfilling the open pits with waste rock material;
- Stabilising and profiling of permanent WRDs;
- Stabilising underground mine workings (existing mining rights area only);
- Dismantling and demolishing of infrastructure;
- Replacing topsoil resources on disturbed areas;
- Ensure that vegetation on rehabilitated areas is sustainable;
- Dismantling and rehabilitation of railway tracks and rehabilitation of roads (depending on end use);
- Rehabilitation of the disturbed areas where infrastructure has been removed by sloping, filling in excavations and re-vegetating where possible;
- The surface of the tailings dam will be covered with waste rock and/or vegetation (new mining rights area only);
- There will be a period of active after-care followed by a passive after-care phase;
- Maintenance of vegetation where this is used for rehabilitation;
- Maintenance of facilities such as fencing, fire breaks, access roads and ramps, overflow structures;
- Removal of any invasive species from the rehabilitated sites;



- Inspecting on an annual basis to repair any erosion gullies; and
- Monitoring of potential groundwater pollution plumes.

5.1 Floral Impact Assessment Results

The below table indicates the perceived risks to the floral ecology associated with all phases of the proposed KMR Expansion Activities. The table also provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

No details were provided for the Kipling Anomaly at the time of the assessment. As such, this feature was assumed to be of similar type as the Opencast Pits and WRDs, where complete loss of floral habitat is anticipated.



Table 3: Impact on the floral habitat, diversity, and SCC for the Pre-Construction Phase associated with all proposed KMR Expansion Activities. Abbreviations are as follows: P = Probability, D = Duration, E = Extent, M = Magnitude and LoR = Loss of Resource, S = Significance.

Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
IMPACT DESCRIPTION: Unnecessary clearing of vegetation and floral SCC outside of the authorised footprint. Overall increased decline of floral diversity and habitat for the local area.																	
Potential failure to demarcate the project footprint areas before construction commences.	-	3	4	2	6	3	36	Moderate	- Minimise loss of indigenous vegetation where possible through adequate planning and, where necessary, by incorporating the sensitivity of the biodiversity report as well as other specialist studies. - It must be ensured that, as far as possible, all proposed infrastructure, including temporary infrastructure, is placed outside of sensitive habitat units. - Access roads should be kept to existing roads, as far as possible, so as to reduce fragmentation of natural habitat outside of the authorised footprint. - It is recommended that prior to the commencement of construction activities that the entire construction servitude be fenced off and clearly demarcated. - Design of infrastructure should be environmentally sound, and all possible precautions taken to prevent potential spills and /or leaks. All spills and /or leaks from equipment must be immediately remedied and cleaned up to ensure that these chemicals do not enter the soils.	2	2	1	4	2	14	Low	61,1
Potential inconsiderate planning of infrastructure placement and design, leading to the loss of intact floral habitat, as well as unnecessary edge effect impacts on areas outside of the proposed mining footprint.	-	3	4	2	6	3	36	Moderate	- Minimise loss of indigenous vegetation where possible through adequate planning and, where necessary, by incorporating the sensitivity of the biodiversity report as well as other specialist studies. - It must be ensured that, as far as possible, all proposed infrastructure, including temporary infrastructure, is placed outside of sensitive habitat units. - Access roads should be kept to existing roads, as far as possible, so as to reduce fragmentation of natural habitat outside of the authorised footprint. - It is recommended that prior to the commencement of construction activities that the entire construction servitude be fenced off and clearly demarcated. - Design of infrastructure should be environmentally sound, and all possible precautions taken to prevent potential spills and /or leaks. All spills and /or leaks from equipment must be immediately remedied and cleaned up to ensure that these chemicals do not enter the soils.	2	2	1	4	2	14	Low	61,1
IMPACT DESCRIPTION: Direct loss of floral SCC from the mining footprint (all proposed KMR expansion activities), with the potential for knock-on effects to result in population declines of range-restricted floral SCC (local to regional impacts). Pre-construction removal and/or rescue and relocation of floral SCC (NEMBA TOPS plants, NCNCA-Protected plants and/or NFA-protected tree species) within the KMR expansion activities.																	
Potential failure to conduct a walkdown of the footprint areas before construction activities where floral SCC are searched and marked for either rescue and relocation (only eligible species), for harvesting of propagules (where SCC cannot be relocated but can be propagated in a plant nursery to form part of rehabilitation activities later down the line), or to obtain numbers of SCC individuals that will be destroyed.	-	3	5	3	6	4	42	Moderate	- Floral SCC recorded within the proposed mining footprint included species protected under the NFA, the NEMBA TOPS regulations, as well as species protected under Schedule 1 and 2 of the NCNCA (refer to sections 3.2.1-3.2.3). A walkdown of the footprint area is required before construction activities commence, where all anticipated floral SCC/protected species are searched, and marked for relocation and/or destruction, so that all necessary permits can be obtained from the DENC and DFFE.	1	2	2	4	2	8	Low	81,0



Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
<p>Potential failure to relocate all floral SCC that are eligible for relocation to appropriate habitat outside the proposed mining footprint, or failure to harvest sufficient propagules of SCC to propagate for rehabilitation later down the line.</p> <p>Potential failure to comply with national (NFA and TOPS) and provincial (NCNCA) legislation regarding permit applications for the removal, destruction, harvesting, or relocation of floral SCC that will be impacted by the proposed KMR Expansion Activities.</p>	-	5	4	4	6	3	70	High	<ul style="list-style-type: none"> - For NFA protected tree species, attempting to relocate mature individuals are often too expensive and/or result in unsuccessful re-establishment due to unavoidable damage to their root systems during their excavation. Where possible, seedlings of affected tree species should be targeted for relocation, and seeds must be harvested prior to vegetation clearance to use in rehabilitation activities. It is important that seedlings and seeds be harvested within a close proximity of an area to be impacted, so as to prevent alteration of population genetics. - Geophytes and succulents are good candidates for rescue and relocation (e.g., the <i>Nerine</i> and <i>Harpagophytum</i> species recorded on site), and these should be targeted for such initiatives. Where possible, propagules of such species must also be harvested and propagated in a plant nursery to use in rehabilitation activities during the closure and rehabilitation phase of the project. - A Rescue and Relocation plan must be drafted and approved by the relevant authorities for all floral SCC that will be impacted by the proposed mining activities. The Rescue and Relocation Plan must be used in conjunction with an approved Rehabilitation Plan for KMR to ensure successful translocation and/or reinstatement of floral SCC and habitat for such species. 	5	4	2	4	2	50	Moderate	28,6
<p>IMPACT DESCRIPTION: Spreading of AIPs, leading to potential loss of floral habitat and species diversity from surrounding natural habitat.</p>																	
<p>Potential failure to update the existing Alien and Invasive Plant (AIP) Management/Control plan before the commencement of mining activities, resulting in the spread of AIPs from the mining footprint to surrounding natural habitat (propagules "hitch-hike" with construction vehicles).</p>	-	3	4	3	8	3	45	Moderate	<ul style="list-style-type: none"> - Prior to the commencement of construction activities, the AIP Management/Control Plan (Eco-Pulse & EMS, 2019b) should be updated to cover all mining activities as well as the newly proposed KMR Expansion Activities. - Removal of alien invasive species should preferably commence during the pre-construction phase and continue throughout the construction and operational phases, as well as post-decommissioning. No AIP propagules should be allowed to spread with construction rubble; and - The AIP Management/Control Plan should be implemented by a qualified professional. No uncertified chemical control of AIPs to occur within the Ga-Mogara Habitat Unit. 	1	2	1	4	2	7	Low	84,4



Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
IMPACT DESCRIPTION:																	
Loss of floral habitat outside of the direct, authorised mining footprint. Decreased potential for successful rehabilitation later down the line.																	
Potential failure to set up an Erosion Control Plan for sloped areas that could lead to increased erosion and potential slope failure of stockpiles. Loss of a nutrient-rich topsoil layer and degradation of soil structure may also result.	-	3	2	1	6	3	27	Low	- Prior to the commencement of construction activities, an erosion control plan and stormwater management plan should be developed.	1	2	0	2	1	4	Low	85.2
Potential inadequate design of stormwater management that could lead to increased erosion.																	



Table 4: Impact on the floral habitat, diversity, and SCC for the Construction Phase associated with all proposed KMR Expansion Activities. Abbreviations are as follows: P = Probability, D = Duration, E = Extent, M = Magnitude and LoR = Loss of Resource, S = Significance.

Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation (%)			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
IMPACT DESCRIPTION:																	
Loss of floral SCC from the authorised KMR Expansion footprint, and potentially from the immediate surrounding areas (on a local scale).																	
Potential failure to have relocated or harvested all floral SCC within the footprint areas prior to the commencement of site clearing activities associated with the construction phase.							<ul style="list-style-type: none"> - It is recommended that all construction personnel be educated in environmental awareness, including the identification of SCC so to prevent accidental or unauthorised harvesting or clearance of SCC without permit application. - No collection of indigenous floral species must be allowed by construction personnel, especially with regards to floral SCC (if encountered and not yet rescued/relocated). - Edge effect control needs to be implemented by fencing off or demarcating the expansion activities' footprint to prevent further degradation and potential loss of floral SCC and their habitat outside of the proposed expansion footprint. - Monitoring of any rescued and relocated floral SCC should commence during the construction phase and continue until it is evident that relocated species have successfully established. 										
Potential failure to monitor the success of relocated floral SCC as well as propagation trials in plant nurseries from harvested propagules where SCC were not eligible for relocation.	-	4	2	3	8	3		52	Moderate	2	2	2	4	2	16	Low	69,2
Potential overexploitation through the harvesting of floral SCC outside of the construction footprint by construction personnel.																	
IMPACT DESCRIPTION:																	
Direct loss of floral diversity and habitat resulting from vegetation clearance and footprint development.																	
Site clearing activities and expansion of Opencast Pits into natural vegetation and Ga-Mogara River.	-	5	4	3	8	4	75	High	- The disturbance footprint of proposed KMR Expansion Activities must be kept as small as possible, especially where it is - expanding into more sensitive habitat - to minimise impact on the surrounding environment (edge effect management also crucial).	5	4	1	6	2	55	Moderate	26,7
Site clearing activities and construction of Attenuation Dams within the Ga-Mogara River and encroaching into adjacent natural habitat.	-	5	4	1	6	2	55	Moderate	- The authorised expansion footprints must be demarcated, and it must be ensured that no unauthorised construction personnel move beyond these areas where natural (and more sensitive) vegetation would be adversely impacted.	4	2	1	4	2	28	Low	49,1
Site clearing activities and development of the Secondary Infrastructure (WRDs and Stockpiles, Kipling Anomaly) within natural vegetation.	-	5	4	2	6	3	60	High	- Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved footprint. Clearing of vegetation should take place	5	4	1	4	2	45	Moderate	25,0



Nature of the impact	Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)	
	P	D	E	M	LoR	S			P	D	E	M	LoR	S			
Site clearing activities and development of the Secondary Infrastructure (ancillary infrastructure such as offices, potable water tanks etc.) within natural vegetation.	-	5	4	1	6	2	55	Moderat	in a phased manner to keep bare soil areas as small as possible and to limit the erosion potential. Additionally, construction personnel and construction vehicles should be kept to the bare minimal per site in order to reduce the construction footprint and potential for soil compaction. - Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed expansion activities. - Planning of temporary roads and access routes should take the site sensitivity plan into consideration. If possible, such roads should be constructed outside of the sensitive rocky ridge habitat and planned in a manner that will not lead to habitat fragmentation	2	4	1	4	2	18	Low	67,3
Site clearing activities and development of the Secondary Infrastructure (Linear infrastructure, namely Haul Road, Pipeline, Rail Loop options) within natural vegetation.	-	5	4	3	6	4	65	High		4	4	1	4	2	36	Moderat	44,6
Dumping of construction material within areas where no construction is planned, thereby increasing the extent of the authorised footprint.	-	3	2	2	4	2	24	Low		2	1	1	4	1	12	Low	50,0
IMPACT DESCRIPTION: Indirect loss of floral diversity and habitat due to potentially poorly managed edge effects																	



Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation (%)			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
<p>Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to ongoing proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas (altering the floral habitat).</p> <p>Compaction of soils outside of the expansion footprint due to indiscriminate driving of construction vehicles through natural vegetation.</p> <p>Habitat fragmentation as a result of construction activities leading to loss of floral diversity and habitat.</p>	-	3	2	2	6	3	30	Moderate	<ul style="list-style-type: none"> - To limit edge effect impacts to the surrounding natural habitat, the below guidelines must be followed: <ul style="list-style-type: none"> • Demarcating all footprint areas during construction activities; • No construction rubble to be disposed of outside of demarcated areas, and should be taken to a registered waste disposal facility; • All soils compacted as a result of construction activities should be ripped, profiled and reseeded; • Minimise the risk of erosion by limiting the extent of disturbed vegetation and exposed soil; and • Manage the spread of AIP species and bush encroachers, which may affect remaining natural habitat within surrounding areas. • Ongoing AIP monitoring and clearing/control should take place throughout all phases of the project activities. The project perimeters should regularly be checked for AIP proliferation to prevent spread into surrounding natural areas; • Management of AIPs during the construction-phase and operational-phase activities must be focused on limiting their introduction and preventing their spread. - Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal. - Upon completion of construction activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area. 	2	2	1	4	2	14	Low	53,3
IMPACT DESCRIPTION:																	
Indirect loss of floral diversity and habitat due to potentially poorly managed edge effects																	
Dust generated during construction activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants, and potentially further decreasing optimal growing/re-establishing conditions.	-	5	2	2	4	2	40	Moderate	<ul style="list-style-type: none"> - Suppress dust in order to mitigate the impact of dust on flora within a close proximity of construction activities. 	3	2	1	4	2	21	Low	47,5



Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation (%)			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
IMPACT DESCRIPTION: Indirect loss of floral diversity and habitat due to construction waste.																	
Waste from construction material leading to disturbance of natural vegetation.	-	4	2	2	4	2	32	Moderate	<ul style="list-style-type: none"> No temporary dump sites should be allowed in areas with natural vegetation. Waste disposal containers and bins should be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility. If any spills occur, they should be cleaned up immediately to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on-site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil. 	2	2	1	4	2	14	Low	56,3
IMPACT DESCRIPTION: Indirect loss of floral diversity and habitat due to due to fires.																	
Destruction of vegetation due to unplanned fires.	-	3	2	2	6	3	30	Moderate	<ul style="list-style-type: none"> No unauthorised fires are to be allowed on the site, unless in areas demarcated and managed for this purpose. Informal fires in the vicinity of the development areas should be prohibited. Where a burning regime is implemented, this should be overseen by a qualified and experienced professional. The mining and construction personnel should be informed about fire control and prevention measures to reduce the frequency of uncontrolled veld fires in areas surrounding and within the proposed KMR Expansion Activities. A fire management plan should be in place in case of unplanned fires. 	2	2	1	4	2	14	Low	53,3



Table 5: Impact on the floral habitat, diversity, and SCC for the **Operational Phase associated with all proposed KMR Expansion Activities. Abbreviations are as follows: P = Probability, D = Duration, E = Extent, M = Magnitude and LoR = Loss of Resource, S = Significance.**

Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation (%)			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
IMPACT DESCRIPTION: Direct loss of floral habitat, SCC, as well as overall species diversity within the local area.																	
<p>Stockpiles, discard dumps and PCD expansion as material is deposited.</p> <p>Increased human presence due to mining expansion during operational phase, potentially leading to illegal harvesting/ collection of SCC or an increased risk of fire frequency impacting on floral communities outside of the mining footprint.</p>	-	3	4	2	6	3	36	Moderate	<ul style="list-style-type: none"> - It is recommended that all construction personnel be educated in environmental awareness, including the identification of SCC so to prevent accidental or unauthorised harvesting or clearance of SCC without permit application. - No collection of indigenous floral species must be allowed by personnel during the operational phase, especially with regards to floral SCC (if encountered and not rescued/relocated). - Edge effect control needs to be implemented by fencing off or demarcating the KMR Expansion footprint to prevent further degradation and potential loss of floral SCC and their habitat outside of the proposed expansion footprint. - Stockpiles, discard dumps and PCD positions, and their expansion as material is deposited, should be kept as small as possible. - Monitoring of any rescued and relocated floral SCC should commence during the construction phase and continue until it is evident that relocated species have successfully established. 	2	4	1	4	2	18	Low	50,0



Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation (%)			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
IMPACT DESCRIPTION: Direct loss of floral habitat, SCC, as well as overall species diversity within the local area.																	
<p>Increased introduction and proliferation of AIPs due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the approved expansion areas.</p> <p>Ongoing intensification of bush encroachment resulting from increased disturbances or habitat fragmentation.</p> <p>Overexploitation through the removal and/or collection of important or sensitive floral SCC beyond the direct footprint areas.</p> <p>Fragmentation of the Ga-Mogara Habitat Unit by Opencast Pit Expansion.</p> <p>On-going disturbance during operational phase may lead to erosion and sedimentation of surrounding floral habitat.</p>	-	4	4	2	6	3	48	Moderate	<ul style="list-style-type: none"> No additional habitat is to be disturbed during the operational phase of the project outside of the demarcated approved footprints (being applied for). Biweekly (recommended) to monthly (minimum requirement) monitoring and recording of the footprint areas must be done by the Environmental Control Officer (ECO) and photographic records kept – special attention should also be paid to potential increase and spread of AIPs (especially in the Ga-Mogara Habitat) and bush encroachment. Where possible existing roads are to be used for access purposes. No vehicles are allowed to indiscriminately drive through sensitive habitat and natural areas. Proliferation of AIPs is expected within any disturbed areas. AIPs must be monitored and must be removed throughout the operational phase of the project to prevent their spread beyond the development footprint areas. Removal of the AIPs, with specific emphasis on Category 1b alien species, encountered within the mining footprint and immediate surrounds must take place to comply with existing legislation – the existing AIP Management/Control Plan needs to be updated. The existing AIP Plan should be updated regularly. Minimise the risk of erosion by limiting the extent of disturbed vegetation and exposed soil (where possible). 	3	4	2	4	2	30	Moderate	37,5
IMPACT DESCRIPTION: Indirect loss of floral diversity and habitat resulting in the die-off of floral species.																	
<p>Blasting and removal of material from opencast pits.</p> <p>Dust generated during operational activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants and potentially further decreasing optimal growing/re-establishing conditions.</p>	-	4	4	2	4	2	40	Moderate	<ul style="list-style-type: none"> Ecological footprint of open pit is to remain as small as possible whilst allowing for economical and optimal extraction of the material. Suppress dust in order to mitigate the impact of dust on flora within a close proximity of construction activities. 	3	4	2	2	2	24	Low	40,0
IMPACT DESCRIPTION:																	



Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation (%)			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
Indirect loss of floral diversity and habitat due to fires.																	
Destruction of vegetation due to unplanned fires resulting from operational activities around the Opencast Pits.	-	3	2	2	6	4	30	Moderate	<ul style="list-style-type: none"> - No unauthorised fires are to be allowed on the site, unless in areas demarcated and managed for this purpose. - Informal fires in the vicinity of the development areas should be prohibited. - Where a burning regime is implemented, this should be overseen by a qualified and experienced professional. - The mining and construction personnel should be informed about fire control and prevention measures to reduce the frequency of uncontrolled veld fires in areas surrounding and within the proposed Opencast Pit Expansion. - A fire management plan should be in place in case of unplanned fires. 	1	1	1	4	3	6	Low	80,0
IMPACT DESCRIPTION:																	
Alteration of floral communities from damming of the Ga-Mogara Habitat Unit and during potential flooding events.																	
Increased sediment loads concentrated in dammed-off sections. Loss of sediment transport to downstream habitat. Fragmentation of movement corridors and potential increase in abundance of AIPs within dammed-off sections with AIP propagules exported to adjacent terrestrial habitat during potential flooding events.	-	4	4	2	6	2	48	Moderate	<ul style="list-style-type: none"> - Implement stormwater management to reduce accumulation of sediment loads within dammed-off sections of the Ga-Mogara Habitat Unit. - Reduce fragmentation of the Ga-Mogara Habitat through improving habitat connectivity along the river and between the river and adjacent terrestrial habitats. - Implement AIP control to reduce the chances of propagules being spread to adjacent habitat during flooding events. 	2	4	2	4	2	20	Low	58,3



Table 6: Impact on the floral habitat, diversity, and SCC for the Closure/Rehabilitation and Cumulative Impact Phases associated with all proposed KMR Expansion Activities. Abbreviations are as follows: P = Probability, D = Duration, E = Extent, M = Magnitude and LoR = Loss of Resource, S = Significance.

Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation (%)			
	P	D	E	M	LoR	S		P	D	E	M	LoR	S				
IMPACT DESCRIPTION: Rehabilitation of the test pit on Devon.																	
Sloping and stabilising of the Test Pit and reinstatement of indigenous floral vegetation to the pre-mined state (preferred).	+	2	3	2	6	2	22	Low	- Rehabilitation must proceed in accordance with the approved rehabilitation plan and must aim to achieve the post-closure land-use, i.e., grazing and wildlife. - Indigenous floral species representative of the surrounding vegetation type must be used for rehabilitation.	4	5	2	6	2	52	Moderate	-136
IMPACT DESCRIPTION: Loss of floral diversity and habitat due to ineffective implementation of rehabilitation activities. Permanent loss of habitat due to permanent WRDs.																	
Permanent loss of floral habitat, floral diversity and floral SCC due to loss of favourable habitat to reinstate floral SCC. Higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity.	-	4	4	3	8	4	60	High	- All infrastructure and footprint areas should be rehabilitated in accordance with the rehabilitation plan. - All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated. - The post-closure rehabilitation land use must be determined and agreed upon for the rehabilitation plan to be drafted. It is recommended that the post-closure land use be to natural vegetation that represents, as far as possible, the pre-mined vegetation communities, with ecological function prioritised. The rehabilitated areas must be able to sustain floral SCC, especially if such species are relocated into rehabilitated sites. - Edge effects such as erosion and AIP proliferation, which may affect adjacent or sensitive habitat, need to be strictly managed adjacent to the footprint areas and as part of the rehabilitation phase.	3	4	2	6	2	36	Moderate	40,0
IMPACT DESCRIPTION: Loss of floral SCC.																	
Potential poor monitoring of relocated SCC resulting in the loss of SCC from the local area and poorly reinstated and represented floral SCC within rehabilitated areas.	-	3	3	2	6	3	33	Moderate	- Monitoring of rescued and relocated floral SCC should continue during the Closure & Rehabilitation Phase until it is evident that the species have successfully established. Where possible, these species should be reintroduced into rehabilitation sites.	2	2	2	4	2	16	Low	51,5
IMPACT DESCRIPTION: Ongoing loss of floral diversity and habitat, including recued/relocated SCC.																	



Nature of the impact	Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)	
	P	D	E	M	LoR	S	P		D	E	M	LoR	S				
Potentially poorly implemented and monitored AIP Management programme, leading to the reintroduction and proliferation of AIP species within the area. Potential failure to monitor rehabilitation as per the Biodiversity Action Plan set out for the mine.	-	4	4	3	6	4	52	Moderate	- Ongoing alien and invasive vegetation and bush encroachment monitoring and control should take place throughout the rehabilitation phase of the project.	3	2	2	4	2	24	Low	53,8
IMPACT DESCRIPTION: Cumulative Impacts																	
Ongoing mining development and ineffective rehabilitation leading to cumulative loss of natural vegetation in the region	-	4	4	3	8	4	60	High	Minimise loss of indigenous vegetation where possible post-closure and ensure that rehabilitation is effectively implemented.	4	4	2	6	2	48	Moderate	20,0



5.2 Impact Discussion

The sections below provide the significance of perceived impacts arising from the proposed development of the KMR Expansion Activities.

The proposed KRM Expansion Activities will inevitably impact upon the terrestrial ecology within the footprint areas as a result of vegetation clearance and earth works. Much of the proposed expansion will occur within habitat that is either already transformed, or which is currently in poor conditions with floral communities notably degraded. Within these areas, the expansion activities are expected to have minimal impacts to the receiving environment and the species therein; instead, with mitigation measures implemented, the impacts can be adequately minimised to remain site-specific to local in extent. Some concerns include the footprint encroaching into habitat of conservation significance such as the Ga-Mogara Habitat Unit, as well as into habitat with increased presence of protected species (provincially and nationally protected).

For floral habitat and diversity, the construction and operational phases (or mining phase) will have the greatest direct and immediate impacts on the receiving environment. Impacts on protected floral species will be higher during the *planning phase* during which SCC should be relocated and/or propagules harvested for propagation in plant nurseries. Relocation of most of the geophyte and succulent SCC on site will likely be successful, with woody species more likely to require harvesting of propagules to propagate in a plant nursery. Avoidance of impacts on SCC population genetics and dynamics will, however, not be entirely possible. Impacts during the construction and operational phase can be reduced to lower impact significance on floral SCC given that sufficient monitoring of relocated and harvested specimens is implemented. During closure and rehabilitation, direct impacts on floral species will be minimal and if rehabilitation is implemented adequately, the overall impact of mining can be reduced.

5.2.1 Impacts on Floral Diversity and Habitat Integrity

The data gathered during the site visit indicate that the Transformed Habitat Unit is of **Low Sensitivity**, the Degraded Thornveld and sections of the Karoid Shrubland of **Moderately Low Sensitivity**, the Mixed Thornveld and other sections of the Karoid Shrubland of **Intermediate Sensitivity**, with the Ga-Mogara Habitat Unit of **Moderately High Sensitivity**. The proposed KMR Expansion Activities will impact on these habitat units to varying degrees and is discussed in more detail below.



Most significant impacts to affect the floral habitat integrity and species diversity associated with the KRM Expansion Activities include, but are not limited to, the following:

- Mining activities within sensitive habitat such as the Ga-Mogara and intact Mixed Thornveld and Karoid Shrubland;
- Continued expansion resulting in increasingly fragmented habitat;
- Increase risk of erosion and poor stormwater management - resulting in loss of soils, the down-slope sedimentation of habitat and the consequent loss of habitat beyond the planned footprint;
- AIP proliferation and woody encroachment into natural vegetation, displacing indigenous flora and altering favourable habitat conditions for the establishment of indigenous species; and
- Rehabilitation efforts are likely to result in sub-optimal recovery of pre-mining conditions, especially regarding the WRDs that will remain permanent features, resulting in residual impacts to floral communities.

The below table provides the extent of each habitat unit that will be impacted by the various aspects of the proposed KMR Expansion Activities.

Table 7: Breakdown of the extent of habitat units lost to the proposed KMR Expansion Activities.

	Ga-Mogara Habitat Unit	Transformed Habitat Unit	Degraded Thornveld	Karoid Shrubland	Mixed Thornveld	TOTAL EXTENT (HA) OF INFRASTRUCTURE IMPACT
Opencast Pits and Attenuation Dams	4%	78%	9%	5%	3%	139 ha
WRDs, Stockpiles and PCDs	0	23%	40%	22%	16%	149 ha
Linear Infrastructure	0	46%	36%	0	18%	61 ha
Ancillary Infrastructure	0	30%	39%	0	31%	19 ha
EXTENT (HA) OF EACH HABITAT UNIT IMPACTED	8 ha	439 ha	449 ha	136 ha	181 ha	

Key Infrastructure: Opencast Pits and Attenuation Dams

The extent of the proposed Opencast Pits' footprint is roughly 139 ha, of which 78% will be in already transformed areas (refer to Table 7). The expansion of the Pits will thus result in minimal (in terms of extent) transformation of natural habitat, with much of the impacted natural areas comprising the Degraded Habitat subunit where no significant loss of floral ecology is anticipated. The Mixed Thornveld will be impacted minimally, and the impact will result in negligible fragmentation of this habitat subunit. The Karoid Shrubland will be impacted most



by the Kipling Pit Shell and will result in the fragmentation and loss of the remaining section of this subunit that is still in a good condition. It should be noted that mining of the barrier pillar comes with risks such as pit wall failure that can result in subsidence and an overall increased extent in the receiving environment. Sound engineering and regular monitoring of pillar stability is of utmost importance.

The Attenuation Dams will have a small, localised direct impact on floral habitat as the dam wall construction is of small extent.

Of increased concern is the impact that will stem from the Opencast Pit expansions and Attenuation Dam development in the Ga-Mogara Habitat Unit. The development of the Attenuation Dams as well as all three Pits will result in sections of this watercourse being intercepted (see Figure 18 below) and fragmented, including the placement of the Kipling Pit Shell in the recently diverted section of the Ga-Mogara River on Mokala Mine. Fragmentation of rivers, even rivers as dry and episodic as the Ga-Mogara River, is likely to have significant impacts on the larger system. Overall river the consequences of river fragmentation is not yet well-understood with research findings that indicate fragmentation results in local and regional impacts to river systems, to findings that were unable to detect the effects of fragmentation (Fuller and Strayer, 2015). Potential impacts of river fragmentation include the loss of species movement, trapped sediment loads, poor recharge of downstream systems, and overall loss of biodiversity. During higher rainfall seasons or wetter years, surface water flows will result in increased sediment loads being trapped in the dammed/fragmented sections of the Ga-Mogara Habitat Unit and could displace into adjacent terrestrial habitat during flooding, thus likely resulting in a vegetation structure and composition change. The downstream habitat, on the other hand, will receive lower sediment loads as flow is intercepted. The impacts on the Ga-Mogara Habitat Unit from the proposed Opencast Pits and development of the Attenuation Dams may not be immediate and is more likely to impact on downstream habitat than on the section within the footprint area.

Expansion of the Opencast Pits and the development of Attenuation Dams in the Ga-Mogara Habitat Unit must be avoided as far as feasible. If this is not possible, investigations should be directed to potentially diverting small sections of the river in the areas where Opencast Pits will impede surface flows. Refer also to the Freshwater Ecological assessment (SAS 202196, 2021) for recommended mitigation and/or avoidance measures.





Figure 18: Visual illustration of sections of the Ga-Mogara River that will be intercepted by the proposed Opencast Pit expansion (red outlines) on Hotazel (left), Kipling (center) and York (right).

Secondary Infrastructure: WRDs, PCDs and Stockpiles

The development of the WRDs, PCDs and Stockpiles will have an extent of roughly 149 ha, most of which (40%) will be within the Degraded Habitat subunit and 23% in already Transformed Habitat, thus having a minimal impact on floral ecology. The Karoid Shrubland and Mixed Thornveld will be impacted adversely within the Kipling sections as the habitat was still in a good condition; however, due to these habitat subunits already fragmented and evidence of edge effects such as bush encroachment becoming evident, as well as these habitats being well represented within the region, the impact is not anticipated to extend beyond local scale impacts.

The WRDs, PCDs and Stockpiles will result in loss of vegetation and species diversity within the KMR expansion footprint but will not result in significant loss to floral ecology on a local to regional scale.

Secondary Infrastructure: Ancillary Infrastructure

The Ancillary Infrastructure comprises a much smaller extent than the above-mentioned activities, i.e., 19 ha, of which roughly 70% will be in transformed and degraded habitat where no significant loss of floral resources are anticipated. The Kipling offices are located in good condition Mixed Bushveld where a high abundance of the protected *Vachellia haematoxylon* was recorded, including scattered *Vachellia erioloba* individuals. The Mixed Thornveld in this section was in a better condition than most of the other areas assessed, and it is recommended (if feasible) that the offices be relocated to a less sensitive area.

Most of the Ancillary Infrastructure has been well thought out and will result in minimal fragmentation of natural habitat. Overall, the direct impact from Ancillary Infrastructure will be



localised in extent but edge effects will need to be managed to ensure indirect impacts (AIP proliferation, bush encroachment) on habitat outside of the direct footprint is prevented.

Secondary Infrastructure: Linear Infrastructure

The proposed Linear Infrastructure includes the development of the Haul Road, Pipeline and Rail Loop expansion. These infrastructures will amount to roughly 61 ha of cleared vegetation, most of which will be associated with the Haul Road. With the Linear Infrastructure largely impacting on transformed and degraded habitat, with only a small section of the Mixed Thornveld on Kipling impacted, the overall direct impact on floral ecology will be moderate and restricted to the local scale.

Indirect impacts such as AIP proliferation and bush encroachment may arise from linear infrastructure as these features typically serve as a corridor for spread – this is already evident adjacent to the existing rail loop on York. Mitigation measures will need to be directed towards keeping footprints as small as possible, preventing footprint creep, and preventing the spread of AIPs and intensification of bush encroachment.

Secondary Infrastructure: Test Pit to be Rehabilitated

As per the closure goals for KMR, rehabilitation of available areas should proceed concurrently and must aim to re-establish the pre-mined habitat as far as possible. If the closure and rehabilitation plans are followed, the rehabilitation of the Test Pit will result in an increase in floral habitat and diversity for Devon.

5.2.2 Impacts on Floral SCC

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

- Placement of mining infrastructure within floral SCC habitat;
- Destruction, removal or harvesting of floral SCC during construction and operational activities; and
- Potentially poorly implemented and monitored rescue and relocation of SCC that will be affected by the proposed project, leading to unsuccessful rescue efforts and loss of SCC individuals.



No threatened species were recorded on site and their potential occurrence within KMR Expansion Activities is low. The habitat was not deemed suitable to support threatened floral species and this aligned with the outcome of the Screening Tool which produced a low sensitivity for the Plant Species Theme.

The proposed KMR Expansion Activities are, however, associated with habitat that supports provincially and nationally protected floral SCC. The proposed activities will therefore directly impact on these species' numbers within the footprint area. The SCC recorded on site include species protected under the NCNCA (Schedule 1 and 2) and the NFA, as well as one NEMBA TOPS listed species. The habitat associated with the Mixed Thornveld and Ga-Mogara Habitat provide the most favourable conditions for these protected species and moderate to high abundances of these species were recorded on site.

Most of the proposed activities will minimally impact on protected floral species. The Pit expansions, WRDs, Stockpiles and Haul Road impacting on areas where protected SCC were present in higher abundances. Schedule 1 and 2 Protected Species require permits from the DENC before vegetation clearing can commence, with TOPS and NFA protected species requiring permits and authorisation from DFFE. Species of geophytes and succulents (mainly Schedule 1, 2 and TOPS species) are good candidates for rescue and relocation, and it is recommended that where these species will be cleared as part of site preparation activities or maintenance activities, they rather be relocated to suitable, similar habitat outside of the proposed footprint area. For woody species (NFA trees) that require more effort to relocate and for which relocation success is often low, it is recommended that propagules be harvested prior to clearing. These propagules can be propagated in a plant nursery for use in rehabilitation activities later down the line.

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

The proposed KMR Expansion Activities will not impact on any CBAs or threatened vegetation types, threatened ecosystem, or protected areas. The activities will, however, impact on an ESA. This relates mostly to the Ga-Mogara Habitat Unit as it is recognised as an important ecological corridor by provincial conservation datasets. The presence of the ESA confirms the outcome of the Screening Tool of Very High Sensitivity.

It is recommended that the ESA, which is already fragmented and transformed in several sections, be avoided as far as possible. The condition of the ESA must be improved through the management of AIPs and promoting habitat connectivity.



5.2.4 Probable Latent Impacts

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

- Permanent loss of and altered floral species diversity;
- Edge effects such as further habitat fragmentation and AIP proliferation;
- Permanent loss of protected floral species and suitable habitat for such species;
- Ongoing bush encroachment in the adjacent natural vegetation communities; and
- Disturbed areas not rehabilitated to an ecologically functioning state with resulting significant loss of floral habitat, species diversity and SCC/protected floral species likely to be permanent.

5.2.5 Cumulative Impacts

The proposed project could further impact on the floral habitat and diversity as well as floral SCC through fragmentation of habitat of increased biodiversity importance and sensitivity (specific reference is made to ingoing disturbance and transformation of the ESA).

AIP spread can potentially become severe if these species are not monitored and managed, especially along linear developments that typically serve as a corridor for spread. These species can spread to adjacent natural areas, thus impacting on the indigenous biodiversity of the region. The abundance of *Prosopis glandulosa* within the Ga-Mogara Habitat unit, if not cleared and controlled, will continue to spread downstream and displace floral communities outside of the mining footprint.

Ongoing mining expansion within the area surrounding Hotazel will contribute to regional scale loss of vegetation types associated with the KMR Expansion Activities, as well as the Kalahari endemic *Vachellia haematoxylon*.



5.3 Floral Monitoring

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

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



6 CONCLUSION

STS was appointed to conduct a Biodiversity Assessment as part of the IEA process for the KMR Expansion Project, near Hotazel in the Northern Cape Province. It is the intention of KMR to expand its existing operations and construct additional infrastructure to improve production capacity. The infrastructure and activities associated with the proposed KMR Expansion Project require a new EA, the amendment of the mine's existing EMPs, a WML and a WULA to authorise the below listed **key infrastructure**:

- A new Opencast Pit mine on Kipling;
- Expansion of the Hotazel and York Opencast Pits to allow for the mining of KMRs boundary pillar associated with each pit; and
- Two attenuation dams on the Ga-Mogara River, to allow for the expansion of the York and Hotazel Opencast Pits.

The above key infrastructure will have **secondary infrastructure** and activities associated with them, including Waste Rock Dumps (WRDs), Run of Mine (RoM) Stockpiles, Pollution Control Dams (PCDs), Haul Road Expansion and additional, smaller surface infrastructure such as offices, parking etc.

Habitat summaries and sensitivities:

Based on the results of the field investigation of July 2021 by STS, three broad habitat units were distinguished for the proposed KMR Expansion Activities:

- **Ga-Mogara Habitat Unit.** The Ga-Mogara habitat refers to the vegetation communities associated with the Ga-Mogara River¹⁰ – conforming to the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998) (NWA) – as delineated by the Freshwater Ecologist (SAS 202196, 2021). The Ga-Mogara Habitat is considered degraded from a floral perspective in most sections associated with the proposed KMR Expansion Activities, with alien vegetation prolific in some sections and impacts from overgrazing and mining pressures more evident in others. The Ga-Mogara Habitat encompasses the channel and banks of the Ga-Mogara River;
- **Savannah Habitat Unit.** This habitat unit includes vegetation communities that are typical of the Savannah biome (i.e., characterised by a grassy ground layer and a distinct upper layer of woody plants) and elements of the two reference vegetation

¹⁰ Please note that for the purposes of this report the spelling "Gamagara River" and the spelling "Ga-Mogara River" as used in the DWS RQIS database, is to be considered synonyms and may be used interchangeably.



types are present within this habitat unit. The Savannah Habitat was divided into three subunits based on variances in species composition, habitat condition, vegetation structure, and/or soil types, namely the Degraded Thornveld, Karoid Shrubland and Mixed Thornveld; and

- **Transformed Habitat Unit.** This habitat is currently transformed in nature due largely to mining activities or mining-related infrastructure.

The data gathered during the site visit indicate that the Transformed Habitat Unit is of **Low Sensitivity**, the Degraded Thornveld and sections of the Karoid Shrubland of **Moderately Low Sensitivity**, the Mixed Thornveld and other sections of the Karoid Shrubland of **Intermediate Sensitivity**, with the Ga-Mogara Habitat Unit of **Moderately High Sensitivity**.

Impact summary

The proposed KRM Expansion Activities will inevitably impact the terrestrial ecology within the footprint areas as a result of vegetation clearance and earthworks. Much of the proposed expansion will occur within habitat that is either already transformed, or which is currently in poor conditions with floral communities notably degraded. Within these areas, the expansion activities are expected to have minimal impacts to the receiving environment and the species therein; instead, with mitigation measures implemented, the impacts can be adequately minimised to remain site-specific to local in extent. Some concerns include the footprint encroaching into habitat of conservation significance such as the Ga-Mogara Habitat Unit, as well as into habitat with increased presence of protected species (provincially and nationally protected).

Most significant impacts to affect the floral habitat integrity, species diversity and SCC associated with the KRM Expansion Activities include, but are not limited to, the following:

- Mining activities within sensitive habitat such as the Ga-Mogara and intact Mixed Thornveld and Karoid Shrubland;
- Placement of mining infrastructure within floral SCC habitat;
- Destruction, removal or harvesting of floral SCC during construction and operational activities;
- Potentially poorly implemented and monitored rescue and relocation of SCC that will be affected by the proposed project, leading to unsuccessful rescue efforts and loss of SCC individuals.
- Continued expansion resulting in increasingly fragmented habitat;



- Increase risk of erosion and poor stormwater management - resulting in loss of soils, the down-slope sedimentation of habitat and the consequent loss of habitat beyond the planned footprint;
- AIP proliferation and woody encroachment into natural vegetation, displacing indigenous flora and altering favourable habitat conditions for the establishment of indigenous species; and
- Rehabilitation efforts are likely to result in sub-optimal recovery of pre-mining conditions, especially regarding the WRDs that will remain permanent features, resulting in residual impacts to floral communities.

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



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APPENDIX A: Floral Method of Assessment

Floral Species of Conservation Concern Assessment

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

The National Web-Based Environmental Screening Tool

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the proposed KMR Expansion Activities. Each of the themes in the Screening Tool consists of theme-specific spatial datasets which have been assigned a sensitivity level namely, “*low*”, “*medium*”, “*high*” and “*very high*” sensitivity. The four levels of sensitivity are derived and identified in different ways, e.g., for **confirmed** areas of occupied habitat for SCC a Very High and High Sensitivity is assigned and for areas of suitable habitat where SCC may occur based on spatial models only, a Medium Sensitivity is assigned. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below¹¹:

- **Very High:** Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km² are considered Critical Habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) D criteria of the IUCN or species listed as Critically/ Extremely Rare under South Africa’s National Red List Criteria. For each species reliant on a Critical Habitat, all remaining suitable habitat has been manually mapped at a fine scale.
- **High:** Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2000) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat.
- **Medium:** Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
- **Low:** Areas where no SCC are known or expected to occur.

¹¹ More details on the use of the Screening Tool for Species of Conservation Concern can be found in the below resources:

- South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.
- The National Web based Environmental Screening Tool website:
<https://screening.environment.gov.za/screeningtool/#/pages/welcome>



BRAHMS Online Website (or the new Plants of Southern Africa (POSA))

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

- This website provides access to South African plant names (taxa), specimens (herbarium sheets) and observations of plants made in the field (botanical records). Data is obtained from the Botanical Database of Southern Africa (BODATSA), which contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).
- Information on habitat requirements etc. is obtained from the SANBI Red List of South African Plants website (<http://redlist.sanbi.org/>).
- Typically, data is extracted for the Quarter Degree Square (QDS) in which the proposed KMR Expansion Activities is situated but where it is deemed appropriate, a larger area can be included.

NEMBA TOPS Species

The Threatened or Protected Species (TOPS) Regulations (2007) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA), were taken into consideration.

Provincial: Specially Protected and Protected Species

The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA), provides a list of Specially Protected Species (Schedule 1) (Section 49(1) of the NCNCA) and Protected Species (Schedule 2) (Section 50(1) of the NCNCA) for the Northern Cape Province. These species formed part of the SCC assessment.

Nationally Protected Trees

The National Forest Act, 1998 (Act No. 10 of 1998), as amended in September 2011 (NFA), affords protection to a list of tree species. All nationally protected trees were included as SCC in this report.

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

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

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

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

Vegetation Surveys

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

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

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a proposed KMR Expansion Activities equally and thus increase the potential



to miss floral SCC. Random sampling methods also tend to require more time in the field to locate the amount of SCC that can be detected using subjective sampling methods - In the context of an EIA where time constraints are often restrictive, priority needs to be given to collecting data in the shortest time possible without compromising the efficiency of locating SCC (SANBI, 2020).

Vegetation structure has been described following the guideline in Edwards (1983). Refer to Figure A1.

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases. Whether the habitat is representative of a Critical Biodiversity Area or forms part of an Ecological Support Area is also taken into consideration;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and
- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

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

Table A1: Floral habitat sensitivity rankings and associated land-use objectives.

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



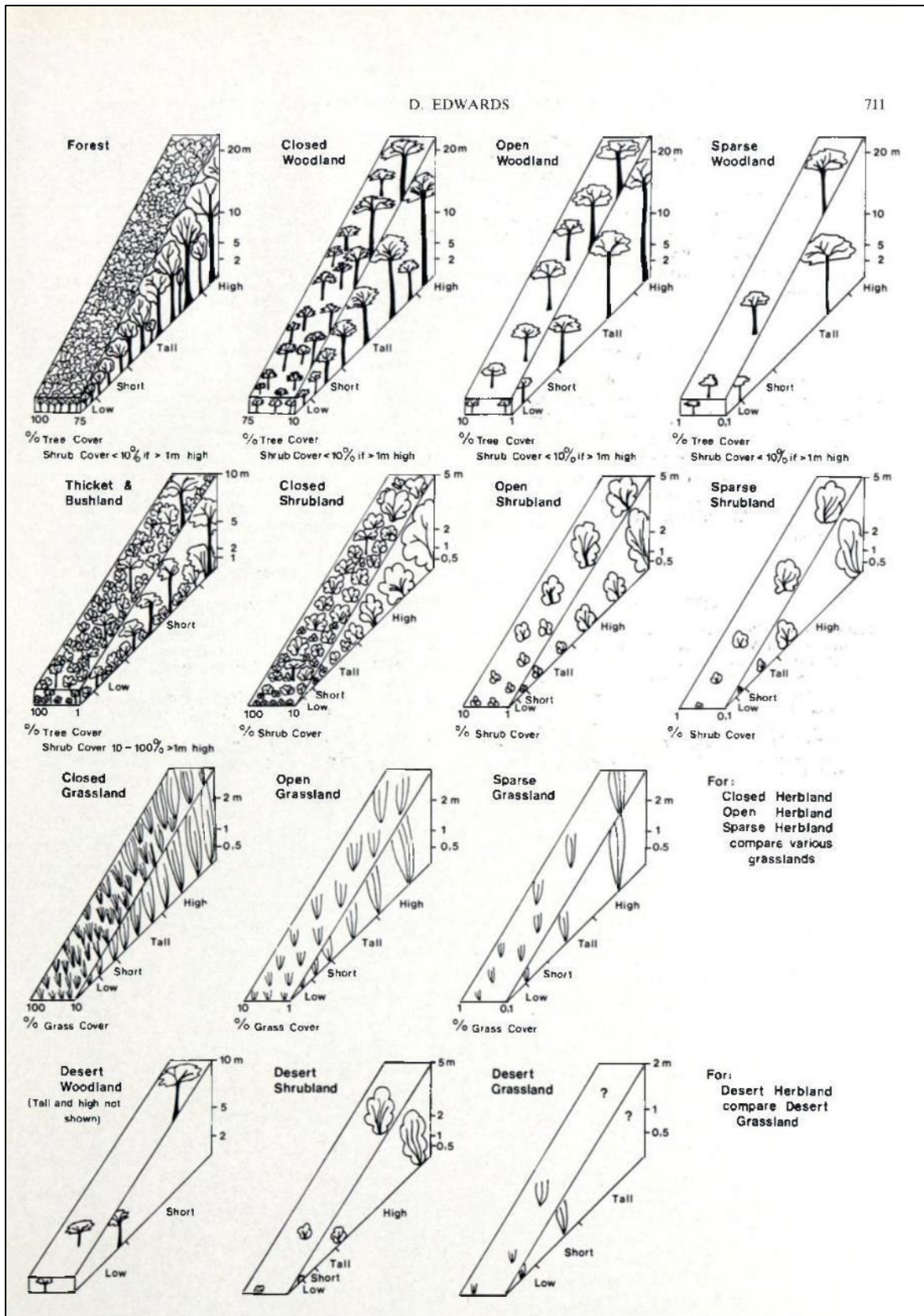


Figure A1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.



APPENDIX B: Floral Species List

Table B1: Dominant floral species encountered during the field assessment. Alien species identified during the field assessment are indicated with an asterisk (*). Protected species are emboldened.

Scientific name	Karoid Shrubland	Mixed Bushveld	Ga-Mogara Habitat	Transformed and Degraded Habitat
WOODY SPECIES				
<i>*Prosopis glandulosa</i>		X	X	X
<i>Aptosimum albomarginatum</i>	X			
<i>Aptosimum elongatum</i>		X		
<i>Aptosimum lineare</i>	X			
<i>Asparagus laricinus</i>	X	X	X	X
<i>Asparagus suaveolens</i>		X		
<i>Barleria rigida</i>	X			
<i>Cadaba aphylla</i>	X			X
<i>Caroxylon (Salsola) cf. patentipilosum</i>	X			X
<i>Chrysocoma ciliata</i>	X	X	X	X
<i>Crotalaria sp.</i>		XX		
<i>Crotalaria virgultalis</i>		X		X
<i>Eriocephalus sp.</i>	X			
<i>Felicia muricata</i>		X	X	
<i>Gomphocarpus tomentosus</i>		X		X
<i>Grewia flava</i>	X	X		X
<i>Hermannia burchellii</i>		X		
<i>Justicia australis</i>	X		X	
<i>Justicia divaricata</i>		X		
<i>Laggera decurrens</i>				X
<i>Lasiosiphon polycephalus</i>	X	X	X	X
<i>Lessertia frutescens</i> (Schedule 1)				X
<i>Lycium bosciifolium</i>		X		
<i>Lycium cinereum</i>		X		X
<i>Lycium hirsutum</i>	X	X	X	X
<i>Melolobium cf. calycinum</i>		X		X
<i>Melolobium cf. microphyllum</i>	X		X	X
<i>Monechma incanum</i>		X		
<i>Pentzia calcarea</i>	X	X		X
<i>Rhigozum trichotomum</i>	X	XX		X
<i>Roepera lichtensteiniana</i>		X		
<i>Rosenia (Oedera) humilis</i>	X	X	X	X
<i>Searsia lancea</i>		X		XX
<i>Senegalia mellifera subsp. detinens</i>	X	XX	X	XX
<i>Tapinanthus oleifolius</i>				X
<i>Tarchonanthus camphoratus</i>		X	X	
<i>Terminalia sericea</i>		X		X
<i>Thesium hystrix</i>	X			
<i>Vachellia erioloba</i>		XX	X	X
<i>Vachellia haematoxylum</i>		X		XX
<i>Vachellia hebeclada subsp. hebeclada</i>	X	X		X
<i>Vachellia karroo</i>			X	



Scientific name	Karoid Shrubland	Mixed Bushveld	Ga-Mogara Habitat	Transformed and Degraded Habitat
<i>Ziziphus mucronata</i>	X	X	X	X
FORB SPECIES				
* <i>Alternanthera pungens</i>				X
* <i>Argemone ochroleuca</i>				X
* <i>Bidens pilosa</i>			X	X
* <i>Datura ferox</i>				X
* <i>Schkuhria pinnata</i>	X		X	
* <i>Tagetes minuta</i>			X	
<i>Acrotome sp.</i>		X	X	X
<i>Amellus tridactylus</i>			X	
<i>Aptosimum elongatum</i>		X		
<i>Arctotis leiocarpa</i>		X	X	
<i>Berkheya ferox</i>	X			
<i>Ceratotheca triloba</i>		X	X	X
<i>Citrullus lanatus</i>		X		X
<i>Citrullus naudinianus</i>		X	X	
<i>Cleome angustifolia</i>				
<i>Cucumis africanus</i>		X	X	X
<i>Cullen tomentosum</i>			X	
<i>Dicoma capensis</i>	X	X		
<i>Dicoma schinzii</i>	X	X		X
<i>Dimorphotheca zeyheri</i>	X			
<i>Geigeria ornativa</i>	X	X	X	X
Harpagophytum procumbens (TOPS and NCNCA)		X		
<i>Helichrysum lucilioides</i>	X	X		
<i>Helichrysum zeyheri</i>	X			
<i>Hermannia modesta</i>	X			
<i>Hirpicium echinus</i>		X		
<i>Indigofera alternans</i>		X		
<i>Invading Asteraceae</i>			X	X
<i>Kyphocarpa angustifolia</i>		X		
<i>Nerine laticoma</i>	X	X	X	
<i>Pentarrhinum insipidum</i>		X		X
<i>Ptycholobium biflorum</i>		X		
<i>Requienia sphaerosperma</i>		X		X
<i>Senecio erysimoides</i>		X	X	
<i>Senna italica</i>		X		
<i>Sesamum triphyllum</i>		X	X	
<i>Trianthema parvifolia</i>	X	X		X
<i>Tribulus zeyheri</i>		X		
<i>Verbesina encelioides</i>				X
<i>Waltheria indica</i>				X
SUCCULENT SPECIES				
* <i>Cylindropuntia imbricata</i>		X	X	X
* <i>Opuntia ficus-indica</i>				
Ruschia sp. (NCNCA)		X		
GRAMINOID SPECIES				



Scientific name	Karoid Shrubland	Mixed Bushveld	Ga-Mogara Habitat	Transformed and Degraded Habitat
<i>Aristida adscensionis</i>		X		X
<i>Aristida congesta</i> subsp. <i>barbicollis</i>		X		X
<i>Aristida congesta</i> subsp. <i>congesta</i>		X		X
<i>Aristida meridionalis</i>		X		
<i>Aristida stipitata</i>			X	
<i>Cenchrus ciliaris</i>		X	X	
<i>Chloris virgata</i>		X	X	
<i>Cymbopogon pospischilii</i>	X			
<i>Cynodon dactylon</i>			XX	
<i>Cyperus margaritaceus</i>			X	
<i>Digitaria eriantha</i>		X		
<i>Enneapogon cenchroides</i>	X	X	X	X
<i>Enneapogon desvauxii</i>	XX			X
<i>Eragrostis echinochloidea</i>	X		X	X
<i>Eragrostis lehmanniana</i>		X		X
<i>Eragrostis pallens</i>		X		
<i>Eragrostis trichophora</i>		X	X	X
<i>Eragrostis/Sporob</i> sp.?		X		X
<i>Eustachys paspaloides</i>				
<i>Fingerhuthia africana</i>		X	X	
<i>Melinis repens</i>	X	X		
<i>Pogonarthria squarrosa</i>	X	X		X
<i>Schmidtia kalahariensis</i>		X	X	X
<i>Schmidtia pappophoroides</i>		X		X
<i>Stipagrostis</i> cf. <i>ciliata</i>		X		
<i>Stipagrostis obtusa</i>	X	X		
<i>Stipagrostis uniplumis</i>		X		X
<i>Tragus racemosus</i>				X
<i>Triraphis schinzii</i>		X		

Table B2: Floral species recorded in by previous assessors either on the KMR properties or within the general Hotazel area. Overlap with the species of Table B1 occurs. Alien species identified during the field assessment are indicated with an asterisk (*). Protected species have been emboldened.

Species Name	Observer
<i>*Argemone mexicana</i>	Ecological Management Services
<i>*Argemone ochroleuca</i>	Ecological Management Services
<i>*Chenopodium album</i>	Ecological Management Services
<i>*Chenopodium multifidum</i>	Ecological Management Services
<i>*Opuntia humifusa</i>	Ecological Management Services
<i>*Salsola kali</i>	Ecological Management Services
<i>Acanthosicyos naudiniana</i>	Ecological Management Services
<i>Achyranthes aspera</i>	Ecological Management Services
<i>Acrotome inflata</i>	Todd (2018); Ecological Management Services
<i>Alternanthera achyrantha</i>	Ecological Management Services
<i>Alternanthera pungens</i>	Ecological Management Services
<i>Alternanthera sessilis</i>	Ecological Management Services
<i>Amaranthus thunbergii</i>	Ecological Management Services



Species Name	Observer
<i>Andropogon amplexans</i>	Ecological Management Services
<i>Andropogon schinzii</i>	Ecological Management Services
<i>Antheophora argentea</i>	Ecological Management Services
<i>Antheophora pubescens</i>	Ecological Management Services
<i>Anthericum macowanii</i>	Ecological Management Services
<i>Anthospermum rigidum</i>	Ecological Management Services
<i>Antizoma angustifolia</i>	Ecological Management Services
<i>Aptosimum albomarginatum</i>	Todd (2018)
<i>Aptosimum depressum</i>	Ecological Management Services
<i>Aptosimum elongatum</i>	Todd (2018)
<i>Aptosimum lineare</i> var. <i>lineare</i>	Todd (2018)
<i>Aptosimum pubescens</i>	Ecological Management Services
<i>Aristida adscensionis</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Aristida congesta</i> subsp. <i>congesta</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Aristida curvata</i>	Ecological Management Services
<i>Aristida diffusa</i> var. <i>burkei</i>	Ecological Management Services
<i>Aristida meridionalis</i>	Todd (2018); Ecological Management Services
<i>Aristida stipitata</i>	Todd (2018); Ecological Management Services
<i>Aristida vestita</i>	Ecological Management Services
<i>Asclepias burchellii</i>	Ecological Management Services
<i>Asparagus africanus</i>	Ecological Management Services
<i>Asparagus compactus</i>	Ecological Management Services
<i>Asparagus laricinus</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Asparagus retrofractus</i>	Todd (2018); Ecological Management Services
<i>Asparagus suaveolens</i>	Ecological Management Services
<i>Asthenatherum glaucum</i>	Ecological Management Services
<i>Atriplex nummularia</i>	Ecological Management Services
<i>Babiana bainesii</i> (Schedule 2 – NCNCA)	Todd (2018)
<i>Babiana hypogea</i> (Schedule 2 – NCNCA)	Ecological Management Services
<i>Barleria macrostegia</i>	Ecological Management Services
<i>Barleria rigida</i>	Todd (2018); Ecological Management Services
<i>Bauhinia esculenta</i>	Ecological Management Services
<i>Berkheya ferox</i>	Ecological Management Services
<i>Blepharis integrifolia</i>	Ecological Management Services
<i>Boophone disticha</i> (Schedule 2 – NCNCA)	Todd (2018), NCC (2019); Ecological Management Services
<i>Boscia albitrunca</i> (NFA & Schedule 2 – NCNCA)	Ecological Management Services
<i>Brachiaria marlothii</i>	Todd (2018); Ecological Management Services
<i>Brachiaria nigropedata</i>	Ecological Management Services
<i>Brachiaria serrata</i>	Ecological Management Services
<i>Brunsvigia radulosa</i> *	Ecological Management Services
<i>Bulbine asphodeloides</i>	Ecological Management Services
<i>Bulbine narcissifolia</i>	Todd (2018)
<i>Bulbostylis burchellii</i>	Ecological Management Services
<i>Cadaba aphylla</i>	Ecological Management Services
<i>Cassia mimosoides</i>	Ecological Management Services
<i>Cassia obovata</i>	Ecological Management Services
<i>Cenchrus ciliaris</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Ceratotheca triloba</i>	Ecological Management Services
<i>Chaenostoma halimifolium</i>	Todd (2018)
<i>Chascanum hederaceum</i>	Ecological Management Services
<i>Chascanum incisum</i>	Ecological Management Services



Species Name	Observer
<i>Chascanum vulgarispinnatifidum</i> var. <i>pinnatifidum</i>	Todd (2018)
<i>Cheilanthes hirta</i>	Ecological Management Services
<i>Chilianthus arboreus</i>	Ecological Management Services
<i>Chrysocoma ciliata</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Chrysocoma tenuifolia</i>	Ecological Management Services
<i>Chrysopogon serrulatus</i>	Ecological Management Services
<i>Citrullus naudinianus</i> (<i>Acanthosicyos naudinianus</i>)	Todd (2018)
<i>Clematis brachiata</i>	Todd (2018)
<i>Cleome angustifolia</i>	Ecological Management Services
<i>Cleome monophylla</i>	Ecological Management Services
<i>Cleome rubella</i>	Todd (2018)
<i>Coccinia sessilifolia</i>	Todd (2018)
<i>Coelachyrum yemenicum</i>	Ecological Management Services
<i>Commelina africana</i> var. <i>africana</i>	Todd (2018); Ecological Management Services
<i>Corbichonia rubriviolacea</i>	Ecological Management Services
<i>Corchorus pinnatipartitus</i>	Todd (2018)
<i>Crassula capitella</i>	Ecological Management Services
<i>Crotalaria spartioides</i>	Ecological Management Services
<i>Crotalaria virgultalis</i>	Ecological Management Services
<i>Cucumis africanus</i>	Todd (2018); Ecological Management Services
<i>Cullen tomentosum</i>	Ecological Management Services
<i>Cyamopsis serrata</i>	Todd (2018)
<i>Cymbopogon excavatus</i>	Ecological Management Services
<i>Cymbopogon plurinodis</i>	Ecological Management Services
<i>Cymbopogon popischilli</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Cynodon dactylon</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Cyperus margaritaceus</i> var. <i>margaritaceus</i>	Todd (2018); Ecological Management Services
<i>Cyperus remotiflorus</i>	Ecological Management Services
<i>Cyperus squarrosus</i>	Ecological Management Services
<i>Datura stramonium</i>	Todd (2018), NCC (2019)
<i>Dichrostachys cinerea</i>	Ecological Management Services
<i>Dicoma macrocephala</i>	Ecological Management Services
<i>Dicoma schinzii</i>	Todd (2018); Ecological Management Services
<i>Digitaria eriantha</i> var. <i>stolonifera</i>	Ecological Management Services
<i>Digitaria polevansii</i>	Ecological Management Services
<i>Digitaria polyphylla</i>	Ecological Management Services
<i>Dimorphotheca zeyheri</i>	Ecological Management Services
<i>Diospyros lycioides</i> subsp. <i>lycioides</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Dipcadi viride</i>	Todd (2018)
<i>Ehretia encelioides</i> <i>encelioides</i>	Todd (2018)
<i>Ehretia rigida</i>	Ecological Management Services
<i>Elephantorrhiza elephantina</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Elionurus argenteus</i>	Ecological Management Services
<i>Enneapogon cenchroides</i>	Todd (2018); Ecological Management Services
<i>Enneapogon desvauxii</i>	Todd (2018); Ecological Management Services
<i>Enneapogon scoparius</i>	Ecological Management Services
<i>Eragrostis biflora</i>	Todd (2018), NCC (2019)
<i>Eragrostis chloromelas</i>	Ecological Management Services
<i>Eragrostis curvula</i>	Ecological Management Services
<i>Eragrostis echinochloidea</i>	Ecological Management Services
<i>Eragrostis lehmanniana</i> var. <i>chaunantha</i>	Todd (2018), NCC (2019); Ecological Management Services



Species Name	Observer
<i>Eragrostis micrantha</i>	Ecological Management Services
<i>Eragrostis nindensis</i>	Todd (2018)
<i>Eragrostis obtusa</i>	Todd (2018); Ecological Management Services
<i>Eragrostis pallens</i>	Ecological Management Services
<i>Eragrostis trichophora</i>	Ecological Management Services
<i>Eriospermum</i> Sp.	Todd (2018)
<i>Euclea undulata</i> var. <i>myrtina</i>	Ecological Management Services
<i>Euphorbia mauritanica</i>	Ecological Management Services
<i>Eustachys paspaloides</i>	Ecological Management Services
<i>Evolvulus alsinoides</i>	Ecological Management Services
<i>Felicia muricata</i> subsp. <i>cinerascens</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Ficus ingens</i>	Ecological Management Services
<i>Fimbristylis exilis</i>	Ecological Management Services
<i>Fimbristylis hispidula</i>	Ecological Management Services
<i>Fingerhuthia africana</i>	Todd (2018); Ecological Management Services
<i>Gazania krebsiana</i> subsp. <i>krebsiana</i>	Todd (2018)
<i>Gazania oxyloba</i>	Ecological Management Services
<i>Geigeria brevifolia</i>	Ecological Management Services
<i>Geigeria ornativa</i>	Todd (2018); Ecological Management Services
<i>Geigeria passerinoides</i>	Ecological Management Services
<i>Gisekia pharnacioides</i> var. <i>pharnacioides</i>	Todd (2018); Ecological Management Services
<i>Gnidia</i> (now <i>Lasiosiphon</i>) <i>polycephala</i>	Todd (2018); Ecological Management Services
<i>Gomphrena celosoides</i>	Todd (2018)
<i>Grewia flava</i>	Todd (2018); Ecological Management Services
<i>Gymnosporia buxifolia</i> (Schedule 2 – NCNCA)	Todd (2018)
<i>Harpagophytum procumbens</i> (TOPS & Schedule 1 – NCNCA)	Ecological Management Services
<i>Helichrysum argyrosphaerum</i>	Ecological Management Services
<i>Helichrysum dregeanum</i>	Ecological Management Services
<i>Helichrysum zeyheri</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Heliotropium ciliatum</i>	Todd (2018)
<i>Hermannia candidissima</i>	Ecological Management Services
<i>Hermannia comosa</i>	Todd (2018); Ecological Management Services
<i>Hermannia jacobaeifolia</i>	Todd (2018); Ecological Management Services
<i>Hermannia linnaeoides</i>	Todd (2018)
<i>Hermannia tomentosa</i>	Todd (2018); Ecological Management Services
<i>Hermannia viscosa</i>	Ecological Management Services
<i>Hermestaedia fleckii</i>	Ecological Management Services
<i>Hermestaedia odorata</i> var. <i>odorata</i>	Todd (2018)
<i>Hertia pallens</i>	Todd (2018)
<i>Heteropogon contortus</i>	Ecological Management Services
<i>Hibiscus atomarginatus</i>	Ecological Management Services
<i>Hibiscus elliotiae</i>	Ecological Management Services
<i>Hibiscus marlothianus</i>	Todd (2018)
<i>Hibiscus pusillus</i>	Todd (2018)
<i>Hoffmannseggia burchellii</i>	Ecological Management Services
<i>Hyparrhenia hirta</i>	Ecological Management Services
<i>Hypertelis salsoloides</i>	Todd (2018)
<i>Indigastrium argyraeum</i>	Ecological Management Services
<i>Indigofera alternans</i>	Ecological Management Services
<i>Indigofera cryptantha</i>	Ecological Management Services
<i>Indigofera daleoides</i> var. <i>daleoides</i>	Todd (2018), NCC (2019); Ecological Management Services



Species Name	Observer
<i>Indigofera hololeuca</i>	Ecological Management Services
<i>Indigofera velutina</i>	Ecological Management Services
<i>Indigofera vicioides</i>	Ecological Management Services
<i>Ipomoea bolusiana</i>	Ecological Management Services
<i>Ipomoea obscura</i>	Ecological Management Services
<i>Jamesbrittenia atropurpurea</i> subsp. <i>atropurpurea</i>	Todd (2018)
<i>Justicia puberula</i>	Todd (2018)
<i>Justicia pulegioides</i>	Ecological Management Services
<i>Kalanchoe brachyloba</i>	Ecological Management Services
<i>Kohautia caespitosa</i> subsp. <i>brachyloba</i>	Todd (2018)
<i>Kyllinga alba</i>	Todd (2018); Ecological Management Services
<i>Kyphocarpa angustifolia</i>	Ecological Management Services
<i>Lantana rugosa</i>	Ecological Management Services
<i>Lantana salviifolia</i>	Ecological Management Services
<i>Lasiocorys capensis</i>	Ecological Management Services
<i>Lebeckia macrantha</i>	Ecological Management Services
<i>Ledebouria ovatifolia</i>	Todd (2018)
<i>Lepidium divaricatum</i>	Ecological Management Services
<i>Leptochloa appletonii</i>	Ecological Management Services
<i>Lepturella capensis</i>	Ecological Management Services
<i>Lessertia macrostachya</i>	Ecological Management Services
<i>Lessertia pauciflora</i> var. <i>pauciflora</i>	Todd (2018)
<i>Leucas capensis</i>	Todd (2018)
<i>Limeum aethiopicum</i> var. <i>intermedium</i>	Todd (2018)
<i>Limeum argute carinatum</i> var. <i>argute</i>	Todd (2018)
<i>Limeum carinatumfenestratum</i> var. <i>fenestratum</i>	Todd (2018)
<i>Limeum sulcatum</i> var. <i>sulcatum</i>	Todd (2018)
<i>Limeum viscosum</i>	Ecological Management Services
<i>Loranthus oleifolius</i>	Ecological Management Services
<i>Lotononis crumanina</i>	Ecological Management Services
<i>Lycium austrinum</i>	Ecological Management Services
<i>Lycium hirsutum</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Lycium oxycladum</i>	Ecological Management Services
<i>Mariscus dregeanus</i>	Ecological Management Services
<i>Marlothia spartioides</i>	Ecological Management Services
<i>Maytenus heterophylla</i>	Ecological Management Services
<i>Megaloprotachne albescens</i>	Ecological Management Services
<i>Melhania didyma</i>	Ecological Management Services
<i>Melhania rupestris</i>	Ecological Management Services
<i>Melinis repens</i> subsp. <i>repens</i>	Todd (2018)
<i>Melolobium candicans</i>	Ecological Management Services
<i>Melolobium exudans</i>	Todd (2018)
<i>Melolobium humile</i>	Ecological Management Services
<i>Melolobium macrocalyx</i> var. <i>macrocalyx</i>	Todd (2018)
<i>Merremia verecunda</i>	Ecological Management Services
<i>Microtea burchellii</i>	Ecological Management Services
<i>Mollugo cerviana</i>	Todd (2018)
<i>Monechma genistifolium</i>	Ecological Management Services
<i>Monechma incanum</i>	Ecological Management Services
<i>Monsonia longipesangustifolia</i>	Todd (2018)
<i>Moraea longistyla</i> (Schedule 2 – NCNCA)	Ecological Management Services



Species Name	Observer
Moraea pallida (Schedule 2 – NCNCA)	Ecological Management Services
<i>Nidorella hottentotica</i>	Ecological Management Services
<i>Nidorella resedifolia</i>	Ecological Management Services
<i>Nolletia ciliaris</i>	Todd (2018); Ecological Management Services
<i>Notholaena eckloniana</i>	Ecological Management Services
Olea europaea (Schedule 2 – NCNCA)	Ecological Management Services
Ornithoglossum viride (Schedule 2 – NCNCA)	Ecological Management Services
<i>Oropetium capense</i>	Todd (2018)
<i>Orphanthera jasminiflora</i>	Ecological Management Services
<i>Osteospermum muricatum</i>	Todd (2018)
<i>Osteospermum scariosum</i>	Ecological Management Services
<i>Otoptera burchellii</i>	Ecological Management Services
Oxalis depressa (Schedule 2 – NCNCA)	Todd (2018)
Oxalis haedulipes (Schedule 2 – NCNCA)	Ecological Management Services
Oxalis lawsonii (Schedule 2 – NCNCA)	Todd (2018)
<i>Oxygonum delagoense</i>	Ecological Management Services
<i>Panicum maximum</i>	Ecological Management Services
<i>Panicum stapfianum</i>	Ecological Management Services
<i>Pavonia burchellii</i>	Todd (2018)
<i>Pavonia macrophylla</i>	Ecological Management Services
<i>Pavonia patens</i>	Ecological Management Services
<i>Pegolettia polygalaefolia</i>	Ecological Management Services
<i>Pegolettia retrofracta</i>	Todd (2018); Ecological Management Services
<i>Peliostomum leuchorhizum</i>	Todd (2018)
<i>Pellaea hastata</i>	Ecological Management Services
<i>Pennisetum setaceum</i>	Ecological Management Services
<i>Pentarrhinum insipidum</i>	Ecological Management Services
<i>Pentzia calcarea</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Pentzia sphaerocephala</i>	Todd (2018)
<i>Pentzia virgata</i>	Ecological Management Services
<i>Phyllanthus humilis</i>	Ecological Management Services
<i>Phyllanthus maderaspatensis</i>	Todd (2018); Ecological Management Services
<i>Plinthus sericeus</i>	Todd (2018)
<i>Plumbago zeylanica</i>	Ecological Management Services
<i>Pogonarthria squarrosa</i>	Todd (2018); Ecological Management Services
<i>Pollichia campestris</i>	Ecological Management Services
<i>Polygala leptophylla</i>	Ecological Management Services
<i>Polygala seminuda</i>	Todd (2018); Ecological Management Services
<i>Portulaca kermesina</i>	Todd (2018)
<i>Prosopis glandulosa</i>	Ecological Management Services
<i>Prosopis velutina</i>	Ecological Management Services
<i>Pteronia glauca</i>	Ecological Management Services
<i>Pteronia incana</i>	Todd (2018)
<i>Pupalia lappacea</i>	Ecological Management Services
<i>Pupalia lappacea</i> var. <i>lappacea</i>	Todd (2018)
<i>Putterlickia pyracantha</i>	Ecological Management Services
<i>Raphionacme velutina</i>	Todd (2018)
<i>Requienia sphaerosperma</i>	Ecological Management Services
<i>Rhigozum obovatum</i>	Ecological Management Services
<i>Rhigozum trichotomum</i>	Ecological Management Services
<i>Rhynchelytrum repens</i>	Ecological Management Services



Species Name	Observer
<i>Rhynchelytrum villosum</i>	Ecological Management Services
<i>Rhynchosia confusa</i>	Ecological Management Services
<i>Rhynchosia totta</i>	Ecological Management Services
<i>Riccia albolimbata</i>	Ecological Management Services
<i>Rosenia humilis</i>	Todd (2018)
<i>Royena pallens</i>	Ecological Management Services
<i>Ruschia griquensis</i> (Schedule 2 – NCNCA)	Ecological Management Services
<i>Salvia verbenaca</i>	Ecological Management Services
<i>Sasola tuberculata</i>	Ecological Management Services
<i>Schizachyrium semiberbe</i>	Ecological Management Services
<i>Schmidtia bulbosa</i>	Ecological Management Services
<i>Schmidtia kalihariensis</i>	Ecological Management Services
<i>Schmidtia pappophoroides</i>	Todd (2018); Ecological Management Services
<i>Searsia ciliata</i>	Todd (2018); Ecological Management Services
<i>Searsia dregeana</i>	Ecological Management Services
<i>Searsia erosa</i>	Ecological Management Services
<i>Searsia lancea</i>	Ecological Management Services
<i>Searsia tenuinervis</i>	Ecological Management Services
<i>Searsia tridactyla</i>	Ecological Management Services
<i>Searsia undulata</i> var <i>burchellii</i>	Ecological Management Services
<i>Sebaea exigua</i>	Ecological Management Services
<i>Sebaea grandis</i>	Ecological Management Services
<i>Seddera capensis</i>	Ecological Management Services
<i>Selago mixta</i>	Todd (2018); Ecological Management Services
<i>Senecio burchellii</i>	Ecological Management Services
<i>Senecio glutinosus</i>	Ecological Management Services
<i>Senecio inaequidens</i>	Todd (2018)
<i>Senecio longiflora</i>	Ecological Management Services
<i>Senegalia mellifera</i> subsp. <i>detinens</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Senna italica</i> subsp. <i>arachoides</i>	Todd (2018), NCC (2019)
<i>Sericorema remotiflora</i>	Ecological Management Services
<i>Sesamum capense</i>	Ecological Management Services
<i>Sesamum triphyllum</i>	Todd (2018)
<i>Setaria verticillata</i>	Ecological Management Services
<i>Sida cordifolia</i>	Ecological Management Services
<i>Sida dregei</i>	Ecological Management Services
<i>Solanum capense</i>	Ecological Management Services
<i>Solanum incanum</i>	Ecological Management Services
<i>Solanum panduriforme</i>	Ecological Management Services
<i>Solanum supinum</i>	Ecological Management Services
<i>Sporobolus fimbriatus</i>	Ecological Management Services
<i>Stachys spathulata</i>	Ecological Management Services
<i>Stipagrostis ciliata</i>	Ecological Management Services
<i>Stipagrostis obtusa</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Stipagrostis uniplumis</i> var. <i>uniplumis</i>	Todd (2018); Ecological Management Services
<i>Striga bilabiata</i> subsp. <i>bilabiata</i>	Todd (2018)
<i>Striga gesneriodes</i>	Ecological Management Services
<i>Striga lutea</i>	Ecological Management Services
<i>Sutera crassicaulis</i>	Ecological Management Services
<i>Sutera griquensis</i>	Todd (2018); Ecological Management Services
<i>Sutera halimifolia</i>	Ecological Management Services



Species Name	Observer
<i>Sylitra biflora</i>	Ecological Management Services
<i>Tagetes minuta</i>	Ecological Management Services
<i>Talinum amotii</i>	Todd (2018)
<i>Talinum caffrum</i>	Ecological Management Services
<i>Tarchonanthus camphoratus</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Tephrosia burchellii</i>	Todd (2018); Ecological Management Services
<i>Tephrosia elongata</i>	Ecological Management Services
<i>Tephrosia longipes</i> subsp. <i>longipes</i>	Todd (2018)
<i>Terminalia sericea</i>	Ecological Management Services
<i>Teucrium</i>	Ecological Management Services
<i>Themeda triandra</i>	Ecological Management Services
<i>Thesium</i>	Ecological Management Services
<i>Thesium hystrix</i>	Ecological Management Services
<i>Tragia dioica</i>	Todd (2018)
<i>Tragus berteronianus</i>	Todd (2018)
<i>Tragus berteronianus</i>	Ecological Management Services
<i>Tragus koelerioides</i>	Ecological Management Services
<i>Triaspis hypericoides</i>	Ecological Management Services
<i>Tribulus terrestris</i>	Ecological Management Services
<i>Tribulus zeyheri</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Tricholaena monachne</i>	Ecological Management Services
<i>Trichoneura grandiglumis</i>	Ecological Management Services
<i>Triraphis andropogonoides</i>	Ecological Management Services
Vachellia erioloba (NFA)	Todd (2018), NCC (2019); Ecological Management Services
Vachellia haematoxylon (NFA)	Todd (2018), NCC (2019); Ecological Management Services
<i>Vachellia hebeclada</i>	Todd (2018); Ecological Management Services
<i>Vachellia karroo</i>	Todd (2018), NCC (2019); Ecological Management Services
<i>Vahlia capensis</i> subsp. <i>vulgaris</i> var.	Todd (2018); Ecological Management Services
<i>Verbesina encelioides</i>	Todd (2018); Ecological Management Services
<i>Viscum rotundifolium</i>	Ecological Management Services
<i>Walafrida densiflora</i>	Ecological Management Services
<i>Walafrida geniculata</i>	Ecological Management Services
<i>Walafrida paniculata</i>	Ecological Management Services
<i>Walafrida saxatilis</i>	Ecological Management Services
<i>Waltheria indica</i>	Ecological Management Services
<i>Xanthium spinosum</i>	Ecological Management Services
<i>Ziziphus mucronata</i> subsp. <i>mucronata</i>	Todd (2018), NCC (2019); Ecological Management Services



APPENDIX C: Floral SCC Assessment Results

South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. Due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction but may nonetheless be of high conservation importance. Because the Red List of South African plants is used widely in South African conservation practices such as systematic conservation planning or protected area expansion, we use an amended system of categories designed to highlight those species that are at low risk of extinction but of conservation concern.

Definitions of the national Red List categories

Categories marked with ^N are non-IUCN, national Red List categories for species not in danger of extinction but considered of conservation concern. The IUCN equivalent of these categories is Least Concern (LC).

- **Extinct (EX)** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
- **Extinct in the Wild (EW)** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
- **Regionally Extinct (RE)** A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
- **Critically Endangered, Possibly Extinct (CR PE)** Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.
- **Critically Endangered (CR)** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
- **Endangered (EN)** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
- **Vulnerable (VU)** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
- **Near Threatened (NT)** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable and is therefore likely to become at risk of extinction in the near future.
- **^NCritically Rare** A species is Critically Rare when it is known to occur at a single site but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
- **^NRare** A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:
 - Restricted range: Extent of Occurrence (EOO) <500 km², OR
 - Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 km², OR
 - Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
 - Small global population: Less than 10 000 mature individuals.
- **Least Concern** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least



Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.

- **Data Deficient - Insufficient Information (DDD)** A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required, and that future research could show that a threatened classification is appropriate.
- **Data Deficient - Taxonomically Problematic (DDT)** A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- **Not Evaluated (NE)** A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in [Plants of southern Africa: an online checklist](#) are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

POC Results for RDL Floral SCC obtained from BODATSA and the Online National Environmental Screening Tool

For this aspect of the POC assessment, a list of RDL species previously recorded within the QDS 2722BB, 2722BD, 2723AA, and 2723AC were pulled from BODATSA / newPOSA (<http://posa.sanbi.org/>) – refer to the below image (Figure C1). This list was further cross-checked with the Screening Tool outcome as well as the NCNCA (2009) flora list (Schedule 1 and Schedule 2) to identify provincially protected species previously recorded for the area.

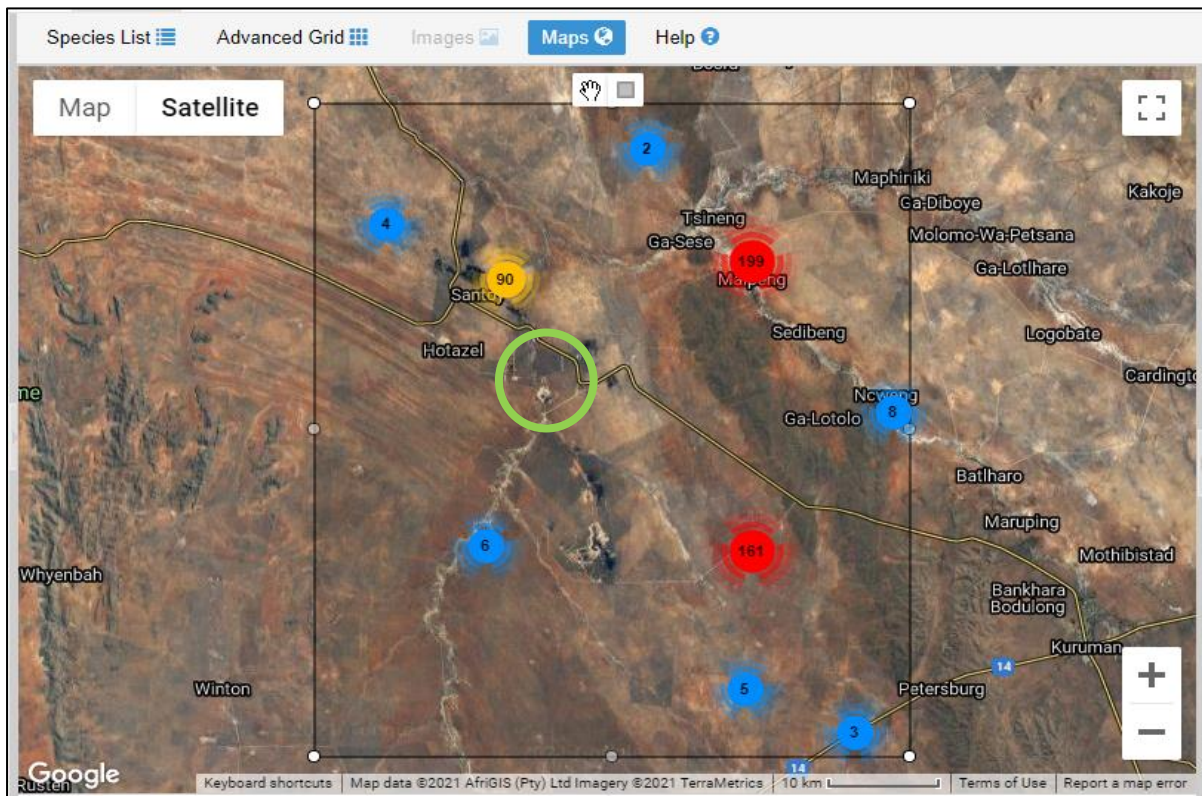


Figure C1: Species list pulled from BODATSA and newPOSA for the QDS 2722BB, 2722BD, 2723AA, and 2723AC. Kudumane encircled in green.



Table C1: POC assessment results for threatened species as identified for the assessed area by the Screening Tool, the BODATSA/newPOSA database. Additionally, the below table provides the POC assessment results for provincially protected floral species as per the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA).

****Threatened status and additional information on species habitat and distribution was obtained from The Red List of South African Plants (<http://redlist.sanbi.org/index.php>). The POC of these floral SCC within the proposed KMR Expansion Activities is also provided.**

Family	Species	POC Score	Habitat and distribution details	IUCN & Protection Status
Aizoaceae	<i>Galenia meziana</i>	Low - Medium	Indigenous (dwarf shrub) Provincial distribution: Eastern Cape, Northern Cape, Western Cape. Major habitats: Terrestrial Description: None provided on the SANBI websites. Suitable habitat on site: N/A	LC Schedule 2
Aizoaceae	<i>Plinthus karoocicus</i>	Medium	Indigenous (dwarf shrub) Provincial distribution: Eastern Cape, Free State, Northern Cape, North West. Major habitats: Terrestrial. Description: None provided. Suitable habitat on site: Potentially on red sandy soils of the Savanna Habitat Unit (Mixed Thornveld).	LC Schedule 2
Aizoaceae	<i>Plinthus sericeus</i>	High	Indigenous (dwarf shrub) Provincial distribution: Free State, Northern Cape, North West. Major habitats: Terrestrial. Description: Red sandy soils in the Kalahari (van Rooyen <i>et al.</i> 2001). Suitable habitat on site: On red sandy soils of the Savanna Habitat Unit (Mixed Thornveld).	LC Schedule 2
Aizoaceae	<i>Ruschia sp.</i>	Confirmed	Indigenous (succulent) Provincial distribution: Major habitats: Terrestrial Description: N/A at the genera level. Suitable habitat on site: <i>Ruschia griquensis</i> was recorded in the Mixed Thornveld subunit of the Savanna Habitat Unit.	Schedule 2
Aizoaceae	<i>Tetragonia calycina</i>	Low	Indigenous (succulent; dwarf shrub) Provincial distribution: Northern Cape, Western Cape. Major habitats: Terrestrial. Description: None provided. Suitable habitat on site: N/A	LC Schedule 2
Aizoaceae	<i>Trianthena parvifolia</i>	Confirmed	Indigenous (succulent; herb) Provincial distribution: Northern Cape, Western Cape. Major habitats: Desert, Nama Karoo, Succulent Karoo.	LC Schedule 2



Family	Species	POC Score	Habitat and distribution details	IUCN & Protection Status
			<p>Description: It occurs in open sandy, stony or gravelly soils, often in disturbed places, 500-1600 m.</p> <p>Suitable habitat on site: Recorded in the Savanna Habitat Unit.</p>	
Amaryllidaceae	<i>Nerine</i> sp.	Confirmed	<p>Indigenous (geophyte)</p> <p>Provincial distribution: N/A at genera level Major habitats: N/A at genera level Description: N/A at genera level</p> <p>Suitable habitat on site: Recorded in the Ga-Mogara Habitat and the Savanna Habitat immediately adjacent to the Ga-Mogara Habitat.</p>	Schedule 2
Apiaceae	<i>Berula thunbergii</i>	Low	<p>Indigenous (hydrophyte; herb)</p> <p>Provincial distribution: Eastern Cape, Gauteng, Limpopo, Western Cape. Major habitats: Freshwater.</p> <p>Suitable habitat on site: N/A</p>	LC Schedule 2
Apiaceae	<i>Deverra burchellii</i>	Medium	<p>Indigenous (Shrub)</p> <p>Provincial distribution: Eastern Cape, Free State, Gauteng, Limpopo, Northern Cape, North West. Major habitats: Terrestrial. Description: None provided.</p> <p>Suitable habitat on site: N/A</p>	LC Schedule 2
Apocynaceae	<i>Microloma armatum</i>	Medium	<p>Indigenous (dwarf shrub; shrub)</p> <p>Provincial distribution: Eastern Cape, Free State, Northern Cape, Western Cape. Major habitats: Albany Thicket, Nama Karoo, Savanna, Succulent Karoo. Description: Wide-range of shrubby habitats, in Namibia it is rarer and appears to be restricted to specific rock formations.</p> <p>Suitable habitat on site: N/A</p>	LC Schedule 2
Apocynaceae	<i>Raphionacme velutina</i>	High	<p>Indigenous (succulent; geophyte; herb)</p> <p>Provincial distribution: Gauteng, KwaZulu-Natal, Limpopo, Northern Cape, North West. Major habitats: Terrestrial.</p> <p>Suitable habitat on site: Savanna Habitat Unit (recorded by Todd 2018 in the Hotazel area).</p>	LC Schedule 2
Celastraceae	<i>Gymnosporia buxifolia</i>	High	<p>Indigenous (shrub; tree)</p> <p>Provincial distribution: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, Western Cape. Major habitats: Terrestrial. Description: Its natural habitat is in grasslands, fynbos, Nama-karoo, forests, thickets and savanna-bushveld. It occurs on hillsides, dry slopes of valleys, sometimes in riverbeds, often on termite mounds and it is often found as undergrowth to taller trees. (SANBI PlantZAfrica).</p>	LC Schedule 2



Family	Species	POC Score	Habitat and distribution details	IUCN & Protection Status
			Suitable habitat on site: avanna Habitat Unit and Ga-Mogara Habitat Unit (recorded by Todd 2018 in the Hotazel area).	
Celastraceae	<i>Putterlickia saxatilis</i>	Unsure	Indigenous; Endemic (shrub) Provincial distribution: Northern Cape. Major habitats: Terrestrial.	LC
Euphorbiaceae	<i>Euphorbia avasmontana</i>	Low	Suitable habitat on site: N/A Indigenous (succulent) Provincial distribution: Northern Cape. Namibia to the Richtersveld and Prieska. Major habitats: Desert, Nama Karoo, Succulent Karoo. Description: Arid rocky slopes.	LC Schedule 2
Euphorbiaceae	<i>Euphorbia crassipes</i>	Low	Indigenous (succulent; shrub) Provincial distribution: Northern Cape. Namibia to Kliprand, Pofadder, Prieska and Kimberley. Major habitats: Nama Karoo, Savanna. Description: Gravelly flats.	LC Schedule 2
Euphorbiaceae	<i>Euphorbia duseimata</i>	Medium	Indigenous (succulent; dwarf shrub) Provincial distribution: Free State, Northern Cape, North West. Major habitats: Terrestrial. Description: Sandy or turfy soils, Kalahari Thornveld and Bushveld (Möller and Becker, 2019).	LC Schedule 2
Euphorbiaceae	<i>Euphorbia pseudotuberosa</i>	Low	Indigenous (succulent; dwarf shrub) Provincial distribution: Free State, Gauteng, Limpopo, Mpumalanga, Northern Cape, North West. Major habitats: Terrestrial. Description: Grassland.	LC Schedule 2
Euphorbiaceae	<i>Euphorbia rhombifolia</i>	Low	Indigenous (succulent; shrub) Provincial distribution: Eastern Cape, Free State, Northern Cape, Western Cape. Major habitats: Terrestrial. Description: It occurs on stony slopes and flats.	LC Schedule 2
Iridaceae	<i>Babiana hypogaea</i>	High	Indigenous (geophyte; herb) Provincial distribution: Free State, Northern Cape, North West. Major habitats: Terrestrial. Description: A species of kalahari sand or stony ground in woodland and grassland.	LC Schedule 2
Iridaceae	<i>Moraea longistyla</i>	Low	Indigenous; Endemic (geophyte; herb)	LC Schedule 2



Family	Species	POC Score	Habitat and distribution details	IUCN & Protection Status
			Provincial distribution: Western Cape. Major habitats: Fynbos. Description: Mainly clay soils, renosterveld or arid fynbos. Suitable habitat on site: N/A	
Iridaceae	<i>Moraea pallida</i>	High	Indigenous (geophyte; herb) Provincial distribution: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West. Major habitats: Terrestrial. Description: Open grassland and bushveld, sometimes in wetlands or rocky sites. Suitable habitat on site: Savanna Habitat Unit.	LC Schedule 2
Pedaliaceae	<i>Harpagophytum procumbens</i>	Confirmed	Indigenous (Herb) Provincial distribution: Free State, Limpopo, Northern Cape, North West Major habitats: Nama Karoo, Savanna. Description: Well drained sandy habitats in open savanna and woodlands. Suitable habitat on site: Areas with red kalahari soils in the Mixed Bushveld subunit if the Savanna Habitat Unit.	NE Schedule 1
Scrophulariaceae	<i>Jamesbrittenia atropurpurea</i> subsp. <i>atropurpurea</i>	High	Indigenous (shrub; dwarf shrub) Provincial distribution: Eastern Cape, Free State, Gauteng, Northern Cape, North West, Western Cape. Major habitats: Terrestrial. Description: None provided. Suitable habitat on site: Savanna habitat Unit. Recorded previously by Todd (2018) within the Hotazel area.	LC Schedule 2

LC = Least Concern; NE = Not evaluated; POC = Probability of Occurrence.

NEMBA TOPS List for South Africa¹²

Table C3: TOPS list for South Africa – plant species.

NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
<i>Adenia wilmsii</i>	No common name	Low	Provincial distribution: Mpumalanga Range: Lydenburg to Waterval Boven Description: Dolerite outcrops or red loam soil, in open woodland, 1300-1500 m.	EN; P

¹² National Environmental Management: Biodiversity Act 10 of 2004 - Threatened or Protected Species Regulations, 2007. Government Notice R152 in Government Gazette 29657 dated 23 February 2007. Commencement date: 1 June 2007 [GN R150, Gazette no. 29657], as amended.



NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
<i>Adenium swazicum</i>	Swaziland Impala Lily	Low	Range: Kruger National Park to Swaziland along the Lebombo Mountains and adjacent areas in south-western Mozambique.	VU
<i>Adenium swazicum</i>	Swaziland Impala Lily	Low	Provincial distribution: Mpumalanga	VU
<i>Aloe albida</i>	Grass Aloe	Low	Provincial distribution: Mpumalanga Range: Aloe albida has a restricted range in the mountains south of Barberton, Mpumalanga, extending to Malolotja in north-western Swaziland.	NT
<i>Aloe pillansii</i> (now <i>Aloidendron pillansii</i>)	False Quiver Tree	Low	Provincial distribution: Northern Cape Range: Richtersveld and southern Namibia.	EN
<i>Aloe simii</i>	No common name	Low	Provincial distribution: Mpumalanga Range: This species is endemic to a small area in the transition area between the Mpumalanga Lowveld and Escarpment, where it occurs from Sabie southwards to White River and around Nelspruit. Description: It occurs along drainage lines and in wetlands in open woodland and grassland, 600-1100 m.	EN; P
<i>Clivia mirabilis</i>	"Oorlogskloof" Bush Lily	Low	Provincial distribution: Northern Cape, Western Cape	VU; P
<i>Diaphanathe millarii</i>	Tree Orchid	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal Range: East London and Durban.	VU
<i>Disa macrostachya</i>	No common name	Low	Provincial distribution: Northern Cape	EN; P
<i>Disa nubigena</i>	No common name	Low	Provincial distribution: Western Cape	Rare; P
<i>Disa physodes</i>	No common name	Low	Provincial distribution: Western Cape	CR; P
<i>Disa procera</i>	No common name	Low	Provincial distribution: Western Cape	EN; P
<i>Disa sabulosa</i>	No common name	Low	Provincial distribution: Western Cape	EN; P
<i>Encephalartos aemulans</i>	Ngotshe Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
<i>Encephalartos altensteinii</i>	Bread Palm	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
<i>Encephalartos arenarius</i>	Dune Cycad	Low	Provincial distribution: Eastern Cape	EN
<i>Encephalartos brevifoliolatus</i>	Escarpment Cycad	Low	Provincial distribution: Limpopo	EW
<i>Encephalartos caffer</i>	Breadfruit Tree	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos cerinus</i>	Waxen Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
<i>Encephalartos cupidus</i>	Blyde River Cycad	Low	Provincial distribution: Limpopo, Mpumalanga Description: Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests.	CR
<i>Encephalartos dolomiticus</i>	Wolkberg Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos dyerianus</i>	Lowveld Cycad	Low	Provincial distribution: Limpopo	CR; P
<i>Encephalartos eugene-maraisii</i>	Waterberg Cycad	Low	Provincial distribution: Limpopo	EN
<i>Encephalartos friderici-guilielmi</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos ghellinckii</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
<i>Encephalartos heenanii</i>	Woolly Cycad	Low	Provincial distribution: Mpumalanga Description: Open areas of montane grasslands amidst scarp forest in deep valleys and ravines.	CR



NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
<i>Encephalartos hirsutus</i>	Venda Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos horridus</i>	Eastern Cape Blue Cycad	Low	Provincial distribution: Eastern Cape	EN
<i>Encephalartos humilis</i>	No common name	Low	Provincial distribution: Mpumalanga Description: Montane and mistbelt grassland, rocky sandstone slopes.	VU; P
<i>Encephalartos inopinus</i>	Lydenburg Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos laevifolius</i>	Kaapsehoop Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga Description: Steep, rocky slopes in mistbelt grassland, 1300-1500 m.	CR
<i>Encephalartos lanatus</i>	No common name	Low	Provincial distribution: Gauteng and western Mpumalanga Description: Sheltered, wooded ravines in sandstone ridges, 1200-1500 m.	NT; P
<i>Encephalartos latifrons</i>	Albany Cycad	Low	Provincial distribution: Eastern Cape	CR
<i>Encephalartos lebomboensis</i>	Lebombo Cycad	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Description: Cliffs and rocky ravines in savanna and grassland.	EN
<i>Encephalartos lehmannii</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Encephalartos longifolius</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Encephalartos middelburgensis</i>	Middelburg Cycad	Low	Provincial distribution: Gauteng, Mpumalanga Description: Open grasslands and in sheltered valleys.	CR
<i>Encephalartos msinganus</i>	Msinga, Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
<i>Encephalartos natalensis</i>	Natal Giant Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos ngoyanus</i>	Ngoye Dwarf Cycad	Low	Provincial distribution: KwaZulu-Natal	VU
<i>Encephalartos nubimontanus</i>	Blue Cycad	Low	Provincial distribution: Limpopo	EW
<i>Encephalartos paucidentatus</i>	No common name	Low	Provincial distribution: Mpumalanga Description: Forest, occurs on steep rocky slopes and alongside streams in deep gorges.	VU; P
<i>Encephalartos princeps</i>	No common name	Low	Provincial distribution: Eastern Cape	VU; P
<i>Encephalartos senticosus</i>	No common name	Low	Provincial distribution: KwaZulu-Natal	VU; P
<i>Encephalartos transvenosus</i>	Modjadje Cycad	Low	Provincial distribution: Limpopo	LC; P
<i>Encephalartos trispinosus</i>	No common name	Low	Provincial distribution: Eastern Cape	VU; P
<i>Encephalartos woodii</i>	Wood's Cycad	Low	Provincial distribution: KwaZulu-Natal	EW
<i>Euphorbia clivicola</i>	No common name	Low	Provincial distribution: Limpopo	CR; P
<i>Euphorbia meloformis</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Euphorbia obesa</i>	No common name	Low	Provincial distribution: Eastern Cape	EN; P
<i>Harpagophytum procumbens</i>	Devil's Claw	Confirmed	Provincial distribution: Free State, Limpopo, Northern Cape, North West	LC; P
<i>Harpagophytum zeyherii</i>	Devil's Claw	Low	Provincial distribution: Gauteng, Limpopo, Mpumalanga, North West	LC; P
<i>Hoodia currorii</i>	Ghaap	Low	Provincial distribution: Limpopo	P



NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
<i>Hoodia gordonii</i>	Ghaap	Medium	Provincial distribution: Free State, Northern Cape, Western Cape Description: Occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds.	DDD; P
<i>Jubaeopsis caffra</i>	Pondoland Coconut	Low	Provincial distribution: Eastern Cape	EN
<i>Merwillia plumbea</i>	Blue Squill	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Major habitats: Grassland Description: Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.	NT
<i>Newtonia hildebrandtii</i> var. <i>hildebrandtii</i>	Lebombo Wattle	Low	Provincial distribution: KwaZulu-Natal	Now LC
<i>Protea odorata</i>	Swartland Sugarbush	Low	Provincial distribution: Western Cape	CR; P
<i>Siphonochilus aethiopicus</i>	Wild Ginger	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: Sporadically from the Letaba catchment in the Limpopo Lowveld to Swaziland. Extinct in KwaZulu-Natal. Widespread elsewhere in Africa. Description: Tall open or closed woodland, wooded grassland or bushveld.	CR
<i>Stangeria eriopus</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
<i>Warburgia salutaris</i>	Pepper-bark Tree	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: North-eastern KwaZulu-Natal, Mpumalanga and Limpopo Province. Also occurs in Swaziland, Mozambique and Zimbabwe and Malawi. Description: Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets.	EN
<i>Zantedeschia jucunda</i>	Yellow Arum Lilly	Low	Provincial distribution: Limpopo	VU

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

NFA Protected Trees

Table C3: Protected trees as defined by The National Forest Act, 1998, (Act No. 84 of 1998) (NFA) for the assessed areas. Additional information on species threat status as defined in The Red List of South African Plants (<http://redlist.sanbi.org/index.php>) is presented.

Family	Scientific Name	IUCN	Growth form	POC
Brassicaceae	<i>Boscia albitrunca</i>	LC	Tree	High
Fabaceae	<i>Vachellia erioloba</i>	LC	Tree	Confirmed
Fabaceae	<i>Vachellia haematoxylon</i>	LC	Tree	Confirmed

