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**BIODIVERSITY ASSESSMENT AS PART OF THE
ENVIRONMENTAL AUTHORISATION PROCESS FOR THE
PROPOSED RAILWAY LINE LINK PROJECT, NEAR
POSTMASBURG,
NORTHERN CAPE PROVINCE**

Prepared for

Envirogistics (Pty) Ltd

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EXECUTIVE SUMMARY

Scientific Terrestrial Services CC (STS) was appointed to conduct a biodiversity assessment as part of the environmental authorisation process for the proposed Beeshoek Railway Line Link Project, near Postmasburg, Northern Cape Province, henceforth referred to as the “Railway Line Link Project”. The Railway Line Link Project consists of the proposed railway line and an associated 50 m investigation corridor.

To allow Beeshoek to export iron ore through the Saldanha Port in the Western Cape Province, the mine has investigated the options of linking Beeshoek to the Transnet Freight Rail (TFR) Ore line, via the existing Kolomela Direct Link. This in turn would allow Beeshoek Mine greater flexibility to also export ore through Saldanha port. Negotiations with Transnet have not as of yet been concluded in terms of allocations, and for this reason the project is presented as the best practical outcome.

The Surface Infrastructure includes the below list (Figure 3):

- Railway Line Link: Airport Bypass.
- Railway Line Link: Single Slip.
- Road Influence.
- Airfield Access roads (including Tommy’s LXing).
- North and South Borrow Pit Bridge.
- -32 Stockpile.
- North and South Bridge Laydown Areas.
- Laydown Area (within the mine).
- Calcrete Material Source.
- Quartzite Material Source.
- Landfill Slide 1.

Desktop research

The Railway Line Link Project is situated within the Savanna Biome and the Eastern Kalahari Bushveld Bioregion. Three vegetation types with a least concern conservation status are crossed by the proposed Railway Line Link Project, namely the Postmasburg Thornveld (western Portion), the Kuruman Thornveld (Eastern Portion) and the Kuruman Mountain Bushveld (eastern section).

No significant biodiversity or conservation features were identified for the Railway Line Link Project from a desktop database perspective.

Floral and Faunal Ecology

Based on the results of the field investigation of October 2020, March 2021, and June 2021, three broad habitat units were distinguished for the Railway Line Link Project:

- **Modified Habitat Unit:** Sections where the vegetation has shifted to a different vegetation type and no longer represents the reference state and can therefore be considered Transformed Habitat or Degraded Thornveld. Within the Railway Line Link Project footprint, this unit refers to areas that have been transformed for mining, road and railway construction, and borders Tommy’s Field Aerodrome. Faunal habitat diversity herein was limited due to the lack of suitable habitat and food resources;
- **Natural Habitat Areas:** This includes vegetation that has not been significantly degraded or shifted from the reference vegetation types:
 - **Calcrete Shrubland:** Most of the Railway Line Link Project falls within this habitat unit, which is located on shallow calcrete soils derived from the Coega/Knersvlakte soil forms. The vegetation mainly comprised shrubland with sparse grass cover. Species diversities were intermediate and trees generally of low diversity and abundance. Habitat integrity varied throughout this habitat unit, with some areas more encroached by indigenous woody species, and other areas characterised by largely intact vegetation. This habitat supported several common faunal species however the intersecting roads and fences limit the movement and occurrence of larger mammals. Common small mammals, inverts, avifauna and reptiles readily utilise this habitat, however, the arid environment limits the overall diversity of species; and



- **Open Thornveld:** The central section of the Railway Line Link Project crosses through this habitat unit. The Open Thornveld Habitat is restricted to the deeper red soils of the Vaalbos and Ploosburg soil forms. Vegetation included an almost continuous grass layer with large tree species such as *Vachellia erioloba* scattered throughout. Habitat integrity varied throughout the site but generally had little disturbances within the sections where the Railway Line Link Project will pass through. Mammal species occurrence was limited in this habitat with only burrows of small mammals being observed periodically. Small reptiles were abundant as were insects and common avifaunal species. Previous disturbances within this habitat and decreased food resources likely limit species diversity and abundance.
- **Non-watercourse habitat:** This habitat unit is associated with seasonal depressions (outside of the proposed footprint) and an anthropogenically derived drainage line (eastern section of the footprint). The non-watercourse habitat is not considered true watercourses as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA). The seasonal depressions provide temporary points of surface water during high rainfall events whilst the moisture collecting here will increase vegetation growth, proving valuable food resources for fauna. The drainage line has water year-round due to mine decant and as such, provides an important source of surface water to fauna, increased food resources as well as breeding site for niche habitat species such as amphibians.

In terms of the Screening Tool, the medium plant species theme is supported for the triggered vulnerable plant species; however, the habitat where this species could occur has been overgrazed and is encroached by *Senegalia melifera* subsp. *detinens*, limiting the long-term viability of potentially occurring populations. A medium animal's theme was also triggered for the species *Sagittarius serpentarius* (Secretary bird) and *Neotis ludwigii* (Ludwig's bustard). The Very High Sensitivity in terms of the Terrestrial Sensitivity is not supported by the biodiversity specialist.

Impact Summary

From a floral perspective, the proposed Railway Line Link Project will result in the clearance of vegetation that is of **intermediate sensitivity** (Natural Habitat Areas) and **moderately low sensitivity** (Non-watercourse habitat, encroached sections in the Natural Habitat Areas, Degraded Thornveld), with some sections of **low sensitivity** (Modified habitat unit). The proposed Railway Line Link Project is associated with floral SCC which will directly be impacted by the proposed activities (SCC within the proposed footprint) – although with mitigation measures implemented, and due to the small extent of the footprint, the impacts can remain localised in extent and is unlikely to impact significantly on SCC population dynamics. The SCC recorded on site include species protected under the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (Schedule 2) and the National Forest Act, 1998 (Act No. 84 of 1998, amended), which are species not threatened in terms of National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) Section 56.

From a fauna perspective, the proposed Railway Line Link Project will result in the clearance of faunal habitat (vegetation) that predominantly ranges from **intermediate to low sensitivity**. The preferential flow path is deemed to be of **moderately high sensitivity** for fauna and will be impacted upon at the various road and railway crossing point. This preferential flow path provides niche habitat and surface water for fauna in the local area and as such, is considered to be of increased importance, even though artificial.

Prior to mitigation measures implemented, impact significance on all aspects of floral ecology varies between **Medium-Low** (Natural Habitat Areas), **Low** (Non-watercourse habitat) and **Low - Very Low** (Modified Habitat unit). With mitigation measures implemented, the direct and indirect impacts on the floral ecology can mostly be reduced to **Low** and **Very low**.

Prior to mitigation measures implemented, impact significance on faunal habitat and diversity varies between **Medium-Low** (Natural habitat areas and non-watercourse habitat) and **Low to Very Low** (Modified Habitat Unit). With mitigation measures implemented, the impacts on the faunal habitat and diversity can mostly be reduced to **Very low** for the Modified Habitat and **Low** for the Non-watercourse Habitat. Impact significance remains **Medium-Low** for the Natural Habitat Areas during the construction phase but can be reduced to **Low** significance during the operational and maintenance phase.



Most significant impacts to affect the floral habitat integrity and species diversity resulting from the proposed Railway Line Link Project construction include, but are not limited to, the following:

- Clearance of habitat with numerous individuals of nationally and provincially protected floral species;
- Habitat fragmented and resulting in reduced movement of species and reduced dispersal opportunities for plant species;
- 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.
- Disturbance, fragmentation and alteration of 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.

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



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LIST OF ACRONYMS

AIP	Alien Invasive Plant
BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resource Act
CBA	Critical Biodiversity Area
CR	Critically Endangered
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectares
IBA	Important Bird Area
IEM	Integrated Environmental Management
IUCN	International Union for the Conservation of Nature
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Rights Area
NBA	National Biodiversity Assessment (2011)
NCNCA	Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)
NCPSDF	Northern Cape Provincial Spatial Development Framework
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NFA	National Forest Act, 1998 (Act No. 84 of 1998, amended)
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
POC	Probability of Occurrence
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RDL	Red Data List
SABAP 2	Southern African Bird Atlas 2
SACAD	South Africa Conservation Areas Database
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Area Database
SCC	Species of Conservation Concern
SRA	Surface Rights Area
SWSA	Strategic Water Source Area
STS	Scientific Terrestrial Services CC
TFR	Transnet Freight Rail
TOPS	Threatened or Protected Species
TSP	Threatened Species Programme
VU	Vulnerable
WRD	Waste Rock Dumps
WSA	Water Source Area



GLOSSARY OF TERMS

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

Alien species (syn. exotic species; non-native species)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Biological diversity or Biodiversity (as per the definition in NEMBA)	The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.
Biome - as per Mucina and Rutherford (2006); after Low and Rebelo (1998).	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate and major large-scale disturbance factors (such as fires).
Bioregion (as per the definition in NEMBA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act;
Critical Biodiversity Area (CBA)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g., southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.
Ecological Support Area (ESA)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Ground-Truth	To check the accuracy of (remotely sensed data) by means of in-situ observations.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
Important Bird and Biodiversity Area (IBA)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (as per the definition in NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.



Listed alien species	All alien species that are regulated in South Africa under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Alien and Invasive Species 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).
RDL (Red Data listed) species	According to the Red List of South African plants (http://redlist.sanbi.org/) and the International Union for Conservation of Nature (IUCN), organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Species of Conservation Concern (SCC)	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.



1 INTRODUCTION

Scientific Terrestrial Services CC (STS) was appointed to conduct a biodiversity assessment as part of the environmental authorisation process for the proposed Beeshoek Railway Line Link and associated surface infrastructure, near Postmasburg, Northern Cape Province; henceforth collectively referred to as the “**Railway Line Link Project**”.

The proposed Railway Line Link Project is located within the Beeshoek Mining Right Area (MRA) and the Mine’s Surface Rights Area (SRA), approximately 9 kilometres (km) north-west of the town of Postmasburg in the Northern Cape Province. The Beeshoek SRA is situated in the Tsantsabane Local Municipality, with neighbouring towns being Postmasburg, located 7 km east and Kathu located 70 km to the north. The existing Beeshoek Mine is divided into two areas that are separated by the R385 regional road that runs in a north-westerly direction between the towns of Postmasburg and Olifantshoek. The “North Mine” is located to the north of the R385, whilst the “South Mine” is located to the south of the R385. The location of the project is presented in Figures 1 and 2.

This report, after consideration and the description of the ecological integrity of the habitat associated with the Railway Line Link Project, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and developing proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.

1.1 Project Description

Assmang (Pty) Ltd is the holder of the new order rights in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) in respect of high-grade hematite iron ore deposits at the Beeshoek Mine, on the farms Beeshoek and Olynfontein. The mining method currently entails an opencast mining operation, which consists of five (5) active opencast pits (Village Opencast Pit, HF Opencast Pit, BF Opencast Pit, East Opencast Pit, Beeshoek North (BN) Opencast Pit). Although other opencast pits are dormant at this time, these are continuously assessed in terms of their economic value for intended remining. The current resources of the mine are approximately 87 million tonnes with a reserve of about 26 million tonnes.



The Beeshoek Mine can be broadly categorised as follows:

- Northern mining area (North Mine): This area comprises active as well as historical mining areas. Several small quarries and mine residue dumps of various categories are located within this area. The area also includes the Iron Ore Beneficiation Plant, Slimes Dam, as well as the BN Opencast Pit.
- Main Offices, Village (demolished) and recreational area; and
- Southern mining area (South Mine): This area comprises large opencast pits and associated Waste Rock Dumps (WRDs). The Village Opencast Pit and associated WRD are the main activities in this area. This area also includes a crushing and screening area as pre-preparation of the run of mine iron ore before being routed by overland conveyor to the Iron Ore Beneficiation Plant located at the North Mine.

To allow Beeshoek to export iron ore through the Saldanha Port in the Western Cape Province, the mine has investigated the options of linking Beeshoek to the Transnet Freight Rail (TFR) Ore line, via the existing Kolomela Direct Link. This in turn would allow Beeshoek Mine greater flexibility to also export ore through Saldanha port. Negotiations with Transnet have not as of yet been concluded in terms of allocations, and for this reason the project is presented as the best practical outcome.

The Surface Infrastructure includes the below list (Figure 3):

- Railway Line Link: Airport Bypass.
- Railway Line Link: Single Slip.
- Road Influence.
- Airfield Access roads (including Tommy's LXing).
- North and South Borrow Pit Bridge.
- -32 Stockpile.
- North and South Bridge Laydown Areas.
- Laydown Area (within the mine).
- Calcrete Material Source.
- Quartzite Material Source.
- Landfill Slide 1.

The line will comprise a 2.8 km main link line of approximately 5.5 m in width with a 5 m bulk fill (varies along the alignment). The line will tie from the existing TFR Postmasburg line at the Beeshoek Iron Ore Mine, crossing over the road accessing Tommys field Airport. The existing R385 will be lifted into the road over rail system to allow for the railway line to cross under the



R385 regional tar road before linking to the existing TFR Yard that services Kolomela Mine. Considering that one 4m access road will be constructed along the alignment with an 8 m buffer on either side of the railway line, the approximate extent of the development is 9 ha (85 400 m²). During the construction phase, the Tommy's field airport will be closed for a limited period to allow for the road crossing. A temporary road deviation (of less than 1 km, will be provided for vehicles travelling on the R385 during the construction of the road bridge. The approach of TFR is to run trains with three rakes of 116 wagons, giving trains a total length of 348 wagons. For this reason, the current operational concept is for Beeshoek to load a single train rake (116 wagons) to form part of a 3-rake train (348 wagons) which would be transported to Saldanha. The other two rakes of the train will be loaded by Kolomela.

The project requirements will include:

- Overall Design:
 - Railway formation – 5.5 m
 - Bulk fill – 5 m
 - One service road – 4 m
 - Buffer – 8 m on each side
- TFR train design
 - 348 wagons (3 x 116 rakes)
 - 30t axle load
- Beeshoek Traffic
 - 1 x 116 rake (Saldanha traffic)
 - 30t axle loads



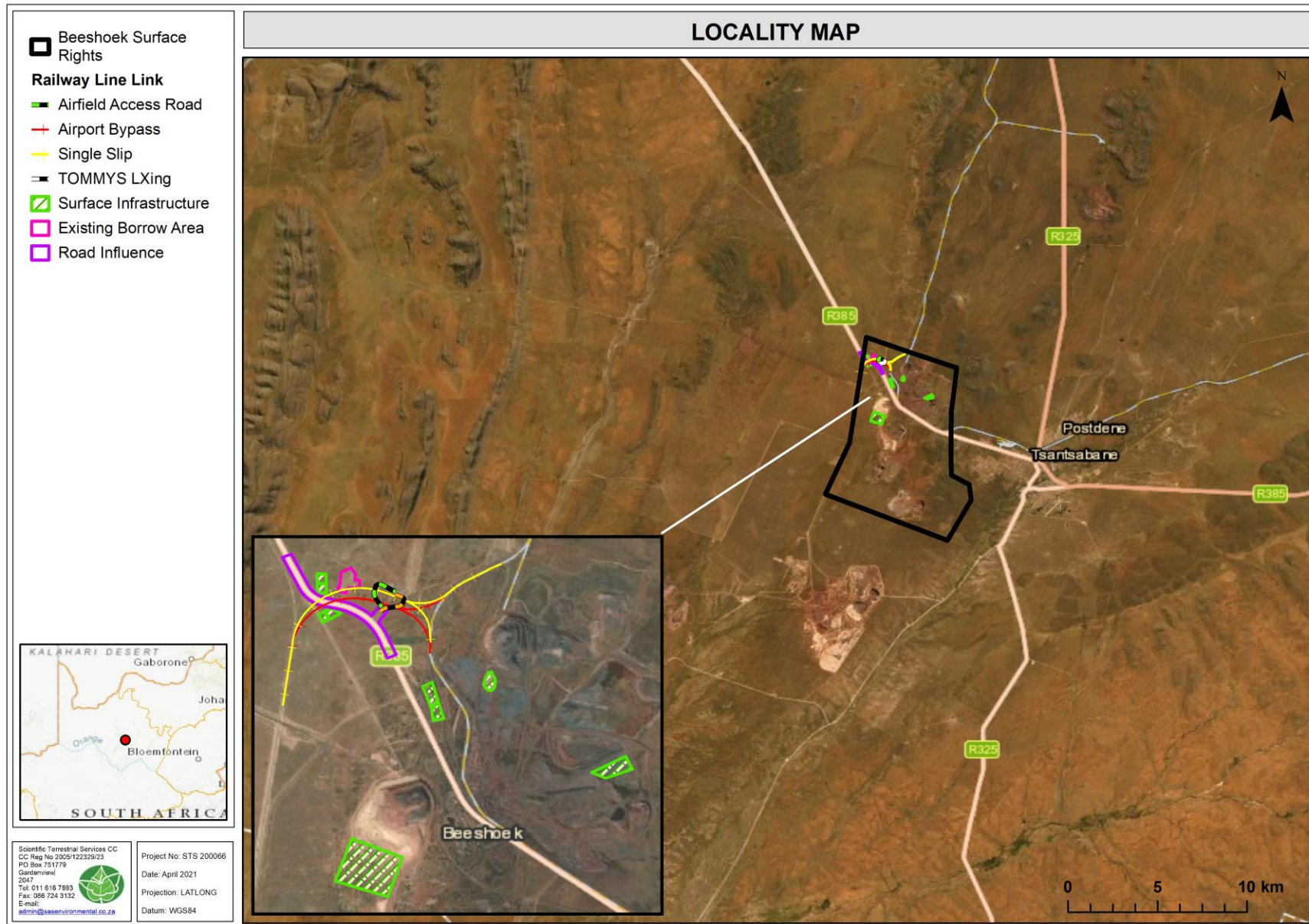


Figure 1: Digital Satellite image depicting the location of the Railway Line Link Project and associated surface infrastructure in relation to surrounding areas.



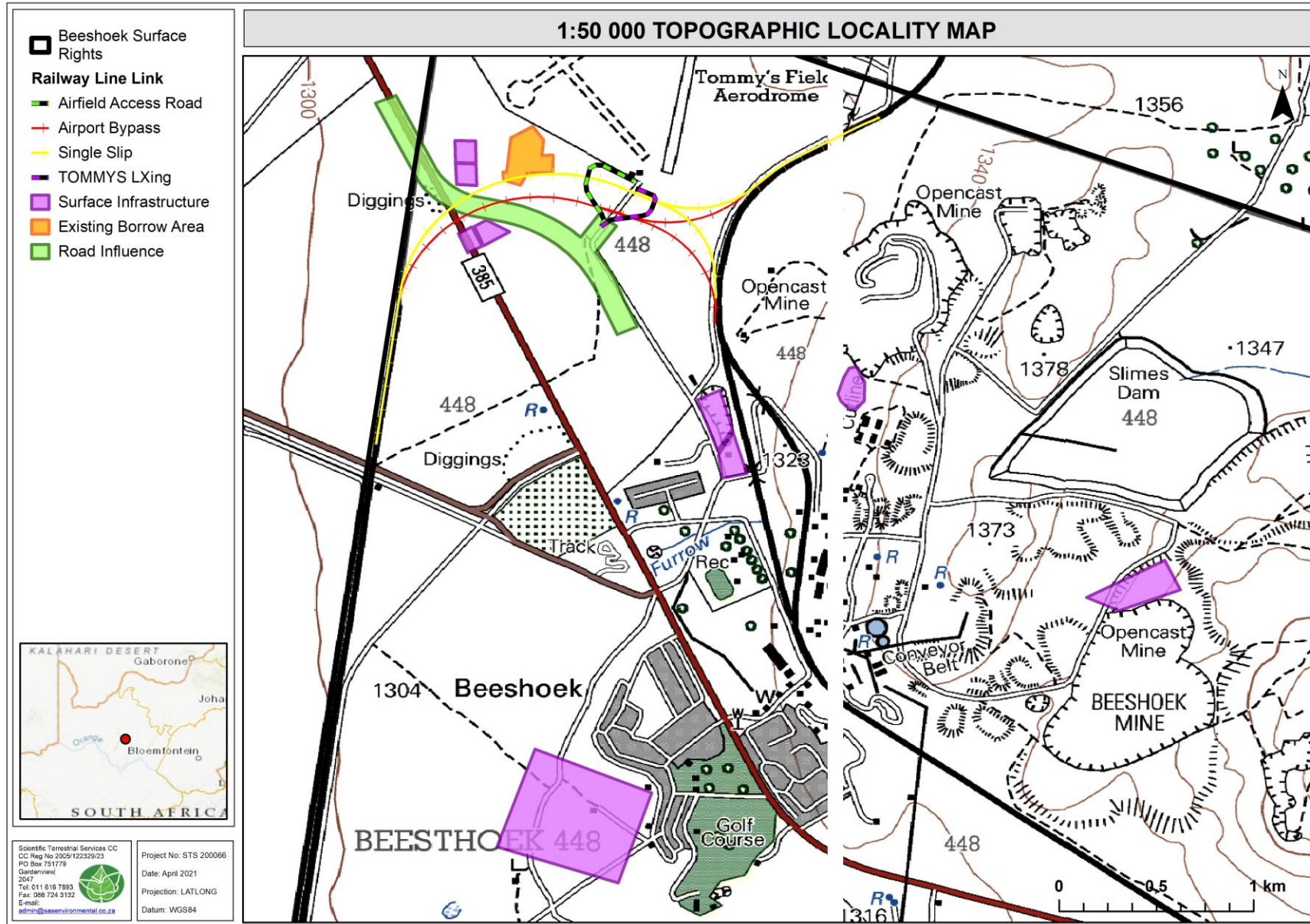


Figure 2: The Railway Line Link Project and associated surface infrastructure depicted on a 1:50 000 topographical map in relation to the surrounding area.



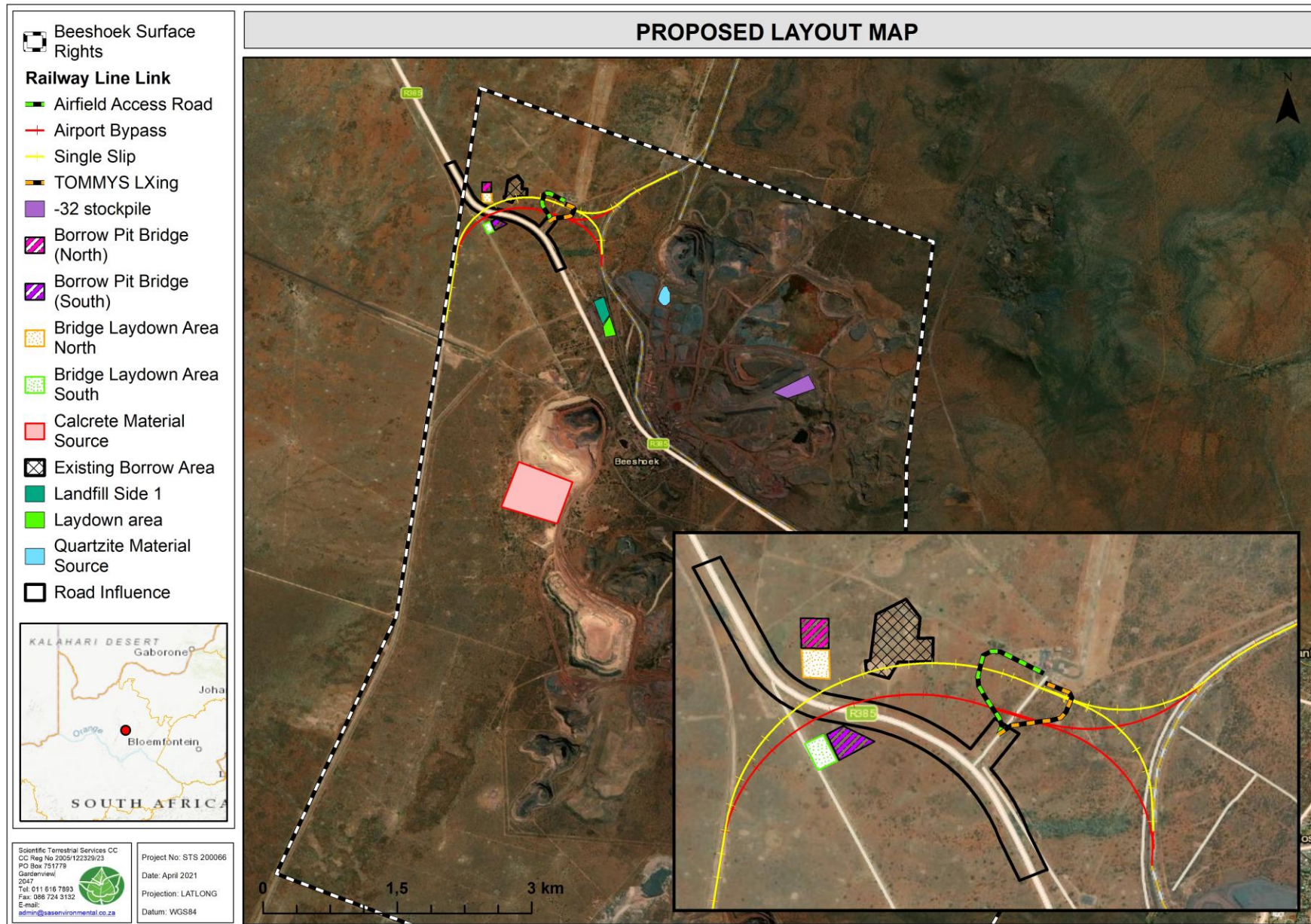


Figure 3: The proposed layout of the Railway Line Link Project and associated surface infrastructure in relation to the surrounding area.



1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To compile a desktop assessment with all relevant information 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/>). The desktop assessment aims to gain background information on the physical habitat and potential floral and faunal ecology associated with the Railway Line Link Project and surface infrastructure;
- To outline the legislative requirements that were considered for the assessment (**Appendix A** of this report);
- To define the Present Ecological State (PES) of the terrestrial biodiversity associated with the Railway Line Link Project and surface infrastructure;
- To determine and describe habitats, communities and the ecological state of the Railway Line Link Project and surface infrastructure, as well as to provide inventories of floral and faunal species as encountered within the Railway Line Link Project and surface infrastructure;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the Railway Line Link Project and surface infrastructure;
- 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 determine the environmental impacts that the construction of the proposed Railway Line might have on the terrestrial biodiversity associated with the Railway Line Link Project and surface infrastructure, as well as potential impacts on the ecology due to activities related to the proposed development; and
- To develop mitigation and management measures for all phases of the development.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The ecological assessment is confined to the Railway Line Link Project and surface infrastructure and immediate surrounding area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment;



- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities have been accurately assessed and considered;
- Due to the often secretive nature and habits of most faunal taxa and the time (season) of the assessment, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the Railway Line Link Project may have been missed during the assessment; and
- The data presented in this report are based on site visits, undertaken on the 29th of October 2020 (spring), the 5th of March 2021 (autumn) and the 29th of June 2021. A more comprehensive assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the Railway Line Link Project.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996¹;
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
 - Government Notice (GN) number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 September 2020 as it relates to the NEMBA; and
 - GN number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the NEMBA.
- The National Forest Act, 1998 (Act No. 84 of 1998, amended) (NFA);
 - GN 536: List of Protected Tree Species as published in the Government Gazette 41887 dated 7 September 2018, as it relates to the NFA;

¹ Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996'. It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.



- Government Gazette 45421 dated 10 May 2019 as it relates to the Department of Forestry, Fisheries and the Environment (DFFE)'s national environmental screening report required with an application for environmental authorisation as identified in regulation 16(1)(v) of EIA Regulations:
 - For the Terrestrial Biodiversity Theme: GN 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity as published in Government Gazette 43110 dated 20 March 2020; and
 - For Animal and Plant Species Themes: GN 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;
- The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA); and
- The Northern Cape Provincial Spatial Development Framework (NCPSDF) as developed in 2011 to meet the requirements of the Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998) and the Municipal Systems Act, 2000 (Act No. 32 of 2000).

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

2 ASSESSMENT APPROACH

2.1 Desktop Assessment

Maps and digital satellite images were generated prior to the field assessment to determine broad habitats, vegetation types and potentially sensitive sites. The biodiversity desktop assessment is confined to the Railway Line Link Project and surface infrastructure and does not include the neighbouring and adjacent properties, although the sensitivity of surrounding areas is included on the respective maps. Relevant databases and documentation that were considered during the assessment of the Railway Line Link Project and surface infrastructure include ²:

² Datasets obtained from:

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



- 2010 National Protected Area Expansion Strategy (NPAES) (Government of South Africa. 2010; DEA & SANBI, 2009), including the below listed vector datasets:
 - NPAES Focus Areas 2010: National Protected Areas Expansion Strategy: Focus areas for protected area expansion (South African National Parks (SanParks), 2010);
 - NPAES Formal: Polygons of formal protected national parks areas in South Africa (SANParks/SANBI, 2013); and
 - NPAES Protected Areas – Informal: Informal conservation areas in South Africa (SANParks/SANBI, 2012).
- The South African Conservation Areas Database, Quarter 2 (SACAD, 2020);
- The South African Protected Areas Database, Quarter 2 (SAPAD, 2020);
- The Northern Cape CBA Map, including the following datasets and research documents:
 - 2016 Northern Cape Critical Biodiversity Areas (NCDENC, 2016a);
 - 2016 Northern Cape Critical Biodiversity Areas Reason (NCDENC, 2016b); and
 - Critical Biodiversity Areas of the Northern Cape: Technical Report (Holness et al. 2016).
- The National Vegetation Map Project (VEGMAP), with the below vector dataset used for information on Biomes, Bioregions and Vegetation Type(s):
 - 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018a)
- The National List of Threatened Ecosystems 2011 (SANBI 2011; South Africa, 2011);
- From the National Biodiversity Assessment (NBA, 2018) Terrestrial Assessment project (Skowno et al., 2019):
 - 2018 Terrestrial ecosystem threat status and protection level - remaining extent (SANBI, 2018b); and
 - 2018 Terrestrial ecosystem threat status and protection level layer (SANBI, 2018c).
- The Mining and Biodiversity Guidelines (Department of Environmental Affairs *et al.*, 2012);
- The Important Bird and Biodiversity Areas (IBA) Programme and vector dataset (BirdLife South Africa, 2015; Marnewick et al., 2015a and 2015b), in conjunction with the South African Bird Atlas Project 2 (SABAP 2); and
- The International Union for Conservation of Nature (IUCN).

Two field assessments were undertaken on the 29th of October 2020 and the 5th of March 2021 to determine the ecological status of the Railway Line Link Project and surface



infrastructure and to “ground-truth” the results of the desktop assessment. Results of the field assessment are presented in Sections 4 and 5.

2.2 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 and background research done for the site, to allow representative recordings of floral communities and optimal detection of SCC (**Appendix B**). 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);
- The subjective sampling method requires that field assessment take place on foot. Based on the broad habitat units delineated before going to site, and points of interest recorded, which is updated based on on-site observations, the selected sample areas were surveyed on foot, following subjective transects, to identify the occurrence of the dominant plant species and habitat diversities, but also to detect SCC which tend to be sparsely distributed;
- Photographs were taken of each vegetation community that are representative of typical vegetation structure of that community, as well as photos of all detected SCC; and
- 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 B1 in **Appendix B**).

For the faunal field surveys, a reconnaissance ‘walkabout’ was undertaken to confirm habitat types, with special emphasis being placed on areas that may potentially support faunal SCC. Sites were investigated on foot to identify and define the faunal assemblage within the footprint area. A detailed explanation of the method of assessment is provided in **Appendix C** of this



report. The faunal categories covered in this assessment include mammals, avifauna, reptiles, amphibians, general invertebrates, and arachnids.

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

2.3 Sensitivity Mapping

All the ecological features of the Railway Line Link Project and surface infrastructure were considered, and sensitive areas were delineated with the use of a Global Positioning System (GPS). In addition, identified locations of SCC and SANBI protected species were also marked by means of GPS. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Railway Line Link Project and Surface Infrastructure based on National and Provincial Databases

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



Table 1: Summary of the terrestrial conservation characteristics for the Railway Line Link Project and surface infrastructure (Quarter Degree Square (QDS) 2822BD).

DESCRIPTION OF THE VEGETATION TYPE(S) RELEVANT TO THE RAILWAY LINE LINK PROJECT ACCORDING TO MUCINA & RUTHERFORD (2018) (FIGURE 4) AND THE NATIONAL BIODIVERSITY ASSESSMENT (2018 TERRESTRIAL DATASET)			
Biome	The Railway Line Link Project is situated within the Savanna Biome.		
Bioregion	The Railway Line Link Project occurs within the Eastern Kalahari Bushveld Bioregion.		
Vegetation type	Postmasburg Thornveld (Svk 14) (western Portion)	Kuruman Thornveld (Svk 9) (Eastern Portion)	Kuruman Mountain Bushveld (Svk 10) (Eastern Boundary)
Altitude (m)	1 180 –1 440 m	1 100 –1 500	1 100 –1 800
Climate	Summer and autumn rainfall with very dry winters.	Summer and autumn rainfall with very dry winters.	Summer and autumn rainfall with very dry winters.
Climate	MAP (mm)	306	371
	MAT (°C)	17.0	16.8
	MFD (Days)	38	40
	MAPE (mm)	2752	2728
	MASMS (%)	84	83
Distribution	Northern Cape Province	North-West and Northern Cape Provinces	Northern Cape and North-West Provinces
Geology & soils	Red aeolian sand of the Kalahari Group overlying the volcanics and sediments of the Griqualand West Supergroup that outcrop in places. Deep soils are of the Hutton form	Some Campbell Group dolomite and chert and mostly younger, superficial Kalahari Group sediments, with red wind-blown (0.3–1.2 m deep) sand. Locally, rocky pavements are formed in places	The Kuruman and Asbestos Hills consist banded iron formation, with jaspilite, chert and riebeckite-asbestos of the Asbestos Hills Subgroup of the Griqualand West Supergroup (Vaalian).
Conservation	Least threatened. Target 16%. None of the unit is conserved in statutory conservation areas, but very little has been transformed	Least threatened. Target 16%. None conserved in statutory conservation areas. Only 2% already transformed.	Least threatened. Target 16%. None conserved in statutory conservation areas. Very little transformed.
Vegetation & landscape features (dominant floral taxa in appendix E)	Flats surrounded by mountains supporting open, shrubby thornveld characterised by a dense shrub layer, often lacking a tree layer. The grass layer is very sparse. Shrubs generally low with a karroid affinity	Flat rocky plains and some sloping hills with very well-developed, closed shrub layer and well-developed open tree stratum consisting of <i>Vachellia erioloba</i> (formerly <i>Acacia erioloba</i>)	Rolling hills with generally gentle to moderate slopes and hill pediment areas with an open shrubveld with <i>Calobota cuspidosa</i> formerly (<i>Lebeckia macrantha</i>) prominent in places. Grass layer is well developed



MINING AND BIODIVERSITY GUIDELINES (2013)		CONSERVATION DETAILS PERTAINING TO THE RAILWAY LINE LINK PROJECT (VARIOUS DATABASES)	
The Railway Line Link Project is situated within an area currently not ranked under the mining and biodiversity guidelines (2013).			
NORTHERN CAPE CRITICAL BIODIVERSITY AREAS (2016) (FIGURE 5)			
Other Natural Areas (ONA)	<p>The Railway Line Link Project is largely associated with areas classified as Other Natural Areas. According to the Technical Guidelines for CBA Maps document ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).</p> <p>There are several small sections that are associated with an Ecological Support Area (ESA), namely the eastern extent of the Railway Line Link: Single Slip, small sections of the Laydown Area (within the mine), the central portions of the Calcrete Material Source, and small sections of the Landfill Slide 1.</p>		<p>The Railway Line Link Project is located within the remaining extent of the Postmasburg Thornveld (western portions, including the Calcrete Material Source), the Kuruman Mountain Bushveld (traversed by the -32 stockpile), and the Kuruman Thornveld (eastern portions, including the Laydown Area within the mine and the Landfill Slide 1), all of which are considered Least Concern ecosystems and are currently Not Protected.</p> <p>Ecosystem types are categorised as “not protected”, “poorly protected”, “moderately protected” and “well protected” based on the proportion of each ecosystem type that occurs within a protected area recognised in the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA) and compared with the biodiversity target for that ecosystem type.</p> <p>The ecosystem protection level status is assigned using the following criteria:</p> <ol style="list-style-type: none"> i. If an ecosystem type has more than 100% of its biodiversity target protected in a formal protected area (either a or b), it is classified as well protected, ii. When less than 100% of the biodiversity target is met in formal protected areas (either a or b), it is classified it as moderately protected, iii. If less than 50% of the biodiversity target is met, it is classified it as poorly protected, and iv. If less than 5% it is hardly protected.
NORTHERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (NCPSDF, 2012)		NBA (2018) (Figure 4)	
<p>The NCPSDF functions as an innovative strategy that will apply sustainability principles to all forms of land use management throughout the Northern Cape as well as to facilitate practical results, as it relates to the eradication of poverty and inequality and the protection of the integrity of the environment.</p> <p>The Railway Line Link Project is located within the Griqualand West Centre (GWC) of Plant Endemism (Figure 6). This semi-arid region is broadly described as savanna, forming part of the Eastern Kalahari Bushveld Bioregion. Studies investigating the endemism of the centre report at least 23 plant species that have restricted distributions (Frisby <i>et al.</i> 2019).</p> <p>The Railway Line Link Project also falls within the Gamagara Corridor (Figure 7). The Gamagara Corridor comprises the mining belt of the John Taolo Gaetsewe and Siyanda Districts and runs from lime acres and Danielskuil to Hotazel in the north. The corridor focuses on the mining of iron and manganese.</p>			
STRATEGIC WATER SOURCE AREAS FOR SURFACE WATER (2017)		National Threatened Ecosystems (2011)	The Railway Line Link Project falls within an area that is considered to be Least Threatened .
Surface Water Strategic Water Source Area (SWSAs) are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. They include transboundary areas that extend into Lesotho and Swaziland. The Sub-National Water Source Areas (WSAs) are not nationally strategic as defined in the report but were included to provide a complete coverage.		NPAES (2009), SAPAD & SACAD (2020, Q3)	The various datasets assessed does not indicate any protected, conservation, or focus areas within 10 km of the Railway Line Link Project.
Name & Criteria	The Railway Line Link Project is not within 10 km of a Strategic Water Source Area.	IBA (2015)	The Railway Line Link Project is not located within or near an IBA (within 10 km).



NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL (ACCESSED 2021)	
The screening tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	
Animal species theme (Figure 8)	For the animal species theme, the Railway Line Link Project is considered to largely be of medium sensitivity , with a small section within the southern portion of the Railway Line Link Project considered to be of low sensitivity . The sensitivities were triggered by the potential occurrence of the following species: <ul style="list-style-type: none"> - Medium: the avifauna species <i>Sagittarius serpentarius</i> (Secretary bird) (Endangered) and - Medium: the avifauna species <i>Neotis ludwigii</i> (Ludwig's bustard) (Endangered).
Plant species theme (Figure 9)	For the plant species theme, the Railway Line Link Project is considered to largely be of low sensitivity , with the eastern portions of the Railway Line Link Project considered to be of medium sensitivity . The sensitivity was triggered by the potential occurrence of a vulnerable plant species.
Terrestrial biodiversity theme	For the Terrestrial Biodiversity Theme, the Railway Line Link Project is considered to be of a very high sensitivity . The triggered sensitivity features include Freshwater ecosystem priority area quaternary catchments and an ESA.

NBA = National Biodiversity Assessment; NPAES = National Protected Areas Expansion Strategy; SAPAD = South African Protected Areas Database; IBA = Important Bird and Biodiversity Area; MAP – Mean annual precipitation; MAT – Mean annual temperature; MAPE – Mean annual potential evaporation; MFD = Mean Frost Days; MASMS – Mean Annual Soil Moisture Stress (% of days when evaporative demand was more than double the soil moisture supply).



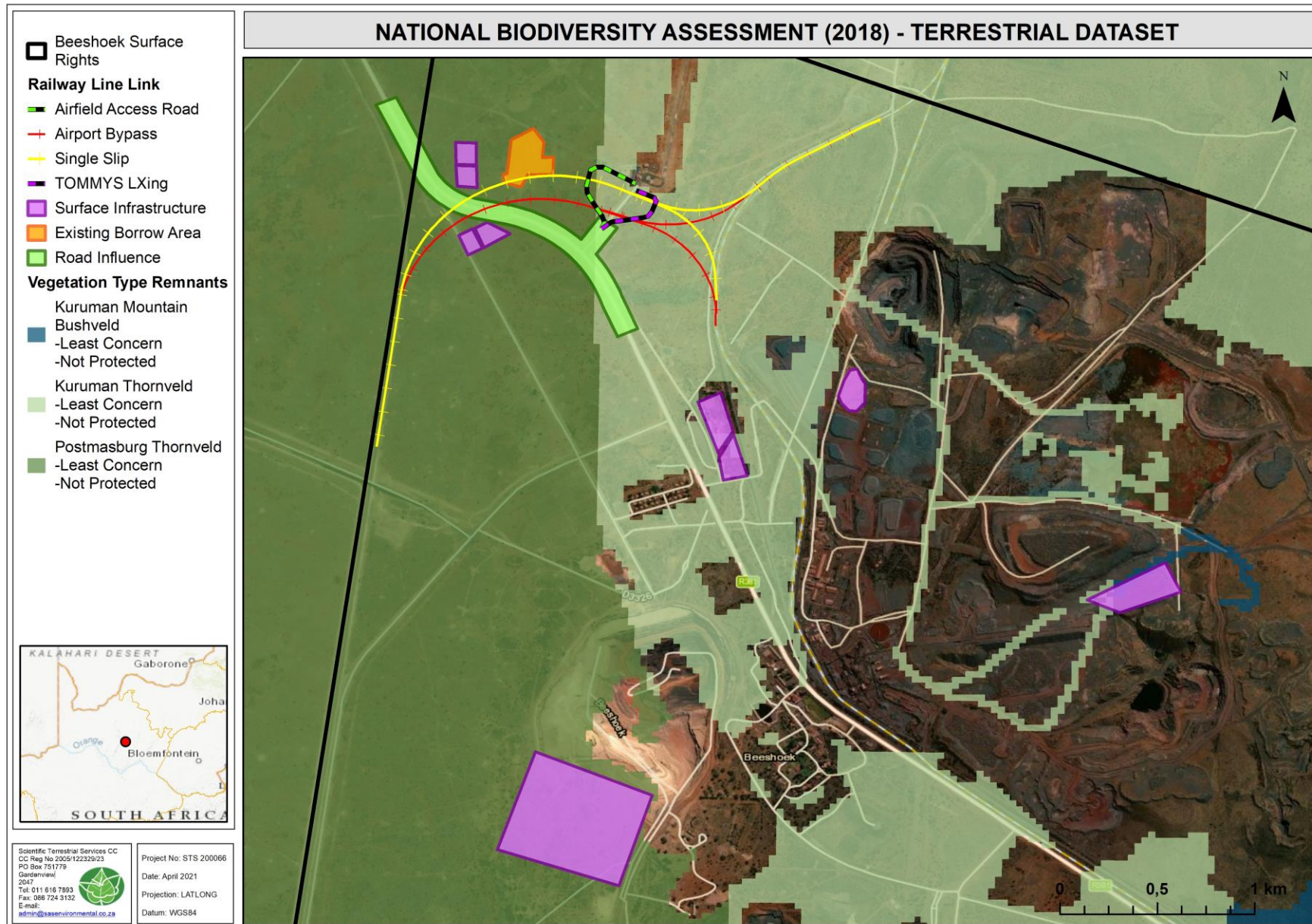


Figure 4: The remaining extent of the Postmasburg Thornveld (LC), Kuruman Thornveld (LC), AND Kuruman Mountain Bushveld (LC) according to the NBA (2018).



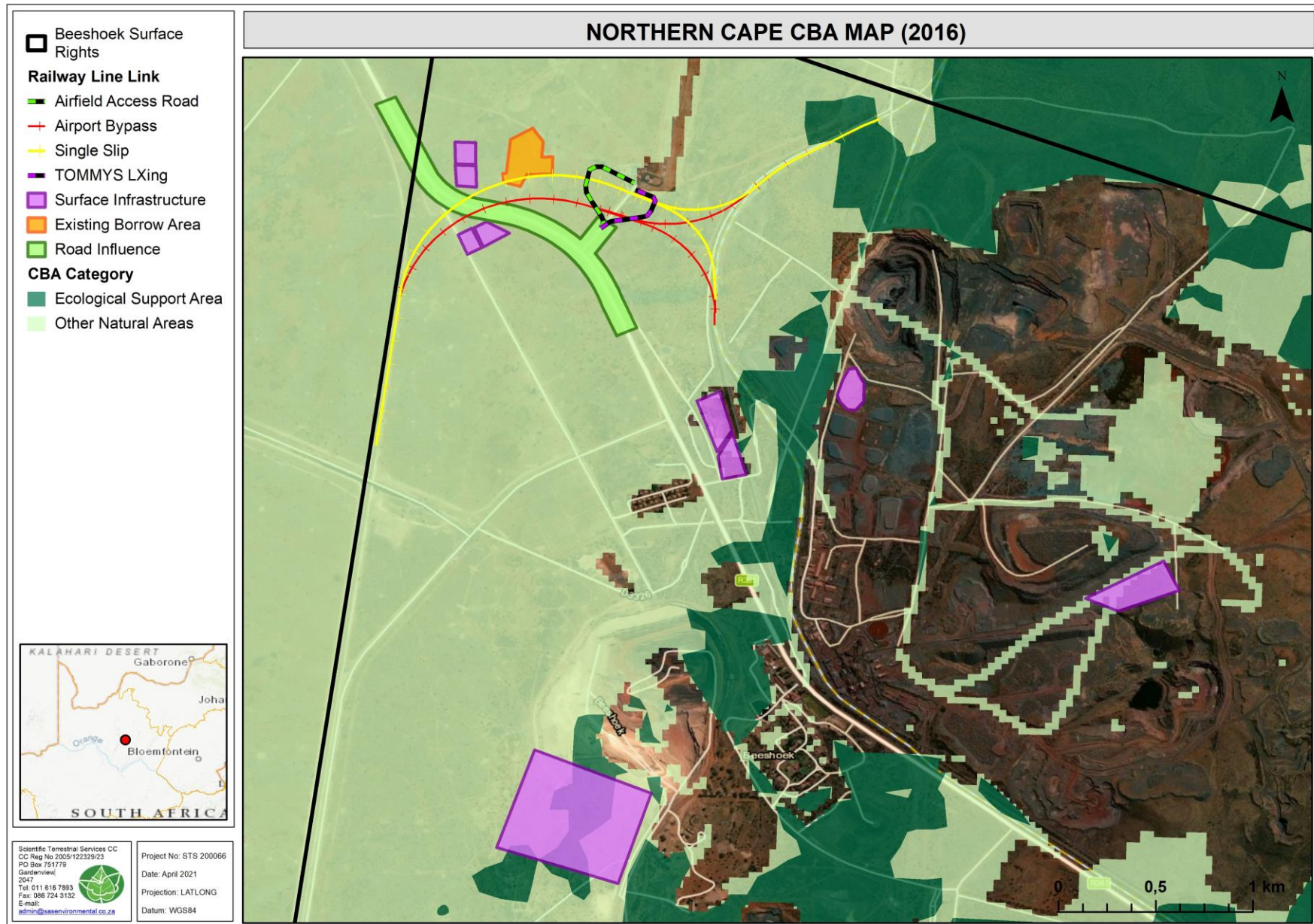


Figure 5: Northern Cape Critical Biodiversity areas associated with the Railway Line Link Project.



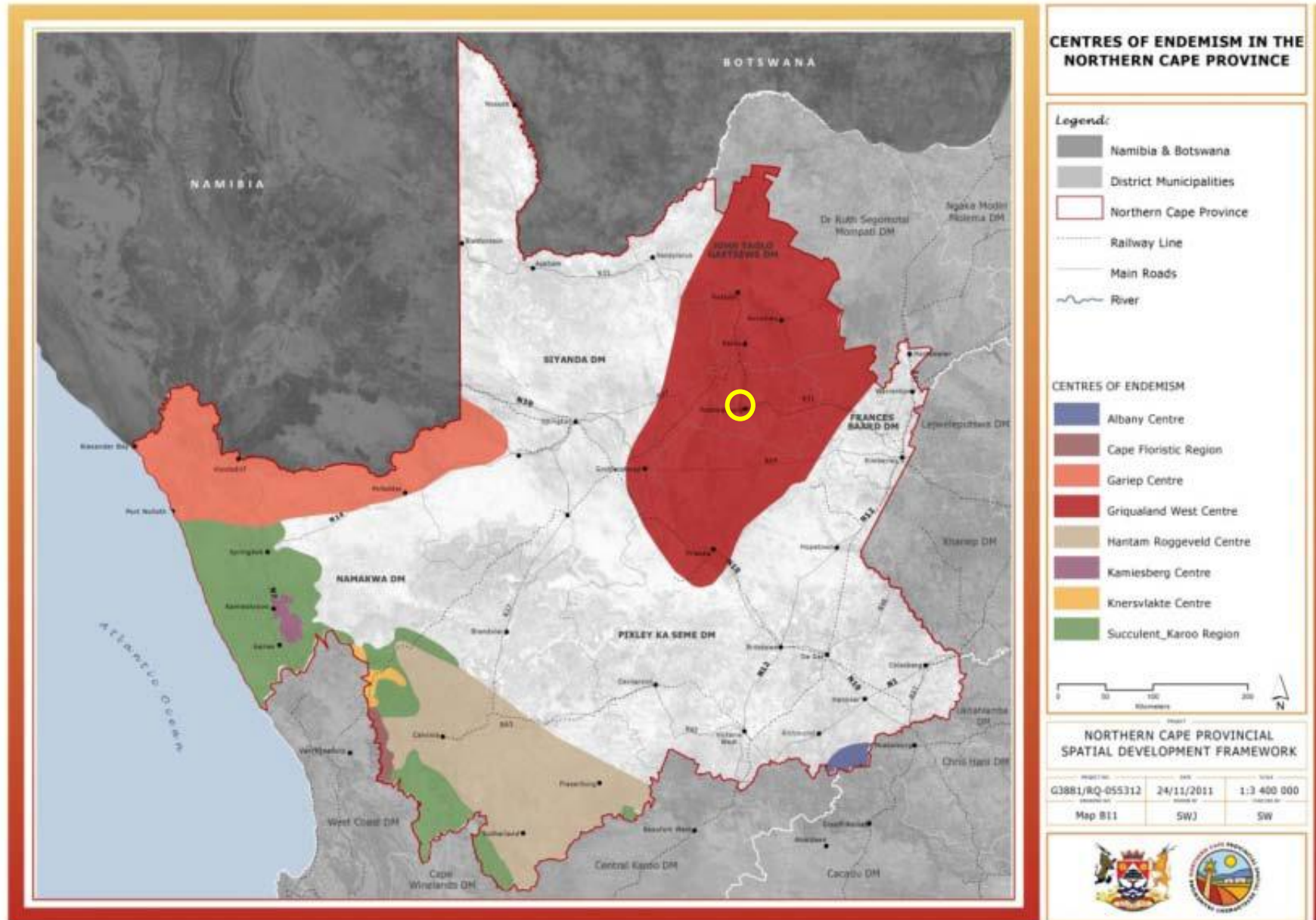


Figure 6: Centres of endemism of the Northern Cape Province: The estimated location of the Railway Line Link Project is indicated by the yellow circle (NPSDF, 2012).



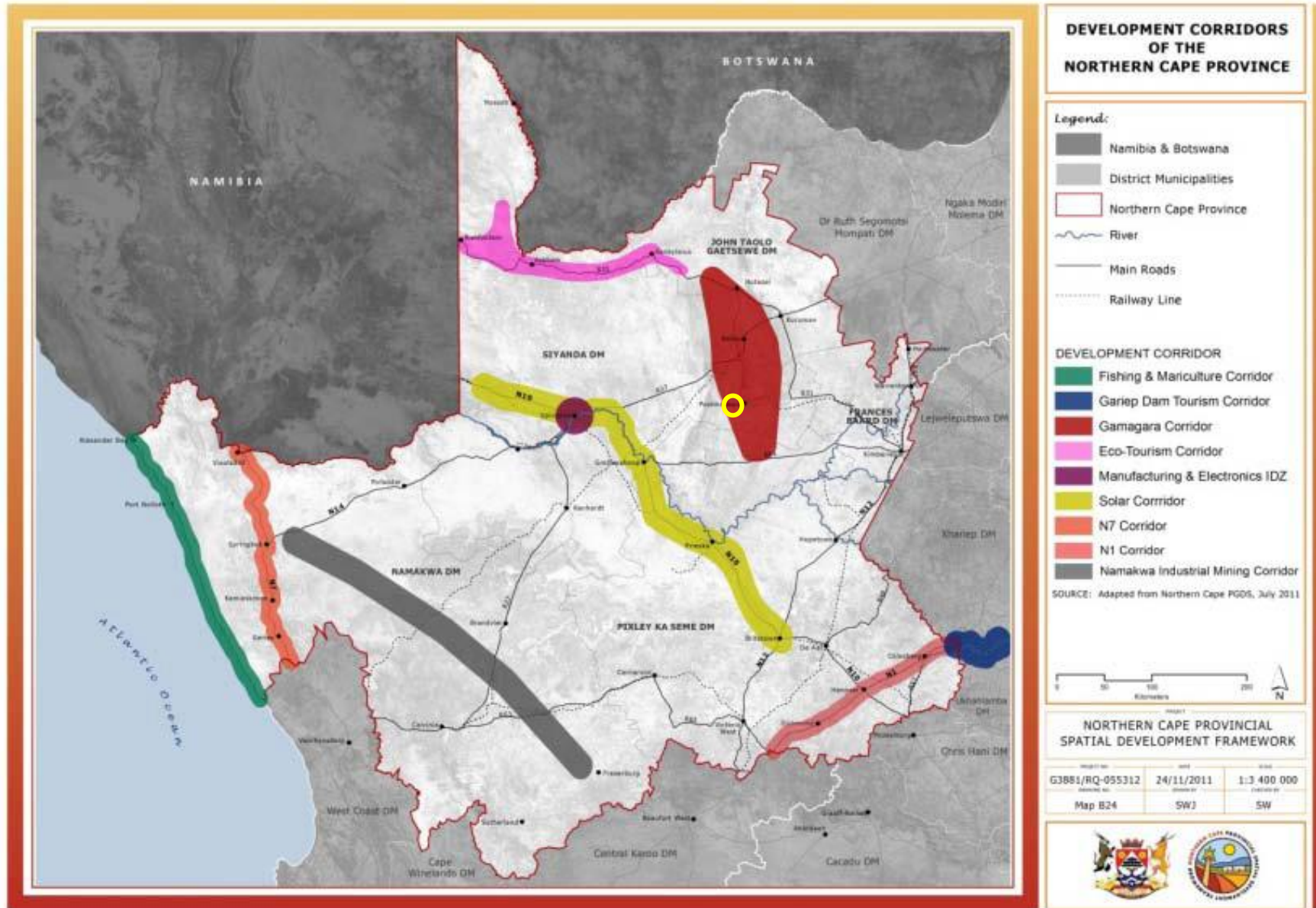


Figure 7: Development corridors of the Northern Cape Province: The estimated location of the Railway Line Link Project is indicated by the yellow circle (NPSDF, 2012).



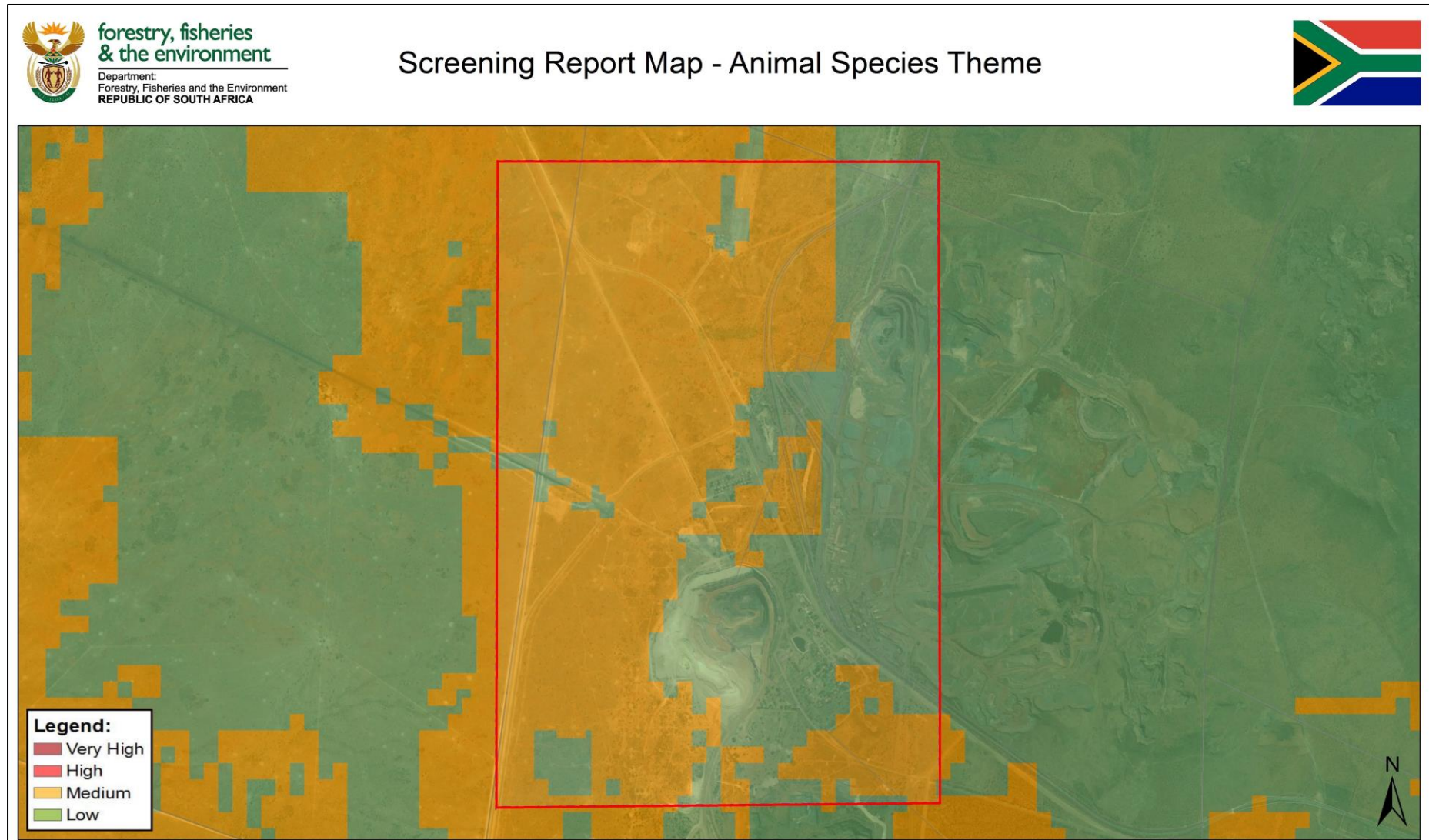


Figure 8: Outcome of the National Web-Based Environmental Screening Tool for the Animal Species Theme.



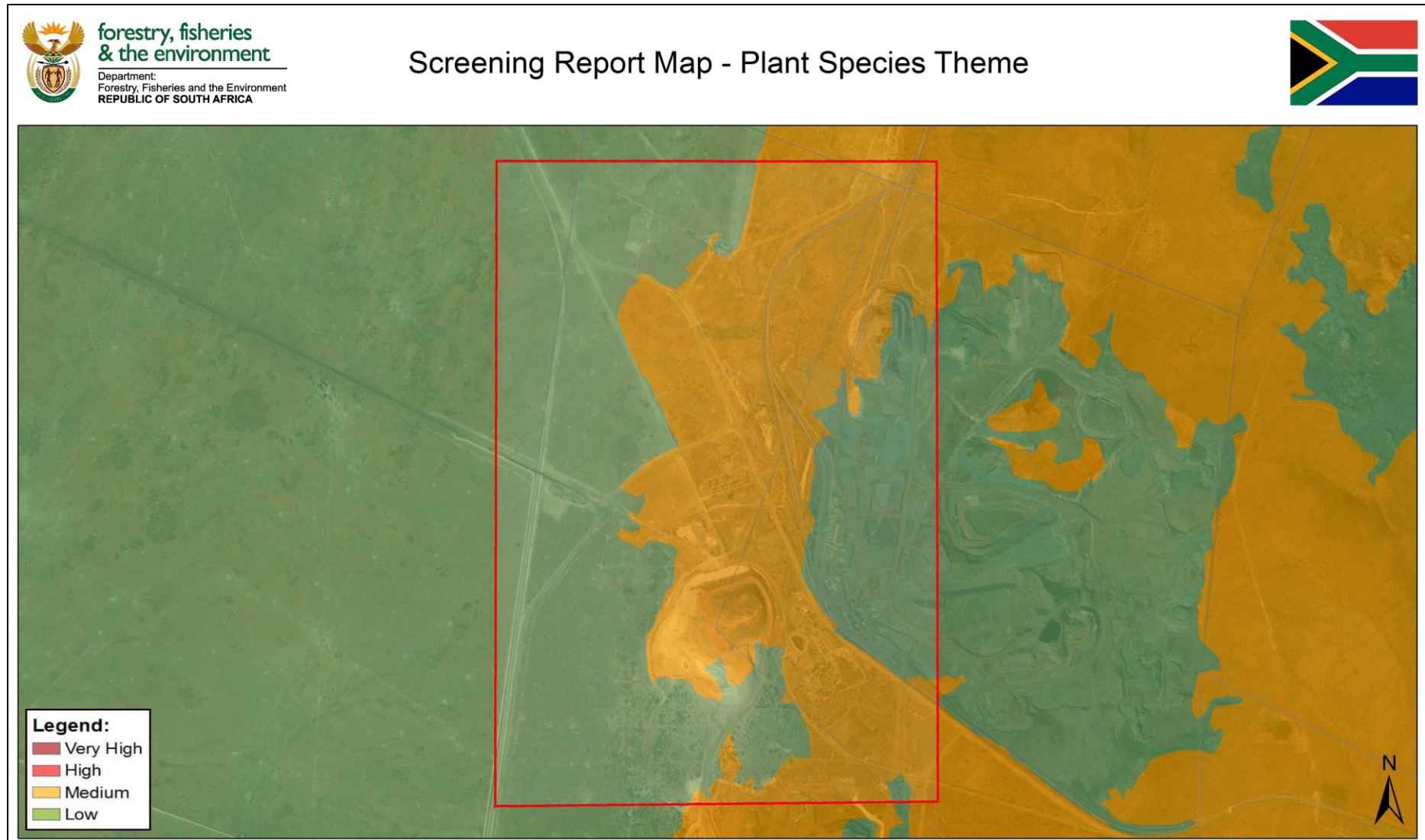


Figure 9: Outcome of the National Web Based Environmental Screening Tool for the Plant Species Theme.



4 RESULTS OF THE FLORAL ASSESSMENT

4.1 Broad-scale vegetation characteristics

The Railway Line Link Project occurs in three vegetation types based on spatial data from the 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland, namely the Kuruman Mountain Bushveld, the Kuruman Thornveld and the Postmasburg Thornveld, all of which are considered to be of least concern. These vegetation types were used as the reference states against which the ground-truthed vegetation communities were compared (descriptions as per Mucina and Rutherford, 2006). It is however known that the vegetation types of the region are poorly assessed, and data is somewhat outdated. As such, the vegetation communities are not anticipated to be entirely representative of these vegetation types as described in literature.

4.2 Ground-truthed vegetation characteristics

Based on the results of the field investigations undertaken in October 2020, March 2021, and June 2021, three broad habitat units were distinguished within the Railway Line Link Project:

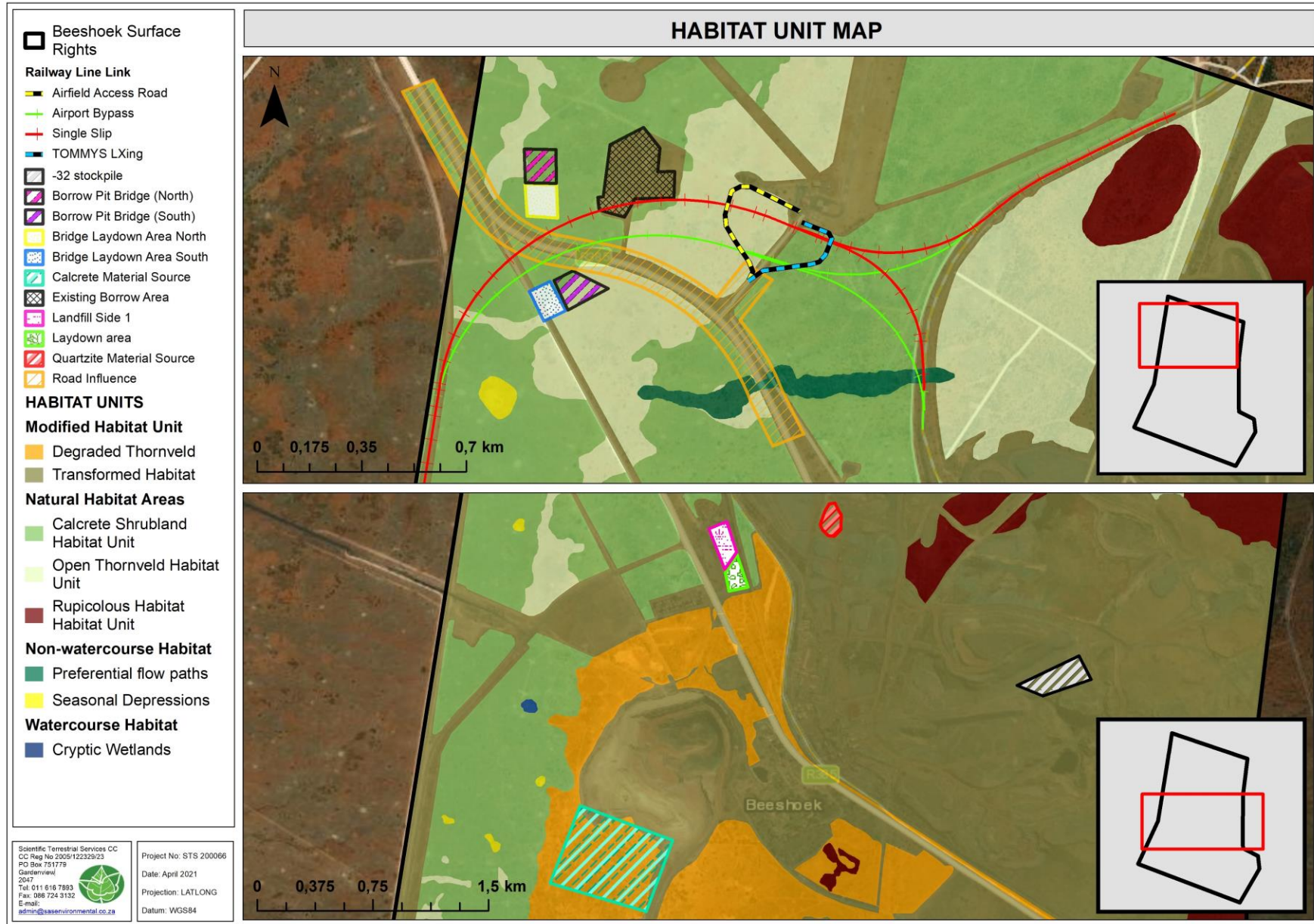
- **Modified Habitat Unit** – sections where the vegetation has shifted to a different vegetation type and no longer represents the reference state and can therefore be considered Transformed Habitat or Degraded Thornveld. Within the Railway Line Link Project footprint, this unit refers to areas that have been transformed for mining, road and railway construction, and borders Tommy's Field Aerodrome;
- **Natural Habitat Areas:** This includes vegetation that has not been transformed:
 - **Calcrete Shrubland:** Much of the Railway Line Link Project falls within this habitat unit, which is located on shallow calcrete soils derived from the Coega/Knersvlakte soil forms. The vegetation mainly comprised shrubland with sparse grass cover. Species diversities were intermediate and trees generally of low diversity and abundance. Habitat integrity varied throughout this habitat unit, with some areas more encroached by indigenous woody species (mainly *Rhigozum trichotomum*), and other areas characterised by largely intact vegetation. This unit was differentiated as the following based on the floral composition:
 - “Pure” Calcrete Shrubland; and
 - “Mixed” Calcrete Shrubland.



- **Open Thornveld Habitat Unit:** The central section of the Railway Line Link Project crosses through this habitat unit. The Open Thornveld Habitat is restricted to the deeper red soils of the Vaalbos and Plooyburg soil forms. Vegetation included an almost continuous grass layer with large tree species such as *Vachellia erioloba* scattered throughout. Habitat integrity varied throughout the site but generally had little disturbances within the sections where the Railway Line Link Project will pass through.
- **Non-watercourse habitat:** This habitat unit is associated with seasonal depressions (outside of the proposed footprint) and an anthropogenically derived drainage line (within the footprint). The **non-watercourse habitat** is not considered true watercourses as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA) (please refer to the freshwater ecosystem assessment undertaken by Scientific Aquatic Services (2021) for further details pertaining to the non-watercourse classification).

For a breakdown of the floral communities, habitat characteristics and conservation sensitivities associated with the above-mentioned habitat units, please refer to Section 4.2.1 – 4.2.3. Figure 10 below depicts the full extent of the habitat units associated with the Railway Line Link Project.






Conceptual illustration of the habitat units associated with the Railway Line Link Project.



4.2.1 Modified Habitat Unit

REFERENCE PHOTOS	
 <p>Existing borrow pit area (left photo), existing rail line (central photo) and active mining areas (right photo)</p>	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>This habitat unit excludes vegetation communities that are in any way representative of the reference state(s). No clear vegetation structure can be linked to these areas as the natural vegetation structure has been altered or completely transformed. These areas are often associated with alien vegetation or a lack of floral heterogeneity.</p>	<p>This habitat was generally species-poor and lacked vegetation cover. Refer to Appendix H for a list of species recorded within this Habitat Unit.</p>
SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC.)	
<p>Presence of Unique Landscapes</p>	<p>None. The habitat is considered transformed, and no significant areas remain that are considered to be important for floral ecology. From a floral perspective, and in its current degraded state, this habitat unit is not important for species diversity or community structure.</p> <p>Apart from the Calcrete Material Source which is located in an ESA, no significant conservation or biodiversity features were identified for this habitat unit within the provincial and national desktop datasets. The Calcrete Material Source is, however, in an area that is degraded from a vegetation perspective, much of which resulting from this section being fragmented for several years along with associated edge effects from the adjacent active mining activities. Its purpose as an ESA and movement corridor has largely been diminished.</p>
<p>Species of Conservation Concern</p>	<p>No threatened SCC are located within this habitat unit, nor are any anticipated to be present.</p> <p>The NFA protected trees, <i>Boscia albitrunca</i> and <i>Vachellia erioloba</i> occurred sparsely in the Degraded Thornveld. Permits from the DFFE should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place.</p> <p>Refer to Appendix F for a list of species assessed as part of the SCC assessment.</p>



CONCLUDING REMARKS





This habitat unit is not considered important from a floral ecological importance and resource management perspective.

Key considerations:

- Very little, very homogenous, or a lack of vegetation is associated with this habitat unit, and thus there is no suitable habitat for 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). No CBAs are mapped within this habitat unit, with the ESA within the footprint area no longer considered part of a movement or support corridor. As such, no constraints on development are recognised from a provincial and national desktop datasets perspective.
- In terms of the National Web-based Environmental Screening Tool outcome, these areas match the Low Sensitivity assigned to the Plant Species Theme; however, it does not align with the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme (due to the habitat being transformed, degraded, and/or fragmented).
- No features of biodiversity significance are associated with the Modified Habitat Unit, but it is recommended that an AIP species management plan be developed to manage AIP proliferation along these areas.



4.2.2 Natural Habitat Areas

REFERENCE PHOTOS			
 <p>Open Thornveld Habitat</p>	 <p><i>Rhigozum trichophora</i>-encroached veld</p>	 <p>"Pure" Calcrete Shrubland</p>	 <p>"Mixed" Calcrete Shrubland</p>
HABITAT OVERVIEW	SPECIES OVERVIEW		
<p>The Open Thornveld occurs in the central section of the proposed Railway Line Link Project and is characterised by areas with deeper red soils of the Vaalbos and Plooyburg soil forms. The habitat typically includes open thornveld with scattered <i>Vachellia erioloba</i> trees, as well as other <i>Senegalia</i> and <i>Vachellia</i> species. Several areas are, however, degraded due to mining edge effects and some grazing pressures, which have resulted in woody species such as <i>Senegalia melifera</i> subsp. <i>detinens</i> and <i>Rhigozum trichophora</i> encroaching into these areas.</p> <p>The "pure" Calcrete Shrubland habitat occurs along the western section of the proposed Railway Line Link Project and can be described as short, open shrubland where the woody component is dominated mainly by dwarf shrubs, with tall shrubs and/or small trees sparsely scattered in between. In areas where disturbances were more prominent, a notable increase in woody encroacher species such as <i>Rhigozum trichotomum</i> was noted.</p> <p>The eastern section of the Railway Line Link Project occurs in habitat that mostly reflects that of the Calcrete Shrubland habitat in term of species composition; however, this section also includes characteristics of the Open Thornveld with the presence of deeper red soils and taller thorn trees – thus not "pure" Calcrete Shrubland ("Mixed" Calcrete Shrubland). Disturbance in this section was notably higher than in the remaining sections of the Railway Line Link Project, largely due to grazing pressures from equine species.</p>	<p>The Open Thornveld has a moderately low to intermediate species richness and is characterised by the presence of taller thorn trees such as <i>Vachellia erioloba</i> and <i>Vachellia tortilis</i> subsp. <i>heteracantha</i>. The grass layer is almost continuous, with some open soil patches scattered throughout this habitat. The best represented grasses included <i>Enneapogon cenchroides</i>, <i>Eragrostis trichophora</i>, <i>Stipagrostis uniplumis</i> and <i>Schmidtia kalahariensis</i>. Forb and succulent species were not abundant but did not lack diversity either. Some rather range-restricted species were recorded in this habitat unit, namely <i>Euphorbia cf. duseimata</i> and an <i>Orbea</i> species. Species from the Aizoaceae family were also abundant within this section (occurring in clumps rather than evenly distributed).</p> <p>The vegetation communities within the "pure" Calcrete Shrubland were of intermediate to moderately high diversity. The woody layer is well represented within this habitat unit and is characterised by sparsely occurring short trees / tall shrubs such as <i>Boscia albitrunca</i>, <i>Senegalia mellifera</i> subsp. <i>detinens</i> and <i>Tarchonanthus camphoratus</i>. Dwarf shrubs occur much more prominently throughout this habitat unit, comprising a range of species, such as <i>Aptosimum lineare</i>, <i>Cadaba aphylla</i>, <i>Erioccephalus cf. ericoides</i>, <i>Lasiosiphon polycephalus</i> (previously <i>Gnidia</i>), <i>Leucas capensis</i>, <i>Monechma incanum</i>, <i>Peliostomum leucorrhizum</i>, <i>Pentzia cf. calcarea</i>, <i>Roepera (Zygophyllum) pubescens</i>, and <i>Caroxylon dealatum</i>. Forbs were poorly represented which is characteristic of the reference state, namely the Postmasburg Thornveld. The graminoid layer was more diverse and comprised <i>Aristida adscensionis</i>, <i>Aristida diffusa</i> subsp. <i>burkei</i>, <i>Cymbopogon pospischilii</i>, <i>Enneapogon cenchroides</i>, <i>Enneapogon desvauxii</i> (abundant), <i>Eragrostis lehmanniana</i>, <i>Eragrostis obtusa</i>, <i>Fingerhuthia africana</i> and <i>Themeda triandra</i>.</p> <p>The eastern section of the Railway Line Link Project where the Calcrete Habitat included influences of Open Thornveld habitat, species richness was considered intermediate. Due to grazing pressures, grass cover was poorly represented and woody encroaching of <i>Senegalia melifera</i> subsp. <i>detinens</i> and <i>Rhigozum trichotomum</i> were prominent in most sections. Refer to Appendix H for a list of species recorded within this habitat unit.</p>		



SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT

Species within the Open Thornveld



From left to right: *Orbea* sp., *Euphorbia* cf. *duseimata*, *Ruschia calcarea*, *Rhigozum trichotomum*, *Vachellia erioloba*

Species within the Calcrete Shrubland



From left to right: *Cadaba aphylla*, *Aptosimum spinescens*, *Eriocephalus* cf. *ericoides*, Lamiaceae species, *Justicia divaricata*

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

<p>Presence of Unique Landscapes</p>	<p>No important features were identified in the Railway Line Link Project footprint area. The habitat is not considered to support significant ecological processes, nor are any significant ecological corridors present.</p>
<p>Species of Conservation Concern</p>	<p>No threatened floral SCC were recorded in this habitat unit during the field assessment. In terms of Section 56 of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA), threatened species are Red Data Listed (RDL) species falling into the Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected (P) categories of ecological status. Nor were any species listed in the NEMBA Threatened or Protected Species lists (TOPS, 2007) identified in this habitat unit. The online National Environmental Screening Tool (or "Screening Tool") has identified one vulnerable plant species for the Beeshoek Mine with potential habitat within the eastern section of the Railway Line Link Project; however, this section of the Railway Line Link Project has been degraded, and it is less likely that this species would be present or have viable populations within this section. Its exclusion can, however, not be accepted without a comprehensive walk down of the footprint area.</p> <p>The nationally protected tree, <i>Boscia albitrunca</i>, or Shepherd's tree, occurred in high abundances throughout this habitat unit, though more abundant in the Calcrete Shrubland than the Open Thornveld. This species is protected under the National Forest Act, 1998 (Act No. 84 of 1998) (as amended in September 2011) (NFA) with a least threatened conservation status. The NFA protected tree, <i>Vachellia erioloba</i>, or the Camel thorn was also recorded but was less abundant and restricted to the areas where soils were deeper (Open Thornveld).</p> <p>Numerous provincially protected species, i.e., those listed in Schedule 2 of the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA), were recorded in the Calcrete Shrubland, with several additional species likely occurring within this habitat unit. Schedule 2 Protected Plants recorded in this habitat unit included the below:</p>



- Species from the Aizoaceae family, *Mestoklema tuberosum*, *Ruschia calcarea* and *Ruschia cf. griquensis*;
- Species from the protected Iridaceae family, namely *Babiana cf. bainesii* **were not present**, but are highly likely to be found in the footprint areas;
- Numerous individuals from the protected genus *Boscia*, i.e., *Boscia albitrunca*;
- Species from the protected genus *Euphorbia*, namely *Euphorbia cf. duseimata*;
- Species from the protected family Amaryllidaceae, namely *Boophone disticha*;
- Species from the protected family Asphodelaceae, namely *Aloe claviflora*; and
- Species of the protected family Apocynaceae, namely *Orbea* species.

Permits from the Department of Environment and Nature Conservation (DENC) and 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 F** for a list of species assessed as part of the SCC assessment.

Concluding Remarks


This habitat unit is of intermediate sensitivity and importance from a floral ecological and resource management perspective, except for sections that have been significantly encroached and which are considered of moderately low sensitivity and importance. No significant impacts on floral ecology are anticipated from the proposed Railway Line Link Project within this habitat unit, given that mitigation measures are sufficiently implemented.

Key considerations:

- Several nationally (NFA) and provincially (Schedule 2) protected species were recorded in this habitat unit, some of which are considered range-restricted (e.g., *Euphorbia cf. duseimata*). If the proposed layout is authorised, it will be necessary to conduct a thorough walkdown of the footprint areas where all protected floral species are marked for relocation to suitable habitat outside the direct footprint (as far as is feasible). The protected species walkdown must be conducted during the flowering season of the species to ensure adequate detection and identification of the species. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. These species require permit applications from the relevant governing authorities such as DFFE and DENC before they can be harmed or relocated or destroyed.
- In terms of the National Web-based Environmental Screening Tool outcome, these areas align with the Medium Sensitivity assigned to the Plant Species Theme as the habitat is suitable for the triggered vulnerable plant species. In terms of the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme, this section is not within the triggered ESA and does not align with the high sensitivity.
- Alien vegetation was noted to encroach into several sections of this habitat unit, but woody encroachment by *Senegalia melifera* subsp. *detinens* and *Rhigozum trichophora* was a more severe problem in this habitat unit. It is recommended that an AIP plan be implemented for this habitat unit especially since the proposed Railway Line Link Project is a linear development and will possibly serve as a corridor along which AIPs can spread.
- The habitat in this section of the Beeshoek Mine is already fragmented by road and rail networks. The addition of the Railway Line Link Project will further fragment the habitat but the impact on floral ecology will be of localised extent.



4.2.3 Non-watercourse Habitat Unit

REFERENCE PHOTOS	
 <p style="text-align: center;">Anthropogenic drainage line (left and centre) and a Seasonal Depression (right photo – not within the footprint).</p>	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>The Moisture-driven habitat comprises a specialist group of vegetation adapted to living in saturated soils; however, this vegetation does not necessarily indicate a watercourse as defined in the NWA. The non-watercourse habitat is not defined as watercourses from an ecological perspective and includes seasonal depressions and an anthropogenic drainage line. Only the anthropogenic drainage line is within the Railway Line Link Project footprint.</p>	<p>The drainage line was lined with tree species, mainly comprising the terrestrial species from the surrounding habitat units. Alien vegetation was also dominant in this section, including <i>Cirsium vulgare</i>, <i>Bidens pilosa</i> and <i>Tagetes minuta</i>. Where water collects more frequently, <i>Phragmites australis</i> stands were present.</p> <p>Refer to Appendix F for a list of species recorded within this habitat unit.</p>
SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC.)	
<p>Presence of Unique Landscapes</p>	<p>From a floral perspective, the non-watercourse habitat is not considered to significantly contribute towards floral ecology within the Railway Line Link Project, nor within the greater region.</p>
<p>Species of Conservation Concern</p>	<p>No threatened SCC are located within this habitat unit, nor are any anticipated to be present. Refer to Appendix F for a list of species assessed as part of the SCC assessment.</p>



SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right: *Erigeron canadensis*, *Helichrysum argyrosphaerum*, *Cirsium vulgare*

Concluding Remarks

This habitat unit is of Moderately Low (non-watercourse habitat) sensitivity from a floral ecological and resource management perspective. The non-watercourse habitat is deemed less important from an ecological perspective and these features are species-poor in terms of native species, but well represented by alien vegetation. There is a low probability of floral SCC occurring within this habitat unit.

Important recommendations:

- For the non-watercourse habitat, none are mapped as ESAs in the 2016 Northern Cape CBA Map and no development constraints recognised for these features.
- In terms of the Screening Tool, the medium plant species theme is not supported for the triggered vulnerable plant species; however, the habitat is suitable for provincially protected floral species that are uniquely adapted to the seasonally, or periodically, soil-saturated conditions. The Very High Sensitivity in terms of the Terrestrial Sensitivity is not supported.
- No features of biodiversity significance are associated with the Non-watercourse Habitat, but it is recommended that an AIP species management plan be developed to manage AIP proliferation along these areas.



4.3 Alien and Invasive Plant 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 legislation³. Many introduced species are beneficial, e.g., almost all agriculture and forestry production are based on alien species, with alien species also widely used in industries such as horticulture. However, some of these species manage to “escape” from their original locations, spread and become invasive. Although only a small proportion of introduced species become invasive (~0.1–10%), those that do proceed to impact negatively on biodiversity and the services that South Africa’s diverse natural ecosystems provide (from ecotourism to harvesting food, cut flowers, and medicinal products) (van Wilgen and Wilson, 2018).

4.3.1 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
- **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.

³ Government Notice number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004).



Duty of care related to listed invasive species are referred to in NEMBA Section 73⁴. The motivation for this duty of care is both environmentally and economically driven. Management of alien species in South Africa is estimated to cost at least ZAR 2 billion (US\$142 million) each year - this being the amount currently spent by the national government's DFFE - i.e. the Working for Water programme (van Wilgen, 2020). Managing AIPs early on will reduce clearing costs in the long run.

4.3.2 Site Results

Of the AIPs recorded during the field assessment, four species are listed under NEMBA Category 1b and one under Category 3. The remaining species are not listed under NEMBA but species such as *Bidens pilosa*, *Chenopodium album* and *Tagetes minuta* are considered problem plants having a negative impact on indigenous floral communities within disturbed and degraded areas. Refer to Table 2 below for more information on the AIPs recorded on site.

Alien vegetation was sparse within the Natural Habitat Areas. Closer to Modified Habitat there were increases in AIPs, especially along fences, railway and road networks. The Non-watercourse habitat, especially the anthropogenic drainage line, had a greater association AIPs.

It is highly recommended that an Alien and Invasive Species Control and Management Plan be set up and implemented to ensure further loss of indigenous floral communities do not occur.

Table 2: Alien and invasive alien species associated with the Railway Line Link Project.

Scientific name	Common Name	NEMBA Status	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Non-watercourse Habitat
WOODY AIPs						
<i>Prosopis glandulosa</i> var. <i>torreyana</i>	Honey mesquite	Category 3 in NC			x	
<i>Schinus molle</i>	Peruvian pepper	Not Listed	x	x	x	
FORBS						
<i>Alternanthera pungens</i>	Khaki weed	Not Listed				
<i>Bidens pilosa</i>	Common Blackjack	Not Listed			x	x
<i>Chenopodium album</i>	Goosefoot	Not Listed			x	x

⁴ Section 73(2): A person who is the owner of land on which a listed invasive species occurs must-

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



Scientific name	Common Name	NEMBA Status	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Non-watercourse Habitat
<i>Cirsium vulgare</i>	Spear thistle, Scotch thistle	Category 1b				x
<i>Erigeron canadens</i>	Horseweed	Not Listed				x
<i>Portulaca oleracea</i>	Common purslane, also known as Duckweed	Not Listed				x
<i>Schkurhia pinnata</i>	Dwarf marigold	Not Listed			x	x
<i>Tagetes minuta</i>	Khaki bush	Not Listed			x	x
SUCCULENTS						
<i>Opuntia ficus-indica</i>	Sweet prickly pear	Category 1b		x	x	
<i>Tephrocactus articulatus</i>	Pinecone cactus, Paperspine cholla	Category 1b		x		
GRAMINOIDS						
<i>Pennisetum setaceum</i>	Fountain grass	Category 1b		x		

5 RESULTS OF THE FAUNAL ASSESSMENT

5.1 Habitat Description in terms of faunal assemblages

The Calcrete shrubland and open thornveld habitats are the dominant habitats associated with the Railway Line Link Project. These habitats are utilised by several common faunal species, whilst more specialised fauna and SCC are less likely to occur in the habitats associated with the Railway Line Link Project due to anthropogenic activities in the area and several fence structures limiting species movement, notably around the current airport area.



The seasonal depressions do not hold water all year round, however they may, following good rains, provide a temporary source of water for fauna. The collection of moisture in these depressions will, however, stimulate additional vegetation growth which may temporarily increase the forage potential of the area for herbivorous species. The anthropogenic drainage line, whilst not natural, does provide a year-round source of water for fauna and as such, does fulfil important function in the landscape.

Sections 5.2 through 5.5 below provides a summary of the outcomes of the faunal investigations within the Railway Line Link Project in relation to the identified habitat units.



5.2 Mammals

Table 3: Field assessment results pertaining to mammal species within the Railway Line Link Project.

Photograph Notes:	Mammal SCC			
	Species	Discussion	Threat Status	POC
<p>Top: Left: <i>Cynictis penicillata</i> (Yellow Mongoose). Right: <i>Cryptomys hottentotus</i> (Common Mole-rat) mounds. Bottom: Multitude of spoor observed along the edge of the ephemeral drainage line. Spoor observed in this area include: <i>Phacochoerus africanus</i> (Warthog), Domestic Goats and <i>Raphicerus campestris</i> (Steenbok).</p>	<p><i>Otocyon megalotis</i> (Bat-eared Fox)</p>	<p>Although not recorded within the Railway Line Link Project or associated buffer, individuals may forage within the area.</p>	<p>Protected - TOPS Specially Protected - NCNCA</p>	<p>M</p>
	<p><i>Orycteropus afer</i> (Aardvark)</p>	<p>This species has been observed in the adjacent Doornfontein property during the 2019 assessment, and as such, may occur within the focus area. If present, this species will most likely only use the Railway Line Link Project for foraging.</p>	<p>Specially Protected - NCNCA</p>	<p>M</p>
	<p><i>Poecilogale albinucha</i> (African Striped Weasel)</p>	<p>This species may occur on an ad hoc basis throughout the extent of the Railway Line Link Project, predominantly whilst foraging, not being limited to certain areas. This species is small enough to traverse all fences.</p>	<p>Specially Protected - NCNCA</p>	<p>M</p>
	<p><i>Vulpus chama</i> (Cape Fox)</p>	<p>This species has previously been observed in the adjacent farms. If present this species will most likely only forage herein.</p>	<p>Specially Protected - NCNCA Protected - TOPS</p>	<p>M</p>
	<p><i>Ictonyx striatus</i> (Striped Polecat)</p>	<p>This species may occur throughout the Railway Line Link Project, not being limited to certain areas. This species is small enough to traverse all fences and will likely move in and out of the habitats whilst foraging.</p>	<p>Specially Protected - NCNCA</p>	<p>M</p>
	<p><i>Felis nigripes</i> (Black-footed Cat)</p>	<p>This species is known to occur in the surrounding areas and although it is unlikely to breed within the area associated with the Railway Line Link Project, it may traverse these areas whilst foraging,</p>	<p>VU Protected - TOPS Specially Protected - NCNCA</p>	<p>M</p>



General Discussion

Mammal diversity within the Railway Line Link Project was low, predominantly as the railway route traverse areas previously disturbed from the construction and operation of roads, the airport and the current rail network. Medium size mammals such as *Phacochoerus africanus* (Warthog) and *Raphicerus campestris* (Steenbok) were evidently the most active mammals along the Railway Line Link Project, with spoor and direct observations being made. The mesopredator *Canis mesomelas* (Black-backed Jackal) is likely to forage along the proposed route as well. Small species such as *Geosciurus inauris* (Ground Squirrel), *Cynictis penicillata* (Yellow Mongoose), *Tatera leucogaster* (Bushveld Gerbil) *Elephantulus* sp. (Elephant Shrew), *Saccostomus campestris* (Pouched Mouse), *Mastomys coucha* (Southern Multimammate Mouse) and *Gerbillurus paebea* (Hairy-footed Gerbil) are also likely to occur within the habitats associated with the Railway Line Link Project. Additionally, these small species form a base food resource for mesopredators, raptors as well as predatory snakes.

The Railway Line Link Project traverses various sections of the SRA which has fences located at several location, limiting large mammal movement. Smaller mammals can more easily move through this fence structure, with several diggings identified underneath the fences, and as such are less inhibited in terms of movement and habitat access. Food resources appear sufficient, yet not abundant, for small and medium size mammals observed and expected, and as such, they will have to utilize areas outside of the Railway Line Link Project to ensure that they maintain sufficient energy intake. The section of property between the eastern railway line and the airport is also used to graze horses, which although not at high intensity, does increase resource competition amongst grazers.

Conclusion


The screening tool did not associate any sensitive or important mammals with the focus area, however following the site assessment, it is considered possible that six SCC (as listed in this table) have a medium probability of utilizing the habitat associated with the Railway Line Link Project.

Overall, the mammal abundance and diversity associated with the Railway Line Link Project was low, most likely attributable to the current and past land use activities, which has further been compounded by an extended dry period in which food resources declined and many mammal species either moved further out into the surrounding landscape in search of available resources or succumbed. The proposed Railway Line Link Project will result in a loss in the loss of habitat along its length whilst contributing to habitat fragmentation, and consequently a further decrease in species diversity and abundance. Many of the mammal species will likely relocate into the surrounding natural habitats with limited impacts to the population numbers.



5.3 Avifauna

Table 4: Field assessment results pertaining to herpetofauna within the Railway Line Link Project.

Photograph Notes:		Mammal SCC			
		Species	Discussion	Threat Status	POC
<p>Top: Left: <i>Mirafra fasciolata</i> (Fawn-coloured Lark). Right: <i>Mirafra sabota</i> (Sabota Lark). Bottom: Left: <i>Euplectes orix</i> (Southern Red Bishop). Right: <i>Prinia flavicans</i> (Black-chested Prinia).</p> 		<p><i>Ardeotis kori</i> (Kori Bustard)</p>	<p>This species has been observed foraging within the southern portion of the SRA during the field assessments for the mine expansion EIA. It is possible that this species may forage within the habitat, which is traversed by the Railway Line Link Project, though it is unlikely to breed herein.</p>	<p>VU - TOPS</p>	<p>M</p>
		<p><i>Neotis ludwigii</i> (Ludwig's Bustard)</p>	<p>This species has been recorded in the SABAP pentad 2820_2255 in 2017. This species will likely favour the Calcrete Shrubland and Open Thornveld Habitats for foraging activities but is unlikely to permanently utilise the associated areas.</p>	<p>VU – TOPS EN - IUCN Specially Protected - NCNCA</p>	<p>M</p>
		<p><i>Sagittarius serpentarius</i> (Secretarybird)</p>	<p>This species, should it occur in the habitats, will likely favour the Calcrete Shrubland and Open Thornveld Habitats within the focus area. This species is likely to only forage herein and not breed or reside permanently.</p>	<p>EN - IUCN Specially Protected - NCNCA</p>	<p>L</p>

General Discussion

Avifaunal species abundance and diversity along the Railway Line Link Project was relatively low. Although the habitat units provide suitable and varying vegetative structure for avifauna, it appears that many species have selected for the natural areas further away from the proposed Railway Line Link Project. The low abundance observed may be attributed to the existing anthropogenic activities in the area but is more likely attributable to the fact that the surrounding natural areas likely provide increased mating opportunities, habitat and food resources as they are located further away from any disturbance activities. Species observed on site, not including the ones listed above, include: *Streptopelia capicola* (Cape turtledove), *Pycnonotus nigricans* (Red-eyed bulbul), *Prinia masulosa* (Karoo Prinia), *Pterocles Namaqua* (Namaqua Sandgrouse) and *Afrotis afroides* (Northern Black Korhaan). Ground dwelling birds (bustards, korhaans, larks and coursers) will favour the more open habitat areas. Avifauna that are dependent or actively select for water bodies were restricted to the anthropogenically derived drainage line were water collects, as well as the seasonal depression when water is present therein. The seasonal depression additionally may provide temporary high forage resources for wading and other birds following periods of high rainfall.

Overall, several areas which the Railway Line Link Project traverses have been disturbed, resulting in fragmentation of the available habitats and loss of habitat for avifauna. The habitats are considered to have an intermediate amount of forage for avian species due general arid nature of the environment and previous habitat disturbances. During the summer months the overall food resource production of the herbaceous layer does increase, especially for granivorous species, and a higher abundance of avifauna can be supported. Additionally, the summer months will see an increase in insect abundance which provides an energy



rich source of food for many avifaunal species. This increase is likely mimicked by an increase in small mammals as well as lizards and skinks which are an important food resource for raptors and some smaller bird species.

Conclusion

Only common avifaunal species were observed along the proposed Railway Line Link Project, whilst there remains the potential that three SCC may utilise the associated habitats for foraging. Overall, species abundance levels will vary within the Railway Line Link Project in accordance with rainfall and seasonal changes and these effects on available food resources, with some avifaunal species migrating north during the winter months.

Clearing of vegetation along the Railway Line Link Project will impact on habitat availability, leading to highly localised migration of avifaunal species to adjacent habitats outside that of the proposed footprint as well as to areas further away. Species that relocate into the surrounding areas will be subject to higher levels of competition for food resources and space which may lead to further species displacement and potentially, species loss. Many of the species observed during the field assessment will likely remain in the area, as they appear to be well adapted to the already existing mine operations, road noise and active railways already present.



5.4 Herpetofauna


Table 5: Field assessment results pertaining to herpetofauna within the Railway Line Link Project.

Photograph Notes:	Discussion
<p>Top: Left: <i>Pedioplanis lineocellata lineocellata</i> (Spotted Sand Lizard). Right: <i>Stigmochelys pardalis</i> (Leopard Tortoise). Bottom: anthropogenically derived drainage line containing water.</p>	<p>No amphibian or reptile SCC were observed within the Railway Line Link Project during the assessments. Further, consultation of the various databases such as the Animal Demography Units Virtual Museum and iNaturalist also indicated no previous records of any herpetofauna SCC. The arid nature of the Railway Line Link Project naturally limits amphibian diversity, yet it will be favoured by reptiles who are generally physiologically well adapted for such climates. The drainage line presents an ideal locality for amphibians to breed within, as it appears to hold water all year round due to water discharge from the mine (although water quality may impact suitability of this water source). Overall amphibian diversity, conferred with the online databases indicates a low expected species composition, with only less water dependant species such as <i>Kassina senegalensis</i> (Bubbling Kassina) (observed) in anthropogenically derived drainage line, <i>Vandijkophrynus gariiepensis gariiepensis</i> (Karoo Toad), <i>Sclerophrys poweri</i> (Power's Toad), <i>Tomopterna cryptotis</i> (Tremelo Sand Frog) and <i>Breviceps adspersus</i> (Bushveld Rain Frog) expected to occur within the Railway Line Link Project. Food resources around the anthropogenically derived drainage line and seasonal depressions are likely to be sufficient for amphibian species due to the increased abundance of insect species surrounding these localities, however this will be seasonal, with the remaining periods of the year noting a decrease in food resources. During this time, it is likely that most amphibian species will go into a state of aestivation or limited activity, either burrowing down into the ground or seeking shelter under larger logs or rocks in the vicinity of these habitats.</p> <p>A low diversity and abundance of reptile species were observed along the proposed Railway Line Link Project, with the majority of species observed being the smaller Sandveld and Sand Lizards - <i>Nucras intertexta</i> (Spotted Sandveld Lizard) and <i>Pedioplanis lineocellata lineocellata</i> (Spotted Sand Lizard) which were observed on many occasions, whilst <i>Agama aculeata aculeata</i> (Common Ground Agama) and an individual as well as a Leopard Tortoise was only observed once. It is important to remember that reptiles are inherently secretive and shy, making their detection and identification in the field challenging. As such, based on the available databases, habitat availability and the databases, the Railway Line Link Project is likely to support a moderate diversity of common reptile species which are well represented in the region. Reptile species are likely to make use of all habitat units, with many of the skinks being closely associated with the areas of infrastructure as they appear to be highly adaptable to modified environments. Food resources for reptiles will follow a cyclical nature, with prey species (invertebrates and small mammals) numbers being determined by seasons and similarly, the vegetation growth/decline accompanying such changes.</p>
 	
<p>Conclusion</p> <p>Reptiles are well adapted to surviving in arid areas and as such, are often some of the only species inhabiting these areas. Likewise, reptiles can adapt to modified environments more readily than other species, provided there are suitable food resources available. Conversely, amphibian species are not well suited to such environments and often are some of the first species to decline in changing environments (through loss of water resources as well as changes to water quality). Many of the reptiles will be able to self-relocate as habitat is cleared, however amphibian species cannot do so as readily, notably those that are more dependent on being located nearby to areas of increased moisture. Should the anthropogenically derived drainage line be disturbed and water flow cease, this will have a significant impact on amphibian species, likely leading to the loss individuals herein who rely on this habitat. Reptile species will likely be able to exist within or adjacent to these areas or relocate to the surrounding natural areas ahead of construction activities.</p>	



5.5 Invertebrates

Table 6: Field assessment results pertaining to invertebrates within the Railway Line Link Project.

Photograph Notes:		Mammal SCC			
Top: Left: <i>Acanthopplus discoidalis</i> (Brown Armoured Corncricket). Right: <i>Chilades trochylus</i> (Grass Jewel Blue). Bottom: Left: <i>Acmaeodera viridaenea</i> (Glittering Jewel Bug). Right: <i>Uroplectes carinatus</i> (Common Lesser-thicktail).		Species	Discussion	Threat Status	POC
	<i>Pterinochilus</i> spp	Species of this genus dig vertical burrows in sandy soil where the either lay in wait for prey species or come out at night and hunt. Suitable sandy substrate for burrowing activities was observed along the Railway Line Link Project route.	Specially Protected – NCNCA	M	
	<i>Ceratogyrus</i> spp and <i>Harpactira</i> spp	Although there are no records of species from either genus occurring within the focus area or surrounds, there remains a possibility that individuals may still occur along the Railway Line Link Project.	Specially Protected – NCNCA Protected - TOPS	L	
	<i>Hadogenes</i> spp and <i>Opisthacanthus</i> spp	Although there are no records of species from either genus occurring within the focus area or surrounds, there remains a possibility that individuals may still occur along the Railway Line Link Project.	Protected – NCNCA Protected - TOPS	L	
	<i>Opisththalmus</i> spp	Species from this genus have been recorded in the region of Postmasburg. Similar habitat presents within the Railway Line Link Project and as such there is an increased likelihood that species from this genre may occur within the focus area.	Protected – NCNCA Protected - TOPS	M	

General Discussion

Although the Railway Line Link Project is located in the more arid, western portion of South Africa, a relatively high abundance of invertebrates was observed. Insect species of the Orders Coleoptera, Orthoptera and Lepidoptera were observed along the entire length of the Railway Line Link Project, though the overall diversity therein was not notably high. The extended dry period which has recently been experienced may have led to the deaths and under-recovery of the more sensitive / niche insect species, leaving the generalist species to proliferate. Generalist species observed have the ability to utilize various plants as food resources, an important adaptation for arid environment survival. Insects are generally the most abundant macro-organisms within landscapes and often perform services vitally important for ecosystem functioning. Therefore, high insect abundance and diversity can indicate a healthy landscape. Insects serve as pollinators, remove detritus material, bury dung and associated parasites below the surface helping to cycle nutrients back into the soil while decreasing the parasitic load within an environment, reducing the risk of disease. Additionally, insects serve as a food resource for various fauna within the focus area, and as such an increased insect diversity and abundance within the focus area buffers forage sustainability for other faunal species as well as helps to maintain ecosystem functioning.

Several Nymphalidae (Monarch butterflies) and Lycaenidae (Coppers and Blues), which are all protected within the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA) are known to occur within the area. The habitat integrity of the study area for insects is considered moderately high. Although habitat transformation has occurred the remaining habitats are largely still inhabitable for insects with food resources varying for different insect orders in accordance with the vegetation and season.



Arachnid species are notoriously hard to detect over a relatively short period of time, which can often lead to the under estimation of diversity and abundance. Taking this into consideration, habitat conditions for arachnids as well as available resources were analysed, whilst additional information on arachnid occurrences and species diversity for the QDS was collected from databases such as iNaturalist and the Animal Demography Unit (ADU). During the site assessment, only a small number of arachnid species were observed, considering the apparent suitability of the habitat. The relatively similar landscape of the Railway Line Link Project, provides suitable habitat for several common arachnids and potential SCC. Many arachnid species only venture out during the safety of night when they can avoid desiccation from the sun, opting to seek refuge under rocks, bark and dead trees during the day. Arachnid species are predatory, preying predominantly on invertebrates and in some instances small reptiles and rodents. Although the Railway Line Link Project was abundant in insect species, many of these were flying and largely arboreal species, limiting actual food availability to ground dwelling arachnids such as scorpions and ground hunting spiders. Further, such food resources are cyclical in nature, commensurate with the seasons, which will, to a degree, inhibit arachnid populations in the focus area. Arachnids observed, apart from those listed above, include Family Agelenidae (Funnel Weaving Spiders), *Argiope australis* (Common Garden Orbweb Spider) and Genus *Thanatus* (Spider).

Conclusion

The proposed Railway Line Link Project will likely support an abundance of invertebrate species, however, due to the arid nature of the region, the diversity thereof will be limited to species that are well adapted to such conditions. Due to the extended dry period experienced up until late 2020, invertebrate assemblages, although well represented for the region, likely still have to fully recover. The proposed Railway Line Link Project construction will impact invertebrates as a result of habitat loss and species displacement. The railway may also lead to increased vibration disturbances in surrounding habitats, which may be unfavourable to ground dwelling arachnids who rely on subtle vibrations to detect prey. Such hinderances to hunting may result in these species relocating to more suitable areas further away, decreasing species abundances and diversity in the surrounding habitat. Overall, although the habitat supports an abundance of invertebrates, the proposed Railway Line Link Project development is unlikely to pose a significant negative impact to vertebrate species.



6 SENSITIVITY MAPPING

Based on the ground-truthed results of the site visit, Table 7 below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development whilst Table 8 presents the faunal sensitivity for each habitat.

Figures 10 - 11 conceptually illustrate the areas considered to be of varying ecological sensitivity and how they will be impacted by the proposed Railway Line Link Project. The areas are depicted according to their sensitivity in terms of the presence or potential for floral SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity (compared to a reference type).

Table 7: A summary of the floral sensitivity of each habitat unit and implications for development.

Habitat Sensitivity	Habitat Unit	Conservation Objective
<p style="text-align: center;">Low</p>	<p>Modified Habitat Unit (Transformed Habitat)</p>	<p>Optimise development potential.</p>
Key Floral Habitat Characteristics		
<ul style="list-style-type: none"> - Indigenous floral diversity was low or absent. - Habitat not representative of the reference states. - Floral SCC are absent. The potential for the habitat to support viable populations of SCC is deemed low. 		
Habitat Sensitivity	Habitat Unit	Conservation Objective
<p style="text-align: center;">Moderately Low</p>	<p>Moisture-driven Habitat (Non-watercourse)</p> <p>“Mixed” Calcrete Shrubland</p> <p>Degraded Thornveld</p>	<p>Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.</p>
Key Floral Habitat Characteristics		
<ul style="list-style-type: none"> - Indigenous floral diversity was low or absent. - Habitat not representative of the reference states. - Floral SCC are absent. The potential for the habitat to support viable populations of SCC is deemed low. - Heavily encroached by <i>Senegalia melifera</i> subsp. <i>detinens</i> and/or <i>Rhigozum trichophora</i>. 		

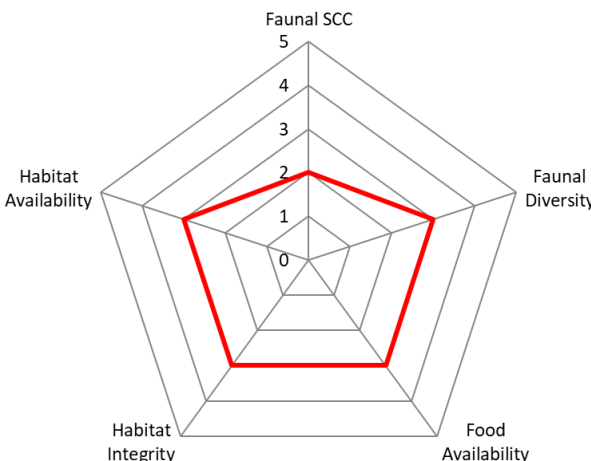
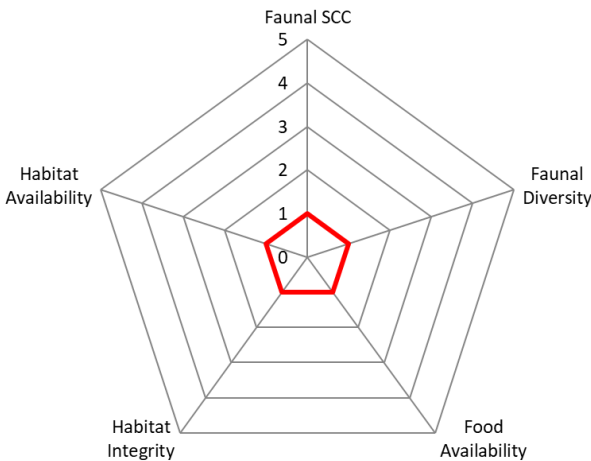


Habitat Sensitivity	Habitat Unit	Conservation Objective
Intermediate	“Pure” Calcrete Shrubland	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.
	Open Thornveld Habitat	
	Key Floral Habitat Characteristics <ul style="list-style-type: none"> - Habitat is largely intact and moderately representative of the reference states, but some degradation has occurred in certain areas due to grazing pressures and encroaching woody species. - The habitat is largely represented by indigenous species with several nationally (NFA) and provincially (Schedule 2) protected floral species present. - No threatened species were recorded in this habitat; however, suitable habitat is present for a vulnerable species triggered by the Screening Tool. 	

Table 8: A summary of the faunal sensitivity of each habitat unit and implications for development.

Habitat Sensitivity	Habitat Unit	Conservation Objective
Moderately High	Anthropogenically derived drainage line	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
	Key Faunal Habitat Characteristics <ul style="list-style-type: none"> - Year-round water resource for faunal species. - Niche habitat provision for amphibian and water dependant species. - Increased vegetation growth providing refuge and higher food resources for fauna. 	



Habitat Sensitivity	Habitat Unit	Conservation Objective
Intermediate		
	<p>“Pure” Calcrete Shrubland</p> <p>Open Thornveld Habitat</p>	<p>Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.</p>
Key Faunal Habitat Characteristics		
<ul style="list-style-type: none"> - Widespread and open habitat supports an abundance of faunal species. - Vegetation provides refuge, breeding areas and food resources for common faunal species. - Faunal SCC are absent. The potential for the habitat to support viable populations of SCC is deemed low. 		
Habitat Sensitivity	Habitat Unit	Conservation Objective
Low		
	<p>Transformed Habitat</p>	<p>Optimise development potential.</p>
Key Faunal Habitat Characteristics		
<ul style="list-style-type: none"> - Indigenous plant diversity was low or absent thereby reducing suitable habitat and food resources for faunal species. - Faunal SCC are absent. The potential for the habitat to support viable populations of SCC is deemed low. 		



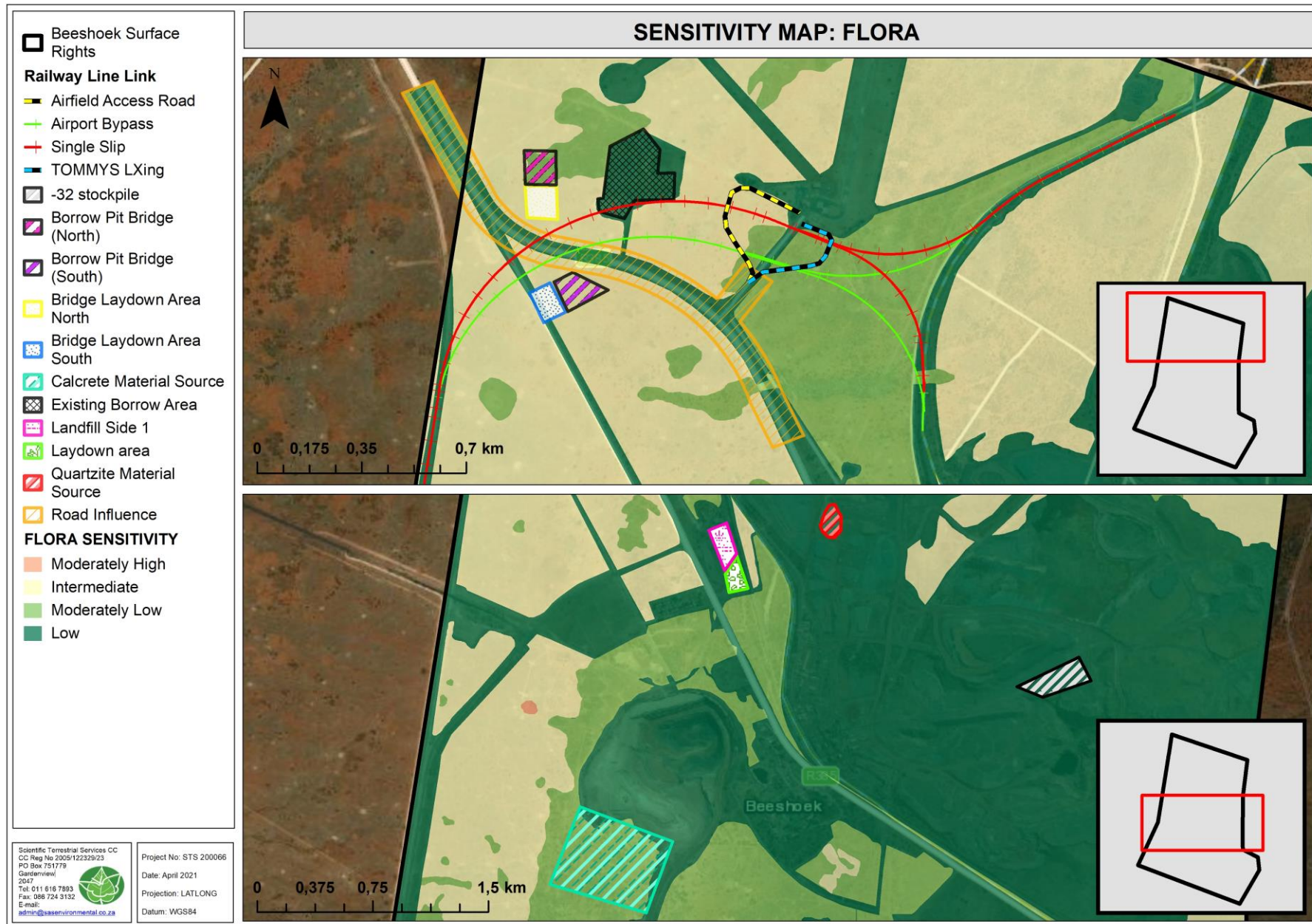


Figure 10: Floral sensitivity map for the Railway Line Link Project.



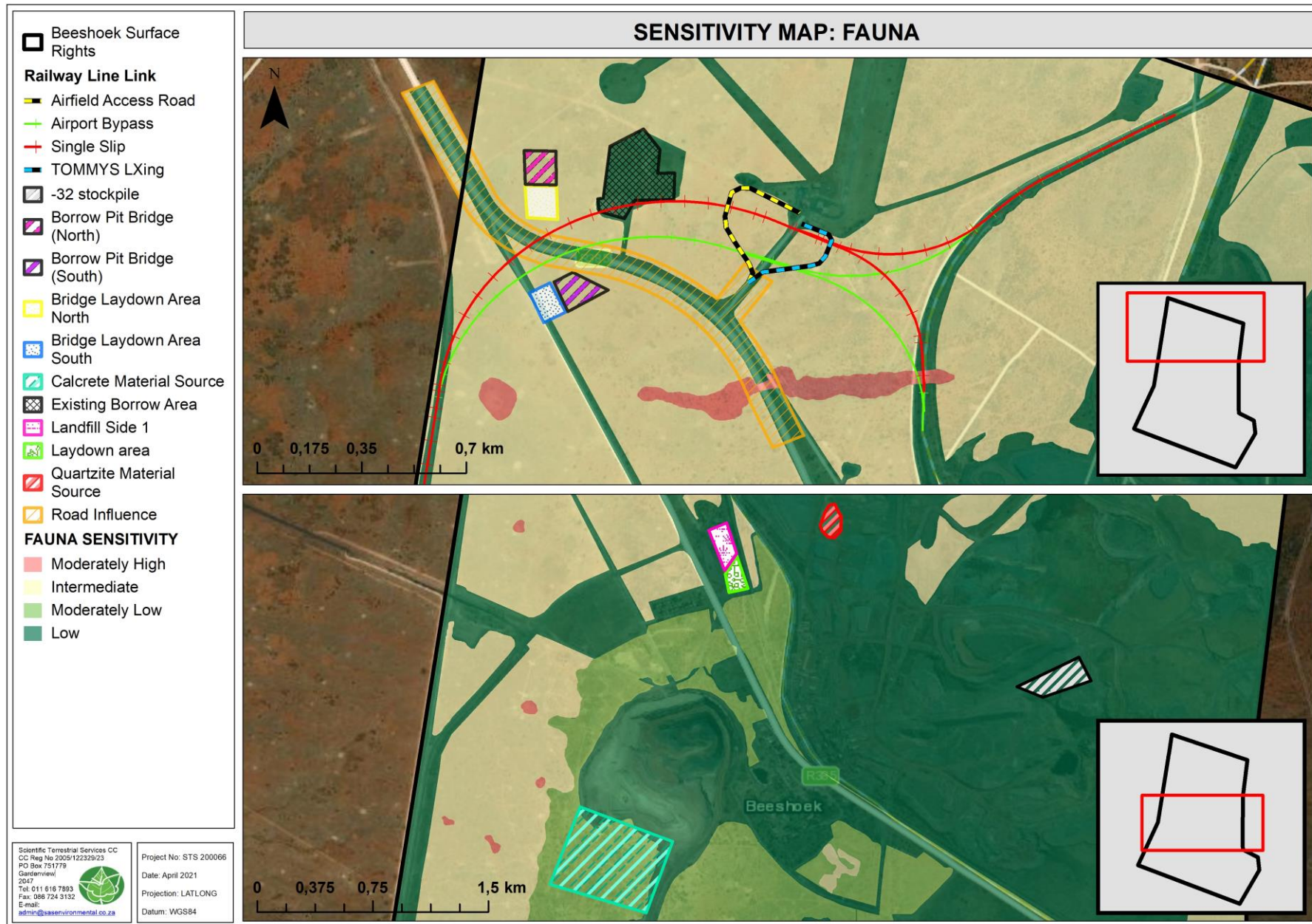


Figure 11: Faunal sensitivity map for the Railway Line Link Project.



7 IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts on the floral and faunal ecology of the Railway Line Link Project. An impact discussion and assessment of all potential pre-construction, construction, operational and maintenance phase impacts are provided in Section 7.1 and 7.2. All mitigatory measures required to minimise the perceived impacts are presented in Section 7.3.

Table 9: Activities and Aspects likely to impact on the faunal and floral resources of the Railway Line Link Project.

ACTIVITIES AND ASPECTS REGISTER	
Pre-Construction Phase	
-	Potential failure to conduct a walkdown of the route prior to construction activity to identify SCC locations.
-	Potential failure to relocate floral or faunal SCC to suitable habitat outside the Railway Line Link Project footprint.
-	Impact: Loss of faunal or floral SCC within the Railway Line Link Project footprint areas in the focus area.
-	Potential failure to obtain permits for nationally and provincially protected plant species that must be removed during the construction phase.
-	Impact: Loss of floral SCC within the Railway Line Link Project footprint areas in the focus area.
-	Inconsiderate planning, infrastructure placement and design, leading to the loss of potential sensitive floral and faunal species and/or habitat for such species, as well as unnecessary edge effect impacts on areas outside of the proposed Railway Line Link Project footprint.
-	Impact: Degradation and modification of the receiving environment, loss of faunal and floral habitat.
-	Potential failure to design and implement an Alien and Invasive Plant (AIP) Management/Control plan before the commencement of construction activities, resulting in the spread of AIPs from the Railway Line Link Project footprint to surrounding natural habitat.
-	Impact: Spreads of AIPs, leading to potential loss of floral species diversity from surrounding natural habitat.
Construction Phase	
-	Site clearing and the removal of vegetation.
-	Impact: Loss of faunal and floral habitat, diversity, and the possible loss of floral SCC.
-	Potential failure to monitor the success of relocated floral SCC.
-	Impact: Loss of SCC individuals.
-	Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the further transformation of adjacent natural habitat.
-	Impact: Loss of favourable faunal and floral habitat outside of the direct Railway Line Link Project footprint, including a decrease in species diversity and a potential loss of faunal and floral SCC.
-	Dumping and laydown of construction material within areas where no construction is planned thereby leading to habitat disturbance - allowing the establishment and spread of AIPs and further alteration of faunal habitat.
-	Impact: Loss of preferred faunal and floral habitat, diversity and SCC as AIPs outcompete the indigenous plant species in these disturbed areas.
-	Potential overexploitation through the trapping and/or hunting of faunal species, including faunal SCC, beyond the direct footprint area.
-	Impact: Local loss of faunal abundance and diversity.
-	Potentially poorly managed edge effects: <ul style="list-style-type: none"> • Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the floral habitat; and • Compaction of soils outside of the focus area due to indiscriminate driving of construction vehicles through natural vegetation.
-	Impact: Loss of floral and faunal habitat, diversity, and SCC within the direct footprint of the proposed development. Loss of surrounding floral and faunal diversity and floral SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.
-	Habitat fragmentation resulting from the construction of linear developments.
-	Impact: Long-term changes in floral structure, faunal movement and behavioural patterns, loss of genetic potential and genetic spread. Potential loss of faunal SCC due to barriers to movement whilst searching out habitat or mates.



ACTIVITIES AND ASPECTS REGISTER
<ul style="list-style-type: none"> - Possible increased fire frequency during construction. - Impact: Loss or alteration of floral and faunal habitat and species diversity.
<ul style="list-style-type: none"> - Dust generated during construction and operational activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants⁵ and potentially further decreasing optimal growing/re-establishing conditions. - Impact: Declines in plant functioning leading to loss of floral species and habitat for optimal growth.
Operational and Maintenance Phases (Railway)
<ul style="list-style-type: none"> - Potential failure to monitor the success of relocated floral SCC. - Impact: Loss of SCC individuals.
<ul style="list-style-type: none"> - Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the footprint area. - Impact: Ongoing or permanent loss of faunal and floral habitat, diversity, and potential SCC.
<ul style="list-style-type: none"> - Increased human presence in the area as part of maintenance activities, potentially leading to illegal harvesting/ collection of SCC plants, the persecution of fauna, or an increased risk of fire frequency impacting on floral and faunal communities in the surrounding natural habitat. - Impact: Loss of faunal and floral habitat, medicinal flora, and SCC, as well as overall species diversity within the local area.
Decommissioning & Closure Phase (Borrow pits, stockpile, material sources)
<ul style="list-style-type: none"> - Ineffective rehabilitation of exposed and impacted areas potentially leading to a shift in vegetation type; - Impact: Permanent loss of floral and faunal habitat, diversity and SCC, and a higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity.
<ul style="list-style-type: none"> - Potential poor management and failure to monitor rehabilitation efforts, leading to: <ul style="list-style-type: none"> • Landscapes left fragmented, resulting in reduced dispersal capabilities of floral species, reduced habitation and dispersal capabilities of faunal species, and an overall decrease in floral and faunal diversity; • Compacted soils limiting the re-establishment of natural vegetation; • Increased risk of erosion in areas left disturbed. - Impact: Long-term (or permanent) loss of floral and faunal habitat, diversity and SCC.
<ul style="list-style-type: none"> - Disturbance of soils as part of demolition activities. - Impact: Loss of favourable growing conditions for floral communities and the subsequent loss of faunal habitat.
<ul style="list-style-type: none"> - Insufficient aftercare and maintenance leading to erosion and sedimentation. - Impact: Loss of floral and faunal habitat and overall species diversity within the area.

7.1 Floral Impact Assessment

7.1.1 Floral Impact Assessment Results

The below table indicates the perceived risks to the floral ecology associated with all phases of the proposed Railway Line Link Project. 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.

⁵ Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.).



Table 10: Impact on the floral ecology the proposed Railway LinkRailway Line Link Project.

Impacting Activities	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PLANNING PHASE																
Habitat and Diversity																
Modified Habitat Unit	3	1	2	1	2	4	5	20 Very low	2	1	1	1	1	3	3	9 Very low
Non-watercourse habitat	3	2	2	1	2	5	5	25 Very low	2	2	1	1	1	4	3	12 Very low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	4	3	3	2	2	7	7	49 Low	2	3	2	1	1	5	4	20 Very low
Species of Conservation Concern																
Modified Habitat Unit and Non-watercourse habitat	4	2	1	2	2	7	5	35 Low	3	2	1	1	1	5	3	15 Very low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	4	3	3	2	2	7	7	49 Low	3	3	2	1	1	6	4	24 Very low
CONSTRUCTION PHASE																
Habitat and Diversity																
Modified Habitat Unit	5	1	2	2	2	6	6	36 Low	3	1	1	2	2	4	5	20 Very low
Non-watercourse habitat	5	2	2	2	2	7	6	42 Low	3	2	1	2	2	5	5	25 Very low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	5	3	3	2	2	8	7	56 Medium-low	5	3	2	2	2	8	6	48 Low
Species of Conservation Concern																
Modified Habitat Unit and Non-watercourse habitat	1	2	1	1	2	3	4	12 Very low	1	2	1	1	2	3	4	12 Very low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	4	3	3	2	2	7	7	49 Low	2	3	2	1	2	5	5	25 Very low
OPERATIONAL AND MAINTENANCE PHASES																
Habitat and Diversity																
Modified Habitat Unit	2	1	2	2	4	3	8	24 Very low	1	1	1	3	4	2	8	16 Very low
Non-watercourse habitat	2	2	2	2	4	4	8	32 Low	2	2	3	3	4	4	10	40 Low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	3	3	2	2	4	6	8	48 Low	1	3	1	1	4	4	6	24 Very low
Species of Conservation Concern																
Modified Habitat Unit and Non-watercourse habitat	1	2	2	2	4	3	8	24 Very low	1	2	1	1	4	3	6	18 Very low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	3	3	2	2	4	6	8	48 Low	2	3	2	1	4	5	7	35 Low
DECOMMISSIONING AND CLOSURE PHASE																
Habitat and Diversity																
Modified Habitat Unit	2	1	3	3	3	3	9	27 Low	1	1	2	2	3	2	7	14 Very low
Non-watercourse habitat	1	2	1	1	1	3	3	9 Very low	1	2	1	1	1	3	3	9 Very low



Impacting Activities	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	3	3	2	2	3	6	7	42 Low	2	3	2	1	2	5	5	25 Very low
Species of Conservation Concern																
Modified Habitat Unit and Non-watercourse habitat	1	2	2	2	4	3	8	24 Very low	1	2	1	1	2	3	6	18 Very low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	3	3	2	2	3	6	7	42 Low	2	3	2	1	2	5	5	25 Very low

7.1.2 Impact Discussion

The impact assessment was undertaken on all aspects of floral ecology deemed likely to be affected by the proposed Railway Line Link Project. Refer to Table 11 for a summary breakdown of the anticipated impacts from the proposed Railway Line Link Project.

Table 11: Habitat Unit impact summary – associated with the Railway Line Link activities.

	Calcrete Shrubland	Cryptic Wetlands	Degraded Thornveld	Episodic Drainage Line	Open Thornveld	Preferential flow paths	Recharge Zone	Rupicolous Habitat	Seasonal Depressions	Transformed Habitat
Extent (ha) of Habitat Unit within the Beeshoek SRA	1196	17	255	8	686	14	25	812	15	2016
Total Extent (ha) of Habitat Unit Impacted by proposed Railway Line Link Project	10	-	26	-	5	1	-	-	-	30
Percentage (%) of each habitat unit impacted within the Beeshoek SRA resulting from the Railway Line Link activities	0,9%	-	10,1%	-	0,7%	3,6%	-	-	-	1,5%

Direct impacts on floral habitat and species diversity will be greatest during the construction phase, with secondary impacts from poorly managed edge effects (e.g., AIP proliferation, disturbed areas left unrehabilitated) to be most significant during the operational and maintenance phases. The impacts will be limited in their extent and the perceived effects on floral ecology can be kept to a local scale with sufficiently implemented mitigation measures. The decommissioning and closure phase can result in positive impacts if vegetation is adequately reinstated.



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 and reinstated as part of rehabilitation activities. 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. With the small extent of the Railway Line Link Project, floral SCC is anticipated to be minimally impacted on, given that mitigation measures are adequately implemented.

7.1.2.1 Impact on Floral Habitat and Diversity

The impact assessment was undertaken on all aspects of floral ecology deemed likely to be affected by the proposed Railway Line Link Project. The proposed Railway Line Link Project will result in the clearance of vegetation that is of **intermediate sensitivity** (Natural Habitat Areas) and **moderately low sensitivity** (Non-watercourse habitat, encroached sections in the Natural Habitat Areas, Degraded Thornveld), with some sections of **low sensitivity** (Modified habitat unit).

The below table summarises the extent of habitat that will be impacted by the proposed Railway Line Link Project in relation to the habitat that will be lost resulting from additionally proposed activities within the Beeshoek SRA (Project 1 – 5: STS 190023, 2021).

Table 12: Approximate extent of habitat impacted by the proposed Railway Line Link Project, including percentage of habitat lost in relation to total habitat that will be lost to additionally proposed activities.

HABITAT UNIT	Calcrete Shrubland	Cryptic Wetlands	Degraded Thornveld	Episodic Drainage Line	Open Thornveld	Preferential flow paths	Recharge Zone	Rupicolous Habitat	Seasonal Depressions	Transformed Habitat
Extent (ha) of Habitat Unit Impacted by proposed Railway Line Link Project	10	-	26	-	5	1	-	-	-	30
Total Extent (ha) of Habitat Unit Impacted by additional activities proposed within the Beeshoek SRA (Project 1 – 5: STS 190023, 2021)	133	-	157	-	107	4	-	131	1	948
Total Extent (ha) of Habitat Unit Impacted by all proposed activities (Projects 1 - 5 & Railway Line Link)	143	-	183	-	112	5	-	131	1	978
Percentage of total habitat unit lost resulting from the Railway Line Link	7%	-	14%	-	4%	11%	-	-	-	3%



Prior to mitigation measures implemented, impact significance on floral habitat and diversity varies between **Medium-Low** (Natural Habitat Areas), **Low** (Non-watercourse habitat) and **Very Low** (Modified habitat unit). With mitigation measures implemented, the direct and indirect impacts on the floral habitat and diversity can mostly be reduced to **Low** and **Very low** for the Modified habitat and Non-watercourse habitat.

The most significant impacts to affect the floral habitat integrity and species diversity resulting from the proposed Railway Line Link Project construction include, but are not limited to, the following:

- Clearance of habitat with numerous individuals of nationally and provincially protected floral species;
- Habitat fragmented and resulting in reduced movement of species and reduced dispersal opportunities for plant species;
- 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; and
- AIP proliferation and woody encroachment into natural vegetation, displacing indigenous flora and altering favourable habitat conditions for the establishment of indigenous species.

7.1.2.2 Impacts on Floral SCC

The proposed Railway Line Link Project is associated with floral SCC, which will directly be impacted by the proposed activities. The SCC recorded on site include species protected under the NCNCA (Schedule 2) and the NFA, which are species not threatened in terms of NEMBA Section 56. The below table provides an indication of the abundance of SCC associated with each habitat unit in which project activities will take place.

Table 13: Floral SCC summary per habitat unit.

HABITAT UNIT	Impacts on protected SCC	Total Extent (ha) of Habitat Unit Impacted by proposed Railway Line Link Project
Calcrete Shrubland	High abundance of protected SCC	10
Degraded Thornveld	Moderate abundance of protected SCC	26
Open Thornveld	Moderate abundance of protected SCC	5
Preferential flow paths	Low association with protected SCC	1
Transformed Habitat	Low association with protected SCC	30

Without mitigation implemented, the anticipated impact significance on floral SCC communities varies between **Low** (Natural Habitat Areas) and **Very Low** (Modified and Non-watercourse habitat). The impacts on SCC are deemed to be mitigatable and thus with



mitigation measures implemented, the impact significance can be reduced to **Low and Very low** significance levels.

The proposed Railway Line Link Project is anticipated to have minimal impact on floral SCC and with mitigation measures implemented the impacts can remain localised in extent. Succulents and geophytes are good candidates for rescue and relocation to suitable sites outside of the proposed Railway Line Link Project footprint. Woody species such as the numerous *Boscia albitrunca* individuals are likely to be transplanted successfully; however, association with termite mounds may lead to establishment complications. *Vachellia erioloba* individuals cannot be transplanted successfully due to the wide extent and morphology of the tree's root system, hence transplanting of trees usually involves substantial removal of roots. However, in general, the whole transplanting process in particular for large trees is an engineering feat and requires substantial involvement of resources and time. Instead, seeds can be harvested from the surrounding areas and / or from the individuals that will be cleared as part of vegetation clearing activities to be propagated off-site and reinstated as part of rehabilitation activities.

Schedule 2 Protected Plants require permits from the DENC before vegetation clearing can commence, with NFA protected species requiring permits and authorisation from DFFE.

Due to the potential for threatened plant species (RDL plants as per NEMBA Section 56) to occur within the proposed railway footprint, it is recommended that a walkdown of the site take place prior to vegetation clearance activities. The walkdown should take place in the optimal season for detecting the threatened species, i.e., typically between November and March, as well as winter months for some species.

Activities which are likely to negatively affect the flora of conservation concern within and around the Railway Line Link Project include, but are not limited to, the following:

- Disturbance, fragmentation and alteration of 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.

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

The proposed development will not impact on CBAs or threatened ecosystems. An ESA will be impacted by the proposed Calcrete material source; however, the section of the ESA has been degraded in terms of habitat integrity. This section of the ESA is also fragmented by



roads, thus limiting potential to serve as an important dispersal corridor. Edge effect impacts from the adjacent mining activities have further degraded floral communities and overall, the ESA is not considered important for ecological processes in the area.

7.1.3 Probable Residual Impacts

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

- Fragmentation of ecologically intact habitat resulting in altered ecological functioning of habitat beyond the authorised Railway Line Link Project footprint;
- Permanent loss of and altered floral species diversity outside of the Railway Line Link Project, including loss of favourable habitat for SCC if effects from AIP proliferation and the intensification of woody encroachment is not managed; and
- Loss of NFA protected tree species resulting from increased vegetation clearing and/or harvesting in the region.

7.1.4 Cumulative Impacts

A significant threat for the floral ecology within the Railway Line Link Project is the potential proliferation of AIP species and particularly a potential for indigenous bush encroachment, resulting in the overall loss of native floral communities within the local area.

7.2 Faunal Impact Assessment

7.2.1 Faunal Impact Assessment Results

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



Table 14: Impact on the faunal ecology the proposed Railway Line Link Project.

Impacting Activities	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PLANNING PHASE																
Habitat and Diversity																
Modified Habitat Unit	3	1	2	1	2	4	5	20 Very low	2	1	1	1	1	3	3	9 Very low
Non-watercourse habitat	3	4	2	1	2	8	5	40 Low	2	4	1	1	1	4	3	12 Very low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	4	3	3	2	2	7	7	49 Low	2	3	2	1	1	5	4	20 Very low
Species of Conservation Concern																
All habitats	4	3	3	2	2	7	7	49 Low	3	3	2	1	1	6	4	24 Very low
CONSTRUCTION PHASE																
Habitat and Diversity																
Modified Habitat Unit	5	1	2	2	2	6	6	36 Low	3	1	1	2	2	4	5	20 Very low
Non-watercourse habitat	5	4	2	2	2	9	6	54 Medium low	3	4	1	2	2	7	5	35 Low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	5	3	3	2	2	8	7	56 Medium-low	5	3	3	2	2	8	7	56 Medium-low
Species of Conservation Concern																
All habitats	5	3	4	2	2	8	8	64 Medium-low	2	3	2	2	2	5	6	30 Low
OPERATIONAL AND MAINTENANCE PHASES																
Habitat and Diversity																
Modified Habitat Unit	2	1	2	2	4	3	8	24 Very low	1	1	1	3	4	2	8	16 Very low
Non-watercourse habitat	2	4	2	2	4	6	8	48 Low	2	4	2	1	4	6	7	42 Low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	3	3	3	2	4	6	9	54 Medium-low	2	3	1	1	4	5	6	30 Low
Species of Conservation Concern																
All Habitats	3	3	3	2	4	6	9	54 Medium-low	2	3	2	1	4	5	7	35 Low
DECOMMISSIONING AND CLOSURE PHASE																
Habitat and Diversity																
Modified Habitat Unit	2	1	3	3	3	3	9	27 Low	1	1	2	2	3	2	7	14 Very low
Non-watercourse habitat	1	2	1	1	1	3	3	9 Very low	1	2	1	1	1	3	3	9 Very low
Natural Habitat Areas (Calcrete Shrubland and Open Thornveld)	3	3	2	2	3	6	7	42 Low	2	3	2	1	2	5	5	25 Very low
Species of Conservation Concern																
All Habitats	3	3	2	2	3	6	7	42 Low	2	3	2	1	2	5	5	25 Very low



7.2.2 Impact Discussion

Direct impacts on faunal habitat and species diversity will be greatest during the construction phase with secondary impacts stemming from poorly managed edge effects and potential hunting/snaring of species during this phase. During the operational phase, these impacts will decrease as there will be less people on site and less vehicles movement, however habitat fragmentation and reduced faunal movement is considered the greatest impact. The impacts will be limited in their extent and the perceived effects on faunal ecology can be kept to a local scale with sufficiently implemented mitigation measures.

Potential impacts on protected faunal species are expected to be higher during the planning phase during which a walk down should be done and where necessary species rescued and relocated. Impacts during the construction and operational phase can be reduced to lower impact significance on faunal SCC provided the walk down is undertaken and all construction teams are monitored to ensure no snare or traps are set and that no species are collected for the pet trade either. Due to the limited extent of the Railway Line Link Project and the already degraded state of the habitats, impacts to faunal SCC are not anticipated to be high, provided mitigation measures are adequately implemented.

7.2.2.1 Impact on Faunal Habitat and Diversity

The impact assessment was undertaken on all aspects of faunal ecology deemed likely to be affected by the proposed development. The proposed development will result in the clearance of vegetation that is largely of **intermediate sensitivity** (Natural habitat areas) but also includes areas of **moderately high** (Non-watercourse habitat) and **low** (Modified habitat unit) sensitivity.

Prior to mitigation measures implemented, impact significance on faunal habitat and diversity varies between **Medium-Low** (Natural habitat areas and non-watercourse habitat) and **Low to Very Low** (Modified habitat unit). With mitigation measures implemented, the impacts on the faunal habitat and diversity can mostly be reduced to **Very low** for the Modified habitat and **Low** for the Non-watercourse habitat. Impact significance remains **Medium-Low** for the Natural Habitat Areas during the construction phase but can be reduced to **Low** significance during the operational and maintenance phase.

Most significant impacts that affect the faunal habitat and species diversity stemming from the proposed Railway Line Link Project construction include, but are not limited to, the following:

- Clearance of habitat leading to the displacement of faunal species;



- Habitat fragmented and resulting in reduced movement of species and potentially reduced dispersal opportunities;
- Increased risk of trapping / snaring and the potential collection for the pet / muti trade;
- AIP proliferation and woody encroachment into natural vegetation, displacing indigenous vegetation and altering favourable habitat conditions for faunal species.

7.2.2.2 Impacts on Faunal SCC

The proposed Railway Line Link Project is associated with habitats that may, from time to time, be utilised by faunal SCC either for foraging or whilst moving through the local area. No SCC were recorded on site, however, several species protected under the NCNCA (Schedule 1 and 2) and within NEMBA Section 56 do have an increased probability of occurring within the area in which the railway is proposed, though, impacts from the development are not expected to pose a significant risk to these species.

Without mitigation implemented, the anticipated impact significance on faunal SCC varies between **Medium-Low and Low**. The impacts on SCC are deemed to be mitigatable and thus with mitigation measures implemented, the impact significance can be reduced to **Low and Very low** levels.

The proposed Railway Line Link Project is not anticipated to have a significant impact on faunal SCC and with mitigation measures implemented, the impacts are likely to remain localised in extent. Not all faunal SCC can be rescued and relocated, notably avifaunal species and in many instance medium sized mammals, especially if they are raising young or in a den. Smaller invertebrate SCC are less capable of relocating, especially burrow dwelling species. A suitable rescue and relocation plan should be developed for such species, with pre-walk downs of the development footprints being undertaken prior to vegetation clearance to identify and mark locations of SCC

7.2.3 Probable Residual Impacts

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

- Ongoing impacts to the anthropogenically derived drainage line;
- Permanent loss of and altered faunal species diversity;
- Edge effects such as habitat fragmentation, AIP proliferation and bush encroachment limiting faunal species habitat utilisation;



- The ongoing loss of SCC/protected faunal species and suitable habitat for such species; and
- It is unlikely that disturbed areas will be rehabilitated to an ecologically functioning state resulting in significant loss of habitat and species diversity, with reinstatement to pre-mining levels being unlikely.

7.2.4 Cumulative Impacts

A significant threat for the faunal ecology within the Railway Line Link Project is the potential proliferation of AIP species, the potential for indigenous bush encroachment and continued habitat disturbance by erosion resulting in the overall loss of native plant communities within the local area. The proposed Railway Line Link Project may also increase the movement of humans within the area and could lead to increased hunting / trapping taking place or a general increase in habitat degradation due to higher levels of anthropogenic activities (specifically during the construction phase). Habitat fragmentation and thus population isolation may also occur for smaller, less mobile fauna.

7.3 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed development to suitably manage and mitigate the ecological impacts that are associated with all phases of the proposed Railway Line Link Project.

Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to floral and faunal diversity, habitat and SCC can be mitigated and minimised.

Table 15: A summary of the mitigatory requirements for the biodiversity associated with the Railway Line Link Project.

Project phase	Pre-construction Phase
Impact Summary	Loss of floral and faunal habitat, species, and SCC
Proposed mitigation and management measures:	
Floral and Faunal Habitat and Diversity	
<ul style="list-style-type: none"> • Minimise loss of indigenous vegetation where possible through planning and where necessary by incorporating the sensitivity of the biodiversity report as well as other specialist studies; • Ensure that no development occurs outside of the planned development footprint; and • Prior to the commencement of construction activities, an AIP Management/Control Plan should be compiled for implementation: <ul style="list-style-type: none"> - Removal of alien invasive species should preferably commence during the pre-construction phase and continue throughout the construction and operational phases. AIPs should be cleared within the focus area before any vegetation clearing activities commence, thereby ensuring that no AIP propagules are spread, or soils contaminated with AIP seeds during the construction phase; and - An AIP Management/Control Plan should be implemented by a qualified professional. No chemical control of AIPs to occur without a certified professional. 	
Floral and Faunal SCC	



<ul style="list-style-type: none"> All floral and faunal SCC and protected species that will be affected by the construction activities must be marked (flora) and where possible, relocated to suitable habitat surrounding the disturbance footprint. A suitable rescue and relocation plan must be compiled. Where relocation is not feasible, seeds and propagules of species that will be cleared must be harvested for propagation off-site and must be reinstated during rehabilitation activities. Permits will be required from provincial (DENC) and national authorities (DFFE). 	
Project phase	Construction Phase
Impact Summary	Loss of floral and faunal habitat, species and SCC
Proposed mitigation and management measures:	
Development footprint	
<ul style="list-style-type: none"> The construction footprint must be kept as small as possible to minimise the impact on the surrounding environment (edge effect management); The construction camp and laydown areas must be included in the final layout plan and placed outside of sensitive habitat as identified in the biodiversity assessments; Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved development footprint; Clearing of vegetation should take place in a phased manner. This will allow for faunal species within the Railway Line Link Project to flee and avoid harm; Smaller species such as scorpions and reptiles will be less mobile during rainfall events and cold days (winter) and as such will not readily be able to move out of an area ahead of ground clearing activities. As such should any be observed in the construction site during clearing and construction activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Construction personnel are to be educated about these species and instructed not to kill them. Smaller scorpion species and harmless reptiles should be carefully relocated by a suitably nominated construction person. For larger venomous snakes, a suitably trained specialist, or on-site personnel, should be contacted to carry out the relocation of the species, should it not move off on its own; Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal; No collection of floral SCC must be allowed by construction personnel; No hunting or trapping of faunal species is to be allowed by construction personnel; Informal fires by construction personnel should be prohibited, and no uncontrolled fires whatsoever should be allowed; Care should be taken during the construction and operation of the proposed railway to limit edge effects to surrounding natural habitat. This can be achieved by: <ul style="list-style-type: none"> Demarcating all footprint areas during construction activities; No construction rubble or cleared alien invasive species are to be disposed of outside of demarcated areas, and should be taken to a registered waste disposal facility; All soils compacted because of construction activities should be ripped and profiled and reseeded; and Manage the spread of AIP species, which may affect remaining natural habitat within surrounding areas; Appropriate sanitary facilities must be provided during the construction of the development and must be removed to an appropriate waste disposal site; No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed because of the construction activities should be disposed of at an appropriate registered dump site away from the development footprint. No temporary dump sites should be allowed in areas with natural vegetation. It is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility; If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on-site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil; and Upon completion of construction activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area. 	
Alien Vegetation	
<ul style="list-style-type: none"> Edge effects arising from the proposed railway such as erosion and alien plant species proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020); Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the construction and operational phase of the development, and a 20 m buffer surrounding the footprint and 	



<p>disturbed areas should be regularly checked for AIP proliferation and to prevent spread into surrounding natural areas; and</p> <ul style="list-style-type: none"> • Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards. 	
<p>Floral and Faunal SCC</p> <ul style="list-style-type: none"> • The relocation success of floral SCC should be monitored during the construction phase to ensure immediate actions can be taken if it becomes evident that relocation is not successful; • No collection of floral or faunal SCC or medicinal floral species must be allowed by construction personnel; • Edge effect control needs to be implemented to prevent further degradation and potential loss of floral and faunal SCC outside of the proposed development footprint area; • No trapping or hunting of fauna whatsoever must be allowed; and • Should the presence of any faunal SCC be noted, or their breeding sites be located, notably ground dwelling or nesting species, within the development footprint a suitably qualified specialist should be consulted on the best way to proceed. 	
Project phase	Operational and Maintenance Phase
Impact Summary	Loss of floral and faunal habitat, species and SCC
<p>Proposed mitigation and management measures:</p> <p>Development footprint</p> <ul style="list-style-type: none"> • Disturbed areas are to be rehabilitated to a similar state as that of pre-disturbance conditions. Where this is not possible due to operational and maintenance requirements, it is recommended that at a minimum a suitable herbaceous layer is maintained within the footprint of the powerline towers so as to ensure that no erosion occurs; and • At a minimum a short herbaceous layer must be maintained around the Railway Line Link Project so that a semblance of faunal habitat is reinstated in these areas. <p>Alien Vegetation</p> <ul style="list-style-type: none"> • Edge effects arising from the proposed development, such as erosion and alien plant species proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020) (see Section 4.3.2 of this report); • Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the operational phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas; and • Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility, which complies with legal standards. <p>Floral and Faunal SCC</p> <ul style="list-style-type: none"> • Monitoring of relocation success should continue for at least three years after the completion of the construction phase, or until it is evident that the species have established self-sustaining populations. 	
Project phase	Decommissioning and Closure Phase
Impact Summary	Loss of floral and faunal habitat, species and SCC
<p>Proposed mitigation and management measures:</p> <p>Rehabilitation</p> <ul style="list-style-type: none"> • All infrastructure and footprint areas should be rehabilitated in accordance with a rehabilitation plan compiled by a suitable specialist; • Rehabilitation efforts must be implemented for a period of at least five years after decommissioning and closure; • Faunal and floral monitoring should be done annually; • Following heavy rains, access roads and areas adjacent to the mining footprints are to be inspected for signs of erosion, which if found must be immediately rectified through appropriate erosion control measures; and • 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. <p>Alien Vegetation</p> <ul style="list-style-type: none"> • Edge effects such as erosion and AIP proliferation need to be strictly managed adjacent to the footprint areas and as part of the rehabilitation phase; • Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards. 	



- Ongoing alien and invasive vegetation monitoring and clearance should take place throughout the rehabilitation phase of the project, and the mine layout and immediate surrounding area (30 m from the perimeters) should be regularly monitored during the rehabilitation phase for AIP re-establishment to prevent spread into surrounding natural areas; and
- An AIP Management and Control Plan must be designed and implemented in order to monitor and control alien floral recruitment in disturbed areas. The alien floral control plan must be implemented for a period of at least three years after post-rehabilitation.

Floral and Faunal SCC

- Monitoring of relocation success for any floral SCC should continue for at least three years after the completion of the construction phase, or until it is evident that the species have established self-sustaining populations; and
- Should the presence of any faunal SCC be noted, or their breeding sites be located within the operational footprint, a suitably qualified specialist should be consulted on the best way to proceed.

8 CONCLUSION

Scientific Terrestrial Services CC (STS) was appointed to conduct a biodiversity assessment as part of the environmental authorisation process for the proposed Beeshoek Railway Line Link Project, near Postmasburg, Northern Cape Province. The Railway Line Link Project consists of the proposed railway line and an associated 50 m investigation corridor.

Based on the results of the field investigation of October 2020, March 2021 and June 2021, three broad habitat units were distinguished for the Railway Line Link Project:

- **Modified Habitat Unit** – sections where the vegetation has shifted to a different vegetation type and no longer represents the reference states:
 - **Transformed Habitat and Degraded Thornveld**
- **Natural Habitat Areas:** This includes vegetation that have not been significantly degraded or shifted from the reference vegetation types:
 - **Calcrete Shrubland and Open Thornveld**
- **Non-watercourse habitat:** This habitat unit is associated with seasonal depressions (outside of the proposed footprint) and an anthropogenically derived drainage line (eastern section of the footprint). The **non-watercourse habitat** is not considered true watercourses as defined in the NWA.

Floral assessment

The proposed Railway Line Link Project will result in the clearance of vegetation that is of **intermediate sensitivity** (Natural Habitat Areas) and **moderately low sensitivity** (Non-watercourse habitat, encroached sections in the Natural Habitat Areas, Degraded Thornveld), with some sections of **low sensitivity** (Modified habitat unit).

The proposed Railway Line Link Project is associated with floral SCC which will directly be impacted by the proposed activities (SCC within the proposed footprint) – although with



mitigation measures implemented, and due to the small extent of the footprint, the impacts can remain localised in extent and is unlikely to impact significantly on SCC population dynamics. The SCC recorded on site include species protected under the NCNCA (Schedule 2) and the NFA, which are species not threatened in terms of NEMBA Section 56.

Prior to mitigation measures implemented, impact significance on all aspects of floral ecology varies between **Medium-Low** (Natural Habitat Areas), **Low** (Non-watercourse habitat) and **Low - Very Low** (Modified Habitat unit). With mitigation measures implemented, the direct and indirect impacts on the floral ecology can mostly be reduced to **Low** and **Very low**.

Faunal assessment

Construction activities will result in the clearance of vegetation from areas of **intermediate** sensitivity (Natural habitat areas), **moderately high** sensitivity (Non-watercourse habitat) and **moderately low** to **low** (Modified habitat unit) sensitivity.

The proposed Railway Line Link Project may potentially impact upon faunal SCC – although these impacts are anticipated to be low, and with mitigation measures implemented, the impacts can remain localised in extent. No SCC were recorded on site; however, potential species include those protected under the NCNCA (Schedule 1 and 2) and that of NEMBA Section 56 (TOPS).

Prior to mitigation measures implemented, impact significance on faunal habitat and diversity varies between **Medium-Low** (Natural habitat areas and non-watercourse habitat) and **Low to Very Low** (Modified Habitat Unit). With mitigation measures implemented, the impacts on the faunal habitat and diversity can mostly be reduced to **Very low** for the Modified Habitat and **Low** for the Non-watercourse Habitat. Impact significance remains **Medium-Low** for the Natural Habitat Areas during the construction phase but can be reduced to **Low** significance during the operational and maintenance phase.

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



9 REFERENCES

- BirdLife South Africa. 2015. Important Bird Areas 2015 [vector geospatial dataset] 2015. Available from the Biodiversity GIS website.
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)
- Constitution of the Republic of South Africa, 1996
- DEA & SANBI. 2009. National Protected Area Expansion Strategy Resource Document.
- Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria. 100 pages.
- Government of South Africa. 2010. National protected area expansion strategy for South Africa 2008. Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Pretoria, South Africa: The Government of South Africa.
- Government Notice R598 Alien and Invasive Species Regulations as published in the Government Gazette 37885 dated 1 September 2014 as it relates to the National Environmental Management Biodiversity Act, 1998 (Act No. 107 of 1998)
- Holness S. 2016. Critical Biodiversity Areas of the Northern Cape: Technical Report.
- Hui C, Richardson DM (2017) Invasion dynamics. Oxford University Press, Oxford. <https://doi.org/10.1093/acprof:oso/9780198745334.001.0001>
- Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015a. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.
- Marnewick MD, Retief EF, Wright DR, Theron NT. 2015b. South Africa's Important Bird and Biodiversity Areas Status Report 2015. Johannesburg: BirdLife South Africa.
- Mucina, L. and Rutherford, M.C. (2006). The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19., (South African National Biodiversity Institute: Pretoria, South Africa). *Memoirs of the Botanical Survey of South Africa*
- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)
- National Web Based Environmental Screening Tool (2021). Accessible online: <https://screening.environment.gov.za/screeningtool/#/pages/welcome>
- NCDENC (Northern Cape Department of Environment and Nature Conservation). 2016a. The 2016 Northern Cape Critical Biodiversity Areas [Vector] 0. Available from the Biodiversity GIS website.
- NCDENC (Northern Cape Department of Environment and Nature Conservation). 2016b. The 2016 Northern Cape Critical Biodiversity Areas Reason [Vector] 2016. Available from the Biodiversity GIS website.
- Richardson DM, Pyšek P, Carlton JT (2011) A compendium of essential concepts and terminology in invasion ecology. In: Richardson DM (ed) Fifty years of invasion ecology. The legacy of Charles Elton. Wiley-Blackwell, Oxford, pp 409–420. <https://doi.org/10.1002/9781444329988>. ch30
- SABAP2, 2015. The South Africa Bird Atlas Project 2 database
- SACAD: Department of Environmental Affairs. 2020. South Africa Conservation Areas Database (SACAD_OR_2020_Q3). Online available: [http://egis.environment.gov.za]
- SANBI. 2011. National List of Threatened Ecosystems 2011 [vector geospatial dataset] 2011. Available from the Biodiversity GIS website.
- SANBI. 2018a. 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland [Vector] 2018. Available from the Biodiversity GIS website.



- SANBI. 2018b. Terrestrial ecosystem threat status and protection level - remaining extent [Vector] 2018. URL: <http://bgis.sanbi.org>
- SANBI. 2018c. Terrestrial ecosystem threat status and protection level layer [Vector] 2018. URL: <http://bgis.sanbi.org>
- SANParks/SANBI. 2013. NPAES Formal [vector geospatial dataset] 2013. Available from the Biodiversity GIS website
- SANParks/SANBI. 2012. NPAES Protected Areas - Informal 2010 [vector geospatial dataset] 2012. Available from the Biodiversity GIS website.
- South African National Parks (SANParks). 2010. NPAES Beeshoek Mines 2010 [vector geospatial dataset] 2010. Available from the Biodiversity GIS website.
- SAPAD: Department of Environmental Affairs. 2020. South Africa Protected Areas Database (SAPAD_OR_2020_Q3). Online available: [<http://egis.environment.gov.za>]
- Skowno, Andrew & C.J., Poole, & Raimondo, Domitilla & K.J., Sink, & Van Deventer, Heidi & Van Niekerk, Lara & Harris, Linda & Smith-Adao, Lindie & Tolley, Krystal & Zengeya, Tsungai & W.B., Foden, & G.F., Midgley, & Driver, Amanda. 2019. National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria.
- South Africa. 2011. National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection. Government Gazette, 558(34809): 1 – 544, December 9.
- STS 190023, 2021. Biodiversity assessment as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed expansion and upgrade for activities associated with the Beeshoek Mine, near Postmasburg, Northern Cape Province. Prepared for EnviroGistics (Pty) Ltd. July 2021.
- Van Wyk, A. E., & Smith, G. F. (2001). Regions of floristic endemism in southern Africa: a review with emphasis on succulents. Umdaus press
- Wilson JRU, Gaertner M, Richardson DM et al (2017) Contributions to the national status report on biological invasions in South Africa. *Bothalia* 47:a2207. <https://doi.org/10.4102/abc.v47i2.2207>



APPENDIX A: Legislative Requirements and Indemnity

THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA, 1996

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

THE CONSERVATION OF AGRICULTURAL RESOURCES ACT, 1983 (ACT NO. 43 OF 1983) (CARA)

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

THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA)

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations (GN R326 as amended in 2017 and well as listing notices 1, 2 and 3 (GN R327, R325 and R324 of 2017), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the Environmental Impact Assessment process depending on the nature of the activity and scale of the impact.

THE NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004) (NEMBA)

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

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

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

Furthermore, a person may not carry out a restricted activity involving either:



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

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

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

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

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

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

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

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

THE NATIONAL FOREST ACT, 1998 (ACT NO. 10 OF 1998), AS AMENDED IN SEPTEMBER 2011 (NFA)

According to the department of Department of Forestry, Fisheries and the Environment (DFFE) (previously the Department of Agriculture, Forestry and Fisheries (DAFF)) ©2019 website (<https://www.daff.gov.za/daffweb3/>):

"In terms of the National Forests Act of 1998 certain tree species (types of trees) can be identified and declared as protected. The Department of Water Affairs and Forestry followed an objective, scientific and participative process to arrive at the new list of protected tree species, enacted in 2004. All trees occurring in natural forests are also protected in terms of the Act. Protective actions take place within the framework of the Act as well as national policy and guidelines. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilisation."

Applicable sections of the NFA pertaining to the proposed project include the below:

Section 12:

Declaration of trees as protected

- 1) The Minister may declare-
 - a. particular tree,
 - b. a particular group of trees,
 - c. a particular woodland; or
 - d. trees belonging to a particular species,
 to be a protected tree, group of trees, woodland or species.



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

Section 15(1):

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

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

MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT 28 OF 2002) (MPRDA)

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

THE NORTHERN CAPE NATURE CONSERVATION ACT, 2009 (ACT NO 9 OF 2009) (NCNCA)

The purpose of this Act is to provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.



Indemnity and Terms of use of this Report

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

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APPENDIX B: Floral Method of assessment

Floral Species of Conservational Concern Assessment

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

The National Web-Based Environmental Screening Tool

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the Railway Line Link Project. 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 below⁶:

- **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.

⁶ More details on the use of the Screening Tool for Species of Conservation Concern can be found in the below resources:

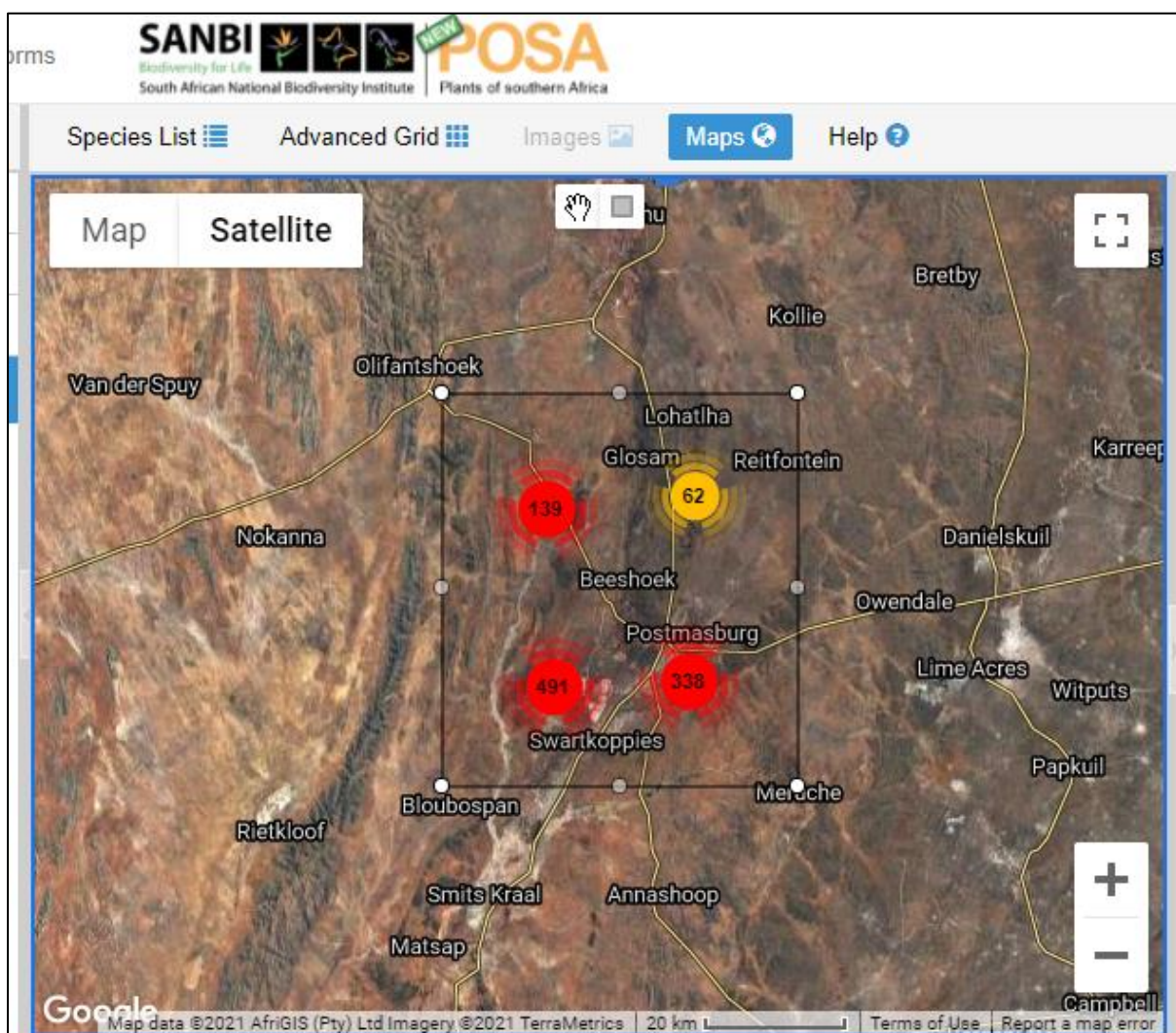
- South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity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



BRAHMS Online Website

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 (see Figure B1 below);

- 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 Railway Line Link Project is situated but where it is deemed appropriate, a larger area can be included. For this study, four QDS' data were extracted, namely the QDS 2822BB, 2823AA, 2822BD and 2823AC.



NEMBA TOPS Species

The National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA) Threatened or Protected Species (TOPS) list (Government Gazette [GN] 29657, as amended in GN R1187 in Government Gazette 30568 of 2007 and again in GN 627 in Government Gazette 43386 of 2020) 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 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.

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 Railway Line Link Project. 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/Railway Line Link Project.

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a Railway Line Link Project 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 B1 below:



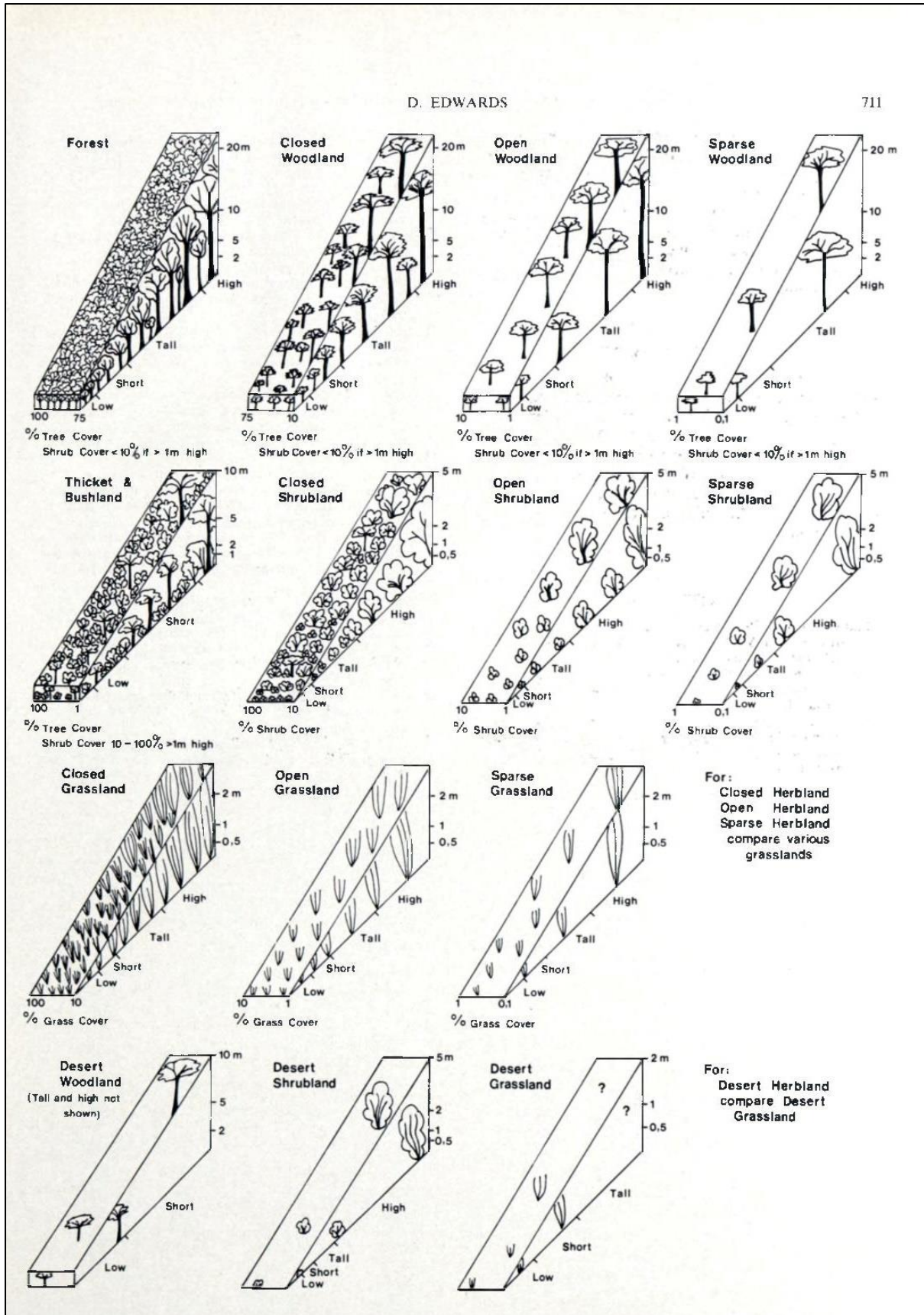


Figure B1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.



Floral Habitat Sensitivity

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

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

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

Table B1: 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.



APPENDIX C: Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of anthropogenic activities near the study area may have an impact on faunal behaviour and in turn the rate of observations. In order to increase overall observation time within the study area, as well as increasing the likelihood of observing shy and hesitant species, Sherman traps were strategically placed within the study area. Sherman traps were used to increase the likelihood of capturing and observing small mammal species, notably small nocturnal mammals.

Mammals

Small mammals are unlikely to be directly observed in the field because of their nocturnal/crepuscular and cryptic nature. A simple and effective solution to this problem is to use Sherman traps. A Sherman trap is a small aluminium box with a spring-loaded door (Figure C1). Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut, thereby capturing the individual. In the event of capturing a small mammal during the night, the animal would be photographed and then set free unharmed early the following morning. Traps were baited with a universal mixture of oats, peanut butter, and fish paste.



Figure C1: Sherman trap and bait used to capture and identify small mammal species.

Furthermore, mammal species were recorded during the field assessment with the use of visual identification, spoor, call and dung. Specific attention was given to mammal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Avifauna

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

Reptiles

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



Amphibians

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

Invertebrates

Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken. Pitfall traps was also utilised during the site assessment and all insect species captured identified, photographed and set free.

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

Arachnids

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

Faunal Species of Conservation Concern Assessment

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

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

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

Faunal Habitat Sensitivity

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

- **Faunal SCC**: The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability**: The presence of suitable habitat for each class;
- **Food Availability**: The availability of food within the assessment area for each faunal class;



- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

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

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

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



APPENDIX D: Impact Assessment Methodology

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

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

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'⁷. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to Table 3. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary⁸.

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment considers the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances

⁷ The definition has been aligned with that used in the ISO 14001 Standard.

⁸ Some risks/impacts that have low significance will however still require mitigation.



where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table D1: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

Probability of impact	RATING
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	RATING
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	RATING
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	RATING
Activity specific/ < 5 ha impacted / Linear developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments affected > 3000m	5
Duration of impact	RATING
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5



Table D2: Significance Rating Matrix.

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Severity + Spatial Scope + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	

Table D3: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
 - Primary project site and related facilities that the client and its contractors develops or controls;
 - Areas potentially impacted by cumulative impacts for any existing project or condition and other project-related developments; and
 - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
 - Pre-construction;
 - Construction; and
 - Operation.
 - If applicable, transboundary or global effects were assessed.
 - Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
 - Particular attention was paid to describing any residual impacts that will occur after rehabilitation.



Mitigation measure development

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

- *Mitigation and performance improvement measures* and actions that address the risks and impacts⁹ are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation*.

Recommendations

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

⁹ Mitigation measures should address both positive and negative impacts



APPENDIX E: Vegetation Types

SVk 9 Kuruman Thornveld

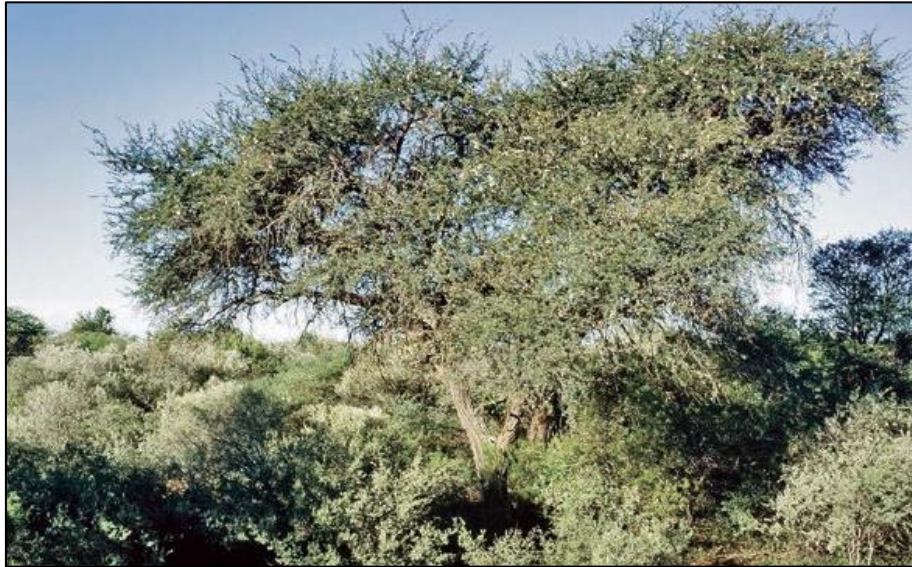


Figure D1: Kuruman Thornveld: *Vachellia (Acaia) erioloba* trees and the overwhelmingly dominant shrub *Tarchonanthus camphoratus* immediately south of Kuruman at an altitude of 1415 m. Image source: Mucina and Rutherford (2006) Figure 9.79, page 520.

Dominant and typical floristic species of Kuruman Thornveld (Mucina & Rutherford, 2012). The table contains the important taxa associated with the vegetation type.

Woody Layer	
Tall Tree	<i>Vachellia erioloba</i> (d).
Small Trees	<i>Senegalia mellifera</i> subsp. <i>detinens</i> (d), <i>Boscia albitrunca</i> ,
Tall Shrubs	<i>Grewia flava</i> (d), <i>Lycium hirsutum</i> (d), <i>Tarchonanthus camphoratus</i> (d), <i>Gymnosporia buxifolia</i>
Low Shrubs	<i>Vachellia hebeclada</i> subsp. <i>hebeclada</i> (d), <i>Justicia divaricatum</i> (d) (formerly <i>Monechma divaricatum</i>), <i>Lasiosiphon polycephalus</i> , <i>Helichrysum zeyheri</i> , <i>Hermannia comosa</i> , <i>Pentzia calcarea</i> , <i>Plinthus sericeus</i> ,
Geoxylic Suffrutex	<i>Elephantorrhiza elephantina</i>
Forb layer	
Herbs	<i>Dicoma schinzii</i> , <i>Gisekia africana</i> , <i>Harpagophytum procumbens</i> subsp. <i>procumbens</i> , <i>Indigofera daleoides</i> , <i>Limeum fenestratum</i> , <i>Nolletia ciliaris</i> , <i>Seddera capensis</i> , <i>Osteospermum scariosum</i> (formerly <i>Tripteris aghillana</i>), <i>Vahlia capensis</i> subsp. <i>vulgaris</i> ,
Grass layer	
Graminoids	<i>Aristida meridionalis</i> (d), <i>Aristida stipitata</i> subsp. <i>stipitata</i> (d), <i>Eragrostis lehmanniana</i> (d), <i>Eragrostis echinochloidea</i> , <i>Melinis repens</i> .
Endemic Taxa	
Herb	<i>Gnaphalium englerianum</i>
Biogeographically Important Taxon ^{GW} Griqualand West endemic, ^K Kalahari endemic, ^S Southernmost distribution in interior of southern Africa	
Small Trees	<i>Vachellia luederitzii</i> var. <i>luederitzii</i> ^K , <i>Terminalia sericea</i> ^S .
Tall Shrub	<i>Vachellia haematoxylon</i> ^K .
Low Shrub	<i>Blepharis marginata</i> ^{GW}
Herb	<i>Corchorus pinnatipartitus</i> ^{GW}
Graminoid	<i>Digitaria polyphylla</i> ^{GW}

(d) = dominant species

(The genus for all *Senegalia* and *Vachellia* spp. were formerly *Acacia*)

Additional Remarks: Disturbed areas north of Kuruman are characterised by *Aristida adscensionis*, *Aristida congesta*, *Enneapogon scoparius*, *Geigeria ornativa*, *Melhania rehmanii*, *Rhigozum trichotomum* and *Sericorema remotiflora* and the absence of *Vachellia erioloba*, *V. haematoxylon* and *Grewia flava*.



SVk 14 Postmasburg Thornveld

Dominant and typical floristic species of Postmasburg Thornveld (Mucina & Rutherford, 2012). The table contains the important taxa associated with the vegetation type.

Woody Layer	
Tall Tree	<i>Vachellia erioloba</i> (d).
Small Trees	<i>Vachellia karroo</i> (d), <i>Vachellia tortilis</i> subsp. <i>heteracantha</i> (d), <i>Searsia lancea</i> (d), <i>Ziziphus mucronata</i> (d).
Tall Shrubs	<i>Searsia tridactyla</i> (d), <i>Diospyros lycioides</i> subsp. <i>lycioides</i> , <i>Ehretia rigida</i> subsp. <i>rigida</i> , <i>Grewia flava</i> , <i>Tarchonanthus camphoratus</i> .
Low Shrubs	<i>Vachellia hebeclada</i> subsp. <i>hebeclada</i> (d), <i>Felicia muricata</i> , <i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i> , <i>Lantana rugosa</i> , <i>Melolobium microphyllum</i> , <i>Chaenostoma halimifolia</i> (formerly <i>Sutera halimifolia</i>).
Succulent Shrubs	<i>Kalanchoe rotundifolia</i> , <i>Lycium cinereum</i>
Forb layer	
Herbs	<i>Dicoma anomala</i> , <i>Geigeria filifolia</i> , <i>Geigeria ornativa</i> , <i>Hibiscus pusillus</i> , <i>Jamesbrittenia aurantiaca</i> , <i>Selago densiflora</i> , <i>Osteospermum scariosum</i> (formerly <i>Tripteris aghillana</i>)
Geophytic Herb	<i>Boophone disticha</i>
Grass layer	
Graminoids	<i>Digitaria eriantha</i> subsp. <i>eriantha</i> (d), <i>Enneapogon scoparius</i> (d), <i>Eragrostis lehmanniana</i> (d), <i>Aristida adscensionis</i> , <i>Aristida congesta</i> , <i>Aristida diffusa</i> , <i>Eragrostis superba</i> , <i>Heteropogon contortus</i> , <i>Melinis repens</i> , <i>Schmidtia pappophoroides</i> , <i>Stipagrostis uniplumis</i>
Biogeographically Important Taxon (Griqualand West endemics)	
Succulent Shrub	<i>Euphorbia bergii</i> .
Graminoid	<i>Digitaria polyphylla</i>

(d) = dominant species

(The genus for all *Senegalia* and *Vachellia* spp. were formerly *Acacia*, and the genus for all *Searsia* spp was formerly *Rhus*)

Additional Remarks: In contrast to eastern parts of the unit, *Tarchonanthus camphoratus* is conspicuously absent in the western parts.

SVk 10 Kuruman Mountain Bushveld



Figure D2: Kuruman Mountain Bushveld: Open low bushveld with the usually leafless *Lebeckia macrantha* clearly visible at an altitude of approximately 1680 m near Bretby between Danielskuil and Kuruman. Image source: Mucina and Rutherford (2006) Figure 9.80, page 521.



Dominant and typical floristic species of Kuruman Mountain Bushveld (Mucina & Rutherford, 2012). The table contains the important taxa associated with the vegetation type.

Woody Layer	
Small Trees	<i>Searsia lancea</i>
Tall Shrubs	<i>Diospyros austro-africana</i> , <i>Euclea crispa</i> subsp. <i>crispa</i> , <i>Euclea undulata</i> , <i>Olea europaea</i> subsp. <i>africana</i> , <i>Searsia pyroides</i> var. <i>pyroides</i> , <i>Searsia tridactyla</i> , <i>Tarchonanthus camphoratus</i> , <i>Tephrosia longipes</i>
Low Shrubs	<i>Searsia ciliata</i> (d), <i>Amphiglossa triflora</i> , <i>Anthospermum rigidum</i> subsp. <i>pumilum</i> , <i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i> , <i>Helichrysum zeyheri</i> , <i>Lantana rugosa</i> , <i>Wahlenbergia nodosa</i>
Succulent Shrubs	<i>Ebracteola wilmaniae</i> , <i>Hertia pallens</i>
Herbaceous Climber	<i>Rhynchosia totta</i>
Forb layer	
Herbs	<i>Dicoma anomala</i> , <i>Dicoma schinzii</i> , <i>Geigeria ornativa</i> , <i>Helichrysum cerastioides</i> , <i>Heliotropium strigosum</i> , <i>Hibiscus marlothianus</i> , <i>Kohautia cynanchica</i> , <i>Kyphocarpa angustifolia</i> .
Geophytic Herb	<i>Boophone disticha</i> , <i>Pellaea calomelanos</i> .
Grass layer	
Graminoids	<i>Andropogon chinensis</i> (d), <i>Andropogon schirensis</i> (d), <i>Anthehora pubescens</i> (d), <i>Aristida congesta</i> (d), <i>Digitaria eriantha</i> subsp. <i>eriantha</i> (d), <i>Themeda triandra</i> (d), <i>Triraphis andropogonoides</i> (d), <i>Aristida diffusa</i> , <i>Brachiaria nigropedata</i> , <i>Bulbostylis burchellii</i> , <i>Cymbopogon caesius</i> , <i>Diheteropogon amplexans</i> , <i>Elionurus muticus</i> , <i>Eragrostis chloromelas</i> , <i>Eragrostis nindensis</i> , <i>Eustachys paspaloides</i> , <i>Heteropogon contortus</i> , <i>Melinis repens</i> , <i>Schizachyrium sanguineum</i> , <i>Trichoneura grandiglumis</i> .
Biogeographically Important Taxon (Griqualand West endemics)	
Tall Shrub	<i>Calobota cuspidosa</i> (formerly <i>Lebeckia macrantha</i>) (d).
Low Shrubs	<i>Justicia puberula</i> , <i>Tarchonanthus obovatus</i>
Succulent Shrub	<i>Euphorbia wilmaniae</i>
Graminoid	<i>Digitaria polyphylla</i>
Herb	<i>Sutera griquensis</i>
Endemic Taxa	
Succulent Shrub	<i>Euphorbia planiceps</i>

(d) = dominant species

(The genus for all *Searsia* spp was formerly *Rhus*)

Additional Remarks: Many species in this unit are widely distributed to the northeast of the subcontinent and reach their southwestern limit in this unit (e.g., *Andropogon schirensis*). There are distinct floristic differences with the relatively nearby and parallel mountains of the SVk 15 Koranna-Langeberg Mountain Bushveld. For example, *Croton gratissimus* is common in the last-mentioned unit but rare in Kuruman Mountain Bushveld. *Calobota cuspidosa* (formerly *Lebeckia macrantha*) shows just the reverse distributional pattern between these units. A very low form (<0.5 m) of *Vachellia hebeclada* is common in the north on Makhubung hill, north of Heuningvlei.



APPENDIX F: Floral SCC

South Africa uses the internationally endorsed [IUCN Red List Categories and Criteria](#) in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. 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.
- ^N**Critically Rare** A species is Critically Rare when it is known to occur at a single site but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
- ^N**Rare** A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:
 - Restricted range: Extent of Occurrence (EOO) <500 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 for RDL Floral SCC obtained from BODATSA and the Online National Environmental Screening Tool

Table F1: Red Data Listed (RDL) plant species recorded in the QDS' 2822BB, 2823AA, 2822BD and 2823AC (Figure F1). Species list obtained from the new Plants of southern Africa (new POSA) online catalogue, or BODATSA. Additional species were obtained from the National Web Based Screening Tool. Information on species distributions and conservation status were derived from the Red List of South African Plants website (<http://redlist.sanbi.org/index.php>).

Scientific Name	IUCN	Habitat description	POC
Sensitive species 249	VU	South African endemic Range: Northern Cape - Postmasburg Major habitats: Kuruman Thornveld Description: Among pebbles in shallow soil	Medium
<i>Aloidendron dichotomum</i>	VU	Range: From Nieuwoudtville east to Olifantsfontein and northwards to the Brandberg in Namibia. Major habitats: Richtersveld Mountain Shrubland, Namaqualand Shale Shrubland, Namaqualand Klipkoppe Shrubland, Northern Knersvlakte Vygieveld, Bushmanland Arid Grassland, Blouputs Karroid Thornveld, Lower Gariiep Broken Veld, Kahams Mountain Desert, Eastern Gariiep Rocky Desert, Upper Gariiep Alluvial Vegetation. Description: On north-facing rocky slopes (particularly dolomite) in the south of its range. Any slopes and sandy flats in the central and northern parts of range.	Low



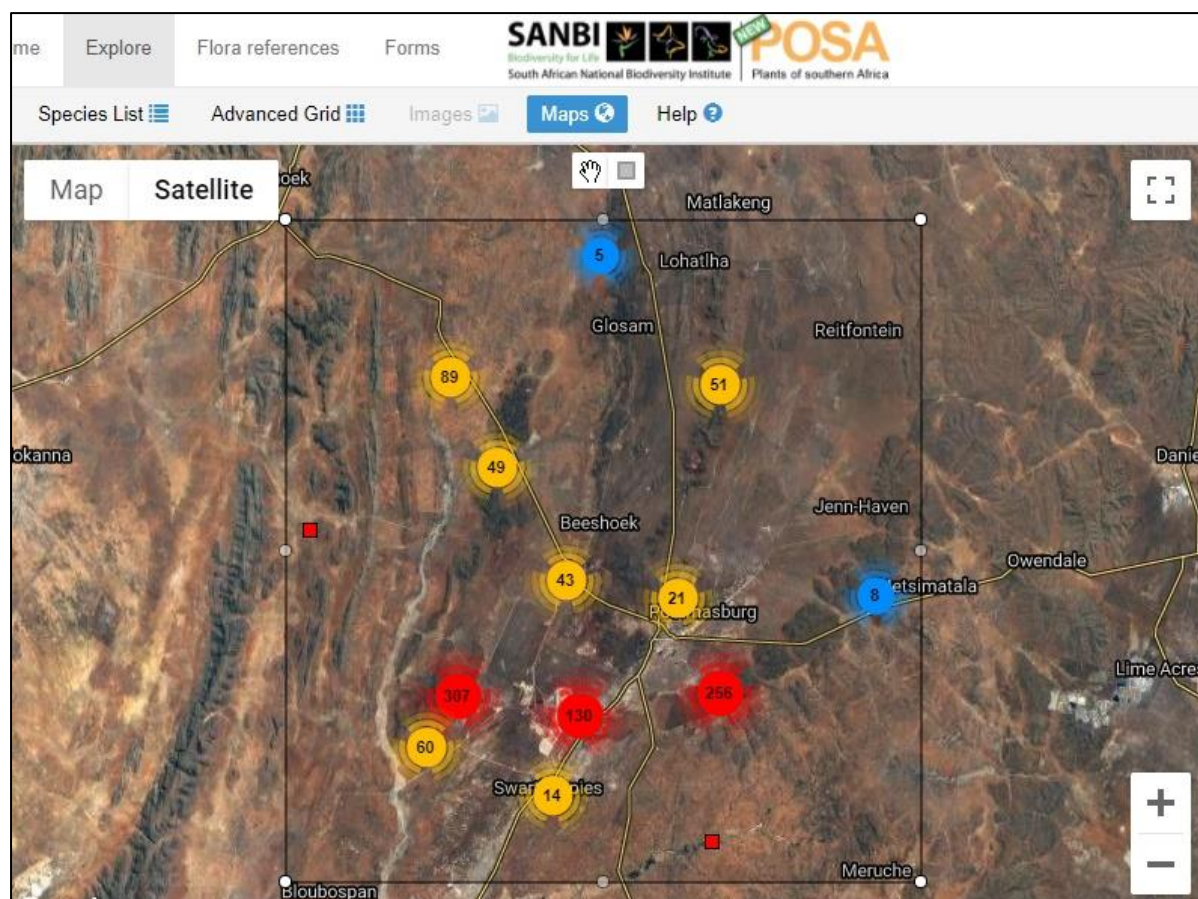


Figure F1: BODATSA / Plants of Southern Africa database search for SCC within the QDS' 2822BB, 2823AA, 2822BD and 2823AC.

NEMBA TOPS List for South Africa¹⁰

Table F2: TOPS list for South Africa – plant species.

Scientific Name	Common Name	POC	Provincial Distribution	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
<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

¹⁰ 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.



Scientific Name	Common Name	POC	Provincial Distribution	Status
<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 Range: Nieuwoudtville.	VU; P
<i>Diaphanthe 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 Range: Namaqualand, Kamiesberg.	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-guillielmi</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
<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



Scientific Name	Common Name	POC	Provincial Distribution	Status
<i>Encephalartos leboomboensis</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	Medium	Provincial distribution: Free State, Limpopo, Northern Cape, North West Description: Well drained sandy habitats in open savanna and woodlands	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
<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



Scientific Name	Common Name	POC	Provincial Distribution	Status
<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, DDD = Data Deficient - Insufficient Information; EN = Endangered, EW = Extinct in the Wild, NT = Near Threatened, VU = Vulnerable, P = Protected, POC = Probability of Occurrence.

NFA Protected Trees

Table F3: Protected trees as defined by The National Forest Act, 1998, (Act No. 84 of 1998) (NFA) for the QDS 2527AA. 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	Confirmed
Fabaceae	<i>Vachellia erioloba</i>	LC	Tree	Confirmed
Fabaceae	<i>Vachellia haematoxylon</i>	LC	Tree	Low



APPENDIX G: Faunal SCC

The tables below list the faunal Species of Conservation Concern for the Railway Line Link Project:

Table G1: TOPS list of faunal species (2007) that may occur within the Northern Cape.

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



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



Table G2: TOPS list of faunal species (2015) that may occur within the Northern Cape.

Scientific Name	Common Name	Threat Status
<i>Homopus signatus</i>	Speckled tortoise	VU
<i>Pachydactylus goodi</i>	Good's Gecko	VU
<i>Cordylus macropholis</i>	Large-scaled Lizard	P
<i>Cordylus imkeae</i>	Rooiberg Girdled Lizard	P
<i>Opisthophthalmus ater</i>	Steinkopf Burrowing Scorpion	CR
<i>Acinonyx jubatus</i>	Cheetah	VU
<i>Manis temminckii</i>	Pangolin	VU
<i>Ceratotherium simum</i>	Southern White Rhinoceros	P
<i>Crocuta crocuta</i>	Spotted Hyaena	P
<i>Felis nigripes</i>	Black-footed Cat	P
<i>Hyaena brunnea</i>	Brown Hyaena	NT
<i>Neophron percnopterus</i>	Egyptian Vulture	CR
<i>Aquila rapax</i>	Tawny Eagle	EN
<i>Torgos tracheliotos</i>	Lappet-faced Vulture	EN
<i>Gyps africanus</i>	White-backed Vulture	CR
<i>Gyps coprotheres</i>	Cape Vulture	EN
<i>Neotis ludwigii</i>	Ludwig's Bustard	EN
<i>Polemaetus bellicosus</i>	Martial Eagle	EN
<i>Terathopius ecaudatus</i>	Bateleur	EN
<i>Anthropoides paradiseus</i>	Blue Crane	P
<i>Ardeotis kori</i>	Kori Bustard	P
<i>Python sebae</i>	African Rock Python	P
<i>Orycteropus afer</i>	Aardvark	P

CR= Critically Endangered, EN=Endangered, NT=Near Threatened, VU=Vulnerable, P=Protected

Faunal Species of Conservation Concern

Table G3: Threatened species not yet listed above that may occur in the Railway Line Link Project.

Common Name	Species	NCCA 2009 Status	IUCN Status
Honey badger	<i>Mellivora capensis</i>	Specially Protected	LC
African wild cat	<i>Felis silvestris</i>	Specially protected	LC
Striped polecat	<i>Ictonyx striatus</i>	Specially protected	LC
African striped weasel	<i>Poecilogale albinucha</i>	Specially protected	LC
Aardwolf	<i>Proteles cristata</i>	Specially protected	LC
Cape fox	<i>Vulpes chama</i>	Specially protected	LC
Southern African hedgehog	<i>Atelerix frontalis</i>	Specially protected	LC
Leopard	<i>Panthera pardus</i>	Specially protected	VU
Black eagle	<i>Aquila verreauxii</i>	Specially Protected	VU
White-backed Vulture	<i>Gyps africanus</i>	Specially Protected	CR
Ludwig's Bustard	<i>Neotis ludwigii</i>	Specieally protected	EN
Martial Eagle	<i>Polemeatus bellicosus</i>	Specially Protected	EN
Tawny Eagle	<i>Aquila rapax</i>	Specially Protected	EN
Cape Vulture	<i>Gyps coprotheres</i>	Specially Protected	EN
Lappet-faced Vulture	<i>Torgos tracheliotos</i>	Specially Protected	EN
Burchell's courses	<i>Cursorius rufus</i>	Protected	VU
Lanner Falcon	<i>Falco biarmicus</i>	Specially Protected	VU
Secretarybird	<i>Sagittarius serpentarius</i>	Specially Protected	VU
Kori Bustard	<i>Ardeotis kori</i>	NA	NT
African Rock Pipit	<i>Anthus crenatus</i>	Protected	NT
Burrowing scorpion	<i>Opisthophthalmus carinatus</i>	Specially Protected	NYBA



Common Name	Species	NCCA 2009 Status	IUCN Status
Burrowing scorpion	<i>Opisththalmus wahlbergii</i>	Specially Protected	NYBA
Common flap-neck chameleon	<i>Chamaeleo dilepis</i>	Specially Protected	LC
African rock python	<i>Python sebae</i>	Specially Protected	-

EN = Endangered, CR = Critically Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, NYBA = Not yet been assessed, NE = Not Evaluated, NA = Not applicable

Table G4: Avifaunal Species for the pentad 2815_2255 within the QDS 2822BD.

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2815_2255	http://sabap2.adu.org.za/coverage/pentad/2815_2255



APPENDIX H: Species List

Floral Species List

Table H1: Dominant iplant species encountered along the Railway Line Link Project, and general surroundings, during the field assessment. Alien species are indicated with an asterisk (*) and protected species are emboldened. “XX” refers to species that were particularly common or abundant.

Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Non-watercourse Habitat
WOODY SPECIES COMPOSITION				
<i>*Prosopis glandulosa</i> var. <i>torreyana</i>		xx	x	
<i>*Schinus molle</i>	x	x	x	
<i>Amphiglossa tecta</i>	x			
<i>Aptosimum albomarginatum</i>	x		x	
<i>Aptosimum lineare</i>	x			
<i>Aptosimum spinescens</i>	x			
<i>Barleria rigida</i>	x		x	
<i>Boscia albitrunca</i> (NFA; Schedule 2 Protected Genus (Boscia))	xx	x	x	
<i>Cadaba aphylla</i>	x	x	x	
<i>Caroxylon dealatum</i>	x		x	
<i>Chrysocoma obtusata</i>	x	x	x	
<i>Diospyros lycioides</i> subsp. <i>lycioides</i>	x	x		x
<i>Ehretia rigida</i> subsp. <i>rigida</i>	x		x	
<i>Eriocephalus</i> cf. <i>ericoides</i> (medicinal)	x		xx	x
<i>Felicia</i> cf. <i>fascicularis</i>	x	x	x	
<i>Grewia flava</i>	x		x	x
<i>Hermannia burchellii</i>			x	
<i>Hermannia stricta</i>	x			
<i>Indigofera charlieriana</i>			x	x
<i>Justicia divaricata</i> (<i>Monechma divaricatum</i>)	x	x	x	
<i>Lasiosiphon polycephalus</i> (previously <i>Gnidia</i>)	x		x	
<i>Leucas capensis</i>	x			
<i>Monechma incanum</i>	x		x	
<i>Oedera humilis</i>	x			
<i>Pegolettia retrofracta</i>	x			
<i>Peliostomum leucorrhizum</i>	x			
<i>Pentzia</i> cf. <i>calcareae</i>	x		x	
<i>Pteronia</i> sp.	x		x	
<i>Rhigozum trichotomum</i>	x	x	xx	
<i>Roepera</i> (<i>Zygophyllum</i>) <i>pubescens</i>	x		x	
<i>Senegalia mellifera</i> subsp. <i>detinens</i>	x	x	x	x
<i>Tapinanthus oleifolius</i>	x	x	x	
<i>Tarchonanthus camphoratus</i>	x	x	x	x
<i>Vachellia erioloba</i> (NFA)	x	x		x
<i>Vachellia karroo</i>				x
<i>Vachellia tortilis</i> subsp. <i>heteracantha</i>	x		x	
<i>Vangueria infausta</i>				
<i>Waltheria indica</i>				x
<i>Ziziphus mucronata</i>	x	x	x	x
FORB SPECIES COMPOSITION				
<i>*Alternanthera pungens</i>		x		
<i>*Bidens pilosa</i>		x	x	x
<i>*Chenopodium album</i>		x	x	x
<i>*Cirsium vulgare</i>				x
<i>*Erigeron canadens</i>				x
<i>*Portulaca oleracea</i>				
<i>*Schkurhia pinnata</i>		x	x	x



Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Non-watercourse Habitat
* <i>Tagetes minuta</i>		x	x	x
<i>Boophone disticha</i> (Schedule 2 Protected family (Amaryllidaceae))			x	
<i>Dicoma capensis</i>	x			
<i>Cleome rubella</i>			x	
<i>Commelina africana</i>				
<i>Cullen tomentosum</i>				x
<i>Dipcadi cf. bakerianum</i>	x	x	x	
<i>Dysphania pumilio</i>	x	x		
<i>Eriospermum cf. porphyrium</i>	x	x	x	
<i>Gazania krebsiana</i> subsp. <i>serrulata</i>			x	
<i>Geigeria filifolia</i>	x		x	
<i>Geigeria ornativa</i>	x	x	x	
<i>Gisekia africana</i> var. <i>africana</i>				
<i>Helichrysum argyrosphaerum</i>	x			
<i>Hermannia comosa</i>	x		x	
<i>Hermannia depressa</i>	x			
<i>Hermannia linearifolia</i>	x			
<i>Hermbstaedtia fleckii</i>	x		x	
<i>Indigofera alternans</i>			x	
<i>Indigofera daleoides</i>	x	x		
<i>Kohautia cynanchica</i>	x			
<i>Kyphocarpa angustifolia</i>	xx		x	
<i>Lacomucinaea lineata</i> (previously <i>Thesium lineatum</i>)	x			
<i>Lepidium cf. englerianum</i>				
<i>Limeum argute-carinatum</i>	x			
<i>Limeum cf. aethiopicum</i>	x		x	
<i>Melolobium microphyllum</i>			x	
<i>Microloma armatum</i>	x	x	x	
<i>Mollugo cerviana</i>			x	
<i>Selago densiflora</i>	x		x	
<i>Sesamum triphyllum</i>	x			x
<i>Sida ovata</i>				
<i>Trianthema parvifolia</i>	xx			
<i>Tribulus zeyheri</i> subsp. <i>zeyheri</i>	x	x		x
<i>Vahlia capensis</i>				x
SUCCULENT SPECIES COMPOSITION				
* <i>Opuntia ficus-indica</i>		x	x	
* <i>Trichocereus schickendantzii</i>	x			x
<i>Aloe claviflora</i> (Schedule 2 Protected family (Asphodelaceae))			x	
<i>Euphorbia cf. duseimata</i> (Schedule 2 Protected Genus (Euphorbia))			x	
<i>Kleinia longiflora</i>	x			
<i>Lycium cinereum</i> (succulent woody species)	x	x	x	x
<i>Mestoklema tuberosum</i> (Schedule 2 Protected family (Aizoaceae))	x		x	
<i>Orbea</i> sp. (Schedule 2 Protected family (Apocynaceae))			x	
<i>Ruschia calcarea</i> (Schedule 2 Protected family (Aizoaceae))	x			
<i>Ruschia cf. griquensis</i> (Schedule 2 Protected family (Aizoaceae))	x		x	
<i>Tridentea</i> sp. (Schedule 2 Protected family (Aizoaceae))	x	x		
<i>Viscum rotundifolium</i>	x		x	
GRAMINOID SPECIES COMPOSITION				
* <i>Pennisetum setaceum</i>		x	x	
<i>Aristida adscensionis</i>	x	x		x
<i>Aristida congesta</i> subsp. <i>congesta</i>		x	x	x
<i>Aristida diffusa</i>	x			
<i>Brachiaria marlothii</i>		x		



Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Non-watercourse Habitat
<i>Cenchrus ciliaris</i>	x	x	x	x
<i>Chloris virgata</i>				x
<i>Cymbopogon pospischilii</i>				x
<i>Cynodon dactylon</i>		x		
<i>Cyperus sp.</i>				x
<i>Enneapogon cenchroides</i>	x		xx	x
<i>Enneapogon desvauxii</i>	xx	xx		x
<i>Eragrostis echinochloidea</i>				
<i>Eragrostis lehmanniana</i>	x		x	x
<i>Eragrostis rotifer</i>				
<i>Eragrostis trichophora</i>	x	x	x	x
<i>Eragrostis x pseudo-obtusa</i>	x			x
<i>Fingerhuthia africana</i>	x		x	x
<i>Phragmites australis</i>		x		x
<i>Schmidtia kalahariensis</i>	x		x	
<i>Schmidtia pappophoroidea</i>		x	x	
<i>Sporobolus fimbriatus</i>	x			
<i>Stipagrostis obtusa</i>	xx			
<i>Stipagrostis uniplumis</i>		x	xx	x

Faunal Species List

Table H2: Mammal species recorded during the field assessment.

Scientific Name	Common Name	IUCN Status
<i>Canis mesomelas</i>	Black-backed Jackal	LC
<i>Cynictis penicillata</i>	Yellow Mongoose	LC
<i>Lepus capensis</i>	Cape hare	LC
<i>Pedetes capensis</i>	Springhare	LC
<i>Cryptomys hottentotus</i>	Common mole rat	LC
<i>Galerella sanguinea</i>	Slender Mongoose	LC
<i>Elephantulus sp</i>	Elephant shrew	LC
<i>Phacochoerus africanus</i>	Warthog	LC
<i>Raphicerus campestris</i>	Steenbok	LC
<i>Hystrix africaeaustralis</i>	Porcupine	LC

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

Table H2: Avifaunal species recorded during the field assessment.

Scientific name	Common name	Status
<i>Streptopelia capicola</i>	Cape turtledove	LC
<i>Pycnonotus nigricans</i>	Red-eyed Bulbul	LC
<i>Columba guinea</i>	Speckled pigeon	LC
<i>Philetairus socius</i>	Sociable Weaver	LC
<i>Uraeginthus granatinus</i>	Violet eared waxbill	LC
<i>Mirafra fasciolata</i>	Fawn-coloured Lark	LC
<i>Urocolius indicus</i>	Red-faced Mousebird	LC
<i>Colies</i>	White-backed Mousebird	LC
<i>Mirafra fasciolata</i>	Fawn-coloured Lark	LC
<i>Laniarius astrococcineus</i>	Crimson-breasted shrike	LC
<i>Sylvietta rufescens</i>	Long-billed crombec	LC
<i>Prinia flavicans</i>	Black-chested Prinia	LC



Scientific name	Common name	Status
<i>Upupa africana</i>	African Hoopoe	LC
<i>Spilopelia senegalensis</i>	Laughing Dove	LC
<i>Afrotis afraoides</i>	Northern Black Korhaan	LC
<i>Sylvia subcaerulea</i>	Chestnut-vented tit-babbler	LC
<i>Calendulauda sabota</i>	Sabota Lark	LC
<i>Prinia masulosa</i>	Karoo Prinia	LC
<i>Emberiza impetuani</i>	Lark-like Bunting	LC
<i>Tricholaema leucomelas</i>	Acacia Pied Barbet	LC
<i>Serinus flaviventris</i>	Yellow Canary	LC
<i>Quelea</i>	Red-billed Quelea	LC
<i>Plocepasser mahali</i>	White-browed Sparrow-weaver	LC
<i>Crithagra albogularis</i>	White-throated Canary	LC
<i>Crithagra atrogularis</i>	Black-throated Canary	LC
<i>Passer melanurus</i>	Cape Sparrow	LC
<i>Sporopipes squamifrons</i>	Scaly-feathered Weaver	LC
<i>Onychognathus naboroupp</i>	Pale Winged Starling	LC
<i>Saxicola torquata</i>	African Stonechat	LC
<i>Anthus cinnamomeus</i>	African Pipit	LC
<i>Sigelus silens</i>	Fiscal Flycatcher	LC
<i>Erythropygia paena</i>	Kalahari scrub Robin	LC

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

Table H4: Herpetofauna species recorded during the field assessment.

Scientific name	Common Name	IUCN Status
<i>Pedioplanis lineoocellata lineoocellata</i>	Spotted sand lizard	NYBA
<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	NYBA
<i>Stigmochelys pardalis</i>	Leopard Tortoise	NYBA
<i>Agama aculeata aculeata</i>	Ground Agama	LC

LC = Least Concern, NYBA = Not Yet Been Assessed

Table H5: General insects recorded during the field assessment.

Scientific Name	Common Name	Status
<i>Hodotermes mossambicus</i>	Northern harvester termite	NYBA
<i>Passalidius fortipes</i>	Burrowing ground beetle	NYBA
<i>Acanthopplus discoidalis</i>	Brown Armoured Corncricket	NYBA
<i>Apterogyna</i> sp.	Velvet ant	NA
<i>Chilades trochylus</i>	Grass Jewel Blue	LC
<i>Acmaeodera viridaenea</i>	Glittering Jewel Bug	LC
<i>Africallagma glaucum</i>	Swamp Bluet	LC
<i>Stips</i> sp.	Ridged seed beetle	NYBA
<i>Gonometa postica</i>	African silk moth	NYBA
<i>Calidea dregii</i>	Rainbow Shield Bug	NYBA
<i>Trinervitermes</i> sp.	Snouted Harvester Termite	NA
<i>Zophosis</i> sp.	Frantic Tortoise Beetle	NA
<i>Acrotylus</i> sp.	Burrowing grasshopper	NA
<i>Conistica saucia</i>	Rock Grasshopper	NYBA
<i>Sphingonotus scabriculus</i>	Blue-wing	NYBA
<i>Acanthacris ruficornis</i>	Garden Locust	NYBA



Scientific Name	Common Name	Status
<i>Anacridium moestum</i>	Tree Locust	NYBA
<i>Heteronitis</i> sp.	Grooved Dung Beetle	NA
<i>Gastrimargus</i> sp.	N/A	NYBA
<i>Rhachitopis</i> sp.	N/A	NYBA
<i>Systophlochius palochius</i>	Orange wing	NYBA
<i>Anterhynchium fallax</i>	N/A	NYBA
<i>Camponotus fulvopilosus</i>	Bal-byter	NYBA
<i>Crematogaster peringueyi</i>	Cocktail Ant	NYBA
<i>Pantala flavescens</i>	Wandering Glider	LC
<i>Phymateus</i> sp.	Milkweed Locust	NA
Asilidae (<i>Neolophonotus</i> sp)	Robber fly	NA
<i>Mylabris oculata</i>	CMR Bean Beetle	NYBA

LC = Least Concern, NYBA = Not yet been assessed by the IUCN

Table H6: Arachnid species recorded during the site assessment.

Common Name	Scientific Name	IUCN Status
<i>Uroplectes carinatus</i>	Common Lesser-thicktail Scorpion	NA
Grass funnel-web spiders	<i>Agelena</i> sp.	NA
Sun spider	Solifugae sp	NA

LC = Least Concern, NYBA = Not Yet Been Assessed, NA = Not applicable



APPENDIX I: Specialist Information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

C. Hooton	BTech Nature Conservation (Tshwane University of Technology)
C. Steyn	MSc Plant Science (University of Pretoria)
N. Cloete	MSc (Environmental Management) (University of Johannesburg)
Kim Marais	BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
S. van Staden	MSc Environmental Management (University of Johannesburg)

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

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Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Member of South African Wetland Forum		

Company of Specialist:	Scientific Terrestrial Services		
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Postal code:	1401	Fax:	011 615 6240/ 086 724 3132
Telephone:	011 616 7893		
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

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

I, Christopher Hooton, declare that -

- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct.



Specialist Signature

I, Christien Steyn, declare that -

- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct




Signature of the Specialist



I, Kim Marais, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Nelanie Cloete, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Stephen van Staden, declare that -

- I act as the independent **specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist





**SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION**

CURRICULUM VITAE OF CHRISTOPHER HOOTON

PERSONAL DETAILS

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

EDUCATION

Qualifications

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

Short Courses

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

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Freshwater Assessments

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





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTIEN STEYN

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Council for Natural Scientific Professions (SACNASP)
 Member of the South African Association of Botanists (SAAB)
 Member of the Botanical Society of South Africa (BotSoc)

EDUCATION

Qualifications

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

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Training

- Advanced Grass Identification Course
- Practical Plant Identification, including Herbarium Usage and Protocols
- Vegetation Classification and Mapping: Use of Geographic Information System for understanding vegetation pattern and biodiversity conservation.
- Introduction to Statistics for Biologists: Applications of plant ecology principles in plant conservation, i.e., species distribution modelling, alien plant invasions, conservation planning
- Plant Functional Trait Course: Hands-on, field-based exploration of plant functional traits, along with experience in the usage of plant traits data in climate-change research and ecosystem ecology





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF **KIM MARAIS**

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)
Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

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

Short Courses

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

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Freshwater Assessments

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

Aquatic Ecological Assessment and Water Quality Studies

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

Legislative Requirements, Processes and Assessments

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





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF NELANIE CLOETE

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

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

Short Courses

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

AREAS OF WORK EXPERIENCE

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

Africa - Democratic Republic of the Congo (DRC)

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Freshwater Assessments

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

Legislative Requirements, Processes and Assessments

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





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF **STEPHEN VAN STADEN**

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

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

Short Courses

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

AREAS OF WORK EXPERIENCE

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

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

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



Freshwater Assessments

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

Aquatic Ecological Assessment and Water Quality Studies

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

Biodiversity Assessments

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

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

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

