TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT FOR THE PROPOSED UPGRADE OF THE NATIONAL ROUTE 1 SECTION 4 BETWEEN DOORNFONTEIN (KM 63.0) AND LAINGSBURG (KM 81.7), TWO BRIDGES AND EIGHTY-SIX MINOR CULVERTS, EIGHT MAJOR CULVERTS IN THE WESTERN CAPE PROVINCE, CENTRAL KAROO DISTRICT MUNICIPALITY AT LAINGSBURG LOCAL MUNICIPALITY.

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JULY 2024

CONDITIONS RELATING TO THIS REPORT

DECLARATION OF INTEREST

Ntumbuluko Consulting Pty (Ltd) has no vested interest in the property studied nor is it affiliated with any other person/body involved with the property and/or proposed development. Ntumbuluko Consulting Pty (Ltd) is not a subsidiary, legally or financially of the proponent. The study was undertaken by Mr Tshuxekani Maluleke, he is a registered Natural Scientists with the following details:

Specialist Name	Tshuxekani Maluleke (Wetland and Biodiversity Specialist)
Declaration of Independence	I declare, as a specialist appointed in terms of the National Environmental Management Act (Act No 108 of 1998) and the associated 2017 Environmental Impact Assessment (EIA) Regulations, 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 Act, regulations and any guidelines that have relevance to the proposed activity; • I will comply with the Act, regulations and all other applicable legislation; • I have no, 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; and • I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.
Signature	
Date	2024/07/15

QUALIFICATIONS

SPECIALIST	QUALIFICATION
Mr Tshuxekani Maluleke (SACNASP Reg. No. 120501)	MSc Environmental Sciences (Wits University) BSc Hons Zoology (University of Limpopo) BSc Hons Animal, Plant and Environmental Sciences (Wits University)

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EXECUTIVE SUMMARY

Ntumbuluko Consulting (Pty) Ltd, was appointed by Earthlink Environmental Services (Pty) Ltd on behalf of The South African National Roads Agency SOC Ltd or SANRAL to conduct a terrestrial Biodiversity Impact Assessment for the Proposed upgrade of National Route 1 Section 4 between Doornfontein (KM 63.0) and Laingsburg (KM 81.7), in the Western Cape Province, Central Karoo district municipality at Laingsburg Local Municipality. The study site was surveyed on the 06th of July 2024 to ascertain the overall state of biodiversity. The National Route 1 Section 4 between Doornfontein (KM 63.0) and Laingsburg (KM 81.7) touches a few Critical Biodiversity Areas (CBA) and an Ecological Support Area (ESA), this implies that these areas should be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services.

The proposed site consists mostly of the Koedoesberge-Moordenaars Karoo vegetation unit and while a small section of the road is located within the Southern Karoo Riviere vegetation unit both the vegetation units are classified as Least Threatened. The area consists of slightly undulating to hilly landscape covered by low succulent scrub and dotted by scattered tall shrubs, patches of 'white' grass visible on plains, the most conspicuous dominants being dwarf shrubs of *Pteronia*, *Drosanthemum* and *Galenia*. The has been disturbed to some extent, especially around the road servitude. The most sensitive areas are linked to the rocky outcrops and the mountain, the mountain closer to Laingsburg will be subjected to cuts during the proposed road upgrade.

STATEMENT AND OPINION OF THE SPECIALIST

The proposed development is deemed environmentally acceptable, provided the mitigation measures and recommendations specified in this report are implemented and adhered to. Based on the size of the road, the proposed upgrade will require a significant amount of vegetation clearing. The site has a Flora Species diversity, and SCC's, A botanical micro-siting investigation of the development footprint is not necessary.

If populations of Critically Endangered, or Endangered SCC are found consider relocating them, and where this is not feasible, permits for their removal must be obtained from the relevant competent authority. Species that are known to survive

translocation should be translocated to the nearest similar habitat type within the site where they will not be disturbed. Where possible avoid the rocky outcrops that are located outside of development footprint, and extra caution will be required when cutting through the mountainous area because they are aligned to the Critical Biodiversity Areas.

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DEFINITIONS

Alien animal	**(a) Any live vertebrate, including a bird and a reptile, but excluding a fish, belonging to a species or subspecies that is not a recognised domestic species and the natural habitat of which is not in the Republic; or** **(b) The egg of such vertebrate.**
Biodiversity	Means the diversity of animals, plants or other organisms, including the diversity of animals, plants or other organisms found within and between— (a) Ecosystems; (b) Habitats; (c) The ecological complexes of which these systems and habitats are part; and (d) Species.

CITES	Means the Convention on International Trade in Endangered Species of Wild Fauna and Flora;
Endangered Species	Means a species is endangered when it is facing a very high risk of extinction in the wild in the near future and includes— (*a*) Any living or dead specimen of such a species; or (*b*) Any egg, skin, bone, feather, seed, flower or any other part or derivative of such a species.
Environment	Means the surroundings within which humans exist and that are made up of— (*a*) The land, water and atmosphere of the earth; (*b*) Microorganisms, plant and animal life; (*c*) Any part or combination of (*a*) and (*b*) and the interrelationships amongst and between them; and (*d*) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing;
Indigenous plant	(*a*) Means any living or dead plant which is indigenous to the Republic, whether artificially propagated or in its wild state; and (*b*) Includes the flower, pollen, seed, cone, fruit, bulb, tuber, stem or root or any other part or derivative of such plant but does not include a plant declared a weed in terms of any legislation.
Protected area	Means— (*a*) A provincial nature reserves; (*b*) A site of ecological importance; (*c*) A protected environment; (*d*) A private nature reserves; or (*e*) A resource use area.
Protected environment	Means an area declared a Protected Environment or Private Nature Reserve in terms of section 21 (1) (*a*).
Rare species	Means a species of fauna and flora referred to in section 68 (*a*) (ii), and includes— (*a*) any living or dead specimen of such a species; or

(e) any egg, skin, bone, feather, seed, flower or any other part or derivative of such a species.

1. INTRODUCTION AND PROJECT DESCRIPTION

1.1 INTRODUCTION

Ntumbuluko Consulting (Pty) Ltd, was appointed by Earthlink Environmental Services (Pty) Ltd on behalf of The South African National Roads Agency SOC Ltd or SANRAL to conduct a terrestrial Biodiversity Impact Assessment for the Proposed upgrade of National Route 1 Section 4 between Doornfontein (KM 63.0) and Laingsburg (KM 81.7), in the Western Cape Province, Central Karoo district municipality at Laingsburg Local Municipality.

The purpose of this study is to describe and characterise the terrestrial environment, habitats, species present on site. A wet season terrestrial biodiversity survey was conducted on the **06th of July 2024**. The survey covered the entirety of the proposed development, with a stratified sampling methodology.

Identification and description of habitats and sensitive receptors were recorded across the project area and potential impacts on terrestrial biodiversity receptors were assessed. In terms of the Protocol for the Specialist Assessment and Minimum Reporting Content Requirements for Environmental Impacts on Terrestrial Biodiversity (GN R. 320 of 2020), prior to the commencement of a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool, must be confirmed by undertaking a site sensitivity verification. The results of the screening tool, together with the site sensitivity verification, ultimately determines the minimum report content requirements. As per the results of the Screening Report generated for the proposed data centre the terrestrial biodiversity theme sensitivity is classified as "**Very High**".

Due to the "Very High" sensitivity rating of the site, a full Terrestrial Biodiversity Specialist Assessment (this report) has been undertaken as part of the Environmental Basic Assessment Process for the proposed road upgrade. The findings and recommendations of this report should inform the Environmental Assessment Practitioner (EAP) and regulatory authorities to make informed decisions as to the ecological viability of the proposed development.

1.2 PROJECT DESCRIPTION

The South African National Roads Agency Soc Ltd (SANRAL) proposes to upgrade the National Road (N1) Section 4 between Doornfontein (Km 63.0) And Laingsburg (Km 81.7). The project commences at Doornfontein stream at km 63.0. Up to km 76.7 the road traverses an easy rolling to flat terrain. From km 76.7 to km 79.6 the speed is reduced due to the very sharp horizontal curves. This section is hilly (commonly referred to as the "pass" section). From km 79.6 the road enters the town of Laingsburg and ends at km 81.7.

The following bridge will be upgraded in the proposed road upgrade project:

- Buffels River Bridge;
- Wilgerhout River Bridge; and
- Doornfontein River Bridge.

Bridge drainage report and Major Culvert drainage report was submitted and approved by SANRAL.

Proposed upgrades:

- Doornfontein River bridge: New bridge for the new left carriageway;
- Wilgerhout River bridge: Raise the deck and widening; and
- Buffels River bridge: New bridge for the right carriageway, new raised deck on existing carriageway.

1.3 STUDY AREA

The South African National Roads Agency Soc Ltd (SANRAL) proposes to upgrade the National Road (N1) Section 4 between Doornfontein (Km 63.0) And Laingsburg (Km 81.7). The project commences at Doornfontein stream at km 63.0. Up to km 76.7 the road traverses an easy rolling to flat terrain. From km 76.7 to km 79.6 the speed is reduced due to the very sharp horizontal curves. This section is hilly (commonly referred to as the "pass" section). From km 79.6 the road enters the town of Laingsburg and ends at km 81.7 (**Figure 1-1**). The section of the road is located within close proximity to the Gouritz Cluster Biosphere Reserve (**Figure *1*-2**).

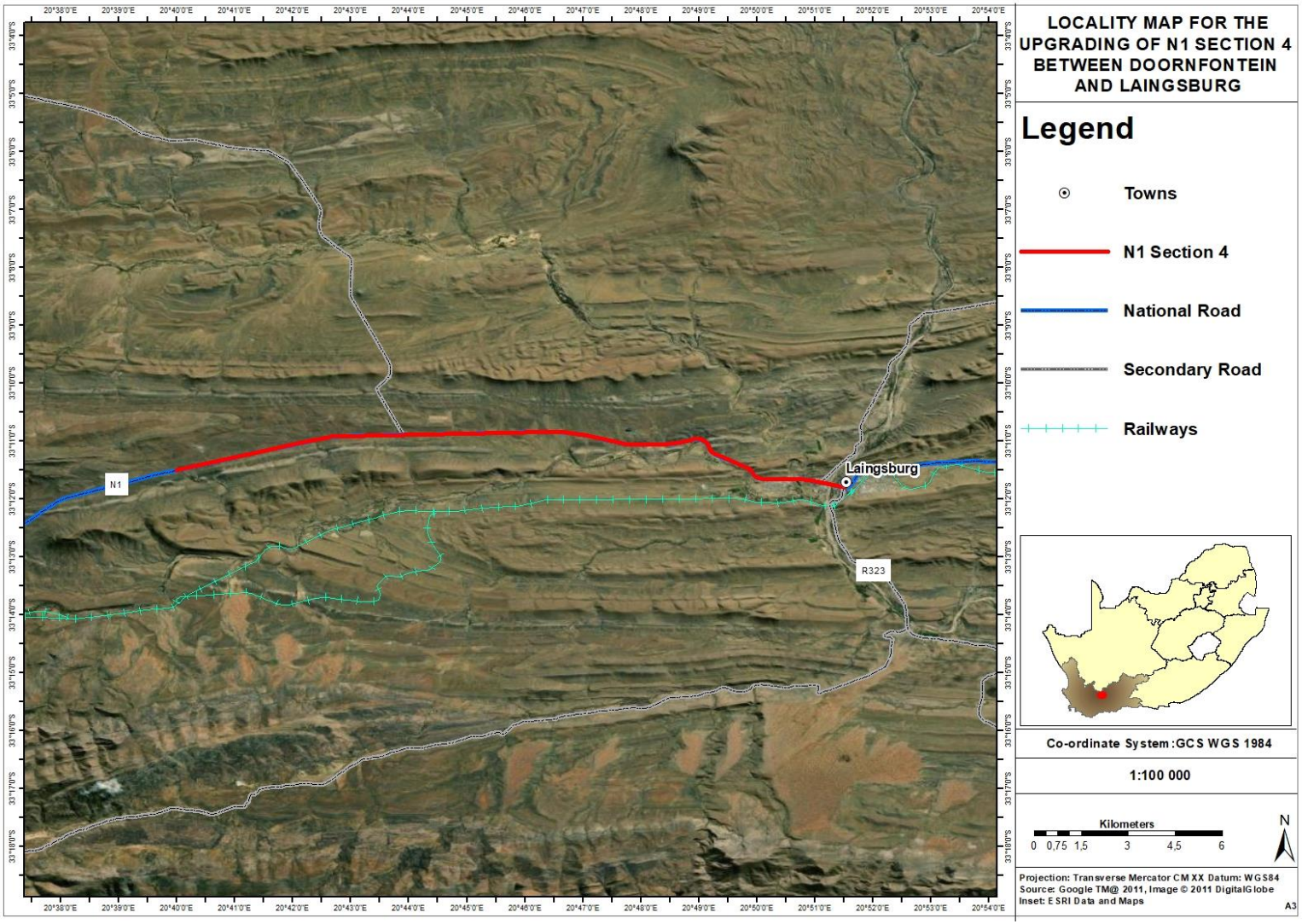


Figure 1-1:Locality Map

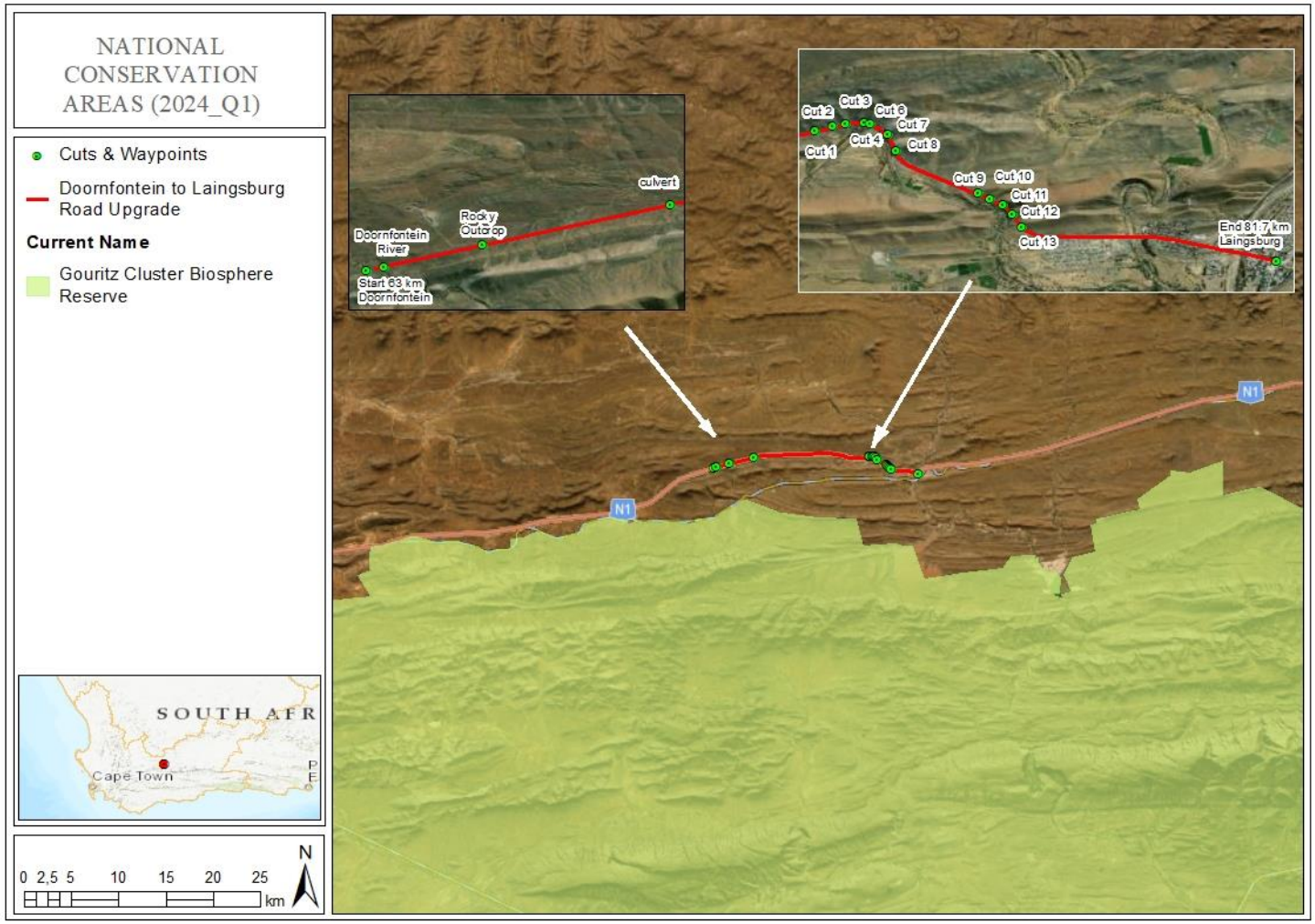


Figure 1-2: National Conservation Areas

1.4 SITE SENSITIVITY VERIFICATION AND MINIMUM REPORT CONTENT REQUIREMENTS

In terms of the Protocol for the Specialist Assessment and Minimum Reporting Content Requirements for Environmental Impacts on Terrestrial Biodiversity (GN R. 320 of 2020) and Terrestrial Animal and Plant Species (GN R. 1150), prior to the commencement of a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool, must be confirmed by undertaking a site sensitivity verification. The results of the screening tool, together with the site sensitivity verification, ultimately determines the minimum report content requirements.

1.5 TERMS OF REFERENCE AND OBJECTIVES

Ntumbuluko Consulting (Pty) Ltd has been appointed to undertake the following specialist functions:

- Describe and map the vegetation types in the study area.
- Describe the biodiversity and ecological state of each vegetation unit.
- Identify plant and animal species of conservation concern (Red Data List, PNCO and TOPS lists). In the case of the fauna, this was done at a desktop level.
- Identify alien plant species, assess the invasive potential and recommend management procedures.
- Assess the potential impacts of the proposed project on both the fauna and flora.
- Provide mitigation measures, rehabilitation process and/or vegetation removal procedures that would reduce the potential impacts of the developments on biodiversity.

1.6 SCOPE OF STUDY

1.6.1 FLORAL STUDY:

- Identify sensitive vegetation types and critical biodiversity areas on site.
- Identify Critical Biodiversity and Ecological Support Areas onsite.

- Describe the potential direct, indirect and cumulative negative and positive impacts of the proposed activity on the vegetation species during construction, operation and decommissioning phases of the project.
- Provide monitoring requirements, mitigation measures and recommendations.

1.6.2 FAUNAL STUDY:

- Describe the existing micro-habitats, and the species associated with those habitats.
- Provide a description of species composition and conservation status in terms of protected, endangered or vulnerable faunal species.
    - This description will include species which are likely to occur within, traverse across or forage within the proposed project area, as well as species which may not necessarily occur on site, but which are likely to be impacted upon as a result of the proposed development.

1.7 LIMITATIONS AND ASSUMPTIONS

This report is based on current available information and, as a result, the following limitations and assumptions are implicit:

- The report is based on a project description received from the client.
- The study was done during the wet season and thus a follow-up is not necessary.
- Species of Conservation Concern (SCC) are difficult to find and difficult to identify, thus species described in this report do not comprise an exhaustive list. It is almost certain that additional SCCs will be found during construction and operation of the development.
- Some areas of the study site were not accessible during the day of the site inspection.
- The specialist responsible for this study reserves the right to amend this report, recommendations and/or conclusions at any stage should any additional or otherwise significant information come to light.

2. LEGAL FRAMEWORK

The following national and provincial legislative guidelines and requirements were followed as part of this study:

2.1 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO 107 OF 1998) (NEMA) AS AMENDED

This Act embraces all three (3) fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands and special attention is given to management and planning procedures. NEMA provides for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

2.2 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT NO 10 OF 2004) (NEM: BA)

NEMBA was signed into law in mid-2004 and entered into effect on 1 September 2004. NEM: BA provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities. Certain activities, known as Restricted Activities, are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the act are keeping, moving, having in possession, importing and exporting, and selling.

2.3 THE NATIONAL BIODIVERSITY FRAMEWORK (2017-2022)

The National Biodiversity Framework (NBF) is a requirement under Section 38 of the National Environmental Management: Biodiversity Act (Act 10 of 2004, hereafter referred to as the 'Biodiversity Act'). The NBF is a short to medium-term coordination tool that shows the alignment between the strategic objectives and outcomes identified in the National Biodiversity Strategy and Action Plan (NBSAP v.2, 2015) and

other key national strategies, frameworks and systems that currently guide the work of the biodiversity sector and identifies mechanisms through which this work is coordinated. It also identifies a set of interventions or "acceleration measures" that can unlock or fast-track implementation of the NBSAP and indicates the relative roles of the many agencies involved in implementing these activities. The purpose of the NBF is not to provide a comprehensive review of all work currently being undertaken in the biodiversity sector, nor to list all of the actions required to conserve and manage South Africa's biodiversity in support of sustainable development.

2.4 CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT NO 43 OF 1983) (CARA):

This act regulates the utilization and protection of wetlands, soil conservation and all matters relating thereto; control and prevention of veld fires, control of weeds and invader plants, the prevention of water pollution resulting from farming practices and losses in biodiversity.

2.5 THE NATIONAL FOREST ACT (ACT NO 84 OF 1998) (NFA)

The main objective of the National Forests Act, 1998 is to promote the sustainable management and development of forests and to provide protection for certain forests and trees. This said protection is provided through the protection of all natural forests (Section 7 (1), the protection of all trees declared to be protected in terms of section 12(1) of the Act, and the regulation of certain activities in a proclaimed State Forest (Section 23(1)(a) – (k)). It should be noted that there are other environmental legislation administered by other State Departments that also regulate natural resources. The Act is responsible for:

- Promotes the sustainable management and development of forests for the benefit of all;
- Creates the conditions necessary to restructure forestry in South Africa;
- Provide special measures for the protection of certain forests and protected trees;
- Promotes the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes;
- Promotes community forestry; and

- Promotes greater participation in all aspects of forestry and the forest products industry by persons disadvantaged by unfair discrimination.

2.6 CONVENTION ON BIOLOGICAL DIVERSITY

The objectives of the CBD are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from commercial and other utilization of genetic resources. The agreement covers all ecosystems, species, and genetic resources.

2.7 CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA (CITES)

The CITES aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Through its three appendices, the Convention accords varying degrees of protection to more than 30,000 plant and animal species.

2.8 CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS

The CMS, or the Bonn Convention aims to conserve terrestrial, marine and avian migratory species throughout their range. Parties to the CMS work together to conserve migratory species and their habitats by providing strict protection for the most endangered migratory species, by concluding regional multilateral agreements for the conservation and management of specific species or categories of species, and by undertaking co-operative research and conservation activities.

2.9 THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

The objectives of the Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security. The Treaty covers all plant genetic resources for food and agriculture, while it's Multilateral System of Access and Benefit-sharing

covers a specific list of 64 crops and forages. The Treaty also includes provisions on Farmers' Rights.

2.10 2.CONVENTION ON WETLANDS (POPULARLY KNOWN AS THE RAMSAR CONVENTION)

The Ramsar Convention provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The convention covers all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities.

2.11 WORLD HERITAGE CONVENTION (WHC)

The primary mission of the WHC is to identify and conserve the world's cultural and natural heritage, by drawing up a list of sites whose outstanding values should be preserved for all humanity and to ensure their protection through a closer co-operation among nations.

2.12 RAMSAR CONVENTION

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Ramsar Convention is the only global environmental treaty that deals with a particular ecosystem. The treaty was adopted in the Iranian city of Ramsar in 1971 and the Convention's member countries cover all geographic regions of the planet.

2.13 INTERNATIONAL PLANT PROTECTION CONVENTION (IPPC)

The IPPC aims to protect world plant resources, including cultivated and wild plants by preventing the introduction and spread of plant pests and promoting the appropriate measures for their control. The convention provides the mechanisms to develop the International Standards for Phytosanitary Measures (ISPMs), and to help countries to implement the ISPMs and the other obligations under the IPPC, by

facilitating the national capacity development, national reporting and dispute settlement. The Secretariat of the IPPC is hosted by the Food and Agriculture Organization of the United Nations (FAO).

2.14 WESTERN CAPE BIODIVERSITY ACT 6 OF 2021

In December of 2021, the Western Cape Premier assented to the WCBA, which will come into effect in a phased manner. Once this Act is fully in force the legislative context within the Western Cape specific to biodiversity management will be harmonised through the repeal of the Sea Shore Act (Act 21 of 1935), the Mountain Catchment Areas Act (Act 63 of 1970), the Nature Conservation Ordinance (1974), and the Western Cape Biosphere Reserves Act (Act 6 of 2011), as well as the Western Cape Nature Conservation Laws Amendment Act (Act 3 of 2000) excluding section 2 and schedule 2. The WCBA will significantly improve the WCG's ability to give effect to the PBSAP, along with the commitments made under the CBD that are applicable to the WCG.

2.15 THE WESTERN CAPE BIODIVERSITY SPATIAL PLAN (BSP)

The 2017 BSP comprises a map of biodiversity priority areas accompanied by a handbook providing contextual information and land use guidelines. It identifies priority areas for biodiversity conservation and ecosystem delivery via the delineation of spatial categories of biodiversity priority areas such as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). The BSP Handbook provides guidelines for land use planning and decision-making, and for land and resource management using the BSP Map10. All the guidelines are informed by the 'Desired Management Objective' for the different categories included in the BSP Map, as well as the relative impact of a land use activity on biodiversity. The BSP is in the process of being updated, and the draft 2023 BSP identifies 24% of the province as CBAs, 13% as ESAs, 16% as Protected Areas, 18% as no natural habitat left remaining and 29% as other natural areas.

2.16 THE WESTERN CAPE PROTECTED AREA EXPANSION STRATEGY (WCPAES)

The WCPAES guides the strategic expansion of protected areas. It aligns with the National Protected Areas Expansion Strategy, CapeNature's Strategic Plan (2021-2025) and the National Environmental Management: Protected Areas Act (Act 57 of 2003; NEM:PAA). It provides guidance for the strategic increase in the protected area network and is updated every five years. The concept of strategic increase is crucial and a key aim of the WCPAES is to increase representation of threatened ecosystem types into the conservation estate. These priority areas are identified in the Conservation Action Priorities Map.

OneCape 2040

OneCape 2040 complements the NDP and was designed to build on the then Provincial Strategic Objectives. OneCape 2040 sets the goal of:

"…creating a resilient, inclusive and competitive Western Cape with higher rates of employment producing growing incomes, greater equality and an improved quality of life"

The vision as stated in OneCape 2040 is that of:

"…a highly-skilled, innovation driven, resource efficient, connected, high opportunity and collaborative society".

2.17 NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected as well as integrated management of water resources with the delegation of powers to institutions at the regional or catchment level. The purpose of the Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in responsible ways. Of specific importance to this application is Section 19 of the NWA, which states that an owner of land, a person in control of land or a person who occupies or uses the land which thereby causes, has caused or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring and

must therefore comply with any prescribed waste standard or management practices.

Regulations GN 704 dated June 1999 under the NWA, 1998 (Act 36 of 1998) stipulates that no development activities may take place within the 1:100 year floodline of a watercourse, or within 100 m of the watercourse, whichever is the furthest.

Regulations GN 509 dated August 2016 under the Section 21 c and i water uses of the NWA, 1998 (Act No 36 of 1998) stipulates the:

"Extent of a watercourse" as:

(a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam.

"Regulated area of a watercourse" for section 21(c) or (i) of the Act water uses in terms of this Notice means:

(a) The outer edge of the 1 in 100-year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
(b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or
(c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

2.18 NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREA (NFEPA) STATUS

In an attempt to better conserve aquatic ecosystems, South Africa has recently categorised its river systems according to set ecological criteria (i.e. ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver et al. 2011) The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act (NEM:BA) biodiversity goals (Nel et al. 2011).

3. TERRESTRIAL BIOSIVERSITY METHODOLOGY

3.1 THE ASSESSMENT

A site inspection was undertaken on the **06th of July 2024** to assess the site-specific ecological state, current land-use, identify potential sensitive ecosystems and identify fauna and flora species associated with the proposed project activities. The site inspection also served to identify potential impacts of the proposed development, and its impacts on the surrounding ecological environment.

In addition to the site visit, key resources that were consulted include the following:

- South African Vegetation Map (SA VEGMAP) (Mucina et al., 2018);
- The National Freshwater Ecosystem Priority Areas (NFEPA, 2011/14);
- The National Environmental Management: Biodiversity Act (NEM:BA), 2004: List of Threatened Ecosystems (2011);
- National Biodiversity Management: Biodiversity Act (NEMBA) List of Threatened or Protected Species (2005);
- The Western Cape Biodiversity Spatial Plan (BSP); and
- International Union for Conservation of Nature (IUCN).

3.2 SPECIES OF CONSERVATION CONCERN

Data on the known distribution and conservation status for each potential Species of Conservation Concern (SCC) has to be obtained to develop a list of 'Species of Concern'. These species are those that may be impacted significantly by the proposed activity. In general, these will be species that are already known to be threatened or at risk, or those that have restricted distributions (endemics) with a portion of their known range falling within the study area i.e. strict endemic and near endemic species. Species that are afforded special protection, notably those that are protected by NEM:BA (Act No. 10 of 2004).

3.3 SAMPLING PROTOCOL

The study site was visually surveyed to evaluate vegetation composition, and faunal assemblages and to provide detailed information on the plant communities present. The aim of the site inspection was to characterise and describe each fauna and flora community within the study site as well as identify areas of high sensitivity and SCC.

Prior to the site visit, sampling locations representative of each vegetation type were identified. At these sampling locations, vegetation types within the study area were assessed and surveyed using plant identification guides and other published literature. Vegetation communities were then described according to the dominant set of species recorded from each type. These were mapped and assigned a sensitivity score using the methodology outlined in Species Environmental Assessment Guideline Document.

3.4 VEGETATION MAPPING

The revised SA VEGMAP (2018) was established in order to "provide floristically based vegetation units of South Africa, Lesotho and Swaziland at a greater level of detail than had been available before." The map was developed using a wealth of data provided by a network of ecologists, biologists and conservation planners that make periodic contributions to the project. These contributions have allowed for the best national vegetation map to date, the last being that of Acocks developed over 50 years ago. The SANBI Vegetation map informs finer scale bioregional plans and includes an additional 47 new vegetation units since its refinement in 2012.

The SA VEGMAP project has two main aims:

1. To determine the variation in and units of Southern African vegetation based on the analysis and synthesis of data from vegetation studies throughout the region, and
2. To compile a vegetation map- The aim of the map was to accurately reflect the distribution and variation on the vegetation and indicate the relationship of the vegetation with the environment. For this reason, the collective expertise of vegetation scientists from various universities and state departments were harnessed to make this project as comprehensive as possible.

The map and accompanying book describes each vegetation type in detail, along with the most important species, including endemic species and those that are biogeographically important.

The SA VEGMAP is compared to actual conditions of vegetation observed onsite during the site assessment through mapping from aerial photographs, satellite images,

literature descriptions (e.g. SANBI and ECBCP) and related data gathered on the ground.

3.5 SENSITIVITY ASSESSMENT

The Species Environmental Assessment guideline (SANBI, 2020) was applied to assess the Site Ecological Importance (SEI) of the project area. The habitats and the species of conservation concern in the project area were assessed based on their conservation importance, functional integrity and receptor resilience (**Table 3-1**). The combination of these resulted in a rating of SEI and interpretation of mitigation requirements based on the ratings.

The sensitivity map was developed using available spatial planning tools as well as by applying the SEI sensitivity based on the field survey.

Table 3-1: Criteria for establishing Site Ecological importance and description of criteria.

CRITERIA	DESCRIPTION
Conservation Importance (CI)	The importance of a site for supporting biodiversity features of conservation concern present e.g. populations of IUCN Threatened and Near-Threatened species (CR, EN, VU & NT), Rare, range- restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.
Functional Integrity (FI)	A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivityto other natural areas and the degree of current persistent ecological impacts.
Biodiversity Importance (BI) is a function of Conservation Importance (CI) and theFunctional Integrity (FI) of a receptor.	
Receptor Resilience (RR)	The intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention.
Site Ecological Importance (SEI) is a function of Biodiversity Importance (BI) and ReceptorResilience (RR)	

3.6 TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT

3.6.1 IMPACT RATING METHODOLOGY

To ensure a balanced and objective approach to assessing the significance of potential impacts, a standardized rating scale was adopted which allows for the direct comparison of specialist studies. This rating scale has been developed in accordance with the requirements of the NEMA EIA Regulations (2014 and subsequent 2017 amendments).

The potential impacts of the proposed establishment of a Borrow pit, existing land uses and the available alternatives sites were rated using a clearly defined rating scale. The significance rating formula is as follows:

Significance = Consequence x Probability

Where

Consequence = Type of Impact x (Intensity + Spatial Scale + Duration)

And

Probability = Likelihood of an Impact Occurring

In addition, the formula for calculating consequence:

Type of Impact = +1 (Positive Impact) or -1 (Negative Impact)

The weight assigned to the various parameters for positive and impacts to biodiversity is provided for in the formula and is presented in **Table 3-2**. The probability consequence matrix is displayed in **Table 3-3**, with the impact significance rating described in **Table 3-4**.

Table 3-2: Biodiversity Impact Assessment Parameter Ratings

RATING	INTENSITY		SPATIAL SCALE	DURATION	PROBABILITY
	Negative Impacts (Type of Impact = -1)	**Positive Impacts (Type of Impact = +1)**			
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or ecosystem. Persistent severe damage. Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.	Noticeable, on-going social and environmental benefits which have improved the livelihoods and living standards of the local community in general and the environmental features.	International The effect will occur across international borders.	Permanent: No Mitigation The impact will remain long after the life of the Project.	Certain/ Definite. There are sound scientific reasons to expect that the impact will definitely occur.
6	Significant impact on highly valued species, habitat or ecosystem.	Great improvement to livelihoods and living standards of a large percentage of	National Will affect the entire country.	Beyond Project Life The impact will remain for some time	Almost certain/Highly probable It is most likely that the impact will occur.

	Irreparable damage to highly valued items of cultural significance or breakdown of social order.	population, as well as significant increase in the quality of the receiving environment.		after the life of a Project.	
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread positive benefits to local communities which improves livelihoods, as well as a positive improvement to the receiving environment.	Province/ Region Will affect the entire province or region.	Project Life The impact will cease after the operational life span of the project	Likely The impact may occur.
4	Serious medium-term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures /	Average to intense social benefits to some people. Average to intense environmental enhancements.	Municipal Area Will affect the whole municipal area.	Long term 6-15 years.	Probable Has occurred here or elsewhere and could therefore occur.

	items of cultural significance.				
3	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some.	Local Extending across the site and to nearby settlements.	Medium term 1-5 years.	Unlikely Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants. Minor medium-term social impacts on local population. Mostly	Low positive impacts experience by very few of population.	Limited Limited to the site and its immediate surroundings.	Short term Less than 1 year.	Rare/ improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the Project but has happened elsewhere. The possibility of the impact materialising

	repairable. Cultural functions and processes not affected.				is very low as a result of design, historic experience or implementation of adequate mitigation measures.
1	Limited damage to minimal area of low significance that will have no impact on the environment. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level social and environmental benefits felt by very few of the population.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month.	Highly unlikely/None Expected never to happen.

Table 3-3: Probability Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Table 3-4: Significance Threshold Limits

Score	Description	Rating
109 to 147	A very beneficial impact which may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change.	

Score	Description	Rating
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and/or social) environment.	
36 to 72	An important positive impact. The impact is insufficient by itself to justify the implementation of the project. These impacts will usually result in positive medium to long-term effect on the social and/or natural environment.	
3 to 35	A small positive impact. The impact will result in medium to short term effects on the social and/or natural environment.	
-3 to -35	An acceptable negative impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the social and/or natural environment.	
-36 to -72	An important negative impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the Project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the social and/or natural environment.	
-73 to -108	A serious negative impact which may prevent the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe effects.	

Score	Description	Rating
-109 to -147	A very serious negative impact which may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects.	

4. SITE CHARACTERISTICS

4.1 GEOLOGY & SOILS

The area consists of mainly mudstone, shale and sandstone of the Adelaide Subgroup (Beaufort Group), accompanied by sandstone, shale and mudstone of the Permian Waterford Formation (Ecca Group) and sandstone and shale of other Ecca Group Formations as well as Dwyka Group diamictites (all of the Karoo Supergroup). This geology gives rise to shallow, skeletal soils. The region is classified as Fc land type (to a large extent), with Ib land type playing a subordinate role.

4.2 CLIMATE

The probability of rain is given for the entire year, but it is higher in winter. The Mean Annual Precipitation (MAP) is slightly above 200 mm. There are two slight rainfall optima: one in March and another spread from May to August. The mean annual temperature is close to 16°C, and the incidence of frost relatively high (30 days). See also climate diagram for SKv 6 Koedoesberge-Moordenaars Karoo (**Figure 4-1**).

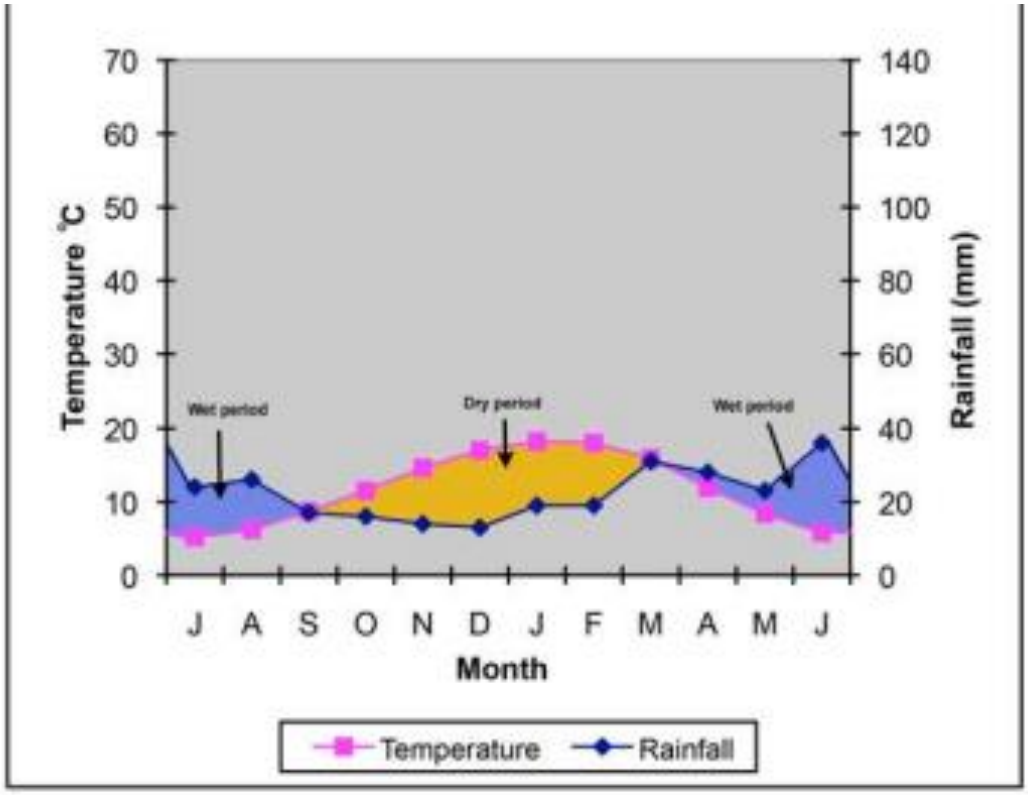


Figure 4-1: Climate diagram for SKv 6 Koedoesberge-Moordenaars Karoo

4.3 VEGETATION & LANDSCAPE ALONG THE NATIONAL ROUTE 1 SECTION 4 BETWEEN DOORNFONTEIN (KM 63.0) AND LAINGSBURG (KM 81.7)

4.3.1 Koedoesberge-Moordenaars Karoo (SKv 6)

The bulk (~98%) of the National Route 1 Section 4 between Doornfontein (KM 63.0) and Laingsburg (KM 81.7) traverses through the Koedoesberge-Moordenaars Karoo (SKv6) vegetation unit (**Figure 4-2**). This vegetation unit is typically found in slightly undulating to hilly landscape which is dominated by low succulent scrub and dotted by scattered tall shrubs, patches of 'white' grass visible on plains, the most conspicuous dominants being dwarf shrubs of *Pteronia*, *Drosanthemum* and *Galenia*.

4.3.2 Southern Karoo Riviere (AZi 6)

A small section (<2%) of the road is found within the Southern Karoo Riviere (AZi 6) (**Figure 4-2**). This vegetation unit is found in narrow riverine flats supporting a complex of *Acacia karroo* or *Tamarix usneoides* thickets (up to 5 m tall) and fringed by tall *Salsola*-dominated shrubland (up to 1.5 m high), especially on heavier (and salt-laden) soils on very broad alluvia. In sandy drainage lines *Stipagrostis namaquensis* may occasionally also dominate. Mesic thicket forms in the far eastern part of this region may also contain *Leucosidea sericea*, *Rhamnus prinoides* and *Ehrharta erecta*.

4.4 DISTRIBUTION OF THE VEGETATION UNITS FOUND ONSITE

4.4.1 Distribution of the Koedoesberge-Moordenaars Karoo (SKv 6)

The Koedoesberge-Moordenaars Karoo vegetation unit is distributed in the Western Cape and Northern Cape (smaller portion) Provinces, Koedoesberge and Pienaarse Berg low mountain ranges bordering on southern Tanqua Karoo and separated by the Klein Roggeveld Mountains from the Moordenaars Karoo in the broad area of Laingsburg and Merweville. The unit also includes the Doesberg region east of Laingsburg and piedmonts of the Elandsberg as far as beyond the Gamkapoort Dam at Excelsior (west of Prince Albert). This vegetation unit thrives in altitudes ranging between 500–1 250 m (most of the area at 680–1 120 m).

4.4.2 Distribution of the Southern Karoo Riviere (AZi 6)

The Southern Karoo Riviere (AZi 6) is distributed in the Western and Eastern Cape Provinces, Alluvia of the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega, and Sundays Rivers and their tributaries), east of Laingsburg as far west as Graaff-Reinet and Jansenville. This vegetation unit is embedded within the Koedoesberge-Moordenaars Karoo, Prince Albert Succulent Karoo, Gamka Karoo, Eastern Lower Karoo, and southern parts of the Eastern Upper Karoo as well as some parts of the Albany Thicket Biome south of Cradock. This vegetation unit thrives in altitudes ranging between Altitude ranging from 250–1 550 m.

4.5 CONSERVATION STATUS OF THE VEGETATION UNITS ONSITE

4.5.1 Conservation status of the Koedoesberge-Moordenaars Karoo (SKv 6)

The Koedoesberge-Moordenaars Karoo vegetation unit is classified as **Least threatened**. A conservation target 19% has been set, with a very small portion enjoying statutory conservation in the Gamkapoort Nature Reserve. The vegetation unit is transformed only to a very small extent. There are no serious alien plant invasions recorded. Erosion is moderate (88%) and only to lesser extent high or very low.

4.5.2 Conservation status of the Southern Karoo Riviere (AZi 6)

The Southern Karoo Riviere (AZi 6) is classified as **Least threatened**. A conservation target 24%, with only an estimated 1.5% statutorily conserved in the Karoo National Park as well as in the Aberdeen, Bosberg, Commando Drift, Gamkapoort and Karoo Nature Reserves and in about 10 private reserves, mainly set up for game farming. Some 12% transformed for cultivation and building of dams, including Beaufort West, Beervlei, De Hoop, Floriskraal, Kommandodrift, Lake Arthur, Leeu-Gamka, Mentz and Vanryneveldspas Dams. The frequent disturbance include floods, concentrated grazing pressure, and associated input of nutrients, increase vulnerability of these habitats to invasion of alien woody species such as *Agave americana*, *Opuntia species*, *Prosopis species*, *Salix babylonica* and *Schinus molle*, and forbs including *Atriplex eardleyae*, *A. lindleyi* subsp. inflata, *Cirsium vulgare*, *Salsola kali and Schkuhria pinnata*.

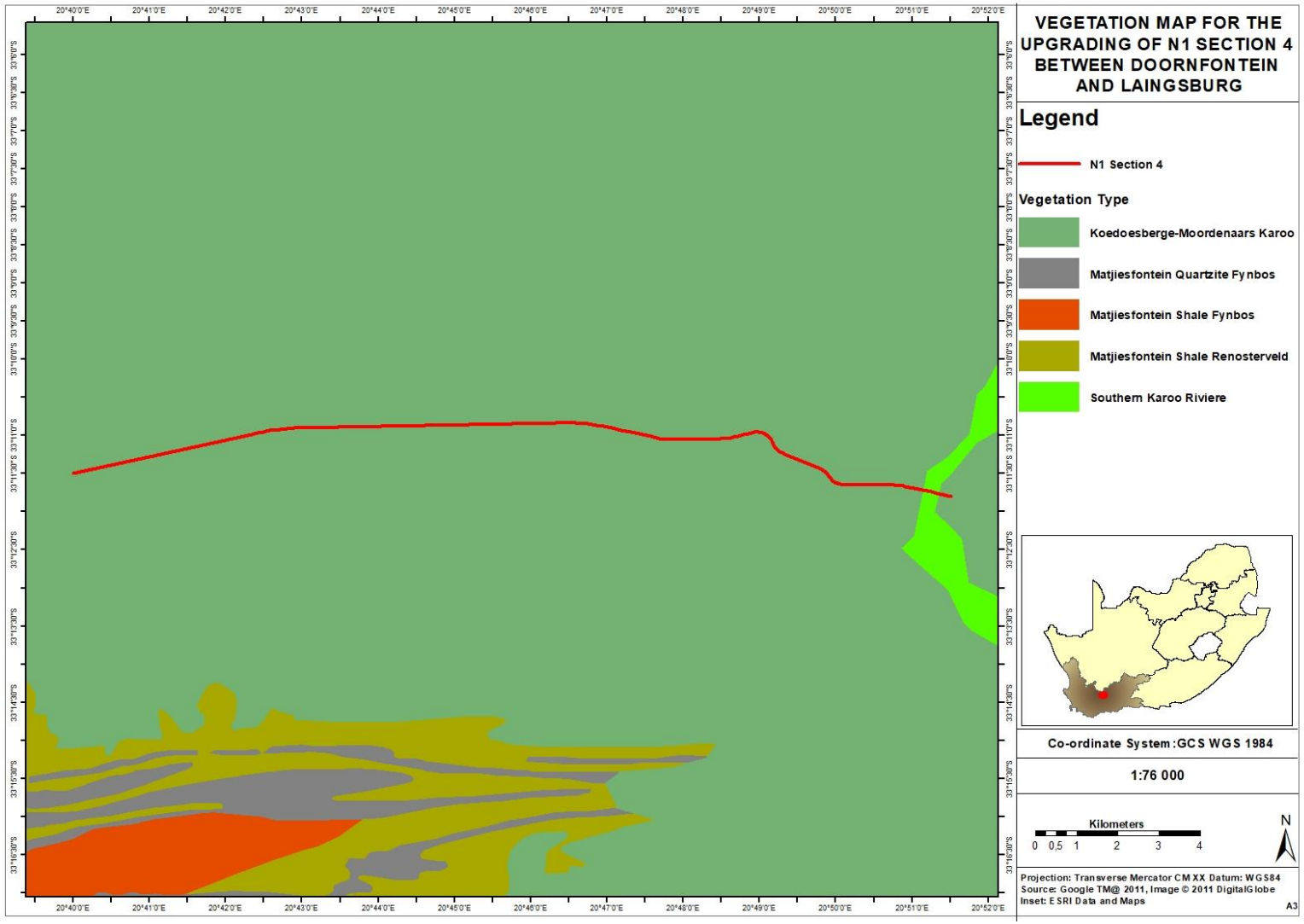


Figure 4-2:Vegetation Map

4.6 IMPORTANT TAXA ASSOCIATED WITH THE STUDY SITE

Table 4-1: Important Taxa within the within the study site (Mucina and Rutherford 2006)

PLANT FORM	*SPECIES*
SKv 6 Koedoesberge-Moordenaars Karoo	
Succulent Shrubs	*Hereroa odorata (d), Antimima fergusoniae, A. maxwellii, A. wittebergensis, Aridaria noctiflora subsp. straminea, Crassula nudicaulis, C. rupestris subsp. commutata, Cylindrophyllum comptonii, Drosanthemum framesii, D. karrooense, D. lique, Euphorbia decussata, E. eustacei, E. mauritanica, Hoodia gordonii, H. grandis, Lycium oxycarpum, Manochlamys albicans, Peersia macradenia, Pelargonium crithmifolium, Ruschia grisea, R. intricata, Salsola aphylla, Sarcocaulon crassicaule, Sceletium rigidum, Tetragonia robusta var. psiloptera, Trichodiadema barbatum, Tylecodon reticulatus, T. wallichii subsp. wallichii, Zygophyllum flexuosum.*
Tall Shrub	*Diospyros pallens.*
Low Shrubs	*Pteronia incana (d), Amphiglossa tomentosa, Aptosimum indivisum, A. spinescens, Asparagus burchellii, A. capensis var. capensis, Athanasia minuta subsp. inermis, Barleria stimulans, Berkheya spinosa, Chrysocoma ciliata, Eriocephalus africanus, E. ericoides, E. pauperrimus, E. spinescens, Euryops lateriflorus, Felicia filifolia, F. macrorrhiza, F. muricata, F. scabrida, Galenia africana, G. fruticosa, Garuleum bipinnatum, Helichrysum lucilioides, Hermannia grandiflora, H. multiflora, Lessertia fruticosa, Limeum aethiopicum, Melolobium candicans, Menodora juncea, Microloma armatum, Monechma spartioides, Muraltia scoparia, Pelargonium hirtum, Pentzia incana, Polygala seminuda, Pteronia adenocarpa, P. ambrariifolia, P. empetrifolia, P. glauca, P. glomerata, P. pallens, P. scariosa, P. sordida, Rhigozum obovatum, Senecio haworthii, Tripteris sinuata, Zygophyllum microphyllum, Z. retrofractum, Z. spinosum. Semiparasitic Shrub: Thesium lineatum.*
Woody Climbers	*Asparagus fasciculatus, A. racemosus, A. retrofractus, Microloma sagittatum.*
Herbaceous Climber	*Fockea sinuata*

Semiparasitic Epiphytic Shrub	*Viscum capense*
Herbs	*Atriplex suberecta, Felicia bergeriana, Gazania jurineifolia subsp. scabra, Hermannia althaeifolia, H. pulverata, Lepidium africanum, L. desertorum, Leysera tenella, Pelargonium minimum, P. nervifolium, Syncarpha dregeana, Ursinia nana, Zaluzianskya inflata, Z. peduncularis. Geophytic Herbs: Drimia intricata, Geissorhiza karooica, Ixia marginifolia, I. rapunculoides, Ornithogalum adseptentrionesvergentulum, Oxalis obtusa, Romulea austinii, R. tortuosa subsp. tortuosa, Strumaria karooica, S. pubescens, Trachyandra thyrsoidea.*
Succulent Herbs	*Astroloba foliolosa, A. spiralis, Brownanthus vaginatus, Crassula deceptor, C. muscosa, C. tomentosa, Deilanthe thudichumii, Haworthia marumiana var. archeri, Mesembryanthemum stenandrum, Pectinaria articulata, Piaranthus parvulus, Psilocaulon coriarium, P. junceum, Quaqua arenicola subsp. arenicola, Q. arida, Q. ramosa, Stapelia pillansii, S. rufa, Stapeliopsis exasperata, Tetragonia microptera, Tripteris aghillana var. integrifolia.*
Parasitic Herb	*Hyobanche glabrata*
Graminoids	*Aristida adscensionis, A. diffusa, Ehrharta calycina, E. delicatula, Enneapogon scaber, Fingerhuthia africana, Karroochloa tenella, Pentaschistis airoides, Stipagrostis ciliata, S. obtusa.*
	AZi 6 Southern Karoo Riviere
Small Trees	*Acacia karroo (d), Rhus lancea (d).*
Tall Shrubs	*Diospyros lycioides (d), Tamarix usneoides (d), Cadaba aphylla, Euclea undulata, Grewia robusta, Gymnosporia buxifolia, Melianthus comosus.*
Low Shrub	*Asparagus striatus.*
Succulent Shrubs	*Lycium cinereum (d), Amphiglossa callunoides, Lycium hirsutum, L. oxycarpum.*
Rocky slopes of river canals Graminoid	*Stipagrostis namaquensis (d)*
Alluvial shrublands & herblands Low Shrubs	*Ballota africana, Bassia salsoloides, Carissa haematocarpa, Pentzia incana.*
Succulent Shrubs	*Malephora uitenhagensis (d), Salsola aphylla (d), S. arborea (d), Drosanthemum lique, Salsola geminiflora, S. gemmifera.*

Graminoids	*Cynodon incompletus (d), Cenchrus ciliaris, Cyperus marginatus.*
Reed beds	*Megagraminoid: Phragmites australis (d).*

4.7 PLANT SPECIES OF CONSERVATION CONCERN

According to the state of environment outlook report for the Western Cape Province, There are 13 489 recorded plant species in the Western Cape Province, which constitutes 56% of South Africa's flora species, and a large number of these are endemic (6 776). Some 1 889 plant species in the Western Cape are classified as threatened, with 330 classified as Critically Endangered, of which 38 are presumed extinct. A further 636 are Endangered and 900 are Vulnerable. These species account for up to 68% of the threatened plant species in the country; 1 695 of these are endemic to the Western Cape (Le Roux et al. 2012). Moreover, there are 3 923 plant species of conservation concern because they are Near Threatened, Data Deficient[1],

The plant species expected to occur within the study site are outlined in **Table 4-1**.

Table 4-2: Plant species of conservation concern expected to occur in grid square 2427CC as well as the conservation status of each (POSA, 2017; SANBI, 2017)

SPECIES OF CONSERVATION CONCERN	RED STATUS	DISTRIBUTION IN STUDY AREA
Eriocephalus grandiflorus	Rare	Koedoesberge-Moordenaars Karoo
Phymaspermum thymelaeoides	Currently not threatened	Koedoesberge-Moordenaars Karoo
Lotononis venosa	Vulnerable	Koedoesberge-Moordenaars Karoo
Cleretum lyratifolium	Rare	Koedoesberge-Moordenaars Karoo
Octopoma nanum	Vulnerable	Koedoesberge-Moordenaars Karoo

[1] Western Cape Department of Environmental Affairs and Development Planning: Final Biodiversity and Ecosystem Health Chapter, February 2018

Peersia macradenia	Local endemic	Koedoesberge-Moordenaars Karoo
Tanquana archeri	Vulnerable	Koedoesberge-Moordenaars Karoo
Adromischus phillipsiae		Koedoesberge-Moordenaars Karoo
Geissorhiza karooica	Near Threatened	Koedoesberge-Moordenaars Karoo
Geissorhiza cantharophila	Local endemic	Koedoesberge-Moordenaars Karoo
Romulea eburnean	Vulnerable	Koedoesberge-Moordenaars Karoo
Lachenalia whitehillensis	Near Threatened	Koedoesberge-Moordenaars Karoo
Brunsvigia josephinae	Vulnerable	Koedoesberge-Moordenaars Karoo
Ruschia beaufortensis (Aizoaceae)	Vulnerable	Southern Karoo Riviere
Peersia frithii (Aizoaceae)	Vulnerable	Southern Karoo Riviere
Tritonia florentiae (Iridaceae)	Vulnerable	Southern Karoo Riviere

4.8 THE WESTERN CAPE BIODIVERSITY SPATIAL PLAN (WCBSP)

The Western Cape Biodiversity Spatial Plan (WCBSP) is a spatial tool that comprises the Biodiversity Spatial Plan Map (BSP Map) of biodiversity priority areas, accompanied by contextual information and land use guidelines that make the most recent and best quality biodiversity information available for land use and development planning, environmental assessment and regulation, and natural resource management. The Western Cape Biodiversity Spatial Plan (WCBSP) classifies the habitats of the province according to conservation value in decreasing value, as follows:

1. Protected Areas (PA);
2. Critical Biodiversity Areas 1 (CBA1);
3. Critical Biodiversity Areas 2 (CBA2);

4. Ecological Support Area 1 (ESA1);
5. Ecological Support Area 2 (ESA2);
6. Other Natural Areas (ONA).

According to the Western Cape Biodiversity Spatial Plan (WCBSP) the National Route 1 Section 4 between Doornfontein (KM 63.0) and Laingsburg (KM 81.7) is located within the following:

1. **Critical Biodiversity Areas 1**: The starting of the of the National Road upgrade touches a CBA[2] (**Figure 4-3**).
2. **Ecological Support Area:** The section of the road where the cuts will take place will is touches a number of Ecological Support Areas 2 (**Figure 4-3**).

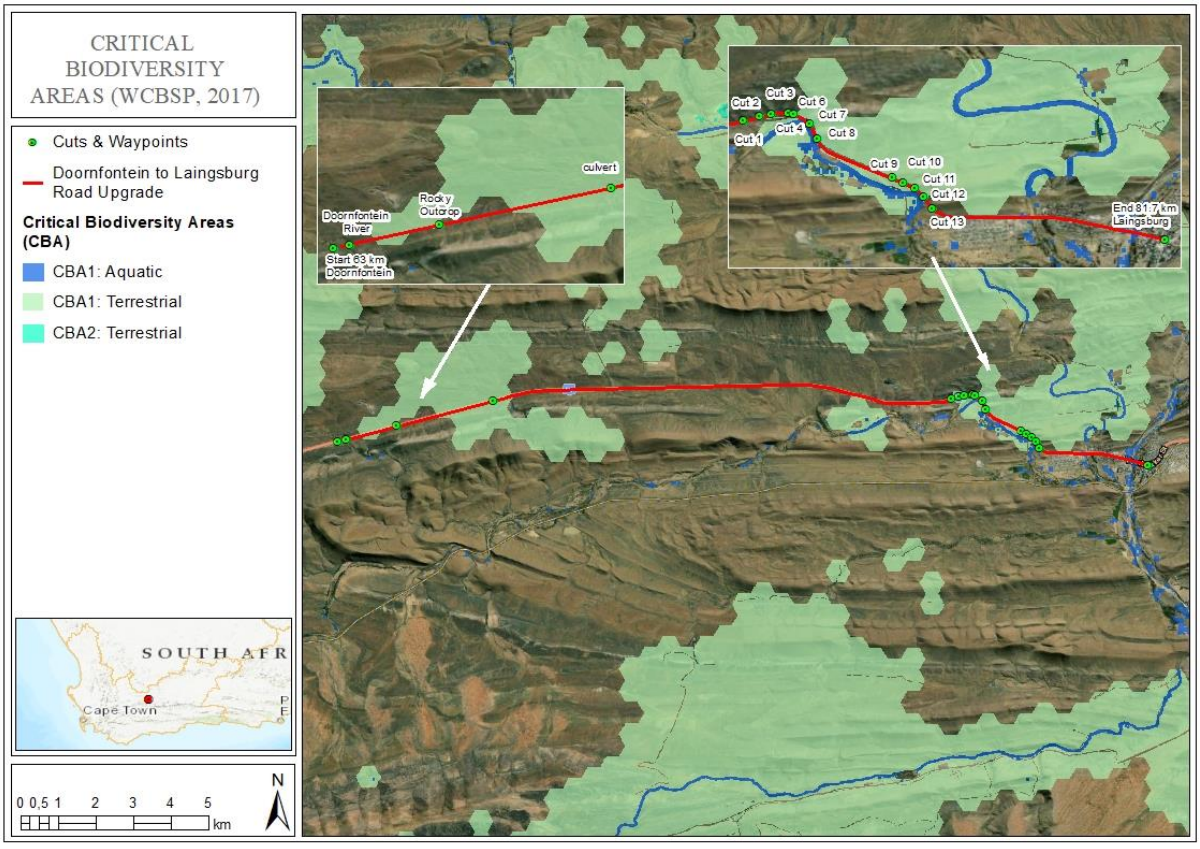


Figure 4-3: Critical Biodiversity Areas (WCBSP,2017).

3. **Important Bird Area:** The road upgrde is located within close proximity to two Important Bird areas namely, Anysberg Nature Reserve and the Swartberg Mountains (**Figure 4-5**).

[2] https://www.capenature.co.za/uploads/files/protected-area-management-plans/A-Summary-Overview-of-the-Biodiversity-Spatial-Plan.pdf

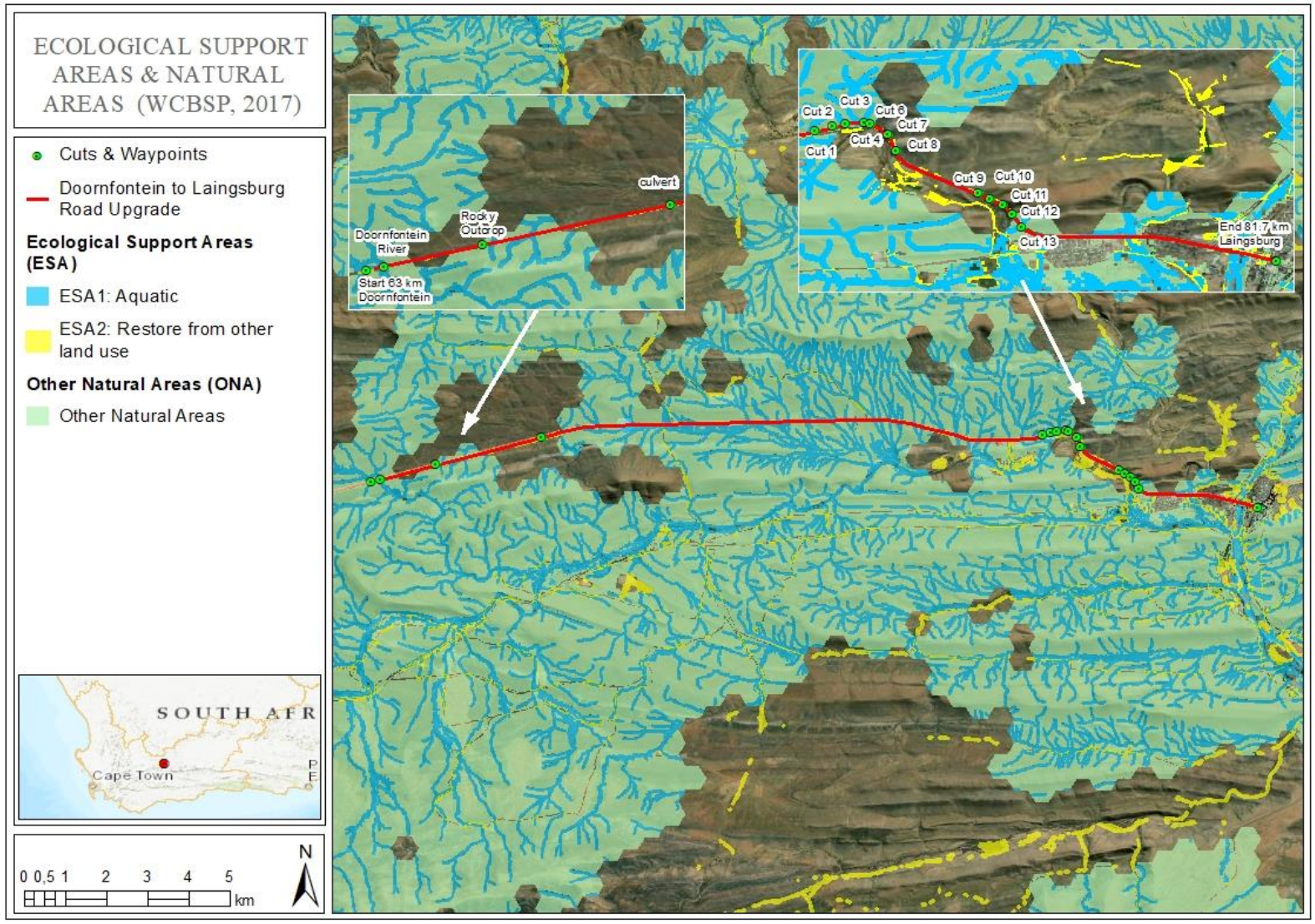


Figure 4-4: Ecological Support Areas and Natural Areas.

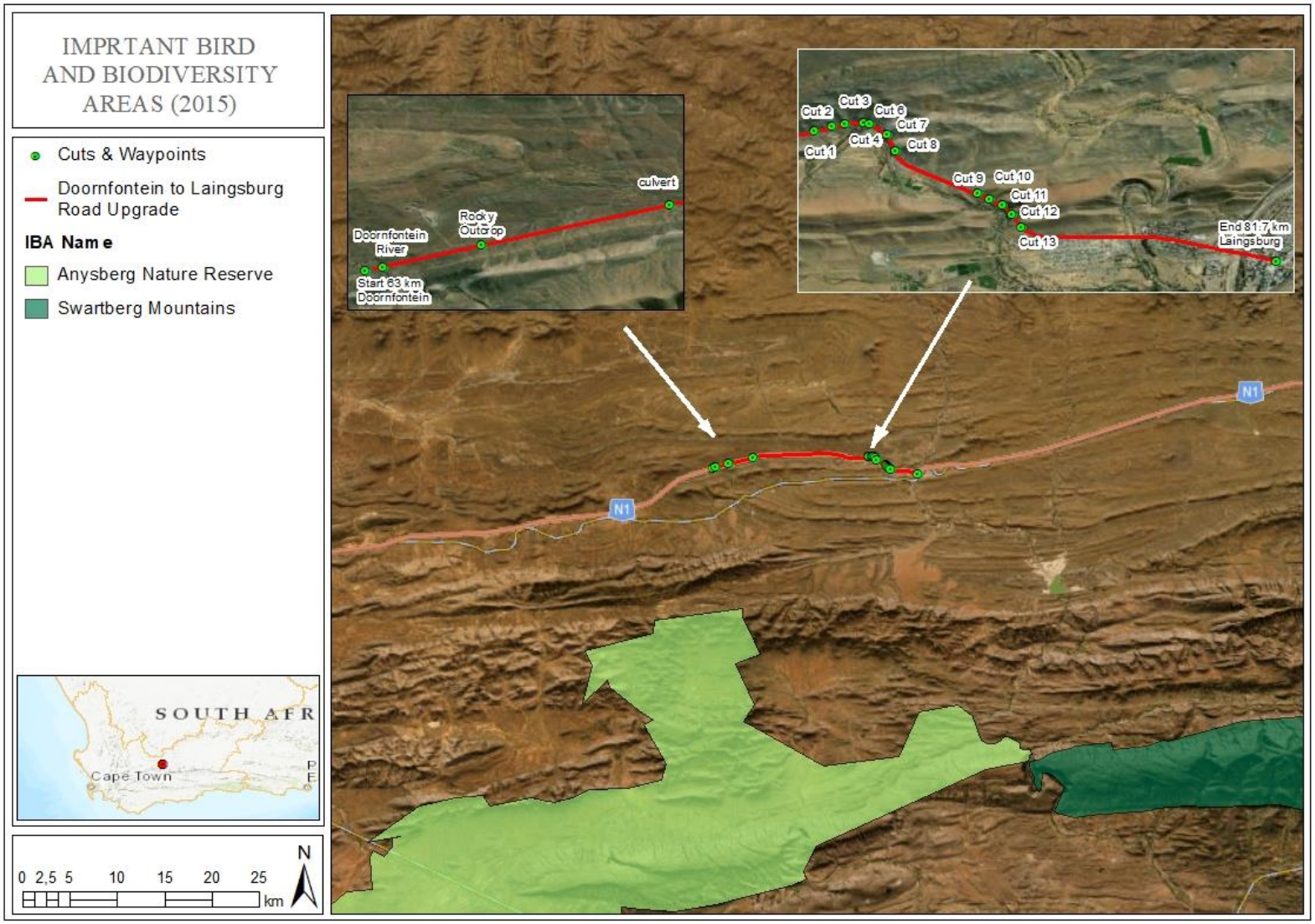


Figure 4-5: Important and Biodiversity Areas.

4.9 HYDROLOGY

The study site is located within the Gouritz Water Management Area (WMA=27), Groot Subwater Management Area (WMA=17). The National Freshwater Ecosystems Priority Areas (NFEPA) identifies important wetlands in South Africa. The proposed development is located within a number of watercourses (**Figure 4-6**).

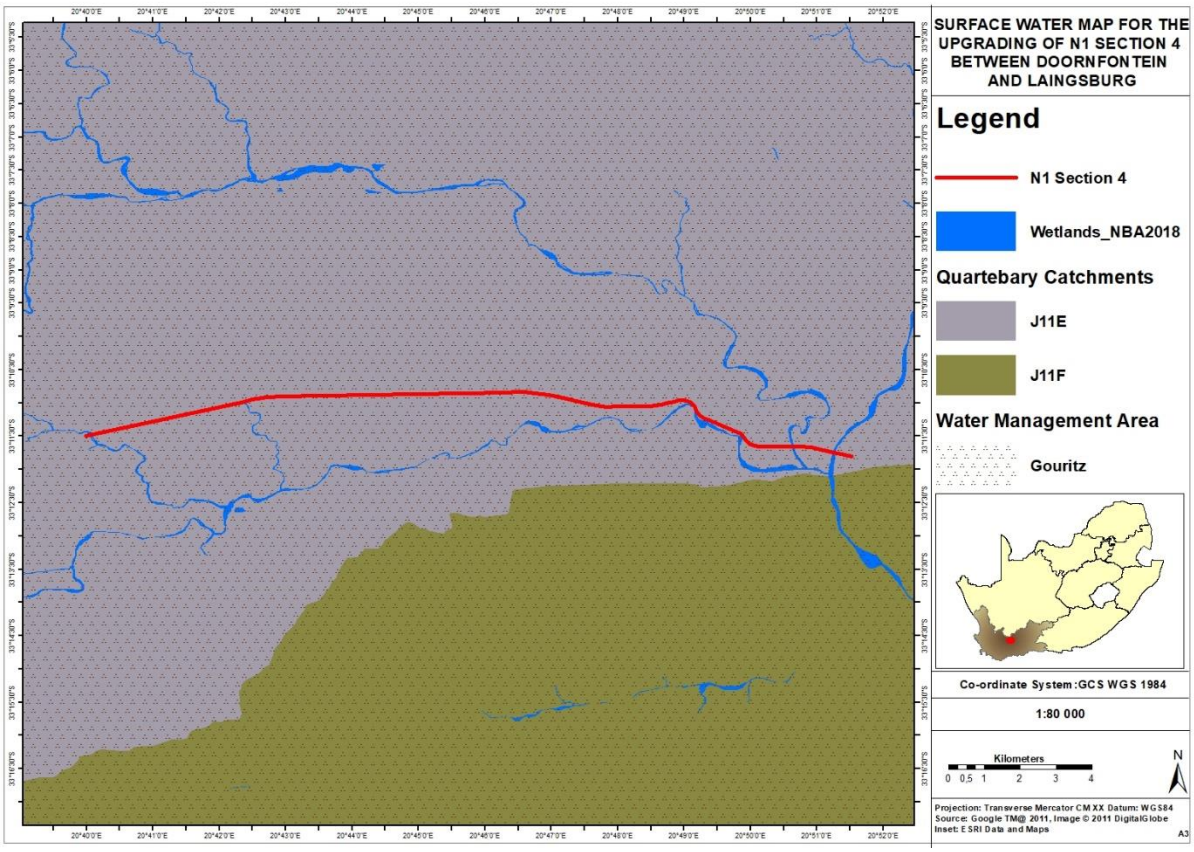


Figure 4-6: Surface Water Map

5. RESULTS

5.1 GENERAL OVERVIEW OF THE OF THE NATIONAL ROUTE 1 SECTION 4 BETWEEN DOORNFONTEIN (KM 63.0) AND LAINGSBURG (KM 81.7)

While National level vegetation maps have described broad vegetation types, local conditions, and micro-habitats (rainfall, soil structure, rocky outcrops, etc.) can result in variations in plant composition. As such, site surveys are critical for the verification of desktop findings and establishing the baseline ecological conditions of a site. The site visit conducted on the **06h of July 2024** confirmed that the vegetation of the project area is dominated by the Koedoesberge-Moordenaars Karoo (**Figure *5-1* to Figure *5-5***). The site has evidence of disturbance which is linked to the road maintenance and a single a quarry (**Figure *5-5***).

Figure 5-1: Aerial Overview of the study site, with evidence of the Koedoesberge-Moordenaars Karoo vegetation unit.

Figure 5-2: Some of the culverts and bridges observed along the road.

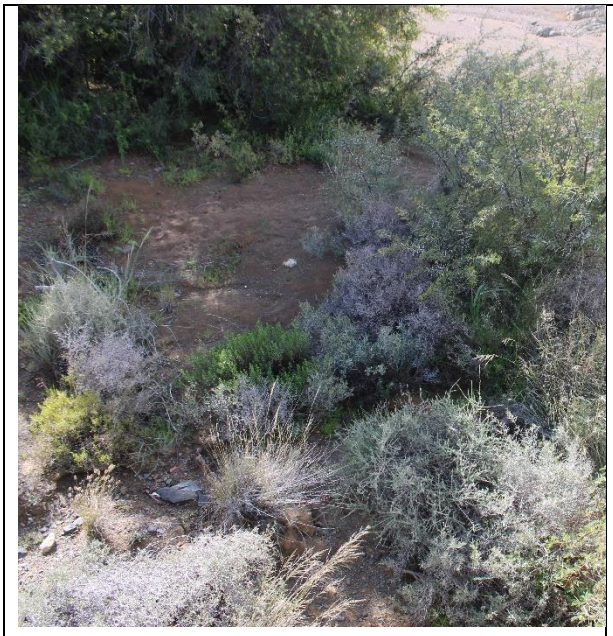
Figure 5-3:Rocky outcrop observed near the start of the road upgrade.

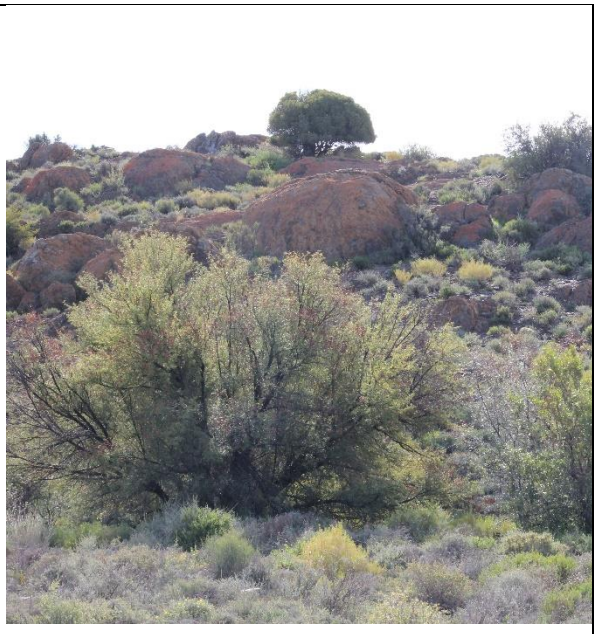
Figure 5-4: Mountainous area earmarked for cutting near Laingsburg near the end of the proposed upgrade.

Figure 5-5: Quarry Observed along the road.

5.2 VEGETATION TYPES RECORDED ON SITE

Euphorbia spp.	Chrysocoma ciliata
	
Cenchrus ciliaris	Thesium lineatum
	
Pteronia incana	Acacia spp.





Rhanterium spp.

Ricinus communis

5.3 ETHNOBOTANICAL PLANT SPECIES

Ethnobotany/ Ethnoecology is a branch of botany that focuses on the use of plants for medicines, cultural and recreational purposes. The overexploitation of indigenous plants for ethnobotanical purposes can be detrimental to populations of those particular plant species, and the other species that depend on its existence for their survival. South Africa has a rich diversity of medicinal plants that not only have a global significance, but also have a cultural and historical role (van Wyk *et al.* 2009).

There is a rapidly growing concern for conservation of medicinal plants that are dwindling in number due to illegal harvesting (Institute of Natural Resources 2003). This is particularly apparent in rural areas where medicinal plants are overexploited by traditional doctors (Mazid *et al.,* 2012).

The study site has *Leysera gnaphalodes* (Figure 5-6), which is a is a perennial aromatic shrublet with radiant yellow flowers that occurs in the winter rainfall parts of South Africa and Namibia. The plant's aromatic flavours give a pleasant infusion that makes an appetizing tea[3].

Figure 5-6: Example of the *Leysera gnaphalodes* (L.) L. found onsite.

5.4 ALIEN INVASIVE SPECIES PRESENT ON SITE

An "invasive species" is any species whose establishment and spread outside of its natural distribution range (i) threatens ecosystems, habitats or other species or has a demonstrable potential to threaten ecosystems, habitats or other species; and (ii) may result in economic or environmental harm or harm to human health. Invasive alien plant species are globally considered as one of the greatest threats to the environment, biodiversity, ecosystem integrity and the economy.

[3] https://pza.sanbi.org/leysera-gnaphalodes

According to the Conservation of Agricultural Resources Act (No. 43 of 1983 - Regulation 15, 30 March 2001) (CARA), for agricultural land, and the National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEMBA), for natural areas, invasive alien plant species should be controlled and eradicated with an emphasis on urgent action in biodiversity priority areas. NEMBA published a list of Alien and Invasive Species (No 599) in 2014 which regulates the management of alien and invasive plants in natural environments**. The study site has a few evidence of Alien invasive species near Laingsburg:**

1. Ricinus communis (CARA 2002 - Category 2 NEMBA - Category 2)

Ricinus communis is a an annual shrub or small tree with a softly woody stem growing up to 4m high with leaf and flowering stalks often with a grey bloom (Figure 5-7). The shiny, dark green or reddish leaves are paler below and star-shaped with serrated margins. Upper flowers are reddish and lower flowers cream. Green, brown or reddish, three-lobed capsules covered with soft spines. The whole plant is poisonous.

Figure 5-7: Ricinus communis observed onsite.

2. Opuntia Spp. (category 1 weed)

Prickly pear (also referred to in South Africa as sweet or mission prickly pear) is of Mexican origin. It is a tree or tall shrub, up to 5 m tall, with a thick, woody trunk (**Figure 5-8**).

Figure 5-8: Prickly pear.

5.5 DESCRIPTION OF FAUNA

According to the desktop study conducted, forty-eight species of mammal are known to occur or likely to occur within the region (Friedmann & Daly 2004, Skinner & Chimimba 2005, Monadjem et al. 2010), and the majority of these can be expected to occur within the study area, given the habitats available and the relatively untransformed nature of much of the study area. The species listed in **Table 5-1** were identified as being possible to occur within the study area or the immediate vicinity of the study site. It must be noted that some of these species are very sensitive to habitat and in some instances; the likeliness for them to occur is minimal.

Table 5-1 : List of mammal species that occur in the project area as well as their global and regional conservation statuses (IUCN, 2018; SANBI, 2016).

#	Scientific name	Common name	Red list category
1	ORDER Rodentia	Unidentified Rodentia	
2	*Raphicerus campestris*	Steenbok	Least Concern (2016)
3	*Sylvicapra grimmia*	Bush Duiker	Least Concern (2016)
4	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)
5	*Otocyon megalotis*	Bat-eared Fox	Least Concern (2016)
6	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern (2016)
7	*Papio ursinus*	Chacma Baboon	LC (IUCN, 2016)
8	*Caracal caracal*	Caracal	Least Concern (2016)
9	*Felis silvestris*	Wildcat	Least Concern (2016)
10	*Panthera pardus*	Leopard	Vulnerable (2016)
11	*Cynictis penicillata*	Yellow Mongoose	Least Concern (2016)
12	*Herpestes pulverulentus*	Cape Gray Mongoose	Least Concern (2016)
13	*Hyaena sp.*	Striped and Brown Hyaenas	
14	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern
15	*Lepus capensis*	Cape Hare	Least Concern
16	*Desmodillus auricularis*	Cape Short-tailed Gerbil	Least Concern (2016)
17	*Otomys unisulcatus*	Karoo Bush Rat	Least Concern (2016)
18	*Parotomys brantsii*	Brants's Whistling Rat	Least Concern (2016)
19	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern (2016)
20	*Procavia capensis capensis*	Cape Rock Hyrax	LC (IUCN 2015, global sp. level)
21	*Genetta tigrina*	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)

5.5.1 FIELD INVESTIGATION FINDINGS

During the site visit, none of mammals described on Table 5-1 above were observed, this can be attributed to the fact that site is fenced off from the road. The likelihood of finding these animals is high

5.6 REPTILES AND AMPHIBIANS

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the Reptile Map database provided by the Animal Demography Unit (ADU, 2017) 13 reptile species are expected to occur in the project area. No species of conservation concern should be present according to the above-mentioned sources within the project area but in situ observations may prove otherwise.

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the Amphibian Map database provided by the Animal Demography Unit (ADU, 2017) 3 amphibian species are expected to occur in the project area, Namely:

1. Vandijkophrynus gariepensis gariepensis
2. Amietia fuscigula
3. Tomopterna delalandii

5.6.1 FIELD INVESTIGATION FINDINGS

None of the expected reptiles were observed on site during the site visit.

5.7 AVIFUANA

Birds are generally regarded as good ecological indicators, because their presence or absence tends to represent conditions pertaining to the proper functioning of an ecosystem. Bird communities and ecological conditions are directly linked to land cover. As the land cover of an area changes, so do the types of birds in that area (The Bird Community Index, 2007). Land cover is directly linked to habitats within the study area. The diversity of these habitats should give rise to many different species.

The proposed development is located within close proximity to the Anysberg Nature Reserve which is classified as an Important Bird Area (IBA). According to the South African Bird Atlas Project (SABAP2), over species of birds have been identified in the

area. According to Birdlife South Africa, "Globally threatened species are Blue Crane, Ludwig's Bustard, Southern Black Korhaan *Afrotis afra*, Martial Eagle and Black Harrier. Regionally threatened species are Karoo Korhaan, Verreauxs' Eagle, Black Stork, Lanner Falcon *Falco biarmicus* and Cape Rockjumper. Restricted-range and biome-restricted species that are common in the IBA are Cape Spurfowl, Cape Bulbul and Karoo Chat. Locally common restricted-range or biome-restricted species are Karoo Lark, Layard's Tit-Babbler, Karoo Eremomela and Namaqua Warbler, while uncommon species in this category are Ludwig's Bustard, Sickle-winged Chat *Cercomela sinuata*, Cape Rockjumper, Victorin's Warbler, Cape Sugarbird, Cape Siskin, Protea Seedeater *Crithagra leucoptera*, Orange-breasted Sunbird, Pale-winged Starling and Black-headed Canary".

5.7.1 FIELD INVESTIGATION FINDINGS

The study is located outside of an Important Bird Area, and the sensitivity is considered Medium to High especially within the neighboring properties. Furthermore, no Species of Conservation Concern were observed during the survey. A few avifaunal species were spotted onsite during the site inspection, All of the avifaunal species observed within the study site are considered to be of Least Concern by the IUCN and are common and widespread species (**Figure *5*-9**).

Figure 5-9: Cape starling observed onsite.

5.8 INVERTEBRATES

Butterflies are a good indication of the habitats available in a specific region (Woodhall 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope or endemic species (specific habitat requirements with populations concentrated in a small area) which may be very specialized (Woodhall 2005). Butterflies are useful indicators as they are relatively easy to locate and catch, and therefore identify.

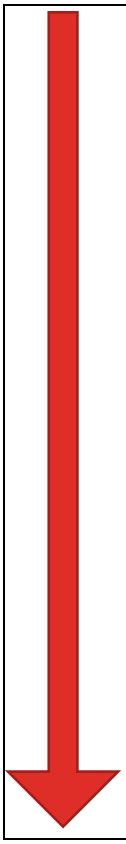
5.8.1 FIELD INVESTIGATION FINDINGS

No butterflies or other invertebrates of conservation concern were seen on site.

6. TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT

The impact assessment is aimed predicting potential impacts of the proposed projects. Impact assessment strives to avoid damage, loss of ecosystems services, and where they cannot be avoided, to reduce and mitigate these impacts (DEA, 2013). Offsets to compensate for loss of habitat are regarded as a last resort, after all efforts have been made to avoid, reduce and mitigate. The mitigation hierarchy is represented in **Table 6-1**.

Table 6-1: Mitigation hierarchy of impacts

	**Avoid or prevent**	Refers to considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services and people. This is the best option but is not always possible. Where environmental and social factors give rise to unacceptable negative impacts, the activity should not take place. In such cases, it is unlikely to be possible or appropriate to rely on the other steps in the mitigation.
	Minimise	Refers to considering alternatives in the project location, sitting, scale, layout, technology and phasing that would minimise impacts on biodiversity, associated ecosystem services. In cases where there are environmental constraints, every effort should be made to minimise impacts.
	Rehabilitate	Refers to rehabilitation of areas where impacts are unavoidable, and measures are provided to return impacted areas to near natural state or an agreed land use after mine closure. Rehabilitation can, however, fall short of replicating the diversity and complexity of natural systems.
	Offset	Refers to measures over and above rehabilitation to compensate for the residual negative impacts on biodiversity after every effort has been made to minimise and then rehabilitate the impacts. Biodiversity offsets can provide a mechanism to compensate for significant residual impacts on biodiversity.

A significant portion of the road servitude with the remaining natural habitat is anticipated to be lost due to the proposed construction and associated activities. The impact of the proposed activity will involve a loss of habitat for both flora and fauna (**Table 6-2**).

6.1 GENERAL IMPACT ASSESSMENT

Table 6-2: Assessment of impacts associated with the proposed development.

CONSTRUCTION PHASE

IMPACT 1: LOSS OF VEGETATION
Cause and Comment ***Direct Impact*** The clearing of land for the construction will result in the loss of vegetation loss. However, vegetation clearance will only be restricted to the road servitude. Therefore, the clearance of vegetation required for the required soil material is likely to impact on the extent and long-term conservation of this vegetation type, which is listed as **Least Threatened**. The overall significance of the project activities at this site, provided the recommended mitigation measures are implemented, would be moderate negative. ***Cumulative Impact*** The bulk of the vegetation is still intact, with evidence of disturbance along certain sections of the road. The proposed development will have a negative impact on the vegetation onsite. The additional loss of vegetation as a consequence of the proposed development will therefore have a High cumulative impact. ***No-Go Alternative***

If the project does not go ahead, the current impacts associated with grazing will continue. However, these are relatively minor within the proposed site and as such, the No-go Alternative is classified as **low negative**.

Mitigation Measures:

- Construction vehicles and machinery must not encroach into identified 'no-go' areas or areas outside the project footprint.
- Topsoil (20 cm, where possible) must be collected and stored in an area of low sensitivity and used to rehabilitate impacted areas that are no longer requiredduring the operational phase (e.g. laydown areas).
- Only indigenous species must be used for rehabilitation.
- Lay down areas must not be located within any watercourses or drainage lines.
- Employees must be prohibited from making open fires during the construction phase.

- The Alien Invasive Management Plan should be complied and implemented.

Significance Assessment:

Impact	Nature	Duration	Extent	Severity	Likelihood	Significance Before Mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance After Mitigation
Available Site	Direct	Permanent	Study-Area	Moderate	Definite	**MODERATE (-)**	Reversible	Resource will be partly lost	Achievable	**MODERATE (-)**

Cumulative	Cumulative	Long-Term	Study - Area	Slight	Possible	**Low (-)**	It is difficult to implement mitigation measures specific to the cumulative impacts as the applicant only has jurisdiction over their development and not over other developments or farming activities in the area. However, it is imperative that the applicant implement the mitigation measures listed above for the direct impacts.	**N/A**
No-Go	Direct	Short-Term	Localised	Moderate	Probable	**Low (-)**	**N/A**	

IMPACT 2: LOSS OF PLANT SPECIES OF CONSERVATION CONCERN

Cause and Comment

Direct Impact

The permanent loss of plant species of conservation, may occur. Some of these are restricted range species with small Areas of Extent. The severity of the impact will be of high significance if a population of one or more of these species is affected. However, if populations of these species are avoided by the careful placement of infrastructure, the impact can be reduced to moderate significance.

Cumulative Impact

SCC have likely already been lost as a result of the existing development onsite. As such, the loss of SCC associated with the proposed activities will likely contribute to the cumulative loss of SCC within the region. However, if the mitigation measures as described in this report are implemented and adhered to, thisimpact can be reduced to moderate negative.

No-Go Alternative

The No-go alternative will not require the clearance of vegetation and will therefore not result in the loss of plant SCC. The no-go alternative is therefore **negligible**.

Mitigation Measures:

- If populations of Vulnerable SCC are found, a permit must be obtained for their relocation to a similar habitat type within the site where they will not be disturbed.

Significance Assessment:

Impact	Nature	Duration	Extent	Severity	Likelihood	Significance Before Mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance After Mitigation
Both Layout Alternatives	Direct	Permanent	Study - Area	Severe	Definite	**HIGH (-)**	Reversible	Resource willbe partly lost	Achievable	**MODERATE (-)**
Cumulative	Cumulative	Long-Term	Study - Area	Severe	May Occur	**HIGH (-)**	Reversible	Resource willbe partly lost	Achievable	**MODERATE (-)**
No-Go	N/A					**NEGLIGIBLE**	**N/A**			

OPERATIONAL PHASE

No direct loss of habitat is expected during this phase of the project. Alien plant invasion is, however expected to occur. In addition, vehicular transport through the site may increase the risk of roadkill of fauna species that occur (**Table 6-3**).

Table 6-3: Loss of habitat during operation phase

Loss of habitat					
Phase	**Operational**				
Criteria	**Details / Discussion**				
Description of impact	• Establishment of alien plant species in disturbed areas				
Mitigation required	• Manage alien invasive species establishment continually through chemical or mechanical removal. • Reinstate vegetation cover through concurrent rehabilitation • Erect signage to control the speed limit for trucks and other vehicles moving through the site				
Parameters	***Intensity***	***Spatial scale***	***Duration***	***Probability***	***Significance***
Pre-Mitigation	Serious (4)	Limited (2)	Short-term (3-5 years) (3)	Likely (6)	Major (negative) (54)
Post Mitigation	Limited (1)	Minor (2)	Short-term (3-5 years) (3)	Likely (4)	Minor (negative) (24)

DECOMMISSIONING PHASE

No direct loss of habitat is expected during this phase of the project. Alien plant invasion is, however expected to occur as vehicles and machinery move throughout the site and disturb the soil (**Table 6-4**).

Table 6-4: Loss of habitat during decommissioning

Loss of habitat	
Phase	**Decommissioning**
Criteria	**Details / Discussion**

Description of impact	• Removal infrastructure and equipment • Disturbance of the soil • Vehicle operation				
Mitigation required	• Minimise the impacted area and revegetate with indigenous where disturbed • Avoid erosion, manage alien invasive species establishment, ensure the re-establishment of natural vegetation • Employ stormwater management measures				
Parameters	***Intensity***	***Spatial scale***	***Duration***	***Probability***	***Significance***
Pre-Mitigation	Very Significant (7)	National (6)	Permanent (6)	Likely (6)	Major (negative) (115)
Post Mitigation	Significant (6)	National (6)	Short-term (3-5 years) (3)	Likely (6)	Minor (negative) (90)

POST CLOSURE PHASE

No direct loss of habitat is expected during this phase of the project. Alien plant invasion should be monitored for up to three years after closure (**Table 6-5**).

Table 6-5: Loss of habitat during post-closure phase

Loss of habitat					
Phase	**Post-closure**				
Criteria	**Details / Discussion**				
Description of impact	• On-going establishment of alien plant species in disturbed areas				
Mitigation required	• Manage alien invasive species establishment continually through chemical or mechanical removal. • Revegetation of the site where previously disturbed.				
Parameters	***Intensity***	***Spatial scale***	***Duration***	***Probability***	***Significance***

Pre-Mitigation	Serious (4)	Limited (2)	Short-term (3-5 years) (3)	Likely (6)	Major (negative) (54)
Post Mitigation	Limited (1)	Minor (2)	Short-term (3-5 years) (3)	Likely (4)	Minor (negative) (24)

7. IMPACT STATEMENT, CONCLUSIONS AND RECOMMENDATIONS

The site inspection was conducted during the wet season, and thus there are plant species that may have been missed or misidentified. Some plant species that emerge and bloom during another time of the year or under very specific circumstances may have been missed entirely. It is important to schedule a follow-up site inspection to update the report where necessary, including the development of additional fine scale maps that will capture the sensitivity of the site.

The study site was surveyed on the 06th of July 2024 to ascertain the overall state of biodiversity. The National Route 1 Section 4 between Doornfontein (KM 63.0) and Laingsburg (KM 81.7) touches a few Critical Biodiversity Areas (CBA) and an Ecological Support Area (ESA), this implies that these areas should be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. A summary of the biodiversity assessment is outlined Below:

7.1 Ecological Characteristics of the study sites:

The proposed site consists mostly of the Koedoesberge-Moordenaars Karoo vegetation unit and while a small section of the road is located within the Southern Karoo Riviere vegetation unit both the vegetation units are classified as Least Threatened. The area consists of slightly undulating to hilly landscape covered by low succulent scrub and dotted by scattered tall shrubs, patches of 'white' grass visible on plains, the most conspicuous dominants being dwarf shrubs of *Pteronia*, *Drosanthemum* and *Galenia*. The has been disturbed to some extent, especially around the road servitude. The most sensitive areas are linked to the rocky outcrops and the mountain that will be cut to expand the upgrade the road.

8. STATEMENT AND OPINION OF THE SPECIALIST

The proposed development is deemed environmentally acceptable, provided the mitigation measures and recommendations specified in this report are implemented and adhered to. Based on the size of the site, the site will require a significant amount

of vegetation clearing. The site has a Flora Species diversity, and SCC's, A botanical micro-siting investigation of the development footprint is not necessary.

If populations of Critically Endangered, or Endangered SCC are found consider relocating them, and where this is not feasible, permits for their removal must be obtained from the relevant competent authority. Species that are known to survive translocation should be translocated to the nearest similar habitat type within the site where they will not be disturbed. Where possible avoid the rocky outcrops that are located outside of development footprint, and extra caution will be required when cutting trough the mountainous area because they are aligned to the Critical Biodiversity Areas.

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10. APPENDIX 1: LIST OF FLORA SPECIES EXPECTED ONSITE

Spreadsheet for creating species lists for describing vegetation types. It allows formatting in the paragrpaphs as contained in the book Mucina and Rutherford (

VegType	Name of vegetation type. Full name, e.g. SVcb 21 Soutpansberg Mountain Bushveld
TaxonList	Important Taxa; Endemic Taxa; Biogeogrphically Important Taxa.
SubDivision	Vegetation type subdivision (optional, e.g. 'Mistbelt bush clumps', 'Open savanna sandveld' in SVcb 21 Soutpansberg M
FamilyName	Name of family in which the taxon is classified. This is not essential, but is useful for quality control purposes.
GrowthForm	Refer to Table 2.1 (page 26 of Mucina & Rutherford (2006))
TaxonName	Name of taxon. Normally no subspecies or variety, unless they are diagnostic or endemic. Avoid sp. or spp. Do not abbr
Superscript	Superscript. It must include an explanation of what the superscript means.
text for superscript	e.g. ([T]Cape thickets, [W]Wetlands) — e.g. T for 'Cape Thickets' in FFs1, (2006)
Dominant	Dominant (biomass) or prominent (e.g. conspicuous). See p. 27 of Mucina & Rutherford (2006). Other unformatted sugg
Sort	This gives the order in which the author intends the species to be listed. Not essential, but highly desirable to give the au
Qualifier	Any qualifier as it appears in the book.e.g. variant 'speciosa'; (West Coast endemic); (southernmost distribution limit)
Growth Form Sort	Refer to the tab **Growth forms and order**. The order should normally follow the order already used in the biome.

VegType	TaxonList	SubDivision	FamilyName	GrowthForm	
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa		AMARANTHACEAE	Low Shrubs	Sericocoma pungens
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa		AMARYLLIDACEAE	Geophytic Herbs	Brunsvigia comptonii
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa		APOCYNACEAE	Succulent Herbs	Pectinaria longipes subsp. longip
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa		APOCYNACEAE	Succulent Herbs	Piaranthus comptus
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa		APOCYNACEAE	Succulent Herbs	Quaqua parviflora subsp. gracili
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa		APOCYNACEAE	Succulent Herbs	Tridentea parvipuncta subsp. pa

SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	ASPHODELACEAE	Succulent Herbs	Aloe longistyla
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	ASTERACEAE	Herbs	Helichrysum cerastioides var. au
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	ASTERACEAE	Herbs	Ifloga molluginoides
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	ASTERACEAE	Low Shrubs	Felicia lasiocarpa
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	CRASSULACEAE	Succulent Herbs	Crassula hemisphaerica
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	HYACINTHACEAE	Geophytic Herbs	Drimia karooica
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Deilanthe peersii
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Hereroa crassa
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Pleiospilos nelii
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Rhinephyllum graniforme
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Ruschia crassa
SKv 6 Koedoesberge-Moordenaars Karoo	Biogeographically Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Ruschia perfoliata
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	AMARYLLIDACEAE	Geophytic Herbs	Strumaria undulata
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	ASPHODELACEAE	Succulent Herbs	Haworthia nortieri var. pehlemar
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	CRASSULACEAE	Succulent Shrubs	Tylecodon faucium
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	GERANIACEAE	Low Shrub	Pelargonium stipulaceum subsp.
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	HYACINTHACEAE	Geophytic Herbs	Lachenalia comptonii
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Antimima karroidea

SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Antimima loganii
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Calamophyllum teretiusculum
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Cerochlamys gemina
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Drosanthemum comptonii
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Ruschia karrooica
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Tanquana archeri
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Trichodiadema hallii
SKv 6 Koedoesberge-Moordenaars Karoo	Endemic Taxa	SANTALACEAE	Semiparasitic Shrub	Thesium marlothii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa		Succulent Shrubs	Hoodia grandis
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ACANTHACEAE	Low Shrubs	Barleria stimulans
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ACANTHACEAE	Low Shrubs	Monechma spartioides
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	AIZOACEAE	Low Shrubs	Galenia africana
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	AIZOACEAE	Low Shrubs	Galenia fruticosa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	AIZOACEAE	Succulent Herbs	Tetragonia microptera
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	AIZOACEAE	Succulent Shrubs	Tetragonia robusta var. psilopter
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	AMARYLLIDACEAE	Geophytic Herbs	Strumaria karooica
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	AMARYLLIDACEAE	Geophytic Herbs	Strumaria pubescens
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Herbaceous Climber	Fockea sinuata

SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Low Shrubs	Microloma armatum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Herbs	Pectinaria articulata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Herbs	Piaranthus parvulus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Herbs	Quaqua arenicola subsp. arenic
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Herbs	Quaqua arida
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Herbs	Quaqua ramosa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Herbs	Stapelia pillansii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Herbs	Stapelia rufa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Herbs	Stapeliopsis exasperata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Succulent Shrubs	Hoodia gordonii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	APOCYNACEAE	Woody Climbers	Microloma sagittatum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPARAGACEAE	Low Shrubs	Asparagus burchellii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPARAGACEAE	Low Shrubs	Asparagus capensis var. capens
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPARAGACEAE	Woody Climbers	Asparagus fasciculatus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPARAGACEAE	Woody Climbers	Asparagus racemosus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPARAGACEAE	Woody Climbers	Asparagus retrofractus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPHODELACEAE	Geophytic Herbs	Trachyandra thyrsoidea
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPHODELACEAE	Succulent Herbs	Astroloba foliolosa

SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPHODELACEAE	Succulent Herbs	Astroloba spiralis
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASPHODELACEAE	Succulent Herbs	Haworthia marumiana var. arch
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Herbs	Felicia bergeriana
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Herbs	Gazania jurineifolia subsp. scabr
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Herbs	Leysera tenella
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Herbs	Syncarpha dregeana
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Herbs	Ursinia nana
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Amphiglossa tomentosa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Athanasia minuta subsp. inermis
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Berkheya spinosa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Chrysocoma ciliata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Eriocephalus africanus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Eriocephalus ericoides
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Eriocephalus pauperrimus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Eriocephalus spinescens
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Euryops lateriflorus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Felicia filifolia
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Felicia macrorrhiza

SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Felicia muricata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Felicia scabrida
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Garuleum bipinnatum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Helichrysum lucilioides
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pentzia incana
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia adenocarpa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia ambrariifolia
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia empetrifolia
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia glauca
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia glomerata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia incana
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia pallens
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia scariosa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Pteronia sordida
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Senecio haworthii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Low Shrubs	Tripteris sinuata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ASTERACEAE	Succulent Herbs	Tripteris aghillana var. integrifolic
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	BIGNONIACEAE	Low Shrubs	Rhigozum obovatum

SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	BRASSICACEAE	Herbs	Lepidium africanum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	BRASSICACEAE	Herbs	Lepidium desertorum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CHENOPODIACEAE	Herbs	Atriplex suberecta
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CHENOPODIACEAE	Succulent Shrubs	Manochlamys albicans
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CHENOPODIACEAE	Succulent Shrubs	Salsola aphylla
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CRASSULACEAE	Succulent Herbs	Crassula deceptor
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CRASSULACEAE	Succulent Herbs	Crassula muscosa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CRASSULACEAE	Succulent Herbs	Crassula tomentosa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CRASSULACEAE	Succulent Shrubs	Crassula nudicaulis
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CRASSULACEAE	Succulent Shrubs	Crassula rupestris subsp. commu
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CRASSULACEAE	Succulent Shrubs	Tylecodon reticulatus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	CRASSULACEAE	Succulent Shrubs	Tylecodon wallichii subsp. wallic
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	EBENACEAE	Tall Shrub	Diospyros pallens
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	EUPHORBIACEAE	Succulent Shrubs	Euphorbia decussata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	EUPHORBIACEAE	Succulent Shrubs	Euphorbia eustacei
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	EUPHORBIACEAE	Succulent Shrubs	Euphorbia mauritanica
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	FABACEAE	Low Shrubs	Lessertia fruticosa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	FABACEAE	Low Shrubs	Melolobium candicans

SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	GERANIACEAE	Herbs	Pelargonium minimum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	GERANIACEAE	Herbs	Pelargonium nervifolium
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	GERANIACEAE	Low Shrubs	Pelargonium hirtum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	GERANIACEAE	Succulent Shrubs	Pelargonium crithmifolium
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	GERANIACEAE	Succulent Shrubs	Sarcocaulon crassicaule
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	HYACINTHACEAE	Geophytic Herbs	Drimia intricata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	HYACINTHACEAE	Geophytic Herbs	Ornithogalum adseptentrionesve
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	IRIDACEAE	Geophytic Herbs	Geissorhiza karooica
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	IRIDACEAE	Geophytic Herbs	Ixia marginifolia
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	IRIDACEAE	Geophytic Herbs	Ixia rapunculoides
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	IRIDACEAE	Geophytic Herbs	Romulea austinii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	IRIDACEAE	Geophytic Herbs	Romulea tortuosa subsp. tortuos
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MALVACEAE	Herbs	Hermannia althaeifolia
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MALVACEAE	Herbs	Hermannia pulverata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MALVACEAE	Low Shrubs	Hermannia grandiflora
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MALVACEAE	Low Shrubs	Hermannia multiflora
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Herbs	Brownanthus vaginatus
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Herbs	Deilanthe thudichumii

SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Herbs	Mesembryanthemum stenandru
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Herbs	Psilocaulon coriarium
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Herbs	Psilocaulon junceum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Antimima fergusoniae
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Antimima maxwellii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Antimima wittebergensis
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Aridaria noctiflora subsp. stramir
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Cylindrophyllum comptonii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Drosanthemum framesii
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Drosanthemum karrooense
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Drosanthemum lique
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Hereroa odorata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Peersia macradenia
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Ruschia grisea
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Ruschia intricata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Sceletium rigidum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MESEMBRYANTHEMACEAE	Succulent Shrubs	Trichodiadema barbatum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	MOLLUGINACEAE	Low Shrubs	Limeum aethiopicum

SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	OLEACEAE	Low Shrubs	Menodora juncea
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	OROBANCHACEAE	Parasitic Herb	Hyobanche glabrata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	OXALIDACEAE	Geophytic Herbs	Oxalis obtusa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Aristida adscensionis
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Aristida diffusa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Ehrharta calycina
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Ehrharta delicatula
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Enneapogon scaber
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Fingerhuthia africana
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Karroochloa tenella
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Pentaschistis airoides
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Stipagrostis ciliata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POACEAE	Graminoids	Stipagrostis obtusa
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POLYGALACEAE	Low Shrubs	Muraltia scoparia
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	POLYGALACEAE	Low Shrubs	Polygala seminuda
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	SANTALACEAE	Semiparasitic Shrub	Thesium lineatum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	SCROPHULARIACEAE	Herbs	Zaluzianskya inflata
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	SCROPHULARIACEAE	Herbs	Zaluzianskya peduncularis

SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	SCROPHULARIACEAE	Low Shrubs	Aptosimum indivisum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	SCROPHULARIACEAE	Low Shrubs	Aptosimum spinescens
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	SOLANACEAE	Succulent Shrubs	Lycium oxycarpum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	VISCACEAE	Semiparasitic Epiphytic Shrub	Viscum capense
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ZYGOPHYLLACEAE	Low Shrubs	Zygophyllum microphyllum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ZYGOPHYLLACEAE	Low Shrubs	Zygophyllum retrofractum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ZYGOPHYLLACEAE	Low Shrubs	Zygophyllum spinosum
SKv 6 Koedoesberge-Moordenaars Karoo	Important Taxa	ZYGOPHYLLACEAE	Succulent Shrubs	Zygophyllum flexuosum

Spreadsheet for creating species lists for describing vegetation types. It allows formatting in the paragrpaphs as contained in the book Mucina and Rutherford (

VegType	Name of vegetation type. Full name, e.g. SVcb 21 Soutpansberg Mountain Bushveld
TaxonList	Important Taxa; Endemic Taxa; Biogeogrphically Important Taxa.
SubDivision	Vegetation type subdivision (optional, e.g. 'Mistbelt bush clumps', 'Open savanna sandveld' in SVcb 21 Soutpansberg Mountain Bus
FamilyName	Name of family in which the taxon is classified. This is not essential, but is useful for quality control purposes.
GrowthForm	Refer to Table 2.1 (page 26 of Mucina & Rutherford (2006))
TaxonName	Name of taxon. Normally no subspecies or variety, unless they are diagnostic or endemic. Avoid sp. or spp. Do not abbreviate genu
Superscript	Superscript. It must include an explanation of what the superscript means.
text for superscript	e.g. ([T]Cape thickets, [W]Wetlands) e.g. T for 'Cape Thickets' in FFs1, page 99 (2006)
Dominant	Dominant (biomass) or prominent (e.g. conspicuous). See p. 27 of Mucina & Rutherford (2006). Other unformatted suggested text c
Sort	This gives the order in which the author intends the species to be listed. Not essential, but highly desirable to give the author's choice
Qualifier	Any qualifier as it appears in the book.e.g. variant 'speciosa'; (West Coast endemic); (southernmost distribution limit)
Growth Form Sort	Refer to the tab **Growth forms and order**. The order should normally follow the order already used in the biome.

VegType	TaxonList	SubDivision	FamilyName	GrowthForm	
AZi 6 Southern Karoo Riviere	Endemic Taxon	CYPERACEAE	Graminoid	Isolepis expallescens	
AZi 6 Southern Karoo Riviere	Important Taxa	ANACARDIACEAE	Small Trees	Rhus lancea	
AZi 6 Southern Karoo Riviere	Important Taxa	ASPARAGACEAE	Low Shrub	Asparagus striatus	
AZi 6 Southern Karoo Riviere	Important Taxa	ASTERACEAE	Succulent Shrubs	Amphiglossa callunoides	
AZi 6 Southern Karoo Riviere	Important Taxa	CAPPARACEAE	Tall Shrubs	Cadaba aphylla	
AZi 6 Southern Karoo Riviere	Important Taxa	CELASTRACEAE	Tall Shrubs	Gymnosporia buxifolia	
AZi 6 Southern Karoo Riviere	Important Taxa	EBENACEAE	Tall Shrubs	Diospyros lycioides	
AZi 6 Southern Karoo Riviere	Important Taxa	EBENACEAE	Tall Shrubs	Euclea undulata	
AZi 6 Southern Karoo Riviere	Important Taxa	FABACEAE	Small Trees	Acacia karroo	
AZi 6 Southern Karoo Riviere	Important Taxa	MALVACEAE	Tall Shrubs	Grewia robusta	
AZi 6 Southern Karoo Riviere	Important Taxa	MELIANTHACEAE	Tall Shrubs	Melianthus comosus	
AZi 6 Southern Karoo Riviere	Important Taxa	SOLANACEAE	Succulent Shrubs	Lycium cinereum	
AZi 6 Southern Karoo Riviere	Important Taxa	SOLANACEAE	Succulent Shrubs	Lycium hirsutum	
AZi 6 Southern Karoo Riviere	Important Taxa	SOLANACEAE	Succulent Shrubs	Lycium oxycarpum	

AZi 6 Southern Karoo Riviere	Important Taxa		TAMARICACEAE	Tall Shrubs	Tamarix usneoides
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	APOCYNACEAE	Low Shrubs	Carissa haematocarpa
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	ASTERACEAE	Low Shrubs	Pentzia incana
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	CHENOPODIACEAE	Low Shrubs	Bassia salsoloides
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	CHENOPODIACEAE	Succulent Shrubs	Salsola aphylla
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	CHENOPODIACEAE	Succulent Shrubs	Salsola arborea
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	CHENOPODIACEAE	Succulent Shrubs	Salsola geminiflora
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	CHENOPODIACEAE	Succulent Shrubs	Salsola gemmifera
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	CYPERACEAE	Graminoids	Cyperus marginatus
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	LAMIACEAE	Low Shrubs	Ballota africana
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	MESEMBRYANTHEMACEAE	Succulent Shrubs	Drosanthemum lique
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	MESEMBRYANTHEMACEAE	Succulent Shrubs	Malephora uitenhagensis
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	POACEAE	Graminoids	Cenchrus ciliaris
AZi 6 Southern Karoo Riviere	Important Taxa	Alluvial shrublands & herblands	POACEAE	Graminoids	Cynodon incompletus
AZi 6 Southern Karoo Riviere	Important Taxa	Reed beds	POACEAE	Megagraminoid	Phragmites australis
AZi 6 Southern Karoo Riviere	Important Taxa	Rocky slopes of river canals	POACEAE	Graminoid	Stipagrostis namaquensis