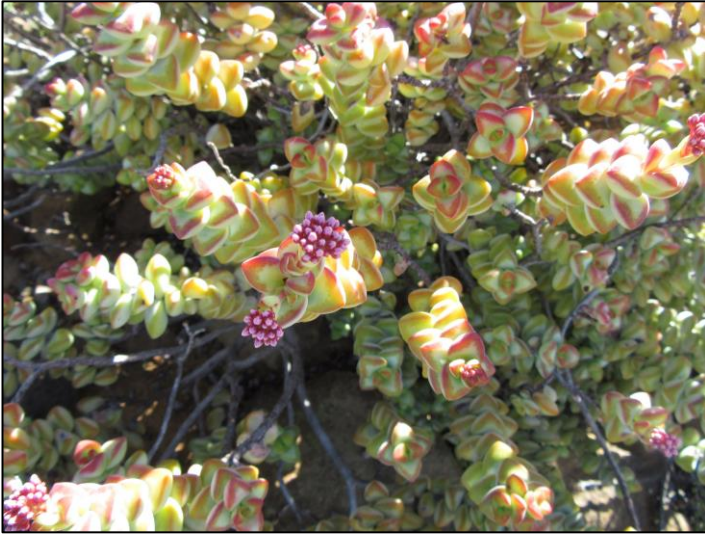




September 2024

TERRESTRIAL BIODIVERSITY
MAINTENANCE MANAGEMENT PLAN FOR
THE POWER LINE BETWEEN BEAUFORT
WEST AND LAINGSBURG, WESTERN CAPE
PROVINCE

Author: M. van der Westhuizen

CLIENT DETAILS	
COMPANY NAME	Zutari
CONTACT PERSON	Jane Mahaba
TEL	069 875 2564
EMAIL	Jane.Mahaba@zutari.com

SPECIALIST DETAILS	
COMPANY NAME	Excellence Ecology
CONTACT PERSON	Mari van der Westhuizen
TEL	082 257 1715
EMAIL	mariwesthuizen@gmail.co.za

DOCUMENT HISTORY	
DATE	VERSION
13 September 2024	V1.0
19 September 2024	V2.0
30 September 2024	V3.0

Executive summary

Excellence Ecology is appointed by Zutari (Pty) Ltd (acting on behalf of the applicant: Eskom Holdings SOC Limited), to undertake a Maintenance Management Plan (MMP) for the 132 kV distribution line and associated pylon structures between the Droërivier and Laingsburg substations. This was prompted by four lattice towers on the 132 kV double-circuit Leeu Gamka – Luttig line that collapsed due to strong winds in the Leeu Gamka area. The MMP will allow Eskom to undertake maintenance activities as needed along the 200 km distribution line.

According to the national web-based environmental screening tool in terms of National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), the project area has the following sensitivities:

- Terrestrial Biodiversity: Very High Sensitivity.
- Animal Species Theme: High Sensitivity.
- Plant Species Theme: Medium Sensitivity.

The desktop survey indicates that:

- The power line traverses several Critical Biodiversity Area (CBA) 1 areas and some Ecological Support Area (ESA) 1 areas. The rest consists of 'Other Natural Areas'.
- The power line traverses several rivers namely the Geelbek, Jakkals, Bloed, Dwyka, Kalkgat, Vlakkraal, Bloukloofleegte, Klip, Saai, Koekemoers, Leeu, Keulders, Sand, Steyns and Stols Rivers and their associated riparian areas. Most of these rivers are secondary rivers, except for the Dwyka, Koekemoers and Leeu Rivers, which are primary rivers. The Leeu River is perennial and all the other rivers are non-perennial.
- The last three kilometres (km) of the power line at Beaufort West traverse the Beaufort West groundwater strategic water source areas.
- The nearest Important Bird Area (IBA) is Karoo National Park, which is roughly 3 km North of the eastern section of the power line.
- The power line does not traverse any Threatened Ecosystem / Red List Ecosystem (RLE).
- The power line does not traverse any National Protected Areas, but the Karoo National Park is 3 km north of the power line, close to Beaufort West and the Henry Kruger Private Nature Reserve is 1 km north of the power line at Leeu Gamka. The power line traverse one National Protected Area Expansion Strategy (NPAES) Focus Areas.

A site visit was conducted from the 11th to the 14th of August 2024 to get baseline information of the area and to identify sensitive areas and Species of Conservation Concern (SCC).

The power line traverse four distinct vegetation types namely:

1. Gamka Karoo
2. Koedoesberge-Moordenaars Karoo
3. Riparian
4. Upper Karoo Hardeveld

These units were mapped and described. Sensitivity was determined for the units, based on whether they are in threatened ecosystems, species diversity, condition and connectivity. Sensitivity is as follows:

- Gamka Karoo: Medium-low
- Koedoesberge-Moordenaars Karoo: Medium
- Riparian: High
- Upper Karoo Hardeveld: Medium

Potential impacts associated with maintenance activities were identified, described and mitigation measures were given. The following impacts were discussed:

- Collision of birds with power lines
- Disturbance of vegetation by heavy vehicles and habitat destruction
- Soil erosion and sedimentation
- Soil and water pollution
- Establishment and spread of alien invasive vegetation

Mitigation measures are given below (see Section 7 for more detail):

- Line markers should be installed on the entire 200 km power lines.
- Construction and maintenance vehicles should stay on the existing service roads as far as possible.
- Peripheral impacts around the maintenance footprint, on the surrounding vegetation of the area, should be avoided.
- During maintenance, sensitive habitats such as riparian areas, must be avoided by construction and maintenance vehicles and equipment, wherever possible, to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
- If groundworks are to take place, an ecologist has to search the area for any protected plant or animal species and they must be relocated to a safe area.
- Areas where groundworks have taken place for maintenance, must be revegetated, using species indigenous to the specific vegetation unit. Soil must be tilled / scarified, especially if it was compacted by groundworks. Mulch should be applied. Seed should be collected from plants present at the site and should be used immediately or stored appropriately and used at the start of the following wet season. Plants such as perennial grasses, shrubs, succulents and geophytes can be removed before groundworks and replaced once work is completed.
- Invasive species must be controlled and monitored after groundworks and rehabilitation.
- If possible, groundworks should be done in the dry season.
- Spill kits must be on-hand to deal with spills immediately.
- All vehicles must be inspected for oil and fuel leaks on a regular basis.
- Any excess or waste material or chemicals must be removed from the site and discarded in the correct ways.
- No littering is to take place.
- Control of invasive plant species involves eradicating the plants present and eradicating the seedlings which emerge. Weeds and invader plants must be controlled in the manner prescribed

for that category by the Conservation of Agricultural Resources Act, No. 43 of 1983 (CARA) or in terms of Working for Water guidelines.

- Institute a monitoring programme where groundworks have taken place for maintenance activities, to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Once detected, an eradication/control programme must be implemented to ensure that the species' do not spread to surrounding natural ecosystems.

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Terms of reference	1
1.2	Legal Framework.....	1
1.3	Assumptions and limitations	2
1.4	Information sources	2
2	METHODS.....	3
2.1	Desktop survey	3
2.2	Flora survey.....	3
2.3	Fauna survey.....	3
2.4	Sensitivity analysis and zoning.....	3
3	BACKGROUND TO THE STUDY AREA	5
3.1	Location	5
3.2	Climate.....	5
3.3	EIA Screening Tool	2
3.4	Vegetation.....	4
3.5	Geology and soil	6
3.5.1	Critical Biodiversity Areas and Ecological Support Areas.....	6
3.5.2	Important Bird Areas (Key Biodiversity Areas)	6
3.5.3	Protected Areas (PA) and National Protected Area Expansion Strategy (NPAES).....	13
3.5.4	Nationally threatened ecosystems.....	13
3.5.5	National Freshwater Ecosystem Priority Areas (NFEPAs) and National Wetland Map 5	13
3.6	Strategic Water Source Areas	14
4	RESULTS.....	21
4.1	Vegetation description.....	21
4.1.1	Gamka Karoo	25
4.1.2	Koedoesberge-Moordenaars Karoo.....	26
4.1.3	Riparian areas	28
4.1.4	Upper Karoo Hardeveld	29

4.2	Plant species level assessment	29
4.2.1	Protected and endemic species.....	29
4.2.2	Protected trees.....	31
4.2.3	EIA screening tool listed species (SCC)	31
4.2.4	Declared invaders	31
4.3	Fauna in and around the project area	33
4.3.1	Fauna species of Conservation Concern.....	33
4.3.2	Fauna habitat types	34
5	Sensitivity analysis	36
6	Potential Impacts and mitigation measures	40
6.1	Collision of birds with power lines	40
6.2	Disturbance of vegetation by heavy vehicles and habitat destruction.....	40
6.3	Soil erosion and sedimentation	41
6.4	Soil and water pollution.....	41
6.5	Establishment and spread of alien invasive vegetation	42
7	DISCUSSION & CONCLUSION.....	43
8	REFERENCES.....	46
	Appendix A: Specialist CV and Declaration of Independence	48
	Appendix B: Plant species recorded in the project area	51
	Appendix C: Fauna species list for QDS 3222BC, 3222AD, 3222CB, 3222CA, 3221DC, 3221DD, 3321BA, 3321AB, 3321AA, 3320BB.....	55

LIST OF FIGURES

Figure 1: Locality Map.....	1
Figure 2: Terrestrial biodiversity theme sensitivity according to the Screening Tool	2
Figure 3: Animal species theme sensitivity according to the Screening Tool.....	3
Figure 4: Plant species theme sensitivity according to the Screening Tool.....	4
Figure 5: Vegetation Map (SANBI, 2018)	8
Figure 6: Critical Biodiversity Areas Map Section 1	9
Figure 7: Critical Biodiversity Areas Map Section 2	10
Figure 8: Critical Biodiversity Areas Map Section 3	11
Figure 9: Important Bird Areas.....	12
Figure 10: Protected Areas and Protected Areas Expansion Strategy Focus Areas.....	15
Figure 11: Threatened Ecosystems / Red List of Ecosystems 2021	16
Figure 12: National Wetland Map 5 and National Freshwater Ecosystem Priority Areas wetlands and rivers, Section 1.....	17
Figure 13: National Wetland Map 5 and National Freshwater Ecosystem Priority Areas wetlands and rivers, Section 2.....	18
Figure 14: National Wetland Map 5 and National Freshwater Ecosystem Priority Areas wetlands and rivers, Section 3.....	19
Figure 15: Strategic Water Source Areas	20
Figure 16: Vegetation units: Section 1	22
Figure 17: Vegetation units: Section 2	23
Figure 18: Vegetation units: Section 3	24
Figure 19: Gamka Karoo.....	25
Figure 20: Gamka Karoo.....	26
Figure 21: Koedoesberge-Moordenaars Karoo.....	27
Figure 22: Pelargonium crithmifolium	27
Figure 23: Koekemoers River north of Leeu Gamka	28
Figure 24: Dry drainage line	29
Figure 25: Ecological sensitivity: Section 1	37
Figure 26: Ecological sensitivity: Section 2	38
Figure 27: Ecological sensitivity: Section 3	39
Figure 28: List of mammals recorded for the project area on the Virtual Museum.....	55
Figure 29: List of birds recorded for the project area on the Virtual Museum	57
Figure 30: List of reptiles recorded for the project area on the Virtual Museum	61
Figure 29: List of frogs recorded for the project area on the Virtual Museum	64

LIST OF Tables

Table 1: Provincially protected species (Nature Conservation Ordinance No. 19 of 1974)	29
Table 2: Endemic species.....	30
Table 3: Screening Tool plant SCC.....	31
Table 4: Sensitive plant SCC given in the screening Tool.....	31
Table 5: Declared invader plant species recorded in the project area.....	32
Table 6: Mammal species of conservation concern that may be present (Screening Tool (in orange) and Virtual Museum)	33
Table 7: Bird species of conservation concern that may be present (Screening Tool (in orange) and Virtual Museum)	34
Table 8: Reptile species of conservation concern that may be present (Screening Tool (in orange) and Virtual Museum)	34
Table 9: Frog species of conservation concern that may be present (Virtual Museum)	34
Table 10: List of recorded trees and shrubs	51
Table 11: List of recorded grasses and reeds	52
Table 12: List of recorded forbs and small succulents	52

List of abbreviations	
BLSA	BirdLife South Africa
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Areas
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
DFFE	Department of Forestry, Fisheries and the Environment
DWAF	Department of Water Affairs and Forestry
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Areas
ESO	Environmental Site Officer
GN	General Notice
GPS	Global Positioning System
IBA	Important Bird Areas
LC	Least Concern
MMP	Maintenance Management Plan
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NFEPA	National Freshwater Ecosystem Protected Areas
NFA	National Forests Act
NPAES	National Protected Area Expansion Strategy
NT	Near Threatened
NWM5	National Wetland Map 5
PA	Protected Areas
RLE	Red List of Ecosystems
SA	South Africa
SANBI	South African National Biodiversity Institute
SARCA	Southern African Reptile Conservation Assessment

List of abbreviations	
SCC	Species of Conservation Concern
SWSA	Strategic Water Source Areas
VU	Vulnerable
WULA	Water Use License Application

1 INTRODUCTION

Excellence Ecology is appointed by Zutari (Pty) Ltd (herein referred to as Zutari) (acting on behalf of the applicant: Eskom Holdings SOC Limited (herein referred to as Eskom)), to undertake a Maintenance Management Plan (MMP) for the 132 kV distribution line and pylon structures between the Droërvier and Laingsburg substations. This was prompted by four lattice towers on the 132 kV double-circuit Leeu Gamka – Luttig line that collapsed due to strong winds in the Leeu Gamka area. The MMP will allow Eskom to undertake maintenance activities as needed along the 200 km distribution line.

1.1 TERMS OF REFERENCE

Basic Terrestrial Biodiversity Impact Assessment for the 200 km power line between Leeu-Gamka and Laingsburg

- Desktop survey to determine which species of conservation concern (SCC) and other sensitivities may be present (Environmental Impact Assessment (EIA) screening tool, Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA), National Freshwater Ecosystem Priority Areas (NFEPA), Important Bird Areas (IBA), Nationally Threatened Ecosystems etc.).
- Site visit to confirm the presence or absence of species of conservation concern and other sensitivities.
- Report writing:
 - Desktop assessment.
 - Broad description of vegetation units, habitat types and sensitive areas.
 - Description of fauna and flora SCC recorded, and fauna SCC expected to be present according to distribution and suitable habitat.
 - Sensitivity map.
 - Identification of potential impacts and mitigation measures.

1.2 LEGAL FRAMEWORK

1. The Constitution of the Republic of South Africa (No. 108 of 1996).
2. The National Environmental Management Act (No. 107 of 1998) (NEMA).
3. National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA).
4. NEM:BA : Publication of lists of species that are threatened or protected, activities that are prohibited and exemption from restriction, 2005. Notice 389 of 2013.
5. NEM:BA. Alien and invasive species lists, 2020.
6. The National Forests Act (No. 84 of 1998) (NFA): Protected tree species.
7. EIA Regulations of 2014 (General Notice (GN) R982 of 2014).
8. Terrestrial Biodiversity, Plant and Animal Species protocols, gazetted 30 October 2020 (GN number 1150), as amended in 2023.

9. Western Cape Biodiversity Spatial Plan Handbook, 2017.
10. Western Cape Biodiversity Act (No. 6 of 2021).

NEMA and the NEM:BA ensure the protection of ecological processes, natural systems and the preservation of biotic diversity within the natural environment. They also ensure the protection of the environment against disturbance, deterioration, defacement or destruction as a result of man-made structures, installations, processes, products or activities.

1.3 ASSUMPTIONS AND LIMITATIONS

- The entire 200 km power line was not assessed in depth, due to time constraints. The area was divided into homogenous units and each unit was sampled. An indication will be given of potential plant and animal SCC that may be present in the area. Global Positioning System (GPS) coordinates of each SCC individual can however not be given.
- In order to obtain a comprehensive understanding of the dynamics of the vegetation and ecology of the study area, surveys should ideally be replicated over several seasons and over a number of years. However, due to project time constraints, such long-term studies are not feasible.
- The site visit was conducted from the 11th to the 14th of August 2024, which is during the end of winter. There has been no rainfall several weeks before the assessment. In spite of this, many plant species were in flower, which promotes plant identification. Some species were however not in flower, and it is possible that certain species may have been missed, as they are only visible / identifiable when in flower and some only flower after good rains.
- Some fauna species are less active during winter and may therefore not have been recorded. The desktop study will however identify species that may be present.
- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the current survey, and as such there is a high confidence in the information provided.

1.4 INFORMATION SOURCES

The following information sources were obtained:

- 1) Relevant maps through GIS mapping, and information on the natural environment of the area concerned.
- 2) Legislation pertaining to the fauna and flora study as relevant.
- 3) The vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford, 2006).
- 4) Red data species lists from the South African National Biodiversity Institute (SANBI).
- 5) South African Red Data Lists for fauna (See reference list for detail).
- 6) Literature on the Karoo Ecology and plants.

2 METHODS

2.1 DESKTOP SURVEY

A desktop survey was completed to determine whether the project area is located in any sensitive areas, like CBA, ESA, NFEPA, IBA, Nationally Threatened Ecosystems, Strategic Water Source Areas (SWSA) etc. Climate and vegetation were also discussed for the project area.

2.2 FLORA SURVEY

A desktop study was completed to find out into which vegetation type, according to Mucina and Rutherford (2006), the project area falls. A field survey was completed on the 11th to the 14th of August 2024, during which vegetation was surveyed.

A search for any SCC was also conducted.

Vegetation was described in terms of dominant and protected species and environmental factors (such as soil type and land use). A list of plant species was compiled for the project area. The red list category, endemism and invasive category are given for each species recorded.

2.3 FAUNA SURVEY

A desktop survey was completed to determine which fauna species of conservation concern may be found in the area, according to the Virtual Museum. Habitat types were identified during the field surveys and described. It could then be seen whether there is the suitable habitat type for species of conservation concern (SCC) that might be present in the area according to their distribution. All fauna encountered on site is listed in this report.

2.4 SENSITIVITY ANALYSIS AND ZONING

The ecological sensitivity of any piece of land is based on its inherent ecosystem service and overall preservation of biodiversity. The project area's sensitivity was determined, considering the following factors:

Ecological function

The ecological function relates to the degree of ecological connectivity between systems within a landscape matrix. Therefore, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to ecosystem service (e.g. wetlands) or overall preservation of biodiversity.

Conservation importance

Conservation importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

Sensitivity scale

High – sensitive ecosystem with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems or with high species diversity and usually provide suitable habitat for a number of threatened or rare species. These areas should be protected.

Medium – These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems or ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species; and

Low – Degraded and highly disturbed / transformed systems with little ecological function and are generally very poor in species diversity.

3 BACKGROUND TO THE STUDY AREA

3.1 LOCATION

The power line runs from the Laingsburg Substation at Laingsburg, through Leeu Gamka up until the Droërivier Substation at Beaufort West (Figure 1). It is located in the Central Karoo District Municipality and spans three local municipalities, namely, the Laingsburg Local Municipality, Prince Albert Local Municipality and Beaufort West Local Municipality in the Western Cape Province.

3.2 CLIMATE

Rainfall mainly in autumn and summer, with a marked peak in March and low levels of cyclonic rain in winter. This region is in the rain shadow of Cape Fold Belt mountains in the south, MAP ranging from about 100 mm in some areas between the Dwyka and Gamka Rivers to about 240 mm against the Great Escarpment. Mean maximum and minimum monthly temperatures in Beaufort West are 38.7°C and -3.2°C for January and July, respectively. Strong north-westerly winds occur in winter (SANBI 2018).

Beaufort West - Laingsburg power line: Terrestrial Biodiversity Maintenance Management Plan

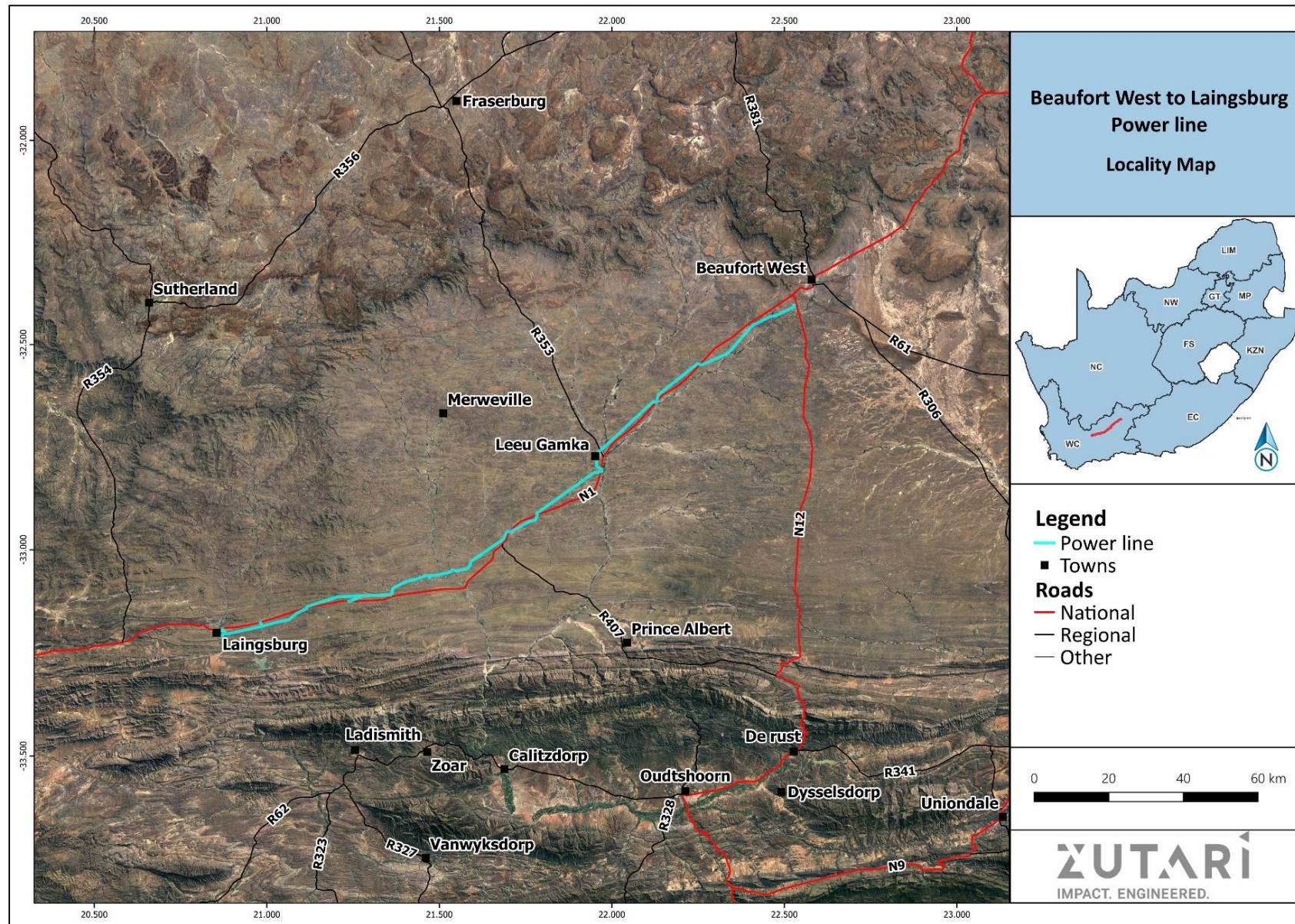


Figure 1: Locality Map

3.3 EIA SCREENING TOOL

According to the national web-based environmental screening tool in terms of NEMA, the site has the following sensitivities:

- Terrestrial Biodiversity: Very High Sensitivity (Figure 2).
- Animal Species Theme: High Sensitivity (Figure 3).
- Plant Species Theme: Medium Sensitivity (Figure 4).

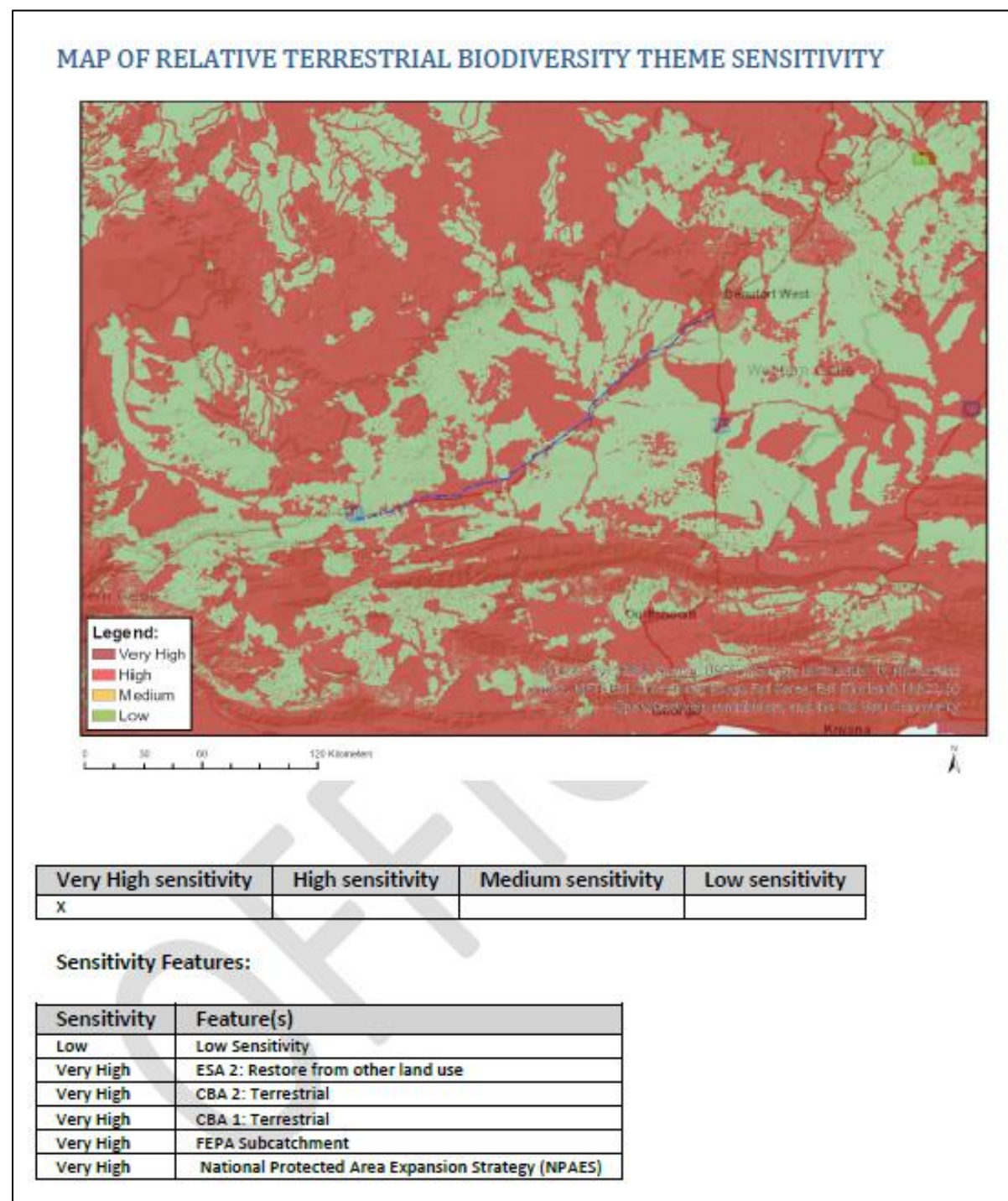
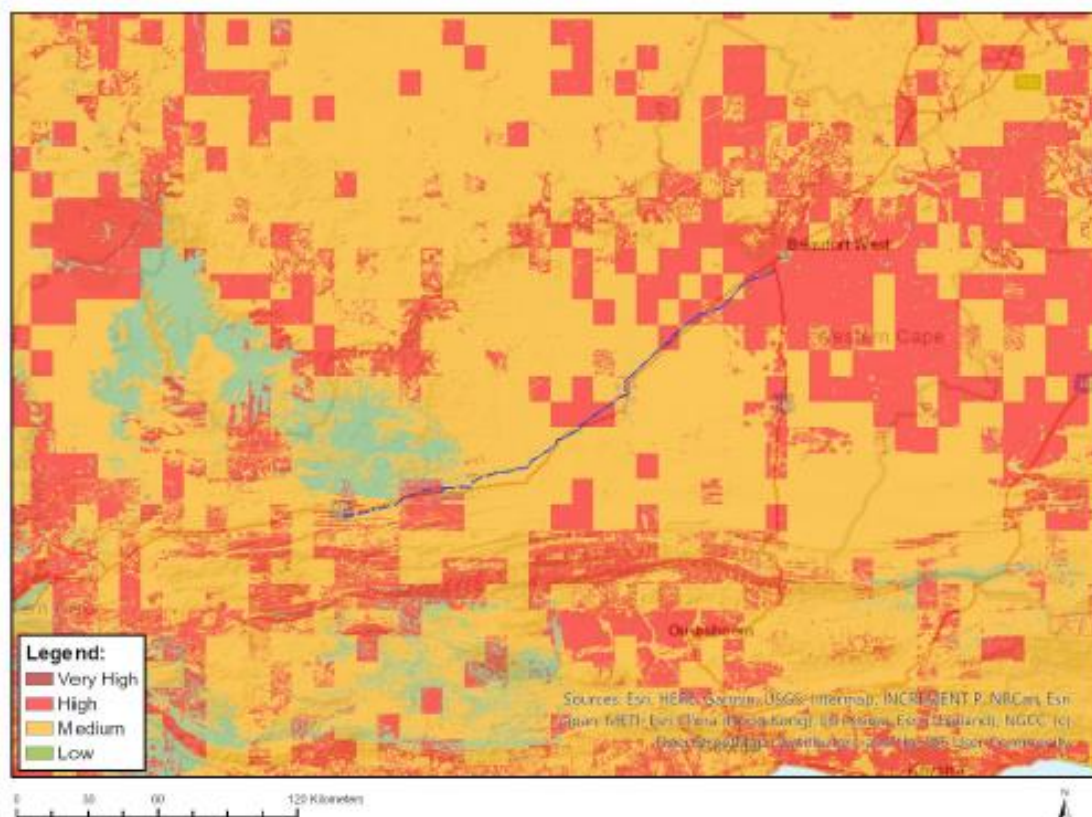


Figure 2: Terrestrial biodiversity theme sensitivity according to the Screening Tool

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Falco biarmicus
High	Aves-Polemaetus bellicosus
High	Aves-Aquila verreauxii
High	Aves-Neotis ludwigii
Low	Subject to confirmation
Medium	Aves-Afrotis afra
Medium	Aves-Neotis ludwigii
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Aquila verreauxii
Medium	Mammalia-Bunolagus monticularis
Medium	Reptilia-Chersobius boulengeri

Figure 3: Animal species theme sensitivity according to the Screening Tool

3.4 VEGETATION

4

Biomes (Mucina & Rutherford, 2006). The study area is located in the Nama Karoo and Succulent Karoo biomes (Mucina & Rutherford, 2006). The Nama-Karoo is a large, landlocked region on the central plateau of the western half of South Africa and extends into southeastern Namibia. The name is derived from the Khoi San word *kuru* meaning 'dry'. It covers an area of 248 284 km². The climate of the Nama-Karoo is essentially continental and is little affected by the ameliorating influences of the oceans. The Nama-Karoo is an arid biome.

The Succulent Karoo is also an arid biome, it is in fact the only international biodiversity hotspot which is entirely in an arid region (Mucina & Rutherford, 2006).

The power line traverses the Koedoesberge-Moordenaars Karoo, Gamka Karoo, Southern Karoo Riviere and the Upper Karoo Hardeveld vegetation units, with the majority of the power line being in the Gamka Karoo vegetation unit (SANBI, 2018) (Figure 5).

The Gamka Karoo vegetation unit is characterised as extremely irregular to slightly undulating plains covered with dwarf spiny shrubland dominated by Karoo dwarf shrubs (e.g. *Chrysocoma ciliata*, *Eriocephalus ericoides*) with rare low trees (e.g. *Euclea undulata*). Dense stands of drought-resistant grasses (*Stipagrostis*, *Aristida*) cover (especially after abundant rains) broad sandy bottomlands. The National Biodiversity Assessment lists this vegetation unit as Least Concern, and the protection level is Poorly protected (SANBI, 2018).

The Koedoesberge-Moordenaars Karoo vegetation unit forms part of the Succulent Karoo Biome. It is characterised as a 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 National Biodiversity Assessment lists this vegetation unit as Least Concern, and the protection level is Not protected (SANBI, 2018).

The Southern Karoo Riviere vegetation unit is azonal vegetation. It is described as narrow riverine flats supporting a complex of *Vachellia 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*. The National Biodiversity Assessment lists this vegetation unit as Least Concern, and the protection level is Poorly protected (SANBI, 2018).

Upper Karoo Hardeveld vegetation unit forms part of the Nama Karoo Biome and is characterised by Steep slopes of koppies, butts, mesas and parts of the Great Escarpment covered with large boulders and stones supporting sparse dwarf Karoo scrub with drought-tolerant grasses of genera such as *Aristida*, *Eragrostis* and *Stipagrostis*. The National Biodiversity Assessment lists this vegetation unit as Least Concern, and the protection level is Poorly protected (SANBI, 2018).

3.5 GEOLOGY AND SOIL

Gamka Karoo vegetation unit

Mudstones and sandstones of the Beaufort Group (Adelaide Subgroup) with some Eccca (Fort Brown Formation) shales supporting very shallow and stony soils of the Glenrosa and/or Mispah forms, typical of Fc land type.

Southern Karoo Rivier vegetation unit

Recent sandy-clayey alluvial deposits rich in salt occurring on mudrocks and sandstones of the Adelaide Subgroup (Beaufort Group of the Karoo Supergroup) that support soils typical of Ia land type. Torrential convectional rains in summer cause sudden flood surges which remodel the riverbed and adjacent alluvium.

Koedoesberge-Moordenaars Karoo vegetation unit

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

Upper Karoo Hardeveld

Primitive, skeletal soils in rocky areas developing over sedimentary rocks such as mudstones and arenites of the Adelaide Subgroup of the Karoo Supergroup and to a lesser extent also the Eccca Group (Waterford and Volksrust Formations) as well as Jurassic dolerite sills and dykes and subsummit positions of mesas and butts with dolerite boulder slopes. Almost entirely Ib land type

3.5.1 Critical Biodiversity Areas and Ecological Support Areas

CBAs are areas required to meet biodiversity targets for ecosystems, species and ecological processes, as identified in a systematic biodiversity plan. ESAs are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of CBAs and/or in delivering ecosystem services. CBAs and ESAs may be terrestrial or aquatic.

The primary purpose of a map of CBAs and ESAs is to guide decision-making about where best to locate development. It should inform land-use planning, environmental assessment and authorisations, and natural resource management, by a range of sectors whose policies and decisions impact on biodiversity. It is the biodiversity sector's input into multi-sectoral planning and decision-making processes (SANBI Biodiversity Advisor, 2017).

The power line traverses several CBA1 areas and some ESA1 areas. The rest consists of 'Other Natural Areas' (Figure 6 to Figure 8) (Cape Nature, 2017).

3.5.2 Important Bird Areas (Key Biodiversity Areas)

IBAs are sites of global significance for bird conservation (Marnewick *et al.*, 2015). The project area is

does not traverse any IBAs. The nearest IBA is Karoo National Park, which is roughly 3 km north of the eastern section of the power line (Figure 9).

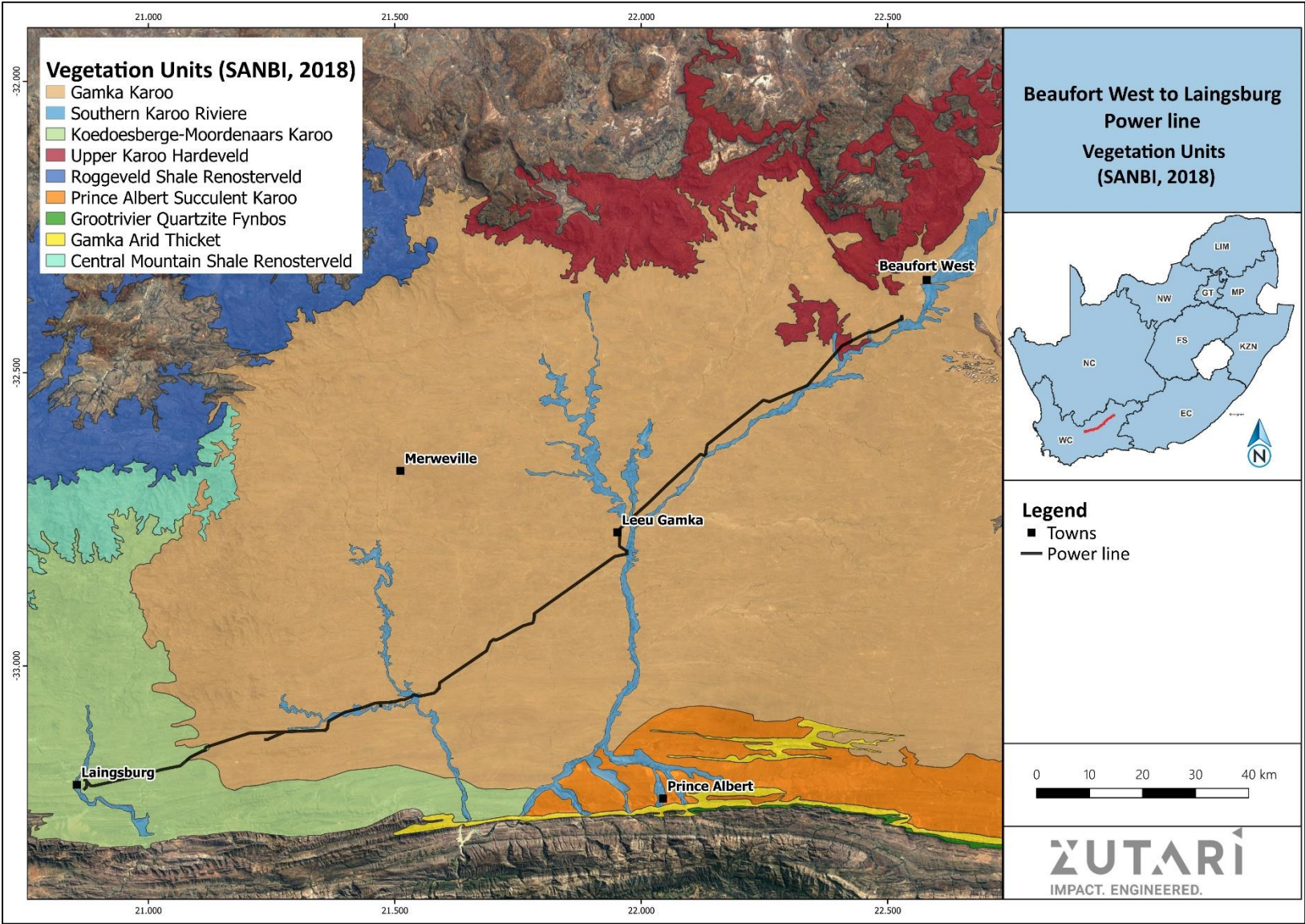


Figure 5: Vegetation Map (SANBI, 2018)

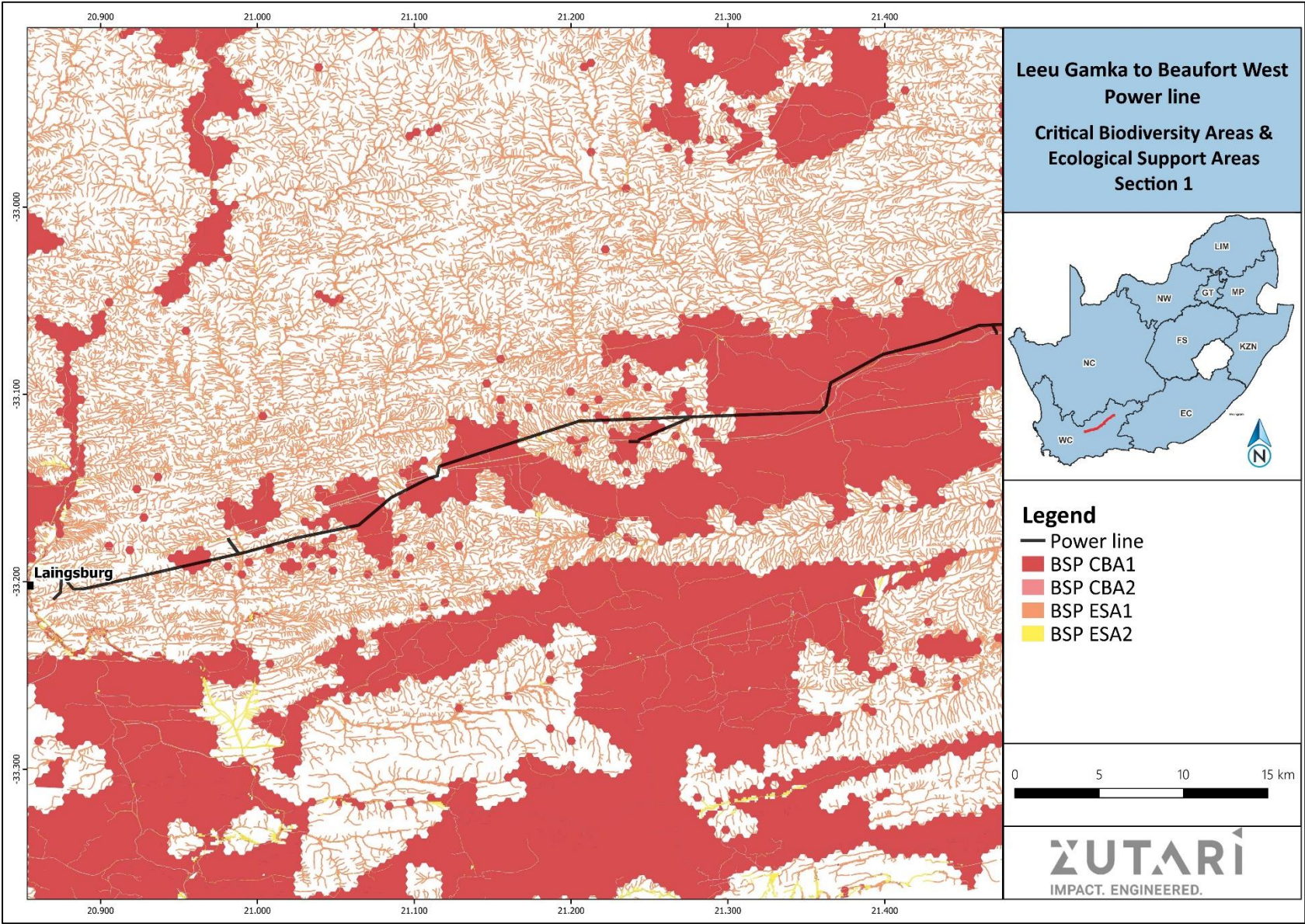


Figure 6: Critical Biodiversity Areas Map Section 1

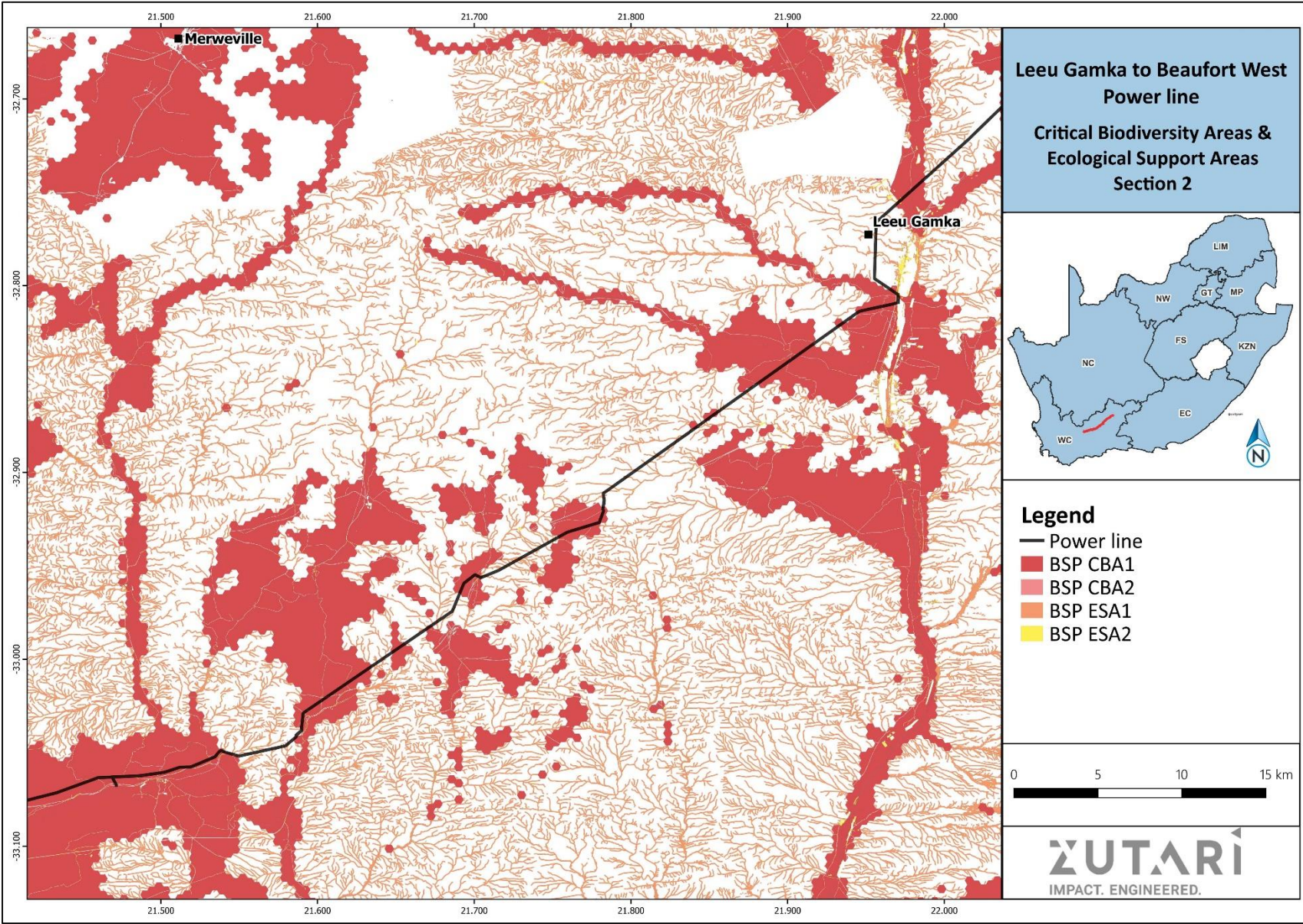


Figure 7: Critical Biodiversity Areas Map Section 2

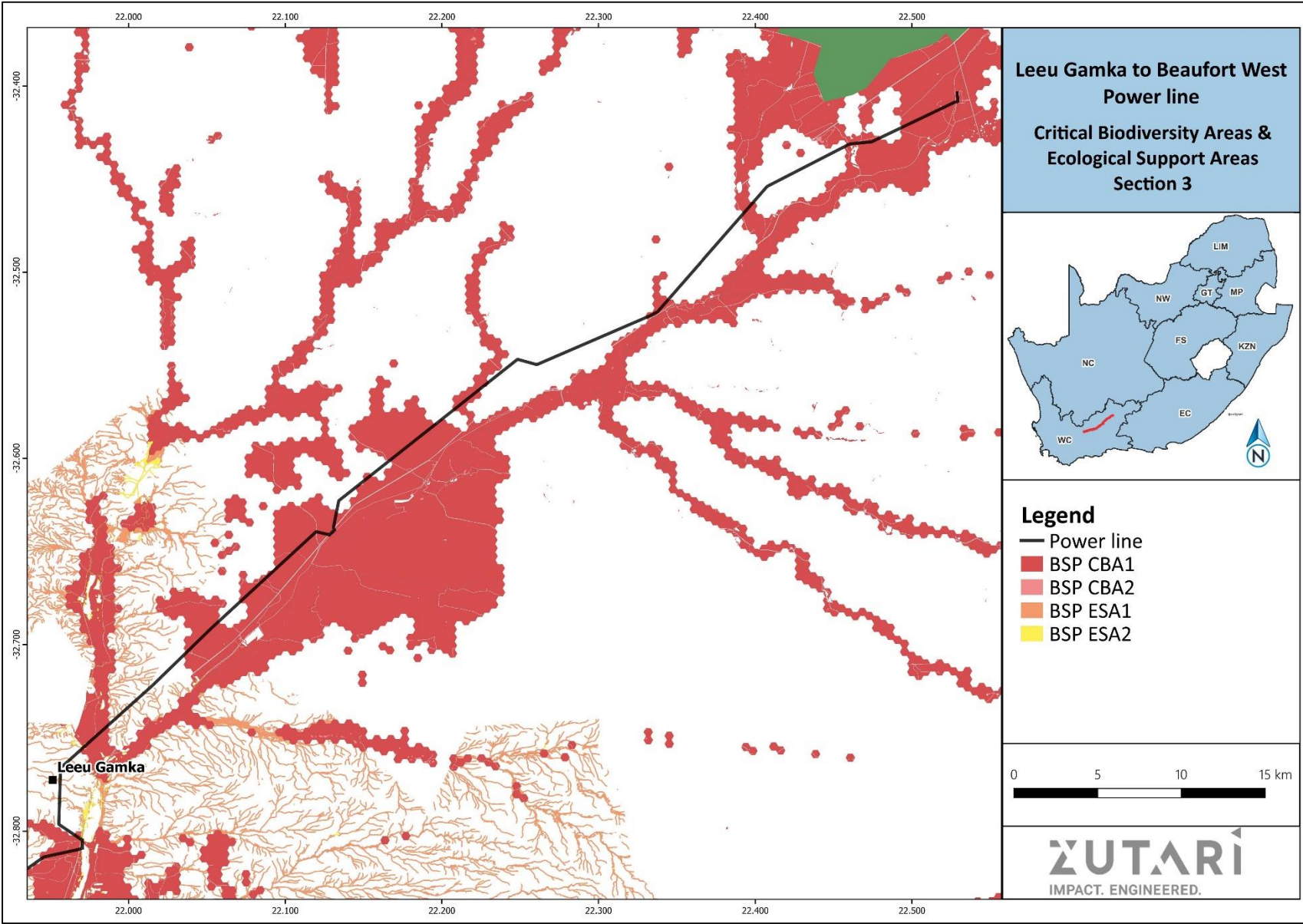


Figure 8: Critical Biodiversity Areas Map Section 3

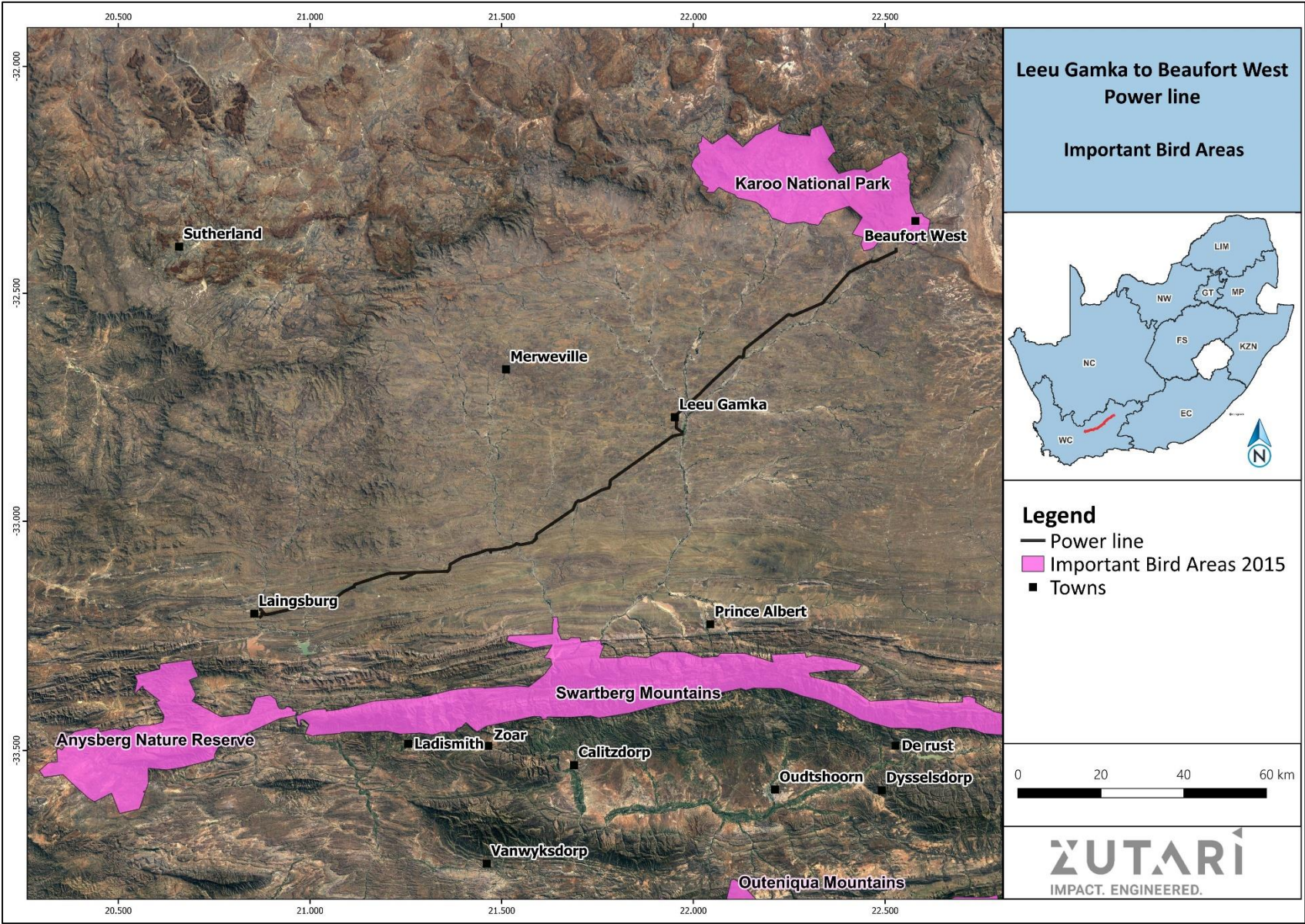


Figure 9: Important Bird Areas

3.5.3 Protected Areas (PA) and National Protected Area Expansion Strategy (NPAES)

Officially protected areas, either Provincially or Nationally that occur close to a project site could have consequences as far as impacts on these areas are concerned. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion.

The power line does not traverse any National Protected Areas, but the Karoo National Park is 3 km north of the power line, close to Beaufort West and the Henry Kruger Private Nature Reserve is 1 km north of the power line at Leeu Gamka. The power line traverse one NPAES Focus Areas (Figure 10).

3.5.4 Nationally threatened ecosystems

NEM:BA provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value.

The list of Threatened Ecosystems was published in 2011 (SANBI, 2011). This dataset has been refined and replaced by the Red List of Ecosystems (RLE) for terrestrial realm for South Africa (2021).

The project area is not located in or near a RLE / Threatened Ecosystem (Figure 11) (SANBI, 2011; SANBI, 2021).

3.5.5 National Freshwater Ecosystem Priority Areas (NFEPA) and National Wetland Map 5

South Africa's freshwater ecosystems are diverse, ranging from sub-tropical in the north-eastern part of the country, to semi-arid and arid in the interior, to the cool and temperate rivers of the fynbos. "Freshwater ecosystems" refer to all inland water bodies whether fresh or saline, including rivers, lakes, wetlands, sub-surface waters and estuaries. Consistent with global trends, high levels of threat have been reported for freshwater ecosystems. According to the National Biodiversity Assessment 2018 nearly 80% of inland wetland ecosystem types in South Africa are threatened and approximately 75% of inland wetland ecosystem types are both threatened and under-protected (SANBI, 2019). South Africa's freshwater fauna also displays high levels of threat: at least one third of freshwater fish indigenous to South Africa are reported as threatened, and a recent southern African study on the conservation status of major freshwater-dependent taxonomic groups (fishes, molluscs, dragonflies, crabs and vascular plants) reported far higher levels of threat in South Africa than in the rest of the region.

Urgent attention is needed to ensure that we conserve some representative natural examples of the different ecosystems that make up the natural heritage of this country for current and future

generations. NFEPA responds to this need, providing strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources (Driver et al., 2011)

The National Wetland Map version 5 (NWM5) shows the distribution of inland wetland ecosystem types across South Africa and includes estuaries and the extent of some rivers (CSIR, 2018).

The power line traverses several rivers namely the Geelbek, Jakkals, Bloed, Dwyka, Kalkgat, Vlakkraal, Bloukloofleegte, Klip, Saai, Koekemoers, Leeu, Keulders, Sand, Steyns and Stols Rivers and their associated riparian areas (Figure 12 to Figure 14). Most of these rivers are secondary rivers, except for the Dwyka, Koekemoers and Leeu Rivers, which are primary rivers. The Leeu River is perennial and all the other rivers are non-perennial.

3.6 STRATEGIC WATER SOURCE AREAS (SWSA)

Water source areas are those areas that supply a disproportionate amount of mean annual runoff to a geographical region of interest. SWSA are those that supply substantial downstream economies and urban centres. These water source areas are vital to the national economy (Nel *et al.*, 2013).

The last three kilometres of the power line at Beaufort West traverse the Beaufort West groundwater SWSAs.

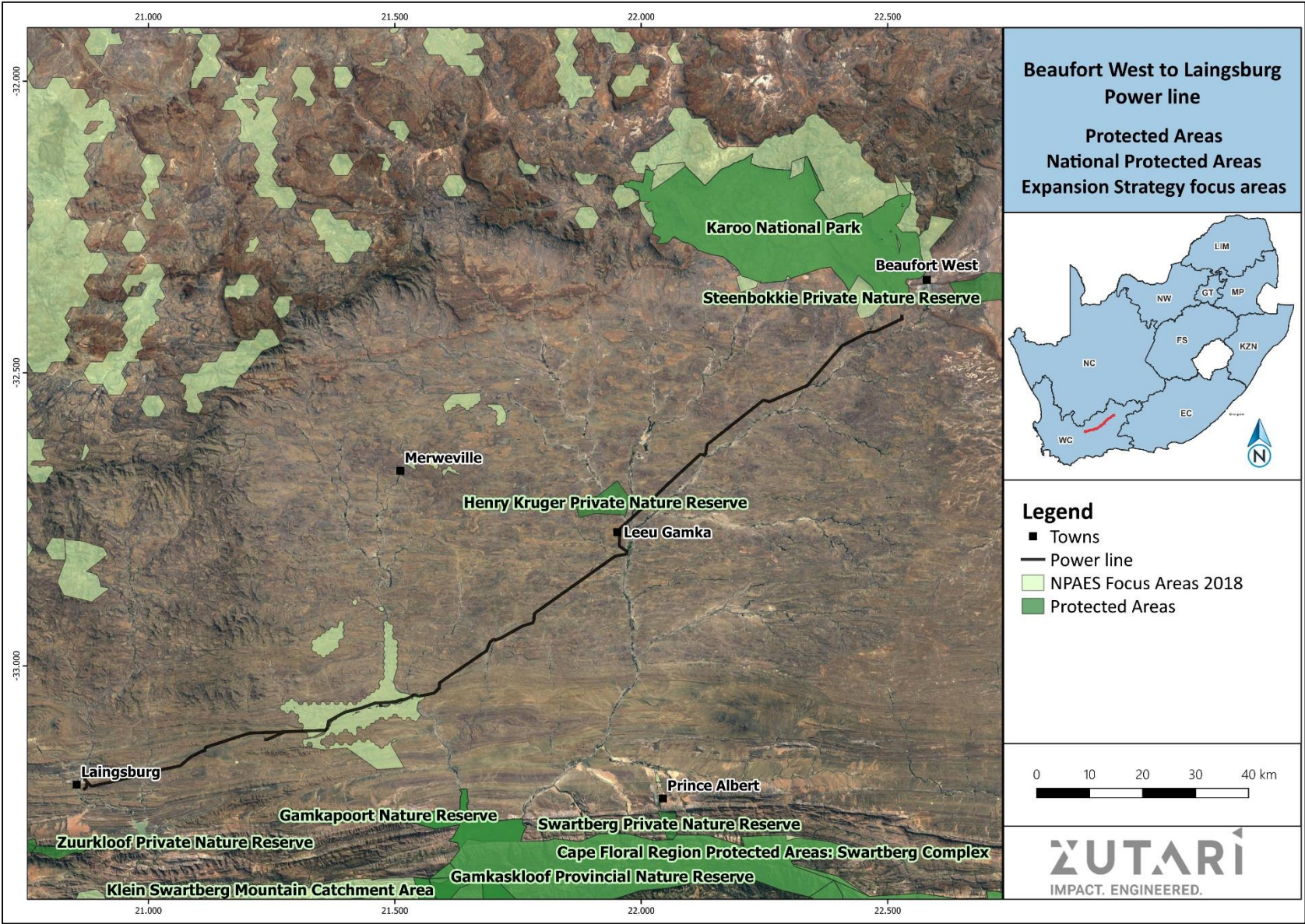


Figure 10: Protected Areas and Protected Areas Expansion Strategy Focus Areas

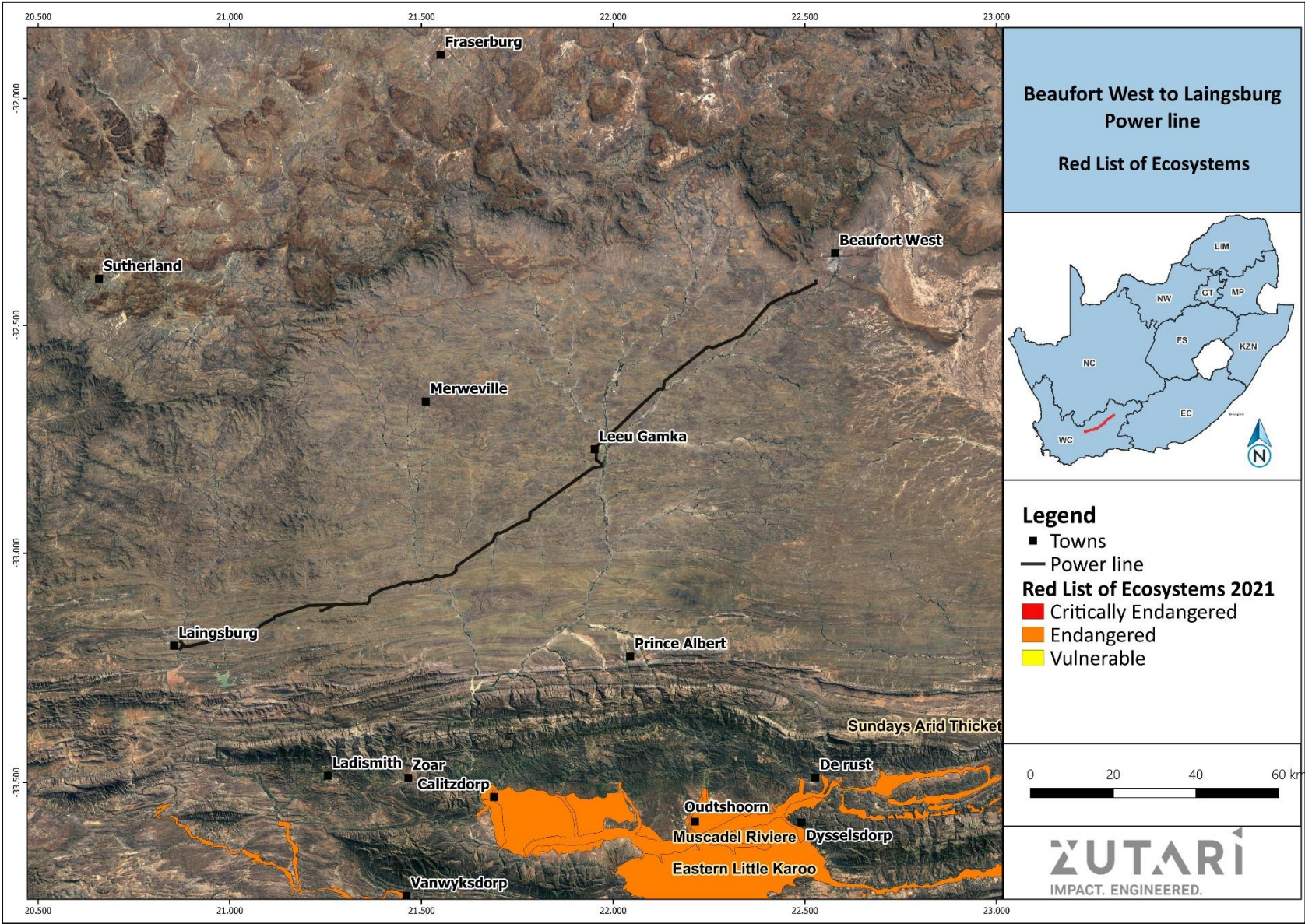


Figure 11: Threatened Ecosystems / Red List of Ecosystems 2021

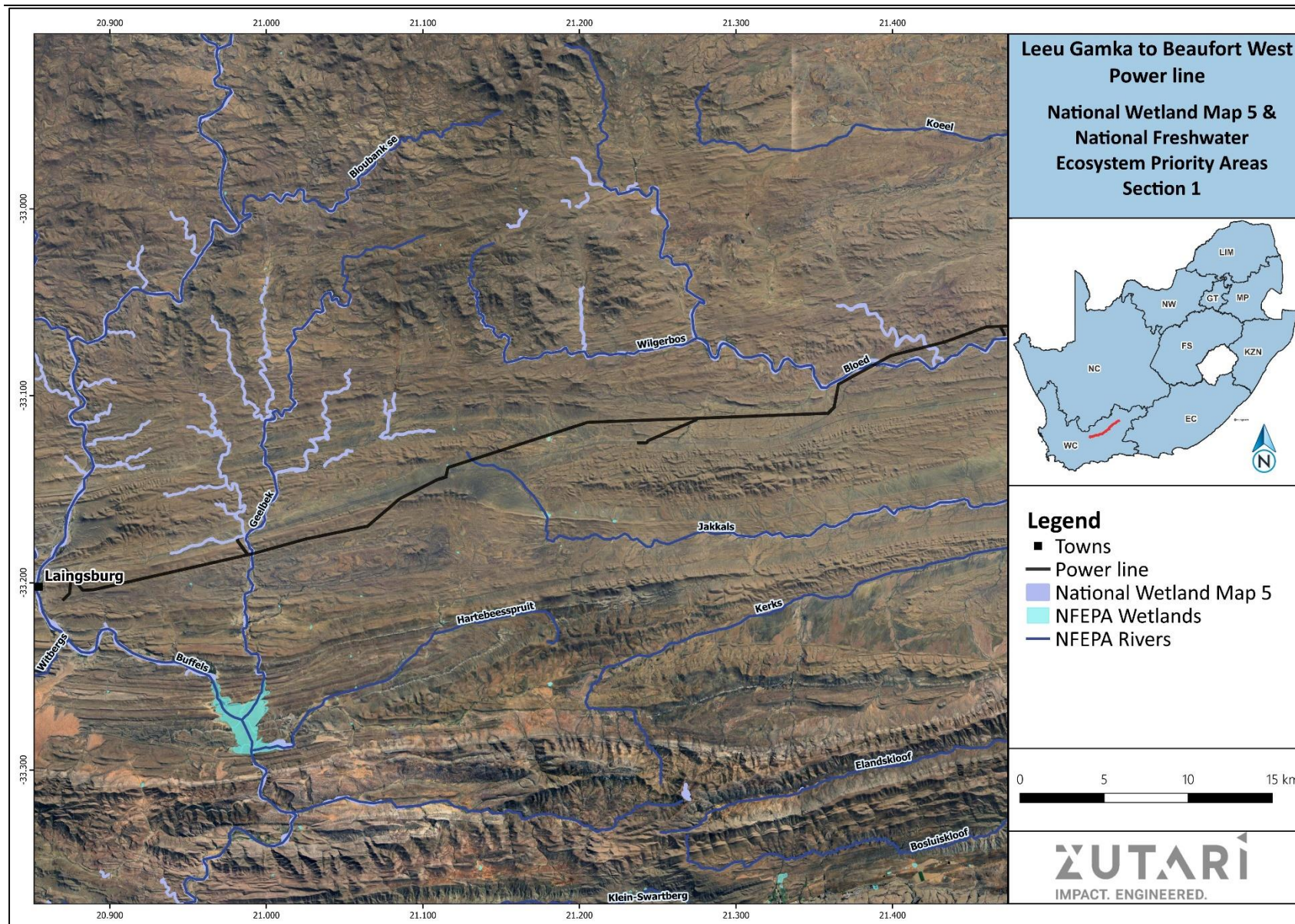


Figure 12: National Wetland Map 5 and National Freshwater Ecosystem Priority Areas wetlands and rivers, Section 1

18

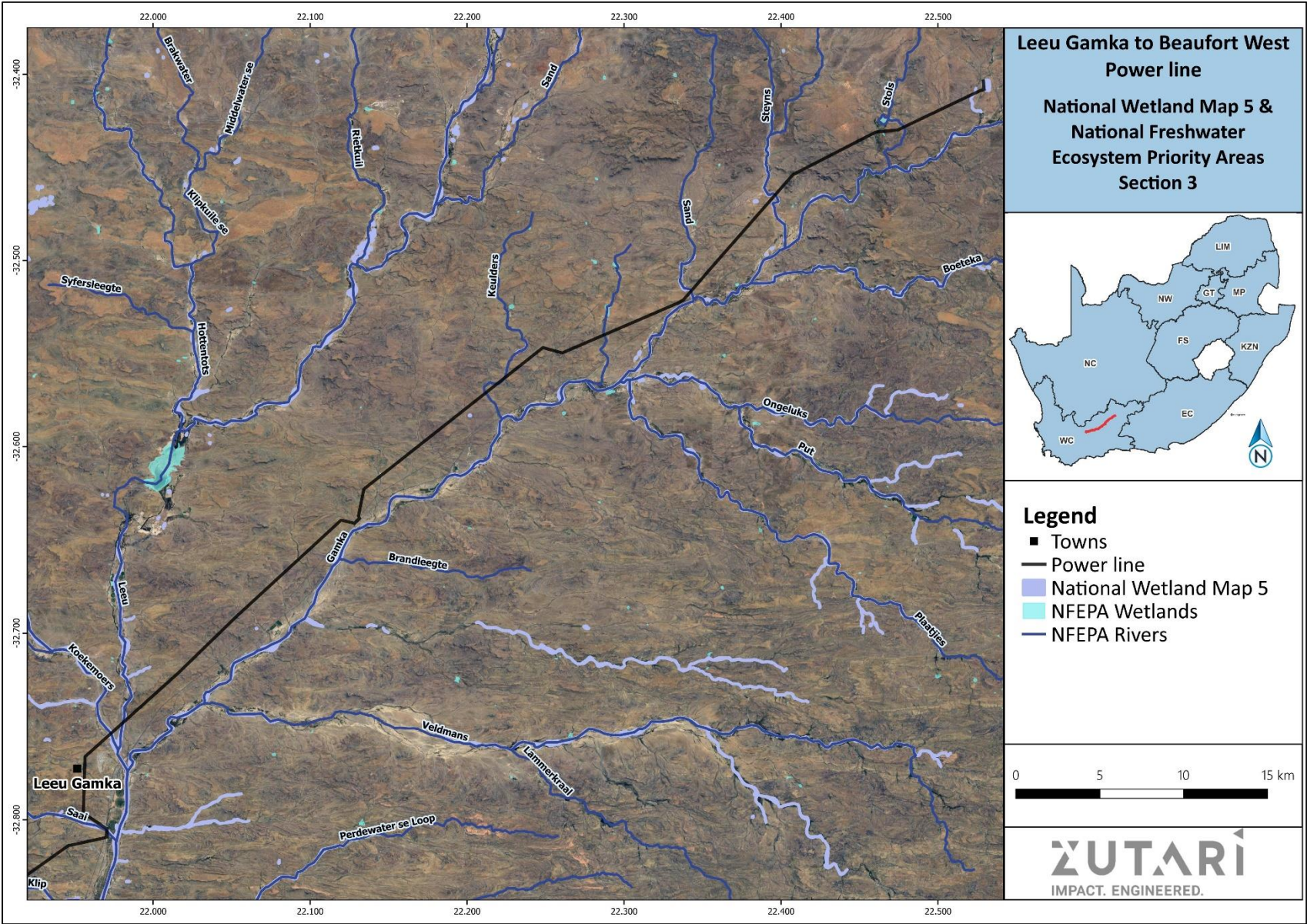


Figure 14: National Wetland Map 5 and National Freshwater Ecosystem Priority Areas wetlands and rivers, Section 3

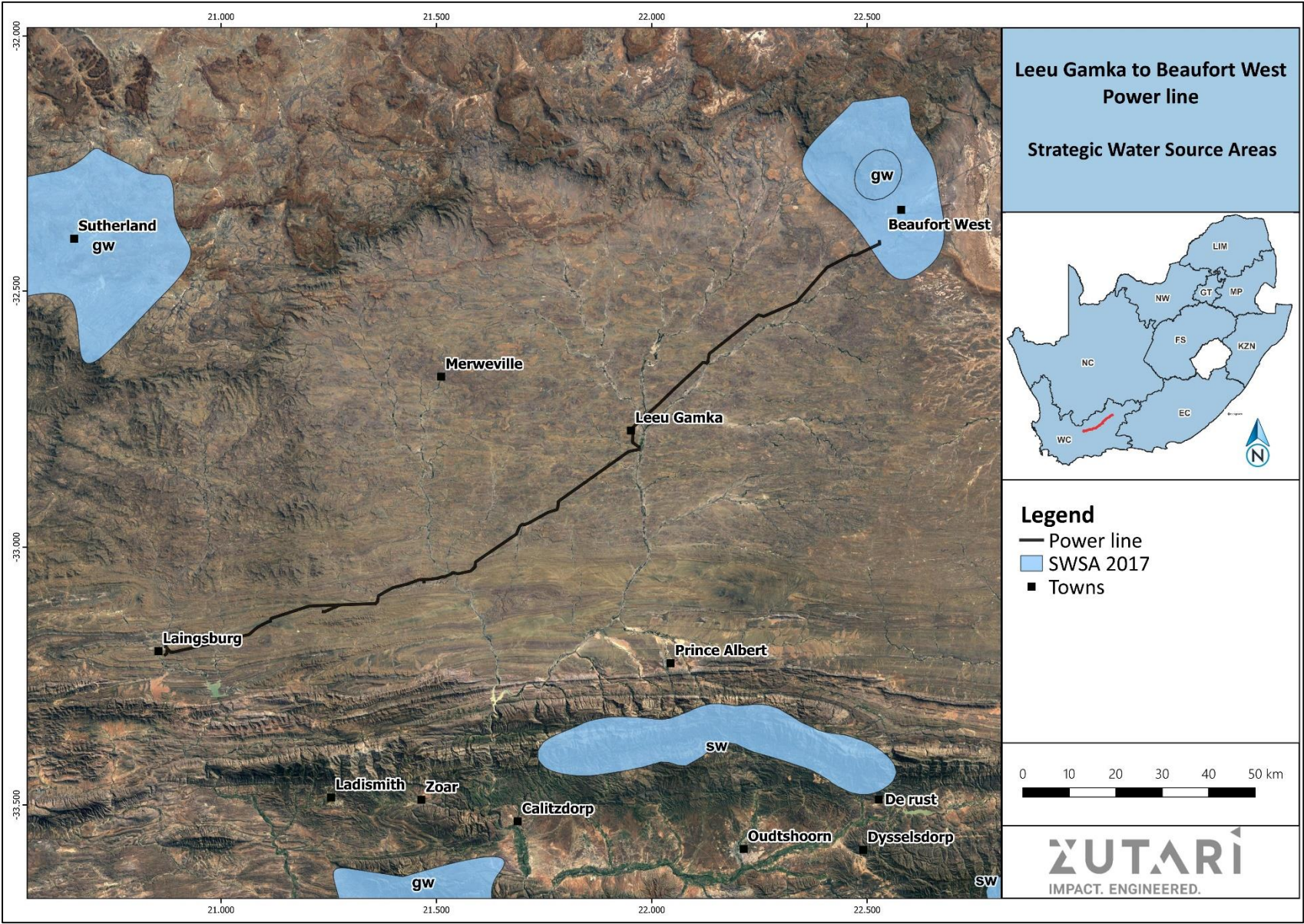


Figure 15: Strategic Water Source Areas

4 RESULTS

4.1 VEGETATION DESCRIPTION

The power line traverse four distinct vegetation types (Figure 16 to Figure 18) namely:

1. Gamka Karoo
2. Koedoesberge-Moordenaars Karoo
3. Riparian
4. Upper Karoo Hardeveld

Transformed areas were also mapped.

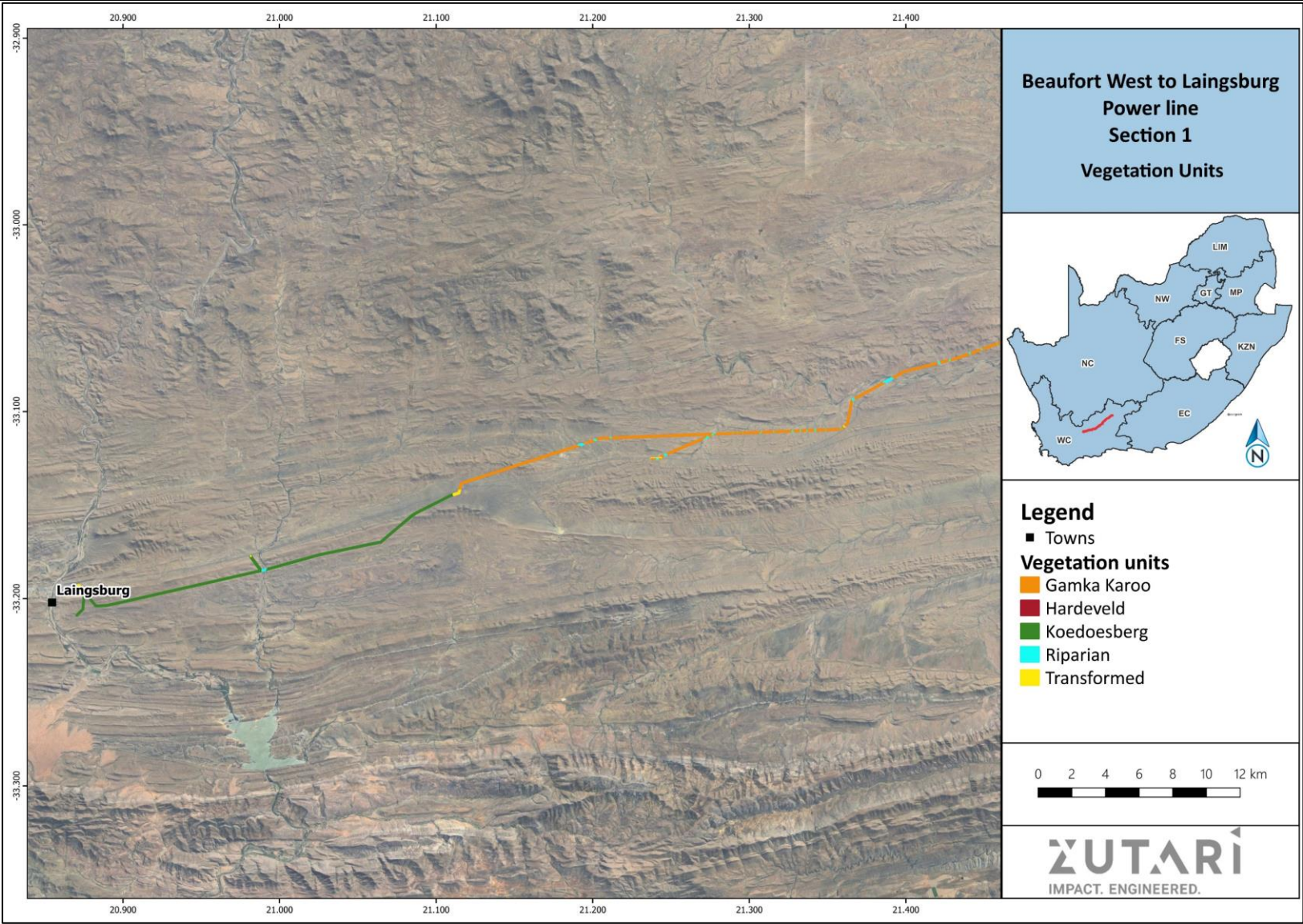


Figure 16: Vegetation units: Section 1

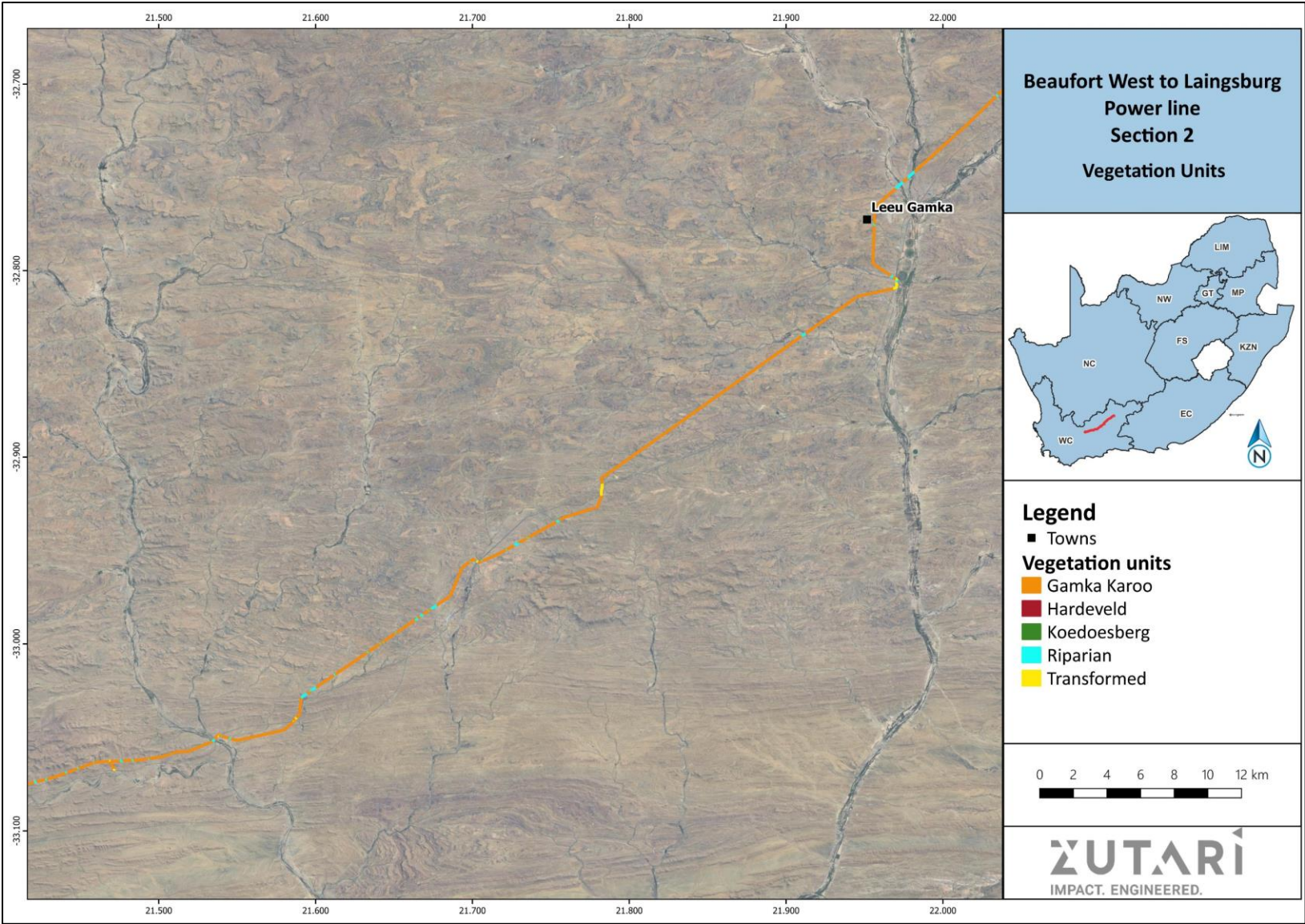


Figure 17: Vegetation units: Section 2

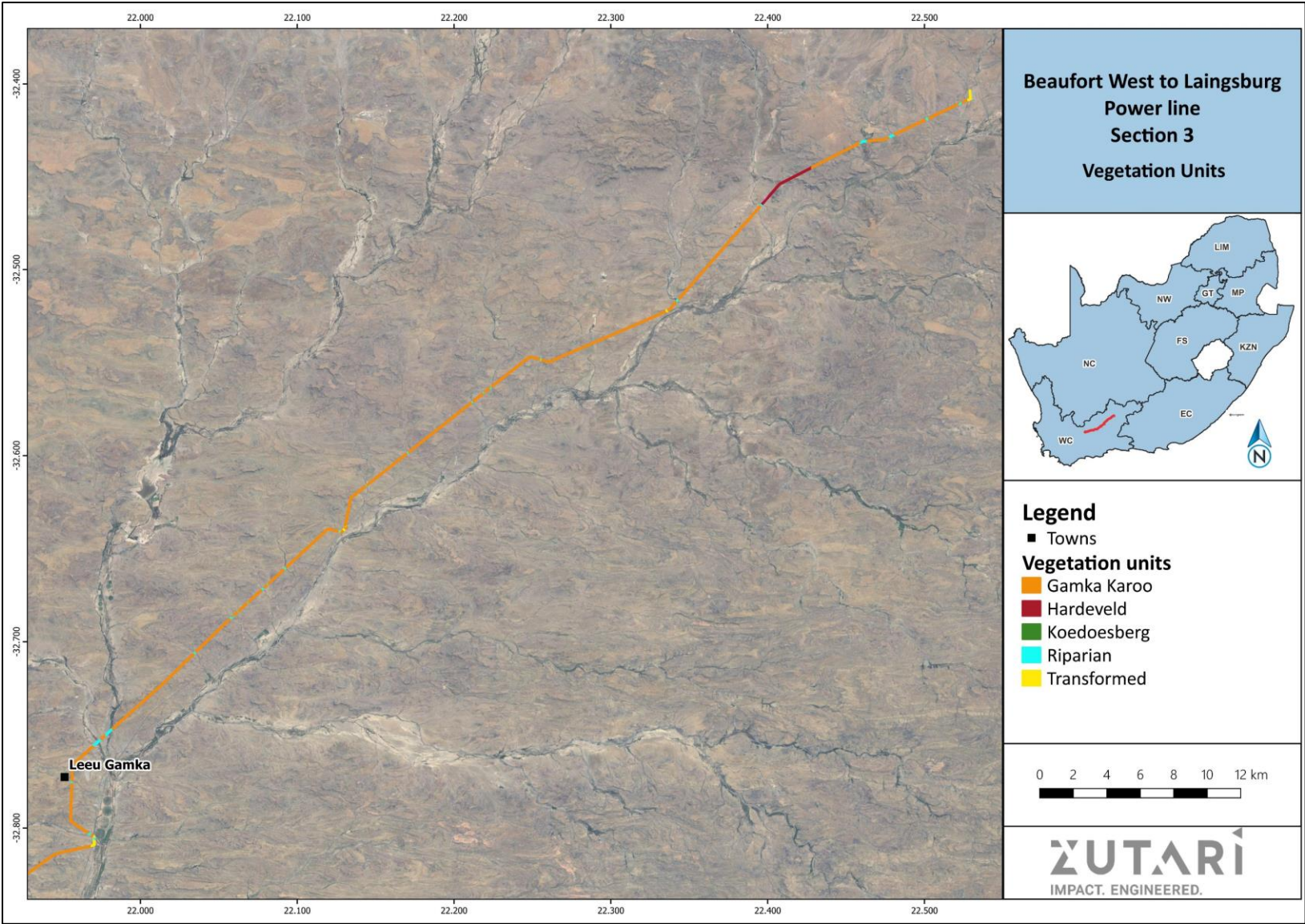


Figure 18: Vegetation units: Section 3

4.1.1 Gamka Karoo

The majority of the power line is in the Gamka Karoo vegetation unit (Figure 19). The Gamka Karoo unit covers vast open plains with some hills. Soil is shallow and rocky. Vegetation is dominated by small shrubs and forbs. Dominant species include the shrubs *Rhigozum obovatum* (Karoo gold, geelgranaat), *Lycium* spp., the grasses *Stipagrostis ciliata*, *S. obtusa*, *Enneapogon* spp. and *Aristida* spp. and the forbs *Arctotis adpressa*, *Felicia namaquana*, *F. ovata*, *Galenia sarcophylla*, *Ifloga glomerata*, *Pentzia* spp., *Ursinia nana* and a variety of mesembs.

Much of this unit is disturbed, as there are service roads under the power lines. Some areas are overgrazed, although most is in a relatively good condition (next to the service roads). The sensitivity of medium-low was given to this unit.



Figure 19: Gamka Karoo



Figure 20: Gamka Karoo

4.1.2 Koedoesberge-Moordenaars Karoo

The Koedoesberge-Moordenaars Karoo is part of the Succulent Karoo Biome which generally has a higher species diversity than the Nama Karoo. There are more succulents in this unit than in the other vegetation units of which some are provincially protected. The soil is generally shallow and rocky and most of it is located on mountain slopes. Dominant species includes the shrubs *Lycium* spp., *Rhigozum obovatum*, *Ruschia intricata* and other mesembs, the grasses *Stipagrostis ciliata*, *S. obtusa*, *Enneapogon* spp. and *Aristida* spp. and forbs and succulents such as *Anacampseros* spp., *Crassula* spp. and *Sericocoma avolans*. See Appendix B for species list of recorded species.

This vegetation unit is generally in a good condition and a sensitivity of Medium was assigned to it.



Figure 21: Koedoesberge-Moordenaars Karoo



Figure 22: *Pelargonium crithmifolium*

4.1.3 Riparian areas

This vegetation unit is embedded within the Koedoesberge-Moordenaars Karoo, and Gamka Karoo vegetation units. They are mostly non-perennial drainage lines, characterised by sandy soils with the exception of a few perennial rivers. The sand is often rich in salt. Vegetation is clearly different from the surrounding vegetation, including tree species such as *Vachellia karroo* (Sweet thorn), *Tamarix usneoides* (Wild Tamarisk) and *Salsola aphylla* (Lye Ganna), *Nidorella ivifolia* (Oven bush). The grass *Stipagrostis namaquensis* (River bushman grass) is found exclusively in this vegetation unit. No plant SCC were recorded in this unit. It may provide suitable habitat for the Critically Endangered Riverine Rabbit (*Bunolagus monticularis*) although none were recorded.



Figure 23: Koekemoers River north of Leeu Gamka



Figure 24: Dry drainage line

4.1.4 Upper Karoo Hardeveld

A small section of the power line not far from Beaufort West traverses the Upper Karoo Hardeveld vegetation unit. It typically occurs on steep slopes and has shallow rocky soils. Vegetation consists of sparse dwarf Karoo scrub with drought-tolerant grasses of genera such as *Aristida*, *Eragrostis* and *Stipagrostis*. Dominant shrubs include *Lycium cinereum* and *Rhigozum obovatum*.

4.2 PLANT SPECIES LEVEL ASSESSMENT

South Africa has been recognized as having remarkable plant diversity with high levels of endemism. In this section protected and endemic species that were recorded in the project area are listed. Screening Tool SCC are given. Declared invaders are listed.

4.2.1 Protected and endemic species

In this section protected plant species and endemic species recorded in the project area is given, while a complete list of recorded plant species is provided in Appendix B. No national red list species were recorded.

Table 1: Provincially protected species (Nature Conservation Ordinance No. 19 of 1974)

Provincially protected plant species		
Family	Scientific name	Common name
Asphodelaceae	<i>Aloe claviflora</i>	Kanonaalwyn

Beaufort West - Laingsburg power line: Terrestrial Biodiversity Maintenance Management Plan

Asphodelaceae	<i>Aloe microstigma</i>	Karoo Aalwyn
Anacampserotaceae	<i>Anacampseros albidiflora</i>	Haasballetjies
Anacampserotaceae	<i>Anacampseros ustulata</i>	Kirriemoer
Iridaceae	<i>Babiana bainesii</i>	Bobbejaanuintjie
Crassulaceae	<i>Crassula pyramidalis</i>	Rygbossie
Asphodelaceae	<i>Haworthia arachnoidea</i>	Spinnekopbolletjie
Asphodelaceae	<i>Haworthiopsis viscosa</i>	Koedoekos
Iridaceae	<i>Moraea collina</i>	Aasuintjie

Table 2: Endemic species

Trees and shrubs		
Scientific name	Common name	Status
<i>Asparagus aethiopicus</i>	Haakdoring	Least concern, Endemic (SA)
<i>Asparagus burchellii</i>	Wild Asparagus	Least concern, Endemic (SA)
<i>Asparagus mucronatus</i>	Katdoring	Least concern, Endemic (SA)
<i>Asparagus striatus</i>	Bergappel	Least concern, Endemic (SA)
<i>Berkheya spinosa</i>	Perdebos	Least concern, Endemic (SA)
<i>Ehretia rigida</i>	Puzzle bush	Least concern, Endemic (SA)
<i>Grewia robusta</i>	Karoo Cross-berry	Least concern, Endemic (SA)
<i>Macledium spinosum</i>	Steekblom	Least concern, Endemic (SA)
<i>Oedera oppositifolia</i>	Blouperdekaroo	Least concern, Endemic (SA)
<i>Pteronia glomerata</i>	Perdebossie	Least concern, Endemic (SA)
<i>Ruschia intricata</i>	Doringvygie	Least concern, Endemic (SA)
<i>Salsola calluna</i>	Rooilootganna	Least concern, Endemic (SA)
Forbs		
Scientific name	Common name	Status
<i>Adromischus maculatus</i>	Bontplakkie	Least concern, Endemic (SA)
<i>Aloe microstigma</i>	Karoo Aalwyn	Least concern, Endemic (SA)
<i>Anacampseros ustulata</i>	Kirriemoer	Least concern, Endemic (SA)
<i>Antimima evoluta</i>		Least concern, Endemic (SA)
<i>Antimima maxwellii</i>		Least concern, Endemic (SA)
<i>Aptosimum indivisum</i>	Karoo Violet	Least concern, Endemic (SA)
<i>Arctotis adpressa</i>	Gousblom	Least concern, Endemic (SA)
<i>Crassula montana</i>		Least concern, Endemic (SA)
<i>Crassula pyramidalis</i>	Rygbossie	Least concern, Endemic (SA)
<i>Crassula rupestris</i>	Concertina Plant	Least concern, Endemic (SA)
<i>Drosanthemum archeri</i>		Least concern, Endemic (SA)
<i>Euphorbia decepta</i>	Melkpol	Least concern, Endemic (SA)
<i>Felicia ovata</i>	Grootbloublommetjie	Least concern, Endemic (SA)
<i>Garuleum bipinnatum</i>	Slanghoutjie	Least concern, Endemic (SA)
<i>Haworthia arachnoidea</i>	Spinnekopbolletjie	Least concern, Endemic (SA)
<i>Hermannia althaeifolia</i>	Bokkiesblom	Least concern, Endemic (SA)
<i>Malephora uitenhagensis</i>		Least concern, Endemic (SA)
<i>Massonia depressa</i>	Suikerkannetjie	Least concern, Endemic (SA)
<i>Moraea collina</i>	Aasuintjie	Least concern, Endemic (SA)
<i>Osteospermum sinuatum</i>	Bietou	Least concern, Endemic (SA)

<i>Pleiospilos compactus</i>	Kwaggavy	Least concern, Endemic (SA)
<i>Quaqua ramosa</i>	Ramshoringghaap	Least concern, Endemic (SA)
<i>Trichodiadema setuliferum</i>	Hairy Nipple Vygie, stervygie	Least concern, Endemic (SA)
<i>Zaluzianskya violacea</i>	Drumsticks	Least concern, Endemic (SA)

4.2.2 Protected trees

No protected trees were recorded in the project area or the surrounding.

4.2.3 EIA screening tool listed species (SCC)

The screening tool listed the following plant SCC for the project area:

Table 3: Screening Tool plant SCC

Protected Plants according to Screening tool

Scientific name	Common name	Status	Habitat
<i>Cotyledon tomentosa</i> subsp. <i>tomentosa</i>	Bear's Paw	Endangered	It grows in arid thicket, on lower, gravelly slopes in sheltered ravines
<i>Eriocephalus grandiflorus</i>	Kapokbos	Rare	Lower foothills in quartz patches
<i>Peersia frithii</i>		Vulnerable	It occurs on slopes or flats of finely weathered Ecca shales
<i>Tritonia florentiae</i>		Rare	It occurs in a variety of vegetation types on gravel flats in washes and drainage lines, flowering in winter and responding rapidly to early winter rains that fall erratically

Table 4: Sensitive plant SCC given in the screening Tool

Sensitive species 1041
Sensitive species 1212
Sensitive species 208
Sensitive species 507
Sensitive species 727

The names of these species may not be given in this report, as they are sensitive to poaching. None of these species were recorded but some of them may be present.

4.2.4 Declared invaders

The following 4 alien invader plant species were recorded in the project area and must be controlled:

Table 5: Declared invader plant species recorded in the project area.

Declared invaders in the project area		
Scientific name	Common name	Invader category
<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1b
<i>Prosopis glandulosa</i>	Honey Mesquite	1b
<i>Salsola kali</i>	Prickly Glasswort / Tolbossie	1b
<i>Tephrocactus articulatus</i>	Pine cone cactus	1a

Category 1 plants are prohibited plants which must be controlled or eradicated. These plants serve no economic purpose and possess characteristics that are harmful to humans, animals or the environment.

Category 1a: Plants are high-priority emerging species requiring compulsory control. All breeding, growing, moving and selling are banned

Category 1b: Plants are widespread invasive species controlled by a management program.

Category 2 plants are invaders with certain useful qualities, such as commercial use or for woodlots, animal fodder, soil stabilisation, etc. These plants are allowed in demarcated areas under controlled conditions and in biocontrol reserves.

Category 3 plants are alien plants that are currently growing in, or have escaped from areas such as gardens, but that are proven invaders. No further planting is allowed (except with special permission), nor trade in propagative material. Existing plant may remain but must be prevented from spreading. Plants within the flood line and watercourses must be removed (Bromilow, 2010).

4.3 FAUNA IN AND AROUND THE PROJECT AREA

4.3.1 Fauna species of Conservation Concern

Species of conservation concern (SCC) are listed if they have been recorded in the relevant quarter degree grid on the Virtual Museum of Biodiversity and Development Institute (Virtual Museum, 2022) and also if they were flagged by the EIA Screening Tool Report for the project area. Screening Tool species are highlighted in orange. Only SCC is included in this section (Table 6 to Table 9). For a complete species list of species recorded in the quarter degree grid, see Appendix B.

Red list categories are as follows:

CR: Critically Endangered, indicating that the species is facing an extremely high risk of extinction.

EN: Endangered, indicating that the species is facing a very high risk of extinction.

VU: Vulnerable, indicating that the species is facing a high risk of extinction.

NT: Near Threatened, is likely to become at risk of extinction in the near future.

Declining: A species is Declining when there are threatening processes causing a continuing decline of the species.

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

Table 6: Mammal species of conservation concern that may be present (Screening Tool (in orange) and Virtual Museum)

Mammal species of conservation concern			
Family	Scientific name	Common name	Red list category
Bovidae	<i>Damaliscus pygargus pygargus</i>	Bontebok	VU (regional), NT (global)
Bovidae	<i>Hippotragus equinus</i>	Roan Antelope	EN (regional), LC (global)
Bovidae	<i>Hippotragus niger niger</i>	Sable Antelope	VU (regional), LC (global)
Bovidae	<i>Pelea capreolus</i>	Vaal Rhebok	NT (regional), NT (global)
Elephantidae	<i>Loxodonta africana</i>	African Bush Elephant	LC (regional), VU A2a (global)
Equidae	<i>Equus quagga</i>	Plains Zebra	LC (regional), NT (global)
Felidae	<i>Felis nigripes</i>	Black-footed Cat	VU (regional), VU (global)
Felidae	<i>Panthera pardus</i>	Leopard	VU (regional), VU (global)
Hyaenidae	<i>Crocuta crocuta</i>	Spotted Hyaena	NT (regional), LC (global)
Hyaenidae	<i>Hyaena brunnea</i>	Brown Hyena	NT (regional), NT (global)
Leporidae	<i>Bunolagus monticularis</i>	Riverine Rabbit	CR (regional), CR (global)

Mammal species of conservation concern			
Family	Scientific name	Common name	Red list category
Muridae	<i>Parotomys littledalei</i>	Littledale's Whistling Rat	NT (regional), LC (global)
Mustelidae	<i>Aonyx capensis</i>	African Clawless Otter	NT (regional), NT (global)

Table 7: Bird species of conservation concern that may be present (Screening Tool (in orange) and Virtual Museum)

Bird species of conservation concern			
Family	Scientific name	Common name	Red list category
Accipitridae	<i>Aquila verreauxii</i>	Verreaux's (Black) Eagle	Global: LC; BLSA: VU
Accipitridae	<i>Circus maurus</i>	Black Harrier	Global: VU; BLSA: EN
Accipitridae	<i>Polemaetus bellicosus</i>	Martial Eagle	Global: VU; BLSA: EN
Ciconiidae	<i>Ciconia nigra</i>	Black Stork	Global: LC; BLSA: VU
Falconidae	<i>Falco biarmicus</i>	Lanner Falcon	Global: LC; BLSA: VU
Motacillidae	<i>Anthus crenatus</i>	African Rock Pipit	Global: LC; BLSA: NT
Otididae	<i>Afrotis afra</i>	Southern Black Korhaan	Global: LC; BLSA: VU
Otididae	<i>Ardeotis kori</i>	Kori Bustard	Global: NT; BLSA: NT
Otididae	<i>Eupodotis vigorsii</i>	Karoo Korhaan	Global: LC; BLSA: NT
Otididae	<i>Neotis ludwigii</i>	Ludwig's Bustard	Global: EN; BLSA: EN
Sagittariidae	<i>Sagittarius serpentarius</i>	Secretarybird	Global: VU; BLSA: VU

Table 8: Reptile species of conservation concern that may be present (Screening Tool (in orange) and Virtual Museum)

Reptile species of conservation concern			
Family	Scientific name	Common name	Red list category
Gekkonidae	<i>Goggia braacki</i>	Braack's Pygmy Gecko	Near Threatened (SARCA 2014)
Testudinidae	<i>Chersobius boulengeri</i>	Karoo Padloper	Near Threatened (SARCA 2014)

Table 9: Frog species of conservation concern that may be present (Virtual Museum)

Frog species of conservation concern			
Family	Scientific name	Common name	Red list category
Pyxicephalidae	<i>Pyxicephalus adspersus</i>	Giant Bull Frog	Near Threatened

4.3.2 Fauna habitat types

The power line spans several habitat types. Most of the project area consists of Karoo veld, which is characterised by small shrubs and forbs, some grass and almost no trees. Trees can be found in the riparian areas. Some bird species, such as Martial Eagles make use of power pylons for breeding, especially where trees are not available.

Ludwig's Bustard occurs in the flat, open, semi-arid shrublands of the Succulent Karoo, Nama Karoo and Namib. The project area is thus perfect for it.

Some species, such as Verreaux's Eagle and Lanner Falcons, prefer rocky outcrops and cliffs for breeding. There are several cliffs in the area.

Rocky areas create suitable habitat for many reptile species. Frogs are to some extent bound to riparian areas, as most of them need water to reproduce.

The Critically endangered riverine rabbit inhabits dense riparian growth along the seasonal rivers in the central Karoo (Nama-Karoo shrubland). Specifically, it occurs in riverine vegetation on alluvial soils adjacent to seasonal rivers.

No fauna species of conservation concern were recorded in the project area, but there is suitable habitat for several SCC species and there are likely some SCC present. Care should be taken not to disturb or kill them during any maintenance operations.

5 Sensitivity analysis

Sensitivity was assigned according to vegetation units:

Gamka Karoo: Medium-low

Koedoesberge-Moordenaars Karoo: Medium

Riparian: High

Upper Karoo Hardeveld: Medium

None of the vegetation units are threatened, they are all Least Concern (SANBI, 2018). The Koedoesberge-Moordenaars-Karoo and Upper Karoo Hardeveld has a higher plant diversity than the Gamka Karoo and therefore they have a medium sensitivity. The Riparian Areas support a wider variety of species and is also well connected to upstream and downstream habitats, creating movement corridors for fauna.

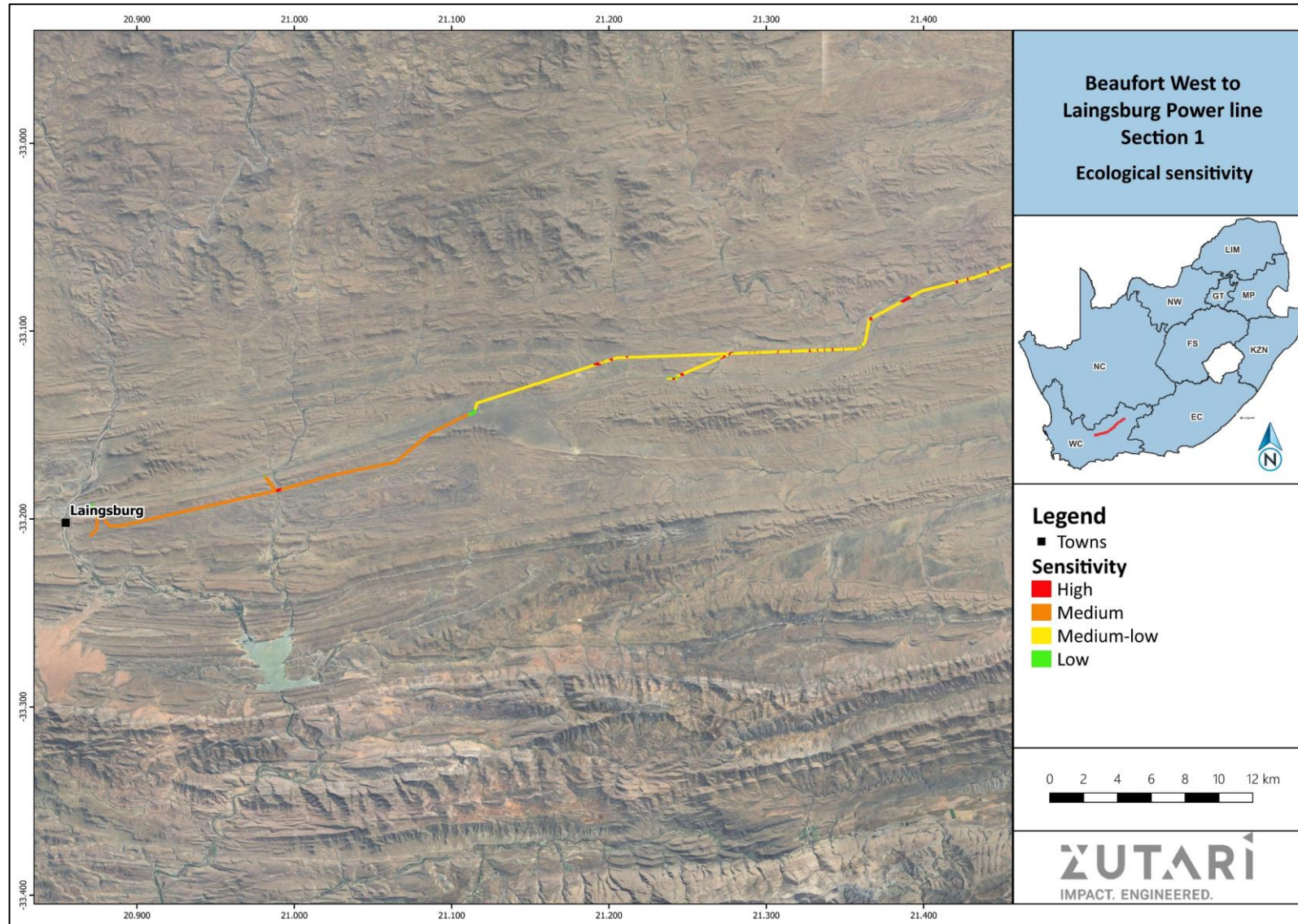


Figure 25: Ecological sensitivity: Section 1

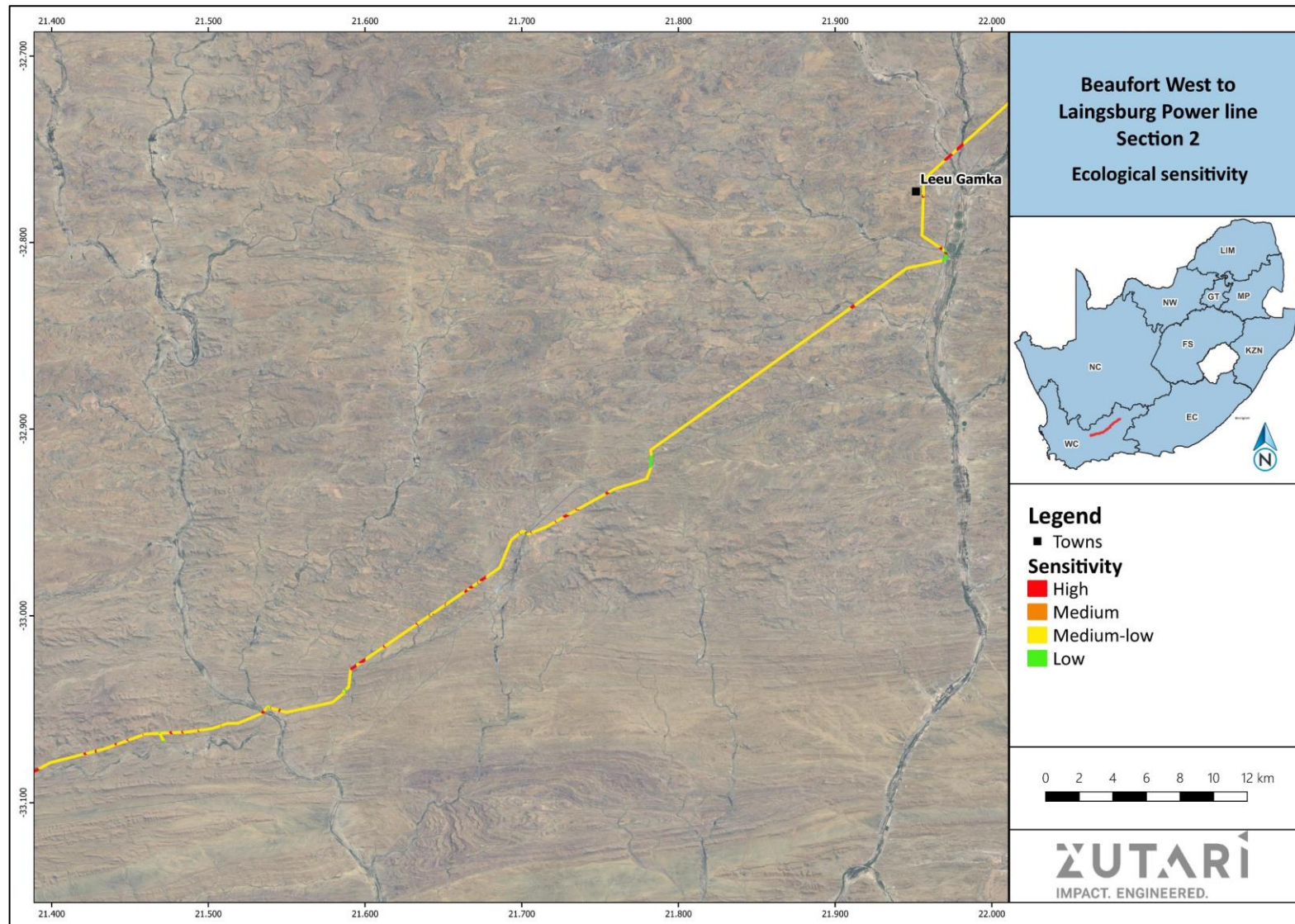


Figure 26: Ecological sensitivity: Section 2

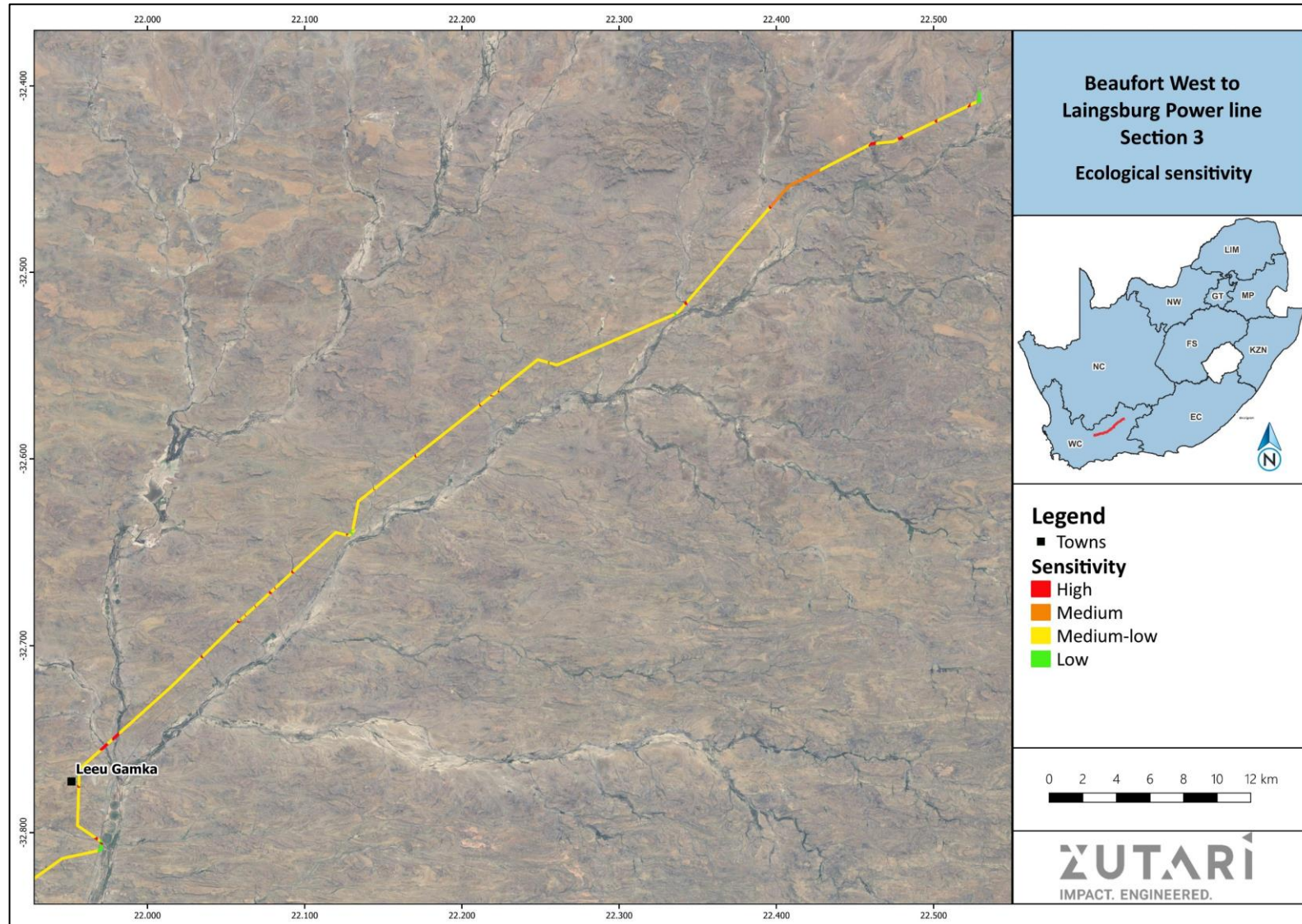


Figure 27: Ecological sensitivity: Section 3

6 Potential Impacts and mitigation measures

Maintenance activities is likely to have a negative impact on the natural environment, mainly because large construction vehicles will need to enter the area. Most of the power line is far from roads and the disturbance of vegetation is inevitable. If pylons have to be replaced, groundworks will disturb the soil and vegetation, which in turn may lead to soil erosion and the increase of invasive plant species. The power line in itself is a hazard for some bird species, as they may collide with it. Potential impacts that may be caused by the power line and maintenance thereof is discussed in the section below, with recommended mitigation measures.

6.1 COLLISION OF BIRDS WITH POWER LINES

Impact

Mortality of birds due to collision with power lines is a serious problem worldwide. This is especially the case with bigger birds as they are clumsy with low manoeuvrability. Bustards are amongst the worst hit. Other birds that are impacted include korhaans, flamingos, secretary birds, cranes, martial eagles, vultures and wetland birds.

Systematic surveys along power lines in the Karoo show that endangered Ludwig's bustards are killed on transmission lines at a rate of one bird per kilometre per year, which amounts to 47,000 birds annually (Jenkins *et al.*, 2012). For a species with a small population confined to the drier parts of south-western Africa, this mortality rate is surely a major threat to its survival.

Mitigation measures

- Research done by Shaw *et al.*, 2021, showed that line markers are effective to prevent collision in some species. In the survey Blue Crane collisions were reduced by 95% when line markers were used. Collision of all large birds were 51% lower with line markers, but it did not have an effect on bustard collisions.
- Line markers should be installed on the entire 200 km power lines.

6.2 DISTURBANCE OF VEGETATION BY HEAVY VEHICLES AND HABITAT DESTRUCTION

Impact

Whenever construction vehicles or other vehicles access the power line, vegetation will be disturbed where vehicles drive and also if pylons are replaced. SCC may be lost and the condition of vegetation will decline. This in turn will negatively affect fauna species and promote the growth of invasive plant species and weeds, as they are generally better adapted to disturbance than indigenous species.

Mitigation measures

- Construction and maintenance vehicles should stay on the existing service roads as far as possible.
- Peripheral impacts around the maintenance footprint, on the surrounding vegetation of the area, should be avoided.
- During maintenance, sensitive habitats such as riparian areas, must be avoided by construction and maintenance vehicles and equipment, wherever possible, to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
- If groundworks are to take place along the 200km power line, an ecologist has to search the area for any protected plant or animal species and they must be relocated to a safe area.
- Areas where groundworks have taken place, has to be revegetated, using species indigenous to the specific vegetation unit. Soil has to be tilled / scarified, especially if it was compacted by groundworks. Mulch should be applied. Seed should be collected from plants present at the site and should be used immediately or stored appropriately and used at the start of the following wet season. Plants such as perennial grasses, shrubs, succulents and geophytes can be removed before groundworks and replaced once work is completed.
- Invasive species must be controlled and monitored after groundworks and rehabilitation.

6.3 SOIL EROSION AND SEDIMENTATION

Impact

Groundworks may lead to soil erosion by wind and rain.

Mitigation

- If possible, groundworks should be done in the dry season.
- Disturbed areas must be revegetated with species indigenous to that area.

6.4 SOIL AND WATER POLLUTION

Impact

Maintenance carries a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or groundwater, leading to potential medium/long-term impacts on fauna and flora.

Littering by maintenance workers and dumping of building materials or other waste will also cause pollution.

Mitigation

- Spill kits must be on-hand to deal with spills immediately.
- All vehicles must be inspected for oil and fuel leaks on a regular basis.
- Any excess or waste material or chemicals must be removed from the site and discarded of in the correct ways.
- No littering is to take place.

6.5 ESTABLISHMENT AND SPREAD OF ALIEN INVASIVE VEGETATION

Impact

Movement of vehicles between sites may spread invasive species.

Disturbance of soil and vegetation may contribute to the growth of invasive plant species, as they are generally more resistant to disturbance than indigenous species.

Mitigation

- Control involves eradicating the plants present, eradicating the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the CARA or in terms of Working for Water guidelines.
- Institute a monitoring programme where groundworks have taken place for maintenance activities, to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Once detected, an eradication/control programme must be implemented to ensure that the species' do not spread to surrounding natural ecosystems.

7 DISCUSSION & CONCLUSION

Excellence Ecology is appointed by Zutari (acting on behalf of the applicant: Eskom), to undertake a MMP for the 132 kV distribution line and pylon structures between the Droërivier and Laingsburg substations. This was prompted by four lattice towers on the 132 kV double-circuit Leeu Gamka – Luttig line that collapsed due to strong winds in the Leeu Gamka area. The MMP will allow Eskom to undertake maintenance activities as needed along the 200 km distribution line.

According to the national web-based environmental screening tool in terms of NEMA, the project area has the following sensitivities:

- Terrestrial Biodiversity: Very High Sensitivity.
- Animal Species Theme: High Sensitivity.
- Plant Species Theme: Medium Sensitivity.

The desktop survey indicates that:

- The power line traverses several CBA1 areas and some ESA1 areas. The rest consists of 'Other Natural Areas'.
- The power line traverses several rivers namely the Geelbek, Jakkals, Bloed, Dwyka, Kalkgat, Vlakkraal, Bloukloofleegte, Klip, Saai, Koekemoers, Leeu, Keulders, Sand, Steyns and Stols Rivers and their associated riparian areas. Most of these rivers are secondary rivers, except for the Dwyka, Koekemoers and Leeu Rivers, which are primary rivers. The Leeu River is perennial and all the other rivers are non-perennial.
- The last three kilometres of the power line at Beaufort West traverse the Beaufort West groundwater strategic water source areas.
- The nearest IBA is Karoo National Park, which is roughly 3 km north of the eastern section of the power line.
- The power line does not traverse any Threatened Ecosystem / RLE.
- The power line does not traverse any National Protected Areas, but the Karoo National Park is 3 km north of the power line, close to Beaufort West and the Henry Kruger Private Nature Reserve is 1km north of the power line at Leeu Gamka. The power line traverse one National Protected Area Expansion Strategy (NPAES) Focus Areas.

A site visit was conducted from the 11th to the 14th of August 2024 to get baseline information of the area and to identify sensitive areas and SCC.

The power line traverse four distinct vegetation types namely:

1. Gamka Karoo
2. Koedoesberge-Moordenaars Karoo
3. Riparian
4. Upper Karoo Hardeveld

These units were mapped and described. Sensitivity was determined for the units, based on whether they are in threatened ecosystems, species diversity, condition and connectivity. Sensitivity is as follows:

- Gamka Karoo: Medium-low
- Koedoesberge-Moordenaars Karoo: Medium
- Riparian: High
- Upper Karoo Hardeveld: Medium

Potential impacts associated with maintenance activities were identified, described and mitigation measures were given. The following impacts were discussed:

- Collision of birds with power lines
- Disturbance of vegetation by heavy vehicles and habitat destruction
- Soil erosion and sedimentation
- Soil and water pollution
- Establishment and spread of alien invasive vegetation

Mitigation measures are given below (see Section 7 for more detail):

- Line markers should be installed on the entire 200 km power lines.
- Construction and maintenance vehicles should stay on the existing service roads as far as possible.
- Peripheral impacts around the maintenance footprint, on the surrounding vegetation of the area, should be avoided.
- During maintenance, sensitive habitats such as riparian areas, must be avoided by construction and maintenance vehicles and equipment, wherever possible, to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
- If significant groundworks are to take place along the 200 km transmission line for maintenance activities, an ecologist has to search the area for any protected plant or animal species, and they must be relocated to a safe area.
- Areas where groundworks have taken place, must be revegetated, using species indigenous to the specific vegetation unit. Soil must be tilled / scarified, especially if it was compacted by groundworks. Mulch should be applied. Seed should be collected from plants present at the site and should be used immediately or stored appropriately and used at the start of the following wet season. Plants such as perennial grasses, shrubs, succulents and geophytes can be removed before groundworks and replaced once work is completed.
- Re-vegetated areas should be monitored every 3 months for the first 12 months and every 6 months thereafter for the next year.
- Invasive species must be controlled and monitored where groundworks and rehabilitation have taken place.
- If possible, groundworks should be done in the dry season.
- Spill kits must be on-hand to deal with spills immediately.
- All vehicles must be inspected for oil and fuel leaks on a regular basis.

- Any excess or waste material or chemicals must be removed from the site and discarded of in the correct ways.
- No littering is to take place.
- Control of invasive plant species involves eradicating the plants present and eradicating the seedlings which emerge. Weeds and invader plants must be controlled in the manner prescribed for that category by the CARA (Conservation of Agricultural Resources Act) or in terms of Working for Water guidelines.
- Institute a monitoring programme where groundworks have taken place for maintenance activities, to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Once detected, an eradication/control programme must be implemented to ensure that the species' do not spread to surrounding natural ecosystems.

8 REFERENCES

- Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & De Villiers, M.S. 2014. Atlas and red list of the reptiles of South Africa, Lesotho and Swaziland. Pretoria: South African National Biodiversity Institute.
- Browmilow, C. 2010. Problem Plants and Alien Weeds in South Africa. Pretoria: Briza Publications.
- CapeNature. 2017. WCBSP Prince Albert [vector geospatial dataset] 2017. Available from the Biodiversity GIS website, downloaded on Tuesday, September 3, 2024.
- Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D. & Davies-Mostert, H.T. 2016. The 2016 Mammal Red List of South Africa Lesotho and Swaziland. Endangered Wildlife Trust & South African National Biodiversity Institute (SANBI).
- Council for Scientific and Industrial Research (CSIR). 2018. National Wetland Map 5 and Confidence Map [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 28 July 2022
- Council for Scientific and Industrial Research. 2011. NFEPA rivers [vector geospatial dataset] 2011. Available from the Biodiversity GIS website, downloaded on 19 April 2021
- Department of Water and Sanitation. 2016. General Authorisation in terms of Section 39 of the National Water Act, 1998 (act no. 36 of 1998) for water uses as defined in Section 21(c) or Section 21(l). Notice 509 of 2016.
- Driver, A., Nel, J.L., Snaddon, K., Murray, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J. & Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. South African National Biodiversity Institute, CSIR, The Freshwater Consulting Group, Water Research Commission, South African National Parks & South African Institute for Aquatic Biodiversity.
- Esler, K.J., Milton, S.J. & Dean, W.R.J. 2010. Karooveld ekologie en bestuur. Pretoria: Briza Publikasies.
- Government of South Africa. 2010. National protected area expansion strategy for South Africa 2008. Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Pretoria, South Africa: the Government of South Africa.
- Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B, Visagie, R. & Ryan, P.G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards *Neotis ludwigii*. *Bird conservation international* 21(3): p303-310.
- Le Roux, A. 2015. Wild flowers of Namaqualand. Cape Town: Struik Nature.
- Marnewick M.D., Retief E.F., Wright D.R., Theron N.T. 2015. South Africa's Important Bird and Biodiversity Areas Status Report 2015. Johannesburg: BirdLife South Africa.
- Mills, G. & Hes, L. 1997. The Complete Book of Southern African Mammals. Struik Winchester, Cape Town.
- Mucina, L. & Rutherford, M.C. (eds). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. Pretoria: South African National Biodiversity Institute.
- Nel, J.L., Colvin, C., Le Maitre, D.C., Smith, J. & Haines, I. 2013. South Africa's Strategic Water Source Areas. CSIR Report CSIR/NRE/ECOS/ER/2013/0031/A, CSIR, Stellenbosch, South Africa.
- Nel, J.L., Driver, A., Strydom, W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J., Nienaber, S., Van Deventer, H., Swartz, E. & Smith-Adao, L.B. 2011. Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. Water Research Commission Report No. TT 500/11.
- Province of the Western Cape. 1974. Nature Conservation Ordinance (19 of 1974).
- Province of the Western Cape. 2021. Western Cape Biodiversity Act no. 6 of 2021. Provincial Gazette Extraordinary 8529.
- SANBI Biodiversity Advisor. 2017. Critical Biodiversity Areas and Ecological Support Areas. <http://biodiversityadvisor.sanbi.org/industry-and-conservation/biodiversity-in-the-urban->

economy/understand/definitions-related-to-urban-land-use-planning/critical-biodiversity-areas-and-ecological-support-areas/ Date of access: 17 July 2022.

- Shaw, J.M., Reid, T.A., Gibbons, B.K., Pretorius, M., Jenkins, A.R., Visagie, R., Michael, M.D. and Ryan, P.G. 2021. A large-scale experiment demonstrates that line marking reduces power line collision mortality for large terrestrial birds, but not bustards, in the Karoo, South Africa. *Ornithological Applications* 123: p1-10.
- Shearing, D. & Van Heerden, K. 2008. *Karoo. South African Wild Flower Guide 6*. Claremont: Botanical Society of South Africa.
- Smith, G.F., Crouch, N.R. & Figueiredo, E. 2020. *Field guide to Succulents in Southern Africa*. Cape Town: Struik Nature.
- South Africa. 1983. *Conservation of Agricultural Resources Act 43 of 1983*.
- South Africa. 1998. *National Environmental Management Act 107 of 1998*.
- South Africa. 1998. *National Water Act 36 of 1998*.
- South Africa. 1998. *The National Forest Act 84 of 1998*. Notice of the list of protected tree species (Updated 2022).
- South Africa. 2005. *National Environmental Management: Biodiversity Act no 10 of 2004: Draft lists of threatened and protected species, 2005*.
- South Africa. 2009. *National Environmental Management: Biodiversity Act no 10 of 2004*.
- South Africa. 2016. *National Environmental Management: Biodiversity Act no 10 of 2004. Alien and invasive species lists, 2020*.
- South African National Biodiversity Institute (SANBI). 2018. *The Vegetation Map of South Africa, Lesotho and Swaziland*, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Online, <http://bgis.sanbi.org/Projects/Detail/186>, Version 2018.
- South African National Biodiversity Institute (SANBI). 2010. *Red list of South African Plants*. <http://redlist.sanbi.org/> Date of access: 15 Jul 2022.
- South African National Biodiversity Institute (SANBI). 2011. *National List of Threatened Ecosystems [vector geospatial dataset]*. Available from the Biodiversity GIS website, downloaded on 1 April 2023
- South African National Biodiversity Institute (SANBI). 2019. *National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report*. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria
- South African National Biodiversity Institute (SANBI). 2018. *National Biodiversity Assessment: Terrestrial ecosystem threat status and protection level layer [Vector] 2018*. Available from the Biodiversity GIS website, downloaded on 13 January 2023.
- South African National Biodiversity Institute (SANBI). 2022 *Red List of Ecosystems (RLE) for terrestrial realm for South Africa - remnants [Vector] 2021*. Available from the Biodiversity GIS website, downloaded on Thursday, March 28, 2024
- Taylor, M.R., Peacock, F. & Wanless, R.M. 2015. *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. Johannesburg: BirdLife South Africa.
- The Virtual Museum. 2023. *The Biodiversity and Development Institute – The Virtual Museum*. <https://vmus.adu.org.za/> Date of access: 14 September 2024.
- Van Oudtshoorn, F. 2004. *Gids tot grasse van Suider-Afrika*. 2de uitg. Pretoria: Briza Publications.
- Van Wyk, B. & Smith, G.F. 2014. *Gids tot die Aalwyne van Suid-Afrika*. Pretoria: Briza Publikasies.
- Water Research Commission. 2017. *Surface and Groundwater Strategic Water Source Areas (SWSA) [Vector] 2017*. Available from the Biodiversity GIS website, downloaded on 13 June 2022.

Appendix A: Specialist CV and Declaration of Independence

CURRICULUM VITAE

Mari van der Westhuizen

(M.Sc. Environmental Sciences, Professional Natural Scientist: Ecological Science)

PERSONAL DETAILS

Name:	Mari van der Westhuizen
Maiden name:	La Grange
Nationality:	South African
Date of birth:	26 October 1985
E-mail address:	mariwesthuizen@gmail.com
Cell phone number:	+27 82 257 1715
Identity number:	851026 0045 083

KEY QUALIFICATION

M. Sc. Environmental Sciences (2010)

B.Sc. Honours in Ecological Remediation and Sustainable Usage (2007)

B. Sc. with Microbiology and Botany at the North West University, Potchefstroom Campus (2006)

AWARDS AND PRIZES

Best Second year Microbiology student (2005)

Best M.Sc. in Botany (2010)

SHORT COURSES COMPLETED

Wetland Legislation (2024) Wetrest

Track and Sign Workshop (2023) Motsumi Bush Courses

Tools for Wetland Assessment (2015) Rhodes University

Landscape Function Analysis course (2010) North West University

Multivariate Statistics course (CANOCO) (2009) University of Kwazulu-Natal

MEMBERSHIP WITH PROFESSIONAL BODIES AND ASSOCIATIONS

Registered as a Professional Natural Scientist in Ecological Science at the South African Council for Natural Scientific Professions (SACNASP), with registration number 400166/15.

South African Association of Botanists (SAAB).

KEY RELEVANT EXPERIENCE

12 years' experience:

- Biodiversity, plant and animal species impact assessments for Environmental Authorisations (Environmental Impact Assessments).
- Wetland assessments for EIA's and WULA's.
- Wetland Rehabilitation Plans.
- Protected tree counts and protected tree license applications.
- Declared invader surveys.
- GIS mapping and data processing (ArcGIS and QGIS).
- Writing and reviewing scientific reports.
- Mentoring junior ecologists.

DECLARATION OF INDEPENDENCE

I, Mari van der Westhuizen, hereby confirm my independence as a specialist and declare that I do not have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which I was appointed as ecologist in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed, specifically in connection with the Terrestrial Biodiversity Maintenance Management Plan for the power line between Beaufort West and Laingsburg, Western Cape Province.



Full Name: Mari van der Westhuizen

Title / Position: Ecologist

Qualification(s): B.Sc. in Botany and Microbiology (2006) North West University;

B.Sc. Honours in Ecological Remediation and Sustainable Usage (2007) North West University;

M.Sc in Environmental Sciences (2010) North West University

Experience (years): 12

Registration(s): SACNASP (Pri.Sci.Nat. # 400166/15 – Ecological Science)

Phone no: 082 257 1715 Email: mari@excellence-ecology.co.za

Appendix B: Plant species recorded in the project area

Table 10: List of recorded trees and shrubs

Trees and shrubs			
Scientific name	Common name	Exotic	Status
<i>Aptosimum spinescens</i>	Doringviooltjie / Kankerbossie	No	Least concern
<i>Asparagus aethiopicus</i>	Haakdoring	No	Least concern, Endemic (SA)
<i>Asparagus burchellii</i>	Wild Asparagus	No	Least concern, Endemic (SA)
<i>Asparagus capensis</i>	Wild asparagus	No	Least concern
<i>Asparagus mucronatus</i>	Katdoring	No	Least concern, Endemic (SA)
<i>Asparagus striatus</i>	Bergappel	No	Least concern, Endemic (SA)
<i>Atriplex lindleyi</i> subsp. <i>inflata</i>	Australian Saltbush	Yes	Not evaluated
<i>Atriplex nummularia</i>	Old Man's Saltbush	Yes	Declared invader 2
<i>Berkheya spinosa</i>	Perdebos	No	Least concern, Endemic (SA)
<i>Cadaba aphylla</i>	Black Storm	No	Least concern
<i>Carissa bispinosa</i>	Karoo Num-num	No	Least concern
<i>Diospyros lycioides</i>	Bluebush	No	Least concern
<i>Ehretia rigida</i>	Puzzle bush	No	Least concern, Endemic (SA)
<i>Eriocephalus ericoides</i>	Kapok bush	No	Least concern
<i>Euclea undulata</i>	Common guarri	No	Least concern
<i>Grewia robusta</i>	Karoo Cross-berry	No	Least concern, Endemic (SA)
<i>Kleinia longiflora</i>	Sjambokbos	No	Least concern
<i>Lacomucinaea lineata</i>	Witstorm, vaalstorm	No	Least concern
<i>Lessertia frutescens</i>	Kankerbos	No	Least concern
<i>Lycium cinereum</i>	Kriedoring	No	Least concern
<i>Lycium hirsutum</i>	River Honey-thorn	No	Least concern
<i>Lycium pumilum</i>	Dwarf Honey-thorn	No	Least concern
<i>Macleodium spinosum</i>	Steekblom	No	Least concern, Endemic (SA)
<i>Melolobium canescens</i>	Heuningbossie	No	Least concern
<i>Monsonia crassicaulis</i>	Noerap	No	Least concern
<i>Oedera humilis</i>	Hartebeeskaroo	No	Least concern
<i>Oedera oppositifolia</i>	Blouperdekaroo	No	Least concern, Endemic (SA)
<i>Pelargonium crithmifolium</i>	Dikbasmalva	No	Least concern
<i>Prosopis glandulosa</i>	Honey mesquite	Yes	Not evaluated

Trees and shrubs			
Scientific name	Common name	Exotic	Status
<i>Pteronia glomerata</i>	Perdebossie	No	Least concern, Endemic (SA)
<i>Rhigozum obovatum</i>	Karoo gold, geelgranaat	No	Least concern
<i>Ruschia intricata</i>	Doringvygie	No	Least concern, Endemic (SA)
<i>Salix mucronata</i>	Cape Willow	No	Least concern
<i>Salsola aphylla</i>	Lye Ganna	No	Least concern
<i>Salsola calluna</i>	Rooilootganna	No	Least concern, Endemic (SA)
<i>Searsia burchellii</i>	Karoo Kuni-bush	No	Least concern
<i>Tamarix usneoides</i>	Wild Tamarisk	No	Least concern
<i>Vachellia karroo</i>	Sweet thorn	No	Least concern

Table 11: List of recorded grasses and reeds

Grasses and reeds			
Scientific name	Common name	Exotic	Status
<i>Aristida diffusa</i>	Iron grass	No	Least concern
<i>Cenchrus ciliaris</i>	Foxtail buffalo grass	No	Least concern
<i>Enneapogon desvauxii</i>	Eight day grass	No	Least concern
<i>Enneapogon scoparius</i>	Bottlebrush grass	No	Least concern
<i>Fingerhuthia africana</i>	Thimble grass	No	Least concern
<i>Phragmites australis</i>	Common reed	No	Least concern
<i>Setaria verticillata</i>	Bur bristle grass	No	Least concern
<i>Stipagrostis ciliata</i>	Tall Busman Grass	No	Least concern
<i>Stipagrostis namaquensis</i>	River bushman grass	No	Least concern
<i>Stipagrostis obtusa</i>	Small Busman Grass	No	Least concern
<i>Typha capensis</i>	Bulrush	No	Least concern

Table 12: List of recorded forbs and small succulents

Forbs			
Scientific name	Common name	Exotic	Status
<i>Acanthopsis disperma</i>	Verneukhalfmensie	No	Least concern
<i>Adromischus maculatus</i>	Bontplakkie	No	Least concern, Endemic (SA)
<i>Aloe claviflora</i>	Kanonaalwyn	No	Least concern
<i>Aloe microstigma</i>	Karoo Aalwyn	No	Least concern, Endemic (SA)
<i>Anacampseros albidiflora</i>	Haasballetjies	No	Least concern
<i>Anacampseros ustulata</i>	Kirriemoer	No	Least concern, Endemic (SA)

Forbs			
Scientific name	Common name	Exotic	Status
<i>Antimima evoluta</i>		No	Least concern, Endemic (SA)
<i>Antimima maxwellii</i>		No	Least concern, Endemic (SA)
<i>Aptosimum indivisum</i>	Karoo Violet	No	Least concern, Endemic (SA)
<i>Arctotis adpressa</i>	Gousblom	No	Least concern, Endemic (SA)
<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	Yes	Declared invader 1b
<i>Augea capensis</i>	Elandslaai	No	Least concern
<i>Babiana bainesii</i>	Bobbejaanuintjie	No	Least concern
<i>Blepharis mitrata</i>	Klapperbossie	No	Least concern
<i>Cadaba aphylla</i>	Black Storm	No	Least concern
<i>Cheilanthes hirta</i>	Parsley Fern	No	Least concern
<i>Chrysocoma ciliata</i>	Bitterbos	No	Least concern
<i>Crassula corallina</i>	Coral Crassula	No	Least concern
<i>Crassula deltoidea</i>	Kata-kiso	No	Least concern
<i>Crassula montana</i>		No	Least concern, Endemic (SA)
<i>Crassula muscosa</i>	Lizard's Tail	No	Least concern
<i>Crassula pyramidalis</i>	Rygbossie	No	Least concern, Endemic (SA)
<i>Crassula rupestris</i>	Concertina Plant	No	Least concern, Endemic (SA)
<i>Cucumis africanus</i>	Wild Cucumber	No	Least concern
<i>Curio radicans</i>	Bobbejaantoontjies	No	Least concern
<i>Dicoma capensis</i>	Karmedik	No	Least concern
<i>Drosanthemum archeri</i>		No	Least concern, Endemic (SA)
<i>Eriocephalus ericoides</i>	Kapok bush	No	Least concern
<i>Euphorbia decepta</i>	Melkpol	No	Least concern, Endemic (SA)
<i>Euphorbia mauritanica</i>	Yellow Milkbush	No	Least concern
<i>Felicia namaquana</i>	Bloublommetjie-opslag	No	Least concern
<i>Felicia ovata</i>	Grootbloublommetjie	No	Least concern, Endemic (SA)
<i>Galenia sarcophylla</i>	Vanwyksbrak	No	Least concern
<i>Garuleum bipinnatum</i>	Slanghoutjie	No	Least concern, Endemic (SA)
<i>Gazania heterochaeta</i>	Botterblom	No	Least concern
<i>Gonialoe variegata</i>	Kanniedood	No	Least concern
<i>Haworthia arachnoidea</i>	Spinnekopbolletjie	No	Least concern, Endemic (SA)
<i>Haworthiopsis viscosa</i>	Koedoekos	No	Least concern

Forbs			
Scientific name	Common name	Exotic	Status
<i>Heliophila carnosa</i>	Rock Sporrie	No	Least concern
<i>Hermannia althaeifolia</i>	Bokkiesblom	No	Least concern, Endemic (SA)
<i>Hermannia desertorum</i>	Suikerbos	No	Least concern
<i>Ifloga glomerata</i>	Bekvol	No	Least concern
<i>Indigofera alternans</i>	Skaap-ertjie	No	Least concern
<i>Kewa salsoloides</i>	Braksuring	No	Least concern
<i>Kleinia longiflora</i>	Sjambokbos	No	Least concern
<i>Kleinia longiflora</i>	Sjambokbos	No	Least concern
<i>Lepidium africanum</i>	Pepperweed	No	Least concern
<i>Lessertia pauciflora</i>	Fyn-ertjie	No	Least concern
<i>Leysera tenella</i>	Vaalteebossie	No	Least concern
<i>Limeum aethiopicum</i>	Koggelmanderboskaroo	No	Least concern
<i>Malephora uitenhagensis</i>		No	Least concern, Endemic (SA)
<i>Malva parviflora</i>	Small mallow	Yes	Not evaluated
<i>Massonia depressa</i>	Suikerkannetjie	No	Least concern, Endemic (SA)
<i>Moraea collina</i>	Aasuintjie	No	Least concern, Endemic (SA)
<i>Nidorella ivifolia</i>	Oven bush	No	Least concern
<i>Ornithoglossum undulatum</i>	Poison Onion	No	Least concern
<i>Osteospermum sinuatum</i>	Bietou	No	Least concern, Endemic (SA)
<i>Pentzia globosa</i>	Bitter Karoo Bush, Vaalkaroo	No	Least concern
<i>Pentzia incana</i>	Skaapkaroo	No	Least concern
<i>Pleiospilos compactus</i>	Kwaggavy	No	Least concern, endemic
<i>Quaqua ramosa</i>	Ramshoringghaap	No	Least concern, Endemic (SA)
<i>Radyera urens</i>	Pampoenbossie	No	Least concern
<i>Salsola kali</i>	Prickly Glasswort / Tolbossie	Yes	Declared invader 1b
<i>Sericocoma avolans</i>	Gras-bo-bos-onder	No	Least concern
<i>Tephrocactus articulatus</i>	Pine cone cactus	Yes	Declared invader 1a
<i>Trachyandra karrooica</i>		No	Least concern
<i>Trichodiadema setuliferum</i>	Hairy Nipple Vygie, stervygie	No	Least concern, endemic
<i>Tylecodon reticulatus</i>	Sifkopkandelaar	No	Least concern
<i>Ursinia nana</i>		No	Least concern
<i>Zaluzianskya violacea</i>	Drumsticks	No	Least concern, Endemic (SA)

Appendix C: Fauna species list for QDS 3222BC, 3222AD, 3222CB, 3222CA, 3221DC, 3221DD, 3321BA, 3321AB, 3321AA, 3320BB

Species highlighted in blue were recorded.

Figure 28: List of mammals recorded for the project area on the Virtual Museum

Family	Scientific name	Common name	Red list category
Bathyergidae	<i>Cryptomys hottentotus</i>	Southern African Mole-rat	Least Concern (2016)
Bovidae	<i>Aepyceros melampus</i>	Impala	Least Concern
Bovidae	<i>Alcelaphus buselaphus caama</i>	Red Hartebeest	Least Concern (2008)
Bovidae	<i>Antidorcas marsupialis</i>	Springbok	Least Concern (2016)
Bovidae	<i>Connochaetes gnou</i>	Black Wildebeest	Least Concern (2016)
Bovidae	<i>Damaliscus pygargus phillipsi</i>	Blesbok	Least Concern (2016)
Bovidae	<i>Damaliscus pygargus pygargus</i>	Bontebok	VU (regional), NT (global)
Bovidae	<i>Hippotragus equinus</i>	Roan Antelope	EN (regional), LC (global)
Bovidae	<i>Hippotragus niger niger</i>	Sable Antelope	VU (regional), LC (global)
Bovidae	<i>Oreotragus oreotragus</i>	Klipspringer	Least Concern (2016)
Bovidae	<i>Oryx gazella</i>	Gemsbok	Least Concern (2016)
Bovidae	<i>Pelea capreolus</i>	Vaal Rhebok	NT (regional), NT (global)
Bovidae	<i>Raphicerus campestris</i>	Steenbok	Least Concern (2016)
Bovidae	<i>Redunca arundinum</i>	Southern Reedbuck	Least Concern (2016)
Bovidae	<i>Redunca fulvorufula</i>	Mountain Reedbuck	Least Concern
Bovidae	<i>Sylvicapra grimmia</i>	Bush Duiker	Least Concern (2016)
Bovidae	<i>Syncerus caffer</i>	African Buffalo	Least Concern (2008)
Bovidae	<i>Taurotragus oryx</i>	Common Eland	Least Concern (2016)
Bovidae	<i>Tragelaphus scriptus</i>	Bushbuck	Least Concern
Bovidae	<i>Tragelaphus strepsiceros</i>	Greater Kudu	Least Concern (2016)
Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	Least Concern (2016)
Canidae	<i>Otocyon megalotis</i>	Bat-eared Fox	Least Concern (2016)
Canidae	<i>Vulpes chama</i>	Cape Fox	Least Concern (2016)
Cercopithecidae	<i>Chlorocebus pygerythrus</i>	Vervet Monkey	Least Concern (2016)
Cercopithecidae	<i>Papio ursinus</i>	Chacma Baboon	LC (IUCN, 2016)
Chrysochloridae	<i>Chlorotalpa sclateri</i>	Sclater's Golden Mole	Least Concern (2016)
Elephantidae	<i>Loxodonta africana</i>	African Bush Elephant	LC (regional), VU A2a (global)
Equidae	<i>Equus quagga</i>	Plains Zebra	LC (regional), NT (global)

Family	Scientific name	Common name	Red list category
Equidae	<i>Equus zebra zebra</i>	Cape Mountain Zebra	Least Concern (2016)
Felidae	<i>Caracal caracal</i>	Caracal	Least Concern (2016)
Felidae	<i>Felis nigripes</i>	Black-footed Cat	VU (regional), VU (global)
Felidae	<i>Felis silvestris</i>	Wildcat	Least Concern (2016)
Felidae	<i>Panthera leo</i>	Lion	Least Concern (2016)
Felidae	<i>Panthera pardus</i>	Leopard	VU (regional), VU (global)
Gliridae	<i>Graphiurus (Graphiurus) ocularis</i>	Spectacled African Dormouse	Least Concern
Herpestidae	<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern (2016)
Herpestidae	<i>Herpestes pulverulentus</i>	Cape Gray Mongoose	Least Concern (2016)
Herpestidae	<i>Suricata suricatta</i>	Meerkat	Least Concern (2016)
Hyaenidae	<i>Crocuta crocuta</i>	Spotted Hyaena	NT (regional), LC (global)
Hyaenidae	<i>Hyaena brunnea</i>	Brown Hyena	NT (regional), NT (global)
Hyaenidae	<i>Proteles cristata</i>	Aardwolf	Least Concern (2016)
Hystriidae	<i>Hystrix africaeaustralis</i>	Cape Porcupine	Least Concern
Leporidae	<i>Bunolagus monticularis</i>	Riverine Rabbit	CR (regional), CR (global)
Leporidae	<i>Lepus capensis</i>	Cape Hare	Least Concern
Leporidae	<i>Lepus saxatilis</i>	Scrub Hare	Least Concern
Leporidae	<i>Pronolagus rupestris</i>	Smith's Red Rock Hare	Least Concern (2016)
Macroscelididae	<i>Elephantulus edwardii</i>	Cape Elephant Shrew	Least Concern (2016)
Macroscelididae	<i>Elephantulus rupestris</i>	Western Rock Elephant Shrew	Least Concern (2016)
Macroscelididae	<i>Macroscelides proboscideus</i>	Short-eared Elephant Shrew	Least Concern (2016)
Muridae	<i>Aethomys granti</i>	Grant's Rock Mouse	Least Concern
Muridae	<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	Least Concern
Muridae	<i>Desmodillus auricularis</i>	Cape Short-tailed Gerbil	Least Concern (2016)
Muridae	<i>Gerbilliscus paeba</i>	Paeba Hairy-footed Gerbil	Least Concern (2016)
Muridae	<i>Mastomys natalensis</i>	Natal Mastomys	Least Concern (2016)
Muridae	<i>Otomys saundersiae</i>	Saunders' Vlei Rat	Least Concern
Muridae	<i>Otomys unisulcatus</i>	Karoo Bush Rat	Least Concern (2016)
Muridae	<i>Parotomys brantsii</i>	Brants's Whistling Rat	Least Concern (2016)
Muridae	<i>Parotomys littledalei</i>	Littledale's Whistling Rat	NT (regional), LC (global)
Muridae	<i>Rhabdomys pumilio</i>	Xeric Four-striped Grass Rat	Least Concern (2016)
Mustelidae	<i>Aonyx capensis</i>	African Clawless Otter	NT (regional), NT (global)
Mustelidae	<i>Ictonyx striatus</i>	Striped Polecat	Least Concern (2016)
Mustelidae	<i>Mellivora capensis</i>	Honey Badger	Least Concern (2016)
Nesomyidae	<i>Dendromus melanotis</i>	Gray African Climbing Mouse	Least Concern (2016)

Family	Scientific name	Common name	Red list category
Nesomyidae	<i>Malacothrix typica</i>	Large-eared African Desert Mouse	Least Concern (2016)
Nesomyidae	<i>Petromyscus collinus</i>	Pygmy Rock Mouse	Least Concern (2016)
Nesomyidae	<i>Saccostomus campestris</i>	Southern African Pouched Mouse	Least Concern (2016)
Procaviidae	<i>Procavia capensis capensis</i>	Cape Rock Hyrax	LC (IUCN 2015, global sp. level)
Soricidae	<i>Crocidura cyanea</i>	Reddish-gray Musk Shrew	Least Concern (2016)
Soricidae	<i>Myosorex varius</i>	Forest Shrew	Least Concern (2016)
Soricidae	<i>Suncus varilla</i>	Lesser Dwarf Shrew	Least Concern (2016)
Vespertilionidae	<i>Cistugo lesueuri</i>	Lesueur's Wing-gland Bat	Least Concern (2016)
Vespertilionidae	<i>Neoromicia capensis</i>	Cape Serotine	Least Concern (2016)
Vespertilionidae	<i>Pipistrellus melckorum</i>	Melcks' Serotine	Least Concern (2016)
Viverridae	<i>Genetta genetta</i>	Common Genet	Least Concern (2016)
Viverridae	<i>Genetta tigrina</i>	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)

Figure 29: List of birds recorded for the project area on the Virtual Museum

Family	Scientific name	Common name	Red list category
Accipitridae	<i>Aquila pennatus</i>	Booted Eagle	LC
Accipitridae	<i>Aquila verreauxii</i>	Verreaux's (Black) Eagle	Global: LC; BLSA: VU
Accipitridae	<i>Buteo [augur] rufofuscus</i>	Jackal Buzzard	LC
Accipitridae	<i>Circus maurus</i>	Black Harrier	Global: VU; BLSA: EN
Accipitridae	<i>Elanus caeruleus</i>	Black-shouldered (Winged) Kite	LC
Accipitridae	<i>Haliaeetus vocifer</i>	African Fish-Eagle	LC
Accipitridae	<i>Melierax canorus</i>	Southern Pale Chanting Goshawk	LC
Accipitridae	<i>Milvus aegyptius</i>	Yellow-billed Kite	LC
Accipitridae	<i>Polemaetus bellicosus</i>	Martial Eagle	Global: VU; BLSA: EN
Accipitridae	<i>Polyboroides typus</i>	African Harrier-Hawk (Gymnogene)	LC
Alaudidae	<i>Calandrella [brachydactyla] cinerea</i>	Red-capped Lark	LC
Alaudidae	<i>Calendulauda albescens</i>	Karoo Lark (split)	LC
Alaudidae	<i>Calendulauda sabota</i>	Sabota Lark	LC
Alaudidae	<i>Certhilauda subcoronata</i>	Karoo Long-billed Lark (split)	LC
Alaudidae	<i>Chersomanes albofasciata</i>	Spike-heeled Lark	LC
Alaudidae	<i>Eremopterix verticalis</i>	Grey-backed Sparrowlark (Finchlark)	LC

Family	Scientific name	Common name	Red list category
Alaudidae	<i>Galerida magnirostris</i>	Large-billed Lark	LC
Alcedinidae	<i>Alcedo cristata</i>	Malachite Kingfisher	LC
Anatidae	<i>Alopochen aegyptiaca</i>	Egyptian Goose	LC
Anatidae	<i>Anas capensis</i>	Cape Teal	LC
Anatidae	<i>Anas smithii</i>	Cape Shoveler	LC
Anatidae	<i>Tadorna cana</i>	South African Shelduck	LC
Apodidae	<i>Apus affinis</i>	Little Swift	LC
Apodidae	<i>Apus caffer</i>	White-rumped Swift	LC
Apodidae	<i>Cypsiurus parvus</i>	African Palm-Swift	LC
Apodidae	<i>Tachymarptis melba</i>	Alpine Swift	LC
Ardeidae	<i>Ardea cinerea</i>	Grey Heron	LC
Ardeidae	<i>Ardea melanocephala</i>	Black-headed Heron	LC
Ardeidae	<i>Ardea purpurea</i>	Purple Heron	LC
Ardeidae	<i>Bubulcus ibis</i>	Cattle Egret	LC
Ardeidae	<i>Ixobrychus minutus</i>	Little Bittern	LC
Ardeidae	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	LC
Charadriidae	<i>Charadrius tricollaris</i>	Three-banded Plover	LC
Charadriidae	<i>Vanellus armatus</i>	Blacksmith Lapwing (Plover)	LC
Charadriidae	<i>Vanellus coronatus</i>	Crowned Lapwing (Plover)	LC
Ciconiidae	<i>Ciconia nigra</i>	Black Stork	Global: LC; BLSA: VU
Cisticolidae	<i>Cisticola subruficapillus</i> [subruficapilla]	Grey-backed (Red-headed) Cisticola	LC
Cisticolidae	<i>Malcorus pectoralis</i>	Rufous-eared Warbler	LC
Cisticolidae	<i>Phragmacia substriata</i>	Namaqua Warbler	LC
Cisticolidae	<i>Prinia maculosa</i>	Karoo Prinia (split)	LC
Coliidae	<i>Colius colius</i>	White-backed Mousebird	LC
Coliidae	<i>Urocolius indicus</i>	Red-faced Mousebird	LC
Columbidae	<i>Columba guinea</i>	Speckled (Rock) Pigeon	LC
Columbidae	<i>Columba livia</i>	Rock (Feral) Dove (Pigeon)	LC
Columbidae	<i>Oena capensis</i>	Namaqua Dove	LC
Columbidae	<i>Streptopelia capicola</i>	Cape Turtle (Ring-necked) Dove	LC
Columbidae	<i>Streptopelia semitorquata</i>	Red-eyed Dove	LC
Columbidae	<i>Streptopelia senegalensis</i>	Laughing (Palm) Dove	LC
Corvidae	<i>Corvus albicollis</i>	White-necked Raven	LC
Corvidae	<i>Corvus albus</i>	Pied Crow	LC
Cuculidae	<i>Chrysococcyx caprius</i>	Dideric (Diederik) Cuckoo	LC
Estrildidae	<i>Amadina erythrocephala</i>	Red-headed Finch	LC
Estrildidae	<i>Estrilda astrild</i>	Common Waxbill	LC
Falconidae	<i>Falco amurensis</i>	Amur (Eastern Red-footed) Falcon (Kestrel)	LC
Falconidae	<i>Falco naumanni</i>	Lesser Kestrel	LC
Falconidae	<i>Falco peregrinus</i>	Peregrine Falcon	LC

Family	Scientific name	Common name	Red list category
Falconidae	<i>Falco rupicolus</i>	Rock Kestrel	LC
Fringillidae	<i>Emberiza capensis</i>	Cape Bunting	LC
Fringillidae	<i>Emberiza impetuani</i>	Lark-like Bunting	LC
Fringillidae	<i>Serinus alario</i>	Black-headed Canary	LC
Fringillidae	<i>Serinus albogularis</i>	White-throated Canary	LC
Fringillidae	<i>Serinus atrogularis</i>	Black-throated Canary	LC
Fringillidae	<i>Serinus canicollis</i>	Cape (Yellow-crowned) Canary	LC
Fringillidae	<i>Serinus flaviventris</i>	Yellow Canary	LC
Glareolidae	<i>Rhinoptilus africanus</i>	Double-banded Courser	LC
Hirundinidae	<i>Hirundo albigularis</i>	White-throated Swallow	LC
Hirundinidae	<i>Hirundo cucullata</i>	Greater Striped-Swallow	LC
Hirundinidae	<i>Hirundo fuligula</i>	Rock Martin	LC
Hirundinidae	<i>Hirundo rustica</i>	Barn (European) Swallow	LC
Hirundinidae	<i>Riparia paludicola</i>	Brown-throated (Plain) Martin	LC
Laniidae	<i>Lanius collaris</i>	Southern Fiscal	LC
Lybiidae	<i>Tricholaema leucomelas</i>	Acacia Pied Barbet	LC
Malaconotidae	<i>Batis pririt</i>	Pirit Batis	LC
Malaconotidae	<i>Tchagra tchagra</i>	Southern Tchagra	LC
Malaconotidae	<i>Telophorus zeylonus</i>	Bokmakierie	LC
Meropidae	<i>Merops apiaster</i>	European Bee-eater	LC
Meropidae	<i>Merops bullockoides</i>	White-fronted Bee-eater	LC
Motacillidae	<i>Anthus cinnamomeus</i>	African (Grassveld/Grassland) Pipit	LC
Motacillidae	<i>Anthus crenatus</i>	African Rock Pipit	Global: LC; BLSA: NT
Motacillidae	<i>Anthus nicholsoni</i>	Nicholson's Pipit	LC
Motacillidae	<i>Motacilla capensis</i>	Cape Wagtail	LC
Muscicapidae	<i>Bradornis infuscatus</i>	Chat Flycatcher	LC
Muscicapidae	<i>Cercomela familiaris</i>	Familiar Chat	LC
Muscicapidae	<i>Cercomela schlegelii</i>	Karoo Chat	LC
Muscicapidae	<i>Cercomela sinuata</i>	Sickle-winged Chat	LC
Muscicapidae	<i>Cercotrichas (Erythropygia) coryphaeus</i>	Karoo Scrub-Robin	LC
Muscicapidae	<i>Cossypha caffra</i>	Cape Robin-chat	LC
Muscicapidae	<i>Monticola brevipes</i>	Short-toed Rock-Thrush	LC
Muscicapidae	<i>Muscicapa striata</i>	Spotted Flycatcher	LC
Muscicapidae	<i>Myrmecocichla formicivora</i>	Ant-eating Chat	LC
Muscicapidae	<i>Oenanthe monticola</i>	Mountain Chat (Wheatear)	LC
Muscicapidae	<i>Oenanthe pileata</i>	Capped Wheatear	LC
Muscicapidae	<i>Sigelus silens</i>	Fiscal Flycatcher	LC
Nectariniidae	<i>Nectarinia [Cinnyris] famosa</i>	Malachite Sunbird	LC

Family	Scientific name	Common name	Red list category
Nectariniidae	<i>Nectarinia [Cinnyris] fusca</i>	Dusky Sunbird	LC
Otididae	<i>Ardeotis kori</i>	Kori Bustard	Global: NT; BLSA: NT
Otididae	<i>Eupodotis vigorsii</i>	Karoo Korhaan	Global: LC; BLSA: NT
Otididae	<i>Neotis ludwigii</i>	Ludwig's Bustard	Global: EN; BLSA: EN
Passeridae	<i>Passer diffusus</i>	Southern Greyheaded Sparrow (split)	LC
Passeridae	<i>Passer domesticus</i>	House Sparrow	LC
Passeridae	<i>Passer melanurus</i>	Cape Sparrow	LC
Phalacrocoracidae	<i>Phalacrocorax africanus</i>	Reed (Long-tailed) Cormorant	LC
Phasianidae	<i>Pternistis capensis</i>	Cape Spurfowl (Francolin)	LC
Phasianidae	<i>Scleroptila africanus</i>	Grey-winged Francolin	LC
Picidae	<i>Dendropicos fuscescens</i>	Cardinal Woodpecker	LC
Picidae	<i>Geocolaptes olivaceus</i>	Ground Woodpecker	LC
Ploceidae	<i>Euplectes orix</i>	Southern Red (Red) Bishop	LC
Ploceidae	<i>Ploceus capensis</i>	Cape Weaver	LC
Ploceidae	<i>Ploceus velatus</i>	Southern Masked-Weaver	LC
Ploceidae	<i>Quelea quelea</i>	Red-billed Quelea	LC
Pteroclididae	<i>Pterocles namaqua</i>	Namaqua Sandgrouse	LC
Pycnonotidae	<i>Pycnonotus nigricans</i>	African Red-eyed Bulbul	LC
Rallidae	<i>Fulica cristata</i>	Red-knobbed Coot	LC
Rallidae	<i>Gallinula chloropus</i>	Common Moorhen	LC
Sagittariidae	<i>Sagittarius serpentarius</i>	Secretarybird	Global: VU; BLSA: VU
Strigidae	<i>Bubo africanus</i>	Spotted Eagle-Owl	LC
Struthionidae	<i>Struthio camelus</i>	Common Ostrich	LC
Sturnidae	<i>Creatophora cinerea</i>	Wattled Starling	LC
Sturnidae	<i>Lamprolornis nitens</i>	Cape Glossy (Glossy) Starling	LC
Sturnidae	<i>Onychognathus morio</i>	Red-winged Starling	LC
Sturnidae	<i>Onychognathus nabouroup</i>	Pale-winged Starling	LC
Sturnidae	<i>Spreo bicolor</i>	Pied (African Pied) Starling	LC
Sturnidae	<i>Sturnus vulgaris</i>	Common (European) Starling	LC
Sylviidae	<i>Acrocephalus gracilirostris</i>	Lesser Swamp- (Cape Reed) Warbler	LC
Sylviidae	<i>Acrocephalus scirpaceus</i>	Common Reed Warbler	LC
Sylviidae	<i>Eremomela gregalis</i>	Karoo (Green/Yellow-rumped) Eremomela	LC
Sylviidae	<i>Eremomela icteropygialis</i>	Yellow-bellied Eremomela	LC
Sylviidae	<i>Parisoma (Sylvia) layardi</i>	Layard's Tit-Babbler (Warbler)	LC
Sylviidae	<i>Parisoma (Sylvia) subcaeruleum</i>	Chestnut-vented Tit-Babbler	LC
Sylviidae	<i>Stenostira scita</i>	Fairy Flycatcher (Warbler)	LC

Family	Scientific name	Common name	Red list category
Sylviidae	<i>Sylvietta rufescens</i>	Long-billed (Cape) Crombec	LC
Threskiornithidae	<i>Bostrychia hagedash</i>	Hadedda Ibis	LC
Threskiornithidae	<i>Threskiornis aethiopicus</i>	African Sacred (Sacred) Ibis	LC
Turdidae	<i>Turdus olivaceus</i>	Olive Thrush (split)	LC
Turdidae	<i>Turdus smithi</i>	Karoo Thrush (split)	LC
Upupidae	<i>Upupa africana</i>	African Hoopoe	LC
Viduidae	<i>Vidua macroura</i>	Pin-tailed Whydah	LC
Zosteropidae	<i>Zosterops virens</i>	Cape White-eye (split)	LC

Figure 30: List of reptiles recorded for the project area on the Virtual Museum

Family	Scientific name	Common name	Red list category
Agamidae	<i>Agama aculeata aculeata</i>	Common Ground Agama	Least Concern (SARCA 2014)
Agamidae	<i>Agama anchietae</i>	Anchieta's Agama	Least Concern (SARCA 2014)
Agamidae	<i>Agama atra</i>	Southern Rock Agama	Least Concern (SARCA 2014)
Chamaeleonidae	<i>Bradypodion ventrale</i>	Eastern Cape Dwarf Chameleon	Least Concern (SARCA 2014)
Chamaeleonidae	<i>Chamaeleo namaquensis</i>	Namaqua Chameleon	Least Concern (SARCA 2014)
Colubridae	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	Least Concern (SARCA 2014)
Colubridae	<i>Dasypeltis scabra</i>	Rhombic Egg-eater	Least Concern (SARCA 2014)
Colubridae	<i>Dipsina multimaculata</i>	Dwarf Beaked Snake	Least Concern (SARCA 2014)
Colubridae	<i>Telescopus beetzi</i>	Beetz's Tiger Snake	Least Concern (IUCN, 2019)
Cordylidae	<i>Cordylus cordylus</i>	Cape Girdled Lizard	Least Concern (SARCA 2014)
Cordylidae	<i>Karusasaurus polyzonus</i>	Karoo Girdled Lizard	Least Concern (SARCA 2014)
Cordylidae	<i>Pseudocordylus microlepidotus namaquensis</i>	Nuweveldberg Crag Lizard	Least Concern (SARCA 2014)
Elapidae	<i>Aspidelaps lubricus lubricus</i>	Coral Shield Cobra	Least Concern (SARCA 2014)
Elapidae	<i>Hemachatus haemachatus</i>	Southern Rinkhals	Least Concern (IUCN 2022)
Elapidae	<i>Naja nivea</i>	Cape Cobra	Least Concern (SARCA 2014)
Gekkonidae	<i>Chondrodactylus angulifer</i>	Giant Ground Gecko	Least Concern (IUCN 2009)

Family	Scientific name	Common name	Red list category
Gekkonidae	<i>Chondrodactylus bibronii</i>	Bibron's Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Goggia braacki</i>	Braack's Pygmy Gecko	Near Threatened (SARCA 2014)
Gekkonidae	<i>Goggia incognita</i>	Southern Striped Pygmy Gecko	Least Concern (IUCN 2022)
Gekkonidae	<i>Lygodactylus capensis</i>	Common Dwarf Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus capensis</i>	Cape Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus geitje</i>	Ocellated Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus kladaroderma</i>	Thin-skinned Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus latirostris</i>	Quartz Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus maculatus</i>	Spotted Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus mariquensis</i>	Marico Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus oculatus</i>	Golden Spotted Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus purcelli</i>	Purcell's Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Ptenopus garrulus maculatus</i>	Spotted Barking Gecko	Least Concern (SARCA 2014)
Gerrhosauridae	<i>Cordylus subtaeniatus</i>	Dwarf Plated Lizard	Least Concern (SARCA 2014)
Gerrhosauridae	<i>Gerrhosaurus typicus</i>	Karoo Plated Lizard	Least Concern (SARCA 2014)
Gerrhosauridae	<i>Tetradactylus tetradactylus</i>	Cape Long-tailed Seps	Least Concern (SARCA 2014)
Lacertidae	<i>Meroles suborbitalis</i>	Spotted Desert Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Nucras livida</i>	Karoo Sandveld Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Nucras tessellata</i>	Western Sandveld Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Pedioplanis burchelli</i>	Burchell's Sand Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Pedioplanis laticeps</i>	Karoo Sand Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Pedioplanis lineocellata pulchella</i>	Common Sand Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	Least Concern (SARCA 2014)
Lamprophiidae	<i>Boaedon capensis</i>	Brown House Snake	Least Concern (SARCA 2014)

Family	Scientific name	Common name	Red list category
Lamprophii dae	<i>Lamprophis aurora</i>	Aurora House Snake	Least Concern (SARCA 2014)
Lamprophii dae	<i>Lamprophis guttatus</i>	Spotted House Snake	Least Concern (SARCA 2014)
Lamprophii dae	<i>Prosymna sundevallii</i>	Sundevall's Shovel- snout	Least Concern (SARCA 2014)
Lamprophii dae	<i>Psammophis crucifer</i>	Cross-marked Grass Snake	Least Concern (SARCA 2014)
Lamprophii dae	<i>Psammophis notostictus</i>	Karoo Sand Snake	Least Concern (SARCA 2014)
Lamprophii dae	<i>Psammophylax rhombeatus</i>	Spotted Grass Snake	Least Concern (SARCA 2014)
Lamprophii dae	<i>Pseudaspis cana</i>	Mole Snake	Least Concern (SARCA 2014)
Pelomedusi dae	<i>Pelomedusa galeata</i>	South African Marsh Terrapin	Least Concern (IUCN 2018)
Scincidae	<i>Acontias meleagris</i>	Cape Legless Skink	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis capensis</i>	Cape Skink	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis homalocephala</i>	Red-sided Skink	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis occidentalis</i>	Western Three-striped Skink	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis sulcata sulcata</i>	Western Rock Skink	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis variegata</i>	Variegated Skink	Least Concern (SARCA 2014)
Testudinida e	<i>Chersina angulata</i>	Angulate Tortoise	Least Concern (SARCA 2014)
Testudinida e	<i>Chersobius boulengeri</i>	Karoo Padloper	Near Threatened (SARCA 2014)
Testudinida e	<i>Homopus femoralis</i>	Greater Padloper	Least Concern (SARCA 2014)
Testudinida e	<i>Psammobates tentorius tentorius</i>	Karoo Tent Tortoise	Least Concern (SARCA 2014)
Testudinida e	<i>Psammobates tentorius verroxii</i>	Verrox's Tent Tortoise	Least Concern (SARCA 2014)
Testudinida e	<i>Stigmochelys pardalis</i>	Leopard Tortoise	Least Concern (SARCA 2014)
Typhlopidae	<i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)
Varanidae	<i>Varanus albigularis albigularis</i>	Rock Monitor	Least Concern (SARCA 2014)
Viperidae	<i>Bitis arietans arietans</i>	Puff Adder	Least Concern (IUCN 2014)

Figure 31: List of frogs recorded for the project area on the Virtual Museum

Family	Scientific name	Common name	Red list category
Bufonidae	<i>Poyntonophrynus vertebralis</i>	Southern Pygmy Toad	Least Concern
Bufonidae	<i>Sclerophrys capensis</i>	Raucous Toad	Least Concern
Bufonidae	<i>Vandijkophrynus gariensis</i> <i>gariensis</i>	Karoo Toad (subsp. <i>gariensis</i>)	Least Concern
Pipidae	<i>Xenopus laevis</i>	Common Platanna	Least Concern (IUCN 2020)
Pyxicephali dae	<i>Amietia fuscigula</i>	Cape River Frog	Least Concern (2017)
Pyxicephali dae	<i>Amietia poyntoni</i>	Poynton's River Frog	Least Concern (2017)
Pyxicephali dae	<i>Cacosternum boettgeri</i>	Common Caco	Least Concern (2013)
Pyxicephali dae	<i>Cacosternum karooicum</i>	Karoo Caco	Least Concern (2013)
Pyxicephali dae	<i>Pyxicephalus adspersus</i>	Giant Bull Frog	Near Threatened
Pyxicephali dae	<i>Strongylopus grayii</i>	Clicking Stream Frog	Least Concern
Pyxicephali dae	<i>Tomopterna delalandii</i>	Cape Sand Frog	Least Concern (IUCN 2013)