BOTANICAL IMPACT ASSESSMENT REPORT

FOR SERVICE INFRASTRUCTURE FOR THE PROPOSED BOSCHENDAL FOUNDERS ESTATE

Prepared for:

Boschendal (Pty) Ltd

Boschendal Estate, Pniel Road,
Groot, Franschhoek, 7690

Prepared by:

Biodiversity Africa

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March 2022

Details of Company

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Authors

Tarryn Martin (Botanical Specialist) (*Pri. Sci. Nat* 008745)

Tarryn has over ten years of experience working as a botanist, nine of which are in the environmental sector. She has worked as a specialist and project manager on projects within South Africa, Mozambique, Lesotho, Zambia, Tanzania, Cameroon, Swaziland and Malawi. The majority of these projects required lender finance and consequently met both in-country and lender requirements.

Tarryn has extensive experience writing botanical impact assessments, critical habitat assessments, biodiversity management plans, biodiversity monitoring plans and Environmental Impact Assessments to International Standards, especially to those of the International Finance Corporation (IFC). Her experience includes working on large mining projects such as the Kenmare Heavy Minerals Mine, where she monitored forest health, undertook botanical impact assessments for their expansion projects and designed biodiversity management and monitoring plans. She has also project managed Environmental Impact Assessments for graphite mines in northern Mozambique and has a good understanding of the Mozambique Environmental legislation and processes.

Tarryn holds a BSc (Botany and Zoology), a BSc (Hons) in African Vertebrate Biodiversity and an MSc with distinction in Botany from Rhodes University. Tarryn's Master's thesis examined the impact of fire on the recovery of C3 and C4 Panicoid and non-Panicoid grasses within the context of climate change for which she won the Junior Captain Scott-Medal (Plant Science) for producing the top MSc of 2010 from the South African Academy of Science and Art as well as an Award for Outstanding Academic Achievement in Range and Forage Science from the Grassland Society of Southern Africa.

Tarryn is a professional member of the South African Council for Natural Scientific Professionals (since 2014).

Declaration of Independence

Tarryn Martin (Botanical Specialist)

- I, Tarryn Martin, declare that, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amended Environmental Impact Assessment Regulations, 2017;
- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this report are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

22-08-2022

SIGNED DATE

Non-Technical Summary

Boschendal (Pty) Ltd has acquired the land use rights to the subdivision and development of eighteen (18) so-called Founders' Estates (FEs) on a portion of its landholdings. The proposed Founders' Estates will comprise 18 different farms of approximately 25 ha each, with each one having an area of 8,000m² (referred to as the "Excluded Area") within which a homestead may be developed (subject to agreement from various authorities/ stakeholders and within the scope of a specific set of guidelines). A Developable Area has been defined within the 8000m² Excluded Area of each FE, ranging from 1,200m² to 2,400m². The exact positioning of each DA within each Excluded Area must still be defined and will be subject to building design, heritage, and environmental considerations. These development footprints are not included in the scope of this environmental application and the DAs would be subject to a separate environmental application/s, if required, once defined.

The subject of this environmental application is the installation of services to each FE with potable water, sewer disposal, electricity, irrigation, fibre internet and access roads, either through the formalisation of existing farm roads or through the construction of sections of new roadways.

A field survey was undertaken during the late flowering season from the 25-27 October 2021. The purpose of the survey was to assess the site-specific botanical state of the project area by recording the species present (both indigenous and alien invasive species), identifying sensitive ecosystems such as rocky outcrops, riparian areas or areas with species of conservation concern, and identifying the current land use.

The findings from this site visit were supplemented with data from a previous baseline assessment and constraints study undertaken by Helme (2019).

The study determined that the vegetation types present within the project area of influence (PAOI) are comprised of

- Intact Boland Granite Fynbos
- Degraded Boland Granite Fynbos
- Agricultural and Transformed Land

Intact Boland Granite Fynbos occurs along the western portion of the project site and along drainage lines and streams. This vegetation type is characterised by species such as *Cliffortia polygonifolia, Cliffortia ruscifolia, Dicerothamnus rhinocerotis, Helichrysum petiolara, Leucadendron salicifolium, Osteospermum moniloferum, Pelargonium alchemilloides, Stoebe plumsosum* and *Searsia angustifolia.* Trees and shrubs along the riparian areas include *Brabejum stellatifolium, Searsia angustifolia, Diospyros glabra* and often invasive species such as *Acacia mearnsii. Pteridium aquilinum* (bracken) typically occurs adjacent to riparian areas.

Within the intact patches are a few patches of Degraded Boland Granite Fynbos that have been infested with alien species and have been or are in the process of being cleared. These areas are often covered in large patches of *Pteridium aquilinum* (bracken), some indigenous species such as

Dicerothamnus rhinocerotis, Helichrysum petiolara, Osteospermum moniloferum as well as saplings of invasive species such as *Acacia longifolia, Acacia mearnsii, Verbena bonariensis* and *Solanum mauritanium.*

The agricultural land is completely transformed and not representative of natural vegetation. Fallow areas are characterised by ruderal and grass species.

The overall SEI was determined to be very high for the intact Boland Granite Fynbos and Medium for the disturbed Boland Granite Fynbos. Given the sensitivity of this vegetation type, which is listed as Endangered, the engineers have worked with the specialists to minimise the impact of the proposed development on the natural environment. This has been achieved by locating infrastructure within existing road servitudes and in areas that are transformed and/or disturbed.

It is estimated that the project infrastructure will result in the permanent loss of 0.1 ha (reservoir site) and disturbance of 0.14ha (infrastructure servitudes) of Boland Granite Fynbos. This equates to 0.1% of the remaining extent of this vegetation type.

Given that the infrastructure is predominantly located within existing road servitudes and in disturbed sites, the associated impacts on the vegetation and species of conservation concern will be low provided the recommended mitigation measures are implemented.

It is recommended that the following conditions are included in the Final EMPr as well as the conditions of the Environmental Authorisation (EA), if granted:

- All necessary plant permits must be obtained prior to the commencement of any construction activities;
- Clearing within the intact Boland Granite Fynbos must be kept to a minimum;
- Where feasible, laydown areas must be placed in previously disturbed sites. This is particularly relevant to the reservoir site;
- If any SCC are to be impacted, these must be relocated to nearest appropriate habitat;
- Where the service infrastructure crosses areas of natural habitat, it is recommended that the trenches are rehabilitated back to their original state;
- When digging trenches, the topsoil must be removed, stored and replaced once the infrastructure has been laid;
- Alien invasive plant clearing should be undertaken in line with an Alien Vegetation Management plan, which should be compiled as part of the EMPr and implemented with immediate effect;
- Trenches must be checked regularly (every 6 months until the site has been returned to 70% of its original state) for the presence of alien invasive species. If individuals of alien invasive plants species are recorded within the disturbed site, they must be immediately removed.
- Only indigenous plant species typical of the local vegetation and approved by a botanist should be used for the rehabilitation of natural habitat.

Given that the footprint of the infrastructure within sensitive areas has been kept to a minimum and the resulting impacts are of a low significance, the specialist is of the opinion that the development can proceed provided the recommendations contained in this report are implemented.

Table of Contents

List of Figures

List of Tables

Glossary of Terms

Alien Invasive Species refers to an exotic species that can spread rapidly and displace native species causing damage to the environment

Biodiversity is the term that is used to describe the variety of life on Earth and is defined as "*the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems*" (Secretariat of the Convention on Biological Diversity, 2005).

Habitat Fragmentation occurs when large expanses of habitat are transformed into smaller patches of discontinuous habitat units isolated from each other by transformed habitats such as farmland.

Key Biodiversity Area are globally recognised sites that contain significant concentrations of biodiversity.

Natural Habitat refers to habitats composed of viable assemblages of plant and/or animal species of largely native origin and/or where human activity has not essentially modified an area's primary ecological function and species composition.

Protected Area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values**.** *(IUCN Definition 2008)*

Acronyms

CBA	Critical Biodiversity Area
CR	Critically Endangered
CCR	Core Cape Subregion
ECO	Environmental Control Officer
EDGE	Evolutionarily Distinct and Globally Endangered
EN	Endangered
EIA	Environmental Impact Assessment
EOO	Extent of Occupancy
FE	Founders Estate
GBIF	Global Biodiversity Information Facility
GCFR	Greater Cape Floristic Region
GIS	Geographical Information System
IBA	Important Birding Areas
IUCN	International Union for Conservation of Nature
KBA	Key Birding Areas
LC	Least Concern
NBSAP	National Biodiversity and Strategy Action Plan
NEMBA	National Environmental Management Biodiversity Act
PNCO	Provincial Nature Conservation Ordinance
SCC	Species of Conservation Concern
QDS	Quarter Degree Square
SA	South Africa
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
TOPS	Threatened and Protected Species
VU	Vulnerable

Specialist Check List

The contents of this specialist report complies with the legislated requirements as described in the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity (GN R. 320 of 2020).

SPECIALIST REPORT REQUIREMENTS ACCORDING TO GN R. 320			SECTION OF REPORT
3.1	The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:		
	3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Page 2-3 Appendix 5 and 6
	3.1.2	A signed statement of independence by the specialist;	Page 3
	3.1.3	A statement of the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2.3
	3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Chapter 2
	3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.3
	3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Section 5.3
	3.1.7	Additional environmental impacts expected from the proposed development;	Chapter 6
	3.1.8	Any direct, indirect and cumulative impacts of the proposed development;	Chapter 6
	3.1.9	The degree to which the impacts and risks can be mitigated;	Chapter 6
	3.1.10	The degree to which the impacts and risks can be reversed;	
	3.1.11	The degree to which the impacts and risks can cause loss of irreplaceable resources;	
	3.1.12	Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Section 7.2
	3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	N/A
	3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Section 7.3
	3.1.15	Any conditions to which this statement is subjected.	Section 7.2
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.		✓
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.		

1. INTRODUCTION

1.1. Project Description

Boschendal (Pty) Ltd (the proponent) has acquired the land use rights to the subdivision and development of eighteen (18) so-called Founders' Estates (FEs) on a portion of its landholdings. The Founders' Estates comprise 18 different farms of approximately 25 ha each, with each one having an area of 8,000m² (referred to as the "Excluded Area") within which a homestead may be developed (subject to agreement from various authorities/ stakeholders and within the scope of a specific set of guidelines). A Developable Area (DA) has been provisionally determined within the 8000m² Excluded Area of each FE, ranging from 1,200m² to 2,400m². The exact positioning of each DA within each Excluded Area must still be defined and will be subject to building design, heritage, and environmental considerations. These development footprints are not included in the scope of this environmental application and each DA would be subject to separate environmental application/s, if required, once defined.

In the interim, the proponent intends to install new service infrastructure and expand on existing infrastructure to ensure that the entire Founders Estate is serviced. The proponent also intends to formalise existing farm roads and develop new sections of roadway.

The scope of the environmental application includes the following:

- The installation of a new bulk foul sewer line, bulk water pipelines and rising main, stormwater infrastructure (swales and culverts) and fibre internet ducts;
- The expansion of existing electricity and irrigation lines;
- The formalisation of existing farm roads;
- The development of new sections of formal roadway (noting that there are existing dirt tracks and paved roads on the site which will be expanded upon in terms of length and not width);
- The construction of a new 100kl reservoir and new sewer pump station;
- The installation of an "external" (beyond the limits of the Founders Estate) sewer pipeline and water pipeline in order to connect the Estate to the municipal network.

Most of the service corridors will be located within existing roadway or informal, transformed road shoulders. However, there will be installation of services beyond existing roadway, and/or close to, within, or across watercourses, which in some areas would also entail the clearance of indigenous vegetation. Where the routings of service lines overlap, services will be installed within the same 1m wide trench.

Each service infrastructure component included in the scope of this Basic Assessment (BA) is summarised in Table 1.2 and depicted in Figure 1.2 below. Further descriptions of each component are included in the main BA report.

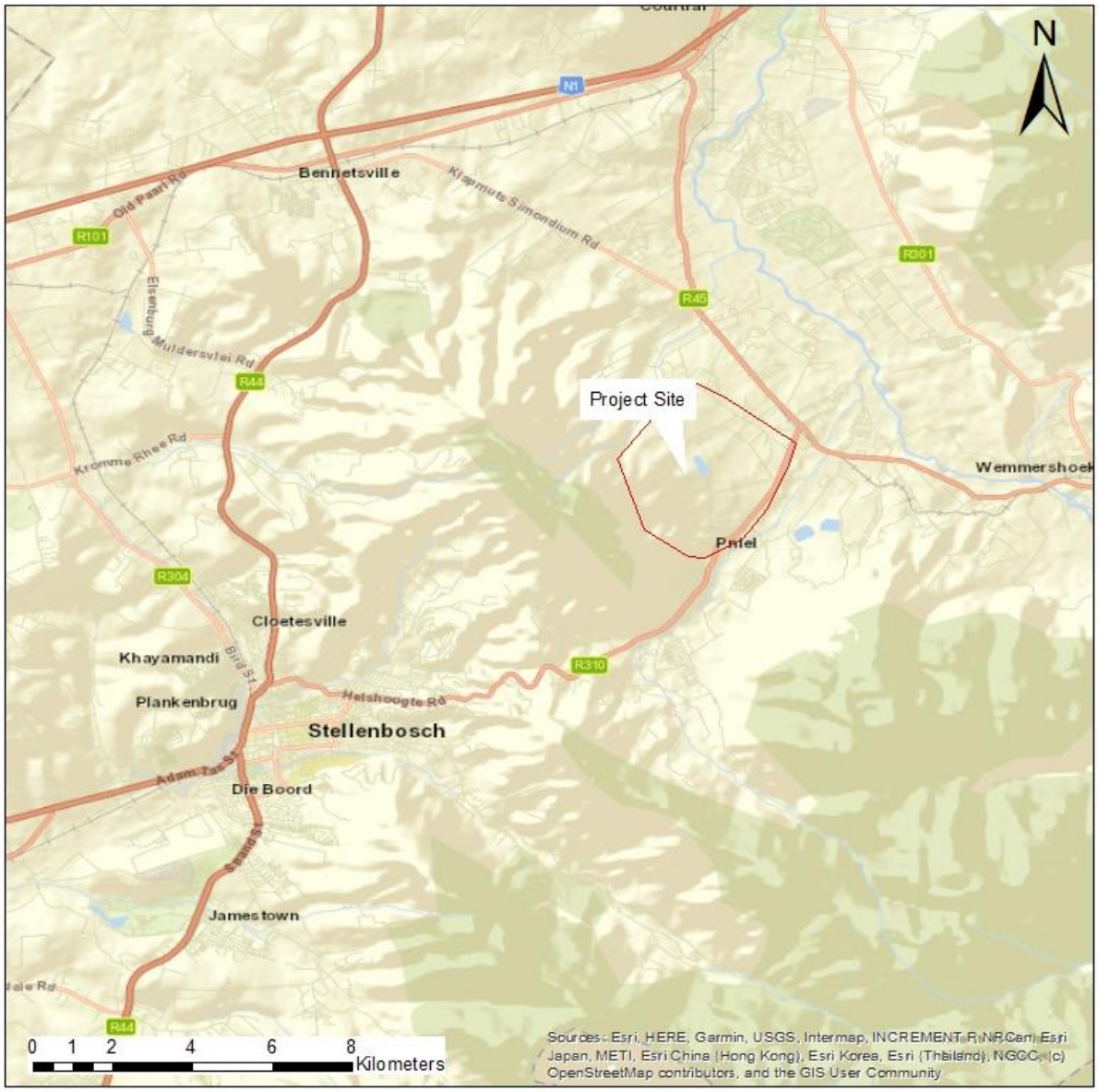

Figure 1.1: Locality map showing the project site in relation to Pniel and Stellenbosch

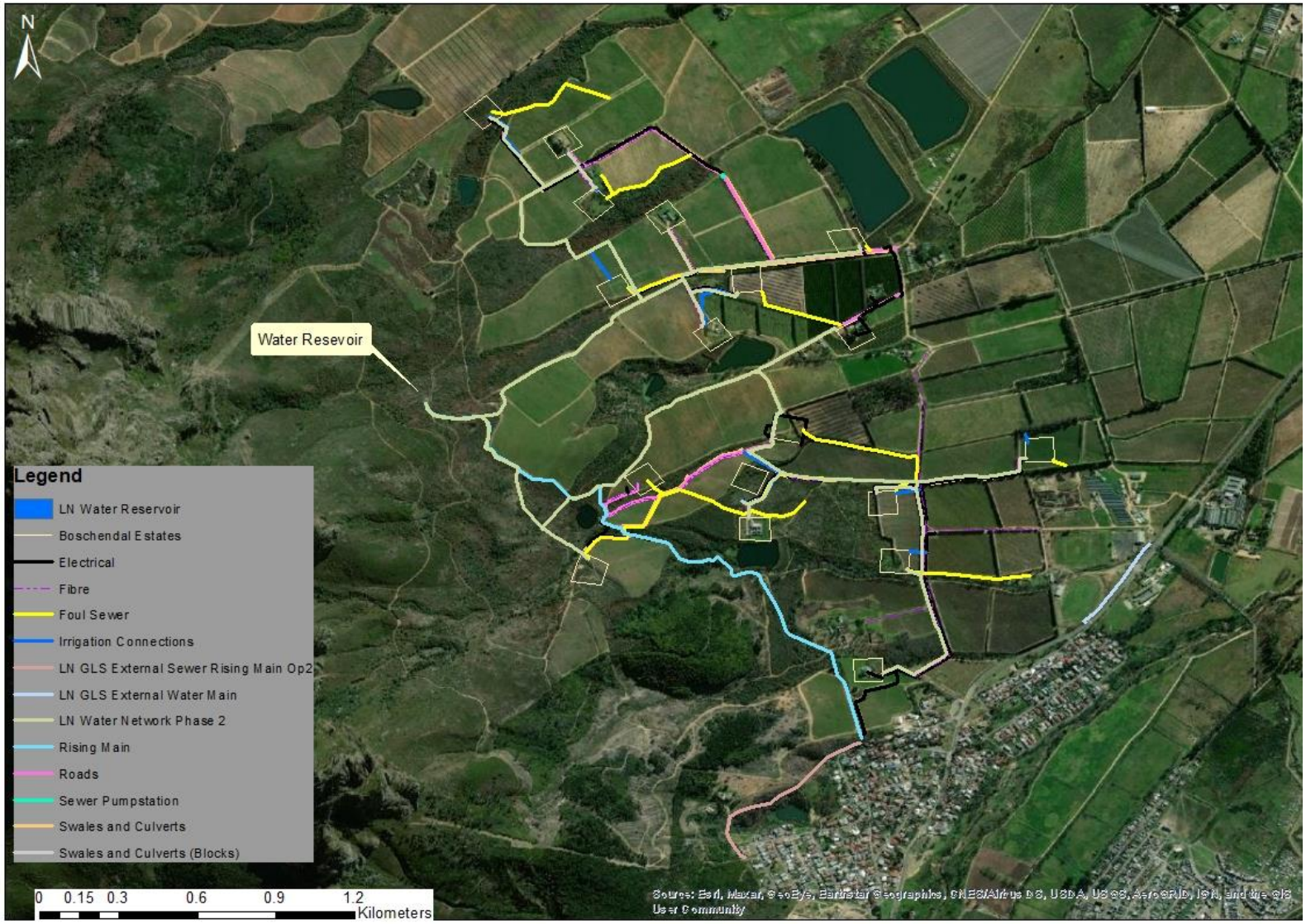

Figure 1.2: Infrastructure Map showing the location of the proposed service infrastructure

Table 1.1: List of infrastructure and dimensions that for part of this assessment

	New Development component	Total length (m)	Width/diameter	Total footprint
Internal Services	Sewer pipelines – below ground	3 750 m	160 mm diameter	3 750 m^2
	Sewer pipelines - above ground	200 m	250 mm diameter	200 m^2
	Water pipelines	7 350 m	110 mm diameter	7 350 m^2
	Rising Main	2 350 m	75 mm diameter	2 350 m^2
	Electricity lines	5 200 m	N/A	5 200 m^2
	Irrigation lines	1 250 m	32 mm diameter	1 250 m^2
	Fibre ducts	6 100 m	90 mm diameter	6 100 m^2
	New roads	335 m	3.0 m – 5 m	1 435 m^2
	Reservoir	N/A	N/A	20 m x 20 m
	Culverts	N/A	N/A	TBC
External Services	Water Pipeline	750 m	250 mm diameter	750 m^2
	Sewer Pipeline	350 m	160 mm diameter	350 m^2

1.2. Objectives

The objectives of the ecological assessment are as follows:

- Undertake a desktop assessment of the site to determine its sensitivity and species of conservation concern (SCC) that could be present within the site.
- Undertake a field survey, to record the following information:
    - Species present
    - Identification of species that are either protected (TOPS and PNCO) or considered threatened (CR, EN, VU) on the South African Red Data List
    - Assess the level of degradation/ecological status of the site (i.e. intact, near natural, transformed).
- Assess the sensitivity of each site using the sensitivity analysis outlined in the Species Guideline Document (2021).
- For areas of moderate and high sensitivity, assess the impact that the construction of the project infrastructure will have on the vegetation and plant SCC.
- Where necessary, provide mitigation measures to reduce the impact of the infrastructure on the environment.
- Provide a specialist statement/opinion.

1.3. Limitations and Assumptions

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

- The report is based on a project description received from the client.
- Species of Conservation Concern (SCC) are difficult to find and may be difficult to identify, thus species described in this report do not comprise an exhaustive list. It is almost certain that additional SCCs are present.
- Sampling could only be carried out at one stage in the annual or seasonal cycle. The survey was conducted in late spring when most plants were flowering. Some early flowering species, specifically geophytes, may have gone undetected, however, the time available in the field, and information gathered during the survey was sufficient to provide enough information to determine the status of the affected area.
- This report only covers the botanical aspects of the site. Faunal aspects are covered in a separate faunal compliance statement.

2. METHODOLOGY

2.1. Project Area

The “project area” or “impacted project site” is defined as the area that will be directly impacted by project infrastructure such as the pipelines, roads, electrical and fibre lines.

The project area of influence (PAOI) refers to the broader area around the project area that may be indirectly impacted by project activities.

2.2. Desktop Assessment

A desktop assessment was undertaken prior to the site visit to determine the vegetation types present, identify species of conservation concern that might occur on site and identify the threat and conservation status of the project site. Key resources were consulted including:

- The DFFE screening report for the site.
- The South African Vegetation Map (Mucina and Rutherford, 2018).
- The Western Cape Biodiversity Spatial Plan (2017).
- The Red List of Ecosystems (SANBI, 2021).
- National Biodiversity Management: Biodiversity Act (NEMBA) List of Threatened or Protected Species.
- The National Biodiversity Assessment (SANBI, 2018).
- The Plants of Southern Africa (POSA) database.
- iNaturalist.

A species list was compiled for the site and the likelihood of occurrence assessed for species listed as Critically Endangered, Endangered, Vulnerable and Near Threatened (Section 4.5.1 and Appendix 2).

2.3. Field Survey

A field survey was undertaken during the late flowering season from the 25-27 October 2021. The purpose of the survey was to assess the site-specific botanical state of the project area by recording the species present (both indigenous and alien invasive species), identifying sensitive ecosystems such as rocky outcrops, riparian areas or areas with species of conservation concern, and identifying the current land use.

The findings from this site visit were supplemented with data from a previous baseline assessment and constraints study undertaken by Helme (2019).

The project site was walked and sample plots were analysed by determining the dominant species in each plot, as well as any alien invasive species and potential SCC occurring within the plots. Each

sample plot was sampled until no new species were recorded. Vegetation communities were then described according to the dominant species recorded from each type, and these were mapped and assigned a sensitivity score.

2.4. Site Sensitivity Assessment

The Species Environmental Assessment guideline (SANBI, 2020) was applied to assess the Site Ecological Importance (SEI) of the project area. The habitats and the species of conservation concern in the project area were assessed based on their conservation importance, functional integrity and receptor resilience (Table 2.1). The combination of these resulted in a rating of SEI and interpretation of mitigation requirements based on the ratings.

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

Table 2-1: Criteria for establishing Site Ecological importance and description of criteria

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

2.5. Description of impact analysis methodology used

2.5.1. Definitions of or criteria for environmental impact parameters

The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the consequence of such an impact occurring before and after implementation of proposed mitigation measures.

The following variables were considered when assessing each impact:

- Extent (spatial scale)
- Duration
- Intensity (severity)
- Probability of occurrence

- Status of the impact i.e. whether it is positive or negative

The tables used to determine each variable for each impact have been included in Appendix 3.

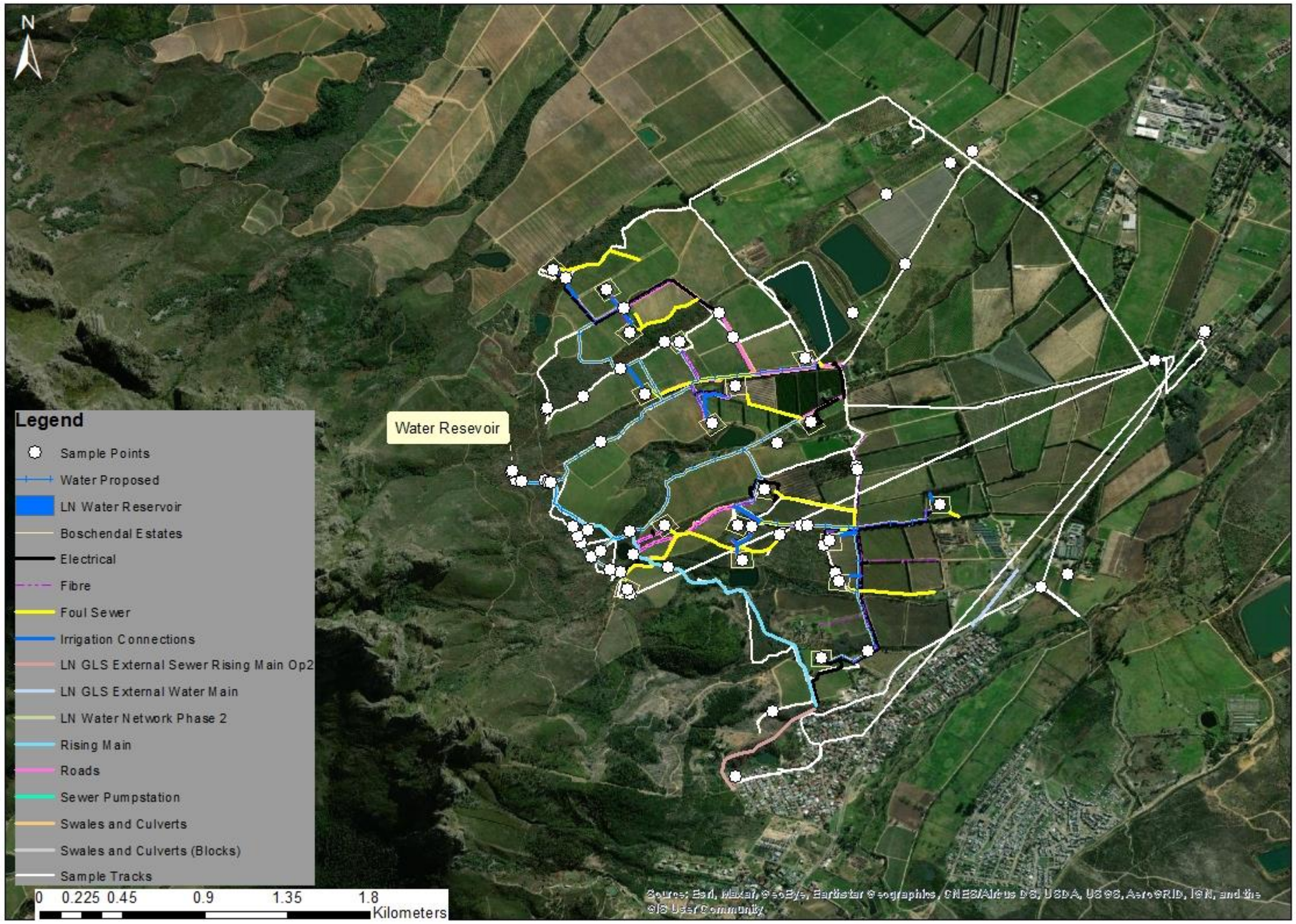

Figure 2.1: Map showing sample sites and tracks within and adjacent to the project site.

3. BIOPHYSICAL DESCRIPTION

3.1. Climate

The project site is situated in the south-western part of the Core Cape Subregion (CCR) which experiences a strictly Mediterranean climate with rainfall occurring primarily in the winter months (Manning and Goldblatt, 2012). Pniel, the closest town to the project site, experiences its highest rainfall from May to September (worldweatheronline, 2021) while summers are typically warm and dry. January and February are the hottest months with average temperatures of 27°C while July and August are the coolest months with minimum average temperatures of 7°C. The steep slopes of the mountain ranges such as the Drakenstein and Simonsberg, that occur within close proximity to the project site, provide greater climatic variation resulting in a higher diversity of habitats and therefore species diversity (Manning and Goldblatt, 2012).

3.2. Topography

The project site is situated on the eastern slopes of the Simonsberg Mountain Range. The site slopes towards the northeast with the elevation changing from 396 masl in the west to 184 masl in the east (Figure 1.1 and 1.2).

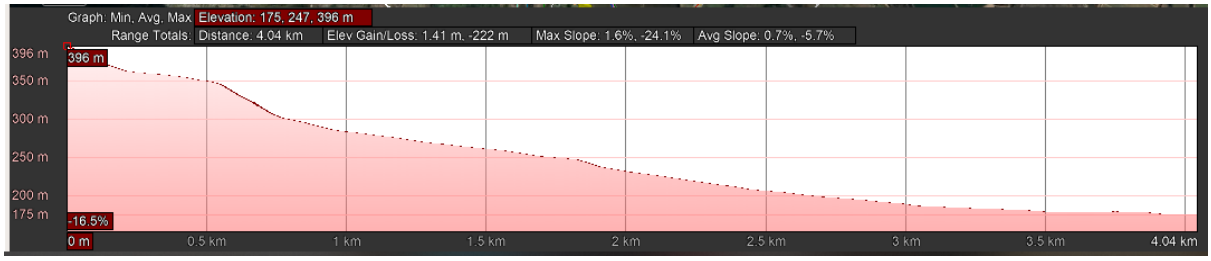

Figure 3.1: Elevation profile showing the change in slope from south west to north east

Figure 3.2: Photograph illustrating the general topography of the site.

3.3. Geology and Soils

The project site is located within the Cape Granite Suite which is comprised of porphyritic, medium or fine grained granite and granodiorite (a coarse-grained plutonic rock containing quartz and plagioclase). It is also comprised of subordinate syenite (a coarse-grained grey igneous rock), gabbro (a dark, coarse-grained plutonic rock of crystalline texture), diorite (a speckled, coarse-grained igneous rock) and quartz porphyry (a type of igneous rock containing large quartz crystals) (CapeFarmMapper, 2021).

The underlying geology gives rise to apedal, freely drained red-yellow soils. Clay content varies between 15 and 35% with soil depths >750mm.

4. VEGETATION AND FLORISTICS

The project site occurs within the Fynbos Biome which occupies most of the Cape Fold Belt as well as the lowlands that occur between the mountains and the Atlantic Ocean in the west and south (Rebelo *et. al*. 2006). In the south it occurs between the mountains and the Indian Ocean. The project falls within the Core Cape Subregion (CCR) of the Greater Cape Floristic Region (GCFR) (Manning and Goldblatt, 2012). The CCR is unique in that within 90 760km^2 (less than 4% of the southern African Continent), there are 9,383 species of vascular plants, of which 9,251 are flowering species, and over 68% are endemic (i.e. don't occur anywhere else in the world). This region is floristically rich and comprises over 46% of the estimated 20% vascular plant species recorded from southern Africa.

According to the National Vegetation Map (2018), which was compiled to provide a greater level of detail for floristically based vegetation units in South Africa, the project site occurs within Boland Granite Fynbos and Swartland Alluvium Fynbos (Figure 4.1).

4.1. Boland Granite Fynbos

Boland Granite Fynbos occurs in the Western Cape Province on the upper slopes of Paardeberg and Paarl Mountain and the lower slopes of the mountains spanning the Groenberg and Hawequasberge, Pniel, Franschhoek, Stellenbosch and Helderberg Municipality as well as in the Du Toitskloof and Wemmershoek Valleys.

This vegetation type occurs on moderately undulating hills and is characterised by fairly dense 1-2m tall shrubland comprised of scrub, asteraceous and proteoid fynbos with restioid and ericaceous fynbos dominating in wetter areas.

This vegetation type is listed as endangered with a conservation target of 30%. Originally this vegetation type covered an estimated 524 ha but at least half has been transformed for vineyards, olive groves and plantations and it is estimated that 54% remains intact. The Red List of Terrestrial Ecosystems of South Africa lists this vegetation type as well protected (RLE, 2021).

4.2. Swartland Alluvium Fynbos

This vegetation type is associated with moderately undulating plains adjacent to mountains. It is characterised by a mix of low, evergreeen shrubland, a graminoid layers and emergent, sparse, moderately tall shrubs. Proteoid, restioid and asteraceous fynbos are typical of this vegetation type with closed-scrub fynbos occurring along river banks.

This vegetation type is listed as endangered with a conservation target of 30%. 10% is conserved and an estimated 70% has been transformed for agriculture (RLE, 2021). This vegetation type is listed as poorly protected.

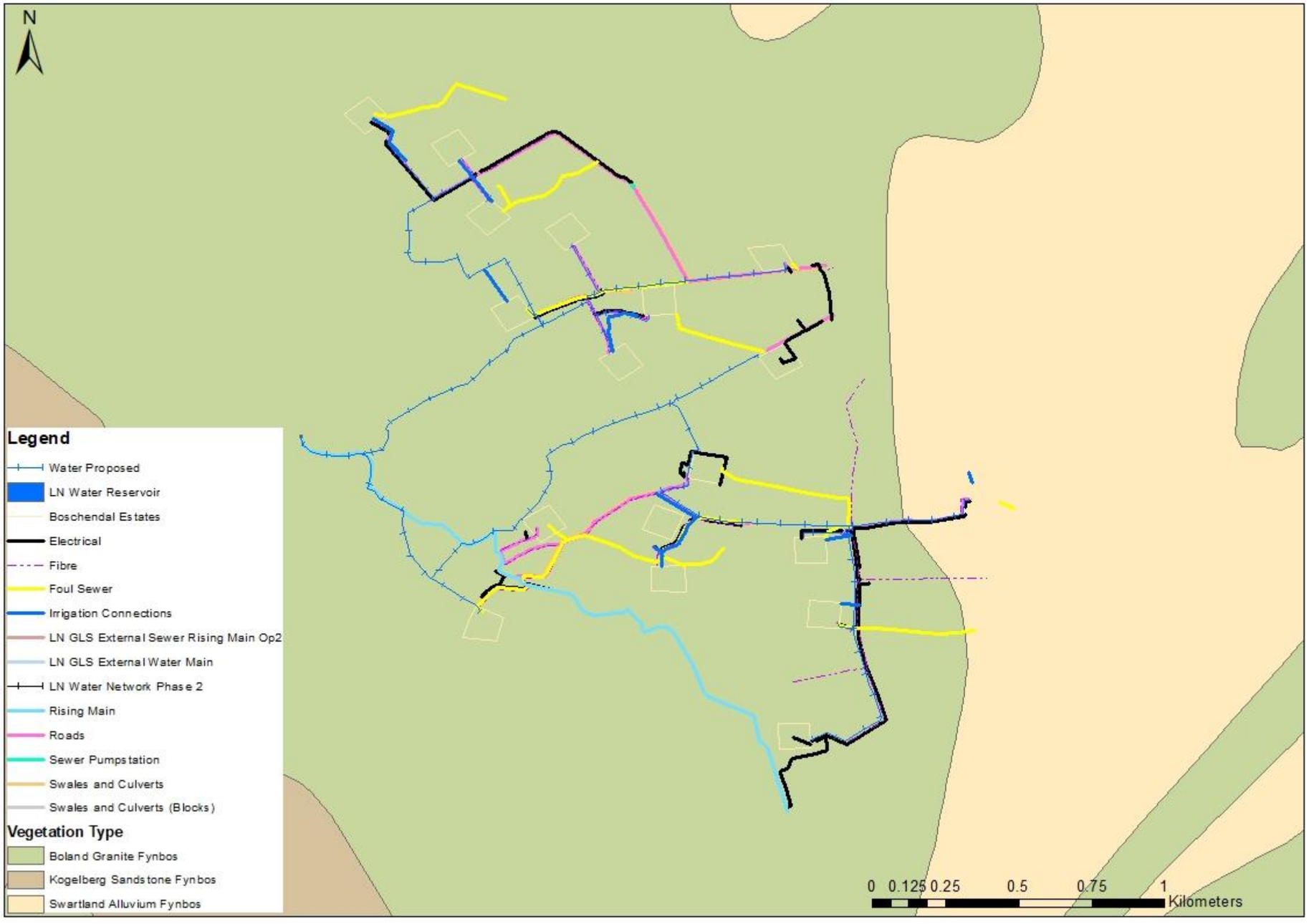

Figure 4.1: National Vegetation Map showing the project area as occurring within Boland Granite Fynbos and Swartland Alluvium Fynbos

4.3. Vegetation types recorded on site

The vegetation types recorded within the PAOI are:

- Intact Boland Granite Fynbos
- Degraded Boland Granite Fynbos
- Agricultural and Transformed Land

Intact Boland Granite Fynbos occurs along the western portion of the project site and along drainage lines and streams. This vegetation type is characterised by the presence of species such as *Cliffortia polygonifolia, Cliffortia ruscifolia, Dicerothamnus rhinocerotis, Helichrysum petiolar, Leucadendron salicifolium, Osteospermum moniloferum, Pelargonium alchemilloides, Stoebe plumsosum and Searsia angustifolia.* Trees and shrubs along the riparian areas include *Brabejum stellatifolium, Searsia angustifolia, Diospyros glabra* and often invasive species such as *Acacia mearnsii. Pteridium aquilinum* (bracken) typically occurs adjacent to riparian areas.

Within the intact patches are a few patches of Degraded Boland Granite Fynbos that have been infested with alien species and have been, or are in the process of, being cleared. These areas are often covered in large patches of *Pteridium aquilinum* (bracken), some indigenous species such as *Dicerothamnus rhinocerotis, Helichrysum petiolar, Osteospermum moniloferum* as well as saplings of invasive species such as *Acacia longifolia, Acacia mearnsii, Verbena bonariensis* and *Solanum mauritanium.*

The agricultural land is completely transformed and not representative of natural vegetation. Fallow areas are characterised by ruderal and grass species.

Project infrastructure has been designed to minimise the impact of the project on sensitive vegetation types. Linear infrastructure such as sewer lines, irrigation lines, electrical, fibre and roads have, where feasible, been placed along existing routes and through areas of low sensitivity. Areas where infrastructure traverses patches of natural vegetation have been highlighted in Table 4-1 and the estimated loss of vegetation calculated.

Table 4.1: Estimated loss of vegetation at the sites where the proposed infrastructure traverse's natural vegetation

Satellite Image	Comment
	Proposed Water Line will result in the disturbance of 0.12ha of Boland Granite Fynbos (413m x 3m wide construction footprint for the trench).
	The proposed waterline will result in the disturbance of 0.0152 ha (52m x 3m wide construction footprint for the trench).

	The foul sewer will result in the loss of 0.016 ha of Boland Granite Fynbos
	The waterline will result in the loss of 0.009 ha of Boland Granite Fynbos

	The Proposed infrastructure will result in the loss of 0.037 ha of Boland Granite Fynbos.

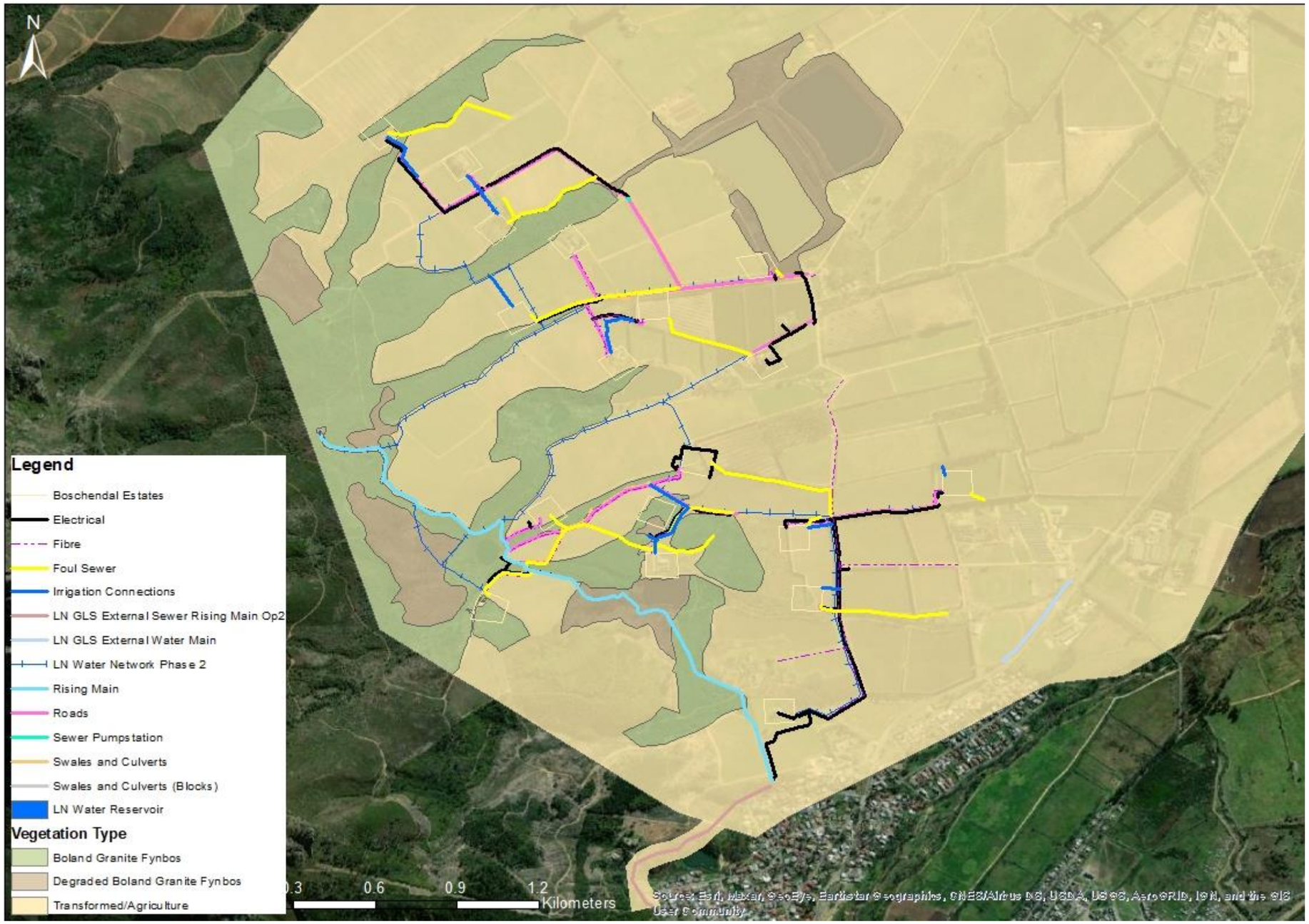

Figure 4.2: Vegetation map of the project area based on data collected from the field survey

4.4. Floristics

Fifty-nine species were recorded within the project area. Of these species, twelve alien invasive and/or ruderal species (Section 4.5), three species of conservation concern (section 4.4.2) and 46 indigenous species were recorded. Refer to Appendix 1 for a list of species recorded on site.

4.5. Species of Conservation Concern

4.5.1. Predicted Species of Conservation Concern

A list of species of conservation concern that could occur within the project site was compiled during the desktop study. This list draws on records from the POSA database, the DFFE screener and the baseline study undertaken by Helme (2019). A list of 105 species of conservation concern that were either critically endangered (CR), endangered (EN) or vulnerable (VU) and that could occur within the site was created. The likelihood of occurrence for each species was assessed by comparing the habitat preference of each species to the available habitat within the project area. Where there was a high likelihood of occurrence, the distribution of each species was also assessed. Of the 105 identified species, three were confirmed to occur on site, fourteen have a high likelihood of occurrence, 30 have a medium likelihood of occurrence and 58 have a low likelihood of occurrence.

Given the number of species that were assessed, the assessment for those that were either confirmed or have a high likelihood of occurrence have been included in Table 4.2. The assessment for species with a medium or low likelihood of occurrence have been included in Appendix 1.

Table 4.2: List of Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) species that have a high likelihood of occurrence on site or were confirmed to occur on site.

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
PROTEACEAE	*Protea burchellii*	VU	Confirmed	This species habitat is variable although it is associated with richer soils (Rebelo *et al.,* 2009). Helme (2019) notes that this species is common within Boschendal Estate on the alluvium east of Dwars River. This species was confirmed to occur within the intact fynbos.
POLYGALACEAE	*Muraltia alba*	Rare	Confirmed	This species occurs in fynbos and is associated with mountain slopes at altitudes of between 600-1732m
PROTEACEAE	*Protea acualos*	NT	Confirmed	This species is associated with sandy and alluvial soils on flats and lower slopes but can also be found in shale and granite fynbos (Rebelo *et al.*, 2019).

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
MALVACEAE	*Hermannia rugosa*	VU	High	This species has a high likelihood of occurrence as habitat is available on site.
ERICACEAE	*Erica filiformis var. filiformis*	VU	High	Suitable habitat is present for this species and as such the likelihood of occurrence is high.
Proteaceae	*Leucadendron daphnoides*	EN	High	Although suitable habitat exists, this species was not recorded within the impacted area. However, it was recorded by Helme (2019) on the slopes of Simonsberg on Boschendal Estate
Proteaceae	*Leucadendron lanigerum var. lanigerum*	EN	High	Although suitable habitat exists, this species was not recorded within the impacted area.
Proteaceae	*Leucospermum grandiflorum*	EN	High	Although suitable habitat exists, this species was not recorded within the impacted area. However, it was recorded by Helme (2019) on the slopes of Simonsberg on Boschendal Estate.
Proteaceae	*Leucospermum lineare*	VU	High	Although suitable habitat exists, this species was not recorded within the impacted area. However, it was recorded by Helme (2019) on the upper slopes of Simonsberg on Boschendal Estate.
Boraginaceae	*Lobostemon capitatus*	VU	High	This species occurs within the transition zone between fynbos and renosterveld and has a distribution that ranges from Porterville to Bredasdorp (Buys *et al.,* 2006). The likelihood of occurrence within the project area is therefore high.
GERANIACEAE	*Sensitive species 588*	EN	High	This species is associated with clay and granite slopes and flats in renosterveld (Raimondo *et al.,* 2007). Suitable habitat is available within the project are. The likelihood of occurrence is thus high.
Iridaceae	*Sensitive species 602*	EN	High	This species is associated with clay slopes in Renosterveld (Goldblatt *et al.*, 2007). Since this habitat is present the likelihood of occurrence is high.
ASTERACEAE	*Muraltia decipiens*	EN	High	This species was recorded by Helme (2019) on alluvium east of Dwars Rivier on Boschendal Estate. It is associated with clay flats and lower mountain

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				slopes. The likelihood of occurrence within the general project area is high.
RHAMNACEAE	*Phylica strigulosa*	VU	High	This species is associated with renosterveld and occurs on stony clay and sandstone slopes at low elevations of 30-760 m (Helme, 2006). Since habitat is available and the site intersects with this species' distribution, the likelihood of occurrence is high.
Proteaceae	*Protea scorzonerifolia*	VU	High	This species is typically limited to granite and shale soils on upper mountain slopes although it has also been recorded on sandstone where there are traces of clay soils (Rebelo *et al.*, 2005). This species was recorded by Helme (2019) on Boschendal Estate within the alluvium east of Dwars River.
PROTEACEAE	*Serruria gracilis*	VU	High	This species is associated with granite fynbos and has a distribution range that intersects with the project site (Rebelo *et al.*, 2015). Although not recorded within the project site the likelihood of occurrence is high.
PROTEACEAE	*Serruria kraussii*	VU	High	This species is associated with granite and sandstone soils and occurs between Helderberg and Jonkershoek (Rebelo *et al.,* 2009). Although available habitat is present the author is unaware of any collection records on the eastern slopes of Simonsberg Mountain. The likelihood of occurrence has therefore been rated as medium for this species.

4.5.2. Confirmed Species of Conservation Concern

Three species of conservation concern were recorded within the intact areas of vegetation. These are:

- *Protea burchelli* listed as Vulnerable
- *Muraltia alba* listed as Rare and
- *Protea acualis* listed as Near Threatened

Impacts on these species are mostly avoided as the only infrastructure through the intact area, is the proposed water pipeline in the west, and sewer and water pipeline crossings across drainage lines.

4.5.3. Species requiring permits

Although a species may not be considered species of conservation concern due to their red list status, a number of species still require permits for their removal and/or destruction. Permits can be applied for through the permitting office at Cape Nature. Species recorded on site that require permits have been listed in Table 4.3.

Table 4.3: Species recorded on site requiring permits for their removal and/or destruction

Family	Species	Red List	Western Cape Nature Conservation Law, 2000
Ericaceae	*Erica plukenetii*	LC	Schedule 4
Hyacinthaceae	*Lachenalia lutea*	LC	Schedule 4
Iridaceae	*Chasmanthe floribunda*	LC	Schedule 4
Proteaceae	*Leucadendron salicifolium*	LC	Schedule 4
Proteaceae	*Protea burchelli*	VU	Schedule 4
Proteaceae	*Protea nitida*	LC	Schedule 4
Proteaceae	*Brabejum stellatifolium*	LC	Schedule 4
Proteaceae	*Protea acaulis*	NT	Schedule 4
Proteaceae	*Protea cynaroides*	LC	Schedule 4
Iridaceae	*Watsonia marginata*	LC	Schedule 4

4.6. **Alien Species**

Seven alien invasive species classified as Category 1b on the National Environmental Management: Biodiversity Act (2004) Alien Invasive Species Lists, 2020 were recorded within the project area (refer to Table 4.4 for a list of species and Figure 4.9 for images of six of the seven species). Allowing the spread of a category 1b species is prohibited and as such the EMPr must include measures for removing the alien invasive species within the impacted areas.

Table 4.4: Alien invasive species recorded within the project area that will require removal

Family	*Species*	Category
Fabaceae	*Acacia mearnsii*	2
Fabaceae	*Acacia longifolia*	1b
Asteraceae	*Cirsium vulgare*	1b
Boraginaceae	*Echium plantagineum*	1b
Meliaceae	*Melia azedarach*	1b
Phytolaccaceae	*Phytolacca octandra*	1b
Pinaceae	*Pinus pinaster*	1b unless a heritage tree
Pittosporaceae	*Pittosporum undulatum*	1b
Salicaceae	*Populus canescens*	2
Solanaceae	*Solanum mauritianum*	1b
Verbenaceae	*Verbena bonariensis*	1b

Figure 4.3: Some of the alien invasive species recorded within the project area. A) *Acacia longifolia,* B) *Verbena bonariensis,* C) *Solanum mauritianum,* D) *Phytolacca octandra,* E) *Echium plantagineum* and F) *Pittosporum undulatum*

5. SENSITIVITY ASSESSMENT

5.1. Western Cape Biodiversity Spatial Plan

The Western Cape Biodiversity Spatial Plan (WCBSP, 2017) maps biodiversity priority areas, including Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) which require safeguarding to ensure the persistence of biodiversity and ecosystems functioning, through a systematic conservation planning process.

CBA's are defined as "*areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species*" (WCBSP Handbook, 2017). The provided map distinguishes between CBA 1 areas, which are those that are likely to be in a natural condition, and CBA 2 areas, which are areas that are potentially degraded or represent secondary vegetation.

ESA's are "*Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of Protected Areas (Pas) or CBAs and are often vital for delivering ecosystem services. They support landscape connectivity, encompass the ecological infrastructure from which ecosystem goods and services flow, and strengthen resilience to climate change*." ESA's should be maintained in a functional and natural state although some habitat loss may be acceptable. As with the CBAs, a distinction is made between ESA 1 that are areas in a natural, near natural or moderately degraded condition and ESA 2 which are degraded and need to be restored.

According to the WCBSP (2017), the footprint of the project infrastructure largely avoids small remnant patches of CBA1 areas and does not impact on any CBA2 areas (Figure 5.1).

The ESAs within the project site are mostly linked to streams and drainage lines. Linear infrastructure has been placed along existing roads and lines where feasible so as to avoid impacting biodiversity features. There are however some areas where this was not feasible and includes the crossing at FE 5 and FE 8. The desired management objectives of the affected biodiversity priority areas are tabulated in Table 5.1.

Table 5.1: Biodiversity priority areas affected by the project infrastructure

Category	Sensitivity Features	Desired Management Objective	Recommendation
CBA 1	Terrestrial	Maintain in a natural or near-natural state, with no further loss of habitat or species	Although CBAs are present, these appear as small fragments throughout the project site and project infrastructure has been designed to avoid these areas. Construction within CBAS that result in additional clearing of natural vegetation must be avoided where feasible.
ESA 1	Terrestrial	Maintain in a functional, near-natural state. Some habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.	Clearing of natural vegetation within ESAs has been largely avoided by placing infrastructure outside of these areas. Some areas designated as ESAs are currently completely transformed and only in these instances has infrastructure been situated within these areas with the exception of the crossings at FE 5 and 8.
ESA 2	Terrestrial	Restore and/or manage to minimize impact on ecological infrastructure functioning; especially soil and water-related services.	

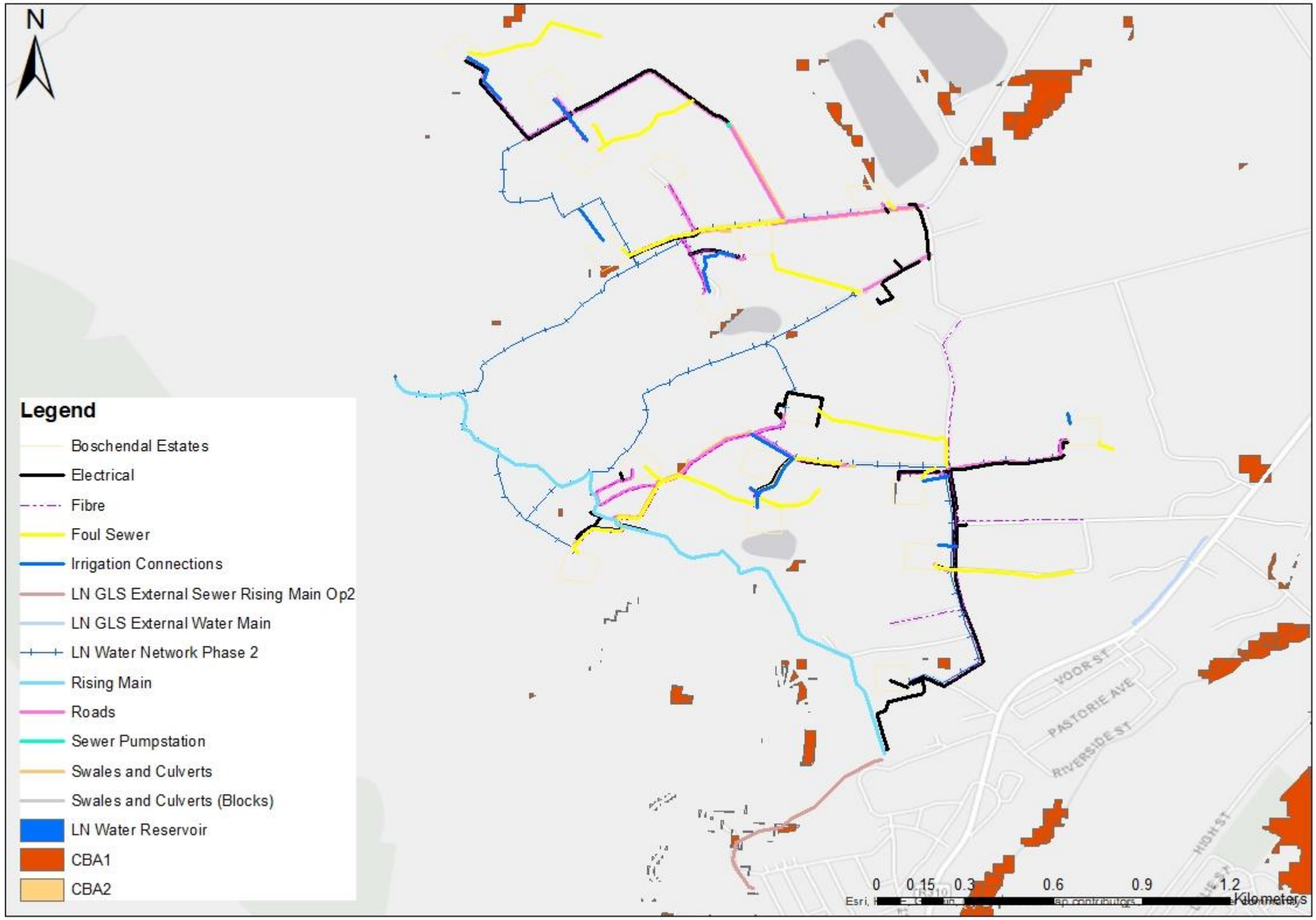

Figure 5.1: The project site in relation to identified CBAs

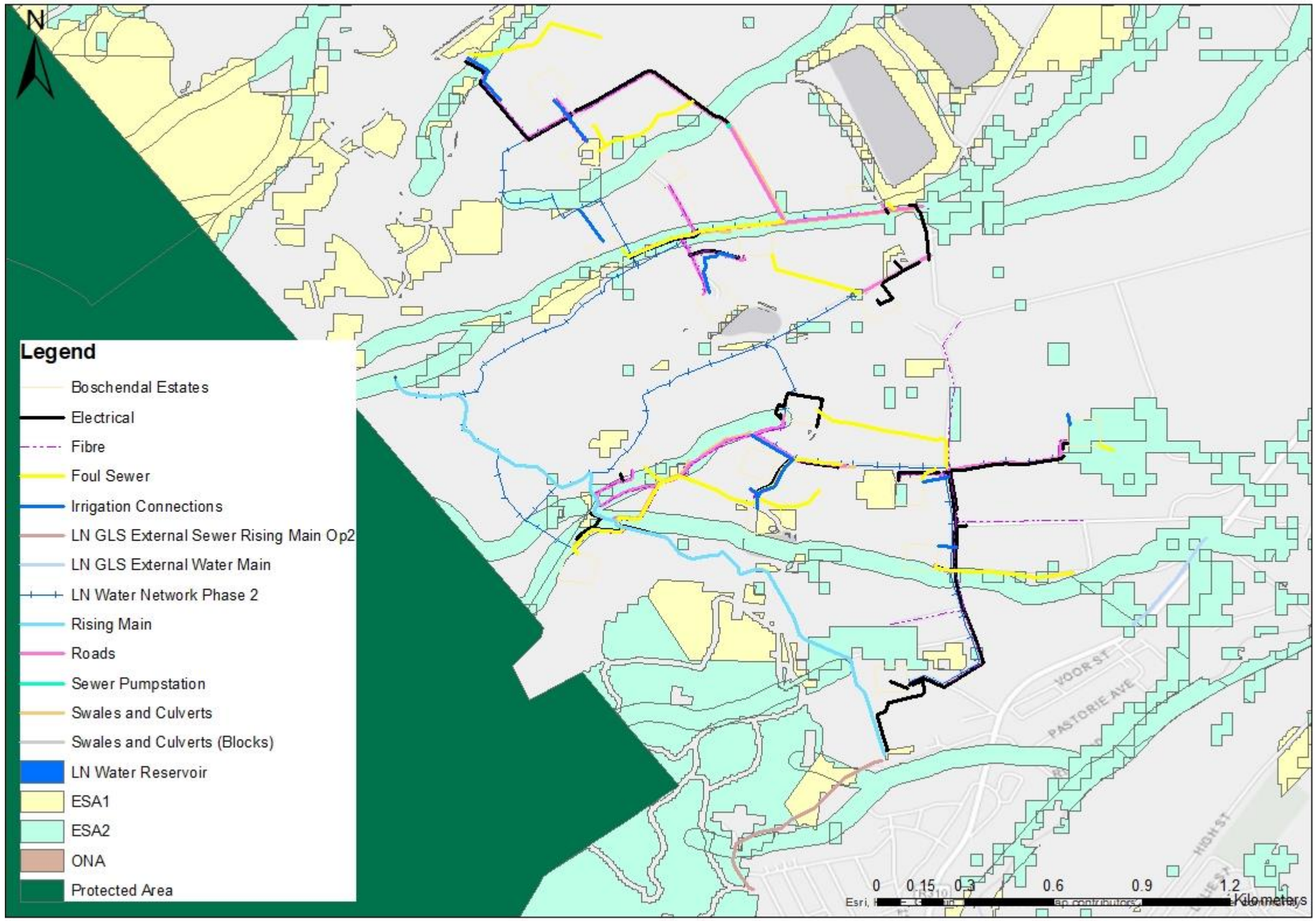

Figure 5.2: The project site in relation to identified ESAs and ONAs

5.2. Ecosystem Threat Status

According to the Western Cape Biodiversity Spatial Plan (2017), the threat status of the ecosystem (Boland Granite Fynbos) present within the project area is listed as Vulnerable. However, the NBA (2018) and the Red List of terrestrial Ecosystems of South Africa (2021) both list this vegetation type (Boland Granite Fynbos) as Endangered. The most recent listing, which is assumed to be the most up to date, has been applied and this vegetation type is considered Endangered.

5.3. Sensitivity Assessment

The Site Ecological Importance (SEI) was assessed for each vegetation type identified for the project site.

5.3.1. Degraded Boland Granite Fynbos

Degraded Boland Granite Fynbos was determined to have a high conservation importance (CI) due to the highly likely occurrence of populations of species of conservation concern and the vegetation type being listed as Endangered. This vegetation type is semi-intact with good habitat connectivity to intact patches of Boland Granite Fynbos and as such the Functional Integrity (FI) was determined to be medium.

The Species Environmental Assessment Guideline (2020) defines resilience as *"the estimated recovery time required to restore an appreciable portion of functionality to the receptor"*. It goes on to say that resilience is linked to a particular disturbance or impact and can therefore vary depending on the type of disturbance. Receptor resilience for this vegetation type was listed as medium as only pipelines, which have a small footprint, will cross through this vegetation type.

Degraded Boland Granite Fynbos is likely to recover to its current state relatively quickly (5-10 years), restoring species composition and functionality of the site if topsoil is replaced on the disturbed sites and the alien invasive species are removed from the area. Species diversity is likely to increase if alien species are managed as seed dispersal from the intact Boland Granite Fynbos to the west is possible.

Although this vegetation type has a high sensitivity due to its status of Endangered, the SEI specific to this project infrastructure, which has a small footprint and is of low impact, is rated as medium. However, if additional clearing occurs within this patch of vegetation, this score is likely to increase to high.

5.3.2. Intact Boland Granite Fynbos

The intact Boland Granite Fynbos is highly likely to support the occurrence of CR, EN and VU plant species (Refer to table 4.2 for a list of species that have a high likelihood of occurrence) and as such has a CI of Very High. FI is rated as Very High due to this vegetation being indigenous and forming an important corridor to the vegetation found on the Simonsberg Mountain range.

As with the degraded Boland Granite Fynbos, only pipelines with a relatively small footprint are anticipated to traverse these areas. Receptor Resilience for this type of infrastructure, which is typically low impact, is rated as high. Overall SEI for this vegetation type is very high.

5.3.3. Transformed Land

The agricultural land surrounding the near-intact and degraded Boland Granite Fynbos is classified as transformed and thus has a very low CI and medium FI. Receptor resilience is considered very high as this area can easily be rehabilitated back to its current state. Overall SEI is very low.

The method used to assess site sensitivity has been described in Section 2.4 above. Table 5.2 provides a summary of how each vegetation type was assessed and Figure 5.1 illustrates the sensitivity for each vegetation type.

Table 5.2: Evaluation of Site Ecological Importance (SEI) of habitat and SCC

Habitat / Species	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience	SEI
Degraded Boland Granite Fynbos	**High**	**Medium**	**Medium**	**MEDIUM**
	Highly likely occurrence of populations of species of conservation concern and the vegetation type, although degraded, is Endangered.	Semi-intact vegetation with good habitat connectivity and mostly minor current negative impacts.	Although habitat is degraded, it is still likely that SCC are present. Habitat is likely to recover slowly (more than 10 years) to restore 70% of original species composition	
Intact Boland Granite Fynbos	**Very High**	**High**	**Low**	**VERY HIGH**
	The intact Boland Granite Fynbos is highly likely to support the occurrence of CR, EN and VU plant species (Refer to Table 4.1). This vegetation type is also listed as Endangered.	This vegetation occurs on the lower slopes of the Simonsberg Mountains. The vegetation on the mid to upper slopes is indigenous although there is infestation of alien invasive plant species. This area has good habitat	Habitat is sensitive and is unlikely to recover fully after a relatively long period	

Habitat / Species	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience	SEI
		connectivity with functional ecosystems and there are limited signs of disturbance.		
Transformed /Agricultural Land	**Very Low**	**Medium**	**Very High**	**VERY LOW**
	No natural habitat remains in the transformed/ agricultiral areas and no confirmed populations of SCC and/or range restricted species are present.	Transformed agricultural land with low rehabilitation potential.	Habitat can be easily returned to its current state.	

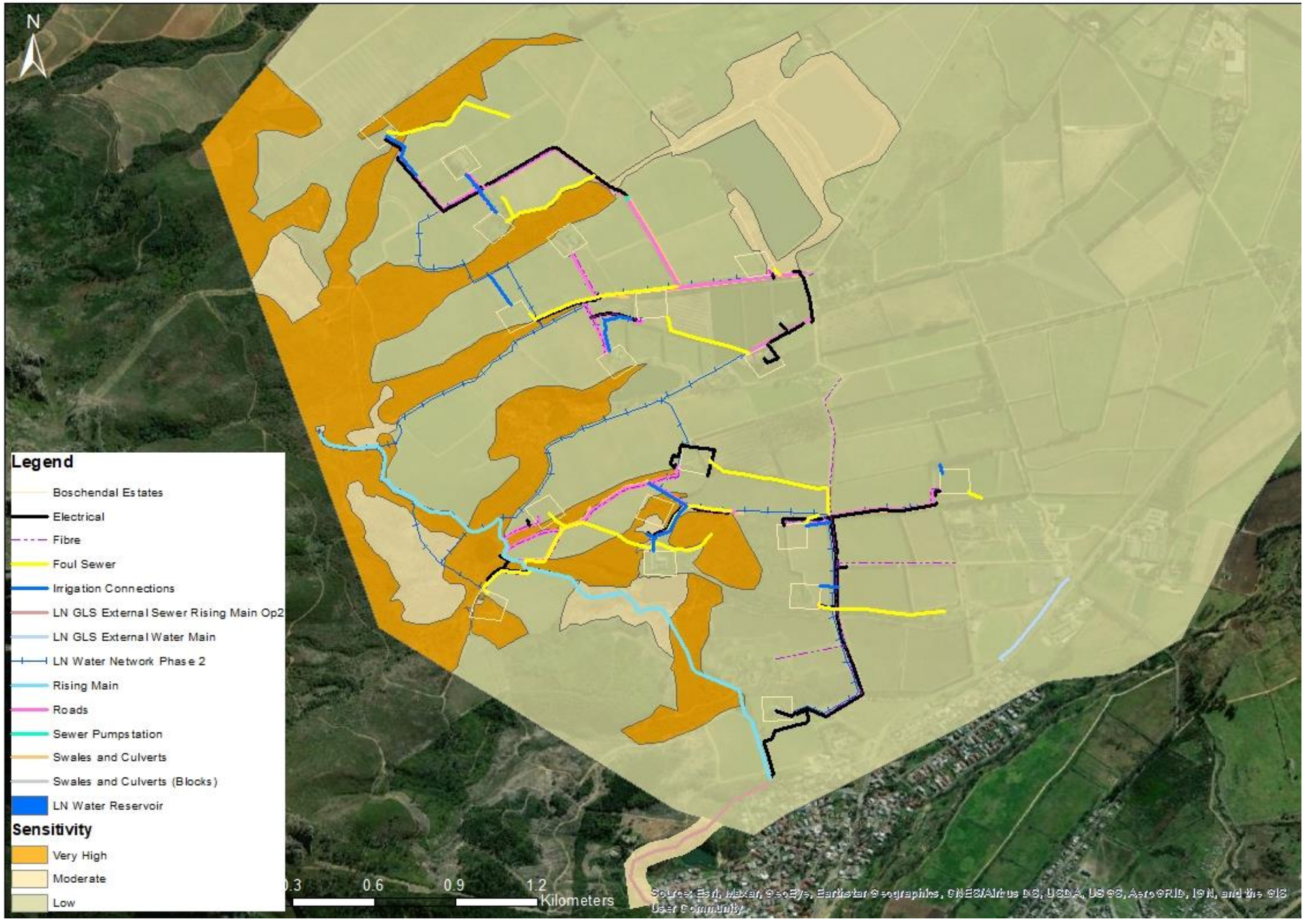

Figure 5.5: SEI map of the project area based on data collected from the field survey.

6. IMPACT ASSESSMENT

6.1. Construction and Operational Phase Impacts

Four impacts have been identified for the project. Two of these are of moderate significance prior to implementing mitigation measures and two of low significance. However, if the suggested mitigation measures are implemented, all impacts can be reduced to low significance.

Table 6.1: Construction phase impacts

Impact 1:	Loss of extent of Boland Granite Fynbos and Degraded Boland Granite Fynbos
Nature of impact and degree to which it can be avoided:	The clearing of vegetation for the laying of the proposed water pipeline, rising main and foul sewer and construction of the reservoir will result in the permanent loss of 0.1ha at the reservoir site and disturbance of 0.2 ha (0.07 ha footprint and an additional 0.14 ha construction footprint) of vegetation at the trench site where the sewer and water lines are laid. This accounts for 0.1% of the total remaining extent of this vegetation type within the Western Cape Province. The impact cannot be completely avoided but it can be minimised to reduce the residual impact.
Extent of impact:	Low
Duration of Impact:	High
Intensity (severity) of Impact:	Low Negative
Probability of occurrence:	High
Degree to which the impact can be reversed:	Reversible
Degree to which the impact may cause irreplaceable loss of resources:	Low
Cumulative impact prior to mitigation:	Given that the footprint of the development within intact vegetation is small, and 0.2ha of the impacted 0.3 ha can be restored, if the recommended mitigation measures are implemented, this impact can be reduced to low.
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Moderate
Degree to which the impact can be mitigated:	Medium
Proposed mitigation:	• Clearing of natural vegetation for the construction of the infrastructure must be kept to a minimum to reduce the impact of the project footprint. • It is recommended that the area is demarcated by the ECO prior to construction and areas outside of the demarcated footprint must not be impacted on, even to store spoil. • The proposed lines that occur within these vegetation types must be walked by a botanist prior to construction to identify any major concerns. • The botanist must perform a 'search-and-rescue' operation if required. • In areas of natural vegetation, the disturbed sites must be rehabilitated back to their original state. •

Degree to which the impact can be monitored	Achievable
Cumulative impact post mitigation:	Low
Significance rating of impact after mitigation (Residual Impact) (Low, Medium, Medium-High, High, or Very-High)	Low
Indirect Impacts	No indirect impacts on the vegetation type are expected
No-Go Alternative	If the project did not go ahead, there would be no loss of vegetation and the impact under the no-go alternative would be negligible.
Impact 2:	**Loss of Plant Species of Conservation Concern**
Nature of impact and degree to which it can be avoided:	There are three confirmed SCC that were recorded during the field survey. Additionally, fourteen have a high likelihood of occurrence within or adjacent to the site. The clearing of vegetation within the Boland Granite Fynbos will result in the loss of biodiversity and may result in the loss of some SCC. However, given that the infrastructure is located predominantly along existing roads and servitudes the loss of SCC is expected to be low. This impact can be avoided by implementing the mitigation measures such as the micro siting of infrastructure to avoid sensitive species.
Extent of impact:	Low
Duration of Impact:	Medium
Intensity (severity) of Impact:	Moderate Negative
Probability of occurrence:	Moderate
Degree to which the impact can be reversed:	Reversible
Degree to which the impact may cause irreplaceable loss of resources:	Low
Cumulative impact prior to mitigation:	The cumulative impact will be low given the small footprint of the infrastructure located within natural vegetation where SCC are located.
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Low
Degree to which the impact can be mitigated:	Medium
Proposed mitigation:	• Clearing of natural vegetation for the construction of the infrastructure must be kept to a minimum to reduce the impact of the project footprint. • It is recommended that the area is demarcated by the ECO prior to construction and areas outside of the

	demarcated footprint must not be impacted on, even to store spoil. • The proposed lines that occur within these vegetation types must be walked by a botanist prior to construction to identify any major concerns. Route adjustments must be made if populations of SCC will be negatively impacted. • The botanist must perform a 'search-and-rescue' operation if required. Given that the footprint of the development within intact vegetation is small, if the recommended mitigation measures are implemented this impact can be reduced to low.
Degree to which the impact can be monitored	Achievable
Cumulative impact post mitigation:	Low
Significance rating of impact after mitigation (Residual Impact)(Low, Medium, Medium-High, High, or Very-High)	Low
Indirect Impacts	No indirect impacts on SCC are expected.
No-Go Alternative	If the project did not go ahead, there may be some loss of SCC within this patch due to the displacement of species by alien invasive plant species. The impact under the no-go alternative would be low.
Impact 3:	**Disruption of Ecosystem Function and Process**
Nature of impact and degree to which it can be avoided:	Habitat fragmentation occurs when a large expanse or strip of habitat is transformed such that the natural landscape is cut into smaller patches that are isolated from each other resulting in a reduction in ecological functioning, species diversity and species richness. This impact occurs when areas are cleared resulting in reduced movement due to the absence of ecological corridors. The project infrastructure has been placed in a considered manner to avoid habitat fragmentation where feasible. Existing roads and infrastructure corridors have been used for the new infrastructure and this infrastructure has been largely placed in areas of low terrestrial ecological sensitivity to avoid impacts of high and very high significance. Only small sections of the proposed water, rising main and foul sewer will cross areas of intact vegetation and the footprint of this infrastructure is relatively small. As such, habitat fragmentation is considered to be low.
Extent of impact:	Low
Duration of Impact:	Low
Intensity (severity) of Impact:	Low Negative

Probability of occurrence:	Medium
Degree to which the impact can be reversed:	Reversible
Degree to which the impact may cause irreplaceable loss of resources:	Low
Cumulative impact prior to mitigation:	The cumulative impact will be low given the small footprint of the infrastructure located within natural ecosystems.
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Low
Degree to which the impact can be mitigated:	High
Proposed mitigation:	• Clearing of natural vegetation for the construction of the infrastructure must be kept to a minimum to reduce the impact of the project footprint. • It is recommended that the area is demarcated by the ECO prior to construction and areas outside of the demarcated footprint must not be impacted on, even to store spoil.
Degree to which the impact can be monitored	Difficult
Cumulative impact post mitigation:	Low
Significance rating of impact after mitigation (Residual Impact) (Low, Medium, Medium-High, High, or Very-High)	Low
Indirect Impacts	No indirect impacts are expected.
No-Go Alternative	If the project did not go ahead, there may be increased habitat fragmentation if the alien invasive plant species that are present were not managed. The impact under the no-go alternative would be low.

Table 6.2: Operational phase impacts

Impact 4:	Infestation of Alien Plant Species
Nature of impact and degree to which it can be avoided:	There are eleven alien invasive species present within the site. These are common in areas that have been recently disturbed such as along the access roads, paths and riparian areas. The construction of the infrastructure may open up new disturbed habitat which could exacerbated the level of infestation. Given that there are already alien invasive species present on site, this impact can't be avoided but it can be minimised by implementing the recommended mitigation measures.
Extent of impact:	Low
Duration of Impact:	Low
Intensity (severity) of Impact:	High Negative
Probability of occurrence:	High
Degree to which the impact can be reversed:	Reversible
Degree to which the impact may cause irreplaceable loss of resources:	High
Cumulative impact prior to mitigation:	Medium
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Moderate
Degree to which the impact can be mitigated:	High
Proposed mitigation:	• An alien invasive management plan must be included in the EMPr. • All category 1b species must be removed. The removal will need to be managed and maintained until these species have been eradicated. It is suggested that locally indigenous species specific to this vegetation type are planted in the gaps left by the removal of alien invasive plants. • No exotic species should be planted within intact patches of Boland Granite Fynbos.
Degree to which the impact can be monitored	Achievable
Cumulative impact post mitigation:	Medium
Significance rating of impact after mitigation (Residual) (Low, Medium, Medium-High, High, or Very-High)	The removal and management of alien invasive species is easily manageable and as such this impact is easily mitigated. Low
Indirect Impacts	If this impact is not mitigated it could result in the further spread of invasive species, particularly along watercourses.

No-Go Alternative	If the project did not go ahead, infestation of alien invasive plant species is likely to continue. The impact under the no-go alternative would be low negative.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Conclusions

The overall SEI was determined to be very high for the intact Boland Granite Fynbos and Medium for the disturbed Boland Granite Fynbos. Given the sensitivity of the vegetation type, which is listed as Endangered, the engineers have worked with the specialists to minimise the impact of the proposed development on the natural environment. This has been achieved by locating infrastructure within existing road servitudes and in areas that are transformed and/or disturbed.

It is estimated that the project infrastructure will result in the permanent loss of 0.1 ha (reservoir site) and disturbance of 0.2ha (infrastructure servitudes) of Boland Granite Fynbos at the sites where the trench is dug to lay the pipelines. This equates to 0.1% of the remaining extent of this vegetation type. Given that the infrastructure is predominantly located within existing road servitudes and in disturbed sites, the associated impacts on the vegetation and species of conservation concern will be low provided the recommended mitigation measures are implemented.

7.2. Recommendations

It is recommended that the following conditions are included in the Final EMPr as well as the conditions of the Environmental Authorisation (EA), if granted:

- All necessary plant permits must be obtained prior to the commencement of any construction activities.
- Clearing within the intact Boland Granite Fynbos must be kept to a minimum.
- Where feasible, laydown areas must be placed in previously disturbed sites. This is particularly relevant to the reservoir site.
- If any SCC are to be impacted, these must be relocated to nearest appropriate habitat.
- Where the service infrastructure crosses areas of natural habitat, it is recommended that the trenches are rehabilitated back to their original state.
- When digging trenches, the topsoil must be removed, stored and replaced once the infrastructure has been placed.
- Alien invasive plant clearing should be undertaken in line with an Alien Vegetation Management plan, which should be compiled as part of the EMPr and implemented with immediate effect.
- Trenches must be checked regularly (every 6 months until the site has been returned to 70% of its original state) for the presence of alien invasive species. When these are found, they must be immediately removed.
- Only indigenous plant species typical of the local vegetation and approved by a botanist should be used for the rehabilitation of natural habitat.

7.3. Ecological Statement and Opinion of the Specialist

Given that the footprint of the infrastructure within sensitive areas has been kept to a minimum and the resulting impacts are of a low significance, the specialist is of the opinion that the development can proceed provided the recommendations contained in this report are implemented.

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APPENDIX 1: LIST OF SPECIES RECORDED ON SITE

Family	Species	Red List	PNCO status
FABACEAE	*Acacia longifolia*	Weed	
FABACEAE	*Acacia mearnsii*	Weed	
RUTACEAE	*Adenandra marginata*	LC	
POACEAE	*Aristida sp.*		
FABACEAE	*Aspalathus ciliaris*	LC	
FABACEAE	*Aspalathus hirta*	LC	
ASPARAGACEAE	*Asparagus scandens*	LC	
ASTERACEAE	*Athanasia trifurcata*	LC	
PROTEACEAE	*Brabejum stellatifolium*	LC	Schedule 4
POACEAE	*Briza sp.*		
LAURACEAE	*Cassytha ciliolata*	LC	
IRIDACEAE	*Chasmanthe floribunda*	LC	Schedule 4
ASTERACEAE	*Cirsium vulgare*	weed	
ROSACEAE	*Cliffortia polygonifolia*	LC	
ROSACEAE	*Cliffortia ruscifolia*	LC	
CPERACEAEA	*Cyperis sp.*		
ASTERACEAE	*Dicerothamnus rhinocerotis*	LC	
EBENACEAE	*Diospyros glabra*	LC	
BORAGINACEAE	*Echium plantagineum*	weed	
ERICACEAE	*Erica plukenetii*	LC	Schedule 4
IRIDACEAE	*Geissorhiza aspera*	LC	Schedule 4
IRIDACEAE	*Gladiolus sp*		Schedule 4
ASTERACEAE	*Helichrysum cymosum*	LC	
ASTERACEAE	*Helichrysum petiolare*	LC	
MALVACEAE	*Hermannia hyssopifolia*	LC	
HYACINTHACEAE	*Lachenalia lutea*	LC	Schedule 4
PROTEACEAE	*Leucadendron salicifolium*	LC	Schedule 4
BORAGINACEAE	*Lobostemon fruticosus*	LC	
FABACEAE	*Lupinus angustifolium*	weed	
CELASTRACEAE	*Maytenus oleoides*	LC	
MELIACEAE	*Melia azedarach*	NE	
POACEAE	*Melinis repens*	LC	
ASTERACEAE	*Metalasia densa*	LC	
POLYGALACEAE	*Muraltia alba*	Rare	
POLYGALACEAE	*Muraltia heisteria*	Lc	
SCROPHULARIACEAE	*Oftia africana*	LC	
ASTERACEAE	*Osteospermum moniliferum*	LC	
GERANIACEAE	*Pelargonium alchemilloides*	LC	
GERANIACEAE	*Pelargonium capitatum*	LC	

GERANIACEAEA	*Pelargonium myrrhifolium cf. ssp myrrhifolium*	LC	
PHYTOLACCACEAE	*Phytolacca octandra*	Weed	
PINACEAE	*Pinus*	Weed	
PITTOSPORACEAE	*Pittosporum undulatum*	Weed	
FABACEAE	*Podalyria myrtillifolia*	LC	
SALICACEAE	*Populus canescens*	Weed	
PROTEACEAE	*Protea acaulis*	NT	Schedule 4
PROTEACEAE	*Protea burchelli*	VU	Schedule 4
PROTEACEAE	*Protea cynaroides*	LC	Schedule 4
PROTEACEAE	*Protea nitida*	LC	Schedule 4
DENNSTAEDTIACEAE	*Pteridium aquilinum*	LC	
ANACARDIACEAE	*Searsia angustifolia*	LC	
ANACARDIACEAE	*Searsia sp.*	LC	
ASTERACEAE	*Senecio pterophorus*	LC	
SOLANACEAE	*Solanum mauritianum*	Weed	
ASTERACEAE	*Stoebe plumosum*	LC	
VERBENACEAE	*Verbena bonariensis*	Weed	
IRIDACEAE	*Watsonia marginata*	LC	Schedule 4
ARACEAE	Zantedeschia aethiopica	LC	

APPENDIX 2: SPECIES LIKLIHOOD OF OCCURRENCE

Table 1: List of Critically Endangered, Endangered and Vulnerable species that have a medium and low likelihood of occurrence within the project site.

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
IRIDACEAE	Sensitive species 85	CR	Low	This species is associated with seasonally wet clay flats. The likelihood of occurrence within the project site is low due to the lack of available habitat.
AIZOACEAE	*Antimima aristulata*	VU	Low	There are fewer than 20 populations of this species remaining in severely fragmented habitats (Raimondo *et al.,* 2006). The survey of the patch of degraded Boland Fynbos that has been impacted by the infrastructure did not appear to have a succulent component present. This fairly small patch has had farming activities around it since at least the early 2000's but possibly as far back as the 1980's and has therefore been exposed to edge effects for some time.
RESTIONACEAE	*Cannomois arenicola*	EN	Low	This species is associated with coastal lowlands occurring on well drained sandy plains. The likelihood of occurrence within the project site is low as the required habitat is not available.
RESTIONACEAE	*Elegia squamosa*	EN	Low	This species has become very rare due to habitat loss. It is associated with seasonally damp clay flats and lower slopes with heavy soils. It is unlikely to occur within the impacted project site as no available habitat is present.
AIZOACEAE	*Erepsia patula*	VU	Low	Known from less than 10 locations between Wellington and Somerset West. There was no evidence of succulent species within or adjacent to the proposed project site and its likelihood of occurrence is thus low.
AIZOACEAE	*Erepsia ramosa*	VU	Low	Once fairly common, populations of this species have declined. This species occurs from Piketberg to the Cape Flats. There was no evidence of succulent species within or adjacent to the site and its likelihood of occurrence is this low.

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
ERICACEAE	*Erica abietina subsp. perfoliosa*	VU	Low	This localised species has an EOO of 11km^2 within the Jonkershoek Valley. It is associated with moist, lower south to southwest facing granite slopes. The project area faces east and is dry Boland Granite Fynbos and is therefore unlikely to provide suitable habitat for this species.
ERICACEAE	*Erica aspalathoides*	VU	Low	This species is typically found on the upper summit slopes of mountains and associated with damp, peaty overhangs and rocky ledges. The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
ERICACEAE	*Erica limosa*	VU	Low	This species is associated with peaty accumulate with quartzitic sands in seeps and wetlands. The likelihood of occurrence at the impacted sites is low due to the lack of suitable habitat.
IRIDACEAE	*Geissorhiza erosa*	EN	Low	This species is associated with damp clay flats. The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
IRIDACEAE	*Geissorhiza humilis*	VU	Low	This species is associated with fynbos, in coarse, sandy soils. The likelihood of occurrence is Medium although it should be noted that this species was not recorded by Helm in the 2019 baseline survey.
IRIDACEAE	*Gladiolus trichonemifolius*	VU	Low	This species is associated with wet sandy flats. The likelihood of occurrence within the infrastructure footprint is low.
ISOETACEAE	*Isoetes capensis*	EN	Low	This species occurs within seasonally flooded depressions and in pools on flats with sandy clay soils. The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
IRIDACEAE	*Ixia erubescens*	EN	Low	This species is associated with seasonally damp, heavy clay or granitic alluvium. The likelihood of occurrence the infrastructure footprint is low due to the lack of suitable habitat.
IRIDACEAE	*Ixia rouxii*	CR	Low	Although this species used to occur from Porterville to Stellenbosch, only fragmented populations remain near

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				Wellington and Wolseley. As such this species is unlikely to occur within the impacted area.
IRIDACEAE	*Ixia sarmentosa*	EN	Low	This species is associated with seasonally wet, lowland flats and slopes. The likelihood of occurrence the infrastructure footprint is low due to the lack of suitable habitat.
HYACINTHACEAE	*Lachnaea capitata*	VU	Low	This species is associated with acid sand flats that are seasonally damp. The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
AIZOACEAE	*Lampranthus filicaulis*	VU	Low	This species is associated with seasonally wet alluvial sands overlaying koffieklip. The likelihood of occurrence within the infrastructure footprinty is low due to the lack of suitable habitat.
AIZOACEAE	*Lampranthus glaucus*	VU	Low	This species is associated with seasonally waterlogged acid sands. The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
AIZOACEAE	*Lampranthus schlechteri*	CR	Low	This species is associated with sandy flats in Swartland Alluvium Fynbos (Klak *et al.*, 2012). The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
AIZOACEAE	*Lampranthus sociorum*	EN	Low	The project area does not occur within the species' distribution range.
PROTEACEAE	*Leucadendron argenteum*	EN	Low	This species is associated with moist, south-facing slopes. Since project site faces east it is unlikely that this species is or was present.
PROTEACEAE	*Leucadendron corymbosum*	VU	Low	This species is associated with wet clay soils in valley bottoms. The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
PROTEACEAE	*Leucospermum hypophyllocarpodendron subsp. canaliculatum*	VU	Low	This species is associated with flats with deep sandy soils at elevations between 0 and 200m. The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
BORAGINACEAE	*Lobostemon regulareflorus*		Low	This species is associated with moist, shaded kloofs. The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
ASTERACEAE	*Metalasia capitata*	VU	Low	This species is associated with acid sand flats. The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
OXALIDACEAE	Oxalis strigosa	EN	Low	This species is known from two localities between Tygerberg and Stellenbosch (Helme *et al.*, 2012). It's likelihood of occurrence within the project site is thus low.
POACEAE	*Pentameris bachmannii*	EN	Low	This species is associated with seasonally waterlogged sands and shales on lowlands (Raimondo and Helme, 2007). The likelihood of occurrence within the infrastructure footprint is low.
FABACEAE	*Podalyria argentea*	EN	Low	This species is associated with wet, peaty soil (Schutte-Vlok, and Raimondo, 2012). The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
FABACEAE	*Podalyria sericea*	VU	Low	This species is associated with granite outcrops on well-drained, humic, sandy loams (Schutte-Vlok, and Raimondo, 2012). The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
PROTEACEAE	*Protea rupicola*	EN	Low	This species is associated with high altitude summit ridges occurring in rocky cracks and crevices where it is protected from fire. The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
FABACEAE	*Psoralea alata*	VU	Low	This species is associated with seasonally damp clay soils on lowland and flat areas (von Staden and Helme, 2012). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
RESTIONACEAE	*Restio paludosus*	VU	Low	This species is associated with seasonally wet sands (Turner et al., 2007). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
RESTIONACEAE	*Restio papillosus*	VU	Low	This species is associated with coastal flats and slopes occurring on sand and clay soil (Turner, 2007). Given that the site is not located near the coast, the likelihood of occurrence is low.
RESTIONACEAE	*Restio pratensis*	EN	Low	This species is associated with seasonally waterlogged areas (Turner and Linder, 2007). Given that the site is typically dry due to its position on the slope, the

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				likelihood of occurrence is low due to the lack of suitable habitat.
RESTIONACEAE	*Restio rigoratus*	EN	Low	This species is associated with seasonally waterlogged areas that typically overlay shale or ferricrete (Helme et al., 2014). Given that the site is typically dry due to its position on the slope, the likelihood of occurrence is low due to the lack of suitable habitat.
AIZOACEAE	*Ruschia geminiflora*	VU	Low	This species is associated with clay flats and alluvial sands, neither of which are present within the project site (Helme *et al.,* 2008). Additionally, there was no succulent component observed within the project area or surrounds during the field survey. As such the likelihood of occurrence is low.
AIZOACEAE	*Ruschia schollii*	EN	Low	This species is associated with lowland shale and granite derived soils (Helme and von Staden, 2006). Although habitat for this species is present, there was no succulent component observed within the project area or surrounds during the field survey. As such the likelihood of occurrence is low.
	Sensitive species 293	EN	Low	Although suitable habitat is available, this species is currently only known from two sub-populations. Since the project site is outside of this species known range, the likelihood of occurrence within the project area is low.
	Sensitive species 299	CR	Low	This species is currently restricted to the area between Wellington and Ceres (von Staden *et al.*, 2012). Since the project area occurs outside of the known distribution, the likelihood of occurrence is low.
HYACINTHACEAE	Sensitive species 526	EN	Low	This species is associated with seasonally moist, stony clay flats renosterveld (Von Satden *et al., 2019)*. The likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
	Sensitive species 599	VU	Low	This species is associated with seasonally wet flats in sandy soil or rocky alluvium (Goldblatt and Raimondo, 2006). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
	Sensitive species 640	VU	Low	This species is associated with seasonally damp depressions at elevations below

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				300m (Koopman and Raimondoa, 2008). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
	Sensitive species 666	VU	Low	This species is associated with shales and sandy flats (von Staden, 2018). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
	Sensitive species 697	EN	Low	This species is associated with grassy renosterveld (Raimondo and Helme, 2007). Since the vegetation present was predominantly fynbos with some renosterveld elements, the likelihood of occurrence of this species within the project area is low.
	Sensitive species 718	VU	Low	This species is associated with moist flats and slopes in coarse, often stony, sandstone-derived soils (von Staden, 2006). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
IRIDACEAE	Sensitive species 72	VU	Low	The likelihood of this species occurring within the project area is low as it is outside of its known distribution. This species is known to occur in the hills between Darling and Mamre as well as the Tulbagh Valley. There are some isolated records from Wellington, Klapmuts and Bottelary Hills.
	Sensitive species 764	CR	Low	This species occurs within granite derived gritty clay and is typically associated with renosterveld (Dorse *et al.,* 2006). This species is only known from two locations, one near Stellenbosch and one near Bottelary Hills, and has a very small EOO 20km^2. The likelihood of occurrence at the impacted site is therefore low.
	Sensitive species 772	CR	Low	This species is associated with seasonally wet clay and loamy alluvial flats (Goldblatt et al., 2013). Although this species was recorded by Helme (2019) on alluvium east of Dwars River, the likelihood of occurrence within the infrastructure footprint is low due to the lack of suitable habitat.
IRIDACEAE	Sensitive species 78	EN	Low	This species is typically found between Malmesbury and Darling and is only know from four locations. The likelihood

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				of it occurring within the project site is low.
	Sensitive species 96	EN	Low	This species is associated with seasonally moist areas on clay flats and slopes within renosterveld and shale fynbos. The likelihood of occurrence within the project site is low as the required habitat is not available.
PROTEACEAE	*Serruria pinnata*	CR	Low	This species is associated with alluvial fynbos on the lowlands adjacent to renosterveld (Rebelow *et al., 2015).* There are fewer than 20 mature individuals remaining in three isolated populations. Given this specie's status it is unlikely to occur within the project area.
Proteaceae	*Serruria stellata*	VU	Low	This species is associated with high altitude sandy flats (Rebelo *et al.,* 2019). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
Aizoaceae	*Skiatophytum skiatophytoides*	VU	Low	This species is associated with lowland coastal fynbos (von Staden *et al.,* 2016). Since the project site is not near the coast, the likelihood of occurrence is low.
Aizoaceae	*Skiatophytum tripolium*	VU	Low	This species is associated with lowland coastal fynbos (von Staden *et al.,* 2016). Since the project site is not near the coast, the likelihood of occurrence is low.
CYPERACEAE	*Trianoptiles solitaria*	EN	Low	This species is associated with damp depressions in acidic sand (von Witt et al., 2015). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
HAEMODORACEAE	*Wachendorfia brachyandra*	VU	Low	This species is associated with damp sandstone or granites (Raimondo et al., 2007). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
FABACEAE	*Xiphotheca reflexa*	EN	Low	This species is associated with sandy plains (Victor *et al.,* 2005). The likelihood of occurrence at the impacted site is low due to the lack of suitable habitat.
APONOGETONACEAE	*Aponogeton angustifolius*	NT	Medium	This species is localised to seasonal streams and wetlands (Mitshali *et al.,* 2009). It might occur within the farm dams. However, if it does, it will not be impacted by project activities.
ASTERACEAE	*Arctotis angustifolia*	EN	Medium	This species is typically associated with Lowland acid fynbos, below 100 m.

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				Although found on Boschendal Estate (Helme, 2019) it was associated with alluvium east of the Dwars River. The likelihood of occurrence within the project site is medium.
ASTERACEAE	*Arctotis angustifolia*	CR	Medium	Only two known and severely fragmented populations remain (Helme *et al.,* 2009). This species was recorded east of the Dwars Rivier by Helme (2019). The likelihood of occurrence within the project site, which is located west of Dwars Rivier, is Medium.
IRIDACEAE	*Aristea lugens*	EN	Medium	Over 90% of this species habitat has been lost and it is now found in agricultural and urban areas (Raimondo, 2006). This species occurs on Renosterveld in low granitic hills and there is therefore a medium likelihood of occurrence at the project site.
FABACEAE	*Aspalathus aculeata*	VU	Medium	This species prefers nutrient rich soils and is dependent on fires for regeneration. There are an estimated 36 small, severely fragmented subpopulations remaining. Approximately 80 to 90% of this species' habitat has been lost to agricultural and urban expansion and urban expansion. It is likely this species was once present on site but its likelihood of occurrence within the impacted areas, is medium. This species was not recorded by N. Helme (2019) within the Boschendal Estate.
FABACEAE	*Aspalathus araneosa*	VU	Medium	This species was formerly once quite common but now less than ten populations remain. It is likely that this species occurs within the intact Boland Granite Fynbos on the slopes of the mountain above the area that will be impacted by project infrastructure. This likelihood drops to medium for the impacted areas which have been exposed to edge effects for a number of years and shows infestation of alien and ruderal species. This species was not recorded by N. Helme (2019) within the Boschendal Estate.
FABACEAE	*Aspalathus attenuata*	EN	Medium	This species is known from five locations and is threatened by the loss of habitat for cultivation of vineyards, wheat and deciduous fruit. It is possible that this species occurs within the intact Boland Granite Fynbos on the slopes of the

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				mountain above the proposed development but this likelihood drops to medium for the impacted areas. This species was not recorded by N. Helme (2019) within the Boschendal Estate.
FABACEAE	*Aspalathus lebeckioides*	VU	Medium	This species is known from fewer than 10 locations and is threatened by the loss of habitat for the cultivation of vineyards, wheat and deciduous fruit and infestation of alien species. It is possible that this species occurs within the intact Boland Granite Fynbos on the slopes of the mountain above the project site but this likelihood drops to medium for the proposed development sites. This species was not recorded by N. Helme (2019) within the Boschendal Estate.
FABACEAE	*Aspalathus muraltioides*	EN	Medium	This species is known from fewer than 7 locations and is threatened by the loss of habitat. It is possible that this species occurs within the intact Boland Granite Fynbos on the slopes of the mountain above the development site but this likelihood drops to medium for the proposed project sires which have been exposed to edge effects for a number of years and shows infestation of alien and ruderal species. It should also be noted that previous studies did not record this species within the Boschendal Estate (Helme, 2019).
ROSACEAE	*Cliffortia phillipsii*	VU	Medium	Fewer than five populations are known, two of which are extinct. It is possible that this species occurs within the intact Boland Granite Fynbos on the slopes of the mountain above the proposed development but this likelihood drops to medium for the proposed site which has been exposed to edge effects for a number of years and shows infestation of alien and ruderal species. It should also be noted that previous studies did not record this species within the Boschendal Estate (Helme, 2019).
IRIDACEAE	*Codonorhiza azurea*	EN	Medium	There are 13 to 15 populations of this species that remain between Stellenbosch, Malmesbury and Saron. This species is locally extinct on the Cape Peninsula. It is possible that this species occurs within the intact Boland Granite Fynbos on the slopes of the mountain above the impacted site but this

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				likelihood drops to medium for the proposed project site which has been exposed to edge effects for a number of years and shows infestation of alien and ruderal species which are likely to have displaced it.
PROTEACEAE	*Diastella buekii*	CR	Medium	Three to four populations remain within the Berg River Valley between Franschhoek and Paarl. This species is associated with moist areas on alluvial sandy flats. This species likelihood of occurrence is Medium within the low lying areas.
AIZOACEAE	*Drosanthemum hispifolium*	VU	Medium	This species occurs from Clanwilliam to Koeberg and is associated with flats in loamy soil. Its likelihood of occurrence is medium.
HYACINTHACEAE	*Lachnaea uniflora*	VU	Medium	This species is associated with sandy flats and sandy areas on lower mountain slopes (Helme *et al., 2006).* Helme (2019) recorded this species on alluvium on Boschendal Estate and as such the likelihood of occurrence is medium.
AIZOACEAE	*Lampranthus dilutus*	EN	Medium	The survey of the areas where the proposed infrastructure will be located did not appear to have a succulent component present. Further to this, a previous baseline survey undertaken by Helme (2019) did not record this species within the Boschendal Estate. The likelihood of occurrence of this species at the site is Medium.
AIZOACEAE	*Lampranthus peacockiae*	VU	Medium	The survey of the areas where the proposed infrastructure will be located did not appear to have a succulent component present. Further to this, a previous baseline survey undertaken by Helme (2019) did not record this species within the Boschendal Estate. The likelihood of occurrence of this species at the site is Medium.
PROTEACEAE	*Leucospermum gueinzii*	EN	Medium	This species is associated with granite-derived clay soils near streams and in kloofs, 300-1000 m. The likelihood of occurrence of this species within the areas that will be impacted by project infrasturcture is medium. Further to this, a previous baseline survey undertaken by Helme (2019) did not record this species within the Boschendal Estate
ASTERACEAE	*Muraltia macropetala*	VU	Medium	This species is associated with clay flats in renosterveld and Boland Granite

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				Fynbos. However, this species was not recorded during the field survey nor was it recorded in the baseline survey for Boschendal undertaken by Helme (2019). The likelihood of occurrence is therefore Medium.
FABACEAE	*Otholobium rotundifolium*	VU	Medium	This species is associated with montane fynbos occurring on granite and shale slopes (Helme and Raimondo, 2005). Although habitat exists for this species within the project site, it was not recorded during the field survey nor in the baseline survey of Boschendal Estate undertaken in 2019 (Helme, 2019). The likelihood of occurrence within the site is therefore Medium.
RHAMNACEAE	*Phylica thunbergiana*	EN	Medium	This species is associated with renosterveld, on lower clays slopes and flats (Raimondo and Helme, 2006). Although there are elements of Renosterveld present within the site, the project area is primarily comprised of fynbos. This species is also known from only 10 small, fragmented populations. The likelihood of occurrence of this within the project site is therefore listed as medium
PROTEACEAE	*Protea lacticolor*	VU	Medium	This species is associated with high altitude shale bands on south and east facing slopes. It typically occurs along stream banks (Rebelo et al., 2019). Although the slope of the project site is east facing, the likelihood of occurrence of this species is medium.
FABACEAE	*Psoralea fascicularis*	EN	Medium	This species is associated with moist areas of lowland fynbos that occur on granite and shale (Stirton *et.al.,* 2018). The likelihood of occurrence is Medium.
RESTIONACEAE	*Restio duthieae*	VU	Medium	This species is associated with slight seepages on loamy soils derived from granites or coastal sand (Raimondo and Turner, 2007). It may be possible that localised populations of this species exist where there are seeps present.
RUSCACEAE	*Sensitive species 364*	VU	Medium	This species occurs from the Cape Flats to Vanrhynsdorp but populations in the southern range of its extent are mostly extinct (Helme and Raimondo, 2007). The likelihood of occurrence within the general project area is Medium.
IRIDACEAE	Sensitive species 458	VU	Medium	This species is associated with clay flats and lower slopes. It is only know from

Family	*Scientific Name*	Red List Status	Probability of occurrence on site	Comment
				eight locations (Raimondo and Goldblatt, 2006). The likelihood of occurrence within the impacted area is medium.
GERANIACEAE	Sensitive species 676	VU	Medium	This species is associated with loamy alluvial sands, and clay flats and its distribution range coincides with the project area (Helme and von Satden, 2013). This species was recorded by Helme (2019) on alluvium east of Dwars River. Since this species is also associated with clay the likelihood of occurrence at the project site has been rated as medium.
GERANIACEAE	Sensitive species 690	VU	Medium	This species is associated with clay flats (Raimondo and Helme, 2007). The likelihood of occurrence of this species has been rated as medium.
ASPHODELACEAE	Sensitive species 744	VU	Medium	This species is associated with damp, loamy sands and typically occurs on the lower mountain slopes and flats. The likelihood of occurrence is medium.
IRIDACEAE	Sensitive species 766	EN	Medium	Although suitable habitat is present for this species, it is only known from five locations which include the lower slopes of Paarl Mountain, Breede River Valley and Du Toits Kloof. It is unlikely that this species occurs within the project site and the likelihood of occurrence is conservatively rated as medium.
FABACEAE	*Xiphotheca lanceolata*	VU	Medium	This species is associated with renosterveld-fynbos mosaic (van der Colff *et al.,* 2015). The likelihood of occurrence within the project site is therefore medium.

APPENDIX 3: IMPACT ASSESSMENT METHODOLOGY

EVALUATION METHODS FOR ENVIRONMENTAL IMPACTS

The evaluation method for determining significance of impacts is shown below.[1]

Note that an adjustment was made, which involved changing the consequence column to the significance column, due to the fact that probability should not necessarily determine significance, as, for example, catastrophic events would be highly significant, even though the probability of such an event occurring is low.

Definitions of or criteria for environmental impact parameters

The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the consequence of such an impact occurring before and after implementation of proposed mitigation measures.

(a) Extent (spatial scale):

Ranking criteria

L	M	H
Impact is localized within site boundary	Widespread impact beyond site boundary; Local	Impact widespread far beyond site boundary; Regional/national

Take into consideration:
- Access to resources; amenity
- Threats to lifestyles, traditions and values
- Cumulative impacts, including possible changes to land uses at and around the site.

(b) Duration:

Ranking criteria

L	M	H
Quickly reversible, less than project life, short term (0-5 years)	Reversible over time; medium term to life of project (5-15 years)	Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources

Take into consideration:
- Cost – benefit economically and socially (e.g. long or short term costs/benefits)

(c) Intensity (severity):

Type of Criteria	Negative			Positive		
	H-	M-	L-	L+	M+	H+
Qualitative	Substantial deterioration, death, illness or injury, loss of habitat/diversity or resource, severe alteration or disturbance of important processes.	Moderate deterioration, discomfort, Partial loss of habitat/biodiversity/resource or slight or alteration	Minor deterioration, nuisance or irritation, minor change in species/habitat/ diversity or resource, no or very little quality deterioration.	Minor improvement, restoration, improved management	Moderate improvement, restoration, improved management, substitution	Substantial improvement, substitution
Quantitative	Measurable deterioration Recommended level will often be violated (e.g. pollution)	Measurable deterioration Recommended level will occasionally be violated	No measurable change; Recommended level will never be violated	No measurable change; Within or better than recommended level.	Measurable improvement	Measurable improvement
Community response	Vigorous	Widespread complaints	Sporadic complaints	No observed reaction	Some support	Favourable publicity

[1] (Adapted from T Hacking, AATS – Envirolink, 1998: An innovative approach to structuring environmental impact assessment reports. In: IAIA SA 1998 Conference Papers and Notes

Take into consideration:

- Cost – benefit economically and socially (e.g. high nett cost = substantial deterioration)
- Impacts on human-induced climate change
- Impacts on future management (e.g. easy/practical to manage with change or recommendation)

(d) Probability of occurrence:

Ranking criteria

L	M	H
Unlikely; low likelihood; Seldom No known risk or vulnerability to natural or induced hazards.	Possible, distinct possibility, frequent Low to medium risk or vulnerability to natural or induced hazards.	Definite (regardless of prevention measures), highly likely, continuous High risk or vulnerability to natural or induced hazards.

The specialist study must attempt to quantify the magnitude of impacts and outline the rationale used. Where appropriate, international standards are to be used as a measure of the level of impact.

(e) Status of the impact:

Describe whether the impact is positive, negative or neutral for each parameter. The ranking criteria are described in negative terms. Where positive impacts are identified, use the opposite, positive descriptions for criteria.

Based on a synthesis of the information contained in (a) to (e) above, the specialist will be required to assess the significance of potential impacts in terms of the following criteria:

(f) Significance: (Duration X Extent X Intensity)

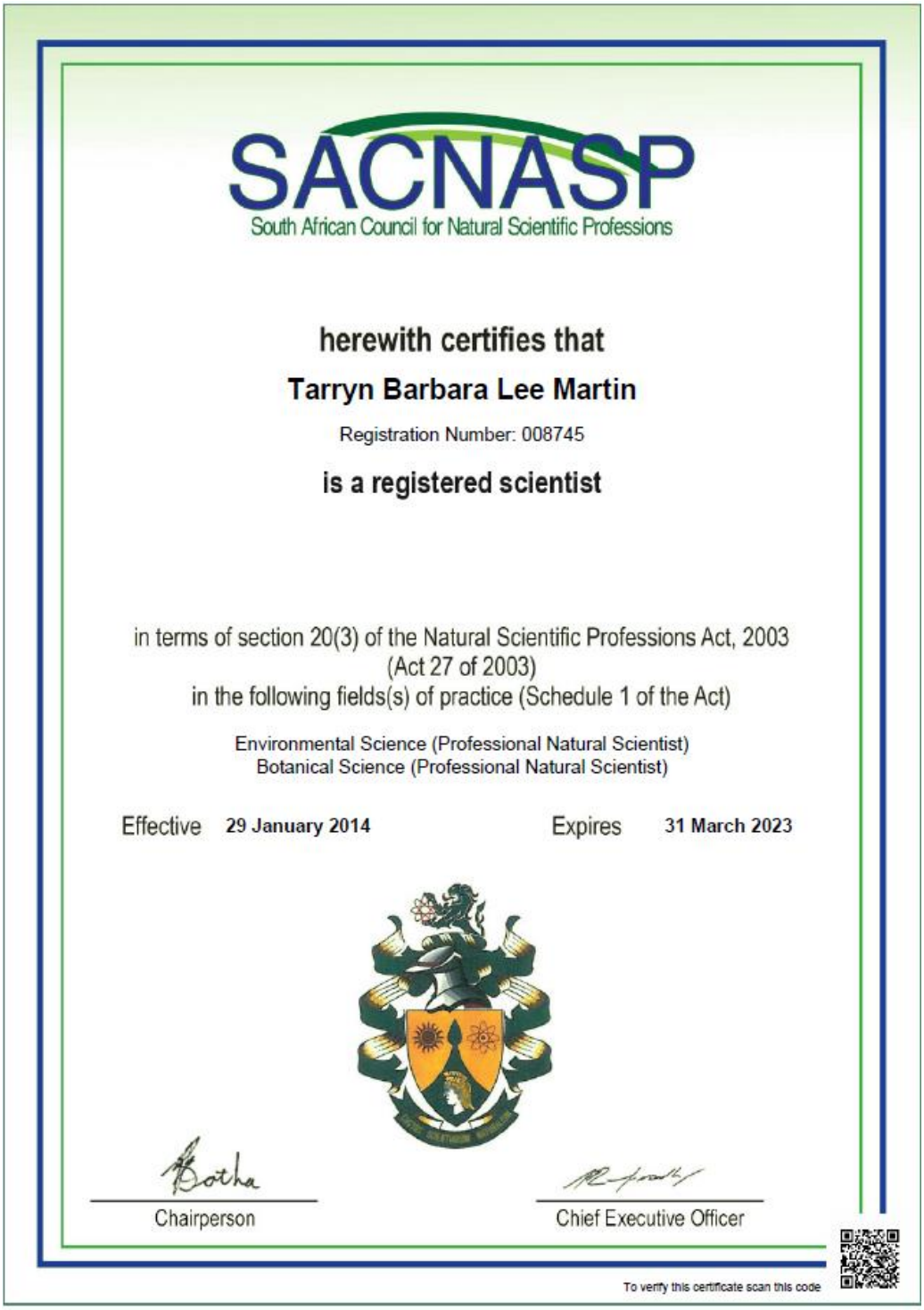
Intensity = L				
Duration	**H**			
	M			Medium
	L	Low		
Intensity = M				
Duration	**H**			High
	M		Medium	
	L	Low		
Intensity = H				
Duration	**H**			
	M			High
	L	Medium		
		L	M	H
		Extent		

Positive impacts would be ranked in the same way as negative impacts, but result in high, medium or low positive consequence.

(g) Degree of confidence in predictions:

State the degree of confidence in the predictions, based on the availability of information and specialist knowledge.

APPENDIX 5: PROOF OF SACNASP REGISTRATION AND HIGHEST QUALIFICATION



SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Tarryn Barbara Lee Martin

Registration Number: 008745

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Environmental Science (Professional Natural Scientist)
Botanical Science (Professional Natural Scientist)

Effective **29 January 2014** Expires **31 March 2023**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

RHODES UNIVERSITY

THIS IS TO CERTIFY THAT

TARRYN BARBARA LEE MARTIN

WAS THIS DAY AT A CONGREGATION OF THE UNIVERSITY
ADMITTED TO THE DEGREE OF

MASTER OF SCIENCE

IN

BOTANY

WITH DISTINCTION

VICE CHANCELLOR

DEAN OF THE FACULTY OF SCIENCE

REGISTRAR

GRAHAMSTOWN
10 APRIL 2010

APPENDIX 6: CV

CONTACT DETAILS

Name	**Tarryn Martin**
Name of Company	**Biodiversity Africa**
Designation	Director
Profession	Botanical Specialist and Environmental Manager
E-mail	tarryn@biodiversityafrica.com
Office number	+27 (0)71 332 3994
Education	2010: Master of Science with distinction (Botany) 2004: Bachelor of Science (Hons) in African Terrestrial Vertebrate Biodiversity 2003: Bachelor of Science
Nationality	**South African**
Professional Body	**SACNASP**: South African Council for Natural Scientific Profession: Professional Natural Scientist (400018/14) **SAAB**: Member of the South African Association of Botanists **IAIASa**: Member of the International Association for Impact Assessments South Africa Member of Golden Key International Honour Society
Key areas of expertise	• Biodiversity Surveys and Impact Assessments • Environmental Impact Assessments • Critical Habitat Assessments • Biodiversity Management and Monitoring Plans

PROFILE

Tarryn has over ten years of experience working as a botanist, nine of which are in the environmental sector. She has worked as a specialist and project manager on projects within South Africa, Mozambique, Lesotho, Zambia, Tanzania, Cameroon and Malawi.

She has extensive experience writing botanical impact assessments, critical habitat assessments, biodiversity management plans, biodiversity monitoring plans and Environmental Impact Assessments to International Standards, especially to those of the International Finance Corporation (IFC). Her experience includes working on large mining projects such as the Kenmare Heavy Minerals Mine, where she monitored forest health, undertook botanical impact assessments for their expansion projects and designed biodiversity management and monitoring plans. She has also project managed Environmental Impact Assessments for graphite mines in northern Mozambique and has a good understanding of the Mozambique Environmental legislation and processes.

Tarryn holds a BSc (Botany and Zoology), a BSc (Hons) in African Vertebrate Biodiversity and an MSc with distinction in Botany from Rhodes University. Tarryn's Master's thesis examined the impact of fire on the recovery of C_3 and C_4 Panicoid and non-Panicoid grasses within the context of climate change for which she won the Junior Captain Scott-Medal (Plant Science) for producing the top MSc of 2010 from the South African Academy of Science and Art as well as an Award for Outstanding Academic Achievement in Range and Forage Science from the Grassland Society of Southern Africa. Tarryn is a professional member of the South African Council for Natural Scientific Professionals (since 2014).

EMPLOYMENT EXPERIENCE

Director and Botanical Specialist, Biodiversity Africa

July 2021 - present

- Botanical and ecological assessments for local and international EIAs in Southern Africa
- Identifying and mapping vegetation communities and sensitive areas
- Designing and implementing biodiversity management and monitoring plans
- Designing rehabilitation plans
- Designing alien management plans
- Critical Habitat Assessments
- Large ESIA studies
- Managing budgets

Principal Environmental Consultant, Branch Manager and Botanical Specialist, Coastal and Environmental Services

May 2012-June 2021

- Botanical and ecological assessments for local and international EIAs in Southern Africa
- Identifying and mapping vegetation communities and sensitive areas
- Designing and implementing biodiversity management and monitoring plans
- Designing rehabilitation and biodiversity offset plans
- Designing alien management plans
- Critical Habitat Assessments
- Large ESIA studies
- Managing budgets
- Cape Town branch manager
- Coordinating specialists and site visits

Accounts Manager, Green Route DMC

October 2011- January 2012

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa
- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction.

Camp Administrator and Project Co-ordinator, Windsor Mountain International Summer Camp, USA

April 2011 - September 2012

- Co-ordinated staff and camper travel arrangements, main camp events and assisted with marketing the camp to prospective families.

Freelance Project Manager, Green Route DMC

November 2010 - April 2011

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa
- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction.

Camp Counselor, Windsor Mountain Summer Camp, USA

June 2010 - October 2010

NERC Research Assistant, Botany Department, Rhodes University, Grahamstown in collaboration with Sheffield University, Sheffield, England

April 2009 - May 2010

- Set up and maintained experiments within a common garden plot experiment
- collected, collated and entered data
- Assisted with the analysis of the data and writing of journal articles

Head Demonstrator, Botany Department, Rhodes University

March 2007 - October 2008

Operations Assistant, Green Route DMC

September 2005 - February 2007

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa
- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction

PUBLICATIONS

- Ripley, B.; Visser, V.; Christin, PA.; Archibald, S.; Martin, T and Osborne, C. Fire ecology of C_3 and C_4 grasses depends on evolutionary history and frequency of burning but not photosynthetic type. *Ecology.* 96 (10): 2679-2691. 2015
- Taylor, S.; Ripley, B.S.; Martin, T.; De Wet, L-A.; Woodward, F.I.; Osborne, C.P. Physiological advantages of C_4 grasses in the field: a comparative experiment demonstrating the importance of drought. *Global Change Biology*. 20 (6): 1992-2003. 2014
- Ripley, B; Donald, G; Osborne, C; Abraham, T and Martin, T. Experimental investigation of fire ecology in the C3 and C4 subspecies of *Alloteropsis semialata. Journal of Ecology.* 98 (5): 1196 - 1203. 2010
- South African Association of Botanists (SAAB) conference, Grahamstown. Title: Responses of C3 and C4 Panicoid and non-Panicoid grasses to fire. January 2010

- South African Association of Botanists (SAAB) conference, Drakensberg. Title: Photosynthetic and Evolutionary determinants of the response of selected C3 and C4 (NADP-ME) grasses to fire. January 2008

COURSES

- Rhodes University and CES, Grahamstown
- EIA Short Course 2012
- Fynbos identification course, Kirstenbosch, 2015.
- Photography Short Course, Cape Town School of Photography, 2015.
- Using Organized Reasoning to Improve Environmental Impact Assessment, 2018, International IAIA conference, Durban

CONSULTING EXPERIENCE

International Projects

- 2020 – 2021: Project manager for the 2Africa subsea cable ESIA in Mozambique.
- 2020 – 2021: Project manager for the Category B EIA for the Wihinana Graphite Mine, Cabo delgado, Mozambique
- 2020 – 2021: Project manager for the category B exploration ESIA for Sofala Heavy Minerals Mine, Inhambane, Mozambique
- 2020: Critical Habitat Assessment for a graphite mine in Cabo Delgado, Mozambique. This assessment was to IFC standards.
- 2020: Analysed the botanical dataset for Lurio Green Resources and provided comment on the findings and gaps.
- 2020: Biodiversity Management Plan and Monitoring Plan for mine at Pilivilli in Nampula Province, Mozambique. This assessment was to IFC standards.
- 2019: Botanical Assessment for a cocoa plantation, Tanzania. This assessment was to IFC standards.
- 2019: Critical Habitat Assessment, Biodiversity Management Plan and Ecosystem Services Assessment for JCM Solar Farm in Cameroon. This assessment was to IFC standards.
- 2019: Undertook the Kenmare Road and Infrastructure Botanical Baseline Survey and Impact Assessment for an infrastructure corridor that will link the existing mine at Moma to the new proposed mine at Pillivilli in Nampula Province, Mozambique. This assessment was to IFC standards.
- 2012 – Present: Kenmare Terrestrial Monitoring Program Project Manager and Specialist Survey, Nampula Province, Mozambique.
- 2018: Conducted a field survey and wrote a botanical report to IFC standards for the proposed Balama Graphite Mine Environmental and Social Impact Assessment (ESIA) in Cabo Delgado Province, Mozambique.
- 2018: Co-authored the critical habitat assessment chapter for the proposed Kenmare Pilivilli Heavy Minerals Mine.
- 2018: Authored the Conservation Efforts chapter for the Kenmare Pilivilli Heavy Minerals Mine.
- 2017-2018: Co-authored and analysed data for the Kenmare Bioregional Survey of *Icuria dunensis* (species trigger for critical habitat) in Nampula Province, Mozambique. This was for a mining project that needed to be IFC compliant.
- 2017: Conducted a field survey and wrote a botanical report to IFC standards for the proposed Ancuabe Graphite Mine Environmental and Social Impact Assessment (ESIA) in Cabo Delgado Province, Mozambique.
- 2017-2018: Managed the Suni Resources Montepuez Graphite Mine Environmental Impact Assessment. This included the management of ten specialists, the co-ordination of their field surveys, regular client liaison and the writing of the Environmental Impact Assessment Report which summarised the

specialists findings, assessed the impacts of the proposed mine on the environment and provided mitigation measures to reduce the impact.
I was also the lead botanist for this baseline survey and impact assessment and undertook the required field work and analysed the data and wrote the report.

- 2017: Undertook the botanical baseline survey and impact assessment for the proposed Kenmare Pilivili Heavy Mineral Mine in Nampula Province, Mozambique. This was to IFC Standards.
- 2017: Ecological Survey for the Megaruma Mining Limitada Ruby Mine Exploration License, Cabo Delgado, Mozambique.
- 2016: Undertook the botanical baseline survey and impact assessment, wrote an alien invasive management plan and co-authored the biodeiveristy monitoring plan for this farm. The project was located in Zambezia Province, Mozambique.
- 2015-2016: Conducted the Triton Minerals Nicanda Hills Graphite Mine Botanical Survey and Impact Assessment. Was also the project manager and specialist co-ordinator for this project. The project was located in Cabo Delgado Province, Mozambique.
- 2015: Was part of the team that undertook a Critical Habitat Assessment for the Nhangonzo Coastal Stream site at Inhassora in Mozambique that Sasol intend to establish drill pads at. This project needed to meet the IFC standards.
- 2014: Lurio Green Resources Wood Chip Mill and Medium Density Fibre-board Plant, Project Manager and Ecological Specialist, Nampula Province, Mozambique. 2014-2015.
- 2013-2014: LHDA Botanical Survey, Baseline and Impact assessment, Lesotho.
- 2014: Biotherm Solar Voltaic Ecological Assessment, Zambia.
- 2013-2014: Lurio Green Resources Plantation Botanical Assessment, Vegetation and Sensitivity Mapping, Specialist Co-ordination, Nampula Province, Mozambique.
- 2013: Syrah Resources Botanical Baseline Survey and Ecological Assessment., Cabo Delgado Mozambique.
- 2013-2014: Baobab Mining Ecological Baseline Survey and Impact Assessment, Tete, Mozambique.

South African Projects

- 2021 - Present: Project Manager for the Sturdee Energy Solar PV facility, Western Cape
- 2021: Ecological Assessment for the Sturdee Energy Solar PV facility, Western Cape
- 2021: Rehabilitation plan for a housing development (Hope Village)
- 2020: Ecological Assessment for the Eskom Juno-Gromis Powerline deviation, Western Cape
- 2020: Project Manager for the Basic Assessment for SANSA development at Matjiesfontein (Western Cape). Project received authorization in 2021.
- 2020: Ecological Assessment for construction of satellite antennae, Matjiesfontein, Western Cape
- 2019: Ecological Assessment for a wind farm EIA, Kleinzee, Northern Cape
- 2019: Ecological Assessment for two housing developments in Zeerust, North West Province
- 2019: Botanical Assessment in Retreat, Cape Town for the DRDLR land claim.
- 2019: Cape Agulhas Municipality Botanical Assessment for the expansion of industrial zone, Western Cape, South Africa, 2019.
- 2018: Ecological Assessment for the construction of a farm dam in Greyton, Western Cape.
- 2018: Conducted the Ecological Survey for a housing development in Noordhoek, Cape Town
- 2018: Conducted the field survey and developed an alien invasive management plan for the Swartland Municipality, Western Cape.

- 2017: Undertook the field survey and co-authored a coastal dune study that assesses the impacts associated with the proposed rezoning and subdivision of Farm Bookram No. 30 to develop a resort.
- 2017: Project managed and co-authored a risk assessment for the use of Marram Grass to stabilise dunes in the City of Cape Town.
- 2015-2016: iGas Saldanha to Ankerlig Biodiversity Assessment Project Manager, Saldanha.
- 2015: Innowind Ukomoleza Wind Energy Facility Alien Invasive Management Plan, Eastern Cape Province, South Africa.
- 2015: Savannah Nxuba Wind Energy Facility Powerline Ecological Assessment, ground truthing and permit applications, Eastern Cape South Africa.
- 2014: Cob Bay botanical groundtruthing assessment, Eastern Cape, South Africa.
- 2013-2016: Dassiesridge Wind Energy Facility Project Manager, Eastern Cape, South Africa.
- 2013: Harvestvale botanical groundtruthing assessment, Eastern Cape, South Africa.
- 2012: Tsitsikamma Wind Energy Facility Community Power Line Ecological Assessment, Eastern Cape, South Africa.
- 2012: Golden Valley Wind Energy Facility Power Line Ecological Assessment, Eastern Cape, South Africa.
- 2012: Middleton Wind Energy Facility Ecological Assessment and Project Management, Eastern Cape, South Africa.
- 2012: Mossel Bay Power Line Ecological Assessment, Western Cape, South Africa.
- 2012: Groundtruthing the turbine sites for the Waainek Wind Energy Facility, Eastern Cape, South Africa.
- 2012: Toliara Mineral Sands Rehabilitation and Offset Strategy Report, Madagascar.