
Specialist terrestrial and botanical report for the stormwater infrastructure proposed on erven 139, 318, and 326 of Herolds Bay, in George local municipality.

Terrestrial Biodiversity & Terrestrial Plant Species Report

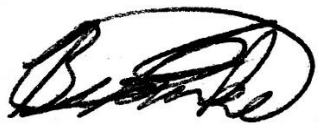


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Date: 30 January 2024
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- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;
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- All the particulars furnished by me in this document are true and correct.



Bianke Fouche (MSc)

January 2024

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1. ABBREVIATIONS

Term	Full spelling / definition
BPA	Biodiversity Priority Area
BSP	Biodiversity Spatial Plan
CBA	Critical Biodiversity Area
CD:NGI	Chief Directorate: National Geo-spatial Information
DFFE	Department of Forestry, Fisheries, and the Environment
EMP	Ecological Management Plan
ESA	Ecological Support Area
NEM:BA	National Environmental Management: Biodiversity Act
ONA	Other Natural Areas
PAOI	Project Area of Influence
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SDP	Site Development Plan
SEI	Site Ecological Importance
SSVR	Site Sensitivity Verification

2. INTRODUCTION

2.1 Background

Confluent Environmental was contracted by Cape EAPrac to undertake a botanical & terrestrial biodiversity assessment of erven 139, 318, and 326 in Herolds Bay. These erven are vacant and are between houses in a residential development. Currently there is a large issue with erosion and stormwater management here, making it imperative that the environmental damage caused by this damage be mitigated as soon as possible.

According to the Department of Forestry, Fisheries, and the Environment (DFFE) Screening Tool, this SSVR is required because the terrestrial plant species theme has been highlighted as having a **Medium** sensitivity along the southern section of the proposed stormwater infrastructure development area (the rest of the area is mapped as a Low sensitivity). The terrestrial biodiversity has a **Very High** sensitivity throughout the site (Fig 1).

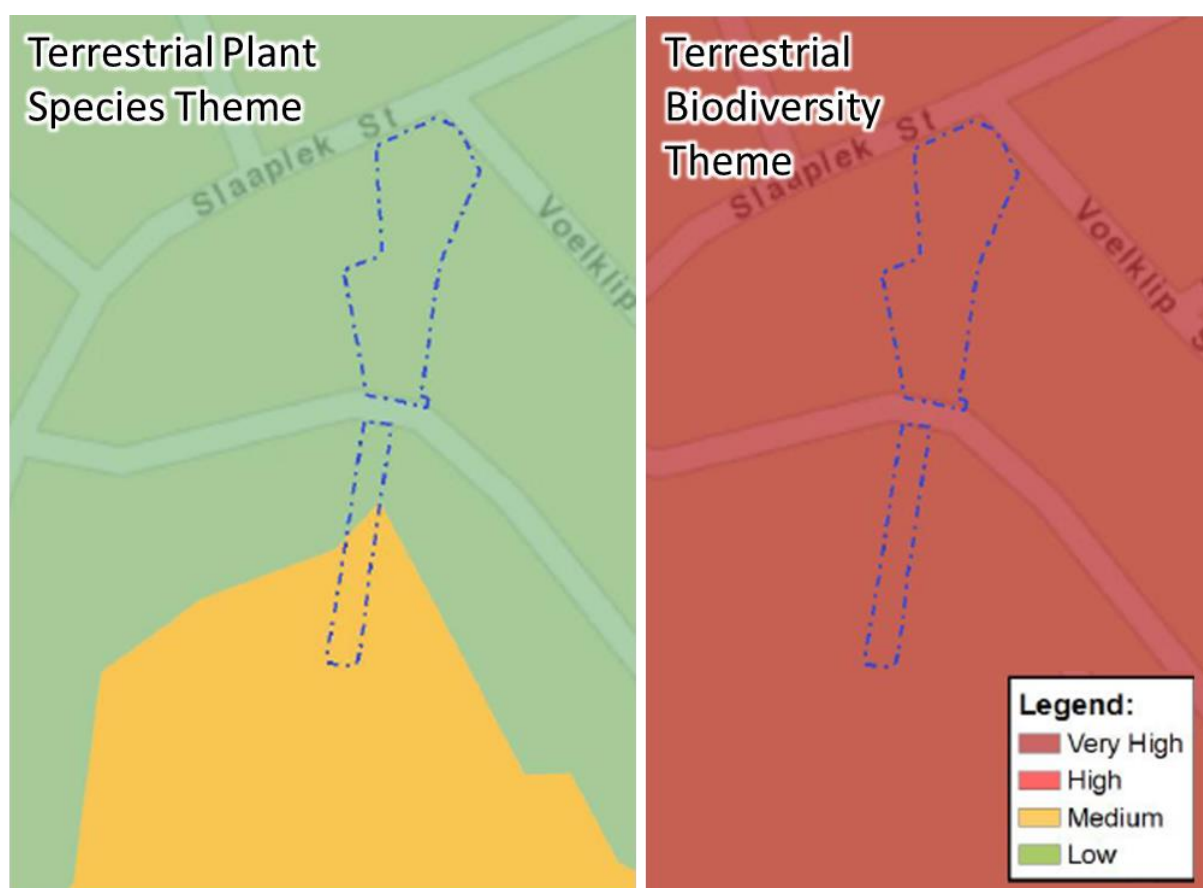


Figure 1: The screening tool generated sensitivity maps for the proposed stormwater infrastructure.

The plant species theme is triggered as a medium sensitivity due to several species of conservation concern (SCC) that are potentially present in the area (these are listed later in this report). The terrestrial biodiversity theme sensitivity is due to the several biodiversity priority areas (BPAs) mapped on the site.

2.2 General Site Location

The erven of interest lie between houses in an established residential area in Herolds Bay (Fig. 2). The erven of interest are located at the start of a valley that extends downwards towards the ocean. Currently severe erosion problems on these erven have necessitated the design and urgent implementation of stormwater infrastructure to prevent further damage to the environment and surrounding dwellings.

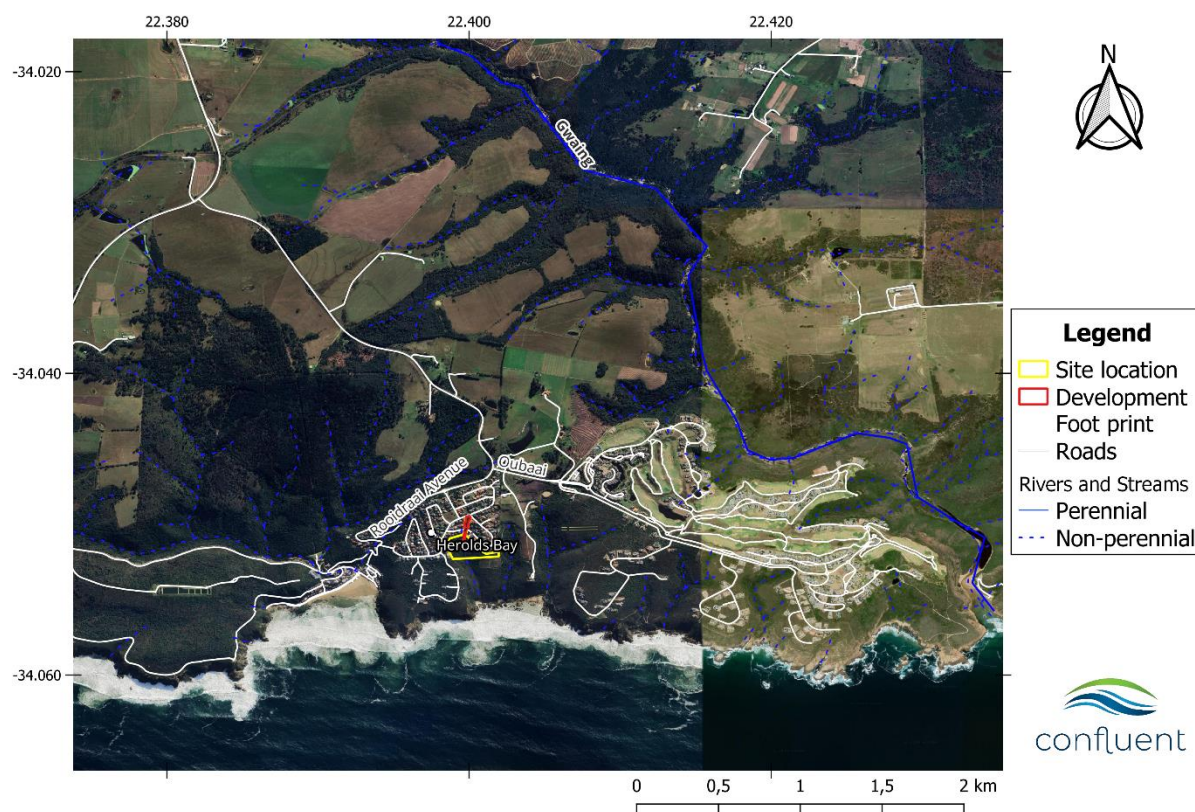


Figure 2: The general location of the proposed stormwater infrastructure. The northern erven are indicated with red outlines, while the erf south of the proposed development area is indicated with a yellow outline.

2.3 Site Development Plan

The Stormwater management plan for the site is illustrated in Fig. 3. A subsoil pipe will be installed on Erf 326 to collect runoff from erven 125 and 327. The subsoil pipe will then connect to a gabion wall along the south of erf 326. Just south of the gabion wall a new double kerb inlet will be installed, and the water will be directed under the road. The current pipe and discharge line under the road will be upgraded to 750 mm. South of the road a headwall will be constructed, which will tie into the stepped gabion basket channel which will extend south of the headwall (Fig. 3). The stepped gabion mattresses will extend from Erf 318 onto erf 139.

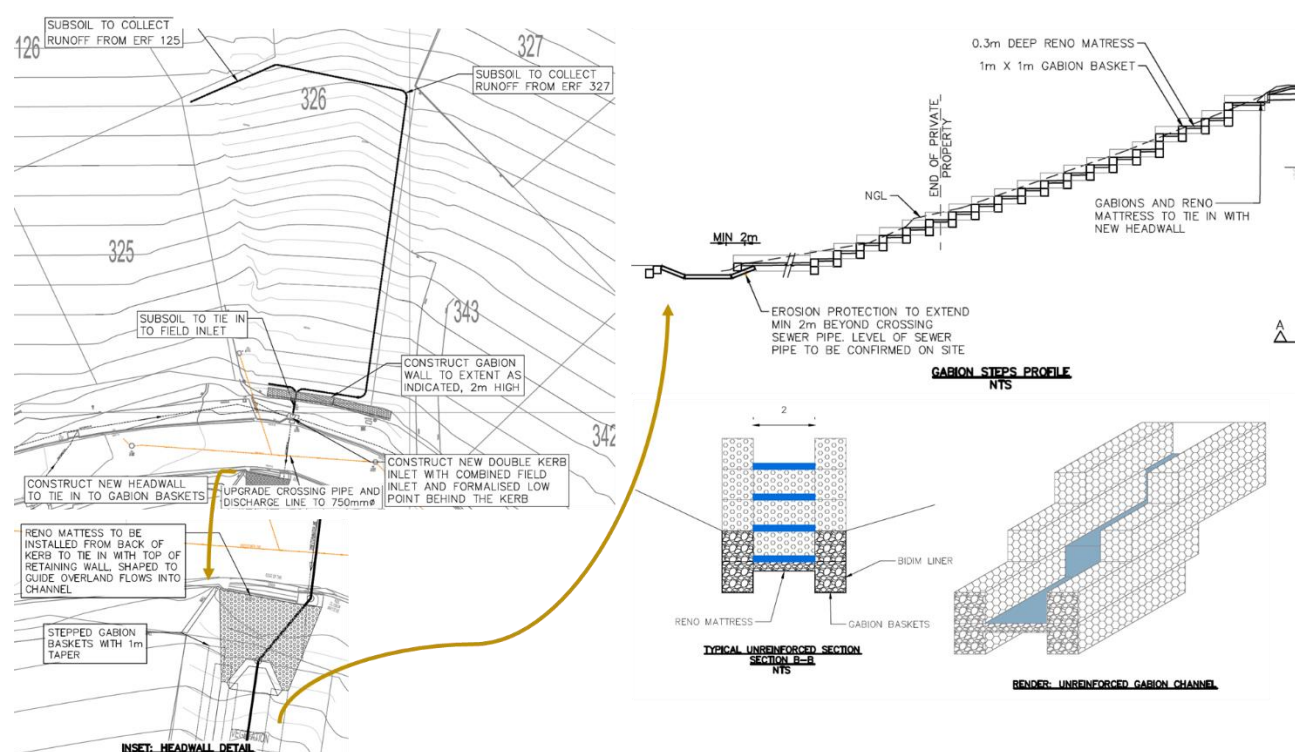


Figure 3: The proposed surface water drainage infrastructure that will start on erf 326 and be channelled via gabion steps from the proposed headwall through the narrow erf 318 onto erf 139.

3. TERMS OF REFERENCE

This screening tool sensitivity verification report provides information on Terrestrial and Botanical diversity and sensitivity of the proposed development. The results presented are based on a desktop and field assessment, which includes a consideration of historical photographic records of the site. The assessment presented in this report follows the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity, and Terrestrial Plant Species themes.

This report follows the requirements of:

- The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), which includes:
 - The protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial plant species (28 July 2023).
 - The protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity (20 March 2020).
- Additional guidelines for the terrestrial biodiversity theme:
 - Ecosystem Guidelines for Environmental Assessment in the Western Cape (de Villiers et al., 2016).

- The Western Cape Biodiversity Spatial Plan Handbook and summary booklet (CapeNature, 2017; Pool-Sandvliet et al., 2017).
- The Subtropical Thicket Ecosystem Programme Handbook: Integrating the natural environment into land-use decisions at the municipal level: towards sustainable development (Pierce & Mader, 2006).
- Additional guidelines for the terrestrial plant species theme:
 - Species Environmental Assessment Guideline: Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa (Verburgt et al., 2020).

The assessment was undertaken by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with relevant expertise in the field of Botanical and/or Ecological science.

3.1 Online Screening Tool

The Department of Forestry, Fisheries, and the Environment (DFFE) screening tool report for the development footprint has identified the **terrestrial plant species theme as having a Low and Medium sensitivity**, and the **terrestrial biodiversity theme as having a Very High sensitivity**. The reasons for the terrestrial plant sensitivity theme are the possible occurrence of species of conservation concern (SCC) on the site. A Medium screening tool sensitivity for plants indicates that:

“Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.” ~ (Verburgt et al., 2020)

A Very High sensitivity rating for terrestrial biodiversity according to the screening tool is triggered for all Biodiversity Priority Areas (BPAs) and other sensitive features (Stewart et al., 2021). BPAs include the various management layers of the Western Cape Biodiversity Spatial Plan (WC BSP), as well as the other sensitive features. Table 1 indicates the BPAs that were triggered for erven 326, 318, and 139.

Table 1: Sources of BPA data for the Terrestrial Biodiversity Theme sensitivity (Stewart et al., 2021). Only BPAs that have been triggered for by the screening tool are listed here.

Sensitivity layer	Data included and source
Critical Biodiversity Areas (CBAs)	Most recent terrestrial CBA spatial footprint for metros, provinces, or bioregional plans, combined to create a national data set.
Ecological Support Areas (ESAs)	Most recent ESA spatial footprint for metros, provinces, or bioregional plans, combined to create a national data set.
Strategic Water Source Areas (SWSAs) (terrestrial)	Surface strategic water source areas, delineated by Mervyn Lotter in October 2020 with substantial input from the SWSA spatial task team as part of the SWSA spatial task team. Note that the protocol only applies to the terrestrial parts of the SWSAs.
Red Listed Ecosystems	Any ecosystem that is listed as Vulnerable, Endangered, or Critically Endangered according to the "Revised National List of Ecosystems that are Threatened and in Need of Protection (NEM:BA Act no.10 of 2004, as amended in November 2022)

4. METHODOLOGY

4.1 Desktop Assessment

The desktop assessment was performed using Cape Farm Mapper and QGIS version 3.28.3 "Firenze". Plant species data was sourced from the following sources:

- The DFFE screening tool listed SCC.
- Information on plant occurrence prior to the site visit was sourced from SANBI's Botanical Research and Herbarium Management System (BRAHMS) for the Plants of Southern Africa (POSA) database.
- iNaturalist observations of the property and surrounding areas.

Ecosystem/ vegetation type data was sourced from:

- The 2018 updated South African National Vegetation Map from SANBI's Biodiversity GIS (BGIS) database, and the National Biodiversity Assessment report of 2018 (Skowno et al., 2018).
- Shapefiles for the Western Cape Biodiversity Spatial Plan (WC-BSP) i.e., information on PAs, CBAs, ESAs, and ONAs were downloaded from BGIS database (CapeNature, 2017; Pool-Sandvliet et al., 2017).
- Cape Farm Mapper for additional spatial information required for the site.
- Chief Directorate: National Geo-spatial Information (CD: NGI) Geospatial Portal and Google Earth for the acquisition of historical aerial imagery of the site.
- The conservation status of ecosystems was found in the Revised National List of Ecosystems that are Threatened and in need of protection, published under the

National Environmental Management: Biodiversity Act (Act No. 10, 2004, as revised in Nov. 2022), and also using the Vegetation of South Africa, Lesotho, and Swaziland.

4.2 Field Assessment

Field work was undertaken on the 26th of January 2024. The method for identifying species was similar to a BioBlitz, also described as a “timed meander”, where the specialist especially keeps an eye out for rarer and threatened species. Some Red Listed Plant species are more easily spotted and found during a site survey than other species. This survey method is an attempt to account for the short and single survey period, where detection probability of some rare and threatened species (e.g., geophytes, small succulents, small perennials etc.) are low (Garrard et al., 2008; Wintle et al., 2012). Observations of individual species and environmental characteristics were documented using a Nikon Coolpix camera. A provisional species list and plant species accumulation curve is provided in Appendix 10.1.

4.3 Assumptions & Limitations

This assessment is subject to a few assumptions, uncertainties, and limitations, as listed below:

- Only one survey took place during the summer on the 26th of January 2024. The species list for the area is therefore limited to the findings of the one field assessment, as well as past records on iNaturalist and the Plants of Southern Africa (POSA) database for the proposed development site and its surrounding areas.
- The species list and SCC reported are not exhaustive, and more species will be added to the list should more sampling effort, and sampling in different seasons occur (Perret et al., 2023).
- Some rare and threatened plant species are difficult to locate and easily overlooked in the field (e.g., geophytes, small succulents, small shrubs, and cryptic spp.). The erosion on the site also means that a lot of the vegetation within the footprint is already damaged and lost.
- The dense thicket and steepness of the terrain made it hard to gain access to some sections of the site. It is possible that focus on “bundu bashing” and getting access to some parts of the site may have caused a lapse in concentration so that an SCC could have been missed on the site.

5. RESULTS: DESKTOP ASSESSMENT

5.1 Terrestrial Biodiversity

5.1.1 Climate

The proposed development is in Herold’s Bay. The temperature is highest in February, averaging a daytime temperature of around 20.4 °C (Fig. 4). The coldest month is July, averaging 13.1 °C. Decembers generally have the most rainy days (ca. 10 days), while May has the fewest (7 days). Rainfall in Herold’s Bay follows a little more erratic pattern, with no striking differences between different seasons of the year (Fig. 4). Relative humidity is highest in February (ca. 76%) and lowest in July (ca. 68%).

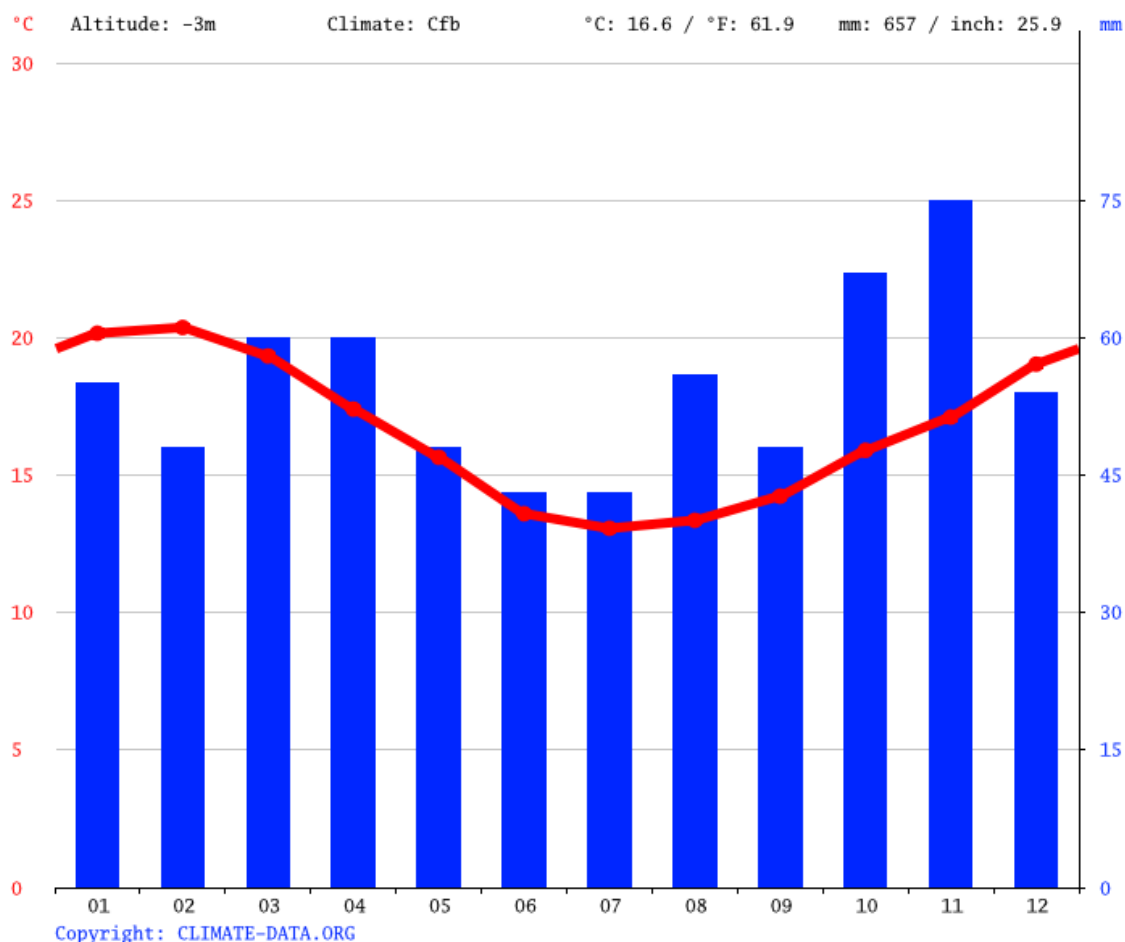


Figure 4: Climate data for Herold's Bay, where month 01 is January and 12 is December. Average Temperature per month is indicated by the red dots, and blue bars indicate average rainfall per month.

5.1.2 Geology and Soil

The soil of this site is well drained and has a high base status. The erodibility of soil here is moderate (erodibility factor of 0.4). Soils here should be well structured and have strong textural contrast in the soil profile, as there is a marked clay accumulation. The site is underlain by Maalgaten granites, which are old geological structures that are then covered by younger aeolian sand and colluvial material. The Residential Estate boasts a diversity of soils due to topographical and slope differences of the various sites on the Residential Estate. The specific Geology around Herold's Bay is Biotite Granite Gneiss (Table Mountain Group) and Gritty quartzite, phyllite, or graphite bearing schist (Kaaimans Group; Krynauw & Gesse, 1980).

5.1.3 Vegetation type(s)

Brakfontein is mapped as **critically endangered (CR) Garden Route Granite Fynbos (FFg 5)** (Fig. 5; Dayaram et al., 2019; Mucina & Rutherford, 2006). South of the site another CR vegetation type is mapped, Groot Brak Dune Strandveld (FS 9).

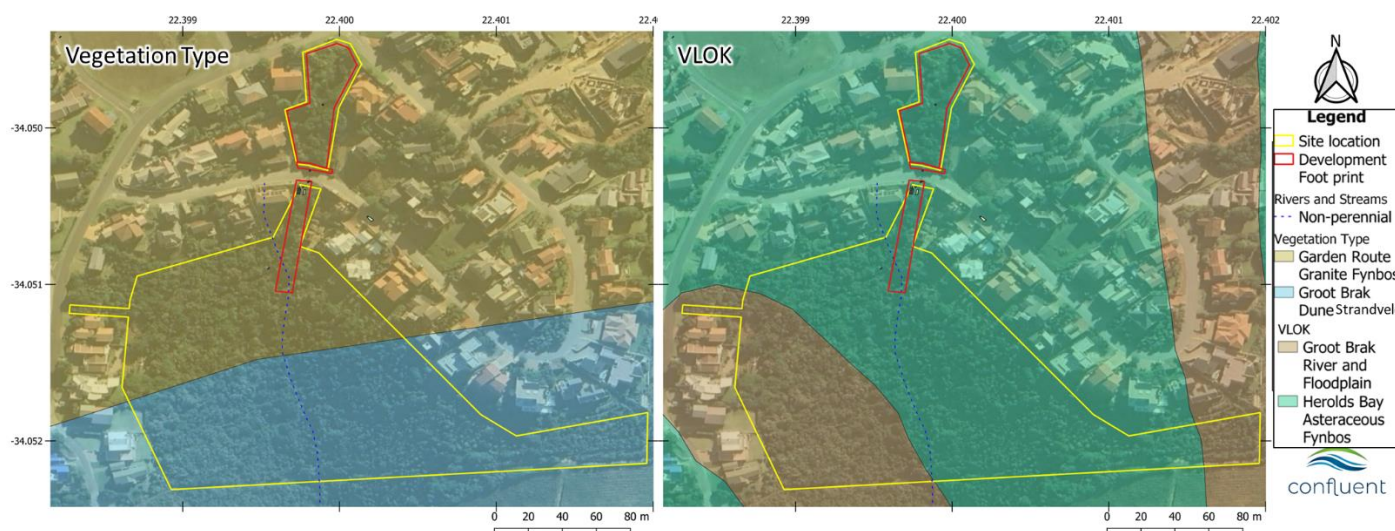


Figure 5: The mapped vegetation type according to the 2018 National Vegetation Map of South Africa (Dayaram et al., 2019; Mucina & Ruthfarmord, 2006) and the Vlok vegetation map categories for Farm RE/236 and the surrounding area.

Garden Route Granite Fynbos is found only in the Western Cape Province in three main sections. The largest section of the is vegetation type is mapped from Groot Brak River to Woodfield. Like shale fynbos, it is associated with undulating hills on coastal forelands. Garden Route Granite Fynbos is typified by dense proteoid and/or ericoid shrubby grassy fynbos depending on the slope and aspect of the landscape. This vegetation type is listed as critically endangered as over 70% of its original extent has been transformed to agriculture or forestry land uses. Remaining patches of this vegetation type is confined mostly to highly fragmented pockets on steeper slopes. Furthermore, even though it is thought that this vegetation type was once dominated by proteoid fynbos, it seems to be easily converted to graminoid fynbos with more frequent fires and / or augmentation with pasture grasses (Mucina & Rutherford, 2006). Some of the typical plants that are associated with Garden Route Granite Fynbos as described in (Mucina & Rutherford, 2006) include (blue entries indicate that the genus was found on the site, and green entries indicate that the species was found on the site):

Tall Shrubs: *Passerina corymbosa*, *Cliffortia serpyllifolia*, *Protea coronata*, *P. lanceolata*, *P. neriifolia*. (The protea observed on the site is a garden escapee or was planted. Proteas are therefore not highlighted in blue here)

Low Shrubs: *Erica discolor variant 'speciosa'*, *E. peltata*, *Phyllica confusa*, *Syncarpha paniculata*, *Agathosma ovata*, *Anthospermum prostratum*, *Aspalathus asparagoides*, *Cliffortia falcata*, *Cullumia bisulca*, *Erica canaliculata*, *E. diaphana*, *E. formosa*, *Eriocephalus africanus*, *Hermannia angularis*, *Leucadendron salignum*, *Lobelia tomentosa*, *Metalasia pungens*, *Mimetes cucullatus*, *Pelargonium fruticosum*, *Oedera calycina*.

Succulent Shrub: *Lampranthus sociorum*.

Semiparasitic Shrubs: *Colpoon compressum*, *Thesium virgatum*.

Semiparasitic Epiphytic Shrub: *Viscum capense*.

Geophytic Herb: *Schizaea pectinata*.

Graminoids: *Tetraria cuspidata*, *Brachiaria serrata*, *Eragrostis capensis*, *Ficinia nigrescens*, *Heteropogon contortus*, *Pentaschistis eriostoma*, *Restio triticeus*, *Themeda triandra*

Groot Brak Dune Strandveld (**also CR**) is also only found in the Western Cape between the mouth of the Gouritz River to Victoria Bay near Wilderness. The largest section of this vegetation type is found near Mossel Bay. It is associated with softly undulating lowlands up to 180m altitude. Usually, the vegetation is dominated by dense and tall (up to 3m) scrub / thicket. Gaps between the bushes often support fynbos elements that often has a marked presence of members of the Ericaceae. Some of the important taxa (Mucina & Rutherford, 2006) for this vegetation type include (blue entries indicate that the genus was found on the site, and green entries indicate that the species was found on the site):

Small Trees: *Chionanthus foveolatus*, *Clausena anisata*.

Tall Shrubs: *Azima tetraacantha*, *Cussonia thyrsiflora*, *Diospyros dichrophylla*, *Euclea racemosa* subsp. *racemosa*, *Grewia occidentalis*, *Gymnosporia buxifolia*, *Maytenus procumbens*, *Metalasia muricata*, *Morella cordifolia*, *Myrsine africana*, *Mystroxydon aethiopicum*, *Olea exasperata*, *Pterocelastrus tricuspidatus*, *Putterlickia pyracantha*, *Searsia crenata*, *S. glauca*, *S. longispina*, *S. lucida*, *Schotia afra* var. *afra*, *Sideroxydon inerme*, *Tarchonanthus littoralis*.

Low Shrubs: *Asparagus suaveolens*, *Ballota africana*, *Carissa bispinosa* subsp. *bispinosa*, *Chironia baccifera*, *Clutia daphnoides*, *Erioccephalus africanus* var. *africanus*, *Helichrysum teretifolium*, *Lauridia tetragona*, *Phyllica axillaris*, *Polygala myrtifolia*.

Succulent Shrubs: *Aloe arborescens*, *Cotyledon orbiculata* var. *dactyloopsis*, *Crassula perforata*, *C. pubescens* subsp. *pubescens*, *Euphorbia burmannii*, *E. mauritanica*, *Tetragonia fruticosa*, *Zygophyllum morgsana*.

Woody Climbers: *Asparagus aethiopicus*, *Cissampelos capensis*, *Rhoicissus digitata*.

Woody Succulent Climber: *Cynanchum viminalis*.

Semiparasitic Shrubs: *Colpoos compressum*, *Thesium fragile*.

Soft Shrub: *Hypoestes aristata*.

Herb: *Commelina africana*, *Indigofera tomentosa* (geographically NB).

Geophytic Herbs: *Brunsvigia orientalis*, *Chasmanthe aethiopica*, *Hesperantha falcata*.

Succulent Herbs: *Carpobrotus edulis*, *Crassula expansa* subsp. *expansa*, *Senecio radicans*, *Freesia alba* (geographically NB).

Herbaceous Climbers: *Astephanus triflorus*, *Cynanchum obtusifolium*, *Kedrostis nana*.

Herbaceous Succulent Climber: *Pelargonium peltatum*.

Graminoids: *Cynodon dactylon*, *Ehrharta erecta*, *Ficinia indica*, *Panicum deustum*, *Stipa dregeana*.

5.1.4 Western Cape Biodiversity Spatial Plan

The Biodiversity Spatial Plan for the Western Cape (WC BSP) contains several conservation planning layers that are used to set priority areas for conserving biodiversity. The definition and objectives of the WC BSP layer mapped on Farm RE/236 is given in BOX 1. Appendix 10.2 illustrates the recommended land-uses associated with the various BSP layers. Erf 139 is a critical biodiversity area (CBA 1), erf 318 is an ecological support area (ESA 2), and erf 326 is not included in the BSP layers (Fig. 6). The reasons for the assignment of the BSP layers in this area are listed below (grey reasons either do not apply to the site, or are outside of the scope of this study to comment on):

- **Garden Route Granite Fynbos.** This is a CR vegetation type. The reason for its status is that remaining patches are narrowly distributed with high rates of habitat loss over the past three decades. This ecosystem is at a high risk of collapse. The only fynbos remaining on the site is associated with road verges. This vegetation type is largely missing on the site.
- **Groot Brak Dune Strandveld.** This vegetation type is at risk of increased development pressure and biodiversity loss through the establishment and spread of invasive plant species. In this case severe erosion is occurring on Erf 318, and this needs to be mitigated as soon as possible (hence the need to this development).
- **Watercourse protection – Southern Coastal Belt, Water source protection - Gwaing, and Coastal Resource Protection - Eden.** Although this BSP trigger falls outside of the scope of this study, the erosion on the site due to inappropriate stormwater management must be mitigated and is the purpose of the proposed activity on the site. Refer to the aquatic specialist report for more comment on this reason.
- **Bontebok extended distribution range.** This BSP trigger falls outside of the scope of this study. Refer to an animal specialist for comment.

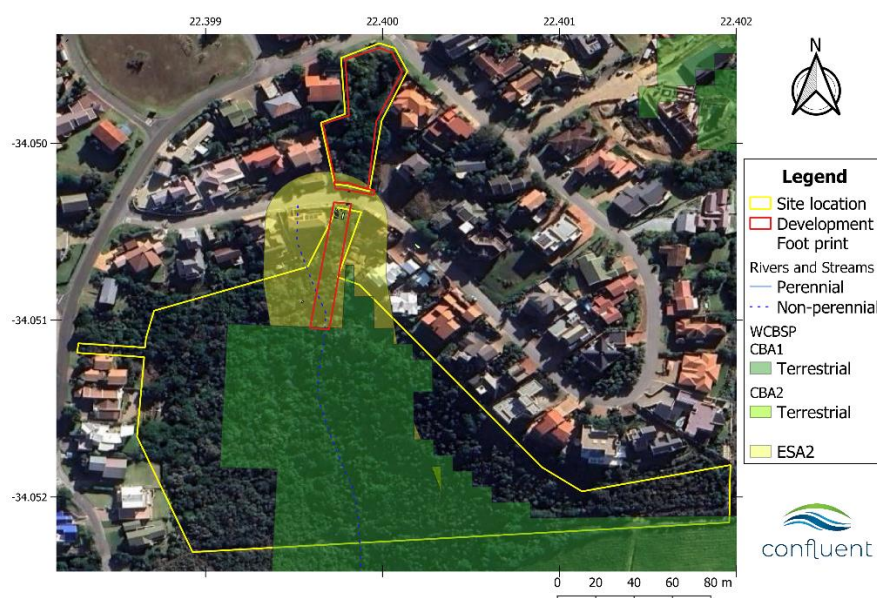


Figure 6: The mapped Western Cape Biodiversity Spatial Plan (WC BSP) categories that have been mapped for Brakfontein (Farm RE/236) and adjacent surrounding landscape.

BOX 1: The Biodiversity Spatial Plan

Critical Biodiversity Area 1

Definition: Areas in a natural condition. Required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure.

Objective: Maintain in a natural or near-natural state, with no further loss of habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.

Ecological Support Area 2

Definition: Not essential for meeting biodiversity targets. Important in supporting functioning of PAs or CBAs. Often vital for ecosystem services.

Objective: Restore/minimise impact on ecological infrastructure functioning, especially soil and water-related services.

5.1.5 Historical Aerial Imagery

High resolution historical imagery (Fig. 7) can be sourced upon request from the CD: NGI Geospatial portal, or from their offices in Mowbray, Cape Town. Google Earth is also a repository of more recent historical images. The oldest historical image from 1936 illustrates a landscape with minimal disturbance. The site is located at the top of one of the valleys that extends towards the ocean to the south. In 1957 disturbance is still minimal, however there is a more pronounced presence of agriculture in the northern section of the site. However, by 1991 the residential development of the area had already isolated the site between houses. Development of this part of Herolds Bay continued, with even more houses visible in 2003. Clearance for the house currently under construction east of Erf 218 is visible for the first time in the July 2022 imagery for the site. The 2023 imagery illustrates how material from the development of the large house is spilling over into Erf 318, where the site is also experiencing bad erosion.

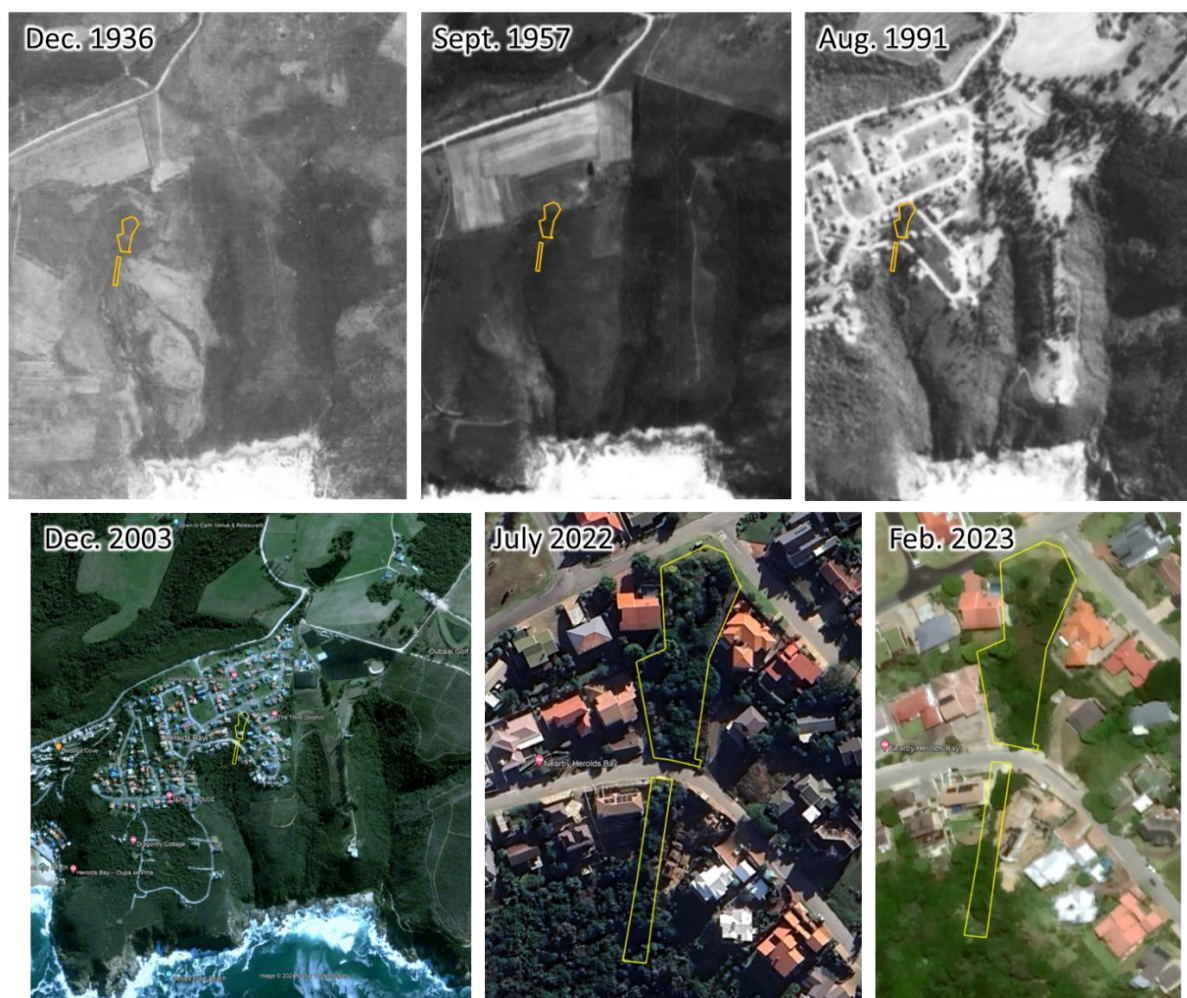


Figure 7: A series of historical imagery sourced from the CD: NGI geospatial portal (top row) and Google Earth (bottom row). The yellow polygons highlight the outlines of erven 318 and 326.

5.2 Plant Species

The plant species theme sensitivity of Medium is dependent on the presence, or likely presence, of several plant species of conservation concern (SCC). The Red List categories are discussed later in the report.

5.2.1 Species of conservation concern (SCC) listed in the screening tool.

Several SCC have the potential to occur on the site. The SCC listed in the screening tool report are listed below.

- *Diosma passerinoides*
- *Erica glandulosa fourcadei*
- *Euchaetis albertiniana*
- *Hermannia lavandulifolia*
- *Lampranthus pauciflorus*
- *Lebeckia gracilis*
- Sensitive species 500
- Sensitive species 516
- Sensitive species 800
- Sensitive species 1024
- Sensitive species 1032

Additional SCC that have been observed nearby on iNaturalist and / or POSA are:

- *Cullumia carlinoides*
- *Gnidia chrysophylla*
- *Leucospermum praecox*
- *Muraltia knysnaensis*
- *Oxalis pendulifolia*

6. RESULTS: FIELD ASSESSMENT

6.1 Vegetation observed.

The vegetation on the site was more consistent with a thicket than with fynbos. The only fynbos elements on the site was found north of the existing road in the road verge. This is because the vegetation here is exposed and fynbos species can persist in the conditions available along the road verge. Large sections of Erf 326 was occupied by garden escapee plants and was no longer a natural thicket (Fig. 8). The thicket vegetation, apart from the road verges and eroded section of Erf 318, was relatively uniform and is likely Groot Brak Dune Strandveld. The vegetation on erf 318 is undergoing unnatural disturbance, with severe erosion on the site, and building material dumped in sections of the erf (Fig. 9). The erosion on the erf is the reason this stormwater management project was initiated, before more damage is done, including damage to the habitats that remain here.



Figure 8: Photos of the site taken on Erf 326. The top left photo shows the open vegetation north of the existing road, top right is the view of the vegetation from the driveway along the western boundary of the erf. The bottom left image illustrates the thicket edge along the residential boundary, and the bottom right image illustrates the invasive fishbone fern (*Nephrolepis cordifolia*) in the understory of the thicket.



Figure 9: Photos of the site taken on Erf 318. This site is being eroded, and a large house is being constructed east of the erosion on the site.

6.2 SCC, invasive species, and other plants observed.

No protected tree species were observed, but the Red Listed *Erica glandulosa fourcadei* (Vulnerable) was observed in a small stand north of the existing road on the site. At the time of the site assessment the flowers were already spent, as illustrated in Fig. 10. Many listed invasive species were observed on the erven (see the list in Appendix 10.1), such as black wattles (*Acacia mearnsii*), bugweed (*Solanum mauritianum*), and the fishbone fern (*Nephrolepis cordifolia*). An explanation of the requirements for various NEMBA invasive species listings is provided in BOX 2.



Figure 10: An image of *Erica glandulosa fourcadei* that was found north of the existing road along the boundary of Erf 326.

BOX 2: NEMBA categories for listed invasive alien plants (IAPs)

Category 1a

- Species which must be combatted or eradicated.
- Immediate steps must be taken to eradicate and combat or eradicate.
- Authorised officials must be permitted to enter properties to monitor, assist with or implement the combatting or eradication.
- If an Invasive Species Management Programme has been developed, a person must combat or eradicate the listed invasive species in accordance with such programme.

Category 1b

- Species which must be controlled.
- Property owners and organs of state must control the listed invasive species within their properties.
- If an Invasive Species Management Programme has been developed, a person must control the listed invasive species in accordance with such programme.
- Authorised officials must be permitted to enter properties to monitor, assist with or implement the control of listed species.
- Any Category 2 listed species (where permits are applicable) which fall outside of containment and control, revert to Category 1b and must be controlled.
- Any Category 3 listed species which occur within a Protected Area or Riparian (wetland) revert to Category 1b and must be controlled.
- The Minister may require any person to develop a Category 1b Control Plan for one or more Category 1b species occurring on a property.

Category 2

Any species listed under Category 2 requires a permit issued by the Department of Forestry, Fisheries, and the Environment (DFFE) to carry out a restricted activity (See Permit Applications.)

- A permit is required to carry out any restricted activity.
- No person may carry out a restricted activity in respect of a Category 2 listed invasive species without a permit.
- A person in control of a Category 2 listed species must take all necessary measures to ensure that specimens of the species do not spread outside of the land or area, such as an aviary) specified in the permit.

Category 3

- Category 3 listed invasive species are subject to certain exemptions in terms of section 70(1)(a) of the NEMBA Act, which applies to the listing of alien invasive species.
- Any category 3 listed plant species that occurs in riparian areas must be considered as category 1b and the appropriate control measures instituted.

6.3 Additional SCC that may be found

All SCC that may be present on the site have been identified using the screening tool report for the site, iNaturalist nearby observations, and the POSA database (Table 2). The probability of occurrence that is stated in this section is a subjective assessment of SCC likelihood on the site.

Table 2: Plant SCC flagged for the site and nearby surroundings, with their likelihood of occurrence on the site.

Species	Common name	Family	Growth form	Source	South African Red List Status	Probability of occurrence
<i>Erica glandulosa</i> subsp. <i>fourcadei</i>	Ridges glandular heath	Ericaceae	Shrub	DFFE Screening tool	Vulnerable B1ab(ii,iii,iv,v)	Confirmed Present north of the existing road in a narrow band
<i>Hermannia lavandulifolia</i>	Lavender-leaved dollsrose	Malvaceae	Herbaceous perennial	iNaturalist	Vulnerable A2c	High Observed nearby
<i>Gnidia chrysophylla</i>	Gold capesaffron	Thymelaceae	Perennial	iNaturalist	Near Threatened B1ab(i,ii,iii,iv,v)	Medium Observed nearby but habitat is not quite right.
<i>Lampranthus pauciflorus</i>	Beach brightfig	Aizoaceae	Succulent	DFFE Screening tool	Endangered B1ab(ii,iii,iv,v)	Medium Species could conceivably occur here
<i>Lebeckia gracilis</i>	Slender ganna	Fabaceae	Shrub	DFFE Screening tool	Endangered A2bc; B1ab(ii,iii,iv,v)	Medium Species could conceivably occur here
<i>Cullumia carlinnoides</i>	Limestone snakethistle	Asteraceae	Perennial	iNaturalist	Near Threatened B1ab(ii,iii,iv,v)	Medium Observed nearby but habitat is not quite right.
<i>Diosma passerinoides</i>	Silcrete bitterbuchu	Rutaceae	Shrub	iNaturalist	Vulnerable A2c; C2a(i)	Medium Observed nearby but habitat is not quite right.
<i>Oxalis pendulifolia</i>	Hangleaf sorrel	Oxalidaceae	Perennial geophyte	iNaturalist	Near Threatened B1ab(i,ii,iii,iv,v)+2 ab(ii,iii,iv,v)	Medium Observed nearby but habitat is not quite right.
Sensitive species 800	-	-	-	DFFE Screening tool	Vulnerable B1ab(iii)	Medium Following the precautionary principle, it is conceivable that this species might be present on the site.
<i>Muraltia knysnaensis</i>	Garden Route purplegorse	Polygalaceae	Perennial	iNaturalist	Endangered B1ab(ii,iii,iv,v)	Medium Observed nearby but habitat is not quite right.
Sensitive species 516	-	-	-	DFFE Screening tool	Endangered A2cd+4cd; B1ab(i,ii,iii,iv,v)+2 ab(i,ii,iii,iv,v)	Medium Following the precautionary principle, it is

						conceivable that this species might be present on the site.
Sensitive species 500	-	-	-	DFFE Screening tool	Endangered C2a(i)	Medium No signs of sp., but following the precautionary principle, it is conceivable that this species might be present on the site.
Sensitive species 1024	-	-	-	DFFE Screening tool	Endangered B1ab(iii,v)+2ab(iii,v); C2a(ii)	Medium No signs of sp., but following the precautionary principle, it is conceivable that this species might be present on the site.
Sensitive species 1032	-	-	-	DFFE Screening tool	Vulnerable C2a(i)	Medium No signs of sp., but following the precautionary principle, it is conceivable that this species might be present on the site.
<i>Euchaetis albertiana</i>	Albertina beardbuchu	Rutaceae	Shrub	DFFE Screening tool	Endangered A2c	Low Habitat incorrect
<i>Leucospermum praecox</i>	Mossel Bay Pincushion	Proteaceae	Shrub	iNaturalist	Vulnerable A2c+3c+4c	Low Habitat incorrect and species unlikely to be present unless planted.

7. SITE SENSITIVITY VERIFICATION

7.1 Terrestrial Biodiversity

The vegetation on the site is rapidly being degraded due to severe erosion from unmanaged stormwater flowing over the erven. Although the site is mapped as critically endangered (CR) Garden Route Granite Fynbos and Great Brak Dune Strandveld, the current conditions on these erven will result in a loss of remaining habitat and habitat quality. The erven also contain a large number of garden escapees, such as the fishbone fern *Nephrolepis cordifolia* and the hybrid protea observed *Protea aurea x mundii* (See the front-page cover of this report). The vegetation on erven 326 and 318 is not representative of Garden Route Granite Fynbos (only the road verges, which are exposed, supports a few fynbos elements). The vegetation may be classified as Groot Brak Dune Strandveld, however large parts of the erven are dominated by garden escapees and the rest of the more natural vegetation is relatively species poor at present.

Erf 318 is in urgent need of mitigation as water flow keeps eroding this narrow erf. The site is a SWSA, and is mapped as part of our BSP, but if the erosion continues here unchecked, it

will cause unnecessary damage to the environment. The terrestrial biodiversity sensitivity of **the proposed project footprint on erven 326 and 318 is Low** due to the level of degradation that has already occurred from erosion here (see Fig. 9). The sensitivity of the more natural **Erf 139 is Very High**. If this project does not go ahead soon, more unnecessary damage to valuable ecosystems will occur.

7.2 Botanical diversity

Although natural thicket remains on the erven, no protected tree species (e.g., Milkwood trees, *Sideroxylon inerme inerme*, and Cheesewood trees, *Pittosporum viridiflorum*) were observed on the site. However, one SCC was observed in the open canopy vegetation immediately north of the existing road, *Erica glandulosa fourcadei* (VU). The site does not contain a significant population of this species; however, its presence means that the section above the road where the gabion wall is proposed is a **High** botanical sensitivity (Fig. 11). The rest of the closed canopy thicket vegetation has a **Low** plant species sensitivity as the vegetation is modified, no SCC were recorded there (Fig. 11), and no SCC are likely to occur within the project area of influence apart from *Hermannia lavandulifolia* (which is a threatened species that thrives in slightly disturbed areas, is widespread, and which will be downgraded in status during the next Red List revision).



Figure 11: The red polygon on the map represents the area with a confirmed *Erica glandulosa fourcadei* population. This polygon is the only area on the site with a High botanical sensitivity. The rest of Erf 326 and 318 has a Low plant species theme sensitivity.

8. IMPACT ASSESSMENT

For any impact assessment, the mitigation hierarchy must be kept in mind (Fig. 12; Ekstrom et al., 2015) in mind. If mitigation measures are likely to be ineffective at minimising large impacts, then avoidance mitigation must be implemented. If an impact cannot be prevented, then minimisation mitigation is preferred. The methods used for this impact assessment is provided in Appendix 10.3.

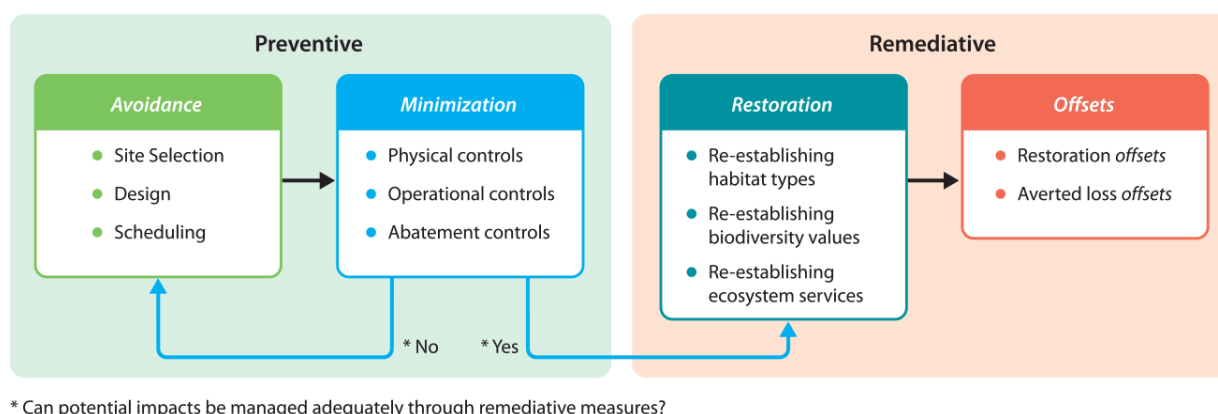


Figure 12: The iterative process of avoiding and minimising the predicted impacts on biodiversity and ecosystem services, as described in (Ekstrom et al., 2015).

8.1 Current impacts

A summary of the current negative impacts on the site are:

- The erosion on erf 318 is causing an ongoing loss of habitat and hazard on the site.
- The construction of a large house directly east of the eroded section on erf 318 is causing additional damage to the vegetation and integrity of the substrate of erf 318.
- Invasive and naturalised plant species on the erven have caused diversity loss on the erven and have resulted in patched of vegetation that is transformed.
- The habitats on erven 326 and 318 are surrounded by an urban residential area which impacts on their connectivity with the wider natural space on erf 139 and surrounds to the south.

8.2 Construction Phase

The construction phase is an essential part of a project as every chosen construction action impacts the surrounding environment. Materials, technology, and management choices affect the environment differently. In this section some ideas for mitigating negative construction phase impacts are proposed.

8.2.1 A loss of the small stand of *Erica glandulosa fourcadei* due to the construction of the 2m high gabion wall north of the existing road between erven 326 and 318.

Description: It is inevitable that this project will lead to vegetation loss on the site, however this is necessary given the erosion issue currently being unmitigated. *Erica glandulosa fourcadei* is the only SCC on the site, and unfortunately some of the plants are within the proposed gabion wall footprint. In order to mitigate the impact on this SCC, an impact assessment is required. The impact alternatives are assessed in Table 3.

Impact consequences:

1. Loss of a SCC sub-population.
2. Reduction in the extent of occurrence (EOO) of SCC.
3. A general loss of suitable habitat for SCC.
4. A loss of genetic variation within remaining SCC stands.
5. A shift towards a negative change in the conservation status of the SCC and other indigenous species affected by the development.

Mitigation measures:

1. Conduct a search and rescue of the *Erica glandulosa fourcadei* population north of the existing road only where they will be impacted by the proposed development.
 - A. A permit may need to be applied for from CapeNature in order to conduct the Erica search and rescue operation.
 - B. Ensure that the plants are watered about an hour before rescuing them.
 - C. Find an area outside of the project area of influence, in an open canopy area somewhere on the erven, and dig holes large enough to support the Ericas using an excavator. Soil dug out of these holes must be kept in a pile next to the holes. The soil piles must either be on driveways or elsewhere in an already disturbed area. The potential replanting spots on the site include around Erf 326 are illustrated in Fig. 13 below:



Figure 13: The yellow pin locations are potentially acceptable transplant locations for *Erica glandulosa fourcadei* on Erf 326. If the southern location is chosen, care must be taken not to damage existing *Ericas* that may already be present. The red area roughly indicated the existing population.

- D. When rescuing the *Ericas*, it is imperative that the soil be removed with the roots. For this reason, an excavator must carefully dig up *Ericas* where they fall within the proposed gabion wall or pipeline footprint.
 - E. The rescued *Ericas* in the excavator, with soil & roots relatively undisturbed, must then be transplanted into the hole/s dug for them. If there are any spaces left in the holes, spades can be used to fill the gaps with the soil.
 - F. The rescued *Ericas* must be watered daily during the construction phase unless it is raining.
2. Fence off the transplanted *Ericas*, and any that have remained in their original place (i.e., the plants that will not be affected by the construction). These are no-go areas for the project.
 3. Vegetation clearing must be limited to the construction footprint.
 4. No cut vegetation slash may be dumped into any watercourses nearby. All waste material must be disposed of responsibly.
 5. Mixing of materials such as concrete may only occur within the permanent disturbance footprint of this project.

Table 3: Construction phase impact 1 - A loss of the small stand of *Erica glandulosa fourcadei* due to the construction of the 2m high gabion wall north of the existing road between erven 326 and 318

CONSTRUCTION	Option 1: <i>Ericas</i> transplanted to the driveway east of Erf 326		Option 2: <i>Ericas</i> transplanted to northern edge of Erf 326		No-go option
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	
Impact 8.2.1	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	No stormwater

	management infrastructure				
Duration	Permanent	Brief	Permanent	Brief	Ongoing
Extent	Very limited	Very limited	Very limited	Very limited	Limited
Intensity	Moderate	Very low	Moderate	Low	High
Probability	Certain	Certain	Certain	Certain	Certain
SCORE	Moderate negative: -84	Negligibly negative: -35	Moderate negative: -84	Minor negative: -42	Moderate negative: -91

8.3 Operational Phase

The operational phase of the project refers to the state of the site after the construction phase has been concluded, when the proposed developments are ready for, or are in use.

8.3.1 A loss of SCC (*Erica glandulosa fourcadei*) due to ongoing site maintenance (or lack of maintenance) practices.

Description: The success of the transplanted *Erica glandulosa fourcadei* will be dependent on the successful management and monitoring of the stormwater infrastructure. Should the infrastructure be neglected, potential impacts that result could have adverse effects for the habitat and SCC. If someone decides to plant a garden over the SCC unknowingly, this is also an undesirable outcome for the successful survival of this small SCC population. This impact is assessed in Table 4.

Impact consequences:

1. A general loss of habitat for plants, pollinators, and other important taxa.
2. Altered soil characteristics which causes unnecessary harm to forest vegetation dynamics.
3. Pollution of the environment.
4. Loss of habitat to invasive plants species and increasingly species poor senescent road verge fynbos.

Mitigation:

1. Alien species must be kept under control, especially along the road verges.
2. No gardens may be planted in the areas where the Ericas are located. In order to make this clear, a plaque with the name of the species and a little history about its Red List status could be made. The Ericas could also be indicated by packing stones around the areas where they are present.
3. Fertilisers and pesticides must be avoided on the road verge, and when used it must be done with caution and may not become routine practice.
4. Kikuyu grass (*Cenchrus clandestinus*) may not be planted following the construction of the stormwater infrastructure, rather buffalo grass (*Stenotaphrum secundatum*) or *Eragrostis capensis* could be considered.

*Table 4: Operational phase impact 1 – A loss of SCC (*Erica glandulosa fourcadei*) due to ongoing site maintenance (or lack of maintenance) practices. A no-go option is not presented as it is assumed the construction phase has taken place for this impact.*

CONSTRUCTION	Option1: Ericas transplanted to the driveway east of Erf 326		Option 2: Ericas transplanted to northern edge of Erf 326	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Impact 8.3.1				
Duration	Ongoing	Brief	Ongoing	Brief
Extent	Very limited	Very limited	Very limited	Very limited
Intensity	Moderate	Very low	Moderate	Very low
Probability	Almost certain	Unlikely	Almost certain	Unlikely
SCORE	Minor negative: -66	Negligible negative: -15	Minor negative: -66	Negligible negative: -15

8.4 Cumulative impacts

No cumulative impacts are anticipated if the stormwater infrastructure project is to go ahead, and if the infrastructure is properly maintained after the construction phase. However, if the infrastructure is not maintained, the impacts on the SCC and habitats could potentially be cumulative, so that it becomes further reaching and more severe as time continues. Currently, this stormwater project is required because of existing cumulative impacts that have resulted from the rapid development of this residential area without appropriate consideration of the potential impacts along this drainage line, which has led to the undesirable situation with erosion here.

9. CONCLUSION

The proposed stormwater infrastructure will not directly affect any high Terrestrial sensitivity areas and will result in the protection and prevention of degradation of Erf 139 which does have a confirmed High Terrestrial Biodiversity sensitivity. Should this project go ahead, the Terrestrial Biodiversity in the corridor of erven 326 and 318 may recover enough to become functional once more as a healthy ESA area – it is therefore essential that this stormwater infrastructure that is proposed be implemented to prevent further degradation of the ecosystem downstream.

For this reason, the impact assessment of this report was not heavily focussed on the Terrestrial Biodiversity trigger (which is focussed on the fact that the direct footprint falls within a SWSA, ESA, and threatened ecosystem, all of which are currently being severely degraded mainly by erosion), but rather on the mitigation measures relating to the flora that will be directly impacted by the proposed stormwater infrastructure project. The road verges with the SCC *Erica glandulosa fourcadei* (VU) has a high botanical sensitivity, however the impact assessment section of this report includes appropriate mitigation measures that will allow the persistence of the population of this SCC. This project is urgent, and its nature is such that it is necessary to prevent further degradation and harm to highly sensitive and larger natural areas downstream (i.e., the CBA and CR endangered habitat on Erf 139). Due to the nature of the proposed activity, it is the opinion of the author that a Terrestrial Biodiversity assessment is not necessary, as the proposed activity itself will lead to the improvement of all the triggers for the terrestrial biodiversity sensitivity that was given in the screening tool report. It is essential that the stormwater management project be implemented before more erosion damage can lead to further degradation of the environment.

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11. APPENDIX

11.1 Provisional plant species list

A species accumulation curve for all the species recorded on the site during the assessment are presented in Fig. 14. All species that were observed during the site visit are in Table 5. The site assessment species list is not exhaustive.

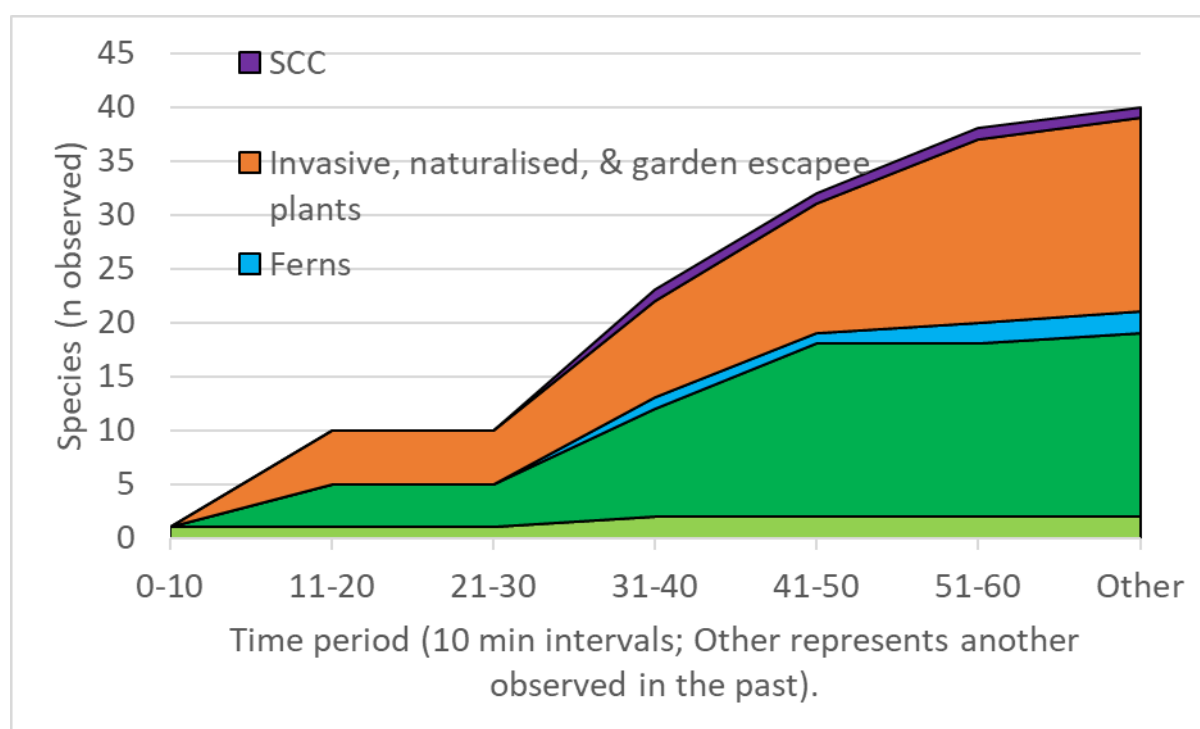


Figure 14: A plant species accumulation curve for the site assessment.

Table 5: A provisional species list made from the site assessment. The orange species are naturalised exotic and red entries are listed invasive species, in green are all the species of conservation concern on the site.

Family	Species	Common name	Information
Liliopsida (Monocots)			
Amaryllidaceae	<i>Agapanthus praecox</i>	blue lily	Naturalised garden escapee
Amaryllidaceae	<i>Clivia miniata</i>	Natal Lily	Naturalised garden escapee
Asparagaceae	<i>Asparagus aethiopicus</i>	African Asparagus	
Asparagaceae	<i>Chlorophytum comosum</i>	Spider plant	Naturalised garden Escapee from West Africa
Poaceae	<i>Cenchrus clandestinus</i>	Kikuyu Grass	Invasive NEMBA cat. 1b CARA cat. 1
Poaceae	<i>Cortaderia selloana</i>	Pampas Grass	Invasive NEMBA cat. 1b CARA cat. 1
Poaceae	<i>Paspalum urvillei</i>	Vasey Grass	Naturalised exotic from South America
Magnoliopsida (Dicots)			
Anacardiaceae	<i>Searsia lucida</i>	Glossy Currantrhus	
Anacardiaceae	<i>Searsia pterota</i>	Wing Currantrhus	
Araliaceae	<i>Hedera canariensis</i>	Canary Islands Ivy	Invasive NEMBA cat. 3
Asteraceae	<i>Helichrysum petiolare</i>	Licorice plant	
Asteraceae	<i>Helminthotheca echioides</i>	bristly oxtongue	Naturalised exotic from North Africa and the Mediterranean
Asteraceae	<i>Nidorella ivifolia</i>	Ivy Vleiweed	
Asteraceae	<i>Osteospermum moniliferum</i>	Bietou	
Asteraceae	<i>Plecostachys serpyllifolia</i>	petite-licorice	
Asteraceae	<i>Senecio angulatus</i>	creeping groundsel	
Asteraceae	<i>Senecio deltoideus</i>	Climbing Ragwort	
Asteraceae	<i>Tarchonanthus littoralis</i>	Coastal Camphorbush	
Basellaceae	<i>Anredera cordifolia</i>	Mignonette vine	Invasive NEMBA cat. 1b CARA cat. 1
Ebenaceae	<i>Diospyros dichrophylla</i>	Poison Starapple	
Ericaceae	<i>Erica glandulosa fourcadei</i>	Ridged Glandular Heath	Vulnerable B1ab(ii,iii,iv,v)
Fabaceae	<i>Acacia mearnsii</i>	black wattle	Invasive NEMBA cat. 2 CARA cat. 2

Lamiaceae	<i>Plectranthus ecklonii</i>	Ecklon spurflower	
Malvaceae	<i>Grewia occidentalis</i>	Crossberry	
Meliaceae	<i>Ekebergia capensis</i>	Cape Ash	
Ochnaceae	<i>Ochna serrulata</i>	Small-leaved plane	
Oleaceae	<i>Olea capensis macrocarpa</i>	Ironwood	
Proteaceae	<i>Protea aurea x mundii</i>	Forest Shuttlecock Hybrid	Naturalised garden escapee
Rosaceae	<i>Pyracantha sp.</i>	firethorns	
Rosaceae	<i>Rhaphiolepis indica</i>	Indian Hawthorn	Naturalised garden Escapee from Japan And China
Rosaceae	<i>Rubus rigidus</i>	White Bramble	
Rubiaceae	<i>Anthospermum aethiopicum</i>	Tall Flowerseed	
Santalaceae	<i>Colpoon compressum</i>	Cape Sumach	
Solanaceae	<i>Physalis peruviana</i>	Cape gooseberry	Naturalised exotic from South America
Solanaceae	<i>Solanum mauritianum</i>	bugweed	Invasive NEMBA cat. 1b CARA cat. 1
Stilbaceae	<i>Halleria lucida</i>	African honeysuckle	
Polypodiopsida			
Dennstaedtiaceae	<i>Pteridium aquilinum capense</i>	Southern Bracken	
Dryopteridaceae	<i>Rumohra adiantiformis</i>	leatherleaf fern	
Nephrolepidaceae	<i>Nephrolepis cordifolia</i>	Fishbone Fern	Invasive NEMBA cat. 1b in some provinces including the Western Cape Not CARA listed.
Polypodiaceae	<i>Phlebodium aureum</i>	golden polypody	Naturalised garden Escapee from the Americas.

11.2 Land use recommendations according to the WC BSP

Recommended acceptable land-uses for each BSP layer is outlined and summarised in Table 6 below.

Table 6: The land-use planning proposed by the Western Cape Biodiversity Spatial Plan

LAND USE CATEGORIES		Conservation	Agriculture	Tourism and Recreational Facilities	Rural Accommodation	Urban	Business & Industrial	Infrastructure Installations													
LAND USE SUB-CATEGORIES (Refer to table 4.7 for descriptions)		Proclaimed Protected Areas	Other Nature Areas	Intensive Agriculture	Extensive Agriculture	Low Impact Facilities	High Impact Facilities	Agri-worker Accommodation	Small Holdings	Urban Development & Expansion	Community Facilities & Institutions	New Settlements	Rural Business	Non-place-bound industry (low-moderate impact)	Non-place-bound industry (high impact)	Extractive Industry (incl. Prospecting)	Linear - roads & rail	Linear - pipelines & canals	Linear - powerlines	Other utilities	
MAP CATEGORY	DESIRED MANAGEMENT OBJECTIVE	Y = Yes: Permissible land uses that are not likely to compromise the biodiversity objective						R = Restricted: Land uses that may compromise the biodiversity objective are only permissible under certain conditions (refer to Table 4.7 for conditions)						N = No: Land uses that will compromise the biodiversity objective and are not permissible							
Protected Area	Must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity.	Land use within proclaimed protected areas are subject to management plan drawn up for that specific protected area.																			
Critical Biodiversity Area 1	Keep natural, with no further loss of habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.	Y	Y	N	R	N	N	N	N	N	N	N	N	N	N	N	N	N	R	N	
Critical Biodiversity Area 2	Keep natural, with no further loss of habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.	Y	Y	N	R	R	N	N	N	N	N	N	N	N	N	N	N	R	R	N	
Ecological Support Area 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.	Y	Y	N	R	R	N	N	N	N	N	N	R	R	N	N	R	R	R	R	
Ecological Support Area 1: Aquatic	Maintain in a functional, near-natural state. Some habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.	Y	Y	N	R	R	N	N	N	N	N	N	N	N	N	N	R	R	R	N	
Ecological Support Area 2	Restore and/or manage to minimise impact on ecological infrastructure functioning, especially soil and water-related services.	Y	Y	N	R	R	N	N	R	N	N	N	N	N	N	N	R	R	R	R	
ONA: Natural to Near-Natural	Minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. Offers flexibility in permissible land uses, but some authorisation may still be required for high impact land uses.	Y	Y	R	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
ONA: Degraded	Minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. Offers flexibility in permissible land uses, but some authorisation may still be required for high impact land uses.	R	R	R	Y	Y	R	R	Y	R	R	R	R	R	R	R	Y	Y	Y	Y	
No Natural Remaining	These areas are suitable for development but may still provide limited biodiversity and ecological infrastructure functions and should be managed in a way that minimises impacts on biodiversity and ecological infrastructure.	R	R	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	

11.3 Impact assessment methods

Individual impacts for the construction and operational phase were identified and rated according to criteria which include their intensity, duration, and extent. The ratings were then used to calculate the consequence of the impact which can be either negative or positive as follows:

$$\text{Consequence} = \text{type} \times (\text{intensity} + \text{duration} + \text{extent})$$

Where type is either negative (i.e., -1) or positive (i.e., 1). The significance of the impact was then calculated by applying the probability of occurrence to the consequence as follows:

$$\text{Significance} = \text{consequence} \times \text{probability}$$

The criteria and their associated ratings are shown in Table 7.

Table 7: Categorical descriptions for impacts and their associated ratings.

Rating	Intensity	Duration	Extent	Probability
1	Negligible	Immediate	Very limited	Highly unlikely
2	Very low	Brief	Limited	Rare
3	Low	Short term	Local	Unlikely
4	Moderate	Medium term	Municipal area	Probably
5	High	Long term	Regional	Likely
6	Very high	Ongoing	National	Almost certain
7	Extremely high	Permanent	International	Certain

Categories assigned to the calculated significance ratings are presented in Table 8.

Table 8: Value ranges for significance ratings, where (-) indicates a negative impact and (+) indicates a positive impact

Significance Rating	Range	
Major (-)	-147	-109
Moderate (-)	-108	-73
Minor (-)	-72	-36
Negligible (-)	-35	-1
Neutral	0	0
Negligible (+)	1	35
Minor (+)	36	72
Moderate (+)	73	108
Major (+)	109	147

Each impact was considered from the perspective of whether losses or gains would be irreversible or result in the irreplaceable loss of biodiversity of ecosystem services. The level of confidence was also determined and rated as low, medium, or high (Table 9).

Table 9: Definition of reversibility, irreplaceability, and confidence ratings.

Rating	Reversibility	Irreplaceability	Confidence
Low	Permanent modification, no recovery possible.	No irreparable damage and the resource isn't scarce.	Judgement based on intuition.
Medium	Recovery possible with significant intervention.	Irreparable damage but is represented elsewhere.	Based on common sense and general knowledge
High	Recovery likely.	Irreparable damage and is not represented elsewhere.	Substantial data supports the assessment