

**FAUNAL AND FLORAL ECOLOGICAL ASSESSMENT AS  
PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT  
PROCESS FOR THE PROPOSED DEVELOPMENT ON  
PORTION 22 AND A PORTION OF PORTION 200 OF THE  
FARM KNOPJESLAAGTE AS WELL AS HOLDING 23 OF  
TIMSRAND AH, GAUTENG PROVINCE**

**Prepared for**

**Nali Sustainability Solutions**

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**Section B: Floral Assessment**

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## EXECUTIVE SUMMARY

The floral assessment revealed that the study area encompasses four habitat units, namely the Egoli Granite Grassland, Secondary Egoli Granite Grassland, Freshwater and Transformed habitat units. Based on the field assessment it was determined that the Egoli Granite Grassland is the most sensitive in terms of floral ecological importance and is considered of moderately high sensitivity. The Secondary Egoli Granite Grassland and Freshwater Resource habitat units is of intermediate importance while the Transformed habitat is of low importance.

It is recommended that the Egoli Granite Grassland and Freshwater Habitat unit demarcated as Private Open Space Area be effectively monitored and managed throughout the life of the proposed development to maintain the ecological importance and sensitivity of this area.

Furthermore the floral Species of Conservation Concern (SCC) identified within the development footprint i.e *Boophone disticha* and *Hypoxis hemerocallidea* should be rescued and relocated to the Private Open Space Area, or used within the landscaping of the project, to negate the need for floral permits from GDARD.

Based on the impact assessment, the impacts on floral habitat, diversity and SCC within the different habitat units varies from medium high to very low significance during the construction and the operational phase of the project prior to mitigation taking place. With effective mitigation implemented, all impacts may be reduced to medium low, low and very low levels during all phases.

It is therefore the opinion of the ecologists that the proposed development be considered favourably from a floral ecological perspective. However, it is essential that cogent, well-conceived and ecologically sensitive site development plans, and the mitigation measures provided in this report, as well as general good construction practice, are strictly adhered to.

## MANAGEMENT SUMMARY

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed industrial township development on Portion 22 and a Portion of Portion 200 of the farm Knopjeslaagte 385 JR and Holding 26 of Timsrand Agricultural Holdings (AH), near Diepsloot, Gauteng province (hereafter referred to as the 'study area').”.

Specific outcomes required from this report include the following:

- To provide inventories of floral species as encountered within the study area;
- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/ or any other special features;
- To conduct a Red Data Listed (RDL) species assessment as well as an assessment of other Species of Conservation Concern (SCC), including potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed mining activities within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area



The following general conclusions were drawn upon completion of the field assessment:

- Four habitat units were identified within the study area, namely, Egoli Granite Grassland<sup>1</sup>, Secondary Egoli Granite Grassland<sup>2</sup>, Freshwater Habitat and Transformed Habitat;
- No AIP species were recorded for the Egoli Granite Grassland habitat, with a moderately high diversity of herbaceous species observed, of which a number is considered indigenous to the Egoli Granite Grassland, namely *Acalypha angustata*, *Justicia anagalloides*, *Pentanisia prunelloides* subsp. *prunelloides* and *Scabiosa columbaria* amongst others, as well as the floral SCC *Boophane disticha* and *Hypoxis hemerocallidea*. Due to extensive cattle grazing of the study area, only a few grass species could be identified. The grass layer is however expected to be more diverse than what was recorded, and this habitat unit is therefore considered to be of moderately high sensitivity. It is recommended that the portion of this habitat unit demarcated as Private Open Space, be effectively monitored and managed to retain its ecological sensitivity for the life of the proposed development.
- The Secondary Grassland was associated with the severe bush encroachment by *Seriphium plumosum*, with the grass layer dominated by *Hyparrhenia hirta*. The habitat unit did, however, provide habitat for the GDARD declining orange listed floral SCC *B. disticha* and *H. hemerocallidea*. This habitat unit is therefore of Intermediate sensitivity;
- Although a number of facultative and obligate wetland species, such as *Cyperus denudatus* var. *denudatus*, *Berkheya radula*, *Kniphofia porphyrantha* were observed within the Freshwater Habitat, various AIP species (*Oenothera rosea*, and *Veronica anagalis-aquatica* amongst others) were also encountered. The Freshwater Habitat unit is therefore considered to be of intermediate sensitivity. The watercourse is however considered to be a unique landscape, and as it provides connectivity to a larger system through the culverts associated with the existing roads, it is recommended that this habitat unit, together with its regulated zones, as per the Freshwater ecological report (SAS, 2018) be excluded from the development.
- The transformed habitat has been transformed due to historic and current hardened infrastructure such as roads, and housing. This habitat is therefore considered severely degraded from its reference state, and of low ecological importance;
- With the floral SCC *B. disticha* and *H. hemerocallidea* scattered throughout the Primary and Secondary Egoli Granite Grassland habitat units, avoidance of all individuals is considered highly unlikely. As such, where individuals are situated within the development footprint, they should be rescued and relocated to the Private Open Space Area, used within the landscaping of the project, or the Agricultural Research Council (ARC) or the South African National Biodiversity Institute (SANBI). This process should be overseen by a suitably qualified specialist.

#### Habitat Sensitivity:

From an ecological perspective, habitat sensitivities range from moderately high to low sensitivities. The table below indicates the sensitivity of the habitat units along with an associated conservation objective and implications for development.

<sup>1</sup> “Primary grasslands are those that have not been significantly modified from their original state; even though they may no longer have their full complement of naturally-occurring species, they have not undergone significant or irreversible modification and still retain their essential ecological characteristics” (Cadman, 2013)

<sup>2</sup> Secondary grasslands are those that have undergone extensive modification and a fundamental shift from their original state (e.g. to cultivated areas) but have then been allowed to return to a ‘grassland’ state (e.g. when old cultivated lands are re-colonised by a few grass species. Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning and the ecosystem services they deliver.” (Cadman, 2013)



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

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
<b>Egoli Granite Grassland</b>	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	This habitat unit is considered to be of Moderately High Ecological importance and sensitivity. This can be attributed to the area confirmed as good quality Grassland, as well as the presence of Orange listed floral species. The CBA status attributed to this habitat unit within the Gauteng C-Plan is therefore accurate. Development within this habitat unit is considered significant, as it will not only impact upon the floral ecology of the area but also the conservation targets for the vegetation type. The majority of this habitat unit has been demarcated as Private Open Space together with the watercourse and its associated regulatory zones which allows for connectivity to the surrounding area, as well as for conservation of the habitat unit, provided that effective ongoing monitoring and maintenance activities are implemented. As such it is recommended that an Environmental Management Plan be designed for this area, and a specialist be appointed to oversee the implementation of this plan, and subsequently the conservation of the Egoli Granite Grassland habitat.
<b>Secondary Egoli Granite Grassland</b>	Intermediate	Preserve and enhance the biodiversity of the habitat unit and surrounds while optimising development potential.	This habitat unit is of intermediate ecological sensitivity, predominantly due to the presence of floral SCC. Development within this habitat unit is therefore likely to result in the loss of some individuals of these species. Loss of individuals can, however, be mitigated should a thorough rescue and relocation plan be implemented and be overseen by a qualified specialist. With mitigation thoroughly implemented the proposed development is considered unlikely to have a significant impact on the floral ecology of the area nor the conservation objective for the province. The disturbance timeframes and footprint must be minimised, and care must be taken to limit edge effects on the Private Open Space Area comprising the more sensitive Egoli Granite Grassland and freshwater habitat units. During the construction phase, disturbance to the vegetation should be restricted to areas where development will take place – this will limit the potential for AIPs to spread.
<b>Freshwater Habitat</b>	Intermediate	Preserve and enhance the biodiversity of the habitat unit and surrounds while optimising development potential.	The freshwater habitat unit is of intermediate ecological importance and sensitivity. Based on the existing layout, the watercourse is excluded from development. The proposed development is therefore not considered to pose a detrimental risk on the floral ecology of this watercourse and can be significantly reduced should all mitigation measures be implemented. Should development take place within close proximity of this habitat unit, care must be taken to prevent any negative impacts on vegetation and edge effects of the development should be managed, with a particular emphasis of AIP monitoring and control.
<b>Transformed Areas</b>	Low	Optimise development potential.	This habitat unit is of low ecological sensitivity due to severe habitat transformation. The placement of infrastructure within the transformed areas will have no significant impacts on the floral ecology and conservation targets of the area. However, to reduce opportunities for AIPs to be exchanged between the Transformed habitat and adjacent Egoli Granite Grassland during construction activities, it is recommended that an AIP management plan be implemented for the clearance of listed alien species before construction commences.

**Floral Impact Assessment:**

The tables below summarise the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation take place. In the consideration of mitigation, it is assumed that a high level of mitigation takes place, but which does not lead to prohibitive costs.

The impact of the proposed development on the floral habitat and diversity is considered to be of medium-low to medium-high significance for the Freshwater Habitat, as well as the Egoli Granite Grassland and Secondary Egoli Granite Grassland habitat units based on the current layout. With mitigation fully implemented all impact can be reduced to medium-low and low significance. The impact on the transformed habitat is considered to be of low significance prior to mitigation, and very low with all mitigation measures fully implemented.



With respect to floral SCC, the impact on the Egoli Granite Grassland and Secondary Egoli Granite Grassland is considered medium-high prior to mitigation. Should mitigation be implemented, and all individuals within the development footprint be rescued and relocated to the Private Open Space Area the impact can be reduced to low significance. As no floral SCC were recorded within the Freshwater Habitat and transformed habitat units, the impact significance on floral SCC is considered to of very low and low significance with mitigation fully implemented.

**Table B: A summary of the impact significance on floral resources in the construction phase**

Site	Impact	Unmanaged	Mitigated
Primary Egoli Granite Grassland	<i>Impact on floral habitat and species diversity</i>	Medium High	Medium Low
	<i>Impact on floral SCC</i>	Medium High	Low
Secondary Egoli Granite Grassland	<i>Impact on floral habitat and species diversity</i>	Medium Low	Medium Low
	<i>Impact on floral SCC</i>	Medium High	Low
Freshwater Habitat	<i>Impact on floral habitat and species diversity</i>	Medium Low	Low
	<i>Impact on floral SCC</i>	Low	Very Low
Transformed Habitat	<i>Impact on floral habitat and species diversity</i>	Low	Very Low
	<i>Impact on floral SCC</i>	Very Low	Very Low

**Table C: A summary of the impact significance on floral resources in the operational phase**

Site	Impact	Unmanaged	Mitigated
Primary Egoli Granite Grassland	<i>Impact on floral habitat and species diversity</i>	Medium High	Low
	<i>Impact on floral SCC</i>	Medium High	Low
Secondary Egoli Granite Grassland	<i>Impact on floral habitat and species diversity</i>	Medium Low	Low
	<i>Impact on floral SCC</i>	Medium Low	Low
Freshwater Habitat	<i>Impact on floral habitat and species diversity</i>	Medium Low	Low
	<i>Impact on floral SCC</i>	Low	Very Low
Transformed Habitat	<i>Impact on floral habitat and species diversity</i>	Very Low	Very Low
	<i>Impact on floral SCC</i>	Very Low	Very Low

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



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## GLOSSARY OF TERMS

<b>Alien and Invasive species</b>	A species that is not an indigenous species; or an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.
<b>CBA (Critical Biodiversity Area)</b>	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
<b>Endemic species</b>	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.
<b>ESA (Ecological Support Area)</b>	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
<b>Indigenous vegetation (as per the definition in (NEMA))</b>	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
<b>Invasive species</b>	Means any species whose establishment and spread outside of its natural distribution range; they threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and may result in economic or environmental harm or harm to human health
<b>RDL (Red Data listed) species</b>	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
<b>SCC (Species of Conservation Concern)</b>	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.
<b>Sward</b>	An expanse of grass
<b>Tussocked Veld</b>	Grassland in which all palatable grass species have been eaten, leaving big tufts of unpalatable grass

## ACRONYMS

<b>AIP</b>	Alien and Invasive Plants
<b>CR</b>	Critically Endangered
<b>EAP</b>	Environmental Assessment Practitioner
<b>EIS</b>	Ecological Importance and Sensitivity
<b>EN</b>	Endangered
<b>EW</b>	Extinct in the Wild
<b>GIS</b>	Geographic Information System
<b>GPS</b>	Global Positioning System
<b>IEM</b>	Integrated Environmental Management
<b>NT</b>	Near Threatened
<b>P</b>	Protected
<b>PES</b>	Present Ecological State
<b>POC</b>	Probability of Occurrence
<b>QDS</b>	Quarter Degree Square
<b>SANBI</b>	South Africa National Biodiversity Institute
<b>SP</b>	Specially Protected
<b>STS</b>	Scientific Terrestrial Services
<b>SCC</b>	Species of Conservation Concern
<b>TOPS</b>	Threatened or Protected Species
<b>VU</b>	Vulnerable





## DOCUMENT GUIDE

The following table indicates the requirements for Specialist Studies as per Appendix 6 of Government Notice 326 as published in Government Notice 40772 of 2017, amendments to the Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Section A: Appendix D
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Section A: Appendix D
b)	A declaration that the specialist is independent	Section A: Appendix D
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
cA)	An indication of the quality and age of base data used for the specialist report	Section 2.1 and Section A: 3
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2.1
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix A and B
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 3 and 4
g)	An identification of any areas to be avoided, including buffers	Section 4
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 4
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.2
j)	A description the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 5
k)	Any mitigation measures for inclusion in the EMPr	Section 5
l)	Any conditions for inclusion in the environmental authorisation	Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 5
(iA)	Regarding the acceptability of the proposed activity or activities	Section 5
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 5
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A



# 1 INTRODUCTION

## 1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed industrial township development on Portion 22 and a Portion of Portion 200 of the farm Knopjeslaagte 385 JR and Holding 23 of Timsrand Agricultural Holdings (AH), near Diepsloot, Gauteng province (hereafter referred to as the 'study area').

The N14 National Highway forms the northern boundary of the study area, while the Diepsloot Urban Built-up area is situated approximately 1.1km southwest of the study area and Timsrand AH is situated south of the study area. The surrounding area is moderately developed and includes residential developments, a mining area to the north and the Centurion Flight Academy to the northeast.

The purpose of this report is to define the floral ecology of the study area as well as mapping and defining areas of increased Ecological Importance and Sensitivity (EIS) and to define the Present Ecological State (PES) of the study area. It is the objective of this study:

- To provide inventories of floral species as encountered within the study area;
- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To identify and consider all sensitive landscapes including primary grassland, rocky ridges, wetlands and/ or any other special features;
- To conduct a Red Data Listed (RDL) species assessment as well as an assessment of other Species of Conservation Concern (SCC), including potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed development activities within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area.



## 1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The floral assessment is confined to the study area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management;
- The study area was recently burned prior to the field investigation and is subject to extensive continuous cattle grazing. The majority of grasses were therefore without inflorescences, and not all species could be identified. The grass layer of the study area, particularly within the Primary Egoli Granite Grassland habitat, is therefore considered to be more diverse than that recorded during the field assessment;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the study area may, therefore, have been missed during the assessment; and
- As part of the assessment, a field assessment was undertaken on the 5<sup>th</sup> and the 6<sup>th</sup> of November 2018, to determine the ecological status of the study area, and to “ground-truth” the results of the desktop assessment. A more accurate assessment would require that assessments take place in all seasons of the year. On-site data was therefore significantly augmented with all available desktop data and specialist experience in the area, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

## 2 ASSESSMENT APPROACH

In order to accurately determine the ecological state of the study area and capture comprehensive data with respect to the floral ecology, the following methodology was used:

- Maps and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. The results of these analyses were then used to focus the fieldwork on specific areas of concern and to identify areas where target specific investigations were required;
- All relevant information as presented by the South African National Biodiversity Institute (SANBI)'s Biodiversity Geographic Information Systems (BGIS) website



(<http://bgis.sanbi.org>), including the Gauteng Conservation Plan (2011), to gain background information on the physical habitat and potential floral and faunal biodiversity associated with the study area;

- The results presented in this report form part of the field investigation undertaken on the 5<sup>th</sup> and 6<sup>th</sup> of November 2018, in order to determine the ecological status of the study area. The field investigation initially entailed a reconnaissance 'walkabout' to determine the general habitat types found throughout the study area. Following this, specific study sites were selected that were considered to be representative of the habitats found within the area, with special emphasis being placed on areas that may potentially support floral Species of Conservation Concern (SCC). These sites were further investigated on foot in order to identify the occurrence of the dominant plant species and habitat diversities. A detailed explanation of the method of assessment is provided in **Appendix A** of this report;
- For the methodologies relating to the impact assessment and development of the mitigation measure, please refer to **Appendix B** of this section of the report.

## **2.1 Sensitivity Mapping**

All the ecological features of the study area were considered, and sensitive areas were assessed and mapped by means of a Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery. The sensitivity map should guide the final design and layout of the proposed development activities.



### 3 RESULTS OF FLORAL ASSESSMENT

During the field assessment, four habitat units were identified within the study area, i.e. the Egoli Granite Grassland, Secondary Grassland, Freshwater Habitat and Transformed Habitat (described in greater detail in sections 3.1 – 3.5).

#### **Egoli Granite Grassland**

A portion (approximately 6.5ha) of the western section of the study area is considered to be Egoli Granite Grassland in good condition. The Egoli Granite Grassland consists of some of the characteristics of a healthy grassland as described by Cadman *et al.*, (SANBI, 2013) such as a high diversity of growth forms, in this instance, graminoids (grasses), forbs, bulbs, shrubs and succulents. Although it was not possible to identify all grass species associated with this vegetation type, due to extensive grazing of the study area, it was evident that the grass species diversity within this portion was significantly higher as compared to the remaining extent of the study area, and the graminoid species diversity is considered more substantial than that recorded. A high grass species diversity as well as an even grass sward, as opposed to tussocked veld is a further sign of a healthy grassland, as was evident within the Egoli Granite Grassland habitat unit. No floral Invasive Alien Plant (IAP) species were recorded during the field assessment, with only a few scattered individuals of the indigenous bush encroacher *Seriphium plumosum* observed. This habitat unit can, therefore, be considered as Primary Grassland as per the definition provided by Cadman *et al.* (SANBI, 2013): "*Primary grasslands are those that have not been significantly modified from their original state; even though they may no longer have their full complement of naturally-occurring species, they have not undergone significant or irreversible modification and still retain their essential ecological characteristics.*" Despite the good quality of the grassland, the habitat unit has started to show signs of disturbance, such as a decrease in basal cover, as well as a number of species often associated with anthropogenic *Hyparrhenia hirta*-dominated Egoli Granite Grassland, as defined by Bredenkamp *et al.* (2006) observed. These signs can predominantly be ascribed to extensive cattle grazing within the area.

#### **Secondary Egoli Granite Grassland**

Based on digital satellite imagery it is evident that this habitat unit has historically been cultivated although it has been returned to a grassland state prior to the earliest google imagery (2005), and as such is classified as Secondary Grassland. The Grassland Ecosystem Guidelines (SANBI, 2013) defines Secondary Grassland as "those that have undergone extensive modification and a fundamental shift from their original state (e.g. to cultivated areas) but have then been allowed to return to a 'grassland' state (e.g. when old cultivated



lands are re-colonised by a few grass species). Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning and the ecosystem services they deliver.” This habitat unit was dominated by the increaser <sup>3</sup> grass species *Hyparrhenia hirta* as well as the bush encroachment species *Seriphium plumosum*, which according to Bredenkamp *et al.* (2013) is a sign of Egoli Granite Grassland with significant anthropogenic influence, whether recent or historic. Despite the obvious signs of disturbance, the habitat unit still provided suitable habitat for the floral SCC *Boophone disticha* and *Hypoxis hemerocallidea*.

### **Freshwater Habitat**

The watercourse traverses the central portion of the study area and was classified as an unchanneled valley bottom wetland (SAS, 2018). Hardened infrastructure such as roads has impacted upon the watercourse. However pipe and box culverts associated with the roads allow for connectivity of the watercourse. The watercourse is currently subjected to extensive cattle grazing, which has resulted in the trampling of vegetation in some areas. These anthropogenic activities together with earthworks and rubble disposal in some portions of the watercourse have led to the establishment of some AIP species such as *Oenothera rosea*, and *Veronica anagalis-aquatica*. Despite AIP establishment within some portions of the wetland, the watercourse was still associated with a variety of facultative and obligate indigenous wetland vegetation such as *Typha capensis*, *Cyperus denudatus* var. *denudata*, *Kniphofia porphyrantha* and *Mimulus gracillies* amongst others. This habitat unit is therefore considered moderately modified from a floral ecological perspective.

### **Transformed Habitat Unit**

The Transformed Habitat Unit was predominantly associated with dilapidated and current infrastructure, and as such comprised predominantly of AIP species and exotic garden ornamentals. This habitat unit no longer provides habitat for indigenous vegetation, and as such is considered transformed and of low ecological significance.

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<sup>3</sup> Unpalatable, robust climax species that can grow without any defoliation



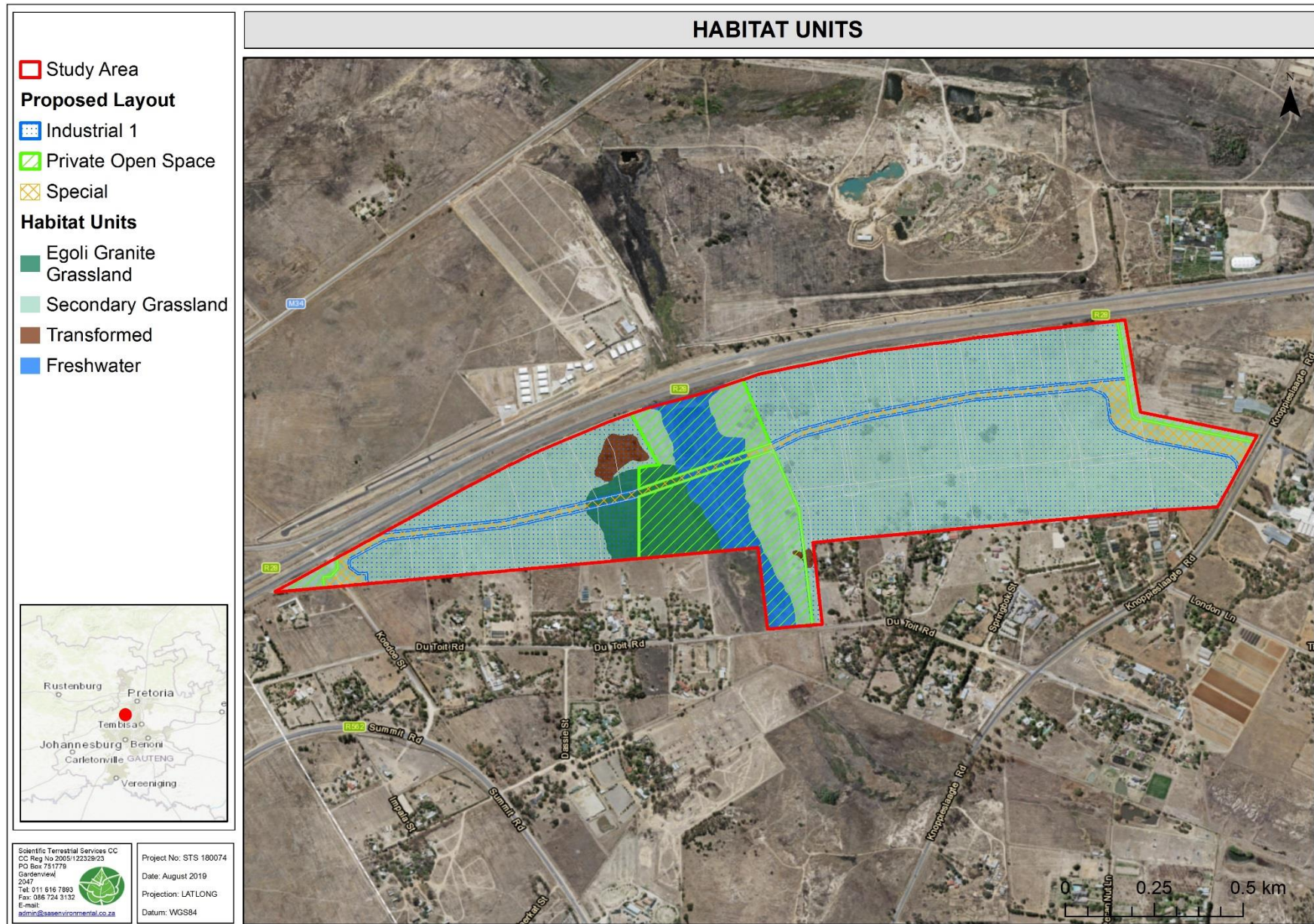

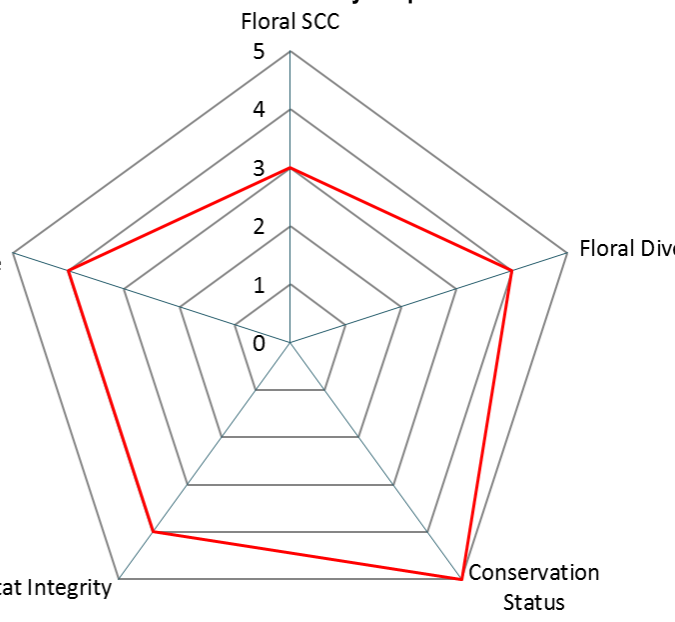



Figure 1: Conceptual illustration of the habitat units within the study area, with the proposed development footprint overlaid on satellite imagery.



### 3.1 Habitat Unit 1: Egoli Granite Grassland Habitat Unit

<p><b>Habitat Unit:</b> Egoli Granite Grassland Habitat Unit</p>	<p><b>Floral Habitat Sensitivity</b></p>	<p><b>Moderately High</b></p>	
<p><b>Notes on Photograph:</b>                  Representative photographs of the Primary Egoli Granite Grassland. Although the area is extensively grazed, the grassland still retains qualities of good quality Mesic Highveld grassland, such as a diversity of different growth forms, no AIP species and a low abundance of bush encroachment species</p>			
<p style="text-align: center;"><b>Floral Habitat Sensitivity Graph</b></p> 			
<p><b>Floral Species of Conservation Concern (SCC)</b></p>	<p>Two floral SCC, <i>Boophone disticha</i> and <i>Hypoxis hemerocallidea</i>, were present within this habitat unit. On a national level, these species are considered of Least Concern (LC) however due to rapid urbanisation, as well as the use of these species for medicinal purposes, the species are considered Declining within the Gauteng province. Both species were encountered throughout the habitat unit, and although all individuals encountered were marked, a grid search for these species were not undertaken, and as such is highly likely that individuals associated with the area might have been missed. An abundance of these species is therefore considered to be higher than what was observed. Due to the ecological importance and sensitivity of this habitat unit, it is recommended that the portion of this habitat unit situated within the green open space area be conserved together with the freshwater habitat, and this area be used as a relocation zone for SCC individuals situated within the development footprint.</p>		


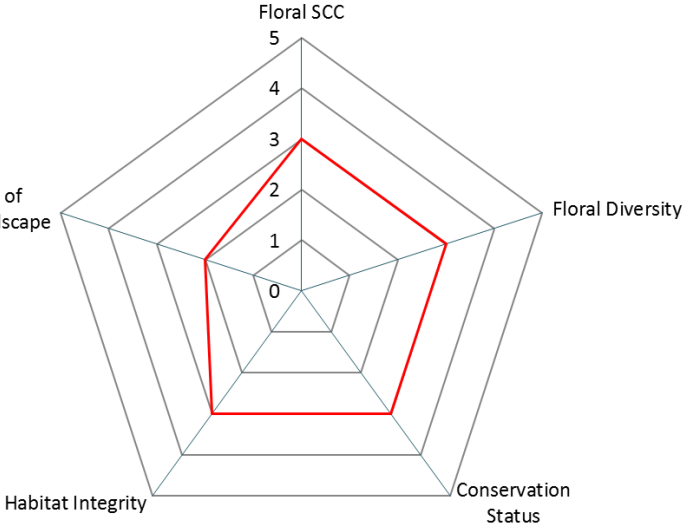




<p><b>Floral Diversity</b></p>	<p>Floral diversity for the Egoli Granite Grassland Habitat Unit is considered to be moderately high. Although a low diversity of grass species was recorded at the time of assessment, the graminoid composition was not dominated by a single species. Furthermore, the graminoid species composition is considered to be more diverse than was recorded, but due to extensive continuous cattle grazing, very few grass species with inflorescences were observed, and as such identification of grass species were limited. The majority of grass species identified is, however, representative of the Egoli Granite Grassland vegetation type, and include species such as <i>Melinis repens</i>, <i>Themeda triandra</i>, <i>Hyparrhenia hirta</i>, <i>Eragrostis chloromelas</i>, <i>E. curvula</i> and <i>Aristida canescens</i>. The diversity of herbaceous species within the habitat unit is considered moderately high with numerous species indigenous to the original Egoli Granite Grassland vegetation, as defined by Bredenkamp et al. (2006), observed, namely <i>Acalypha angustata</i>, <i>Aloe greatheadii</i>, <i>Hypericum aethiopicum</i>, <i>Justicia anagalloides</i>, <i>Pentanisia prunelloides</i> subsp. <i>prunelloides</i> and <i>Scabiosa columbaria</i> amongst others. The woody species diversity is considered to be low, with only three species recorded namely <i>Asparagus suaveolens</i>, <i>Gomphocarpus fruticosus</i> and <i>Seriphium plumosum</i>. For a full list of species encountered during the field assessment, refer to Appendix D.</p>	<p><b>Business Case, Conclusion and Mitigation Requirements:</b> This habitat unit is of moderately high floral sensitivity. This can be attributed to the grassland comprising a moderately high floral diversity, largely intact grassland habitat, rendering the grassland of good quality, and subsequently increasing the conservation significance of the habitat unit. Development within this habitat unit is considered detrimental. However, the impact has been lowered with the exclusion of the majority of this habitat unit which has been demarcated as Private Open Space.</p> <p>According to the GDARD Requirements for Biodiversity Assessments (GDARD, 2014), all good quality natural vegetation should be defined as ecologically sensitive, and a 200m buffer be provided to mitigate for delirious effects. A 200m buffer surrounding this habitat is however deemed unfeasible, as the portion to the north has historically been utilised for residential housing, and as such will offer little protection to this habitat Furthermore, the secondary grassland to the west was degraded due to extensive bush encroachment by <i>S. plumosum</i>, and it is considered that a 200m buffer to the west will not serve to protect this habitat but will likely result in further degradation of the Primary Egoli Granite Grassland due to bush encroachment to this area. A 200m buffer is further likely to impact upon the feasibility of the project. In the absence of the development, the survival of the Primary Egoli Granite Grassland cannot be guaranteed, as the area is currently extensively grazed, and ongoing degradation of this area is considered definite. Furthermore, the layout has been revised to incorporate as much as possible of the sensitive Egoli Granite Grassland. Although a portion will be lost, the freshwater habitat and associated buffer zone as per the freshwater assessment report (SAS, 2019) will also form part of the Private Open Space Area which will provide and ecological corridor for species movement to and from the Egoli Granita Grassland. Provided that this area is effectively rehabilitated, and AIP control are implemented, regularly monitored and maintained, this ecological corridor is considered sufficient to support the ecological function of the Egoli Granite Grassland.</p>
<p><b>Conservation Status of Vegetation Type / Ecosystem</b></p>	<p>The vegetation type associated with the study area is listed as endangered (Mucina &amp; Rutherford 2012). Furthermore, the majority of the study area with the exception of the transformed areas is considered to fall within the remaining extent of the Egoli Granite Grassland ecosystem according to the National Threatened Ecosystem Database (2011). The Gauteng Conservation Plan (C-Plan V3.3, 2011), indicate the habitat unit as a CBA, important for “Red and Orange” listed plant habitat and for primary vegetation. During the field assessment, orange listed floral SCC were observed. This habitat unit was furthermore confirmed to be grassland of good quality. The conservation importance of this habitat unit is therefore considered to be high.</p>	<p>The grassland is connected to the watercourse, which according to the current layout is excluded from development and designated as Private Open Space. This will allow for habitat connectivity of the portion of the Egoli Granite Grassland also incorporated into the Private Open Space. It is therefore the opinion of the specialist that conservation of this portion of Egoli Granite Grassland together with the Freshwater habitat will increase the likelihood of survival of this grassland, provided that this area is regulatory monitored and maintained for edge effects, as well as AIP species actively controlled to prevent spread of such species from the watercourse to the Egoli Granite Grassland.</p> <p>All floral SCC situated within the development footprint should be rescued and relocated to the Egoli Granite Grassland situated within the Private Open Space area. This will negate the need for permits to be obtained from GDARD.</p>
<p><b>Habitat integrity / Alien and Invasive species</b></p>	<p>No AIP species were observed within this habitat unit. The habitat unit furthermore provided suitable habitat for floral SCC as well as for a variety of species considered indigenous to the Egoli Granite Grassland vegetation type. The habitat unit is however extensively grazed, and as such, some level of disturbance was observed, albeit currently of limited significance. The habitat integrity of this habitat unit is therefore considered to be moderately high.</p>	
<p><b>Presence of Unique landscape</b></p>	<p>This habitat unit is considered to be a good quality grassland within an urbanised setting and is therefore considered a unique landscape within an urban setting.</p>	



### 3.2 Habitat Unit 2: Secondary Grassland Habitat Unit


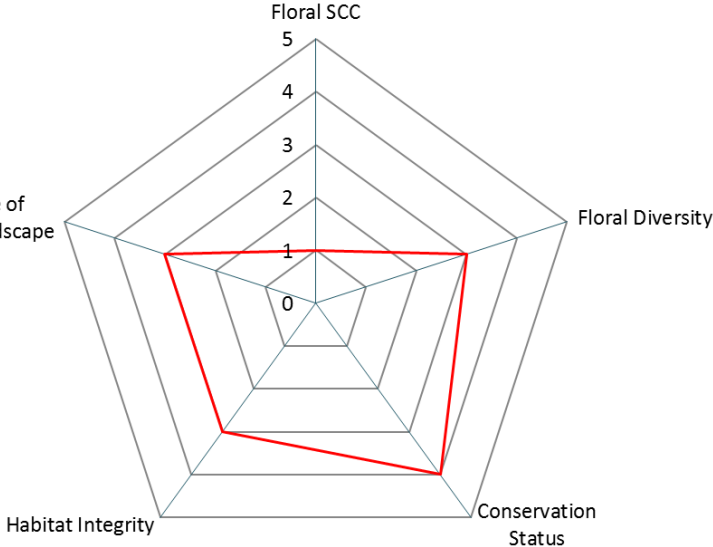
<b>Habitat Unit:</b> Secondary Grassland	<b>Floral Habitat Sensitivity</b>	<b>Intermediate</b>		
<p><b>Notes on Photograph:</b>  <b>Top:</b> Representative photographs of the Secondary Grassland Habitat dominated by the shrub <i>Seiphium plumosum</i> and the grass species <i>Hyparrhenia hirta</i>  <b>Bottom:</b> Clumps of the geoxylic suffrutex (Underground Tree) <i>Elephantorrhiza elephantina</i> (Left) and the Alien Invasive Plant (AIP) species <i>Acacia decurrens</i> (Right) observed within the habitat unit.</p>				
<p style="text-align: center;"><b>Floral Habitat Sensitivity Graph</b></p> <p style="text-align: center;"><b>Floral Habitat Sensitivity</b></p> 				
<p><b>Floral Species of Conservation Concern (SCC)</b></p>	<p>Two floral SCC, <i>Boophone disticha</i> and <i>Hypoxis hemerocallidea</i>, were present within this habitat unit. Both species are considered to be of Least Concern (LC) nationally but are classified as Declining in the Gauteng province, which can be attributed to the rapid urbanisation of the Province, as well as both plants harvested extensively for the muti (traditional medicine) trade, causing a decline in available natural habitat for these species. Both species were encountered throughout the habitat unit, and although all individuals encountered were marked, it is expected that the abundance of individuals will be higher than what was observed. As it is considered unlikely for individuals within this habitat unit to be preserved, it is recommended that all species situated within the development footprint, be rescued and preferably be relocated to the Egoli Granite Grassland habitat, if it is deemed feasible for the aforementioned habitat unit to be excluded from development.</p>			



<p><b>Floral Diversity</b></p>	<p>Floral diversity for the Secondary Grassland Habitat Unit is of an intermediate level. The grass diversity is considered low for the vegetation type, as Egoli Granite Grassland comprises predominantly of grass species with a limited diversity of herbs and woody species expected to occur. With the exception of the grass species <i>Imperata cylindrica</i>, all grass species observed within this habitat unit is considered representative of the Egoli Granite Grassland, namely <i>Hyparrhenia hirta</i>, <i>Melinis repens</i>, <i>Themeda triandra</i>, and <i>Aristida canescens</i>. The diversity of herbs within the habitat unit is considered moderately high with several species indigenous to the Egoli Granite Grassland vegetation type observed, namely <i>Gnidia capitata</i>, <i>Helichrysum nudifolium</i>, <i>Kohautia amatymbica</i> and <i>Nidorella hottentotica</i>. The woody species diversity is considered to be of an intermediate level for a grassland ecosystem. The abundance of some woody species encountered is however considered high with species such as <i>Seiphium plumosum</i> which has become dominant throughout the habitat unit as well as <i>Elephantorrhiza elephantina</i> and <i>Acacia decurrens</i> which has formed dense stands in areas.</p> <p>IAP species had low diversity and abundance within this habitat unit, with the exception of <i>A. decurrens</i> which have formed clumps throughout the habitat unit, particularly within the eastern portion of the study area. Other IAP species observed within this habitat are <i>Araijia sericifera</i>, <i>Campuloclimium macrocephalum</i>, <i>Solanum elaeagnifolium</i>, <i>S. nigrum</i> and <i>Verbena bonariensis</i>.</p> <p>For a full list of species encountered during the field assessment, refer to Appendix D.</p>	<p><b>Business Case, Conclusion and Mitigation Requirements:</b></p> <p>This habitat unit is of intermediate floral sensitivity. Due to the degraded state of the habitat unit, and the area no longer considered to be primary habitat, the proposed development in this habitat unit is not considered to have a detrimental impact on the floral habitat and diversity of the area.</p> <p>The development will, however, impact on floral SCC. Should all individuals, however, be rescued and relocated to the Private Open Space or used within the landscaping of the project, it will not only lower the impact on the conservation of these species but also negate the need to obtain permits from GDARD.</p>
<p><b>Conservation Status of Vegetation Type / Ecosystem</b></p>	<p>The vegetation type associated with the study area is listed as endangered (Mucina &amp; Rutherford 2012). Furthermore, the majority of the study area with the exception of the transformed areas is considered to fall within the remaining extent of the Egoli Granite Grassland ecosystem according to the National Threatened Ecosystem Database (2011). The Gauteng Conservation Plan (C-Plan V3.3, 2011), indicate the secondary grassland habitat as a CBA, important for “Red and Orange” listed plant habitat and for primary vegetation. Due to the secondary grassland habitat historically being utilised for crop cultivation, and the degraded state of the habitat unit, the vegetation can no longer be considered as Primary vegetation. Orange listed species as discussed above, where however observed within this habitat unit, as such the conservation importance of the habitat unit is of intermediate significance.</p>	<p>In order to limit the spread of AIP species from this habitat unit to the Private Open Space, and subsequently lower post-construction / operational AIP control and rehabilitation efforts, it is recommended that all Plant material removed during ground clearance activities be disposed of at a registered waste facility, and not be dumped within the study area.</p>
<p><b>Habitat integrity / Alien and Invasive species</b></p>	<p>This habitat unit has historically been utilised for crop cultivation and has been allowed to return to its grassland state and is considered to be in a subclimax state of succession. The area is currently extensively grazed, which has further altered the species composition, with the area predominantly dominated by <i>Hyparrhenia hirta</i> and <i>Seriphium plumosum</i>. Despite a low diversity of grasses within the Secondary Grassland Habitat Unit, the habitat unit did provide habitat for a variety of herbaceous species, with a low diversity of IAP species observed. The habitat integrity, although altered to some degree is considered to be of an intermediate level</p>	
<p><b>Presence of Unique landscape</b></p>	<p>This habitat unit did provide suitable habitat for orange listed plant species as discussed above. These species were also observed within the Primary Egoli Granite Grassland, and despite being considered declining in the Gauteng Province, are relatively widespread throughout the country. This habitat unit is therefore not considered a unique landscape from a floral ecological perspective.</p>	



### 3.3 Habitat Unit 3: Freshwater Habitat Unit

<b>Habitat Unit:</b> Freshwater	<b>Floral Habitat Sensitivity</b>	<b>Intermediate</b>		
<b>Notes on Photograph:</b> Representative photographs of the Freshwater habitat associated with the central portion of the study area. From the photographs it is evident that the watercourse is subject to extensive cattle grazing, and trampling.				
<p style="text-align: center;"><b>Floral Habitat Sensitivity Graph</b></p> <p style="text-align: center;"><b>Floral Habitat Sensitivity</b></p> 				
<b>Floral Species of Conservation Concern (SCC)</b>	No floral SCC were observed within this habitat unit at the time of the assessment. The watercourse does, however, provide suitable habitat for the floral SCC <i>Crinum macowanii</i> and <i>Eucomis autumnalis</i> , however no evidence of these species was observed. Should these species, however, be observed at any time of the proposed development, they should be left undisturbed.			



<b>Floral Diversity</b>	Floral diversity is intermediate for this habitat unit; with various facultative and obligate grass and sedge species observed, such as <i>Calamagrostis epigejos</i> var. <i>capensis</i> , <i>Typha capensis</i> , <i>Cyperus denudatus</i> var. <i>denudatus</i> and <i>Kyllinga melanosperma</i> amongst others. Very few woody species were observed within the watercourse and was predominantly IAPs such as <i>Morus alba</i> , <i>Senna didymobotria</i> , and <i>Solanum mauritianum</i> , with only a single individual of the South African indigenous tree <i>Vachellia karroo</i> also encountered. The species richness of the herbaceous layer is considered moderate, with only a single species indigenous to the Egoli Granite Grassland recorded, namely <i>Nidorella hottentotica</i> . The majority of herbs encountered is common widespread species indigenous to South Africa often associated with moist areas such as <i>Berkheya radula</i> , <i>Kniphofia porphyrantha</i> , <i>Mimulus gracillies</i> <i>Ranunculus multifidus</i> and <i>Trachyandra asperata</i> var. <i>asperata</i> . Furthermore, the largest species diversity of herbaceous IAPs was observed within the watercourse, and include species such as <i>Oenothera rosea</i> , <i>Veronica anagalis-aquatica</i> , <i>Campuloclinium macrocephalum</i> , <i>Cirsium vulgare</i> and <i>Solanum nigrum</i>	
<b>Conservation Status of Vegetation Type/Ecosystem</b>	The Gauteng Conservation Plan (C-Plan V3.3, 2011), indicate the watercourse as a CBA, important for “Red and Orange” listed plant habitat and for primary vegetation. This system is also indicated by the C-Plan (2011) as a perennial river. Despite the degraded state of the watercourse, and the lack of confirmed floral SCC, the watercourse serves an as important ecosystem, particularly within an urbanised setting, by providing ecosystem services such as flood attenuation and erosion control (SAS, 2018). It also provides habitat and food for a larger variety of faunal species. The watercourse furthermore serves as a movement corridor for faunal species to and from the area, particularly as the study area is bordered by hardened infrastructure such as roads. As such the conservation importance of this habitat, unit is considered to be moderately high and should be excluded from development as far as possible.	<p><b>Business Case, Conclusion and Mitigation Requirements:</b></p> <p>According to the current layout plan, the watercourse is excluded from the proposed development and demarcated as Private Open Space, with the exception of the upgrade of the existing road traversing the system. As per the current layout whereby the watercourse together with its regulatory zones have been excluded from the development, the impact of the proposed development on the floral ecology of the system is not considered significant.</p> <p>In order to lower post-construction rehabilitation costs of the Private Open Space Area, it is recommended that the Private Open Space be demarcated from the development footprint, and no construction personnel or vehicles be allowed within this area as well as AIP control, monitoring and management be implemented at the onset of ground clearing activities.</p>
<b>Habitat integrity/Alien and Invasive species</b>	The habitat integrity of the watercourse is considered to be of an intermediate level. The lowered integrity can mainly be attributed to extensive cattle grazing of the system, as well as the system situated within a medium to high-density area, resulting in increased water inputs into the system and subsequent dispersal of IAP species from the surrounding area into the watercourse.	
<b>Presence of Unique Landscapes</b>	The watercourse despite being degraded, and increased proliferation of IAP species, can still be considered a unique landscape, particularly as the wetland feature provide habitat for floral species adapted to saturated soil conditions. This feature furthermore serves as a movement corridor for faunal species as well as for dispersal of floral species, as the watercourse is connected to the surrounding area via culverts.	



### 3.4 Habitat Unit 4: Transformed Habitat Unit

<b>Habitat Unit:</b> Transformed Habitat		<b>Floral Habitat Sensitivity</b>	<b>Low</b>
<b>Notes on Photograph:</b> Representative photograph of the Transformed Habitat Unit			
<p align="center"><b>Floral Habitat Sensitivity Graph</b></p>			
<b>Floral Species of Conservation Concern (SCC)</b>		No floral SCC were encountered during the field assessment, nor it is considered likely that any such species will be present within these areas, due to the severe habitat transformation that has taken place.	
<b>Floral Diversity</b>		Floral diversity is moderately low and comprised predominantly garden ornamental trees historically planted and IAP species such as <i>Melia azedarach</i> , <i>Ailanthus altissima</i> , <i>Populus deltoides</i> , <i>Brachichoton populneus</i> , and <i>Tagetes miniuta</i> amongst others. For a comprehensive species list for the habitat unit, refer to Appendix D.	
<b>Conservation Status of Vegetation Type/Ecosystem</b>		The Transformed habitat is not indicated on the Gauteng C-Plan as a CBA, nor an ESA, and can be attributed to the area historically used as a residential residence. The habitat unit is considered severely degraded and no longer represent the reference state i.e. Egoli Granite Grassland. The conservation status of this habitat unit is therefore considered low.	<p><b>Business Case, Conclusion and Mitigation Requirements:</b></p> <p>This habitat unit is of low ecological importance and sensitivity due to the level of habitat degradation caused by hardened infrastructure, historic ornamental gardens and AIP proliferation.</p> <p>There are therefore no development constraints associated with this habitat unit, and the impact of the proposed development on this habitat unit is considered to be low.</p>
<b>Habitat integrity/Alien and Invasive species</b>		The habitat within this habitat unit has been severely altered and is therefore considered transformed and comprised predominantly of dilapidated buildings and IAP species. The habitat integrity of the habitat unit is therefore considered to be low.	
<b>Presence of Unique Landscapes</b>		From a floral perspective, this habitat unit is not important for species diversity or community structure and cannot be considered a unique landscape.	



### 3.5 Floral Species of Conservation Concern Assessment

Threatened/protected species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is a threatened species. Furthermore, SCC are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare and Declining.

An assessment considering the presence of any floral SCC, as well as suitable habitat to support any such species, was undertaken. The GDARD conservation lists were acquired for the Quarter Degree Square (QDS) 2528CC. All SCC listed for the QDS, together with their calculated Probability of Occurrence (POC) ratings are tabulated in Appendix C. Table 5 below represents those species that obtained a POC score of 60% or more.

**Table 1: Floral SCC with a high probability of occurrence score (POC) within the QDS 2528CC. Refer to Appendix C for the full list of SCC with their POC scores.**

FAMILY	SPECIES	THREAT STATUS	POC (%)	Motivation
Amaryllidaceae	<i>Boophone disticha</i>	LC (National); Declining (Provincial)	100	Numerous individuals of the species were observed during the field assessment within the Egoli Granite Grassland and Secondary Grassland Habitat Units
Hypoxidaceae	<i>Hypoxis hemerocallidea</i>	LC (National); Declining (Provincial)	100	Individuals of this species were observed throughout the Egoli Granite Grassland and Secondary Grassland Habitat Units during the field investigation
Amaryllidaceae	<i>Crinum macowanii</i>	LC (National); Declining (Provincial)	60	The study area is situated within the known distribution range of the species, and the watercourse provides suitable habitat for the species.
Hyacinthaceae	<i>Eucomis autumnalis</i>	LC (National); Declining (Provincial)	60	The watercourse and Egoli Granite Grassland habitat units provide suitable habitat for the species. The study area is furthermore located within the known distribution range of the species.

LC = Least Concern

From this list, two floral SCC were encountered within the study area, i.e. *Boophone disticha* and *Hypoxis hemerocallidea*. Both species were encountered within the Egoli Granite Grassland and Secondary Grassland habitat units. Although all individuals and colonies were marked by means of GPS during the field assessment, a higher abundance of individuals is expected to occur within these habitat units, than what was recorded during the current assessment, and as such all individuals should be marked and rescued and relocated to suitable similar habitat outside of the development footprint.





**Figure 2: Floral SCC encountered in the study area. *Hypoxis hemerocallidea* (left), and *Boophone disticha* (right)**

Additionally, the floral SCC *Eucomis autumnalis* and *Crinum macowanii* have a high POC score (60%) which means that the study area has the habitat that can support the growth of this species. This species prefers damp conditions and as such is expected to occur predominantly within the Freshwater Habitat. During the field assessment, special attention was paid to the presence of these species, particularly within the watercourse. No individuals of the species were observed, and although not impossible, it is considered unlikely that individuals were missed during the site assessment.

It is considered unlikely that construction of the proposed development will be able to prevent damage to these individuals, and as such it is advised that all *B. disticha* and *H. hemerocallidea* individuals be rescued and relocated by a suitably qualified specialist and either relocated to Private Open Space Area, utilised within the landscaping plan of the project, or moved to registered nurseries, the Agricultural Research Council (ARC) or the South African National Biodiversity Institute (SANBI). Any other floral SCC encountered during the construction phase of the proposed development should also be relocated by a suitably qualified specialist and, where required, the necessary permits should be applied for at GDARD.

### **3.6 Alien and Invasive Plant (AIP) Species**

Alien and invasive floral species are floral species of exotic origin which are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural “check” mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species





through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

Alien vegetation invasion causes degradation of the ecological integrity of an area, causing (Bromilow, 2001):

- A decline in species diversity;
- Local extinction of indigenous species;
- Ecological imbalance;
- Decreased productivity of grazing pastures; and
- Increased agricultural input costs.

During the floral assessment, dominant alien and invasive floral species were identified and are listed in the table below.

Of the alien species recorded during the site visit (Table 2 below), 10 are listed as NEMBA Category 1b, three as NEMBA Category 2 and three as NEMBA Category 3. The remainder are not considered invasive but are still considered problem plants in South Africa (Bromilow, 2001). The majority of alien species encountered are predominantly woody tree species associated with the transformed area, with a moderate diversity of forb AIPs also observed, particularly within the watercourse and secondary grassland habitat units.

Alien species located within the proposed development areas need to be removed on a regular basis as part of maintenance activities according to the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R864 of 2016.



**Table 2: Dominant alien floral species identified during the field assessment with their invasive status as per NEMBA: Alien and Invasive Species Lists, GN R598 of 2016.**

TREES AND SHRUBS				
Species	English name	Country of Origin	Category*	Habitat Unit
<i>Acacia decurrens</i>	Green Wattle	Australia	2	Secondary Grassland
<i>Agave americana</i>	Spreading century-plant	South America	N/L for the Gauteng Province	Transformed
<i>Ailanthus altissima</i>	Tree-of-heaven	China	1b	Transformed
<i>Brachyhiton populneus</i>	Kurrajong	Australia	N/L	Transformed
<i>Ficus carica</i>	Common Fig	Western Asia	N/L	Transformed
<i>Melia azedarach</i>	Syringa	China	1b	Transformed Habitat
<i>Morus alba</i>	White mulberry, Silkworm mulberry	Northern China	3	Freshwater & Transformed
<i>Opuntia ficus-indica</i>	Sweet Prickly pear	Central America	1b	Transformed
<i>Pinus palustris</i>	Longleaf Pine	USA	N/L	Secondary Grassland
<i>Populus deltoides</i>	Match Poplar	USA	N/L	Transformed
<i>Senna disymbotrica</i>	Peanut Butter Cassia	Tropical Africa	1b	Freshwater
<i>Solanum mauritianum</i>	Bugweed	South America	1b	Freshwater & Transformed
<i>Solanum sisymbriifolium</i>	Dense-thorned Bitter Apple	South America	1b	Freshwater
FORBS AND GROUNDCOVERS				
Species	English name	Country of Origin	Category*	
<i>Campuloclinium macrocephalum</i>	Pompom weed	Central & South America (Mexico to Argentina)	1b	Secondary Grassland & Freshwater
<i>Cirsium vulgare</i>	Spear Thistle	Europe and Asia	1b	Freshwater
<i>Heliotropium amplexicaule</i>	Blue Heliotropes	South America	N/L	Freshwater
<i>Oenothera rosea</i>	Rose Evening Primrose	Americas	N/L	Freshwater
<i>Solanum elaeagnifolium</i>	Silverleaf nightshade	North-east Mexico and the south-west USA	1b	Secondary Grassland & Freshwater
<i>Solanum nigrum</i>	Nightshade	Europe	N/L	Secondary Grassland
<i>Tagetes minuta</i>	Khaki bush, K haki weed, African marigold	South and North America	N/L	Freshwater & Transformed
<i>Taraxacum officinale</i>	Common Dandelion	Europe	N/L	Transformed
<i>Verbena bonariensis</i>	Tall verbena,	South America	1b	Secondary Grassland & Freshwater
<i>Veronica anagallis-aquatica</i>	Water Speedwell	Europe	N/L	Freshwater
CLIMBERS				
Species	English name	Country of Origin	Category*	
<i>Araujia sericifera</i>	Moth Catcher	Peru	1b	Secondary Grassland

1a: **Category 1a** – Invasive species that require compulsory control.

1b: **Category 1b** – Invasive species that require control by means of an invasive species management programme.

2: **Category 2** – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.

3: **Category 3** – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).



### 3.7 Medicinal Floral Species

Medicinal plant species are not necessarily indigenous species, with many of them regarded as alien invasive weeds. The table below presents a list of dominant plant species with traditional medicinal value, plant parts traditionally used and their main applications, which were identified during the field assessment.

**Table 3: Dominant traditional medicinal floral species identified during the field assessment. Medicinal applications and application methods are also presented (van Wyk, Oudtshoorn, Gericke, 2009).**

Species	Name	Plant parts used	Medicinal uses
<i>Boophone disticha</i>	Poison bulb, Sore-eye flower	Bulb scales	<i>Boophone disticha</i> has many medicinal uses. Traditional healers use it to treat pain and wounds. Parts of the plant are used by certain African tribes and also by some Europeans to cure various ailments: the outer covering of the bulb is applied to boils and abscesses; fresh leaves are used to stop bleeding of wounds.
<i>Elephantorrhiza elephantina</i>	Elandsbean	Underground rhizomes	Used as a traditional remedy for a wide range of ailment including diarrhoea and dysentery, stomach disorders, haemorrhoids, and perforated peptic ulcers, and as emetics. Also popular for the treatment of skin diseases and acne.
<i>Gomphocarpus fruticosus</i>	Milkweed, Wild Cotton	Leaves mainly used, sometimes the roots.	Leaves are used as snuff and as a sedative in the treatment of headache and tuberculosis. Roots are used to relieve stomach pain and general aches in the body.
<i>Helichrysum nudifolium</i>	Everlasting	Leaves and twigs, sometimes the roots	Used in the treatment of coughs, colds, fever, infections, headache, and menstrual pain. Also, a popular ingredient for wound dressing. <i>H. nudifolium</i> tea is an old Cape remedy for colds and chest ailments.
<i>Hilliardiella oligocephala</i>	Bicoloured-leaved Vernonia	Leaves and twigs, rarely the roots	Infusions are taken as stomach bitters to treat abdominal pain and colic. Other ailments treated include rheumatism, dysentery and diabetes. The roots have been used to treat ulcerative colitis.
<i>Hypericum aethiopicum</i>	St. John's Wort	Above ground parts	Used for the treatment of backache and loin pain, as well as for fevers and wounds.
<i>Hypoxis hemerocallidea</i>	African star grass or African potato	Tuberous rootstock (corn).	Dizziness, bladder infections and insanity are treated by using the infusions of the corn as an emetic. Stems and leaves can be used with other ingredients to treat prostate problems. Within the past couple of years, <i>H. hemerocallidea</i> has become commercialised as a source of extracts used in prostate preparations, as well as in various tonics and so called immune boosting preparations.
<i>Pelargonium luridum</i>	Wild Geranium	Tuberous, fleshy rootstock	Water or milk decoctions of the tubers are taken orally to treat diarrhoea and dysentery.
<i>Pentanisia prunelloides</i>	Wild Verbena	Fleshy tuberous root, sometimes the leaves	Wide range of uses has been recorded. Decoctions are often used for burns, swellings, sore joints and rheumatism. Also used in the treatment of heartburn, vomiting, fever, chest pain, toothache, tuberculosis, blood impurities, haemorrhoids and snake bite. Also, often regularly taken by pregnant woman to ensure easy childbirth. A leaf poultice is applied for a retained placenta.
<i>Scabiosa columbaria</i>	Wild Scabious	Leaves or fleshy roots	Plant used as a remedy for colic and heartburn. Dried roasted roots are made into a wound-healing ointment, and the powdered roots are also used as a pleasant-smelling baby powder.
<i>Tagetes minuta</i>	Khaki bush, Khaki weed, African marigold	Leaves, stalks and flowers	It is also grown commercially in South Africa, France and North America for its essential oil. The oil is very effectively used for wounds and a wide variety of infections.
<i>Typha capensis</i>	Bulrush	Thick, fleshy rhizomes	A decoction of the rhizomes is used for venereal diseases or during pregnancy to ensure an easy delivery, and for dysmenorrhoea, diarrhoea, dysentery and to enhance male potency and libido. It is also taken to treat unspecified problems related to the genitals, to promote fertility in woman, and to improve circulation. Decoctions are taken orally or applied externally to promote the expulsion of the placenta. It is said to strengthen uterine contractions.



Species	Name	Plant parts used	Medicinal uses
<i>Boophone disticha</i>	Poison bulb, Sore-eye flower	Bulb scales	<i>Boophone disticha</i> has many medicinal uses. Traditional healers use it to treat pain and wounds. Parts of the plant are used by certain African tribes and also by some Europeans to cure various ailments: the outer covering of the bulb is applied to boils and abscesses; fresh leaves are used to stop bleeding of wounds.
<i>Vachellia karroo</i>	Sweet Thorn	Bark, leaves and gum	Bark and leaves are used in the Cape as a remedy for diarrhoea and dysentery. The gum, bark and leaves have also been used as an emollient and astringent for colds, conjunctivitis and haemorrhage. The gum is also used as food and taken for oral thrush.

The species listed in the table above are common, widespread species and not confined to the study area; nor are they unique within the region. However, *Hypoxis hemerocallidea* and *Boophone disticha* are classified as Declining in the Gauteng Province, mainly due to the rapid urbanisation in Gauteng, which has caused a decline in available natural habitat. Several *H. hemerocallidea* and *Boophone disticha* species were found in the Egoli Granite Grassland, and Secondary Grassland habitat units. These species would need to be rescued and preferably relocated to the Private Open Space Area, which should be undertaken by an aptly qualified specialist. Thus, if rescue and relocation is implemented for *H. hemerocallidea* and *Boophone disticha*, no other risks to their populations within the larger region, or locally, are foreseen for medicinal plants.

## 4 SENSITIVITY MAPPING

The figure below conceptually illustrates the areas considered to be of increased ecological sensitivity, as well as recommended buffer zones for habitat units of increased sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for floral SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The table below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.



**Table 4: A summary of the sensitivity of each habitat unit and implications for the development.**

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
<b>Egoli Granite Grassland</b>	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	This habitat unit is considered to be of Moderately High Ecological importance and sensitivity. This can be attributed to the area confirmed as good quality Grassland, as well as the presence of Orange listed floral species. The CBA status attributed to this habitat unit within the Gauteng C-Plan is therefore accurate. Development within this habitat unit is considered significant, as it will not only impact upon the floral ecology of the area but also the conservation targets for the vegetation type. The majority of this habitat unit has been demarcated as Private Open Space together with the watercourse and its associated regulatory zones which allows for connectivity to the surrounding area, as well as for conservation of the habitat unit, provided that effective ongoing monitoring and maintenance activities are implemented. As such it is recommended that an Environmental Management Plan be designed for this area, and a specialist be appointed to oversee the implementation of this plan, and subsequently the conservation of the Egoli Granite Grassland habitat.
<b>Secondary Egoli Granite Grassland</b>	Intermediate	Preserve and enhance the biodiversity of the habitat unit and surrounds while optimising development potential.	This habitat unit is of intermediate ecological sensitivity, predominantly due to the presence of floral SCC. Development within this habitat unit is therefore likely to result in the loss of some individuals of these species. Loss of individuals can, however, be mitigated should a thorough rescue and relocation plan be implemented and be overseen by a qualified specialist. With mitigation thoroughly implemented the proposed development is considered unlikely to have a significant impact on the floral ecology of the area nor the conservation objective for the province. The disturbance timeframes and footprint must be minimised, and care must be taken to limit edge effects on the Private Open Space Area comprising the more sensitive Egoli Granite Grassland and freshwater habitat units. During the construction phase, disturbance to the vegetation should be restricted to areas where development will take place – this will limit the potential for AIPs to spread.
<b>Freshwaters</b>	Intermediate	Preserve and enhance the biodiversity of the habitat unit and surrounds while optimising development potential.	The freshwater habitat unit is of intermediate ecological importance and sensitivity. Based on the existing layout, the watercourse is excluded from development. The proposed development is therefore not considered to pose a detrimental risk on the floral ecology of this watercourse and can be significantly reduced should all mitigation measures be implemented. Should development take place within close proximity of this habitat unit, care must be taken to prevent any negative impacts on vegetation, and edge effects of the development should be managed, with a particular emphasis of AIP monitoring and control.
<b>Transformed Areas</b>	Low	Optimise development potential.	This habitat unit is of low ecological sensitivity due to severe habitat transformation. The placement of infrastructure within the transformed areas will have no significant impacts on the floral ecology and conservation targets of the area. However, to reduce opportunities for AIPs to be exchanged between the Transformed habitat and adjacent Egoli Granite Grassland during construction activities, it is recommended that an AIP management plan be implemented for the clearance of listed alien species before construction commences.



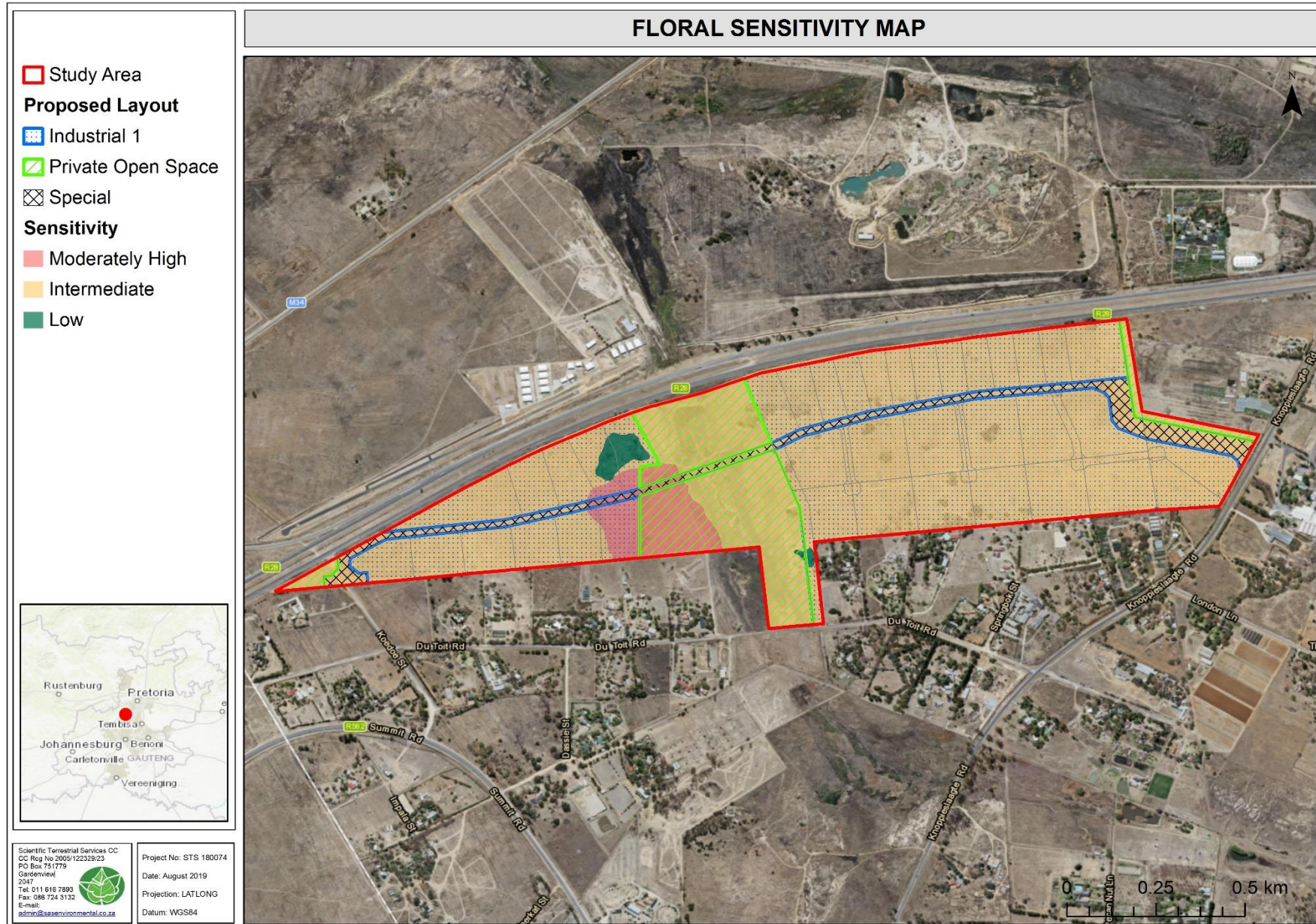


Figure 3: Sensitivity map for the study area.



## 5 FLORAL IMPACT ASSESSMENT

The table below serves to summarise the significance of the perceived impacts on the floral ecology of the proposed development. Individual impacts identified are presented in Section 5.1 and Appendix H of this report. A summary of all potential construction and operational phase impacts are provided in Section 5.2. All the required mitigatory measures needed to minimise the impact is presented in Section 5.3.

### Activities and aspects register

The table below identifies potential activities that might take place during the various phases of the proposed development, which could possibly impact on the floral ecology of the area. It should be noted that these activities listed in the table below were utilised during the impact assessment as pre-mitigated impacts to ascertain the significance of the perceived impacts prior to mitigation measures.

Pre-Construction	Construction	Operational and Maintenance Phases
Poor planning of the development phase plan, leading to vegetation clearance of the entire development footprint thereby exposing bare soils for longer time periods leading to re-establishment of Alien Species and subsequent spread to the Private Open Space Area;	Site clearing and the removal of sensitive habitat, particularly relating to the loss of primary grassland and habitat for floral SCC	Increased introduction and proliferation of alien plant species leading to further transformation of natural vegetation
Failure to rescue and relocate floral SCC to the Private Open Space Area leading to permanent loss of these individuals	Construction of the proposed development resulting in the removal and destruction of the floral SCC	Increased human movement and hardened infrastructure surfaces within the study area leading to soil compaction, erosion and disturbance, thereby impacting floral re-establishment
Failure to demarcate and enclose the Private Open Space Area, prior to the arrival/staging of heavy vehicles on site, leading to indiscriminate driving through sensitive habitat and subsequent loss of floral habitat and diversity.	Vegetation clearance and construction activities could lead to disturbance and compaction of soils outside of the footprint area and, hence, a decreased potential for indigenous floral species to re-establish, and AIP proliferation	Loss of species diversity with increased human activity and potential alien species proliferation
Failure to design and implement an AIP control plan, prior to commencement of the project, leading to spread of these species to the Egoli Granite Grassland	Failure to implement a rehabilitation and alien floral control plan, resulting in a spread of alien invasive species to areas outside the development footprint, particularly to the Primary Egoli Granite Grassland and Watercourse Habitat resulting in further loss of floral habitat and biodiversity.	Increased littering as a result of more human activity, further altering floral habitat and diversity.
	Failure to demarcate sensitive habitat and/or floral SCC, leading to removal and permanent loss of these areas.	Illegal harvesting/ collection of medicinal plants and SCC impacting on floral communities



Pre-Construction	Construction	Operational and Maintenance Phases
	Disturbance caused to vegetation and soils, as well as increased human-related activities during construction, causing alien and invasive plant species proliferation - leading to loss of floral biodiversity	Inadequate rehabilitation of compacted soil areas leading to limited vegetation regrowth
	Dumping of material outside designated areas leading to loss of terrestrial habitat. This, in turn, leading to alien species colonising open and disturbed patches	Inadequate implementation of a rehabilitation, management and maintenance plan leading to increased alien invasive plant proliferation and further loss of natural vegetation within the Private Open Space Area.
	Harvesting of terrestrial plant species and increased fire risk due to an increase of personnel in the area	
	Inappropriate or lack of dust suppression methods during construction affecting the growth of floral species	
	Decreased ecoservice provision & decreased ability to support biodiversity by grassland and freshwater habitat due to vegetation and soil disturbance	

### Impact on Floral Diversity and Habitat

Based on the current layout, the development footprint will span the entire study area with the exception of the Watercourse Habitat, its regulatory zones, as well as a portion of the Egoli Granite Grassland immediately west of the watercourse, which is zoned as Private Open Space.

During the field assessment, a portion of the study area immediately west of the watercourse was identified as good quality Egoli Granite Grassland, and subsequently deemed to be of moderately high sensitivity, as floral disturbance was deemed moderately low, with the floral species composition still considered representative of the Egoli Granite Grassland. Furthermore, the Freshwater and Secondary Egoli Granite Grassland habitat units are of intermediate ecological importance and sensitivity, with the floral habitat, diversity and integrity for both habitat units also considered to be of intermediate significance. The watercourse and Egoli Granite Grassland habitat units are furthermore considered unique landscapes, particularly within an urban setting. It is therefore recommended that the area demarcated as private open space be conserved for all phases of the project, as well as an effective rehabilitation, management and monitoring plan be implemented throughout the life of the development, to ensure the conservation of these habitat units.





It is furthermore imperative that impacts are mitigated as efficiently and effectively as possible through all phases of the development, to limit the impact on the floral habitat and diversity of the area. Failure to implement mitigation measures will result in a decrease and alteration as well as permanent loss of sensitive floral habitat and diversity as well as the introduction and proliferation of alien and invasive plant species which will further contribute to habitat loss. At present, alien plant diversity is deemed to be very low to moderately low throughout the study area, and in order to continue maintaining the current levels of floral diversity and habitat, particularly within the Egoli Granite Grassland it must be ensured that these existing alien and invasive plant species are monitored and controlled. Bush encroachment, particularly within the Secondary Egoli Granite Grassland habitat was however considered significant and should be monitored and controlled together with AIP species.

### **Impact on Floral SCC**

The proposed development is highly likely to impact on the floral SCC *Boophone disticha* and *Hypoxis hemerocallidea*, as individuals of these species were encountered throughout the Egoli Granite Grassland and Secondary Egoli Granite Grassland habitat units, and as such avoidance of all individuals are considered highly unlikely. These SCC will be impacted upon as a result of vegetation clearance activities, edge effects and improper rehabilitation activities.

As stipulated in Section 3.7 above, it is recommended that all individuals of these species situated within the development footprint, be rescued and relocated to the Egoli Granite Grassland associated with the Private Open Space Area. Alternatively, floral SCC can be used within the landscaping of the project or relocated a registered nursery, the ARC or SANBI.

### **Probable Latent Impacts**

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

- Continued loss of the Egoli Granite Grassland habitat situated within the Private Open Space;
- Continued loss of and altered floral species diversity;
- Alien and invasive plant proliferation within the Private Open Space;
- Permanent loss of floral SCC and suitable habitat; and
- Disturbed areas are highly unlikely to be rehabilitated to pre-development conditions of ecological functioning and significant loss of floral habitat, species diversity and floral SCC will most likely be permanent.

### **Cumulative Impacts**



The study area although situated within a low to medium density area is still situated within an urban setting. As such the majority of the surrounding area has been transformed to residential small holdings, mining and agriculture, as well as other anthropogenic related infrastructure such as roads, and an airport associated with the Centurion Flight Academy. Furthermore, the Diepsloot Informal Settlement is situated approximately 1 km to the west. The floral ecology of the area has therefore been under severe pressure from urbanisation, which has resulted in the degradation and transformation of large portions of the Egoli Granite Grassland Vegetation type. The proposed development will, therefore, result in further transformation of the floral ecology, habitat and diversity of the area.

In the absence of the development, the current ecological status and sensitivity of the receiving environment cannot be guaranteed to persist, as a result of ongoing anthropogenic activities such as extensive cattle grazing, and urban expansion. Should the current ecological condition of the sensitive habitat areas included in the Private Open Space area be maintained as a result of effective monitoring and management, the likelihood of these habitat units to persist in the landscape can be significantly improved, which will further contribute to conservation targets of the province.

### **5.1 Assessment Summary**

The tables below serve to summarise the findings of the impact study undertaken with reference to the perceived impacts stemming from the proposed development activities as found in Appendix E. The tables below indicate the significance of the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. As such the post-mitigation impacts for the Egoli Granite Grassland and Freshwater habitat units is therefore undertaken on the assumption that these habitat units together with the recommended setback areas be maintained for the life of the development, Should all the mitigation measures as set out in this report not be actively and efficiently implemented, it is considered unlikely that these areas will be conserved for the life of the development, and the post-mitigation impact scores will increase.



The following tables represent the findings of the impact assessment pertaining to the proposed capital layout projects.

**Table 5: A summary of the impact significance on floral resources in the construction phase**

Site	Impact	Unmanaged	Mitigated
Primary Egoli Granite Grassland	<i>Impact on floral habitat and species diversity</i>	Medium High	Medium Low
	<i>Impact on floral SCC</i>	Medium High	Low
Secondary Egoli Granite Grassland	<i>Impact on floral habitat and species diversity</i>	Medium Low	Medium Low
	<i>Impact on floral SCC</i>	Medium High	Low
Freshwater Habitat	<i>Impact on floral habitat and species diversity</i>	Medium Low	Low
	<i>Impact on floral SCC</i>	Low	Very Low
Transformed Habitat	<i>Impact on floral habitat and species diversity</i>	Low	Very Low
	<i>Impact on floral SCC</i>	Very Low	Very Low

**Table 6: A summary of the impact significance on floral resources in the operational phase**

Site	Impact	Unmanaged	Mitigated
Primary Egoli Granite Grassland	<i>Impact on floral habitat and species diversity</i>	Medium High	Low
	<i>Impact on floral SCC</i>	Medium High	Low
Secondary Egoli Granite Grassland	<i>Impact on floral habitat and species diversity</i>	Medium Low	Low
	<i>Impact on floral SCC</i>	Medium Low	Low
Freshwater Habitat	<i>Impact on floral habitat and species diversity</i>	Medium Low	Low
	<i>Impact on floral SCC</i>	Low	Very Low
Transformed Habitat	<i>Impact on floral habitat and species diversity</i>	Very Low	Very Low
	<i>Impact on floral SCC</i>	Very Low	Very Low

## 5.2 Integrated Impact Mitigation

The table below highlights the key integrated mitigation measures that are applicable to the proposed development in order to suitably manage and mitigate the ecological impacts, that are associated with the construction and operation phases of the proposed development activities. Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to floral and faunal diversity, habitat and SCC can be adequately mitigated and minimised.

**Table 7: A summary of the mitigatory requirements for floral resources**

Project phase	<i>Construction Phase</i>
<b>Impact Summary</b>	<i>Loss of floral habitat, species and SCC</i>
	- Any disturbance of sensitive floral habitat i.e. the Private Open Space Area as well as protected species or species of conservation concern must be actively avoided. As such the Private Open Space Area should be enclosed prior to heavy vehicles/machinery arriving on site, or the establishment of the site contractors camp, to prevent indiscriminate driving or movement through the sensitive area;



	<ul style="list-style-type: none"> <li>- An Environmental Management Plan should be designed for the Private Open Space Area and should be implemented at the onset of construction. This plan should be effectively implemented to ensure ongoing and sufficient monitoring and management of the Private Open Space area. It is recommended that the Plan be overseen by a floral specialist;</li> <li>- With regards to the <i>Boophone disticha</i> and <i>Hypoxis hemerocallidea</i> individuals encountered during the site assessment:             <ul style="list-style-type: none"> <li>• During the surveying and site-pegging phase of surface infrastructure, all floral SCC and protected species that will be affected by surface infrastructure must be marked;</li> <li>• All individuals situated within the development footprint should be rescued and either relocated to:                 <ul style="list-style-type: none"> <li>○ The Private Open Space Area,</li> <li>○ Used within the landscaping plan of the development or</li> <li>○ Relocated to a registered nursery, the ARC or SANBI;</li> </ul> </li> <li>• It should be noted that should individuals be removed from the study area to an area not listed above, permits might be required from GDARD, and</li> <li>• The rescue and relocation plan should be overseen by a suitably qualified specialist;</li> <li>• Should any other floral SCC, however, be encountered during the construction of the development all activities should be stopped immediately, and a suitably qualified specialist be consulted as to the possibility of rescue and relocation of the species encountered;</li> </ul> </li> <li>- No collection of floral SCC, protected floral species or medicinal floral species must be allowed by construction personnel. Moreover, the number of floral SCC removed for construction of the infrastructure should be kept to a minimum and no plants should be needlessly destroyed;</li> <li>- Edge effect control needs to be implemented to ensure no further degradation and potential loss of floral SCC outside of the proposed development footprint area occurs;</li> <li>- Appropriate sanitary facilities must be provided during the construction phase and all waste must be removed to an appropriate waste facility;</li> <li>- No dumping of waste on site should take place. As such it is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste;</li> <li>- If any spills occur, they should be immediately cleaned up. In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practised preventing the ingress of hydrocarbons into the topsoil. It should be ensured that no spills leak into the Freshwater resource associated with the central portion of the study area,</li> <li>- Informal fires by construction personnel should be prohibited, and no uncontrolled fires whatsoever should be allowed;</li> <li>- Removal of vegetation should be restricted to what is absolutely necessary;</li> <li>- Alien vegetation, as listed in section 3.7 of this report, must be removed from the study area and should be initiated prior to site clearing activities taking place, and be continued during both the construction and operational phases, with specific mention of Category 1b and 2 species in line with the NEMBA Alien and Invasive Species Regulations (2016);</li> <li>- Edge effects of all construction activities, such as erosion and alien and invasive plant species proliferation, which may affect the sensitive habitat areas as stipulated in this report, as well as adjacent grassland and freshwater resource habitat within surrounding areas, need to be strictly managed adjacent to the proposed development footprint areas. Specific mention in this regard is made to Category 1b and Category 2 species identified within the development footprint areas (refer to section 3.7 of this report); and</li> <li>- Upon completion of construction activities, it must be ensured that no bare areas remain and that indigenous grassland species be used to revegetate the disturbed area. Recommended seed mix: Mayfort Biosome Grassland seedmix: <a href="http://mayford.co.za/veld-grass/">http://mayford.co.za/veld-grass/</a>.</li> </ul>
<b>Project phase</b>	<i>Operational and Closure Phase</i>
<b>Impact Summary</b>	<i>Loss of floral habitat, species and SCC</i>
	<ul style="list-style-type: none"> <li>- The Private Open Space Area should remain demarcated for the life of the operation, and no entry of unauthorised personnel should be allowed;</li> <li>- Ongoing alien and invasive plant monitoring and eradication/control should take place throughout the operational phase of the development, and the project perimeters should be regularly checked during the operational phase for alien and invasive plant proliferation as well as bush encroachment to prevent spread into surrounding natural areas. Specific mention in this regard is made to Category 1b and Category 2 species identified within the development footprint areas (refer to section 3.6 of this report);</li> <li>- Indigenous vegetation should be used during the landscaping of the project, maintenance and monitoring of garden ornamentals used in the landscaping should be included in the monitoring and maintenance plan to prevent the spread of such species to the sensitive habitat units excluded from the development;</li> </ul>



	<ul style="list-style-type: none"><li>- No indiscriminate disposal of waste must be permitted. Bins should be provided along the open space area, to allow for the disposal of waste. Bins should be emptied twice weekly and disposed of registered waste facilities;</li><li>- It is further recommended that the current presence of <i>Seriphium plumosum</i> be controlled as particularly within the Primary Egori Granite Grassland, as currently, it is estimated about 10 million ha in South Africa have been infested by <i>Seriphium plumosum</i> which endangers sustainable grassland production, animal production, food security and biodiversity. The 49<sup>th</sup> Southern African Plant Invaders Atlas (SAPIA) Newsletter (July 2018) gave the following comment on its control: “Various control methods are available for bankrupt bush and recommended depending on a number of factors, for example, plant density, cost-effectiveness and timelines. Chemical control is the most effective recommended method while burning and manual clearing of the shrub lead to higher densities if not properly managed. Manual clearing and chemical control, however, can become economically unfeasible. All these control measures are probably temporary, with re-invasion inevitable. Aftercare needs to focus on the control of seedlings”;</li><li>- The rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a suitable specialist. This rehabilitation plan should consider all development phases of the project indicating rehabilitation actions to be undertaken during and once construction has been completed, ongoing rehabilitation during the operational phase of the project;</li><li>- Monitor the success of rehabilitation efforts seasonally; and</li><li>- Continue with, and update, the alien and invasive plant control plan accordingly.</li></ul>
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## 6 CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct a floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed industrial township development near Diepsloot, Gauteng province.

During the field assessment, four habitat units were identified, i.e. Egoli Granite Grassland, Secondary Egoli Granite Grassland, Freshwater Habitat and Transformed Habitat. During the field assessment it was evident that the study area is extensively used for cattle grazing. This together with historic crop cultivation has resulted in the degradation of the study area to various degrees.

The transformed habitat has been transformed to historic and current hardened infrastructure such as roads, and housing. This habitat is therefore considered severely degraded from its reference state, and of low ecological importance.

The Secondary Grassland was associated with severe bush encroachment by *Seriphium plumosum*, with the grass layer dominated by *Hyparrhenia hirta*. Although a number of facultative and obligate wetland species were observed within the freshwater resource, various AIP species were also encountered. The Secondary Egoli Granite Grassland, and Freshwater habitat units are therefore considered to be of intermediate sensitivity.

No AIP species were recorded for the Egoli Granite Grassland habitat, with a moderately high diversity of herbaceous species observed, of which a number is indigenous to the Egoli Granite Grassland. Due to the grazing of the area, only a few grass species could be identified, the grass layer is, however expected to be more diverse than what was recorded. This habitat unit is therefore considered to be of moderately high sensitivity, and it is recommended that the portion of this habitat unit demarcated as Private Open Space, be effectively monitored and managed to retain its ecological sensitivity for the life of the proposed development.

The floral SCC *Boophone disticha* and *Hypoxis hemerocallidea* were observed throughout the and Secondary Egoli Granite Grassland, and care should be taken during the construction of the development, not to destroy individuals of these species. Where individuals are situated within the development footprint, they should be rescued and relocated to the Private Open Space Area. This process should be overseen by a suitably qualified specialist.

The impact of the proposed development on the floral habitat and diversity is considered to be of medium-low to medium-high significance for the Freshwater Resource, as well as the Egoli Granite Grassland and Secondary Egoli Granite Grassland habitat units based on the current layout. With mitigation fully implemented, all impact can be reduced to medium-low and low significance. The impact on the transformed habitat is considered to be of low



significance prior to mitigation, and very low with all mitigation measures fully implemented. With respect to floral SCC, the impact on the Primary and Secondary Grassland is considered medium-high prior to mitigation. Should mitigation be implemented, and all individuals within the development footprint be rescued and relocated the impact can be reduced to low significance. As no floral SCC were recorded within the freshwater resource and transformed habitat units, the impact significance on floral SCC is considered to of very low and low significance with mitigation fully implemented.

The objective of this study was to provide sufficient information on the floral ecology of the area, together with other studies on the physical and socio-cultural environment for the Environmental Assessment Practitioner (EAP) and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The needs for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure economic development of the country.

It is recommended that, from a floral ecological perspective, the proposed development activity be considered acceptable, provided that the recommended mitigation measures for the identified impacts (as outlined in Section 5.2 of this report) are adhered to.

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



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## APPENDIX A: Floral method of Assessment

### *Floral Species of Conservational Concern Assessment*

Prior to the field visit, a record of floral SCC and their habitat requirements was acquired from SANBI for the Quarter Degree Square in which the MRA is situated, as well as relevant regional, provincial and national lists. Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC was determined using the following calculations wherein the distribution range for the species, specific habitat requirements and level of habitat disturbance were considered. The accuracy of the calculation is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Each factor contributes an equal value to the calculation.

Distribution						
	Outside of known distribution range					Inside known distribution range
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat availability						
	No habitat available					Habitat available
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat disturbance						
	0	Very low	Low	Moderate	High	Very high
Site score						
EVC 1 score	5	4	3	2	1	0

[Distribution + Habitat availability + Habitat disturbance] / 15 x 100 = POC%

### *Floral Habitat Sensitivity*

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

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

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



**Table A1: Floral habitat sensitivity rankings and associated land-use objectives.**

Score	Rating significance	Conservation objective
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.



## APPENDIX B: Impact Assessment Methodology

### *Ecological Impact Assessment Method*

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

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

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'<sup>4</sup>. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the Table D1. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary<sup>5</sup>.

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts.

<sup>4</sup> The definition has been aligned with that used in the ISO 14001 Standard.

<sup>5</sup> Some risks/impacts that have low significance will however still require mitigation.



Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 108 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

**Table B1: Criteria for assessing significance of impacts**

#### LIKELIHOOD DESCRIPTORS

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

#### CONSEQUENCE DESCRIPTORS

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



**Table B2: Significance Rating Matrix.**

		CONSEQUENCE (Severity + Spatial Scope + Duration)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	2	4	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	3	6	9	12	16	20	24	28	32	36	40	44	48	52	56	60
	4	8	12	16	20	25	30	35	40	45	50	55	60	65	70	75
	5	10	15	20	24	30	36	42	48	54	60	66	72	78	84	90
	6	12	18	24	30	36	42	49	56	63	70	77	84	91	98	105
	7	14	21	28	35	42	48	56	64	72	80	88	96	104	112	120
	8	16	24	32	40	48	54	63	72	81	90	99	108	117	126	135
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

**Table B3: Positive/Negative Mitigation Ratings.**

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

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction; and
  - Operation.
- If applicable, transboundary or global effects were assessed.



- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

## **Mitigation measure development**

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

- *Mitigation and performance improvement measures* and actions that address the risks and impacts<sup>6</sup> are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation*.

## **Recommendations**

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

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<sup>6</sup> Mitigation measures should address both positive and negative impacts



## APPENDIX C: Floral SCC

**Table G1: Floral SCC for the 2528CC as obtained from GDARD, with additional information on their threat status as defined in The Red List of South African Plants (<http://redlist.sanbi.org/index.php>). The Potential of Occurrence (POC) of these floral SCC within the study area is also provided.**

Family	Species	National Threat status	Provincial Status	Habitat	POC %
Crassulaceae	<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	NT	NT	South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld in the south	0
Amaryllidaceae	<i>Boophone disticha</i>	LC	Declining	Dry grassland and rocky areas.	100
Hyacinthaceae	<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	VU	VU	Low and medium altitudes, usually along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screens, sometimes found scrambling at the margins of karroid, succulent bush in the Eastern Cape. Occurs in bushy kloofs at the coast and inland in KwaZulu-Natal. In Gauteng, Mpumalanga and North West Province it is often found in open woodland or on steep rocky hills usually in well-shaded situations. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm	0
Orchidaceae	<i>Brachycorythis conica</i> subsp. <i>transvaalensis</i> .	CR	CR	Short, open grassland and wooded grassland, on sandy gravel overlying dolomite, sometimes also on quartzite, 1 000-1 705 m.	20
Asteraceae	<i>Callilepis leptophylla</i>	LC	Declining	Grassland or open woodland, often on rocky outcrops or rocky hill slopes	20
Apocynaceae	<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	VU	VU	Associated with ridges and quartzitic rocky outcrops in pockets of soil among rocks in direct sunshine or shaded areas	0
Pteridaceae	<i>Cheilanthes deltoidea</i> subsp. <i>silicicola</i>	VU	VU	Southwest-facing soil pockets and rock crevices in chert rock	0
Capparaceae	<i>Cleome conrathii</i>	NT	NT	Stony quartzite slopes, usually in red sandy soil, grassland or deciduous woodland, all aspects.	0
Amaryllidaceae	<i>Crinum macowanii</i>	LC	Declining	Mountain grassland and stony slopes in hard dry shale, gravely soil or sandy flats	60
Aizoaceae	<i>Delosperma gautengense</i>	VU	VU	Amongst rocks on south-facing slopes	0
Acanthaceae	<i>Dicliptera magaliesbergensis</i>	VU	VU	Forest, savanna (Riverine forest and bush).	0
Hyacinthaceae	<i>Drimia sanguinea</i>	NT	NT	Open veld and scrubby woodland in a variety of soil types.	40
Hyacinthaceae	<i>Eucomis autumnalis</i>	LC	Declining	Damp, open grassland and sheltered places from the coast to 2450 m	60
Asteraceae	<i>Gnaphalium nelsonii</i>	NT	NT	Seasonally wet places in grassland and savanna, and along dry watercourses	20
Gunneraceae	<i>Gunnera perpensa</i>	LC	Declining	Damp marshy area and vleis from coast to 2400 m	40
Orchidaceae	<i>Habenaria barbertoni</i>	NT	NT	Rocky hillsides, in bushveld in association with acacias, 1000-1500 m	0



Family	Species	National Threat status	Provincial Status	Habitat	POC %
Orchidaceae	<i>Habenaria kraenzliniana</i>	NT	NT	Stony, grassy hillsides, 1000-1400 m	40
Orchidaceae	<i>Habenaria mossii</i>	EN	EN	Open grassland on dolomite or in black, sandy soil.	0
Orchidaceae	<i>Holothrix randii</i>	NT	NT	Grassy slopes and rock ledges, usually southern aspects	0
Hypoxidaceae	<i>Hypoxis hemerocallidea</i>	LC	Declining	Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Appears to be drought and fire tolerant	100
Aquifoliaceae	<i>Ilex mitis. var. mitis</i>	LC	Declining	Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes	20
Mesembryanthemaceae	<i>Lithops lesliei. subsp. lesliei</i>	NT	NT	Primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses.	20
Fabaceae	<i>Melolobium subspicatum</i>	VU	VU	Grassland.	40
Fabaceae	<i>Pearsonia bracteata</i>	NT	NT	Plateau grassland	20

CR= Critically Endangered, EN= Endangered, NT = Near Threatened, VU= Vulnerable, LC = Least Concern; POC = Probability of Occurrence.





## APPENDIX D: Floral Species List

Table D1: Dominant floral species encountered within the study area. Alien species are indicated with an asterisk (\*). Protected species as indicated in Bold.

Species *Alien **Succulent	Habitat Unit			
	Egoli Granite Grassland	Secondary Grassland	Freshwater Resource	Transformed
<b>TREES AND SHRUBS</b>				
* <i>Acacia decurrens</i> 2		X		
* <i>Agave americana</i>				X
* <i>Ailanthus altissima</i> 1b				X
* <i>Brachychiton populneus</i>				X
* <i>Ficus carrica</i>				X
* <i>Melia azedarach</i> 1b				X
* <i>Morus alba</i> 3			X	X
* <i>Opuntia ficus-indica</i> 1b				X
* <i>Pinus palustris</i>		X		
* <i>Populus deltoides</i>				X
* <i>Senna didymobotria</i> 1b			X	
* <i>Solanum mauritianum</i> 1b			X	X
* <i>Solanum sisymbriifolium</i> 1b			X	
<i>Asparagus suaveolens</i>	X	X		
<i>Celtis africana</i>				X
<i>Elephantorrhiza elephantina</i>		X		
<i>Gomphocarpus fruticosus</i>	X	X		X
<i>Lopholaena coriifolia</i>	X	X		
<i>Parinari capensis</i>	X			
<i>Searsia pyroides</i>		X		X
<i>Seriphium plumosum</i>	X	X		
<i>Vachellia karroo</i>			X	
<b>CLIMBERS</b>				
* <i>Araujia sericifera</i> 1b		X		
<i>Pentarrhinum inspidum</i>		X		X
<b>FORBS AND GROUNDCOVERS</b>				
* <i>Campuloclinium macrocephalum</i> 1b		X	X	
* <i>Cirsium vulgare</i> 1b			X	
* <i>Heliotropium amplexicaule</i>			X	
* <i>Oenothera rosea</i>			X	
* <i>Solanum elaeagnifolium</i> 1b		X	X	
* <i>Solanum nigrum</i>		X		
* <i>Tagetes minuta</i>			X	X
* <i>Taraxacum officinale</i>				X
* <i>Verbena bonariensis</i> 1b		X	X	
* <i>Veronica anagallis-aquatica</i>			X	
<i>Acalypha angustata</i>	X	X		
<i>Aloe greatheadii</i>	X			
<i>Berkheya insignis</i>	X			
<i>Berkheya radula</i>			X	
<b><i>Boophone disticha</i></b>	X	X		
<i>Bulbine capitata</i>	X	X		
<i>Chamaecrista comosa</i>		X		
<i>Dianthus mooiensis</i> subsp. <i>kirkii</i>	X			
<i>Dipcadi viride</i>			X	
<i>Eriosema salignum</i>		X	X	
<i>Felicia muricata</i>	X	X	X	
<i>Gazania krebsiana</i>		X	X	
<i>Gerbera ambigua</i>	X		X	
<i>Gnidia capitata</i>	X	X		
<i>Graderia subintegra</i>	X			
<i>Helichrysum nudifolium</i>	X	X	X	



Species *Alien **Succulent	Habitat Unit			
	Egoli Granite Grassland	Secondary Grassland	Freshwater Resource	Transformed
<i>Helichrysum rugulosum</i>	X	X		
<i>Hermannia coccocarpa</i>			X	
<i>Hermannia depressa</i>		X		
<i>Hibiscus microcarpus</i>	X			
<i>Hilliardiella oligocephala</i>	X	X	X	X
<i>Hypericum aethiopicum</i>	X	X		
<i>Hypoxis acuminata</i>	X	X		
<b><i>Hypoxis hemerocallidea</i></b>	X	X		
<i>Hypoxis iridifolia</i>	X	X		
<i>Indigofera hiliaris</i>		X		
<i>Justicia anagalloides</i>	X			
<i>Kniphofia porphyrantha</i>			X	
<i>Kohautia amatybica</i>	X	X		
<i>Lasiosiphon sericocephalus</i>		X		
<i>Ledebouria ovatifolia</i>	X	X		
<i>Ledebouria revoluta</i>	X	X		
<i>Leonotis dysophylla</i>		X	X	
<i>Mimulus gracillis</i>			X	
<i>Nemesia fruticans</i>		X		
<i>Nidorella hottentotica</i>	X	X	X	
<i>Ocimum obovatum</i>	X			
<i>Pachycarpus schinzianus</i>	X	X		X
<i>Pelargonium luridum</i>	X			
<i>Pentanisia prunelloides subsp. latifolia</i>	X			
<i>Polygala amatymbica</i>	X			
<i>Polygala hottentotta</i>	X	X		
<i>Ranunculus multifidus</i>			X	
<i>Raphionacme hirsuta</i>	X	X		
<i>Scabiosa columbaria</i>	X			
<i>Solanum panduriforme</i>		X		
<i>Sphenostylis angustifolia</i>		X		
<i>Thesium pallidum</i>	X			
<i>Trachyandra asperata</i> var. <i>basutoensis</i>			X	
<i>Vernonia galpinii</i>		X		
<b>GRASSES/ REEDS AND SEDGES</b>				
<i>Aristida canescens</i>	X	X		
<i>Calamagrostis epigejos</i> var. <i>capensis</i>			X	
<i>Cynodon dactylon</i>	X		X	
<i>Cyperus denudatus</i> var. <i>denudatus</i>			X	
<i>Eragrostis chloromelas</i>	X			
<i>Eragrostis lcurvula</i>	X			
<i>Fuirena pubescens</i>			X	
<i>Hemarthria altissima</i>			X	
<i>Hyparrhenia hirta</i>	X	X		X
<i>Imperata cylindrica</i>	X	X	X	
<i>Kyllinga melanosperma</i>			X	
<i>Melinis repens</i>	X	X	X	X
<i>Ornithogalum tenuifolium</i>			X	
<i>Pennisetum thunbergii</i>			X	
<i>Schoenoplectus brachyceras</i>			X	
<i>Setaria spacelata</i> var. <i>spacelata</i>	X			X
<i>Sporobolus africanus</i>			X	
<i>Themeda triandra</i>	X	X		
<i>Typha capensis</i>			X	



## APPENDIX E: Floral Impact Assessment Tables

### E1. Impact assessment pertaining to the proposed development activities

The following tables highlight the perceived impact pertaining to the relevant habitats affected by the proposed development, namely the Egoli Grassland, Secondary Egoli Granite Grassland, Freshwater Resource and the Transformed Habitat.

**Table E1: Impact on floral habitat and species diversity of the Egoli Granite Grassland Habitat Unit**

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	4	2	3	9	9	81 (Medium High)
Operational phase	4	4	3	2	4	8	9	72 (Medium High)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	4	3	1	3	8	56	49 (Medium Low)
Operational phase	2	4	3	1	4	6	8	48 (Low)

**Table E2: Impact on Impact on floral SCC within the Egoli Granite Grassland Habitat Unit**

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	3	2	3	9	8	72 (Medium High)
Operational phase	4	4	3	2	4	8	9	72 (Medium High)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	4	2	1	3	7	6	42 (Low)
Operational phase	2	4	2	1	4	6	7	42 (Low)



**Table E3: Impact on floral habitat and species diversity of the Secondary Egoli Granite Grassland Habitat Unit**

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	3	3	8	9	72 (Medium Low)
Operational phase	4	3	3	2	4	7	9	63 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	2	2	3	8	7	56 (Medium Low)
Operational phase	2	3	2	1	4	5	7	35 (Low)

**Table E4: Impact on Impact on floral SCC within the Secondary Egoli Granite Grassland Habitat Unit**

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	4	3	3	8	10	80 (Medium High)
Operational phase	4	3	3	2	4	7	9	63 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	2	2	3	6	7	42 (Low)
Operational phase	3	3	2	1	4	6	7	42 (Low)

**Table E5: Impact on floral habitat and species diversity of the Freshwater Resource Habitat Unit**

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	3	3	8	9	72 (Medium Low)
Operational phase	4	3	3	2	4	7	9	63 (Medium Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	2	2	3	7	7	49 (Low)
Operational phase	3	3	2	1	4	6	7	42 (Low)



**Table E6: Impact on Impact on floral SCC within the Freshwater Resource Habitat Unit**

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	2	2	3	6	7	40 (Low)
Operational phase	2	3	2	2	4	5	8	40 (Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	1	3	1	1	3	4	5	20 (Very Low)
Operational phase	1	3	1	1	4	4	6	24 (Very Low)

**Table E7: Impact on floral habitat and species diversity of the Transformed Habitat Unit**

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	1	2	2	3	6	7	42 (Low)
Operational phase	2	1	2	2	4	3	8	24 (Very Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	1	1	1	3	5	5	25 (Very Low)
Operational phase	1	1	1	1	4	2	6	41 (Very Low)

**Table E8: Impact on Impact on floral SCC within the Transformed Habitat Unit**

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	1	2	2	3	3	7	21 (Very Low)
Operational phase	2	1	2	2	4	3	8	24 (Very Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	1	1	1	1	3	2	5	10 (Very Low)
Operational phase	1	1	1	1	4	2	6	12 (Very Low)

