

# **FLORAL ASSESSMENT IN SUPPORT OF THE ENVIRONMENTAL AUTHORISATION AND WATER USE LICENSE PROCESS FOR THE PROPOSED RIETFONTEIN HOUSING PROJECT LOCATED IN THE CITY OF JOHANNESBURG, GAUTENG PROVINCE**

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## EXECUTIVE SUMMARY

Field and Form Landscape Science was appointed to undertake a floral assessment as part of the environmental assessment and authorisation process for the proposed Rietfontein Housing Project, that forms part of the Gauteng Rapid Land Release Programme (RLRP), to be situated on the Remaining Extent of Portion 129 of the Farm Rietfontein No. 301 IQ, within the City of Johannesburg Metropolitan Municipality, Gauteng Province; hereafter referred to as the “study area”. The study area is 83.4 hectares (ha) in extent and based on available information at the time of compilation of this report, the development of approximately 3 600 housing units are proposed.

The terms of reference for the floral assessment are defined as follows:

- To provide an overview of applicable environmental legislation as well as national and regional planning guidelines to be considered in planning the project;
- To provide a broad description of the biophysical characteristics of the study area and its surroundings as applicable to the floral assessment;
- To categorise and describe the vegetation present within the study area according to defined vegetation units and to provide an overview of vegetation structure and floral species composition;
- To provide an indication of the conservation importance of each vegetation unit identified within the study area;
- To identify floral Species of Conservation Concern (SCC) that could potentially occur in the study area and surrounds, to determine whether suitable habitat for such species is available, and to confirm their presence where possible; and
- To assess the potential impacts that may occur as a result of the proposed project and to provide site specific mitigation measures and ongoing management measures that will be required to reduce such impacts should the project be approved.

### Desktop Assessment

The results of the desktop assessment, in terms of the environmental setting and conservation characteristics pertaining to the study area are summarised in the table below.

Aspect	Conservation Characteristic
Biome	Grassland Biome
Bioregion	Mesic Highveld Grassland Bioregion
Quarter Degree Square (QDS)	2627BD
Listed Threatened Ecosystem (2011)	-
Vegetation Type (2006, 2012)	Carletonville Dolomite Grassland (Vulnerable (VU))
National Biodiversity Assessment (NBA; 2018)	Carletonville Dolomite Grassland ecosystem (Least Concern (LC)) Seep wetland to the northeast, within 200m of the study area (National Wetlands Map 5; NBA 2018).
Gauteng Conservation Plan (C-Plan; 2011)	Critical Biodiversity Area (CBA): Important Area (primary vegetation and orange Listed floral species habitat) within the eastern portion of the study area.
Gauteng Ridges v7	No ridges are indicated.

### Field Assessment

A field assessment was undertaken over a period of one day on 15 January 2020 to determine the floral ecological status of the study area. During the field assessment, four broad vegetation units based on floral species composition and structure, and ecological functioning were identified, namely

the Open Grassland vegetation unit, the Open Rocky Grassland vegetation unit, the Modified Grassland vegetation unit and the Severely Modified Grassland vegetation unit. Upon conclusion of the assessment the conservation importance and development implications of the proposed project on each vegetation unit were determined as outlined below.

Vegetation Unit and approximate area	Floral Ecological Sensitivity	Development Implications
Open Grassland (±9 ha)	Medium	This vegetation unit should be conserved if possible and development and disturbance within these areas should be minimised as far possible. Edge effects should be strictly managed to avoid habitat degradation.
Open Rocky Grassland (±1 ha)	Medium High	The habitat associated with this vegetation unit should be conserved and disturbance and edge effects within this area should be strictly managed to avoid habitat degradation.
Modified Grassland (±23 ha)	Medium Low	Development within these areas should be optimised. Although past disturbances led to the degradation of habitat in these areas, some loss of biodiversity and habitat will occur. Through developing these areas, it is proposed that surrounding natural open grassland habitat be enhanced through i.e. the removal of alien vegetation and existing waste material from site. As far as possible green open space between housing units should be allowed. Edge effects within these areas, particularly during the construction process, should be strictly managed to avoid disturbance of any open grassland habitat to be conserved as part of the project.
Severely Modified Grassland (±50ha)	Low	Development within this vegetation unit will not lead to a significant loss of floral biodiversity and habitat due to current high levels of disturbance, and these areas should be optimised for development. Waste material from dumping, as well as alien vegetation should be removed from this vegetation unit.

An enquiry to the Gauteng Department of Agricultural and Rural Development (GDARD) regarding the potential presence of national and provincial floral Species of Conservation Concern (SCC), which include International Union for Conservation of Nature (IUCN) and South African National Biodiversity Institute (SANBI) threatened floral species (listed in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU)), near-threatened floral species, as well as provincially Declining species, indicated that no such species are known to occur within the study area or within 5km thereof. Several floral SCC are however known to occur within the larger 2627BD QDS. During the field assessment, a thorough search was undertaken for the species indicated by GDARD to occur within the QDS. Other floral SCC considered include species listed in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004; NEMBA) Threatened or Protected Species (TOPS) Regulations, protected tree species in terms of the National Forests Act (Act No. 84 of 1998) and protected and specially protected plant species in terms of the Transvaal Nature Conservation Ordinance (No. 12 of 1983; TNCO). No floral SCC were however encountered within the study area.

From an assessment of the habitat available within the study area, the possibility exists that both *Hypoxis hemerocallidea* (Least Concern (LC); provincially Declining) and *Boophone disticha* (LC; provincially Declining) may historically have been present within the study area. Active removal of plants for medicinal purposes was noted during the field assessment, which lowers the probability of floral SCC to be present.

## Impact Assessment

An impact assessment was undertaken, and the results summarised below.

Impact: Loss of floral habitat		
Development phase	Significance prior to mitigation	Significance post mitigation
Construction	High	Medium
Operational	Medium	Low
Impact: Loss of floral diversity		
Construction	Medium	Low
Operational	Medium	Low
Impact: Loss of floral SCC		
Construction	Medium	Low
Operational	Low	Low

## Conclusion

Based on the information gathered during the background and field assessments with regard to the ecological condition of the vegetation within the study area, it is evident that the majority of the indicated CBA: Important Area (Gauteng C-Plan, 2011) within the eastern portion of the study area comprises old agricultural fields, areas that have historically been impacted and areas where recent and current waste dumping have significantly altered available habitat. A small portion of isolated indigenous grassland remain relatively intact within the CBA boundaries within the northeast of the study area. The area indicated by the NBA (2018) to form part of remnant Carletonville Dolomite Grassland vegetation is also mostly modified, although reasonable, albeit relatively fragmented, areas of unmodified grassland vegetation, largely representative of this vegetation type, remain.

It is the opinion of the specialist that the proposed project be considered favourably, provided that the mitigation measures as set out in this report are implemented. As mentioned above, more than half of the vegetation within the study area is currently severely degraded due to ongoing waste dumping activities and resultant alien invasive species encroachment. When comparing historical Google Earth aerial imagery from 2004 with aerial imagery up to 2019, it is evident that these disturbance footprints continually increase, which together with existing and new access routes further fragment remaining indigenous habitat. Based on the aforementioned and site observations, this trend is expected to continue into the future. As far as possible, the open grassland and particularly the open rocky grassland vegetation units, where an increased species diversity and ecological functioning have been observed and that are of medium to medium-high floral ecological sensitivity (Figure A), should be conserved as part of a natural open space area, and green open space should be allowed between housing units to minimise impact on floral habitat and floral species diversity. It is important that control and management of NEMBA Category 1b listed alien invasive floral species take place throughout the construction and operational phases of the proposed project. Further mitigation measures are included in Section 7 of this report.



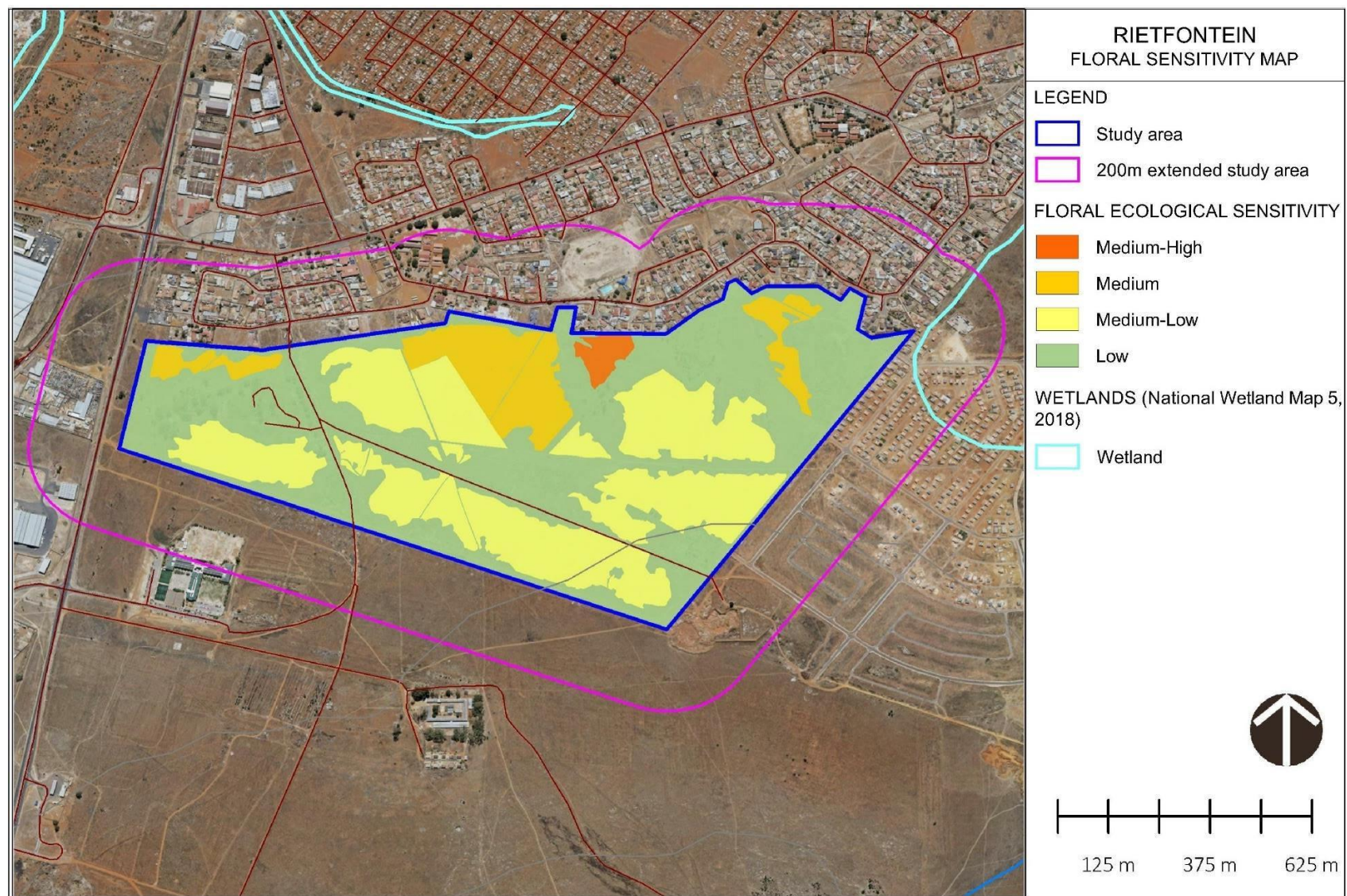


Figure A: Floral ecological sensitivity map for the study area.

## SPECIALIST REPORT REQUIREMENTS

Specialist report requirements in terms of Appendix 6 of the National Environmental Management Act (NEMA; Act No 107 of 1998) Amendments to the Environmental Impact Regulations, 2014 published on 7 April 2017<sup>1</sup>.

	Requirement stipulated in Appendix 6	Section
1a	Details of	
	(i) the specialist who prepared the report; and	Appendix D
	(ii) the expertise of that specialist to compile a specialist report including	Appendix D
b	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix D
c	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.2
cA	an indication of the quality and age of base data used for the specialist report	Sections 2 & 3
cB	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7
d	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3 and 4.1.2
e	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
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 4 and 6.5.
g	an identification of any areas to be avoided, including buffers	Section 6.5
h	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6.5
i	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
j	a description of the findings and potential implications of such findings on the impact of the proposed activity including identified alternatives on the environment or activities;	Sections 6 & 7
k	any mitigation measures for inclusion in the EMPr	Section 7
l	any conditions for inclusion in the environmental authorisation	Section 7
m	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8
n	a reasoned opinion	
	(i) as to whether the proposed activity, activities or portions thereof should be authorised;	Section 9 & Executive Summary
	(1A) regarding the acceptability of the proposed activity or activities; and	Section 9 & Executive Summary
	(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 9 & Executive Summary
o	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not Applicable
p	summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not Applicable
q	any other information requested by the competent authority	Not Applicable

<sup>1</sup> At the time of assessment, the proposed “Procedures to be Followed for the Assessment and Minimum Criteria for Reporting of Identified Environmental Themes in Terms of Section 24(5)(A) and (H) of the National Environmental Management Act, 1998, when Applying for Environmental Authorisation”, which will replace the NEMA Appendix 6 requirements, has not yet been promulgated.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	ii
SPECIALIST REPORT REQUIREMENTS .....	vi
TABLE OF CONTENTS .....	vii
LIST OF FIGURES .....	viii
LIST OF TABLES .....	viii
LIST OF ABBREVIATIONS.....	ix
1. INTRODUCTION .....	1
1.1 Background .....	1
1.2 Terms of Reference .....	1
1.3 Limitations and Assumptions .....	4
2. LEGISLATIVE BACKGROUND .....	5
2.1 The National Environmental Management: Biodiversity Act (NEMBA; Act No. 10 of 2004) .....	5
2.2 National Forests Act (Act No. 84 of 1998) .....	6
2.3 National Environmental Management: Protected Areas Act (NEMPAA; Act No. 57 of 2003) .....	6
2.4 Conservation of Agricultural Resources Act (1983) .....	7
2.5 Transvaal Nature Conservation Ordinance (1983) .....	7
3. NATIONAL AND REGIONAL PLANNING FRAMEWORKS .....	9
3.1 National Biodiversity Assessment (2018) .....	9
3.2 Gauteng Conservation Plan (C-Plan) Version 3.3 (GDARD, 2011).....	9
3.3 Gauteng Red List Species Guidelines (2006).....	9
3.4 Gauteng Development Guidelines for Ridges (2001, updated 2004, 2006, 2019) ...	10
4. METHOD OF ASSESSMENT .....	13
4.1 Floral Assessment.....	13
4.2 Impact Assessment.....	15
5. DESCRIPTION OF THE RECEIVING ENVIRONMENT .....	17
5.1 Climate .....	17
5.2. Surface Water.....	17
5.3 Geology and Soils .....	17
5.4 Vegetation Type .....	17
6. RESULTS OF THE FLORAL ASSESSMENT.....	18
6.1 Vegetation Units.....	20
6.2 Floral Species of Conservation Concern .....	24
6.3 Alien Invasive Floral Species .....	26
6.4 Medicinal Floral Species .....	27
6.5 Sensitivity Mapping .....	28
7. RESULTS OF THE IMPACT ASSESSMENT .....	31
8. FLORAL MONITORING .....	35
9. CONCLUSION .....	35
10. REFERENCES .....	36
APPENDIX A SPECIES LISTS .....	37
APPENDIX B REPRESENTATIVE SPECIES OF CARLETONVILLE DOLOMITE GRASSLAND .....	40
APPENDIX C NATIONAL RED LIST CATEGORIES.....	41
APPENDIX D DETAILS OF SPECIALIST .....	42

## LIST OF FIGURES

Figure 1: Topographic locality map indicating the location of the study area in relation to the surrounding region .....	2
Figure 2: Aerial locality map indicating the location of the study area in relation to the surrounding region .....	3
Figure 3: Location of listed threatened ecosystems (2011) in relation to the study area .....	8
Figure 4: Location of remnant Carletonville Dolomite Grassland vegetation in relation to the study area (NBA 2018). .....	11
Figure 5: CBAs, ESAs and ridges, in the vicinity of the study area as indicated by the Gauteng C-Plan (2011). .....	12
Figure 6: Vegetation units identified within the vicinity of the study area. ....	19
Figure 7: Indigenous Grassland vegetation unit within the north of the study area .....	20
Figure 8: Representative photographs of the Open Rocky Grassland vegetation unit.....	21
Figure 9: Representative photographs of the Modified Grassland vegetation unit, showing <i>Stoebe plumosum</i> encroachment (top left), and dense, largely monotypic stands of <i>Digitaria tricholaenoides</i> (bottom).....	22
Figure 10: Representative photographs of the Severely Modified vegetation unit, indicating alien tree stands (top left), dumping of construction material along the northern boundary of the study area (top right), access roads (bottom left) and ongoing dumping (bottom right) .....	23
Figure 11: Removal of <i>S. coronatus</i> from the grassland habitat noted during the field assessment. ....	28
Figure 12: Floral ecological sensitivity map for the study area. ....	30

## LIST OF TABLES

Table 1: Floral habitat sensitivity rankings and associated conservation objectives.....	15
Table 2: Summary of vegetation type associated with the study area (Mucina & Rutherford, 2006). .....	17
Table 3: Floral SCC listed for the 2627BD QDS (POSA, 2013; BODATSA, 2019, GDARD, 2020).....	24
Table 4: Alien and invasive floral species identified during the field assessment across all vegetation units.....	26
Table 5: Medicinal floral species identified during the field assessment across all vegetation units.....	27
Table 6: Scores achieved in terms of the floral ecological sensitivity for each vegetation unit. ....	28
Table 7: Results and development implications of the floral ecological sensitivity analysis. ....	28
Table 8: Impact 1 – Loss of floral habitat.....	31
Table 9: Impact 2 – Loss of floral species diversity.....	32
Table 10: Impact 3 – Loss of floral SCC.....	34



## LIST OF ABBREVIATIONS

<b>°C</b>	Degrees Celsius
<b>BGIF</b>	Global Biodiversity Information Facility
<b>BGIS</b>	Biodiversity Geographic Information Systems
<b>BODATSA</b>	Botanical Database of southern Africa
<b>CARA</b>	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
<b>CBA</b>	Critical Biodiversity Area
<b>CITES</b>	Convention on International Trade in Endangered Species of Wild Fauna and Flora
<b>C-Plan</b>	Gauteng Conservation Plan version 3.3.
<b>CR</b>	Critically Endangered
<b>DDD</b>	Data Deficient – Insufficient Information
<b>DDT</b>	Data Deficient – Taxonomically Problematic
<b>EAP</b>	Environmental Assessment Practitioner
<b>EN</b>	Endangered
<b>ESA</b>	Ecological Support Area
<b>EW</b>	Extinct in the Wild
<b>GDARD</b>	Gauteng Department of Agriculture and Rural Development
<b>GIS</b>	Geographic Information System
<b>GPS</b>	Global Positioning System
<b>ha</b>	Hectares
<b>IUCN</b>	International Union for the Conservation of Nature
<b>m</b>	Metres
<b>mamsl</b>	metres above mean sea level
<b>MAP</b>	Mean Annual Precipitation
<b>mm</b>	Millimetre
<b>NBA</b>	National Biodiversity Assessment (2018)
<b>NEMA</b>	National Environmental Management Act (Act No. 107 of 1998)
<b>NEMBA</b>	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
<b>NPAES</b>	National Protected Areas Expansion Strategy (2008)
<b>NT</b>	Near Threatened
<b>PACA</b>	Protected and Conservation Areas
<b>POSA</b>	Plants of southern Africa
<b>PRECIS</b>	Pretoria National Herbarium Computerised Information System
<b>QDS</b>	Quarter Degree Square (1:50,000 topographical mapping references)
<b>RE</b>	Regionally Extinct
<b>RLRP</b>	Gauteng Rapid Land Release Programme
<b>SANBI</b>	South African National Biodiversity Institute
<b>SCC</b>	Species of Conservation Concern
<b>TNCO</b>	Transvaal Nature Conservation Ordinance (No. 12 of 1983)
<b>TOPS</b>	Threatened or Protected Species
<b>VU</b>	Vulnerable

# 1. INTRODUCTION

## 1.1 Background

Field and Form Landscape Science was appointed to undertake a floral assessment as part of the environmental assessment and authorisation process for the proposed Rietfontein Housing Project, that forms part of the Gauteng Rapid Land Release Programme (RLRP), to be situated on the Remaining Extent of Portion 129 of the Farm Rietfontein No. 301 IQ, within the City of Johannesburg Metropolitan Municipality, Gauteng Province; hereafter referred to as the “study area”.

The study area is located in the south of Johannesburg, immediately to the south of Themb’Elihle and southeast of Lenasia. The study area is 83.4 hectares (ha) in extent and is characterised by undeveloped land which extends further to the south beyond the study area. The residential areas of Lawley, Ennerdale, Lenasia South and Zakariyya Park are located further to the southwest, south and southeast. The study area is bordered by Klipspruit Valley Road in the west, and by unnamed gravel roads in the south and east. The R553 (Golden Highway) runs 2.5km to the east and the N1 highway further to the east. The location of the study area is illustrated in Figures 1 & 2.

Based on available information at the time of compilation of this report, approximately 3 600 housing units are proposed as part of the Rietfontein Housing Project.

## 1.2 Terms of Reference

The scope of the floral assessment is defined as follows:

- To provide an overview of any applicable environmental legislation as well as national and regional planning guidelines to be considered in planning the project;
- To provide a broad description of the biophysical characteristics of the study area and its surroundings as applicable to the floral assessment;
- To categorise and describe the vegetation present within the study area according to defined vegetation units and to provide an overview of vegetation structure and floral species composition;
- To provide an indication of the conservation importance of each vegetation unit identified within the study area;
- To identify floral Species of Conservation Concern (SCC) that could potentially occur in the study area and surrounds, to confirm their presence where possible and to identify whether suitable habitat for such species is available; and
- To assess the potential impacts that may occur as a result of the proposed project and to provide site specific mitigation measures and ongoing management measures that will be required to reduce such impacts should the project be approved.





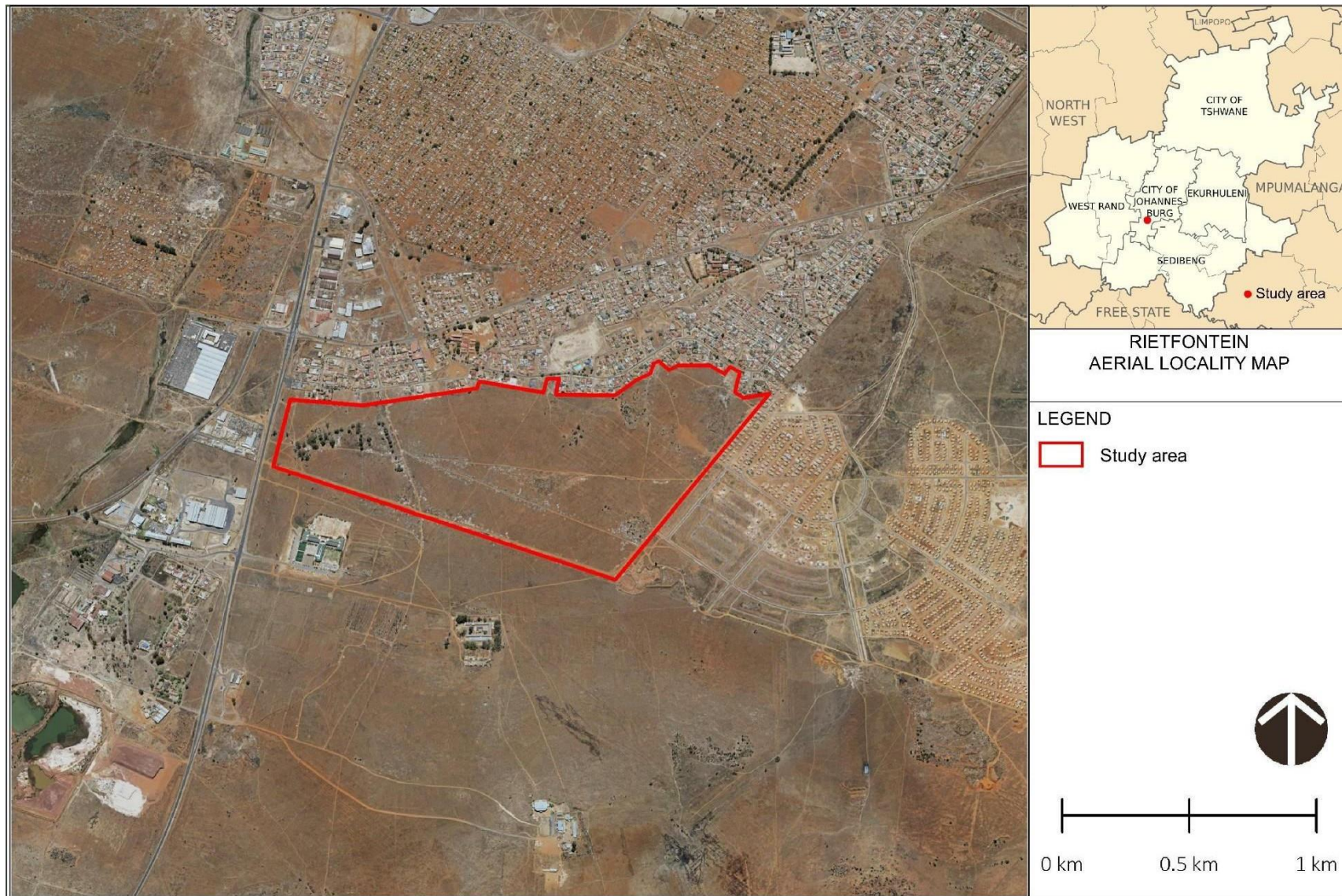


Figure 2: Aerial locality map indicating the location of the study area in relation to the surrounding region.

### 1.3 Limitations and Assumptions

The following limitation and assumptions are applicable to the assessment:

- The content of this report is based on information gathered and databases consulted at the time of investigation;
- Sections 2 and 3 of this report contain data accessed as part of the desktop assessment. It is important to note, that although all databases utilised provide useful and often verifiable high-quality data, the various databases consulted do not always provide an entirely accurate indication of the study area's actual site characteristics. This information is however considered to be useful as background information to the study, and the data were used to inform the field assessment, specifically where areas of increased conservation importance are indicated. In each instance, the year the database was generated is indicated. All databases used were found to be reliable and corresponded with reasonably accuracy with the field observations;
- At the time of assessment, a layout plan of the proposed housing project was not yet available and no site alternatives applicable to the floral assessment, were provided;
- Due to the complexity of natural ecosystems and seasonality of species, it is possible that some floral aspects, including certain floral species, may have been overlooked, however all effort was made by the consultant to gather and convey accurate information;
- The field assessment was conducted over a period of one day (15 January 2020) and as such does not account for seasonal variation or long-term temporal changes in biodiversity. The season and time period during which the field assessment took place is however deemed suitable for floral assessments in Gauteng and falls within the November – April period recommended by the Gauteng Department of Agriculture and Rural Development (GDARD) in the GDARD Requirements for Biodiversity Assessments version 3 (2014). At the time of assessment, no evidence of recent fires was noted and many of the floral species were in flower, which allowed for ease of identification;
- Natural systems are dynamic and intricate, and the possibility exists that additional information with regard to the study area may come to light at a later stage;
- The presence of sensitive ecological features within 200m of study area was considered as part of the assessment and in line with GDARD (2014) requirements, but the emphasis of the floral assessment was within the boundaries of the study area as indicated in Figures 1 & 2;
- Vegetation mapping is based on data obtained through Global Positioning System (GPS) mapping during the field assessment, in conjunction with aerial imagery. Potential georeferencing errors, including limitations in GPS accuracy may result in slight discrepancies in the maps produced; and
- The majority of floral SCC are extremely seasonal and only flower during specific periods of the year. Prior information on potential threatened flora was however known and special emphasis was placed on searching for such species during the field assessment.



## 2. LEGISLATIVE BACKGROUND

### 2.1 The National Environmental Management: Biodiversity Act (NEMBA; Act No. 10 of 2004)

#### 2.1.1 National List of Threatened Ecosystems (2011)

The NEMBA provides for the listing of threatened or protected ecosystems in one of four categories: 'Critically Endangered (CR)', 'Endangered (EN)', 'Vulnerable (VU)' or 'Protected'. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems.

According to the National List of Threatened Terrestrial Ecosystems (2011) database, the study area is not located within a listed threatened ecosystem. The Kliprivier Highveld Grassland (CR) and Soweto Highveld Grassland (CR) ecosystems are located 1.6km to the northeast and 3.2km to the south, respectively (Figure 3).

#### 2.1.2 Alien and Invasive Species Regulations (2014)

The NEMBA Alien and Invasive Species Regulations (2014) aims to:

- Prevent the unauthorised introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur;
- Manage and control alien and invasive species, to prevent or minimise harm to the environment and biodiversity; and
- Eradicate alien and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Categories according to the Alien and Invasive Species Regulations (2014) are as follows:

- Category 1a: Invasive species requiring compulsory control. Plants are to be removed and destroyed. Any Category 1a listed plants must be combatted or eradicated.
- Category 1b: Invasive species that require control by means of an invasive species management programme.
- Category 2: Invasive species which require a permit to carry out a restricted activity within an area, as specified in the permit. If an Invasive Species Management Programme has been developed, a person must control the listed invasive species in accordance with such a programme.
- Category 3: Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purpose of the regulation be considered to be a Category 1b Listed Invasive Species. If an Invasive Species Management Programme has been developed, a person must control the listed invasive species in accordance with such a programme.

The NEBMA Alien and Invasive Species Lists (2016) include national lists of invasive species to be read together with the Alien and Invasive Species Regulations (2014). A list of alien floral species recorded in the study area, including the applicable alien and invasive species category is included in Section 6.3.

### 2.1.3 Threatened or Protected Species Regulations (2015)

The NEMBA provides for listing of Threatened or Protected Species (TOPS). If a species is listed as threatened, it must be further classified as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). In addition to these categories, Protected species are defined as “any species which is of such high conservation value or national importance that it requires national protection”. Species listed in this category include, amongst others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, referred to as Restricted Activities, are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the Act are keeping, moving, having in possession, importing and exporting, and selling. No floral TOPS were recorded within the study area (refer to Section 6.2).

### 2.2 National Forests Act (Act No. 84 of 1998)

An updated list of protected tree species was published under section 12(1) (d) of the National Forests Act (Act No. 84 of 1998) on 7 September 2018 (note that a more recent notice was published on 6 December 2019, but no species list was included). In terms of section 15(1) of the National Forests Act (Act No. 84 of 1998), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.

GDARD (2014) also requires that surveys be undertaken to determine whether any of the following protected tree species are present on site: *Vachellia (Acacia) erioloba*, *Boscia albitrunca*, *Combretum imberbe*, *Ilex mitis* var. *mitis*, *Pittosporum viridiflorum*, *Prunus africana*, *Sclerocarya birrea* subsp. *caffra*.

No protected tree species in terms of the National Forests Act (Act No 84 of 1998) were recorded within the study area (refer to Section 6.2).

### 2.3 National Environmental Management: Protected Areas Act (NEMPAA; Act No. 57 of 2003)

The NEMPAA was promulgated in order to provide for (among other things) the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national Register of Protected Areas, and for the management of those areas in accordance with national norms and standards.

#### 2.3.1 South African Protected Areas Database (SAPAD, 2019) and South African Conservation Areas Database (SACAD, 2019)

The SAPAD and SACAD are Geographic Information System (GIS) inventories of all Protected and Conservation areas in South Africa. The Protected and Conservation Areas (PACA) database<sup>2</sup> also includes data on privately owned protected areas. This Register comprises of all data

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<sup>2</sup> [www.egis.environment.gov.za](http://www.egis.environment.gov.za)

required for the Register of Protected Areas (legally declared) as well as data on Conservation Areas (areas responsibly managed for biodiversity conservation but not legally declared as Protected Areas).

According to the SAPAD (2019) and SACAD (2019) databases, the study area is not affected by, or located in close proximity to protected areas or formal or informal conservation areas.

#### 2.3.2 The National Protected Areas Expansion Strategy (NPAES; 2010)

Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the 2008 National Protected Area Expansion Strategy (NPAES). According to the NPAES database (2010), the study area is not located within an NPAES Focus Area.

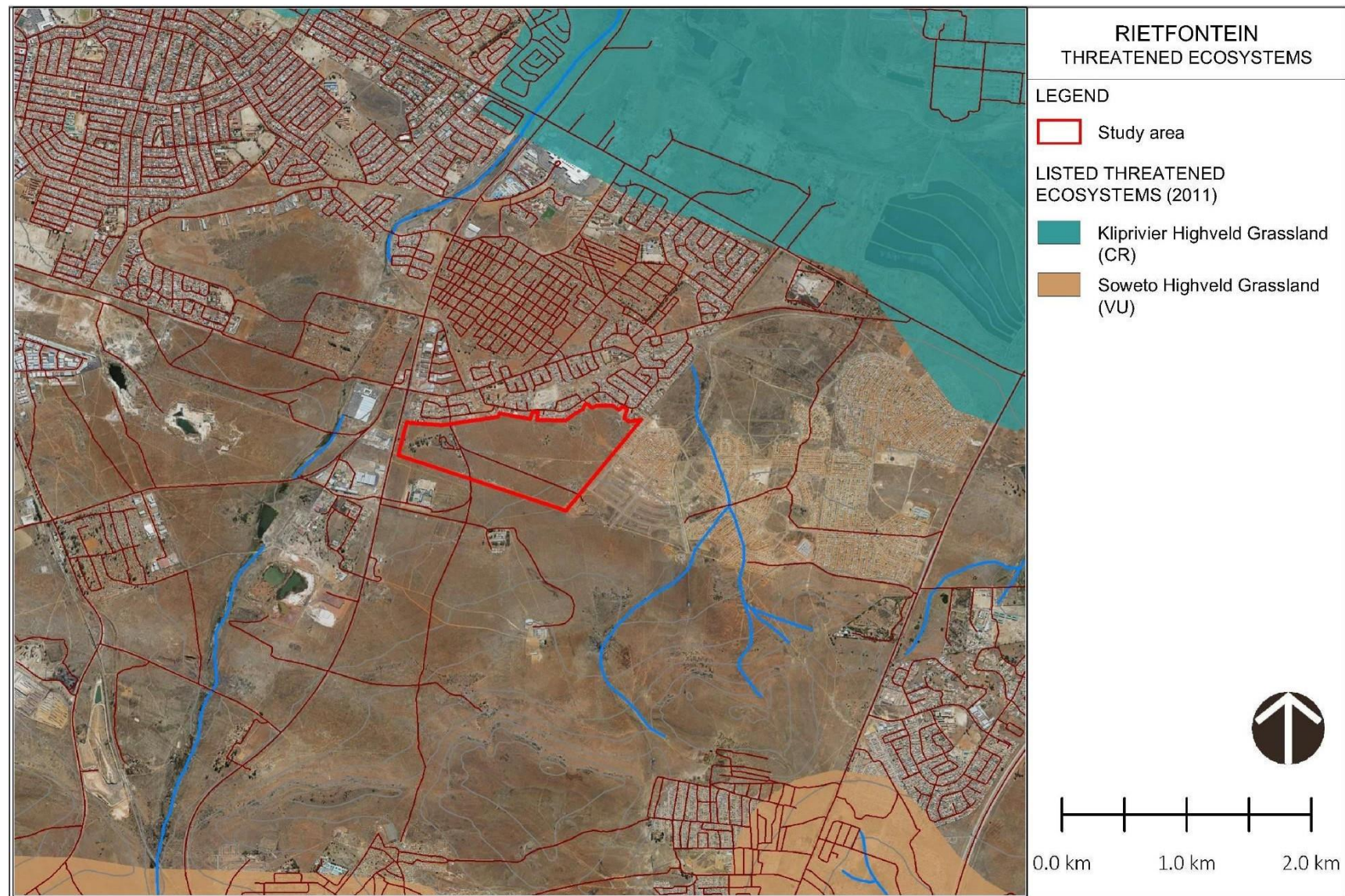
#### 2.4 Conservation of Agricultural Resources Act (CARA; Act No. 43 of 1983)

Amendments to regulations under the CARA provide for the declaration of weeds and invader plants, with weeds regarded as alien plants with no known useful economic purpose, while certain invader plants may serve useful purposes as ornamentals, as sources of timber and may provide other benefits despite their aggressive nature. Declared weeds, which are prohibited plants, are described as Category 1 plants, declared invader plants with a commercial or utility value are described as Category 2 plants, and Category 3 plants include mostly ornamental plants of which no further planting is allowed, except with special permission. A list of alien floral species recorded in the study area, including the alien and invasive species categories in terms of CARA is included in Section 6.3.

#### 2.5 Transvaal Nature Conservation Ordinance (TNCO; No. 12 of 1983)

The TNCO provides for the protection of Protected and Specially Protected plant species, as per Schedules 11 and 12 respectively, whereby a permit is required to pick, donate, sell, export or remove such species. No floral species protected in terms of the TNCO were recorded in the study area (refer to Section 6.2). The Gauteng Nature Conservation Bill of 2014, which will repeal the TNCO, has not yet been promulgated.





**Figure 3: Location of listed threatened ecosystems (2011) in relation to the study area.**

### 3. NATIONAL AND REGIONAL PLANNING FRAMEWORKS

#### 3.1 National Biodiversity Assessment (NBA; 2018)

The NBA is the primary tool for monitoring and reporting on the state of biodiversity in South Africa. It is prepared as part of SANBI's mandate to monitor and report regularly on the status of South Africa's biodiversity, and is a collaborative effort from many institutions and individuals. The NBA focusses primarily on assessing biodiversity at the ecosystem and species level, with efforts being made to include genetic level assessments. Two headline indicators that are applied to both ecosystems and species are used in the NBA: threat status and protection level. The products of the NBA include seven technical reports, a technical synthesis report and several popular outputs (Skowno et al., 2019).

According to the most recent NBA database, dated 2018 and released in 2019, the western portion and a small portion in the northeast of the study area, are considered to form part of the remaining extent of Carletonville Dolomite Grassland, a poorly protected ecosystem, with a threat status of Least Concern (LC) (Figure 4).

#### 3.2 Gauteng Conservation Plan (C-Plan) Version 3.3 (GDARD, 2011)

The Gauteng C-Plan v3.3 focuses on the mapping of biodiversity priority areas within Gauteng, as compiled by GDARD (2011). The C-Plan v3.3 was consulted in order to determine if any site-specific issues and areas are considered to be of increased ecological or conservational importance and sensitivity within the vicinity of the study area.

The eastern portion of the study area is indicated to fall within a Critical Biodiversity Area (CBA), which is identified as 'Important' due to the presence of Orange Listed floral species habitat and primary vegetation (GDARD 2011; Figure 5). CBAs are areas containing Irreplaceable, Important and Protected Areas and are defined as areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses (SANBI; BGIS 2013).

#### 3.3 Gauteng Red List Species Guidelines (2006)

The Gauteng Red List Species Guidelines (2006) aim to facilitate the conservation of the Red List Plant species of Gauteng and are to be used by the Department, applicants and any other person or organisation that is responsible for managing, or whose actions affect, areas in Gauteng where populations of Red List Plant species grow. The purpose of the guidelines is as follows:

- To promote the conservation of Red List Plant Species in Gauteng, which are species of flora that face risk of extinction in the wild;
- To promote the conservation of diverse landscapes which forms part of the overall environmental preservation of diverse ecosystems, habitats, communities, populations, species and genes in Gauteng; and
- To provide a decision-making support tool to any person or organisation that is responsible for managing, or whose actions affect, areas in Gauteng where populations of Red List Plant Species grow, whether such person or organisation be an organ of state or private entity or



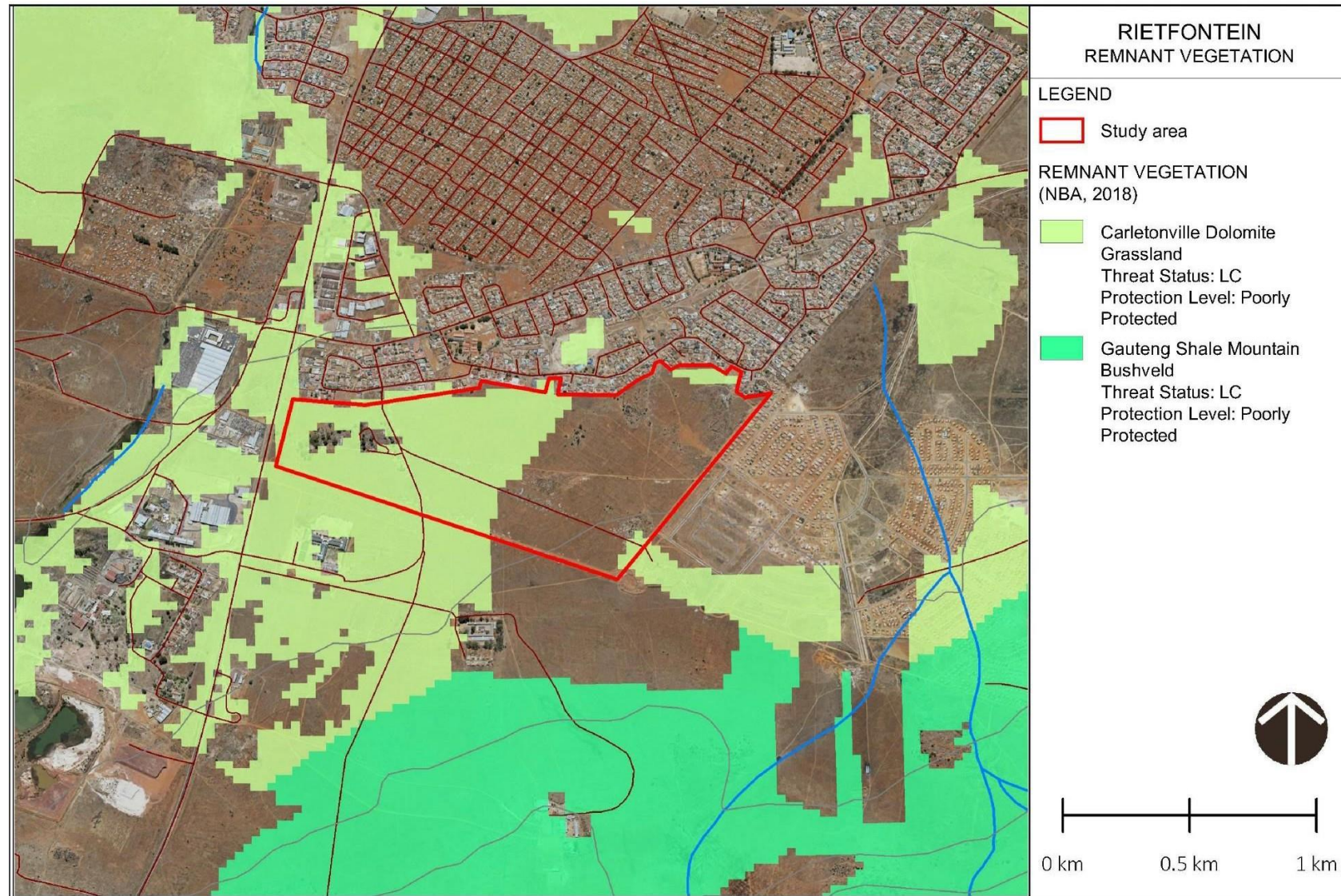
individual; thereby enabling the conservation of the Red List Plant Species that occur in Gauteng.

A list of Red List Plant species and other floral SCC that has the potential to occur within the study area is included in Section 6.2. No SANBI threatened floral species, or Red List plant species indicted for the Gauteng Province were recorded from the study area.

### 3.4 Gauteng Development Guidelines for Ridges (2001, updated 2004, 2006, 2019)

The Gauteng C-Plan Version 3.3 database (2011) identifies a number of key areas which represent a high diversity of environmental parameters in relatively small areas as CBAs or ESAs. Designated CBA and ESA areas include the ridges and higher-altitude areas occurring in the Gauteng province, because of the relatively large topographic and geological diversity within these areas, which are critical for ensuring the long-term persistence of both species and ecosystems. These areas include the ecological gradients required to allow species and habitats to adjust to climate change impacts and are also likely to include important refuge areas (City of Tshwane, 2016). The aforementioned is further supported by the GDARD Requirements for Biodiversity Assessments (2014) which states that all ridges must be designated as sensitive.

According to the GDARD: Gauteng Ridges Version 7 dataset, no transformed or untransformed ridges are located within the study area. A Class 2 ridge is however indicated approximately 1.2km to the south and southeast of the study area (Figure 5).



**Figure 4: Location of remnant Carletonville Dolomite Grassland vegetation in relation to the study area (NBA 2018).**



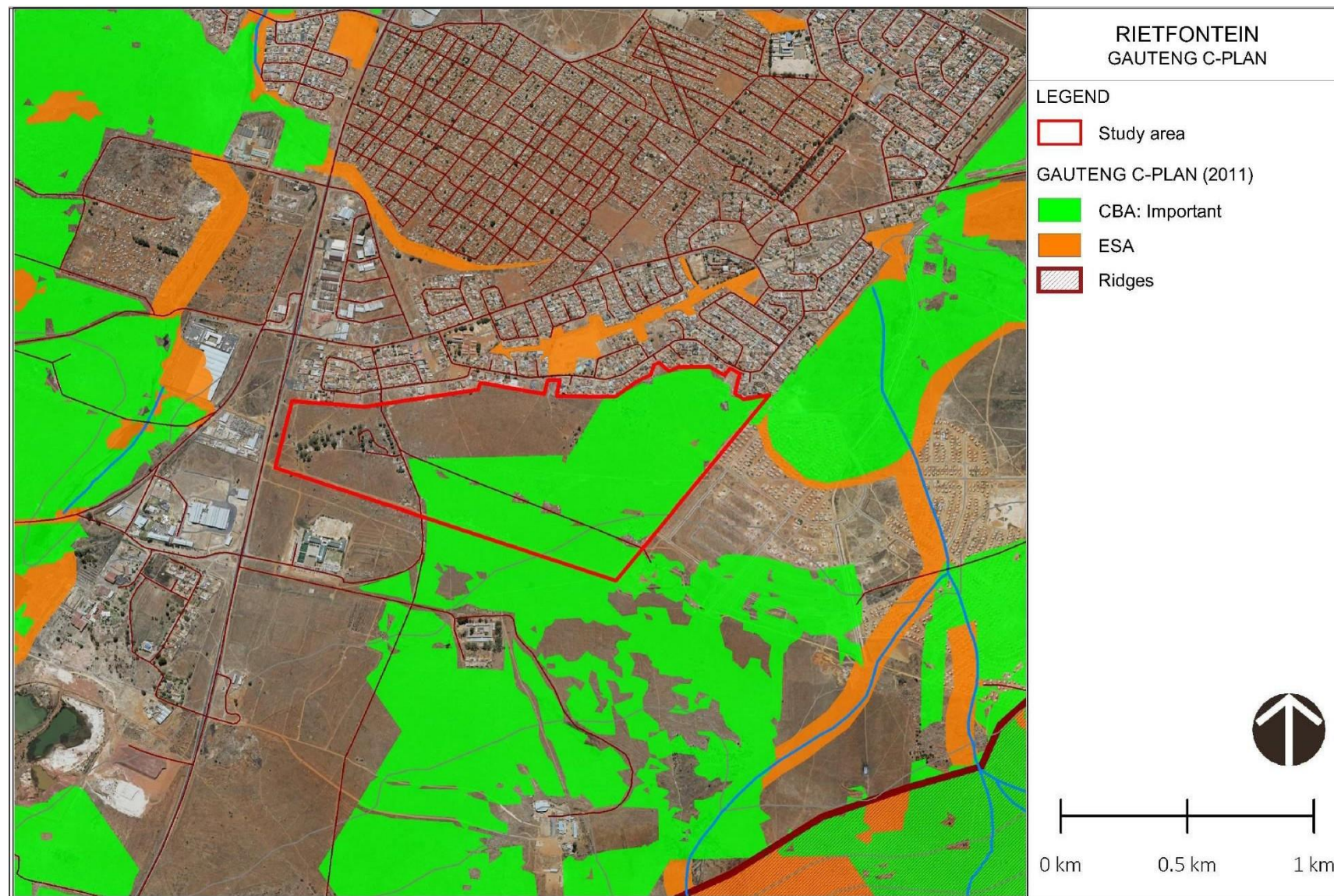


Figure 5: CBAs, ESAs and ridges, in the vicinity of the study area as indicated by the Gauteng C-Plan (2011).

## 4. METHOD OF ASSESSMENT

### 4.1 Floral Assessment

#### 4.1.1 Desktop Assessment

Prior to undertaking a field assessment, a background and literature review was undertaken. Relevant information was obtained from the following sources:

- An overview of the regional vegetation was obtained from relevant literature such as Mucina & Rutherford (2006; 2012) and the NBA (2018), which include the most recent vegetation classification of South Africa, as well as information contained in general field guides for region;
- Other national and regional databases such as protected areas (SAPAD, 2019), conservation areas (SACAD, 2019), land cover classes (BGIS, 2014), drainage lines and wetlands (National Freshwater Ecosystem Protection Areas (NFEPA), 2011; NBA National Wetland Map 5, 2018) and relief were also used to identify areas where potential sensitive habitat such as drainage lines and ridges occur, and also to identify areas where natural, untransformed vegetation is likely to be present that may provide suitable habitat for floral SCC;
- The South African National Biodiversity Institute's (SANBI) National Herbarium Pretoria (PRE) Computerised Information System (PRECIS) Information Database, SANBI's Botanical Database of southern Africa (BODATSA, 2019) and the Global Biodiversity Information Facility (GBIF) were used to determine floral SCC and other species that has the potential to occur within the study area;
- Maps, recent aerial photographs and information on the extent of potential remnant vegetation (NBA, 2018) were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially ecological sensitive areas; and
- The SANBI Red List<sup>3</sup> was used to update the conservation status of floral SCC as per Section 6.2 and to confirm any recent taxonomic changes.

#### 4.1.2 Field Assessment

- A field assessment was undertaken in line with the Gauteng Requirements for Biodiversity Assessment Version 3 (GDARD, 2014) over a period of one day on 15 January 2020 in order to determine the ecological condition of the study area and its surrounds;
- The vegetation of the study area was grouped into relatively homogenous vegetation units based on aerial photography, different land uses, defined vegetation types and other available information as set out in Section 4.1.4 above;
- During the field assessment, a drive- and walkaround was undertaken for orientation purposes during which time visual observations pertaining to the various ecological attributes of the study area and associated habitat were made;
- The walkaround was followed by an on-foot survey whereby vegetation and floral species present within each of the vegetation units were identified and the boundaries of each vegetation unit refined using a handheld Garmin GPS device;

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<sup>3</sup> <http://redlist.sanbi.org>

- Note was made of the ecological condition and sensitivity of the vegetation present within each vegetation and impacts and disturbances were identified. Any special features considered to be of ecological importance were noted. Specific emphasis was placed on the potential occurrence of floral SCC, including those highlighted by GDARD to occur in the 2627BD Quarter Degree Square (QDS), and areas providing suitable habitat for such species; and
- Species encountered were compared with regional species lists available for the expected Carletonville Dolomite Grassland vegetation type.

#### 4.1.3 Floral Species of Conservation Concern

Prior to the field assessment, a record of floral SCC and the habitat requirements of these species was acquired GDARD, and various SANBI and other databases, for the QDS 2627BD within which the study area is located. Throughout the floral assessment, specific attention was paid to the identification of any of these SCC as well as identification of suitable habitat that could potentially sustain these species.

##### 4.1.3.1 IUCN and SANBI RDL Categories

According to [www.redlist.sanbi.org](http://www.redlist.sanbi.org), South Africa uses the internationally endorsed International Union for the Conservation of Nature (IUCN) Red List Categories and Criteria in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction, with the purpose of highlighting those species that are most urgently in need of conservation action.

The assessments contained in the Red List of South African plants are regional or national assessments, which mean that if a plant species is not endemic to South Africa, only that part of the species' distribution range falling within South Africa was evaluated in the assessment. Therefore, a species' status on the national Red List may differ from its global status on the IUCN Red List. Non-IUCN, national Red List categories for species not in danger of extinction, but considered of conservation concern are also included, with the IUCN equivalent of these categories being Least Concern (LC).

Threatened species are those species that are currently 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, while floral SCC are species that have a high conservation importance in terms of conserving 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, Declining, Data Deficient – Insufficient Information (DDD) and Data Deficient – Taxonomically Problematic (DDT). Descriptions of the various National Red List Categories are included as Appendix C.

##### 4.1.3.2 Other

For the purpose of this assessment, other species of conservation importance are included under the term 'floral SCC', namely those species as listed under the NEMBA TOPS regulations (2015), tree species listed under the National Forests Act (Act No. 84 of 1998) as protected, as well as specially protected and protected floral species as listed under the TNCO (No. 12 of 1983) as outlined in Sections 2.1.3, 2.2 and 2.5, respectively.



#### 4.1.4 Sensitivity Mapping

The floral habitat sensitivity of each broad vegetation 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 vegetation unit. Each of the following parameters are rated on a scale of 1 to 5 (where a score of '1' is lowest and '5' is highest):

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the vegetation unit;
- **Unique Landscapes:** The presence of unique landscapes (such as wetland and other freshwater features, ridges or rocky outcrops) or the presence of an ecologically intact vegetation unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the vegetation 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 vegetation 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 vegetation unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilisation or development of the applicable vegetation unit in question. The different classes and land-use/conservation objectives are presented in the table below.

**Table 1: Floral habitat sensitivity rankings and associated conservation objectives.**

Score	Rating significance	Conservation objective
>1 - ≤2	Low	Optimise development potential within these areas.
>2 - ≤2.6	Medium Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
>2.6 - ≤3.4	Medium	Conserve and enhance biodiversity of the vegetation unit and surrounds while optimising development potential.
>3.4 - ≤4.2	Medium High	Conserve and enhance the biodiversity of the vegetation unit, limit development and disturbance.
>4.2 - ≤5	High	Conserve and enhance the biodiversity of the vegetation unit, no-go alternative must be considered.

#### 4.2 Impact Assessment

Direct, indirect and cumulative impacts identified through the specialist study have been assessed in terms of the following criteria:

**Nature of Impact**, which includes a description of what causes the effect, what will be affected and how it will be affected.

**Extent of the Impact**, whereby a value between 1 and 5 will be assigned as appropriate:

- (1) Site (site only)
- (2) Local (site boundary and immediate surrounds)
- (3) Regional
- (4) National

**(5) International**

**Duration**, where the length that the impact will last for is described as either:

- (1) Immediate (<1 year)
- (2) Short term (1-5 years)
- (3) Medium term (5-15 years)
- (4) Long term (ceases after the operational life span of the project)
- (5) Permanent

**Magnitude (consequences) of the Impact**, where the intensity or severity of the impact is indicated as either:

- (0) None
- (2) Minor
- (4) Low
- (6) Moderate (environmental functions altered but continue)
- (8) High (environmental functions temporarily cease)
- (10) Very high/ unsure (environmental functions permanently cease)

**Probability of Occurrence**, which describes the likelihood of the impact actually occurring. The likelihood of the impact actually occurring is indicated as either:

- (1) None (the impact will not occur)
- (2) Improbable (probability very low due to design or experience)
- (3) Low probability (unlikely to occur)
- (4) Medium probability (distinct probability that the impact will occur)
- (5) High probability (most likely to occur)
- (6) Definite

**Significance of the Impact**

Based on the ratings outlined above, the potential impacts are assigned a significance rating (S). This rating is formulated by adding the sum of the numbers assigned to extent (E), duration (D) and magnitude (M), and multiplying this sum by the probability (P) of the impact.

$$S = (E+D+M) \times P$$

**The significance ratings are as follows**

- (<30) low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
- (30 – 60) medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
- (>60) high (i.e. where the impact must have an influence on the decision process to develop in the area)

Other aspects considered include:

- The status of the impact, which are assessed as either having a:  
Negative effect (i.e. at a 'cost' to the environment);  
Positive effect (i.e. a 'benefit' to the environment); or  
Neutral effect on the environment.
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the degree to which the impact can be mitigated.

## 5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

### 5.1 Climate

The climate of the region is warm-temperate, with high summer temperatures. Severe, frequent frost occurs in winter. The area receives summer rainfall and has a Mean Annual Precipitation (MAP) of 593mm (Mucina & Rutherford, 2006).

### 5.2. Surface Water

The study area is relatively level, slopes slightly in the direction of the Klip River approximately 3.8km to the north and occurs at an altitude of between 1 590 and 1 603 metres above mean sea level (mamsl). Very little topographical variation is present within the study area, and no distinct rocky outcrops or valleys occur within the study area.

### 5.3 Geology and Soils

The geology of the study area and surroundings is characterised by dolomite and chert of the Malmani Subgroup (Transvaal Supergroup) supporting mostly shallow Mispah and Glenrosa soil forms typical of the Fa land type, which dominates the landscapes of this unit. Deeper red to yellow apedal soils (Hutton and Clovelly forms) occur sporadically, representing the Ab land type (Mucina & Rutherford, 2006).

### 5.4 Vegetation Type

The study area is located within the Grassland Biome of South Africa and specifically within the Mesic Highveld Grassland Bioregion. The vegetation associated with the study area has previously been defined as Bankenveld (Acocks, 1953) and more recently as Rocky Highveld Grassland (Low & Rebelo, 1996). In terms of the most recent vegetation classification of South Africa (Mucina & Rutherford, 2006, 2012; NBA, 2018), the study area is located within the Carletonville Dolomite Grassland vegetation type.

A summary of the main ecological features of the Carletonville Dolomite Grassland vegetation type is included in Table 2 below. A list of species typical of this vegetation type is included as Appendix B.

Table 2. Summary of vegetation type associated with the study area (Mucina & Rutherford, 2006).

Vegetation Type	Gm15 Carletonville Dolomite Grassland
Distribution	This vegetation type occurs in North-West (mainly) and Gauteng Provinces and marginally in the Free State Province. It occurs in the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province. Altitude 1 360–1 620m, but largely 1 500–1 560m.
Landscape	Slightly undulating plains dissected by prominent rocky chert ridges. Species-rich grasslands forming a complex mosaic pattern dominated by many species.
Characteristic vegetation	Species-rich grasslands forming a complex mosaic pattern dominated by many species.
Conservation	Vulnerable (VU), with a conservation target of 24%. Small extent conserved in statutory (Sterkfontein Caves—part of the Cradle of Humankind World Heritage Site, Oog Van Malmanie, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, Groenkloof) and in at least six private conservation areas. Almost a quarter already transformed for cultivation, by urban sprawl or by mining activity as well as the building of the Boskop and Klerkskraal Dams. Erosion very low (84%) and low (15%).

## 6. RESULTS OF THE FLORAL ASSESSMENT

During the field assessment, four broad vegetation units were identified within the study area, namely:

- Open, near-natural grassland, which occurs in the north of the study area in a fragmented distribution;
- Open, rocky near-natural grassland, which occurs in one area within the northern portion of the study area;
- Modified grassland that occurs within the southern, central and eastern portions of the study area. These areas are associated with historically cultivated and impacted areas; and
- Severely modified grassland, which comprises the majority of the study area. These areas are associated with existing vehicular and pedestrian access roads, extensive dumping and resultant alien species encroachment, as well as with dense trees stands dominated by alien and invasive tree species.

The location and extent of these vegetation units in relation to the study area are illustrated in Figure 6 below.



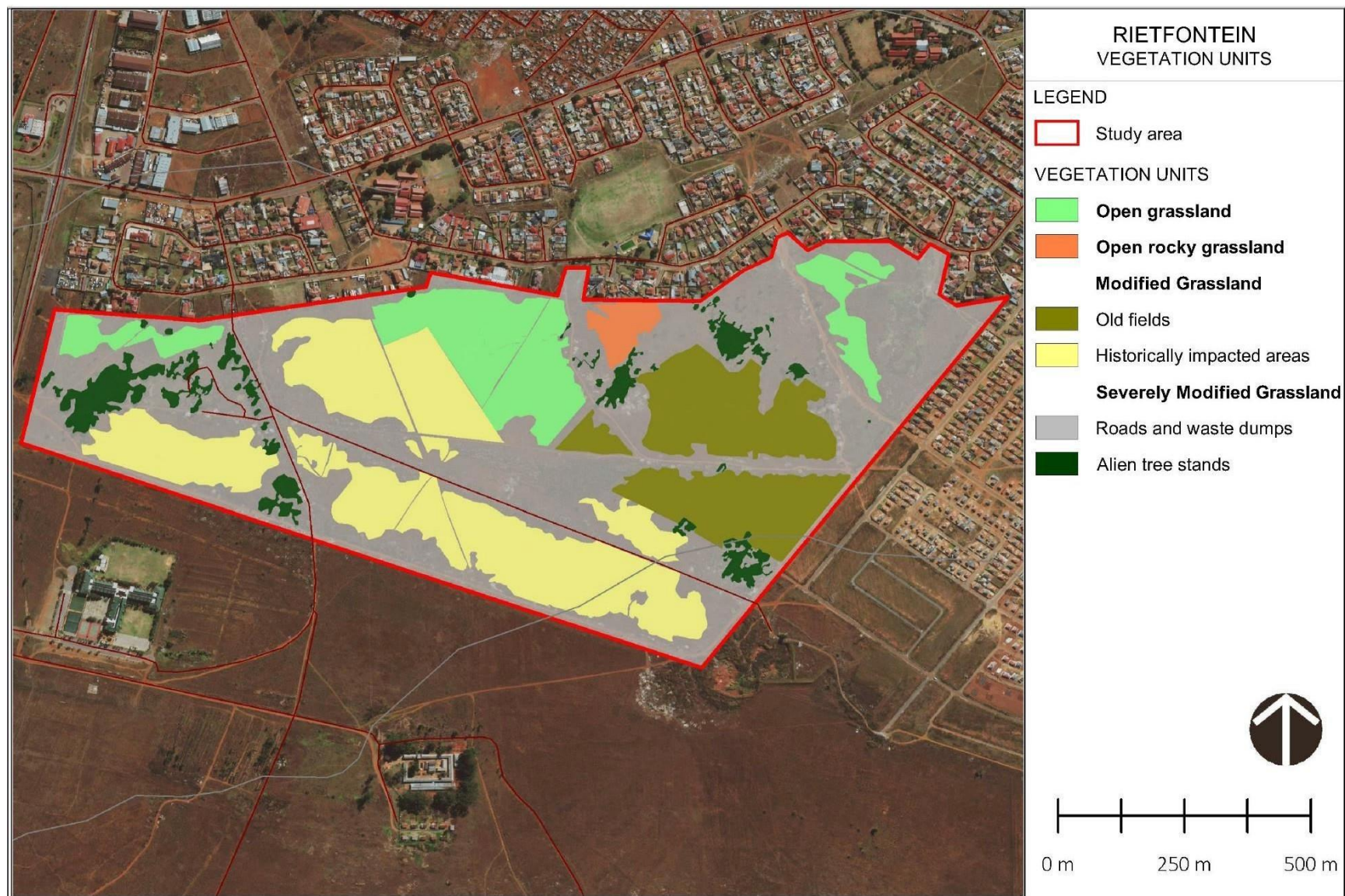


Figure 6: Vegetation units identified within the vicinity of the study area.



## 6.1 Vegetation Units

### 6.1.1 Open Grassland

Indigenous, near-natural grassland vegetation is present within the northern portions of the study area, in a discontinuous distribution (Figure 7). These areas are mostly located some distance from the main access roads traversing the study area and prominent waste dumps, and do not appear to have been affected by historical cultivation activities and other significant historical anthropogenic disturbances. Although some changes in composition and structure may have taken place, the ecosystem functions are essentially unchanged.

The species composition of the Open Grassland vegetation unit is largely representative of the Carletonville Dolomite Grassland vegetation type, with dominant graminoid species present including *Eragrostis racemosa*, *Trachypogon spicatus*, *Heteropogon contortus*, *Alloteropsis semialata* subsp. *eckloniana*, *Brachiaria serrata*, *Digitaria monodactyla*, *D. tricholaenoides*, *Melinis nerviglumis*, *M. repens* subsp. *repens*, *Elionurus muticus*, *Themeda triandra* and the terrestrial sedge *Bulbostylis burchellii*. Forbs species within these areas also include typical species of the expected vegetation type such as *Sphenostylis angustifolia*, *Senecio coronatus*, *Senecio inornatus*, *Indigofera comosa*, *Pygmaeothamnus zeyheri* var. *rogersii*, *Hilliardiella oligocephala*, *Pentanisia prunelloides*, *Elephantorrhiza elephantina*, *Acalypha angustata*, *Helichrysum nudifolium* var. *nudifolium*, *Ipomoea ommaneyi*, *Kohautia amatymbica* and *Chamaecrista mimosoides*.



Figure 7: Open Grassland vegetation unit within the north of the study area.

Few alien species are present within this vegetation unit. *Stoebe plumosum*, an indigenous weed that invades productive grassland and natural veld, and often proliferates in overgrazed areas occurs sporadically throughout this vegetation unit, and in certain areas dominance by indigenous *Nidorella* spp. was observed. This vegetation unit is an overall fair ecological condition and has the potential to support floral SCC, although it was noted from the field assessment that certain plant species are harvested for medicinal purposes. Floral species encountered within the Open Grassland vegetation unit during the field assessment are listed in Appendix A.

#### 6.1.2 Open Rocky Grassland

A portion of the indigenous grassland associated with the study area is located within a distinct continuously rocky area, where the vegetation differs from the surrounding grasslands (Figure 8). This area has, per area unit, an increased floral richness when compared to the Open Grassland vegetation unit, and although several species known from the surrounding grassland areas also occur in this vegetation unit, several grass and forb species occur here that have not been noted elsewhere within the study area. Such species include the grass species *Sporobolus pectinatus*, *Panicum coloratum*, *Bewisia biflora*, *Chrysopogon serrulatus* and *Urelytrum agropyroides*, and forb species such as *Dianthus mooiensis*, *Hypoxis iridifolia*, *Tephrosia elongata*, *Ocimum obovatum* and *Indigofera hedyantha*.

Other grass species typical of the Carletonville Dolomite Grassland vegetation type that are abundant within the Open Rocky Grassland vegetation unit include *Alloteropsis semialata* subsp. *eckloniana*, *Melinis nerviglumis*, *Schizachyrium sanguineum*, *Trichoneura grandiglumis*, *Tristachya leucothrix*, *Eragrostis racemosa* and *Brachiaria serrata*, and forbs such as *Ipomoea ommanneyi*, *Pentanisia prunelloides* and *Senecio coronatus*.



**Figure 8: Representative photographs of the Open Rocky Grassland vegetation unit.**

Although the indigenous weed *Stoebe plumosum* also occurs within and in the vicinity of this vegetation unit and no floral SCC were recorded from this area, the Open Rocky Grassland vegetation unit provides suitable habitat for such species. This vegetation unit is not included within the boundary of the Gauteng C-Plan CBA, but is indicated by the NBA (2018) to form part of the remaining extent of the Carletonville Dolomite Grassland ecosystem.

Floral species encountered within this vegetation unit during the field assessment are listed in Appendix A.



### 6.1.3 Modified Grassland

Significant portions of the study area have been impacted by historical disturbances, most notably historical cultivation activities (Figure 9). A large historically cultivated field (cultivated prior to 2004) is located within the eastern portion of the study area, while other areas along the southern boundary and towards the centre of the study area have also been subjected to anthropogenic impacts, which, based on a comparison with the vegetation composition and structure associated with the old field in the east of the study area, is likely to have also included cultivation and ploughing. Evidence of such disturbance is supported by a review of historical aerial imagery.

Although general vegetation within these areas support several indigenous grass species typical of the expected vegetation type, including climax grasses such as *Themeda triandra*, *Alloterospis semialata* subsp. *eckloniana* and *Digitaria tricholaenoides*, as well as a number of representative forb species, the overall vegetation structure has been altered as a result of disturbance. Although areas of increased biodiversity occur, extensive monospecific stands of *T. triandra* and *D. tricholaenoides* in particular, with limited forb abundance are present throughout this vegetation unit, and large stands of *Stoebe plumosum* occur sporadically. Although the overall abundance of alien species is low, the invasive species *Campuloclinium macrocephalum* was recorded from this vegetation unit.



**Figure 9: Representative photographs of the Modified Grassland vegetation unit, showing *Stoebe plumosum* encroachment (top left), and dense, largely monotypic stands of *Digitaria tricholaenoides* (bottom).**

The grassland vegetation associated with the Modified Grassland vegetation unit currently appears to be naturally recovering from historical disturbances and is in an overall fair to poor ecological condition. Edge effects as a result of ongoing dumping activities continue to impact and encroach on

this vegetation unit. Due to historical disturbances, the vegetation unit is unlikely to support floral SCC. Floral species encountered within the Modified Grassland vegetation unit during the field assessment are listed in Appendix A.

#### 6.1.4 Severely Modified Grassland

The Severely Modified Grassland vegetation unit (Figure 10) is associated with stands of alien trees within the western portion of the study area, as well as within the eastern portion of the study area in the vicinity of the large historical agricultural field. The tree stands, which appear to be periodically felled, comprise mostly listed invasive tree species such as *Eucalyptus camaldulensis* and *Melia azedarach*, with other alien tree species including *Schinus molle*, *Celtis sinensis*, the succulent *Opuntia ficus-indica*, and a low abundance of indigenous tree species such as *Searsia pyroides* and *S. lancea*.

The Severely Modified Grassland vegetation unit also includes existing vehicular access roads and pedestrian thoroughfares which have been cleared of vegetation. Areas along and adjacent to these access routes have historically been used for disposal of domestic waste material, with this activity, including the burning of waste material on site still ongoing (historical Google imagery indicates dumping to have commenced between 2004 and 2008). The areas along the length of the northern boundary of the study area specifically have also been impacted by the disposal of waste in the form of construction and building material, and large dumps of waste material also occur elsewhere within the study area.



**Figure 10: Representative photographs of the Severely Modified vegetation unit, indicating alien tree stands (top left), dumping of construction material along the northern boundary of the study area (top right), access roads (bottom left) and ongoing dumping (bottom right).**



As a result of the aforementioned disturbances, the areas mentioned have been severely encroached and overgrown by alien vegetation, of which listed alien invasive species such as *Mirabilis jalapa*, *Ipomoea purpurea*, *Canna indica* and *Datura stramonium* occur in a high abundance, along with a number of other alien floral species. Large areas of grassland have also been replaced by dense stands of the indigenous weed *Cyperus esculentis* subsp. *esculentis*, and other species that are indicative of disturbance such as *Physalis viscosa*, *Cleome maculata* and the grass species *Urochloa panicoides*. Although several indigenous floral species persist within the Severely Modified Grassland vegetation unit, the vegetation structure and overall composition has been significantly, and probably irreversibly altered.

The Severely Modified Grassland vegetation unit has a low potential to support floral SCC as a result of the high level of historical and current anthropogenic impacts. Floral species encountered within the Severely Modified Grassland vegetation unit during the field assessment are listed in Appendix A.

## 6.2 Floral Species of Conservation Concern

An assessment considering the occurrence of any floral SCC including suitable habitat to support any such species was undertaken. The floral SCC listed in Table 3 below, are indicated by the SANBI POSA and BODATSA databases and through an enquiry to GDARD to occur within the 2627BD QDS. GDARD indicated that no known SANBI or provincially threatened species are known from within the boundary of the study area or within 5km thereof, although several such species are known from the QDS. Habitat requirements for the floral SCC listed below were obtained from [www.redlist.sanbi.org](http://www.redlist.sanbi.org). The various threat status categories are defined in Appendix C.

**Table 3: Floral SCC listed for the 2627BD QDS (POSA, 2013; BODATSA, 2019, GDARD, 2020).**

Species	Threat status	Habitat	Possibility of occurring within the study area
<i>Boophone disticha</i>	LC* (Decreasing)	Dry grassland and rocky areas.	Medium - suitable habitat for this species is available within the study area, but if previously present is likely to have been removed for medicinal use. This species was not recorded during the field assessment.
<i>Cineraria longipes</i>	VU	Grassland, amongst rocks on steep slopes of hills and ridges and along seepage lines, on all aspects and on a range of rock types including quartzite, dolomite and shale.	Low - no suitable habitat available within the study area.
<i>Crinum bulbispermum</i>	LC* (Decreasing)	Near rivers, streams, seasonal pans and in damp depressions.	Low - no suitable habitat available within the study area.
<i>Delosperma davyi</i>	DDT	Wetter and shady habitats riverine forests (Hartmann 2009)	Low - no suitable habitat available within the study area.
<i>Dioscorea sylvatica</i>	VU	Wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs.	Low - no suitable habitat available within the study area.
<i>Habenaria mossii</i>	EN	Open grassland on dolomite or in black, sandy soil.	Medium - suitable habitat for this species is available within the study area. This species was not recorded during the field assessment, but only flowers from

			March to April. The species is known from very few localities.
<i>Hypoxis hemerocallidea</i>	LC* (Decreasing)	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.  Extensive commercial exploitation since 1997 has caused declines in some subpopulations, especially in Gauteng, South Africa, where it is additionally threatened by habitat loss and degradation. This species is however naturally abundant and widespread.	Medium - suitable habitat for this species is available, but if previously present is likely to have been removed for medicinal use. This species was not recorded during the field assessment.
<i>Khadia beswickii</i>	VU	Open shallow soil over rocks in grassland.	Low - although limited suitable habitat for this species is available, the species is perennial and was not recorded from the study area. This species is only known from ten locations.
<i>Lepidium mossii</i>	DDD	Known only from one location in Gauteng. Habitat conditions are unknown.	Low
<i>Lithops lesliei</i> subsp. <i>lesliei</i>	NT	Primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses.	Low - suitable habitat for this species is available, but if previously present is likely to have been removed for medicinal use. This species was not recorded during the field assessment.

\*Previously indicated by the SANBI Red List as Declining, but since the 2017 updates to the SANBI Red List, indicated to be of Least Concern. These species are however still indicated by GDARD as Declining within the Gauteng Province and is included in the Orange List.

Of the floral SCC species listed in Table 3 above, none were encountered within the study area. The habitat available within the Open Grassland and Open Rocky Grassland vegetation units, and even within more disturbed areas, is ideally suited for both *Hypoxis hemerocallidea* and *Boophone disticha* to occur. Limited suitable habitat for *Lithops lesliei* subsp. *lesliei*, *Khadia beswickii* and the orchid species *Habenaria mossii* is available, and it should be noted that the latter species is rare and known from extremely few localities which lowers its probability to occur within the study area. During the field assessment, it was noted that certain medicinal plant species were actively being removed from site (refer to Section 6.4), and it is therefore speculated that *H. hemerocallidea* and *B. disticha*, if present (and possibly also *L. lesliei* subsp. *lesliei*, if historically present), would have already been harvested from the study area. Of the *Hypoxis* genus (of which not all species are used in traditional medicine to the same degree as *H. hemerocallidea*), only a single specimen of *H. iridifolia* was recorded during the field assessment.

In addition to no IUCN or SANBI threatened or near-threatened species recorded from the study area, no floral TOPS as provided for under NEMBA or protected species in terms of the National Forests Act (Act No. 84 of 1998) and TNCO (No. 12 of 1983) were recorded from within the boundaries of the study area. Of the TNCO provincially protected floral species, a possibility exists that *Eucomis* sp.,

*Habenaria* sp. (Orchidaceae plant family) and *Gladiolus* spp. may occur within the Open Grassland and Open Rocky Grassland vegetation units.

### 6.3 Alien Invasive Floral Species

Alien and invasive floral species lead to degradation of the ecological integrity of an area, which in turn may lead to, amongst others, a decline in indigenous species diversity and potential local floral species' extinction, an ecological imbalance and the decreased productivity of land (Bromilow, 2010).

During the field assessment, the dominant alien and invasive floral species encountered were identified and are listed in Table 4 below. The Categories 1a, 1b, 2 and 3 Listed Invasive Species Categories as indicated by the Alien and Invasive Species Lists (2016) are also shown, as well as the categories as per CARA (Act No. 43 of 1983).

**Table 4: Alien and invasive floral species identified during the field assessment across all vegetation units.**

Species	Common name	CARA
Category 1b		
<i>Agave americana</i>	Spreading century plant	Category X2
<i>Campuloclinium macrocephalum</i>	Pompom weed	Category 1
<i>Canna indica</i>	Indian shot	Category 1
<i>Datura stramonium</i>	Common thorn apple	Category 1
<i>Eucalyptus camaldulensis</i>	River red gum	Category 2
<i>Ipomoea purpurea</i>	Morning glory	Category 3
<i>Melia azedarach</i>	Seringa	Category 3
<i>Mirabilis jalapa</i>	Four o'clock	Category X3
<i>Opuntia ficus-indica</i>	Sweet prickly pear	Category 1
<i>Solanum elaeagnifolium</i>	Silver-leaf bitter apple	Category 1
<i>Solanum sisymbriifolium</i>	Dense-thorned bitter apple	Category 1
<i>Verbena bonariensis</i>	Wild verbena	Not Listed
Category 2		
<i>Acacia mearnsii</i>	Black wattle	Category 2
<i>Morus alba</i>	White mulberry	Category 3
<i>Ricinus communis</i>	Castor oil plant	Category 2
Category 3		
<i>Acacia baileyana</i>	Bailey's wattle	Category 3
Not Listed		
<i>Alternanthera pungens</i>	Khakiweed	Not listed
<i>Amaranthus hybridus</i>	Smooth pigweed	Not listed
<i>Bidens pilosa</i>	Common blackjack	Not listed
<i>Celtis sinensis</i>	Chinese nettle tree	Category X3
<i>Chenopodium album</i>	White goosefoot	Not listed
<i>Chenopodium murale</i>	Nettle-leaves goosefoot	Not listed
<i>Conyza bonariensis</i>	Flax-leaf fleabane	Not listed
<i>Eucalyptus cinerea</i>	Silver dollar tree	Not listed
<i>Euphorbia heterophylla</i>	Fire plant	Not listed
<i>Gomphrena celosioides</i>	Prostrate globe-amaranth	Not listed
<i>Helianthus annuus</i>	Sunflower	Not listed
<i>Lepidium africanum</i>	Common peppergrass	Not listed
<i>Myosotis scorpioides</i>	Water forget-me-not	Not listed
<i>Physalis viscosa</i>	Starhair groundcherry	Not listed
<i>Plantago lanceolata</i>	Narrowleaf plantain	Not listed
<i>Portulaca oleraceae</i>	Common purslane	Not listed
<i>Richardia brasiliensis</i>	Mexican clover	Not listed
<i>Schinus molle</i>	Pepper tree	Category X3



<i>Schkuhria pinnata</i>	Small khakiweed	Not listed
<i>Tagetes minuta</i>	Khakiweed	Not listed
<i>Yucca gloriosa</i>	Spanish dagger	Not listed

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

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

**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.

**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.

**X** – Proposed weeds and invaders

From the table above it is evident that a moderate to high diversity of listed alien invasive species occurs within the study area, with a number of Category 1b species present within the Severely Modified Grassland vegetation unit in particular. Listed alien species within the study area have to be controlled throughout the lifetime of the proposed project in terms of the Alien and Invasive Species Regulations (2014).

#### 6.4 Medicinal Floral Species

Many floral species encountered within the study area are known to have medicinal uses or have been potential to be used for medicinal purposes. The list below includes those species recorded within the study area, with medicinal value as indicated by Van Wyk et al. (2005) and Van Wyk & Gericke (2003).

**Table 5: Medicinal floral species identified during the field assessment across all vegetation units.**

Species	Common name	Plant parts used
<i>Datura stramonium</i>	Thornapple	Leaves and green fruit
<i>Elephantorrhiza elephantina</i>	Elandsbean	Rhizomes
<i>Gomphocarpus fruticosa</i>	Milkweed	Leaves and roots
<i>Helichrysum</i> spp.	Everlastings	Leaves, twigs and roots
<i>Hilliardiella oligocephala</i>	Groenamara	Leaves, twigs and roots
<i>Leonotis</i> sp.	Wild dagga	Leaves, stems and roots
<i>Pentanisia prunelloides</i>	Wild verbena	Root and leaves
<i>Ricinus communis</i>	Castor oil plant	Seeds, fruit and leaves
<i>Vachellia karroo</i>	Sweet thorn	Bark, leaves, gum and roots

The medicinal floral species encountered within the study area occur throughout all vegetation units. Certain of the medicinal species included in the table above, such as *Ricinus communis* and *Datura stramonium* are listed invasive species.

During the field assessment, active removal of medicinal species such as *Senecio coronatus*, from the open grassland habitat within the study area was noted (Figure 11). Removal of plants from the study area may account for the absence of more commonly occurring floral SCC such as *Boophone disticha* and *Hypoxis hemerocallidea*.



**Figure 11: Removal of *S. coronatus* from the grassland habitat noted during the field assessment.**

### 6.5 Sensitivity Mapping

The results of the sensitivity analysis of each vegetation unit according to the method described in Section 4.1.4 identified are outlined in the table below.

**Table 6: Scores achieved in terms of the floral ecological sensitivity for each vegetation unit.**

Vegetation Unit	Floral SCC (potential)	Unique landscapes	Conservation status	Indigenous floral diversity	Habitat integrity	Total	Average
Open Grassland	3	3	3	4	4	16	3.2
Open Rocky Grassland	4	4	3	4	4	18	3.6
Modified Grassland	2	2	3	2	3	12	2.4
Severely Modified Grassland	1	1	3	1	1	7	1.4

The development implication for each vegetation unit and corresponding ecological sensitivity class is outlined in the table below.

**Table 7: Results and development implications of the floral ecological sensitivity analysis.**

Vegetation Unit and approximate area	Floral Ecological Sensitivity	Development Implications
Open Grassland (±9 ha)	Medium	This vegetation unit should be conserved if possible and development and disturbance within these areas should be minimised as far possible. Edge effects should be strictly managed to avoid habitat degradation.
Open Rocky Grassland (±1 ha)	Medium High	The habitat associated with this vegetation unit should be conserved and disturbance and edge effects within this area should be strictly managed to avoid habitat degradation.
Modified Grassland (±23 ha)	Medium Low	Development within these areas should be optimised. Although past disturbances led to the degradation of habitat in these areas, some loss of biodiversity and habitat will occur. Through developing these areas, it is proposed that surrounding natural open grassland habitat be enhanced through i.e. the removal of alien vegetation and existing waste material from site. As far

		as possible green open space between housing units should be allowed. Edge effects within these areas, particularly during the construction process, should be strictly managed to avoid disturbance of any open grassland habitat to be conserved as part of the project.
Severely Modified Grassland (±50ha)	Low	Development within this vegetation unit will not lead to a significant loss of floral biodiversity and habitat due to current high levels of disturbance, and these areas should be optimised for development. Waste material from dumping, as well as alien vegetation should be removed from this vegetation unit.

The floral ecological sensitivity map developed for the proposed project is included as Figure 12 below. This map also indicates a 200m extended study area as per GDARD requirements and illustrates the location of a seep wetland as indicated by the National Wetland Map 5 database (NBA, 2018), which may constitute a sensitive ecological feature within 200m of the study area. From Figure 12, it is evident that a portion of the area indicated as a wetland by the applicable database has been lost to development.



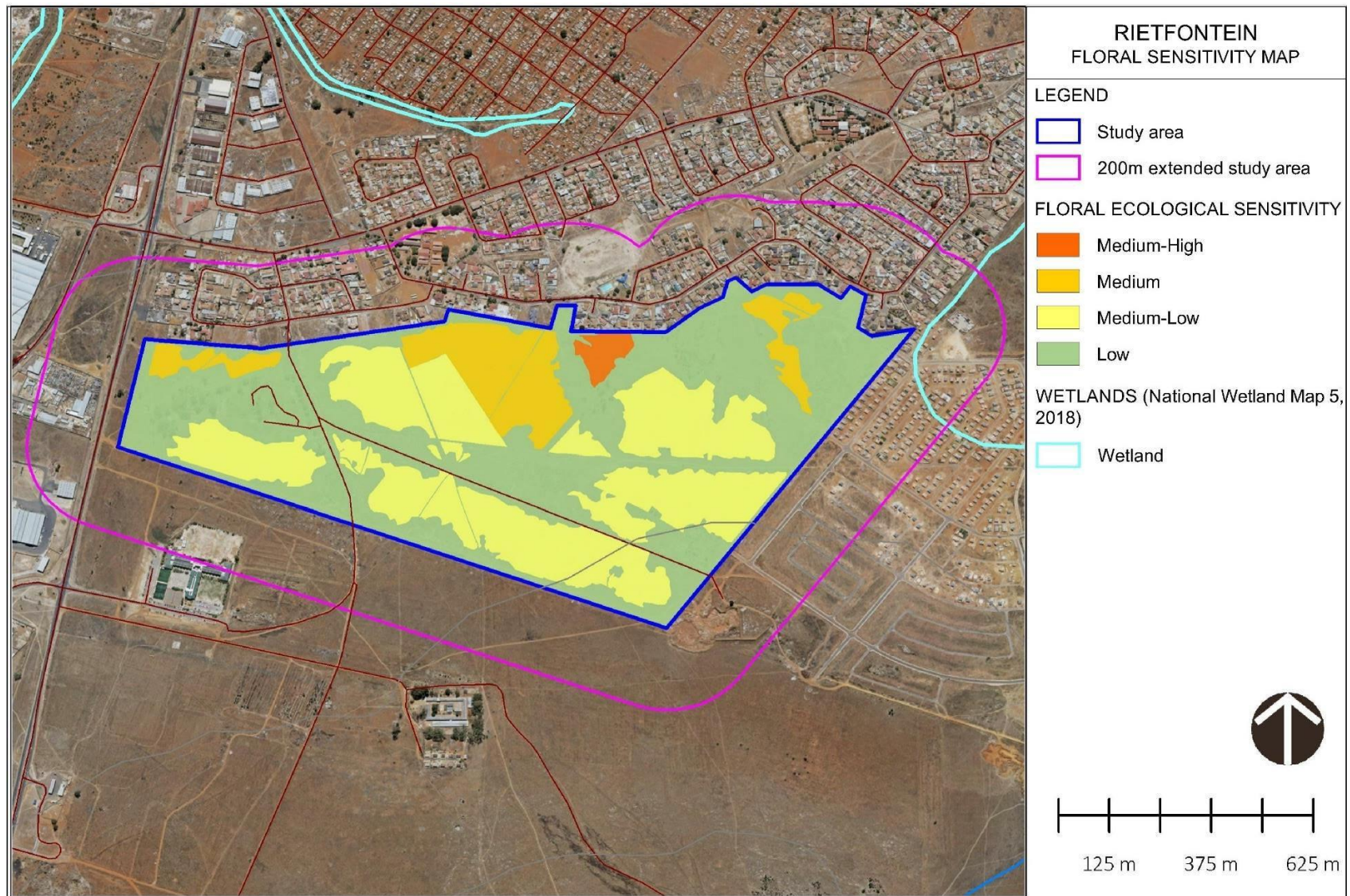


Figure 12: Floral ecological sensitivity map for the study area.



## 7. RESULTS OF THE IMPACT ASSESSMENT

The results of the impact assessment from a floral perspective are outlined below, with significance ratings provided for the envisioned pre- and post-mitigation scenarios. In the context of the proposed housing project and eventual development of housing units, the mitigation measures included in the section below are intended to prevent degradation to the floral ecology within the study area as a result of the construction and operation of the proposed infrastructure, with specific reference of areas of increased floral ecological sensitivity.

**Table 8: Impact 1 – Loss of floral habitat.**

<b>Nature:</b> Loss of floral habitat Loss of floral habitat may result from various activities during the construction and operational phases of the project, including: <ul style="list-style-type: none"> <li>• Clearing of vegetation for construction purposes.</li> <li>• Disturbance of soils and changes to stormwater runoff patterns leading to erosion.</li> <li>• Localised destruction of habitat of increased ecological sensitivity due to the encroachment of construction activities into these areas.</li> <li>• An increase in alien and invasive floral species as a result of habitat disturbance and failure to manage current alien and invasive species and their spread within the study area.</li> <li>• Movement of construction and operational vehicles through habitat areas of increased ecological sensitivity.</li> <li>• Compaction of soils due to vehicular movement.</li> <li>• Dust generation.</li> <li>• Littering and dumping of waste material outside of designated areas, and failure to remove and prevent further dumping and burning of waste material on site.</li> <li>• Uncontrolled fires during the construction phase leading to loss of floral habitat surrounding the development areas.</li> <li>• Landscaping with alien species leading to altered floral habitat within surrounding natural and open space areas.</li> <li>• Ineffective rehabilitation of all exposed and impacted areas during the construction phase.</li> <li>• Compaction of soils reducing floral re-establishment success.</li> </ul>		
	Without mitigation	With mitigation
<b>CONSTRUCTION PHASE</b>		
<b>Probability</b>	Definite (5)	Highly probable (4)
<b>Duration</b>	Long term (4)	Long term (4)
<b>Extent</b>	Local area (2)	Site (1)
<b>Magnitude</b>	High (8)	Moderate (6)
<b>Significance</b>	<b>70 (High)</b>	<b>44 (Medium)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>OPERATIONAL PHASE</b>		
<b>Probability</b>	High probability (4)	Medium probability (3)
<b>Duration</b>	Long term (4)	Medium term (3)
<b>Extent</b>	Local area (2)	Site (1)
<b>Magnitude</b>	Moderate (6)	Low (4)
<b>Significance</b>	<b>48 (Medium)</b>	<b>21 (Low)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>		
<b>Irreplaceable loss of resources?</b>	Low	
<b>Can impacts be mitigated?</b>	Moderate	
<b>Mitigation:</b>	Yes	
The following mitigation measures are proposed in order to limit or reduce the impact of the proposed project on floral habitat:		

<ul style="list-style-type: none"> <li>• The location and extent of areas of increased floral ecological importance and sensitivity (such as open grassland and open rocky grassland areas) should be considered during the pre-construction and planning phases, and in developing a final layout for the proposed project.</li> <li>• As much as possible areas of increased floral ecological sensitivity should be incorporated as natural open space, forming part of the proposed project, where possible and the creation of ecological corridors incorporating the vegetation units of increased ecological sensitivity should be considered.</li> <li>• The amount of vegetation cleared during construction should be limited to only what is required and necessary.</li> <li>• Site camps and other temporary infrastructure are to be placed within areas that are already modified.</li> <li>• Where natural open space areas are incorporated into the project layout, these areas should be clearly indicated on site and be off limits for construction vehicles and workers.</li> <li>• Construction vehicles should be restricted to travelling only on designated, preferably existing, roadways, to limit the disturbance footprint of the proposed development activities.</li> <li>• Edge effects from construction activities, such as erosion and alien floral species proliferation and spread, should be managed throughout all development phases.</li> <li>• Alien plant proliferation within the study area should be controlled through the implementation of an ongoing monitoring and eradication programme for all invasive and weed plant species growing within the study area, with specific emphasis on NEMBA Category 1b species. This may be done over a period of time with a phased approach taken.</li> <li>• Existing waste and construction material should be removed from site, and future dumping activities prohibited.</li> <li>• No littering or dumping of waste and construction material within natural open space areas to be excluded from the development footprint areas may be allowed. All excess material must be removed from the construction areas once works has been completed.</li> <li>• Any disturbed and compacted areas outside of the immediate development footprint areas must be ripped, reprofiled and revegetated with an indigenous grass species mixture upon completion of construction works. As far as possible, indigenous plants naturally growing within the region (refer to Appendix B) should be used for this purpose (GDARD 2014).</li> <li>• As part of the landscaping for the housing units, if applicable, it is recommended that an indigenous approach be taken, which will also impact positively on management, water use and sustainability of any landscaped areas. Such an approach will also ensure habitat provision for indigenous faunal species. It is recommended that as much as possible of the open grassland vegetation be incorporated into the future landscaping of the housing units.</li> <li>• Should lawns be considered, indigenous <i>Cynodon dactylon</i> is recommended instead of <i>Pennisetum clandestinum</i> (Kikuyu) or <i>Dactyloctenium australe</i> (LM lawn). Where the addition of trees is considered, such species should only include species indigenous to the region, such as <i>Celtis africana</i>, <i>Searsia lancea</i>, <i>Searsia pyroides</i>, <i>Olea europaea</i> subsp. <i>africana</i> and <i>Combretum erythrophyllum</i>.</li> </ul>
<p><b>Cumulative impacts:</b></p> <p>Overall cumulative impacts as a result of the proposed project are considered to be medium. Cumulative impacts may include the combined impact of various similar development projects in the larger rural region, which could cumulatively lead to the loss of migratory connectivity and support habitat for areas indicated as CBAs, as well as further degradation of intact Carletonville Dolomite Grassland that may occur in the area.</p>
<p><b>Residual Risks:</b></p> <p>Residual risks associated with the project is considered to be medium. Such risks include ineffective rehabilitation leading to permanent habitat loss and the ongoing proliferation of alien species once construction activities have been completed.</p>

**Table 9: Impact 2 – Loss of floral species diversity.**

<p><b>Nature:</b> Loss of floral species diversity</p> <p>Loss of floral species diversity may result from various activities during the construction and operational phases of the project, including:</p> <ul style="list-style-type: none"> <li>• Clearing of vegetation for construction purposes.</li> <li>• Failure to include areas of existing grassland vegetation as natural open space areas into the proposed project layout.</li> <li>• Construction of infrastructure and access roads through areas of increased ecological sensitivity (open grassland and open rocky grassland areas).</li> </ul>
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<ul style="list-style-type: none"><li>• An increase in alien and invasive floral species as a result of disturbance and failure to control existing alien species on site.</li><li>• Erosion as a result of soil disturbance and inefficient storm water management.</li><li>• Movement of construction and operational vehicles through vegetation units of increased ecological sensitivity.</li><li>• Compaction of soils due to vehicular movement.</li></ul>		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>CONSTRUCTION PHASE</b>		
<b>Probability</b>	Highly probable (4)	Probable (3)
<b>Duration</b>	Long term (4)	Medium term (3)
<b>Extent</b>	Regional Area (3)	Local Area (2)
<b>Magnitude</b>	Moderate (6)	Low (4)
<b>Significance</b>	<b>52 (Medium)</b>	<b>27 (Low)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>OPERATIONAL PHASE</b>		
<b>Probability</b>	Probable (3)	Improbable (2)
<b>Duration</b>	Long term (4)	Medium term (3)
<b>Extent</b>	Local Area (2)	Site (1)
<b>Magnitude</b>	Low (4)	Minor (2)
<b>Significance</b>	<b>30 (Medium)</b>	<b>12 (Low)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	
<b>Irreplaceable loss of resources?</b>	Moderate	
<b>Can impacts be mitigated?</b>	Yes	
<b>Mitigation:</b> <ul style="list-style-type: none"><li>• Areas of increased floral ecological importance and sensitivity (open grassland and open rocky grassland) should be considered during the pre-construction and planning phases, and in developing a final layout for the proposed project.</li><li>• As much as possible areas of increased floral ecological sensitivity should be incorporated as natural open space forming part of the proposed project where possible and the creation of ecological corridors incorporating the vegetation units of increased ecological sensitivity should be considered.</li><li>• The amount of vegetation cleared for development purposes should be limited to what is absolutely necessary.</li><li>• Where natural open space areas are incorporated into the project layout, these areas should be clearly indicated on site and be off limits for construction vehicles and workers.</li><li>• Construction vehicles should be restricted to travelling only on designated roadway, and as far as possible existing roadways, to limit the ecological footprint of the proposed development activities.</li><li>• Edge effects from construction activities should be managed throughout the development.</li><li>• No littering or dumping of waste and construction material within surrounding natural areas may be allowed. All excess material must be removed from the construction areas once works has been completed.</li><li>• Alien plant proliferation within the study area should be controlled through the implementation of an ongoing monitoring and eradication programme for all invasive and weed plant species growing within the study area, with specific emphasis on NEMBA Category 1b species. This may be done over a period of time with a phased approach taken.</li><li>• Any disturbed and compacted areas outside of the immediate development footprint areas must be ripped, reprofiled and revegetated with an indigenous grass species mixture upon completion of construction works. As far as possible, indigenous plants naturally growing within the region (refer to Appendix B) should be used for this purpose (GDARD 2014).</li></ul>		
<b>Cumulative impacts:</b> <p>Overall cumulative impacts on floral diversity as a result of the proposed project are considered to be moderate to low. Cumulative impacts may include the combined impact of various similar developments in the area. Cumulative impacts may include the cumulative loss of floral species diversity within the larger region. The disturbance of large areas of natural vegetation in the region may contribute towards increased alien plant species proliferation, as well as bush encroachment in the region.</p>		

**Residual Risks:**

Residual risks include the permanent loss of and altered floral species diversity within the vicinity of the proposed infrastructure and surrounds as a result of ineffective or lack of rehabilitation activities where disturbance has occurred.

**Table 10: Impact 3 – Loss of floral SCC.**

<b>Nature:</b> Loss of floral SCC		
Loss of potential floral SCC may result from various activities during the construction and operational phases of the project, including:		
<ul style="list-style-type: none"><li>• Site clearance and removal of vegetation leading to a direct loss of confirmed floral SCC, potential floral SCC and medicinal species, including the fragmentation of potential floral SCC populations.</li><li>• Construction of infrastructure and access roads through sensitive habitat leading to a loss of potential floral SCC and medicinal species.</li><li>• Removal or collection of medicinal/ protected floral species from the study area and surrounds.</li><li>• Vehicular movement beyond existing access roads and the designated development footprint area and ineffective management of edge effects leading to impacts on potential floral SCC.</li><li>• Poor management of edge effects leading to impacts on potential floral SCC.</li></ul>		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>CONSTRUCTION PHASE</b>		
<b>Probability</b>	Low probability (2)	Improbable (1)
<b>Duration</b>	Permanent (5)	Permanent (5)
<b>Extent</b>	Local area (2)	Site (1)
<b>Magnitude</b>	High (8)	Moderate (6)
<b>Significance</b>	<b>30 (Medium)</b>	<b>12 (Low)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>OPERATIONAL PHASE</b>		
<b>Probability</b>	Improbable (1)	Improbable (1)
<b>Duration</b>	Permanent (5)	Permanent (5)
<b>Extent</b>	Local area (2)	Site (1)
<b>Magnitude</b>	High (8)	Moderate (6)
<b>Significance</b>	<b>15 (Low)</b>	<b>12 (Low)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>		
	Low	
<b>Irreplaceable loss of resources?</b>		
	High	
<b>Can impacts be mitigated?</b>		
	Yes	
<b>Mitigation:</b>		
<ul style="list-style-type: none"><li>• No floral SCC were encountered within the study area, but there is a low probability of provincially protected species occurring within the study area.</li><li>• In the event that any floral SCC be noted during the surveying and pre-construction phase of the project within the proposed development footprint area, such species must be clearly marked on site or by means of GPS coordinates and the local authorities must be alerted. Upon approval of the authorities, such species should be relocated to similar habitat within or in the vicinity of the study area with the assistance of a suitably qualified specialist.</li><li>• No collection of floral SCC or medicinal floral species must be allowed by construction or operational personnel.</li><li>• Edge effect control needs to be implemented to ensure no further degradation and potential loss of floral SCC outside of the proposed project footprint area.</li><li>• It must be ensured that development activities are kept strictly within the designated and approved development footprint areas.</li></ul>		
<b>Cumulative impacts:</b>		
A high number of floral SCC are known to occur in the larger region (2627BD QDS). Transformation and further loss of habitat within the area may over time result in such species facing extinction.		
<b>Residual Risks:</b>		
Should floral SCC be unknowingly impacted or destroyed during the development process, loss of such species within the study area is likely to be permanent.		



## 8. FLORAL MONITORING

Floral monitoring must include monthly alien and invasive species assessments during the construction phase of the project within any open space areas considered as part of the proposed project. Where the spread of alien and invasive species, specifically those listed under NEMBA as Category 1b invasive species within such areas and areas adjacent to the study area is noted, immediate eradication action should be undertaken. It must further be ensured that all dumping activities that may impact on remaining natural vegetation are ceased.

All open space areas forming part of the proposed project must be checked regularly for erosion during the construction phase of the project and within areas where alien vegetation has been cleared. Monthly construction phase monitoring must ensure that suitable indigenous vegetation cover is achieved within any areas devoid of vegetation once the construction of housing units has been completed, and that any erosion noted is treated immediately using soft engineering techniques.

## 9. CONCLUSION

Based on the information gathered during the background and field assessments with regard to the ecological condition of the vegetation within the study area, it is evident that the majority of the indicated CBA: Important Area (Gauteng C-Plan, 2011) within the eastern portion of the study area comprises old agricultural fields, areas that have historically been impacted and areas where recent and current waste dumping have significantly altered available habitat. A small portion of isolated indigenous grassland remain relatively intact within the CBA boundaries within the northeast of the study area. The area indicated by the NBA (2018) to form part of remnant Carletonville Dolomite Grassland vegetation is also mostly modified, although reasonable, albeit relatively fragmented, areas of unmodified grassland vegetation, largely representative of this vegetation type, remain.

It is the opinion of the specialist that the proposed project be considered favourably, provided that the mitigation measures as set out in this report are implemented. As mentioned above, more than half of the vegetation within the study area is currently severely degraded due to ongoing waste dumping activities and resultant alien invasive species encroachment. When comparing historical Google Earth aerial imagery from 2004 with aerial imagery up to 2019, it is evident that these disturbance footprints continually increase, which together with existing and new access routes further fragment remaining indigenous habitat. Based on the aforementioned and site observations, this trend is expected to continue into the future. As far as possible, the open grassland and particularly the open rocky grassland vegetation units, where an increased species diversity and ecological functioning have been observed and that are of medium to medium-high floral ecological sensitivity (Figure A), should be conserved as part of a natural open space area, and green open space should be allowed between housing units to minimise impact on floral habitat and floral species diversity. It is important that control and management of NEMBA Category 1b listed alien invasive floral species take place throughout the construction and operational phases of the proposed project. Further mitigation measures are included in Section 7 of this report.

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## APPENDIX A SPECIES LISTS

Species encountered within the various vegetation units identified within the study area. Alien species are indicated with an asterisk. No floral SCC were encountered.

Species	Conservation Status	Vegetation Units			
		Indigenous grassland	Indigenous rocky grassland	Impacted Grassland	Modified Grassland
TREES AND SHRUBS					
*Acacia baileyana	NEMBA Cat 3				X
*Acacia mearnsii	NEMBA Cat 2				X
*Agave americana	NEMBA Cat 1b				X
*Celtis sinensis	Alien				X
*Eucalyptus camaldulensis	NEMBA Cat 1b				X
*Eucalyptus cinerea	Alien				X
*Eucalyptus sp.	Alien				X
*Morus alba	NEMBA Cat 2				X
*Melia azedarach	NEMBA Cat 1b				X
*Opuntia ficus-indica	NEMBA Cat 1b				X
*Schinus molle	Alien				X
*Yucca gloriosa	Alien				X
Asparagus laricinus	LC				X
Diospyros lycioides subsp. lycioides	LC				X
Elephantorrhiza elephantina	LC	X		X	
Gomphocarpus fruticosus	LC				X
Searsia lancea	LC				X
Searsia pyroides	LC				X
Vachellia karroo	LC				X
FORBS					
*Alternanthera pungens	Alien				X
*Amaranthus hybridus	Alien				X
*Bidens pilosa	Alien				X
*Campuloclinium macrocephalum	NEMBA Cat 1b	X			X
*Canna indica	NEMBA Cat 1b				X
*Chenopodium album	Alien				X
*Chenopodium murale	Alien				X
*Conyza bonariensis	Alien				X
*Datura stramonium	NEMBA Cat 1b				X
*Euphorbia heterophylla	Alien				X
*Gomphrena celosioides	Alien				X
*Helianthus annuus	Alien (crop)			X	
*Ipomoea purpurea	NEMBA Cat 1b				X
*Lepidium africanum	Alien				X
*Mirabilis jalapa	NEMBA Cat 1b				X
*Myosotis scorpioides	NEMBA Cat 2				X
*Physalis viscosa	Alien				X
*Plantago lanceolata	Alien				X
*Portulaca oleracea	Alien				X
*Richardia brasiliensis	Alien				X
*Ricninis communis	NEMBA Cat 1b				X
*Schkuhria pinnata	Alien				X
*Solanum elaeagnifolium	Alien	X			
*Solanum sisymbriifolium	NEMBA Cat 1b				X
*Tagetes minuta	Alien				X

Species	Conservation Status	Vegetation Units			
		Indigenous grassland	Indigenous rocky grassland	Impacted Grassland	Modified Grassland
<i>*Verbena bonariensis</i>	NEMBA Cat 1b	X			X
<i>Acalypha angustata</i>	LC	X		X	X
<i>Albucca glauca</i>	LC	X			X
<i>Albucca</i> sp.	LC	X			
<i>Anthospermum rigidum</i> subsp. <i>pumilum</i>	LC		X	X	
<i>Chamaecrista mimosoides</i>	LC	X	X	X	X
<i>Cleome maculata</i>	LC	X	X	X	X
<i>Cleome monophylla</i>	LC				X
<i>Commelina africana</i>	LC			X	X
<i>Commelina erecta</i>	LC				X
<i>Crabbea angustifolia</i>	LC	X	X		
<i>Cyanotis speciosa</i>	LC	X	X		X
<i>Dianthus mooiensis</i>	LC		X		
<i>Dipcadi viride</i>	LC	X		X	
<i>Eriosema salignum</i>	LC	X			
<i>Felicia muricata</i>	LC	X	X	X	
<i>Helichrysum nudifolium</i> var. <i>nudifolium</i>	LC	X	X	X	
<i>Helichrysum rugulosum</i>	LC	X			X
<i>Helichrysum</i> sp.	LC	X			
<i>Hermannia lancifolia</i>	LC	X		X	
<i>Hilliardiella oligocephala</i>	LC	X		X	
<i>Hypoxis iridifolia</i>	LC		X		
<i>Indigofera comosa</i>	LC	X	X		
<i>Indigofera filipes</i>	LC	X		X	X
<i>Indigofera hedyantha</i>	LC		X		
<i>Indigofera</i> sp.	LC	X			
<i>Ipomoea ommanneyi</i>	LC	X	X		
<i>Kohautia amatymbica</i>	LC	X		X	
<i>Lactuca inermis</i>	LC	X			X
<i>Ledebouria ovatifolia</i>	LC	X			
<i>Ledebouria revoluta</i>	LC	X	X		X
<i>Ledebouria</i> sp.	LC				
<i>Leobordia divaricata</i>	LC	X			
<i>Leobordia foliosa</i>	LC	X			
<i>Leonotis</i> sp.	LC	X			
<i>Limeum viscosum</i>	LC				X
<i>Momordica balsamina</i>	LC				X
<i>Monsonia angustifolia</i>	LC				X
<i>Nemesia fruticans</i>	LC	X			
<i>Nidorella anomala</i>	LC	X	X		
<i>Nidorella hottentotica</i>	LC	X		X	
<i>Nidorella podocephala</i>	LC	X			
<i>Nidorella resedifolia</i> subsp. <i>resedifolia</i>	LC	X	X	X	X
<i>Oxalis obliquifolia</i>	LC			X	
<i>Ocimum obovatum</i>	LC		X		
<i>Oxygonum dregeanum</i>	LC	X			X
<i>Pentanisia prunelloides</i>	LC	X	X	X	
<i>Pentarrhinum insipidum</i>	LC			X	X
<i>Pollichia campestris</i>	LC	X		X	X



Species	Conservation Status	Vegetation Units			
		Indigenous grassland	Indigenous rocky grassland	Impacted Grassland	Modified Grassland
<i>Pseudopegolettia tenella</i> (= <i>Vernonia galpinii</i> )	LC	X	X		X
<i>Pygmaeothamnus zeyheri</i>	LC	X		X	
<i>Selago densiflora</i>	LC	X		X	
<i>Senecio coronatus</i>	LC	X	X	X	
<i>Senecio inornatus</i>	LC				X
<i>Senecio venosus</i>	LC	X			
<i>Sida cordifolia</i>	LC				X
<i>Silene burchellii</i>	LC	X			
<i>Solanum lichtensteinii</i>	LC	X			
<i>Solanum panduriforme</i>	LC	X			
<i>Sphenostylis angustifolia</i>	LC	X			
<i>Stoebe plumosum</i>	LC	X	X	X	X
<i>Tephrosia elongata</i>	LC		X		
<i>Ursinia nana</i>	LC	X	X		
<i>Vahlia capensis</i>	LC	X	X		
<i>Vigna vexillata</i>	LC	X		X	
<i>Wahlenbergia caledonica</i>	LC	X			X
<i>Zornia linearis</i>	LC	X			
<i>Zornia milneana</i>	LC	X			
GRASSES					
<i>Alloteropsis semialata</i> subsp. <i>eckloniana</i>	LC	X	X	X	X
<i>Aristida congesta</i> subsp. <i>congesta</i>	LC	X	X	X	
<i>Aristida scabrivalvis</i>	LC	X		X	
<i>Bewsia biflora</i>	LC		X		
<i>Brachiaria serrata</i>	LC	X	X	X	X
<i>Chrysopogon serrulatus</i>	LC		X		
<i>Cynodon dactylon</i>	LC	X		X	X
<i>Digitaria eriantha</i>	LC	X			
<i>Digitaria monodactyla</i>	LC	X	X		
<i>Digitaria tricholaenoides</i>	LC	X	X	X	X
<i>Diheteropogon amplexans</i>	LC	X	X	X	
<i>Elionurus muticus</i>	LC	X			
<i>Eragrostis capensis</i>	LC	X			
<i>Eragrostis chloromelas</i>	LC	X		X	X
<i>Eragrostis curvula</i>	LC	X	X	X	X
<i>Eragrostis gummiflua</i>	LC			X	X
<i>Eragrostis lehmanniana</i>	LC	X	X		
<i>Eragrostis racemosa</i>	LC	X		X	
<i>Eragrostis cf sclerantha</i>	LC	X			
<i>Heteropogon contortus</i>	LC	X	X	X	X
<i>Hyparrhenia hirta</i>	LC			X	X
<i>Loudetia simplex</i>	LC		X		
<i>Melinis nerviglumis</i>	LC	X	X	X	
<i>Melinis repens</i> subsp. <i>repens</i>	LC	X		X	X
<i>Microchloa caffra</i>	LC	X			
<i>Panicum coloratum</i>	LC		X		
<i>Panicum maximum</i>	LC				X
<i>Panicum natalense</i>	LC	X	X		
<i>Paspalum scrobiculatum</i>	LC			X	
<i>Pogonarthria squarrosa</i>	LC	X			X

Species	Conservation Status	Vegetation Units			
		Indigenous grassland	Indigenous rocky grassland	Impacted Grassland	Modified Grassland
<i>Schizachyrium sanguineum</i>	LC		X	X	X
<i>Setaria pallide-fusca</i>	LC				X
<i>Setaria sphacelata</i> var. <i>sphacelata</i>	LC	X			X
<i>Sporobolus iocladius</i>	LC	X			
<i>Sporobolus pectinatus</i>	LC		X		
<i>Themeda triandra</i>	LC	X	X	X	X
<i>Trachypogon spicatus</i>	LC	X	X		
<i>Trichoneura grandiglumis</i>	LC	X	X		
<i>Tristachya leucothrix</i>	LC	X	X		
<i>Urelytrum agropyroides</i>	LC		X		
<i>Urochloa panicoides</i>	LC				X
REEDS RUSHES AND SEDGES					
<i>Bulbostylis burchellii</i>	LC	X	X	X	
<i>Cyperus congestus</i>	LC	X		X	
<i>Cyperus esculentis</i> subsp. <i>esculentis</i>	LC			X	X
<i>Cyperus margaritaceus</i>	LC	X			
<i>Cyperus obtusiflorus</i> var. <i>obtusiflorus</i>	LC	X			
<i>Cyperus rupestris</i>	LC	X	X		
<i>Kyllinga alba</i>	LC				X

## APPENDIX B REPRESENTATIVE SPECIES OF CARLETONVILLE DOLOMITE GRASSLAND

The floral species, typical of natural-state Carletonville Grassland are presented in the table below. Species representative of this vegetation type recorded in the study area are indicated in bold, and dominant species are indicated as (d).

### Typical floristic species of Carletonville Dolomite Grassland (Mucina & Rutherford, 2006).

Shrubs	Herbs	Graminoids
<i>Anthospermum rigidum</i> subsp. <i>pumilum</i>	<i>Acalypha angustata</i>	<i>Aristida congesta</i> (d)
<i>Elephantorrhiza elephantina</i>	<i>Barleria macrostegia</i>	<i>Eragrostis racemosa</i> (d)
<i>Indigofera comosa</i>	<i>Boophone disticha</i>	<i>Brachiaria serrata</i> (d)
<i>Parinari capensis</i> subsp. <i>capensis</i>	<i>Chamaecrista mimosoides</i>	<i>Heteropogon contortus</i> (d)
<i>Pygmaeothamnus zeyheri</i> var. <i>rogersii</i>	<i>Crabbea angustifolia</i>	<i>Cynodon dactylon</i> (d)
<i>Searsia magalismsontana</i>	<i>Dianthus mooiensis</i>	<i>Digitaria tricholaenoides</i> (d)
<i>Tylosema esculentum</i>	<i>Dicoma anomala</i>	<i>Diheteropogon amplexans</i> (d)
<i>Ziziphus zeyheriana</i>	<i>Euphorbia inaequilatera</i>	<i>Eragrostis chloromelas</i> (d)
	<i>Habenaria mossii</i>	<i>Loudetia simplex</i> (d)
	<i>Helichrysum caespitium</i>	<i>Schizachyrium sanguineum</i> (d)
	<i>Helichrysum miconiifolium</i>	<i>Setaria sphacelata</i> (d)
	<i>Helichrysum nudifolium</i> var. <i>nudifolium</i>	<i>Themeda triandra</i> (d)
	<i>Hilliardiella oligocephala</i>	<i>Alloteropsis semialata</i> subsp. <i>eckloniana</i>
	<i>Ipomoea ommaneyi</i>	<i>Andropogon schirensis</i>
	<i>Justicia anagalloides</i>	<i>Aristida canescens</i>
	<i>Kohautia amatymbica</i>	<i>Aristida diffusa</i>

	<i>Kyphocarpa angustifolia</i>	<i>Bewisia biflora</i>
	<i>Ophrestia oblongifolia</i>	<i>Bulbostylis burchellii</i>
	<i>Pollichia campestris</i>	<i>Cymbopogon caesius</i>
	<i>Senecio coronatus</i>	<i>Cymbopogon pospischilii</i>
		<i>Elionurus muticus</i>
		<i>Eragrostis curvula</i>
		<i>Eragrostis gummiflua</i>
		<i>Eragrostis plana</i>
		<i>Eustachys paspaloides</i>
		<i>Hyparrhenia hirta</i>
		<i>Melinis nerviglumis</i>
		<i>Melinis repens</i> subsp. <i>repens</i>
		<i>Monocymbium ceresiiforme</i>
		<i>Panicum coloratum</i>
		<i>Pogonarthria squarrosa</i>
		<i>Trichoneura grandiglumis</i>
		<i>Triraphis andropogonoides</i>
		<i>Tristachya leucothrix</i>
		<i>Tristachya rehmannii</i>

(d) = dominant species for the vegetation type

## APPENDIX C NATIONAL RED LIST CATEGORIES

### National Red List Categories – Version 2017.1 (SANBI, 2017).

Category	Definition
Extinct (EX)	A species is Extinct when there is no reasonable doubt that the last individual has died.
Extinct in the Wild (EW)	A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
Regionally Extinct (RE)	A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
Critically Endangered, Possibly Extinct (CE PE)	Possibly Extinct is a special tag associated with the category CR, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.
Critically Endangered (CR)	A species is CR when the best available evidence indicates that it meets at least one of the five IUCN criteria for CR, indicating that the species is facing an extremely high risk of extinction.
Endangered (EN)	A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
Vulnerable (VU)	A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
Near threatened (NT)	A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.
*Critically Rare	A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
*Rare	A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows: <ul style="list-style-type: none"> <li>• Restricted range: Extent of Occurrence (EOO) &lt;500 km<sup>2</sup>, OR</li> </ul>

Category	Definition
	<ul style="list-style-type: none"> <li>Habitat specialist: Species is restricted to a specialised microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 km<sup>2</sup>, OR</li> <li>Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR</li> <li>Small global population: Less than 10 000 mature individuals.</li> </ul>
*Declining	A species is Declining when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for CR, EN, VU or NT, but there are threatening processes causing a continuing decline of the species.
Least Concern (LC)	A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
Data Deficient - Insufficient Information (DDD)	A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.
Data Deficient - Taxonomically Problematic (DDT)	A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.

\*Categories marked with \* are non-IUCN, national Red List categories for species not in danger of extinction, but considered to be of conservation concern. The IUCN equivalent of these categories is Least Concern (LC).

## APPENDIX D DETAILS OF SPECIALIST

### DECLARATION OF INDEPENDENCE

I, **Michelle Pretorius**, declare that -

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



Signature of the Specialist Dated 20 January 2020



## CURRICULUM VITAE – MICHELLE PRETORIUS Pr.Sci.Nat Pr.LArch.Tech

### PERSONAL DETAILS

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Address: 2 Lynnro Gardens, 110 Lynnro Avenue, Lynnwood Manor, 0081

Telephone: 082 442 7637

Driver's License: Code 08

Marital Status: Married

Languages: Afrikaans, English

### PROFESSIONAL MEMBERSHIP

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Professional Natural Scientist (Ecology and Botany) - South African Council for Natural Scientific Professions (SACNASP) Registration number: 400003/15

Professional Landscape Architectural Technologist - South African Council for the Landscape Architectural Profession (SACLAP) Registration number: 20253

Member of the Botanical Society of South Africa (BotSoc) since 2011

Member of the Grassland Society of southern Africa (GSSA) since 2018

Member of the Land Rehabilitation Society of southern Africa (LaRRSA) since 2017

Volunteering: Administrator of the Gauteng Custodians of Rare and Endangered Wildflower (CREW) group since 2016.

### EDUCATION

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#### University of Pretoria

MSc (Environmental Ecology)	In progress
BSc (Hons) Plant Science with Distinction	2008 – 2009
BSc (LArch) Landscape Architecture	2004 – 2006
BSc (Botany)	2001 – 2003

#### Short Courses Attended

Wild Orchids of Southern Africa Conference - WOSA	2018, 2019
ILASA/ LaRSSA Conference	2018
Advanced Grass Identification Course - African Land-use Training	2018
Asteraceae Identification Course - SANBI	2018
Identification Course: Sedges - SANBI/ CREW	2017
Wetland Rehabilitation and Construction Course - ILASA	2016
Invasive Species Training - SAGIC	2016
Global Mapper Training - Blue Marble	2014
Rehabilitation of Mine-impacted Land - African Land-use Training	2011
Mine Closure and Rehabilitation Conference - ITC	2011
Rehabilitation of Degraded Land - African Land-use Training	2010

### WORK EXPERIENCE

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<b>Field and Form Landscape Science/ Independent Specialist Consultant</b>	2016 – present
Specialist floral and vegetation assessments and opinions, including Red Data floral species assessments, impact assessments, plant species identification, habitat evaluation and the compilation of vegetation management plans.	
Alien Floral Species Management and Control Plans	
Floral Species Rescue and Relocation planning and implementation	
Visual Impact Assessments across all development sectors	
Terrestrial and Wetland Rehabilitation Planning, design and implementation	
Landscape Planning and Evaluation	
Open Space, Ecological and Environmental Management Plans	
Ecological Conditional Requirements for Green Star Ratings	
Environmental Control Officer (ECO) function and reporting	
Protected tree identification and permit applications	

<b>Scientific Aquatic Services (SAS)</b>	2011 – 2015
<b>Bokamoso Landscape Architects and Environmental Consultants</b>	2009 – 2011
<b>Insite Landscape Architects and Environmental Consultants</b>	2007 – 2009
<b>Lifestyle College</b>	
Guest lecturer	2018, 2019
<b>University of Pretoria</b>	
Guest lecturer	2019
External Examiner – 3 <sup>rd</sup> year landscape architecture students (PWT322)	2014
External Examiner – 2 <sup>nd</sup> year landscape architecture students (LAN 212, LAN 222)	2013
Invited as guest lecturer by Botany Department	2010
Tutored first year BSc students in Botany	2003 – 2004
Presented practical courses in ecology for students from Vista University	2003 – 2004

## FLORAL ASSESSMENTS: KEY PROJECT EXPERIENCE

Selected projects since 2011 include (but are not limited to) the projects below, with work undertaken as independent specialist since 2016 and prior to 2016 as vegetation specialist at previous employment.

### Floral and Vegetation Assessments

- Terrestrial Floral Ecological Assessment as part of the Environmental Impact Assessment Process for the Proposed Driefontein Mining Project near Middelburg, Mpumalanga Province 2019
- Vegetation Assessment for the Proposed Subdivision and Development of Residential Units on Portion 551 (a Portion of Portion 43) of the Farm Witpoort 406JR, Gauteng Province 2019
- Floral Species of Conservation Concern Assessment for the Proposed Development of Distance Measuring Equipment for the O.R. Tambo International Airport Terminal Manoeuvring Area, Gauteng Province – FAOR3 (Magaliesberg) 2018
- Eco-Conditional Requirements (Eco-0) Assessment for Green Star South Africa Rating Purposes, of an Office Building At The Vsad Reatile Bulk Petroleum Products Storage And Distribution Facility, Heidelberg, Gauteng Province 2018
- Vegetation Assessment for the Proposed Mixed-Use Development on Part of Portion 29 of the Farm Hatherley No. 331 – JR, City of Tshwane, Gauteng Province 2018
- Field work and review: Survey Report: Populations of *Chlorophytum radula* on Woodbush Plantation, Magoebaskloof, Tzaneen, Limpopo Province 2018
- Vegetation Assessment for the Proposed Wildealskloof Mixed-Use Development, Mangaung Local Municipality, Bloemfontein, Free State Province 2017
- Vegetation input: Sebilong CPA Master Plan near Thabazimbi, Limpopo Province
- Specialist opinion on the occurrence of *Brachylaena discolor*, *Myoporum tenuifolium* and *Acacia cyclops* on Erf 3991, Plettenberg Bay within the Bitou Municipality, Western Cape Province 2017
- Vegetation assessment as part of the site Master Plan for the Simon's Town Penguin Colony – Seaforth to Frank's Bay, Western Cape Province 2017
- Vegetation assessment for the proposed construction of the Thusanang Powerline and Substations in Westonaria, Gauteng 2017
- Terrestrial Vegetation Rehabilitation Plan for the Proposed Construction of the Thusanang Powerline and Substations in Westonaria, Gauteng 2017
- Rehabilitation Plan for Areas Affected by Infilling and Waste Disposal at Number 45a Union Street Wilbotsdal, Randfontein, Gauteng 2017
- Floral assessment as part of the Environmental Assessment and Authorisation Process for the proposed Evander Shaft 6 plant upgrade, new tailings dam area and associated tailings delivery and return water pipeline near Evander, Mpumalanga Province 2017
- Floral ecological assessment as part of the Environmental Assessment and Authorisation process for the proposed construction of a ferrochrome smelter near Northam, Limpopo Province 2016
- Floral ecological assessment as part of the Authorisation Process for a section of the proposed F46 Pipeline Project, Weltevredenpark, Roodepoort, Gauteng Province 2016
- Desktop Mapping of riparian vegetation within the Spitskop and Mareesburg Project Areas, in the vicinity of Steelpoort, Limpopo Province 2016
- Vegetation status quo report for the open space area to the south of Waterstone College, Kibler Park, City of Johannesburg, Gauteng Province 2016

- Desktop investigation into the potential occurrence of floral Species of Conservation Concern in the vicinity of the proposed Umshwati Pipeline, including proposed management strategies, Kwazulu-Natal Province 2015
- Floral ecological assessment for the Royal Bafokeng Platinum Environmental Authorisation to include the proposed Styldrift Shaft 2 and associated infrastructure, North West Province. 2015
- Ecological assessment for the Royal Bafokeng Resources Styldrift Mining Complex – Environmental Authorisation to include the proposed Styldrift Tailings Storage Facility, return water dams, topsoil stockpile and other associated infrastructure, North West Province 2015
- Terrestrial ecological scan as part of the Environmental Authorisation process for the proposed township development (referred to as Sallies Ext 17) to be situated on Portion 329 of the Farm Witpoortjie 117 IR, Brakpan, Gauteng Province 2015
- Ecological opinion for the proposed Rustenburg Development, North West Province 2015
- Terrestrial ecological scan as part of the Environmental Authorisation process for a proposed stormwater outlet structure development, Mamelodi Ext 2, Gauteng Province 2015
- Habitat ecological scans as part of the feasibility study for various sections of the proposed new Gautrain Alignments, Gauteng Province 2015
- Floral ecological assessment as part of the Environmental Assessment and Authorisation process for a proposed township development in Diepsloot, Gauteng Province 2015
- Terrestrial Ecological Scan and Wetland Ecological Assessment, Including Aquatic Input, for the Proposed Bosmont Park Recreational Development, City of Johannesburg, Gauteng Province 2014
- Floral assessment as part of the environmental authorisation process for the proposed Marikana in-pit rehabilitation project at the Aquarius Marikana Mine, Rustenburg Local Municipality, North West Province 2014
- Floral specialist input as part of the environmental assessment and authorisation process for the construction of the CS-5 ventilation shaft in the vicinity of the Kroondal Platinum Mine, North West Province 2013
- Floral assessment for the Xstrata Rhovan operation in the vicinity of Brits, North-West Province 2013
- Floral specialist input and EMP for the proposed Erf 275 Meerhof residential development, Hartebeespoort Dam, North West Province 2012