Proposed Housing Development:
Ennerdale Ext.9, Gauteng

Vegetation Assessment in Support of the Environmental Authorisation and Water Use License Process

Date: January 2020

Report drafted on behalf of

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Indemnity

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information at the time of study. Therefore, the author reserves the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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The Environmental Impact Assessment Regulations (Government Notice No. R982 of 4 December 2014), requires that certain information is included in specialist reports. The terms of reference, purpose of the report, methodologies, assumptions and limitations, impact assessment and mitigation (where relevant to the scope of work) and summaries of consultations (where applicable) are included within the main report. Other relevant information is set out below:

Expertise of author:

- Working in the field of ecology, and in specific vegetation related assessments, since 2007;
- Is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions in the field of ecology (Reg. No. 400019/11); and
- Has been working with plants indigenous to South Africa since 1997.

Declaration of independence:

Dimela Eco Consulting in an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by Dimela Eco Consulting is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

Disclosure:

Dimela Eco Consulting undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to Dimela Eco Consulting by the client, and in addition to information obtained during the course of this study, Dimela Eco Consulting present the results and conclusion within the associated document to the best of the authors professional judgement and in accordance with best practise.

_____ ____2020.01.23._____

Antoinette Eyssell-Knox Date

SACNASP Reg. No. 400019/11

COMPLIANCE WITH THE APPENDIX 6 OF THE AMENDED 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix D
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Preceding page and separate provincial document
c) an indication of the scope of, and the purpose for which, the report was prepared;	1. Introduction -p1
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	2 Methodology
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	2 Methodology
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	5 Vegetation Vulnerability / Sensitivity – p20
g) an identification of any areas to be avoided, including buffers;	5 Vegetation Vulnerability / Sensitivity – p22
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;	Figure 10 Sensitivity map – p22
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	1.2 Assumptions – p2
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;	6. Impact assessment – p29 7. Conclusion – p35
k) any mitigation measures for inclusion in the EMPr;	6. Impact assessment – p34
l) any conditions for inclusion in the environmental authorisation;	6 Impact assessment
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	6. Impact assessment – p25 7. Conclusion – p30
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity 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;	7. Conclusion – p30
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	NA
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	NA
q) any other information requested by the competent authority.	-

EXECUTIVE SUMMARY

Dimela Eco Consulting was appointed by GA Environment (Pty) Ltd to undertake a vegetation assessment of a site in Ennerdale Ext. 9 (Gauteng) that is proposed for a housing project. The project forms part of the Rapid Land Release Programme for the Gauteng Department of Human Settlements.

The vegetation investigation involved desktop studies, a field survey and a report indicating amongst others:

- Supply background information on the site relating to conservation plans, protected areas and threatened ecosystems;
- Report and map describing the vegetation communities found on the site and immediate surrounds and its conservation importance and function within the landscape;
- Discussion of plants of conservation concern that could be present on the site, as well as those confirmed to occur during the field survey;
- Map indicating confirmed or potential habitat for plant species that are of conservation concern as well as ecologically sensitive vegetation groupings; and
- Assessment and report on the impacts that the proposed development could have on the vegetation on site and directly adjacent thereto, as well as mitigation measures to limit or negate these perceived impacts.

This assessment relied on a site visit undertaken on the 15th of January 2020. Good summer rain preceded the site visit and therefore was not seen as a limitation. However, the grass layer was dense and could have obscured plant species of conservation concern. Threatened species are usually also cryptic species that are easily overlooked when not in flower. Limited background information was available at the time of writing this report and no layout plans were available yet.

The proposed site is located on the adjoining Erven 5445 and 5446 in Ennerdale, Ext 9 (City of Johannesburg). The site is approximately 35Ha in size and the coordinates of the approximate centre point of the site are 26°24'21.85"S 27°49'39.61"E. The site falls within the quarter degree square 2627BD.

The site is situated in the Soweto Highveld Grassland vegetation type that is classified as Endangered. Soweto Highveld Grassland is also listed as a Vulnerable ecosystem. No rivers or wetlands are present on the site. A buffer of a wetland area falls within 500m south of the site. According to the Gauteng Conservation Plan (version 3.3), the site falls within a Critical Biodiversity Area (CBA): Important, based on the presence of primary vegetation.

Available historical aerial imagery does not indicate any large-scale cultivation or disturbance on the site. However, small areas of cultivation could be seen, and it is likely that parts of the grassland on the site was historically baled or mowed. Also, patchy occurrences of certain grasses and forbs might indicate

that the site was historically grazed. At the time of this assessment, the site was vacant with several footpaths criss-crossing through the veld.

Much of the site was found to be dominated by *Themeda triandra* (red grass) and included species typical of Soweto Highveld Grassland. Most of the site was not cultivated or disturbed in the last 10 years and therefore the vegetation can be classified as indigenous as per Listing Notices in terms of sections 24(2) and 24D of the National Environmental Management Act, 1998).

One broad vegetation group dominates the site and was classified as near-natural Soweto Highveld Grassland. However, changes in species composition were noted in areas where historical infrastructure was situated, where cultivation took place, where small-scale disturbances and dumping took place and along the western boundary. These are described as sub-groups and broadly discussed as semi-natural *Hyparrhenia hirta*-grassland and modified and degraded grassland.

Broad vegetation community	Importance and vulnerability	Gauteng Conservation Plan Category	Main mitigation measures and discussion
Near-natural Soweto Highveld Grassland	Medium-high	CBA: Important	• Development of an informal settlement north of the site has reduced the extent of the CBA in the area and the site will soon be the last portion of the CBA left. The cumulative impact of the informal settlement coupled with the proposed development on the site will be high as it will destroy the CBA. If not actively conserved, the informal settlement could also spill over to the site. • Development within these areas is undesirable and impacts are difficult to mitigate, if at all. • Impacts must be avoided or managed by an ecological management plan If development is allowed by the GDARD, the following must be implemented: • Plan the layout in such a way as to maintain an open space through the site, thereby maintaining the function of the CBA. Open space within the development can also contribute as steppingstones through the developed areas, if it is maintained in a natural to semi-natural state e.g. eco parks where the natural state is maintained with no manicured gardens are lawns.

Broad vegetation community	Importance and vulnerability	Gauteng Conservation Plan Category	Main mitigation measures and discussion
			• No areas of medium- high sensitivity should be fragmented and low impact development in such areas must be manageable e.g. paths
***H. hirta* grassland**	Medium	CBA: Important	• If development proceeds, it must be concentrated in the modified and degraded grassland as well as *Hyparrhenia hirta* grassland to reduce fragmentation and ensuring the functionality of the CBA. • Development may not impact on the adjacent near-natural grassland
Modified and degraded	Low	CBA: Important	• If development proceeds, it must be concentrated in the modified and degraded grassland as well as *Hyparrhenia hirta* grassland to reduce fragmentation and ensuring the functionality of the CBA.

The *Hyparrhenia hirta* grassland and degraded land can be considered for development, provided that the bulk of the near-natural Soweto Highveld Grassland be conserved. Development within the near-natural grassland is undesirable and impacts should be avoided or managed by an ecological management plan that aims to ensure functional and good condition grassland in open space within the development. It must be noted that the development of an informal settlement north of the site has reduced the extent of the CBA in the area and the site will soon be the last portion of the CBA left. The cumulative impact of the informal settlement coupled with the proposed development on the site will be high as it will destroy the CBA. If not actively conserved, the informal settlement could also spill over to the site.

The *Hyperrhenia hirta* grassland is in a secondary to a sub-climax state and in a fair ecological condition, maintaining much of its function as grassland and CBA. Such areas could be considered for development provided that open space, maintaining the function of a CBA are conserved. Conserving good condition grassland within development is a challenge and needs to be managed to protect the grassland and CBA from degradation.

The degraded vegetation was considered modified from the reference state and not sensitive to development. It must be noted that these areas fall within an CBA and that if they are developed, the continued functionality of the CBA must be maintained by providing open spaces within the development, linking to the adjacent natural grassland.

TABLE OF CONTENTS

EXECUTIVE SUMMARY ii
1. INTRODUCTION 1
1.1 Terms of reference 1
1.2 Assumptions and Limitations 1
2. Methodology 2
2.1 Literature Review 2
2.2 Definitions 2
2.3 Field survey 2
2.4 Mapping 3
2.4 Sensitivity Analysis 3
3. BACKGROUND TO THE STUDY SITE 3
3.1 Locality 3
3.2 Topography and Hydrology 2
3.3 Overview of historic vegetation type 2
3.4 Listed Ecosystems 4
3.5 Soils 4
3.6 Gauteng Conservation Plan 4
4. RESULTS OF THE ASSESSMENT 7
4.1 Land use and disturbances 7
4.2 Vegetation Survey Overview 10
4.2.1 Near-natural Soweto Highveld Grassland 12
4.3 Plant Species of Conservation Concern 16
4.4 Protected plants 17
4.4.1 NEMBA Threatened or Protected Plant Species (TOPS) 17
4.4.2 Provincially Protected Plants 18
4.5 Alien Invasive Plant Species 18
5. VEGETATION VULNERABILITY AND IMPORTANCE 20
5.1 Rating and Analysis of Vegetation Importance 20
5.2 Discussion 21
5.2.1 Medium-high sensitivity 21
5.2.2 Medium sensitivity 23

5.2.3 Low sensitivity 23
6. IMPACT ASSESSMENT AND MITIGATION 23
6.1 Assessment Criteria 23
6.2 Impact Assessments 25
6.2.1 Destruction of near-natural, good grassland and fragmentation 25
6.2.2 Potential destruction of protected plants and plant species of conservation concern 28
6.2.3 Potential increase in invasive vegetation 29
7. CONCLUSION 30
8. REFERENCES 31
9. GLOSSARY 33
APPENDIX A: METHODOLOGY 36
A1 Sample point map 36
A2 Vegetation Sensitivity Evaluation 36
APPENDIX B: PLANTS SPECIES RECORDED 39
APPENDIX C: PLANTS OF CONSERVATION CONCERN 47
APPENDIX D: SPECIALIST QUALIFICATIONS 49

FIGURES

Figure 1: Locality map 1
Figure 2: Hydrology of the area that the site is situated in 3
Figure 3: Soils on and around the site 5
Figure 4: The proposed housing site in relation to the Gauteng Conservation Plan. 6
Figure 5: Google Earth imagery of the site in 2009 and 2012 7
Figure 6: Most recent Google Earth aerial imagery of the site dated 2019 8
Figure 7: Aerial imagery of the site in 1985 and 2002 does not show cultivation or degrading activities 9
Figure 8: Broad vegetation groups on the site 11
Figure 9: Threatened species and species of conservation concern (Gauteng) 16
Figure 10: Sensitivity Map. 22
Figure 11: Sample point map 36

TABLES

Table 1: Typical species occurring in the Soweto Highveld Grassland (Mucina and Rutherford, 2006) 2
Table 2: Weighting scores 20
Table 3: Scoring of vegetation delineated within the site 21

PHOTOGRAPHS

Photograph 1: a) Historically cultivated patch north of the clinic, b-d) dirt paths traverse the site and dumping was noted along these roads and the site boundaries. 8
Photograph 2: a) *Eucalyptus* trees re-sprouting on the site and b) a manhole on the eastern boundary of the site 10
Photograph 3: Soweto Highveld Grassland on the site 12
Photograph 4: *Senecio* and *Helichrysum* species were the dominant forbs on the site 13
Photograph 5: *Hyparrhenia* and *Senecio* dominated grassland in the south-western portion of the site 14
Photograph 6: Vegetation within the historically cultivated area 15
Photograph 7: Degraded vegetation around the site boundary 15

1. INTRODUCTION

Dimela Eco Consulting was appointed by GA Environment (Pty) Ltd to undertake a vegetation assessment of a site in Ennerdale (Gauteng) that is proposed for a housing project. The following Housing Typology is proposed:

- 60% RDP, 40% Mixed Use (Social Housing and Business Ground Floor)
- Number of Units: 3000
- At the time of the compilation of this document, either one or two schools had been proposed on the site by the Town Planners and feedback from the Client is awaited.

The projects forms part of the Rapid Land Release Programme for the Gauteng Department of Human Settlements.

1.1 Terms of reference

This vegetation investigation involved desktop studies, a field survey and a report indicating amongst others:

- Supply background information on the site relating to conservation plans, protected areas and threatened ecosystems;
- Report and map describing the vegetation communities found on the site and immediate surrounds and its conservation importance and function within the landscape;
- Discussion of plants of conservation concern that could be present on the site, as well as those confirmed to occur during the field survey;
- Map indicating confirmed or potential habitat for plant species that are of conservation concern as well as ecologically sensitive vegetation groupings; and
- Assessment and report on the impacts that the proposed development could have on the vegetation on site and directly adjacent thereto, as well as mitigation measures to limit or negate these perceived impacts.

1.2 Assumptions and Limitations

Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. This assessment relied on a site visit undertaken on the 15th of January 2020. Good summer rain preceded the site visit and therefore was not seen as a limitation. However, the grass layer was dense and could have obscured plant species of conservation concern. Threatened species are usually also cryptic species that are easily overlooked when not in flower. Limited background information was available at the time of writing this report and no layout plans were available yet.

2. METHODOLOGY

The assessment entailed a literature review which included short listing plants of conservation concern that could potentially occur on or near the site. The methodology used is shortly summarised below.

2.1 Literature Review

The description of the regional vegetation relied on literature from Mucina & Rutherford (2006). Plant names follow Germishuizen *et al* (2006) and the following reference books were used to assist with plant identification: Van Wyk & Van Wyk (1997), Van Wyk & Malan (1997), Pooley (1998), Henderson (2001), Van Oudtshoorn (2002) and Bromilow (2010).

2.2 Definitions

Standardised definitions, as recommended by Lexicon for Biodiversity Planning in South Africa by the South African National Biodiversity Institute (SANBI) were used to describe the state of vegetation and ecological condition (SANBI, 2016).

Natural or near natural:	An ecological condition class in which composition, structure and function are still intact or largely intact. Can apply to a site or an ecosystem (good ecological condition).
Semi-natural or moderately modified	An ecological condition class in which ecological function is maintained even though composition and structure have been compromised (Fair ecological condition).
Severely or irreversibly modified	An ecological condition class in which ecological function has been compromised in addition to structure and composition. Can apply to a site or an ecosystem (Poor ecological condition).

Indigenous vegetation was regarded as indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding 10 years (Listing Notices in terms of sections 24(2) and 24D of the National Environmental Management Act, 1998).

2.3 Field survey

The site visit took place on the 15th of January 2020. Good summer rain fell during December and rainfall was not considered a limitation. Prior to the site visit, the vegetation was delineated into homogenous units on currently available Google Earth imagery. As most of the site was historically cultivated, the field survey focussed on identifying natural and untransformed vegetation, unique features that could indicate local sensitivities such as threatened and protected plants, as well as sensitive ecological features such as wetlands, ridges and rivers that are essential for the maintenance of ecosystems and ecological processes. Random transects were walked and vegetation recorded (see sample point map,

Appendix A). Plant identification and vegetation description relied on species recorded in the sampling points along the walked transects.

2.4 Mapping

Mapping was done by comparing georeferenced ground survey data to the visual inspection of available Google-Earth Imagery and in that way extrapolating survey reference points to the entire study area. Delineations are therefore approximate, and due to the intricate mosaics and often gradual mergers of vegetation associations, generalisations had to be made. Mapped associations will thus show where a certain vegetation unit is predominant, but smaller inclusions of another vegetation association in this area do exist but have not been mapped separately.

2.4 Sensitivity Analysis

It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Vegetation is thus an important determination of the biodiversity of an area. The vegetation sensitivity assessment aimed to identify whether the broad vegetation associations present on the site are of ecological importance as it is amongst others:

- Situated in a listed ecosystem or threatened vegetation unit;
- Habitat or potential habitat to plant species of conservation concern, protected plants or protected trees as well as the probability of such species to survive or re-establish itself following disturbances, and alterations to their specific habitats;
- Situated within ecologically sensitive features such as wetlands, riparian areas or ridges, koppies and inselbergs,
- In good ecological condition and functional.

This implies that the sensitivity, not only aspects that currently prevail in the area should be taken into consideration, but also if there is a possibility of a full restoration of the original environment and its biota, or at least the rehabilitation of ecosystem services resembling the original state after an area has been significantly disturbed. The criteria and weighting scores used to determine the vegetation sensitivity, function and conservation importance are given in Appendix A.

3. BACKGROUND TO THE STUDY SITE

3.1 Locality

The proposed site is located on the adjoining Erven 5445 and 5446 in Ennerdale, Ext 9 (City of Johannesburg) (Figure 1). The site is approximately 35Ha in size and the coordinates of the approximate centre point of the site are 26°24'21.85"S 27°49'39.61"E. The site can be accessed from Katz Road (northerly direction), Samuel Road (westerly and southerly direction) and Street B/Smith Walk towards

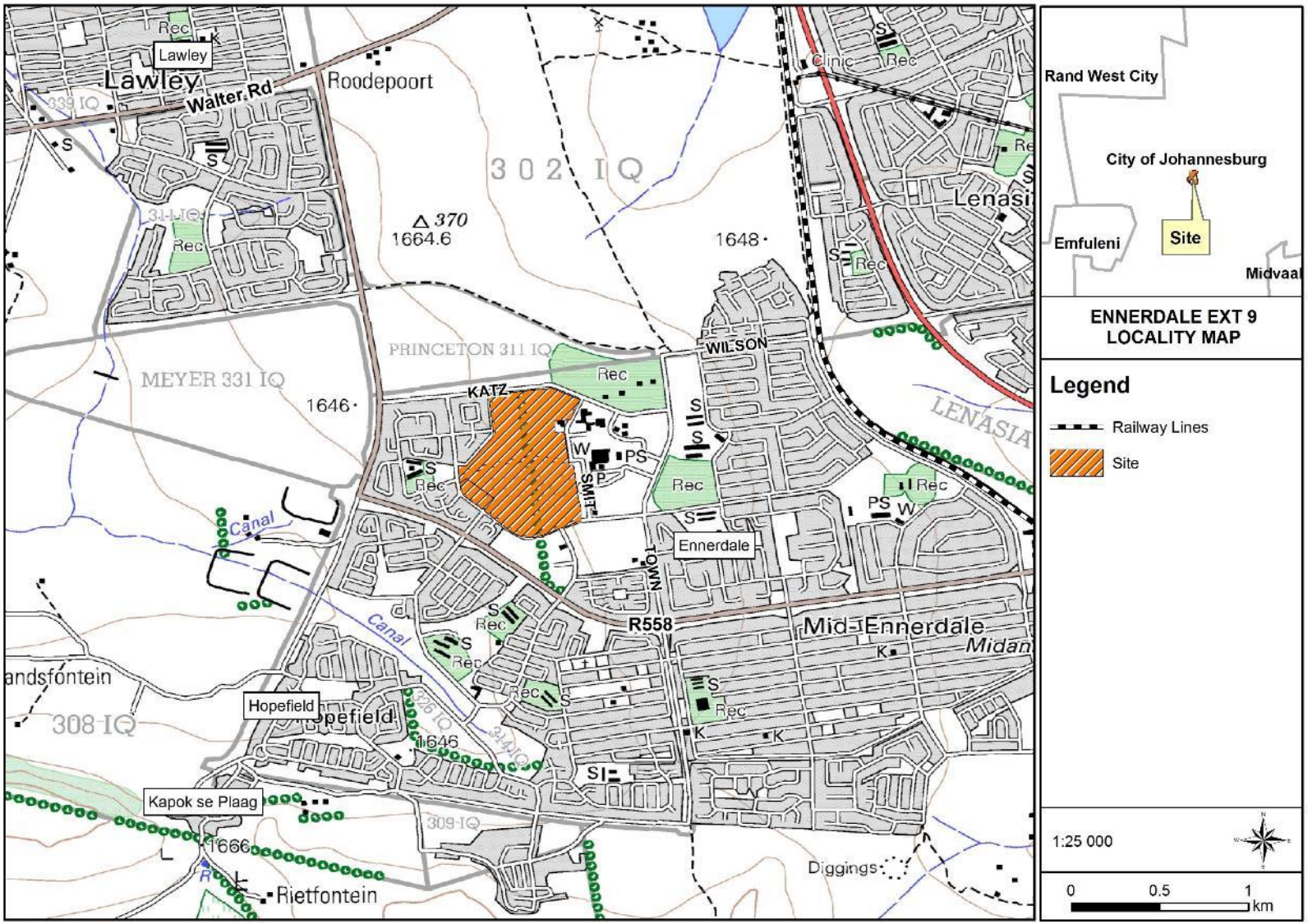


Figure 1: Locality map

the east. Some of the key landmarks surrounding the site are located east of the site and include the Ennerdale Ext. 9 Clinic, the City of Johannesburg Metropolitan Municipality Region 9 Customer Care Centre and the Metropolitan Shopping Centre in the east. The site falls within the quarter degree square 2627BD.

3.2 Topography and Hydrology

The site slopes slightly south-westward with the lowest portion of the site situated along Samuel Road. As per existing national and provincial spatial layers, no rivers or wetlands are expected to occur on the site (Figure 2). A buffer of a wetland area falls within 500m south of the site.

3.3 Overview of historic vegetation type

The site is situated within the Grassland Biome that experiences summer rainfall and dry winters with frost (and fire), which are unfavourable to tree growth. Therefore, grasslands comprise mainly of grasses and plants with perennial underground storage organs, for example bulbs, tubers and suffrutex species. In some grassland areas, the surface topography (e.g. rocky hills and protected valleys) creates habitats that are favourable to shrublands and trees (Mucina & Rutherford, 2006). The grassland biome is under severe threat from urbanisation, industrialisation, mining and agriculture, especially in Gauteng. The site is situated in the Soweto Highveld Grassland vegetation type that is classified as Endangered as the extent conserved is less than the targeted extent that should be conserved (Mucina and Rutherford, 2006). This grassland comprises a moderately undulating landscape that supports short to medium high and dense grassland dominated mainly by the grass *Themeda triandra*. Wetlands, rocky outcrops and ridges are embedded in this grassland.

Table 1: Typical species occurring in the Soweto Highveld Grassland (Mucina and Rutherford, 2006)

Graminoids:	*Andropogon appendiculatus* (d), *Brachiaria serrata* (d), *Cymbopogon pospischilii* (d), *Cynodon dactylon* (d), *Elionurus muticus* (d), *Eragrostis capensis* (d), *E. chloromelas* (d), *E. curvula* (d), *E. plana* (d), *E. planiculmis* (d), *E. racemosa* (d), *Heteropogon contortus* (d), *Hyparrhenia hirta* (d), *Setaria nigrirostris* (d), *S. sphacelata* (d), *Themeda triandra* (d), *Tristachya leucothrix* (d), *Andropogon schirensis*, *Aristida adscensionis*, *A. bipartita*, *A. congesta*, *A. junciformis* subsp. *galpinii*, *Cymbopogon caesius*, *Digitaria diagonalis*, *Diheteropogon amplectens*, *Eragrostis micrantha*, *E. superba*, *Harpochloa falx*, *Microchloa caffra*, *Paspalum dilatatum*.
Herbs:	*Hermannia depressa* (d), *Acalypha angustata*, *Berkheya setifera*, *Dicoma anomala*, *Euryops gilfillanii, Geigeria aspera* var. *aspera*, *Graderia subintegra*, *Haplocarpha scaposa*, *Helichrysum miconiifolium*, *H. nudifolium* var. *nudifolium*, *H. rugulosum*, *Hibiscus pusillus*, *Justicia anagalloides*, *Lippia scaberrima*, *Rhynchosia effusa*, *Schistostephium crataegifolium*, *Selago densiflora*, *Senecio coronatus*, *Hilliardiella oligocephala*, *Wahlenbergia undulata*.
Geophytic herbs	*Haemanthus humilis* subsp. *hirsutus*, *H. montanus*
Low Shrubs:	*Anthospermum hispidulum*, *A. rigidum* subsp. *pumilum*, *Berkheya annectens*, *Felicia muricata*, *Ziziphus zeyheriana*.
Herbaceous Climber	*Rhynchosia totta*

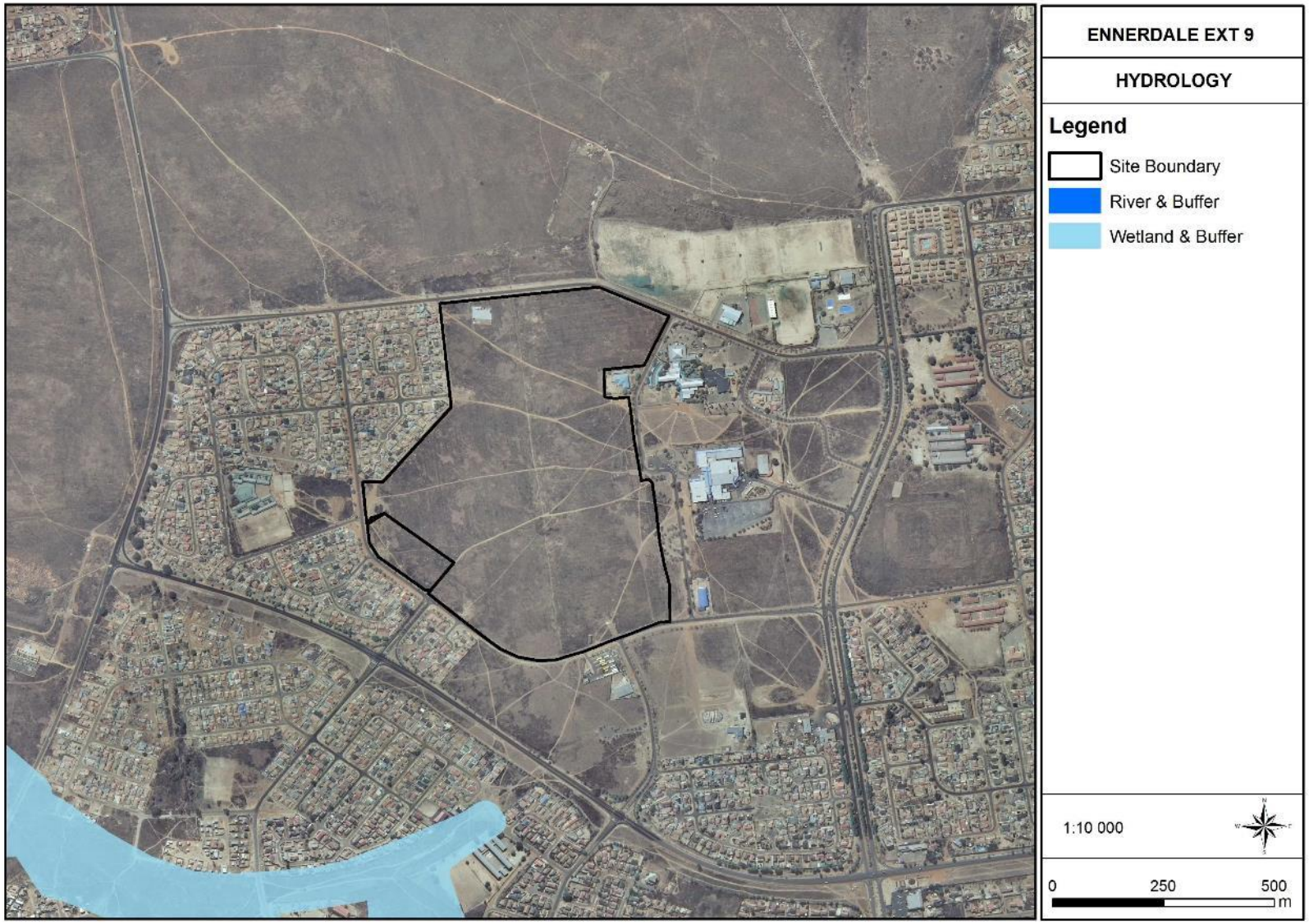


Figure 2: Hydrology of the area that the site is situated in Ennerdale Ext.9

3.4 Listed Ecosystems

The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for listing threatened or protected ecosystems in one of four categories: critically endangered (CR), endangered (EN), Vulnerable (VU) or Protected (Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Government Gazette 34809, Government Notice 1002, 9 December 2011)). The ecosystem status is based on the percentage of original area remaining untransformed (by croplands, mining, urban development & roads) in relation to the biodiversity target and a threshold for ecosystem functioning. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems.

The site is situated within the Soweto Highveld Grassland, which is listed as a Vulnerable ecosystem.

3.5 Soils

The site comprises very shallow (<300 mm) soils, sand on hard rock, in complex association with rock outcrops and steep land to the east (Ms/R). In general, the group contains usually shallow, brown, structureless soils with low base status overlying either weathering rock of the Glenrosa (Gs) form, or hard rock and hard plinthite of the Mispah (Ms) form. The western portion of the site also comprise shallow soil (300-600mm), brown/grey structureless loamy sand/sandy loam/sandy clay loam, non-calcareous on sandstone/quartzite, with rock outcrops (Figure 3).

3.6 Gauteng Conservation Plan

The Gauteng Conservation Plan (Version 3.3) (GDARD, 2011) classified areas within the province based on its contribution to reach the conservation targets within the province. These areas are grouped as Critical Biodiversity Areas (CBAs) or Ecological Support Corridors (ESAs). The CBAs comprise 'Irreplaceable' areas that must be conserved and areas classified as 'Important' to reach the conservation targets of the Province. ESA's are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. (ESAs) to ensure sustainability in the long term.

According to the Gauteng Conservation Plan (version 3.3) (Cplan), the site falls within a CBA: Important (Figure 4). The CBA classification was based on the presence of primary vegetation.

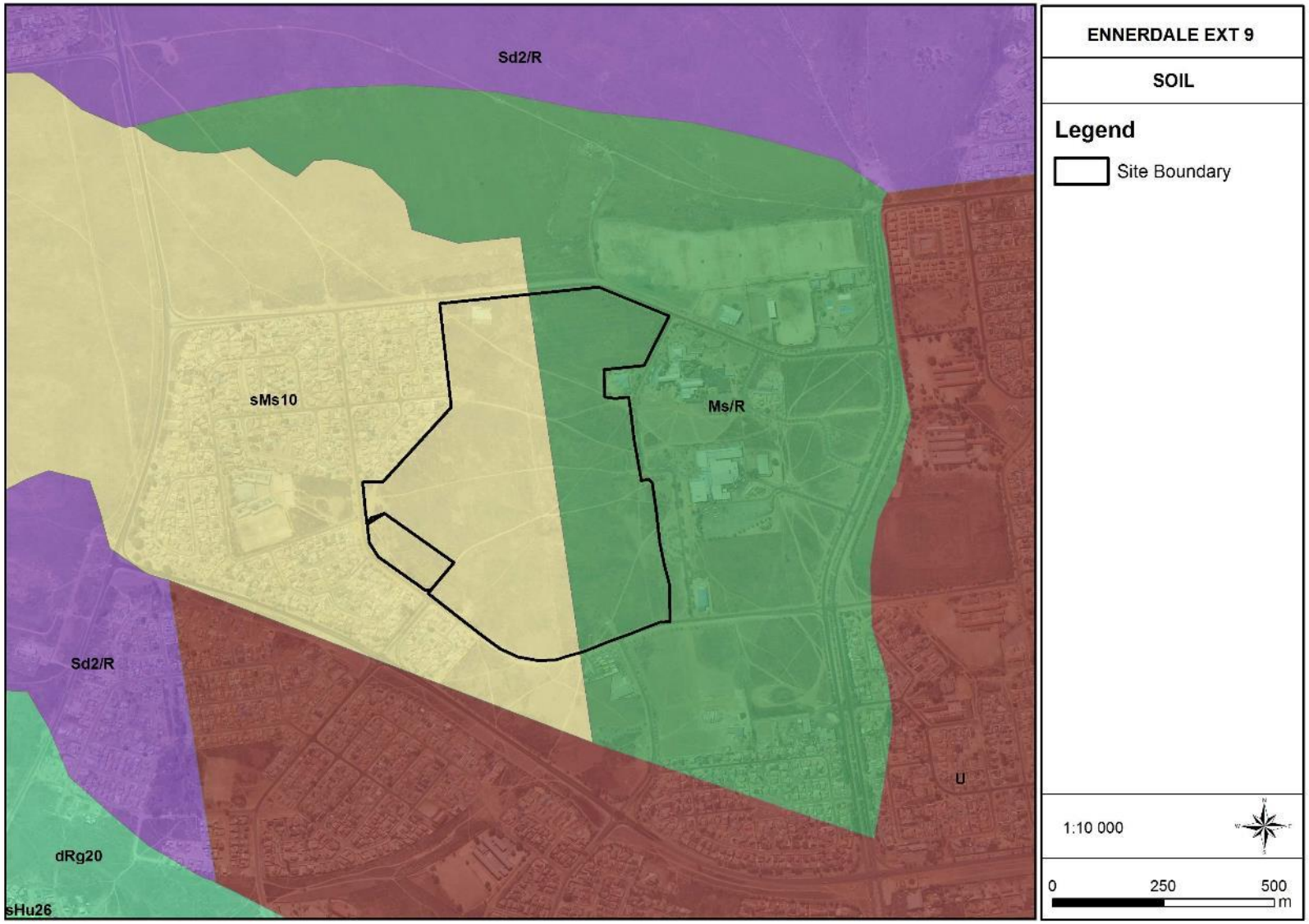


Figure 3: Soils on and around the site

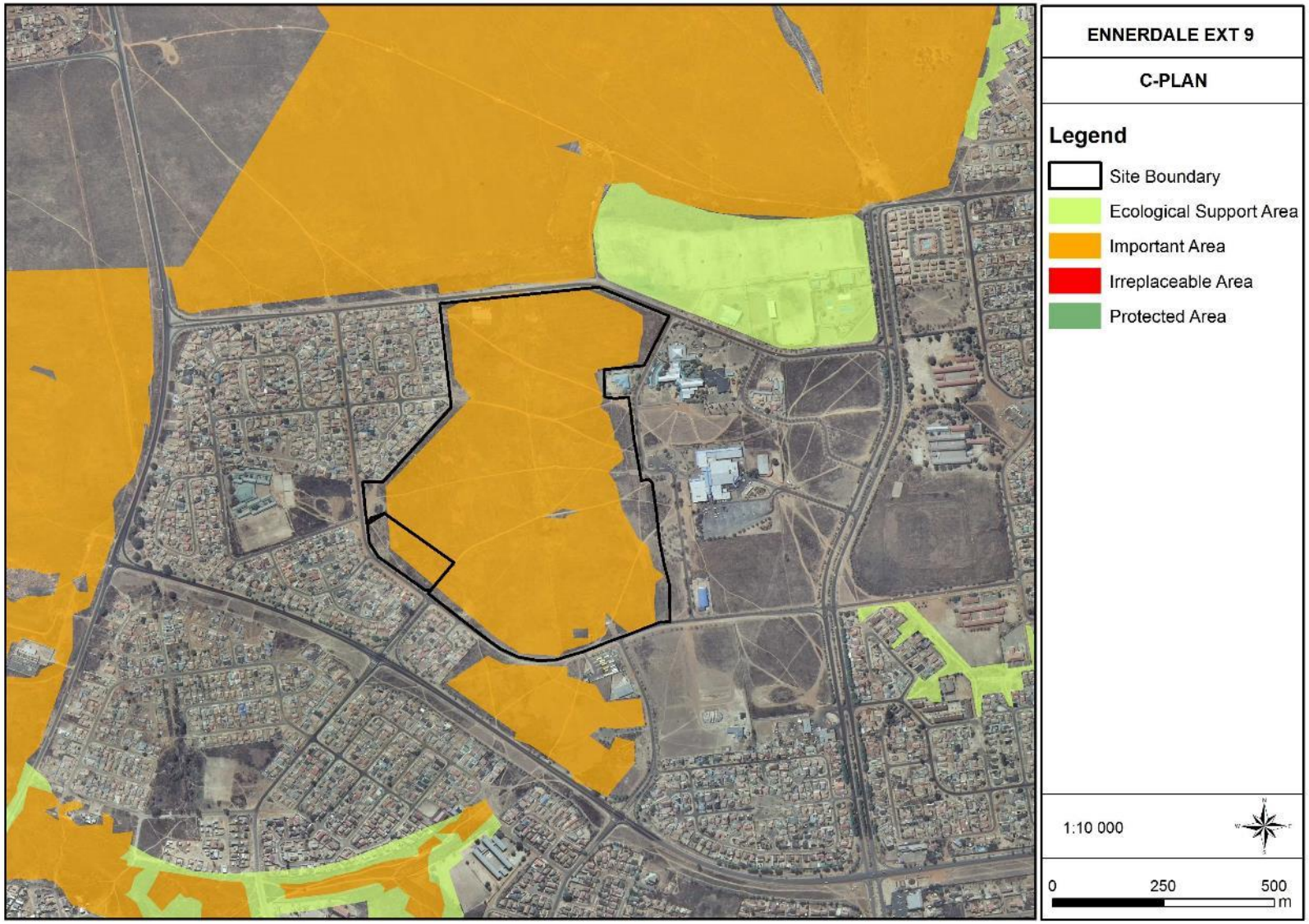


Figure 4: The proposed housing site in relation to the Gauteng Conservation Plan.

4. RESULTS OF THE ASSESSMENT

4.1 Land use and disturbances

Historical Google Earth imagery indicate that most of the site is likely in a natural state. Limited historical disturbances took place. It seems that grass was historically mowed or baled on the northern portion of the site (Figure 5). A portion on the western section may have been cultivated for a short period or baled. A small patch north of the clinic was historically cultivated (Figure 6; Photograph 1).

Figure 5: Google Earth imagery of the site in 2009 and 2012

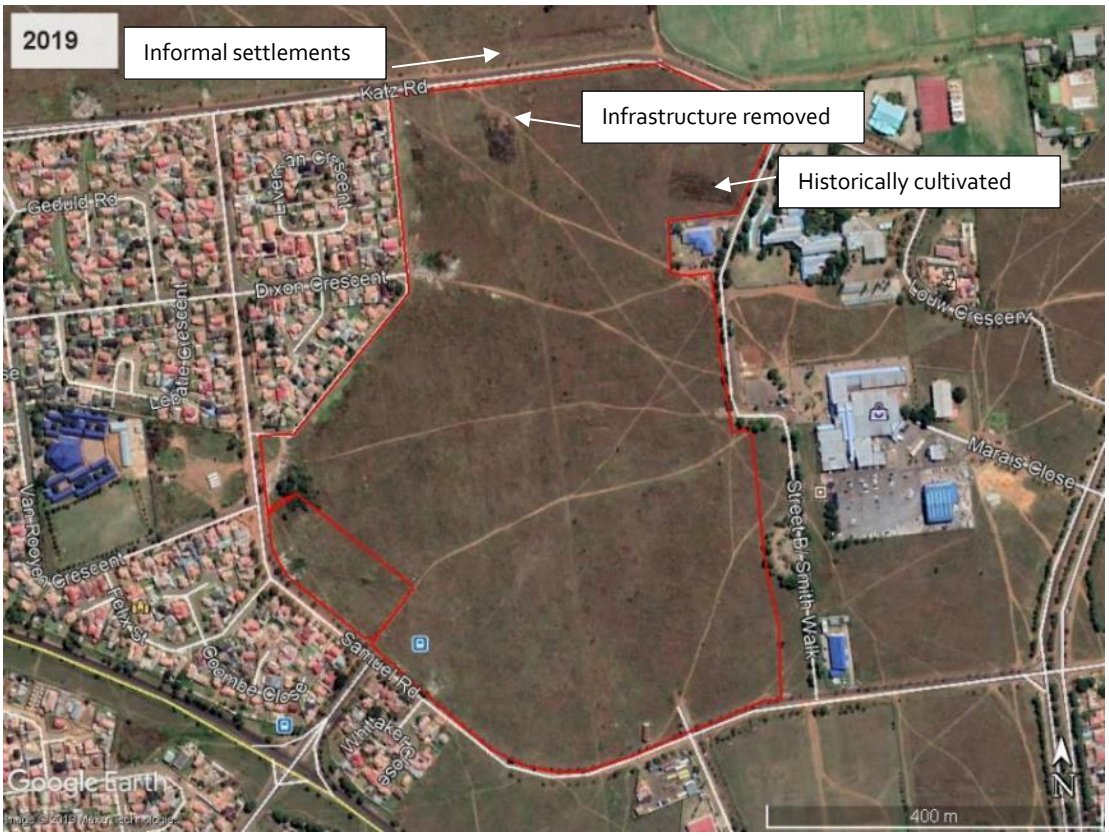


Figure 6: Most recent Google Earth aerial imagery of the site dated 2019

Photograph 1: a) Historically cultivated patch north of the clinic, b-d) dirt paths traverse the site and dumping was noted along these roads and the site boundaries.

Aerial imagery dated 1985 and 2002 shows that no large-scale soil disturbances (e.g. cultivation) took place on the site (Figure 7). Smaller portions that seems like it was cultivated can be seen on Figure 5&6. Two rows of trees occurred from north to south on the site (part of historical boundary of the land). These have since been removed; however, the *Eucalyptus* trees are re-sprouting (Photograph 2a). It is assumed that a pipeline traverses the site as a manhole was noted on the eastern boundary (Photograph 2b). Open space remains to the north of the site but are separated by the recent construction of informal houses.

Figure 7: Aerial imagery of the site in 1985 and 2002 does not show cultivation or degrading activities

Photograph 2: a) *Eucalyptus* trees re-sprouting on the site and b) a manhole on the eastern boundary of the site

4.2 Vegetation Survey Overview

Vegetation associations identified during this study are based on the overall similarity in vegetation structure, species composition, and abiotic features such as moistness, rockiness or historical disturbances. Aerial imagery indicated that limited soil disturbances took place on the site. In addition, much of the site was found to be dominated by *Themeda triandra* (red grass) and included species typical of Soweto Highveld Grassland (Table 1; Mucina and Rutherford, 2006). Most of the site was not cultivated or disturbed in the last 10 years and therefore the vegetation can be classified as indigenous as per Listing Notices in terms of sections 24(2) and 240 of the National Environmental Management Act, 1998).

One broad vegetation group dominates the site and were classified as near-natural Soweto Highveld Grassland. However, changes in species composition were noted in areas where historical infrastructure was situated, where cultivation took place, along the western boundary and where small-scale disturbances and dumping took place. These are described as sub-groups and broadly discussed as semi-natural *Hyparrhenia hirta*-grassland and modified and degraded grassland.

The following vegetation groups are discussed below and mapped in Figure 8:

1. Near-natural Soweto Highveld Grassland
    - 1.1 *Hyparrhenia hirta* grassland (semi-natural)
    - 1.2 Modified and degraded grassland

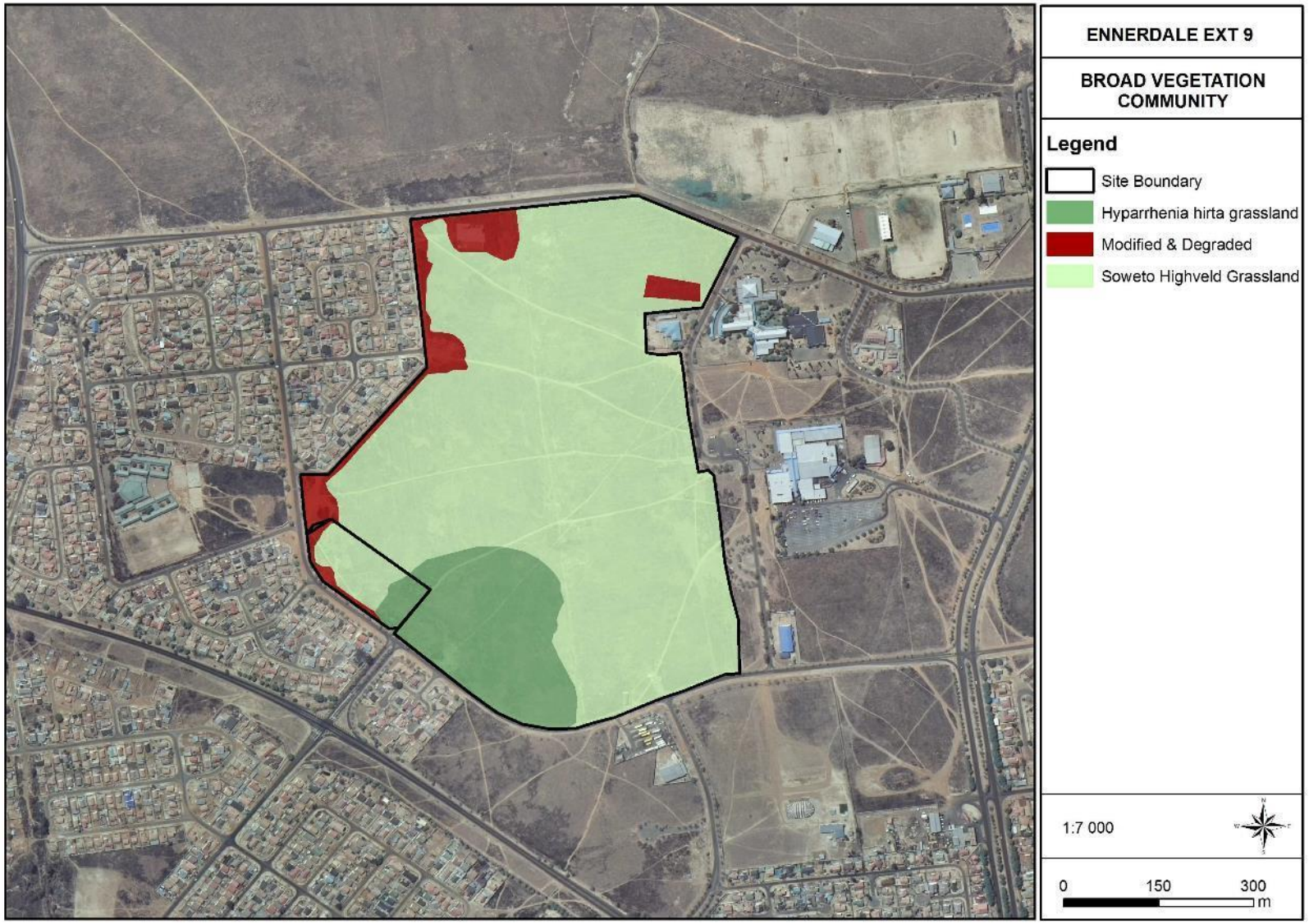


Figure 8: Broad vegetation groups on the site

4.2.1 Near-natural Soweto Highveld Grassland

Most of the site comprised natural to near-natural grassland in which vegetation composition, structure and function are still intact or largely intact. The grassland is typically dominated by *Themeda triandra* (red grass) along with other grass species such as *Cymbopogon pospischilii* (narrow-leafed turpentine grass), *Melinis nerviglumis* (bristle-leaved red top), *Brachiaria serrata* (saw-tooth grass) and *Hyparrhenia hirta* (thatch grass) (Photograph 3). Other notable grasses were *Aristida congesta*, *Heterepogon contortus* (spear grass) and *Trichoneura grandiglumis* (small rolling grass) (Appendix B). The frequency of these three grasses in patches on the site could indicate past overgrazing on the site.

Photograph 3: Soweto Highveld Grassland on the site

The forb layer was dominated by species of the Asteraceae (daisy) and Fabaceae (pea) families. The most dominant species were Asteraceae of the genus *Senecio* and *Helichrysum.* Grazing allows for the increase of unpalatable grasses and forbs, as well as poisonous species such as the *Senecio's*. The dominance of *Senecio* species on the site supports the theory that the site was possibly overgrazed in the past (Photograph 4). Other common forbs were *Helichrysum rugulosum, Hermannia depressa, H transvaalensis, Indigofera zeheyri, Hilliardiella oligocephala* (bitterbossie), *Ipomoea crassipes* (leafy-flowered Ipomoea), *Ajuga ophrydis* and *Nemesia fructicans* (wildeleeubekkie) (Appendix B). Less common species included *Pelargonium luridum, Clematis villosa* (pluimbossie) and *Afrosciadium magalismontanum* (wild parsley).

Photograph 4: *Senecio* and *Helichrysum* species were the dominant forbs on the site

Herbaceous geophytes were expected, but only *Gladiolus* cf *elliotii* (not in flower at time of assessment) and *Hypoxis* species (*H. rigidula and H iridifolia*) were recorded. It is likely that bulbous species such as *Boophone distichia* historically occurred on the site and was harvested for their medicinal value or perished due to baling of the grassland.

Although the grassland was impacted on historically, it is in a near-natural state and in a good ecological condition. This result supports the Gauteng Conservation Plans classification as a CBA, based on the presence of primary or at least near-natural grassland.

No plant species of conservation concern were recorded in walked transects on the site at the time of the field survey, however, suitable habitat is present (Appendix C).

Hyparrhenia hirta grassland

Large patches of the grass *Hyparrhenia hirta* (thatch grass) occurs on the site, most notably in the south-western corner (Photograph 5). This grass in high frequencies could indicate past disturbances. However, available aerial imagery was examined, and no large-scale disturbances were noted. It is thought that the

site was historically grazed and that the large patches of *Hyparrhenia hirta* grassland here were likely cattle pens were trampling and grazing, or baling impacted on the vegetation (a few rock heaps were found where it was cleared from surrounding land, likely to make mowing/baling easier). The area could also have been indirectly impacted on by the building of the surrounding residential areas. Other common grasses here were *Heteropogon contortus*, *Cynodon dactylon* (couch grass), *Melinis repens* (Natal Red-top) and *Trichoneura grandiglumis* (small rolling grass). *Themeda trianda* and *Cymbopogon pospischilii* had a sparser occurrence here. *Senecio* and *Helichrysum* species also dominated the forb layer, along with *Hermannia depressa* and patches of *Conyza podocephala*.

Photograph 5: *Hyparrhenia* and *Senecio* dominated grassland in the south-western portion of the site

No plant species of conservation concern were recorded here, and the vegetation was in a semi-natural state in which ecological function is maintained even though composition and structure have been compromised (fair ecological condition).

Modified grassland

Modified landscapes are regarded as areas where the vegetation structure and composition have been compromised and are not representative of the reference state, in this case, Soweto Highveld Grassland (SANBI, 2016). Modified land can range from moderately modified to severely or irreversibly modified. Subsequently, these areas are usually of a poor to fair ecological condition.

A small patch of grassland was historically cultivated north of the clinic (Photograph 6). *Hyparrhenia hirta, Melinis repens* and *Cynodon dactylon* were the dominant grasses. The forb diversity was low and included the weedy *Conyza podocephala, Pseudognaphalium luteo-album* (cud weed) and *Tagetes minuta* (khaki weed) (Appendix B). This vegetation is modified but through succession will reach a secondary grassland state in a couple of years.

Photograph 6: Vegetation within the historically cultivated area

Other degraded areas included areas were dumping took place, mainly along the western boundary, as well as where the historical infrastructure was situated on the north-western corner of the site (Photograph 7).

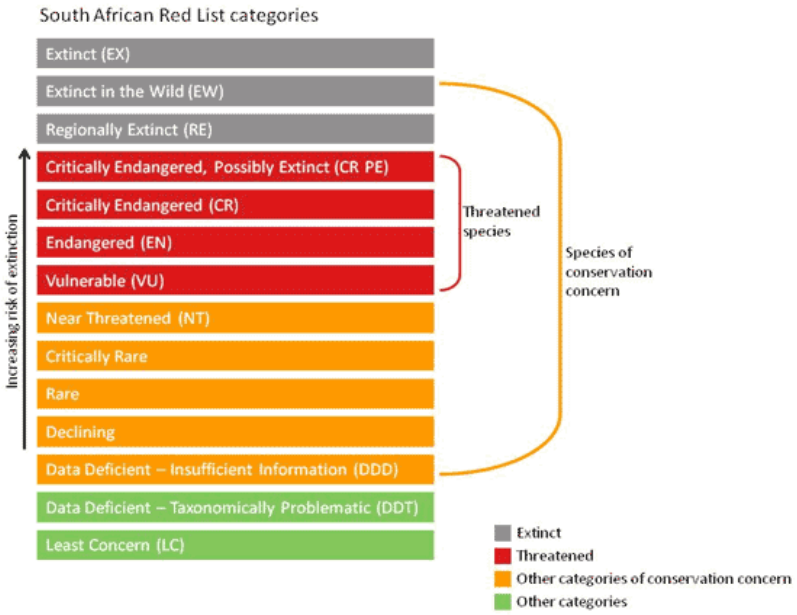
Photograph 7: Degraded vegetation around the site boundary

These areas typically included grasses such as *Cynodon dactylon, Paspalum* species, *Eragrostis curvula* and *Hyparrhenia* hirta. Weedy pioneer species dominated the forb layer. Indigenous trees such as *Vachellia karroo* (sweet thorn) and *Searsia lancea* (karee) colonised the disturbed areas along with the shrub *Asparagus larcinus*.

The degraded areas are modified from the reference state and considered to be of a poor ecological condition. No plant species of conservation concern were recorded in walked transects and sampled areas at the time of the site visit, and none are expected to occur here.

4.3 Plant Species of Conservation Concern

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near-threatened, Critically rare, Rare and Declining (Figure 9). Chapter 4, Part 2 of NEMA Biodiversity Act, 2004 (Act No. 10, 2004) provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival.



(Source: http://redlist.sanbi.org/redcat.php)

Figure 9: Threatened species and species of conservation concern (Gauteng)

A list of plants of conservation concern was compiled using information from the South African National Biodiversity Institute's (SANBI) checklist (SANBI, 2009), Raimondo *et al*, (2009) and information received from the Gauteng Department of Agriculture and Rural Development (GDARD) for the quarter degree

square (qds) 2627BD. A list of eight (8) plants of conservation concern that were previously recorded in the quarter degree square (qds) that the project area is situated in and for which suitable habitat is present within or close to the project area, is given in Appendix C.

None of these species were recorded in walked transects at the time of the survey. Threatened species are usually also cryptic species that are easily overlooked when not in flower. In addition, the grass layer was dense after the good rains and could have obscured smaller plants. Of the species listed in Appendix C, only the *Hypoxis* and *Habenaria* species have a possibility to occur on the site.

4.4 Protected plants

4.4.1 NEMBA Threatened or Protected Plant Species (TOPS)

Chapter 4, Part 2 of the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) provides for listing of plant and animal species as threatened or protected. If a species is listed as threatened, it must be further classified as Critically Endangered, Endangered or Vulnerable. These species are commonly referred to as TOPS listed. The Act defines these classes as follows:

- Critically endangered species: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- Endangered species: any indigenous species facing a high risk of extinction in the wild soon, although it is not a critically endangered species.
- Vulnerable species: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known 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. The first list of threatened and protected species published under NEMBA was published in the government gazette on the 23rd of February 2007 along with the Regulations on Threatened or Protected Species.

At the time of this assessment, no TOPS listed species were recorded within the proposed development footprint or are expected to occur.

4.4.2 Provincially Protected Plants

Several provincially protected plants are listed in the Transvaal Nature Conservation Ordinance Act No. 12 of 1983. These plants are not to be removed, damaged, or destroyed without permit authorisation from Gauteng Department of Agriculture and Rural Development (GDARD).

The genus Gladiolus is protected and therefore the *G. elliotii* that was recorded on the site. Furthermore, it is likely that the grassland provide habitat to protected orchid species, although none were recorded at the time of this assessment.

4.5 Alien Invasive Plant Species

The occurrence of invasive plant species was surprisingly low for grassland within developed areas. Common invasive weeds such as *Campuloclinium macrocephalum* (pom-pom weed), *Verbena* species and *Cirsicum vulgare* were absent from the site. Invasive species were limit and those recorded occurred mainly within the modified grassland and are listed in Appendix B.

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. On 29 July 2016 the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 864 of 2016). The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse. Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.

Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.

Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

The alien plant species identified on the study site are listed in Appendix B. Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

(a) notify the competent authority in writing

(b) take steps to manage the listed invasive species in compliance with

(i) section 75 of the Act;

(ii) the relevant invasive species management programme developed in terms of regulation 4; and

(iii) any directive issued in terms of section 73(3) of the Act.

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5. VEGETATION VULNERABILITY AND IMPORTANCE

It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Therefore, the vegetation of an area will largely determine the ecological sensitivity thereof.

5.1 Rating and Analysis of Vegetation Importance

In order to determine the vegetation condition and importance on the site, weighting scores as listed below (Table 2) were applied. Vegetation of conservation importance were classified based on the findings of the study and the criteria as listed in Appendix A. The sensitivity analysis results were classified as per Table 3, geographically represented in Figure 10 and discussed below.

Table 2: Weighting scores

Scoring	Sensitivity	Explanation
13-18	High	• Development within these areas is not supported. • Impacts are difficult to mitigate, if at all • Such features usually protected by legislation or guiding policies.
12	Medium-high	• Development within these areas is undesirable and impacts are difficult to mitigate, if at all. • Impacts must be avoided or managed by an ecological management plan
7-11	Medium	• Development within these areas could proceed with limited impact to sensitive vegetation, provided that appropriate mitigation measures are taken. • High impact developments should be considered with caution, if at all. Development must be restricted in footprint and impacts managed and mitigated by an approved management plan. Edge effects to higher sensitivity classes in its proximity must be mitigated / prevented.
6	Low-medium	• Developable areas that are connected to sensitive features. • Edge effects must be presented.
0-5	Low	• Most types of development can proceed within these areas with little to no impact on conservation worthy vegetation. Edge effects to other proximate sensitivity classes must be mitigated / prevented.

Table 3: Scoring of vegetation delineated within the site

Broad vegetation community	Conservation Status of regional Vegetation* unit	Predominant state	Protection by legislation/ policies	Plants of conservation concern	Ecological Function	Conservation Importance / unique habitat	Total Score out of max of 18	Importance and vulnerability
Near-natural Soweto Highveld Grassland	2	2	3 CBA	1	2	2	**12**	**Medium-high**
***H. hirta* grassland**	2	2	2 CBA	1	1	1	**9**	**Medium**
Modified and degraded	0	1	2 CBA	0	0	0	**3**	**Low**

*not applicable to areas devoid of natural vegetation

5.2 Discussion

5.2.1 Medium-high sensitivity

Most of the site comprised near natural Soweto Highveld Grassland, irrespective of historical disturbances. As per the GDARD Requirements for Biodiversity Assessments Version 2 (2012): "*All good condition natural vegetation must be designated as ecologically sensitive. The location and extent of all primary grassland (even if it is in a poor/degraded condition) must be mapped and designated as ecologically sensitive".*

Although no plant species of conservation concern were recorded at the time of the assessment, the site falls within a CBA. This CBA is being fragmented from larger open space by the development of informal settlements to the north of the site. The vegetation plays a role as habitat, open space and groundwater recharge.

Development within the grassland is undesirable and impacts should be avoided or managed by an ecological management plan that aims to ensure functional and good condition grassland in open space within the development. It must be noted that the development of an informal settlement north of the site has reduced the extent of the CBA in the area and the site will soon be the last portion of the CBA left. The cumulative impact of the informal settlement coupled with the proposed development on the site will be high as it will destroy the CBA. If not actively conserved, the informal settlement could also spill over to the site.

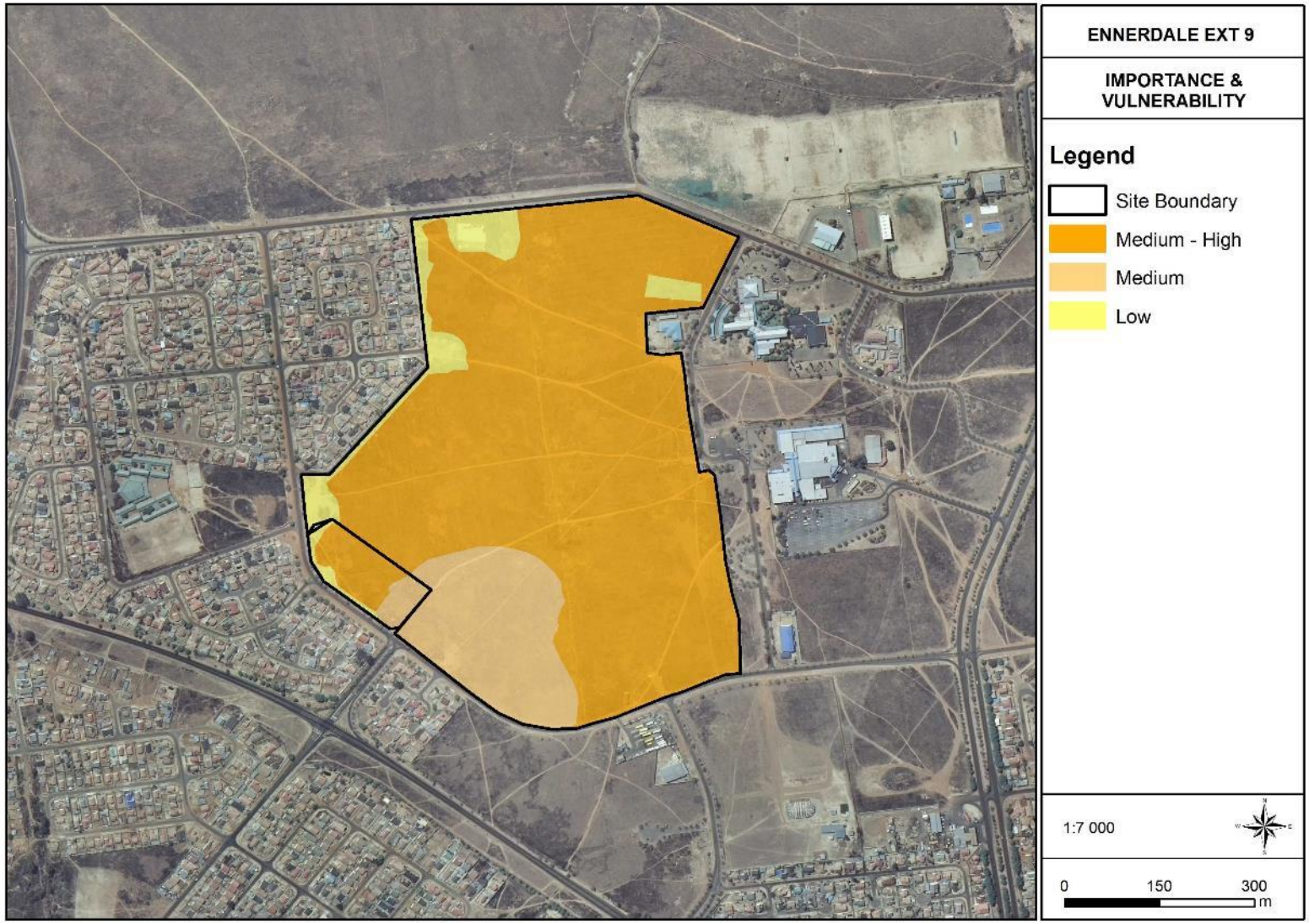

Figure 10: Sensitivity Map.

5.2.2 Medium sensitivity

The *Hyparrhenia hirta* dominated grassland comprised much the same forb diversity as the near-natural Soweto Highveld Grassland. No plant species of conservation concern were recorded. The vegetation is in a secondary to a sub-climax state and in a fair ecological condition, maintaining much of its function as grassland and CBA. Such areas could be considered for development provided that open space, maintaining the function of a CBA are conserved. Conserving good condition grassland within development is a challenge and needs to be managed to protect the grassland and CBA from degradation.

5.2.3 Low sensitivity

The degraded vegetation was considered modified from the reference state and not sensitive to development. It must be noted that these areas fall within an CBA and that if they are developed, the continued functionality of the CBA must be maintained by providing open spaces within the development, linking to the adjacent natural grassland.

6. IMPACT ASSESSMENT AND MITIGATION

Mankind depends on the natural environment for many ecological services provided for by ecosystems, ecological processes and plant species in general. However, any development activities in natural systems will impact on the surrounding natural environment and usually in a negative way. In order to limit or negate these impacts, the source, extent, duration and intensity of the possible impacts needs to be identified. Once the significance of the impacts is understood, the development could both adequately plan for and mitigate these impacts to a best practise and acceptable level. However, if the impacts are significant, especially in already threatened ecosystems and vegetation units, and no adequate mitigation measures could reduce or avert these impacts, then the development should not be allowed to proceed.

6.1 Assessment Criteria

The possible impacts, as described in the next section, were assessed based on the Significance Rating. The Significance of the impact is calculated as follows and rating significance is explained below:

Significance = Consequence *(Extent + Duration+ Magnitude)* **X Probability**

I. The **nature,** which shall include a description of what causes the effect, what will be affected and how it will be affected.
II. The **extent,** wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
III. The **duration,** wherein it will be indicated whether

- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
- medium-term (5–15 years) – assigned a score of 3;
- long term (> 15 years) - assigned a score of 4; or
- permanent - assigned a score of 5;

IV. The **consequences (magnitude)**, quantified on a scale from 0-10, where
- 0 is small and will have no effect on the environment,
- 2 is minor and will not result in an impact on processes,
- 4 is low and will cause a slight impact on processes,
- 6 is moderate and will result in processes continuing but in a modified way,
- 8 is high (processes are altered to the extent that they temporarily cease), and
- 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

V. The **probability** of occurrence, which shall describe the likelihood of the impact occurring. Probability will be estimated on a scale of 1–5, where
- 1 is very improbable (probably will not happen),
- 2 is improbable (some possibility, but low likelihood),
- 3 is probable (distinct possibility),
- 4 is highly probable (most likely) and
- 5 is definite (impact will occur regardless of any prevention measures).

VI. The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and

VII. The **status**, which will be described as either positive, negative or neutral.

VIII. The degree to which the impact can be reversed.

IX. The degree to which the impact may cause irreplaceable loss of resources.

X. The degree to which the impact can be mitigated.

The **significance** weightings for each potential impact are as follows:

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- **60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

6.2 Impact Assessments

The tables below list the activities that could impact on the vegetation because of the proposed development, as well as impacts that may be associated with the operation thereof. The tables also list recommended mitigation measures to limit the impacts.

No decommissioning phase is envisaged and therefore not discussed. Mitigation measures should be incorporated into the Environmental Management Programme. *Note that no layout plan was available at the time of this assessment.*

6.2.1 Destruction of near-natural, good grassland and fragmentation

Nature: Vegetation on the study site will need to be removed for the construction of the proposed development and its associated infrastructure. The removal of vegetation from the site could also lead to a loss in the current ecological function as a CBA and a general loss of species and genetic diversity, increasing fragmentation and leading to smaller patches of vegetation prone to edge effects. Areas that will not be developed, but that may be impacted on by construction related activities (e.g. where building materials are stored) must also be considered. In addition, the illegal disposal of construction material such as oil, cement etc. or vehicle access could destroy vegetation and compact soil.

Direct Impacts:

- Destruction of semi-indigenous vegetation
- Potential increase in runoff and erosion
- Potential spread of alien invasive vegetation
- Potential contamination of soils with hydrocarbons and/or other pollutants

Indirect Impacts:

- Increase of fragmentation and edge effects into surrounding vegetation
- Change in surface and groundwater flow
- Fragmentation

CONSTRUCTION PHASE	Without mitigation	With mitigation
Probability	Definite (5)	Probable (3)
Duration	Permanent (5)	Medium term (3)
Extent	Site (2)	Site, excluding open spaces incorporated into layout (1)
Magnitude	High (8)	Low (4)
Significance	**75 (High)**	**24 (Low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE (assuming construction mitigation was implemented)		
Probability	Probable (3)	Probable (3)
Duration	Permanent (5)	Medium term (3)
Extent	Site and surrounds (3)	Limited to Site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**42 (Medium)**	**24 (Low)**
Status (positive or negative)	Negative	Negative

Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, loss of a CBA, particularly as the CBA north of the site is being developed	Yes
Can impacts be mitigated?	Moderately. The only feasible mitigation is to avoid sensitive grassland vegetation as well as edge effects into these grasslands. Sensitive vegetation must be conserved, and a large portion of the site may only be considered for low impact development. Open space could be incorporated into the development to maintain a functional grassland. However, operational activities such as dumping, mismanagement and mowing of the grasslands will likely degrade the grassland.	

Mitigation:

Planning phase

Development within the grassland is undesirable as it will destroy the CBA and good condition grassland. If the development does not proceed, the grassland must be protected from informal development and maintained to prevent degradation.

If development is allowed by the GDARD, the following must be implemented:

- Plan the layout in such a way as to maintain an open space through the site, thereby maintaining the function of the CBA. Open space within the development can also contribute as steppingstones through the developed areas, if it is maintained in a natural to semi-natural state e.g. eco parks where the natural state is maintained with no manicured gardens are lawns.
- Development must be concentrated in the modified and degraded grassland as well as *Hyparrhenia hirta* grassland to reduce fragmentation and ensuring the functionality of the CBA. Development may not impact on the adjacent near-natural grassland
- No areas of medium- high sensitivity should be fragmented and low impact development in such areas must be manageable e.g. paths
- Planned fencing / boundary walls of the site should take cognisance of ecological processes and allow for the movement of insects and smaller fauna that are imperative for pollution and seed distribution.

Construction:

- An independent Ecological Control Officer (ECO) should be appointed to oversee construction.
- Planning of the construction site must incorporate eventual rehabilitation of areas destroyed by construction and that does not contain infrastructure.
- Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. Ideally, the construction areas should be fenced off.
- Maintain site demarcations in position until the cessation of construction work.
- Only remove vegetation where necessary and retain vegetation in place for as long as possible prior to removal.
- A vegetation rehabilitation plan should already be implemented during construction to rehabilitate areas of grassland that will be affected by edge effects. Such a plan should use indigenous species from the study area and must restore disturbed areas beyond the footprint of the infrastructure to what it was

prior to construction, thereby making the impact on the remainder of the site negligible in the long term. Due to the dry climate, natural colonisation could take a long time, in which vegetation may degrade further or become dominated by encroacher or invasive plant species. Therefore, timeous rehabilitation is imperative. Even in the event of good rains, annual pioneer plants are short-lived and therefore an effort must be made to keep as many shrubs in place as possible or to replace these as part of rehabilitation.

  - The grassland can be removed as sods and stored within transformed vegetation or other disturbed areas. The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.
  - Grasses that naturally occur in the area should be sown / hydroseeded in the disturbed footprint.

- Where topsoil needs to be removed, store such in a separate area where such soils can be protected until they can be re-used for post-construction rehabilitation where applicable. Never mix topsoil with subsoils or other spoil materials.
- Maintain site demarcations in position until the cessation of construction work.
- After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to construction.
- Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
- Ensure there is a method statement in place to remedy any accidental spillages immediately

Operational:

- Rehabilitate construction camps and any other grassland vegetation that was impacted on by the construction. Use grass sods that were removed prior to construction to rehabilitate the construction footprints. Sods must not be stored for lengthy periods and should not be stacked on top of each other or on top of grazed and moist grasslands. The sods should preferably be removed during the winter months and replanted by springtime latest.
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, livestock or pedestrian access.
- Ensure that maintenance work to fences does not take place haphazardly, but according to a fixed plan, using formal access roads. Maintenance workers may not trample natural vegetation and work should be restricted to previously disturbed footprint. In addition, mitigation measures as set out for the construction phase should be adhered to.
- No activities may impact negatively on the grassland vegetation on or adjacent to the site.

Cumulative impacts: Loss of good condition grassland and a CBA within Gauteng

Residual Risks:

- Degradation of grassland in the open spaces within the development
- Fragmentation of natural habitats by fencing and housing.
- Localised alteration of soil surface characteristics and loss of flora.
- The colonisation of the disturbance footprint by alien invasive plant species.

6.2.2 Potential destruction of protected plants and plant species of conservation concern

Nature: One provincially protected Gladiolus species was recorded and occurred sporadically on the site. The near-natural grasslands could also support plant species of conservation concern that were not recorded at the time of the assessment. Where open space is maintained within the development, operational activities could cause edge effects into these species habitats e.g. trampling, dumping, and off-road vehicles.

The sources of this impact could include:

- Clearing of and damage to vegetation in construction footprint, access roads, construction camps, vehicle / machinery traffic and trampling by workers;
- Illegal disposal and dumping of construction material such as cement or oil, as well as maintenance materials during construction.
- Once established, the development could cause edge effects into these species habitats e.g. trampling, dumping, and off-road vehicles.

	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Probable (3)	Improbable (3)
Duration	Permanent (5)	Short-term (2)
Extent	Limited to site (1)	Limited to site (1)
Magnitude	Moderate (6)	Low (4) Only if plants / suitable habitat is avoided or relocated, else rating stays at 6
Significance	**36 (medium)**	**21 (low)**
Status (positive or negative)	Negative	Positive only if species are relocated or avoided and protected
OPERATIONAL PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Short term (2)	Very short term (1)
Extent	Limited to Site (1)	Limited to the Site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**27 (medium)**	**12(low)**
Status (positive or negative)	Negative	-
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- An ecologist / botanist should search the site for the occurrence of plant species of conservation concern, either early in the growing season before the grass layer become too dense (e.g. November) or later in the season when orchids species are usually in flower (February-March)
- If such species are recorded, its threat status will determine whether the species can be relocated or whether development must respect a buffer area around the species habitat. Subsequently, a rescue, relocate and management plan must be implemented for such species.

- The species can only be removed once a permit for the removal or relocation of such species were granted by the GDARD.

Construction:

- Ideally, an on-site ecologist should be present when excavation takes place to ensure that any species not identified during this phase, are protected from destruction. Note that the species could be dormant for some time until favorable conditions arise.
- Protected plants must be removed by a suitably qualified specialist and replanted in suitable habitat on the site. Their survival must be monitored for at least two growing seasons after relocation.
- Construction workers may not tamper or remove these plants, and neither may anyone collect seed from the plants without permission from the local authority.

Operational:

- The relocated species should be monitored for at least two years post relocation. If die back is noted, a specialist should be consulted, and corrective action taken as soon as possible.

Cumulative impacts:

- If mitigation measures are adequately implemented, no cumulative impacts are expected.

Residual Risks:

- Degradation of habitat due to invasion by alien invasive plant species or a change in fire regime.
- Edge effects from the development and increased traffic into sensitive areas.

6.2.3 Potential increase in invasive vegetation

Nature: The seed of alien invasive plant species that occur on and in the vicinity of the construction areas could spread into the disturbed and stockpiled soil. Also, the construction vehicles and equipment were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the construction site

	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Highly probable (4)	Probable (3)
Duration	Long-term (4)	Short-term (2)
Extent	Local Area (2)	Site bound (1)
Magnitude	High (8)	Low (4)
Significance	**56 (medium)**	**21 (low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Highly probable (4)	Improbable (2)
Duration	Long term (4)	Short term (2)
Extent	Limited to Local Area (2)	Limited to the Site (1)
Magnitude	High (8)	Low (4)
Significance	**56 (medium)**	**14(low)**
Status (positive or negative)	Negative	Positive removal of such species

Reversibility	Moderate	High
Irreplaceable loss of resources?	High	Moderate
Can impacts be mitigated?	Yes	

Mitigation:

Construction:

- Alien invasive species, in particular category 1b species that were identified on site must be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation.
- All alien seedlings and saplings must be removed as they become evident for the duration of construction.
- All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO.
- If filling material is to be used, this should be sourced from areas free of invasive species.

Operational:

- Only use indigenous species for rehabilitation and garden or open space layouts.
- Rehabilitation within the grassland should include a suitable, indigenous seed mix. The area should be monitored to ensure that indigenous species colonise the disturbance footprint and that infestation by alien and invasive species are prevented.
- Remove alien invasive species from the disturbance footprint as soon as they become apparent.

Cumulative impacts: Several invasive species are present within the area that the proposed development is situated in. Therefore, if mitigation measures to limit and prevent the spread of alien species are not implemented, the cumulative impact could lead to remaining natural vegetation transformed by alien plant species.

Residual Risks: Re-infestation in areas initially cleared.

7. CONCLUSION

Development within the near-natural grassland is undesirable and impacts should be avoided or managed by an ecological management plan that aims to ensure functional and good condition grassland in open space within the development. It must be noted that the development of an informal settlement north of the site has reduced the extent of the CBA in the area and the site will soon be the last portion of the CBA left. The cumulative impact of the informal settlement coupled with the proposed development on the site will be high as it will destroy the CBA. If not actively conserved, the informal settlement could also spill over to the site.

The *Hyperrhenia hirta* grassland is in a secondary to a sub-climax state and in a fair ecological condition, maintaining much of its function as grassland and CBA. Such areas could be considered for development provided that open space, maintaining the function of a CBA are conserved. Conserving good condition grassland within development is a challenge and needs to be managed to protect the grassland and CBA from degradation.

The degraded vegetation was considered modified from the reference state and not sensitive to development. It must be noted that these areas fall within an CBA and that if they are developed, the continued functionality of the CBA must be maintained by providing open spaces within the development, linking to the adjacent natural grassland.

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9. GLOSSARY

Alien species Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity

Conservation concern (Plants of..) Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see **Threatened**), Extinct in the wild, Data deficient, **Near threatened**, Critically rare, Rare and **Declining**. These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading.

Conservation status An indicator of the likelihood of that species remaining extant either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on.

Critically Endangered A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

Data Deficient There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.

Declining A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo *et al*, 2009).

Edge effect Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution

Endangered A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future

Exotic species Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity

Forb	A herbaceous plant other than grasses.
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas
Irreversibly modified	An ecological condition class in which the ecosystem has been modified completely, with an almost complete loss of composition and structure. All or most ecosystem function has been destroyed and the changes are irreversible. Can apply to a site or an ecosystem.
Mitigation	The implementation of practical measures to reduce adverse impacts
Moderately modified	An ecological condition class in which ecological function is predominantly unchanged even though composition and structure have been compromised. Equates to a fair ecological condition or semi-natural
Natural	Unmodified. No significant changes in composition, structure or function have taken place. Good ecological condition.
Near Natural	Small changes in composition and structure may have taken place, but ecosystem functions are essentially unchanged. Good ecological condition
Near Threatened	A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable and is therefore likely to qualify for a threatened category in the near future (Raimondo *et al*, 2009).
Protected Plant	According to Provincial Nature Conservation Ordinances or Acts, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.
Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. *Now termed Plants of Conservation Concern*
Semi-natural	Ecological function is predominantly unchanged even though composition and structure have been compromised. Fair ecological condition
Severely modified	An ecological condition class in which loss of composition, structure and ecological function is extensive. The land is in a poor ecological condition.
Species diversity	A measure of the number and relative abundance of species
Species richness	The number of species in an area or habitat

Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo *et al,* 2009)
Transformation	The removal or radical disturbance of natural vegetation, for example by crop agriculture, plantation forestry, mining or urban development. Transformation mostly results in a serious and permanent loss of biodiversity and fragmentation of ecosystems, which in turn lead to the failure of ecological processes. Remnants of biodiversity may survive in transformed landscapes
Vegetation Unit	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels and appear similar in vegetation structure and especially floristic composition".
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future (Raimondo *et al*, 2009)

APPENDIX A: METHODOLOGY

A1 Sample point map

Figure 11: Sample point map

A2 Vegetation Sensitivity Evaluation

The following criteria and weighting were used to determine the vegetation sensitivity, function and conservation importance:

1. The status of the regional vegetation that is expected to occur on the study site, only where natural vegetation is remaining.

Conservation status*	Scoring
Critically Endangered	3
Endangered	2
Vulnerable	1
Least threatened	0

*This scoring is not applicable (N/A) for areas devoid of natural vegetation.

2. Predominant state or condition of the vegetation

Vegetation condition	Scoring
Primary state	3
Sub-climax state	2
Secondary state	1
No natural vegetation remaining	0

3. Whether the vegetation or ecological feature is protected by legislation:

Legislation	Scoring
National legislation	3
Provincial policies and guidelines	2
Municipal or other protection	1
No legislated protection	0

4. The presence of suitable habitat for plants of conservation concern as well as the actual occurrence thereof.

Suitable habitat / presence	Scoring
Confirmed presence of red listed species (Threatened)	3
Confirmed presence of Orange listed (Near threatened, Declining), and Suitable habitat and some likelihood of occurrence of Threatened species	2
Suitable habitat but unlikely to occur	1
No suitable habitat	0

5. Ecological Function: areas important to ecological processes such as ecological corridors, hydrological processes and important topographical features such as ridges.

Ecological function	Scoring
High: Sensitive vegetation communities with low inherent resistance or resilience towards disturbance factors; vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.	3
Medium to high: Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with a high degree of connectivity with other ecological systems OR disturbed vegetation connected to an ecological and protected system e.g. ridge, wetland or river	2
Medium: Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree or limited connectivity with other ecological systems	1
Low: Degraded and highly disturbed vegetation with little ecological function	0

6. Conservation Importance: indication of the necessity to conserve areas based on factors such as the importance of the site on a national and/or provincial scale and on the ecological state of the area (degraded or pristine). This is determined by the presence of a high diversity, rare or endemic species and areas that are protected by legislation.

Ecological importance	Scoring
High: Ecosystems with high species diversity and usually provide suitable habitat for a number of threatened species. OR protected ecosystems e.g. wetlands, riparian vegetation etc. These areas should be protected	3
Medium to high: Ecosystems with intermediate levels of species with the possible occurrence of threatened species	2
Medium: Ecosystems with intermediate levels of species diversity without any threatened species.	1
Low: Areas with little or no conservation potential and usually species poor (most species are usually exotic).	0

Weighting scores

Scoring	13-18	12	7-11	6	0-5
Sensitivity	High	Medium-high	Medium	Low-medium	Low

APPENDIX B: PLANTS SPECIES RECORDED

1= species recorded
M= medicinal properties
P= provincially protected
D= declining
NT=near-threatened

Species	Common name	Habitat notes	Near Natural grassland	*H hirta* grassland	Modified & degraded
Trees					
Acacia (Vachellia) karroo (M)	Sweet Thorn	Widespread, often proliferate in overgrazed areas		**1**	**1**
Combretum erytrohyllum	River Bushwillow	Grassland and bushveld, usually along rivers or streams			**1**
Searsia lancea	Sour Karee	Grassland and bushveld			**1**
Total number of indigenous tree species = 3			**0**	**1**	**3**
Grasses					
Andropogon schirensis	Stab Grass	Rocky slopes in well-drained soils, often in moist places.	1		
Aristida congesta	Tassel Three-awn	Disturbed, overgrazed or farmed land. Increaser II grass	1	1	
Brachiaria serrata	Saw-tooth grass	Rocky, undisturbed places	1		
Cymbopogon pospischilii	Narrow-leafed Turpentine Grass	Grassland.	1	1	

Species	Common name	Habitat notes	Near Natural grassland	*H hirta* grassland	Modified & degraded
Cynodon dactylon	Couch grass	Most soils, usually in disturbed areas. Increaser II grass, palatable	1	1	1
Diheteropogon amplectus	Broad-leaved Bluestem	Open grassland as well as open areas within bushveld. Mostly in poor rocky slopes. Decreaser	1		
Eragrostis capensis	Heart-seed Love Grass	Disturbed areas often in vlei-areas	1		
Eragrostis chloromelas	Narrow Curly leaf	Open Grassland.	1		
Eragrostis curvula	Weeping Love Grass	Mostly occurs in disturbed areas / sown as pasture. Increaser II grass	1	1	1
Eragrostis plana	Tough Love Grass	Disturbed areas, mostly in moist patches. Increaser II grass		1	1
Heteropogon contortus	Spear Grass	Rocky, sloped land and common on disturbed road reserves. Increaser II grass. Palatable in early summer	1	1	
Hyparrhenia hirta	Common Thatching Grass	Well drained, rocky soil in open grassland and disturbed areas. Increaser I grass	1	1	1
Melinis nerviglumis	Bristle-leaved Red Top	Undisturbed grassland, rocky slopes and soils.	1		
Melinis repens	Natal Red Top	Disturbed grassland. Increaser II grass.		1	1
Paspalum dilatatum	Dallis Grass	Introduced grass, moist areas in vlei's and close to rivers. Sometimes planted for pasture			1
Pogonarthria squarrosa	Herringbone Grass	Disturbed places, sparsely distributed in natural, open grassland. Sub climax grass that colonise disturbed sandy soils. Not palatable, Increaser II	1	1	1

Species	Common name	Habitat notes	Near Natural grassland	*H hirta* grassland	Modified & degraded
Setaria pallida-fuscua	Garden Bristle Grass	Disturbed areas e.g. next to roads and where rainwater collect			1
Themeda triandra	red grass	Undisturbed or disturbed open grassland. Decreaser Grass	1	1	
Tragus berteronianus	Carrot-seed grass	Pioneer, indicator of disturbance. Increaser II, annual grass			1
Trichoneura grandiglumis	Small Rolling Grass	Open grassland and bushveld, rocky slopes, flood plains or as a sub-climax grass in disturbed areas. Increaser II grass	1		
Urochloa mosambicensis	Bushveld Signal Grass	Disturbed areas such as farmland, also in compacted soils. Good grazing grass. Increaser II		1	1
Total number of indigenous grass species = 21			**15**	**11**	**10**
Shrubs / Forbs					
Acalypha angustata	Copper Leaf	Grassland, rocky grassland	1		
Afrosciadium magalismontanum	Wild parsley	Grassland	1		
Ajuga ophrydis (M)		Grassland, often in colonies	1		
Albuca cf setosa	Fibrous Slime Lily / Slangkop	Plains, rocky areas	1		
Asparagus laricinus	Cluster-leaved Asparagus / katdoring	Thicket or disturbed areas, waste places. Difficult to eradicate if encraoching into grassland	1		1
Berkheya zeyheri subsp zeyheri		Grassland, rocky	1		

Species	Common name	Habitat notes	Near Natural grassland	*H hirta* grassland	Modified & degraded
Chaetacanthus costatus		Grassland, often rocky places and hillsides	1		
Chamaecrista comosa		Grassland	1	1	
Clematis villosa	Pluimbossie	Grassland, particularly rocky ridges	1		
Conyza podocephala		Roadsides and disturbed grasslands	1	1	1
Eriosema cordatum		Grassland and open bushveld	1		
Eriosema psoraleoides	Shrubby Yellow Eriosema	Grassland and open bushveld - usually in disturbed areas	1	1	
Felicia muricata		Grassland, proliferating in overgrazed/disturbed places	1	1	
Gladiolus elliotii (P)	Sheeted Gladiolus	Grasslands	1		
Helichrysum coriaceum	Vaalteebossie	Grassland and rocky hillsides	1		
Helichrysum nudifolium (M)	Hottentot's tea	Grassland	1	1	
Helichrysum pallidum		Grassland	1		
Helichrysum rugulosum (M)		Grassland, often in vlei's or patches in disturbed areas	1	1	
Hermannia depressa	Rooi-opslag / Creeping Hermannia	Grassland, also in trampled and overgrazed areas	1	1	

Species	Common name	Habitat notes	Near Natural grassland	*H hirta* grassland	Modified & degraded
Hermannia transvaalensis		Grassland.	1		
Hibiscus microcarpus		Grassland	1		
Hibiscus pusillus		Grassland, rocky areas and disturbed places	1		
Hilliardiella oligocephala (M)	Bitterbossie	Grassland	1		
Hypericum aethiopicum	St. John's Wort / Vlieepisbossie	Grassland	1		
Hypoxis iridifolia		Grassland	1		
Hypoxis rigidula **(M)**	Kaffirtulp	Grassland	1		
Indigofera daleoides		Grassland, often in disturbed places	1		
Indigofera filipes		Grassland, often in disturbed places	1	1	
Indigofera heydyantha	Aameibossie	Grassland, often in rocky places	1		
Indigofera zeyheri		Rocky grassland, sometimes in moist depressions		1	
Ipomoea crassipes	Leafy-flowered Ipomoea	Grassland	1		
Ipomoea ommaneyi	Beespatat	Grassland	1		
Ledebouria revoluta		Grassland, bushveld	1		
Lippea scaberrima		Grassland, rocky or open bushveld	1		
Nemesia fructicans	Wildeleeubekkie	Shallow soils on exposed rock, also in disturbed areas	1	1	

Species	Common name	Habitat notes	Near Natural grassland	*H hirta* grassland	Modified & degraded
Osteospermum scariosum		Grassland	1		
Oxalis depressa	Suring	Rocky areas, shade	1	1	
Pelargonium luridum (M)		Grassland, often in moist places.	1		1
Pentarrhinum insipidum	Donkieperske /African Heartvine	Forest margins, woodland	1		1
Polygala hottentotta	Small Purple Broom	Common in grassland, often in damp places	1	1	
Rhynchosia cf totta	Yellow Carpet Bean	Grassland, open woodland and forest margins	1		
Salvia runcinata	Wildesalie	Grassland, under trees, often in disturbed areas or even vlei's		1	
Selago densiflora		Grassland and bushveld.	1		
Senecio coronatus (M)	Woolly Grassland Senecio / Sybossie	Grassland usually in large colonies	1	1	
Senecio innornatus		Grassland often in moist places	1	1	
Senecio cf pentactinus		Grassland, often in rocky places		1	
Seripheum plumosum (Stoebe plumosa)	Bankruptbush	Grassland, often proliferating in overgrazed areas.	1		

Species	Common name	Habitat notes	Near Natural grassland	*H hirta* grassland	Modified & degraded
Sida dregei	Spiny sida	Disturbed places, shade		1	1
Solanum panduriforme	Poison Apple	Disturbed places, often under trees (probably an indigenous specie)	1	1	
Tephrosia capensis var capensis		Grassland	1		
Vigna vexillata		Grassland	1		
Wahlenbergia undulata		Grassland, often in seasonally moist places.	1		
Xysmalobium undulatum	Bitterhout	Moist grassland and vlei's	1		
Zornia linearis		Grassland and bushveld, often in disturbed areas.	1		
Total number of indigenous forb species = 54			50	18	5
Sedges				1	1
Cyperus esculentus		Weedy exotic in marshy or ploughed areas	1	1	1
Cyperus rotundus subsp rotundus	Purple nut-sedge	Moist areas, weedy in culitvated areas	1		
Cyperus rupestris var rupestris		Rocky sheets or edges of pools	1		
Total number of sedge species = 3			**2**	**1**	**1**
Alien / Invasive Species				1	
Eucalyptus specie	Blue Gum	Category 2 (CARA)	1		
Euphorbia (Chamaesyce) inaequilatera	Smooth Creeping Milkweed	Exotic species, colonising disturbed and exposed areas	1	1	

Species	Common name	Habitat notes	Near Natural grassland	*H hirta* grassland	Modified & degraded
Gomphrena celosiodes	Prostrate Globe Amaranth	Cosmpolitain Weed	1	1	
Hibiscus trionum	Bladderweed	Invasive weed in disturbed places.	1		1
Hypochaeris radicata	Hairy Wild Lettuce	Weed in gardens and waste places	1		
Melia azedarach	Syringa	Category 1b (3 in urban areas)			1
Oenothera stricta	Yellow Evening Primrose	Weed along roadsides and disturbed areas	1	1	1
*Pseudognaphalium luteo-album**	Cud Weed	Moist places in grassland.	1	1	1
Raphanus raphanistrum	Wild Radish	Native to Europe, weed in moist places			1
Tagetes minuta	Khaki Weed	Weed in disturbed places. Has become naturalised and due to the vast amount of seed set, difficult to control			1
Verbena aristegera (=V. tenuisecta)	Fine-leaved Verbena	Garden escape, now naturalised along roadsides and disturbed areas	1		
Total number of alien and invasive species = 11			**7**	**4**	**6**

APPENDIX C: PLANTS OF CONSERVATION CONCERN

The species listed below have previously been recorded in the qds and are the most likely to occur on or in proximity to the site. At the time of this assessment, none of these species were recorded in walked transects on the site.

Specie	Conservation status (Gauteng)	Habitat and likelihood of occurring on the site	Flowering time
Cineraria longipes	Vulnerable	This specie occurs in grassland amongst rocks and along seepage areas and exclusively on basalt koppies on south facing slopes in association with *Pteridium*. *No suitable habitat*	March-May
Delosperma purpureum	Endangered	South-facing slopes, in shallow soils among crystalline or conglomerate quartzitic rocks, in sun or in partial shade, rarely in shade, in grassland with some trees. Witwatersrand area. *No suitable habitat*	Nov-April
Dioscorea sylvatica	Vulnerable	Wooded places with fair to reasonably good rainfall (e.g. moister bushveld areas, coastal bush and wooded mountain kloof) *No suitable habitat*	Oct-Jan
Habenaria mossii	Endangered	Occurs in grassland on dolomite. In black or sandy soil. *Potential occurrence in the grassland, however, the soil is considered a limiting factor.*	March-April
Hypoxis hemerocallidea	Declining (reclassified to LC nationally)	Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland. *Suitable habitat is present, and the plant is highly likely to occur. It was not recorded in walked transects and might have been harvested from the site for its medicinal properties.*	Sept-March
Khadia beswickii	Vulnerable	Open shallow soil over rocks in grassland. Known locations are declining due to habitat loss to urban and infrastructure development, alien plant invasion, mining and collecting for the specialist succulent horticultural trade. The plants main distribution is around the town of Nigel Suitable habitat is present; however, the site is outside of this species known distribution and was not recorded in walked transects at the time of the field survey.	Jul-April

Specie	Conservation status (Gauteng)	Habitat and likelihood of occurring on the site	Flowering time
Lepidium mossii	*Data deficient - D*	unknown - known from a locality in Nancefield and the Free State	*unknown*
Lithops lesliei subsp. lesliei	Near Threatened	Rocky grassland. This plant is well camouflaged in brown shale on hilltops and difficult to spot when not in flower. *Suitable habitat is present, however, the probability of occurring is low.*	March-June

APPENDIX D: SPECIALIST QUALIFICATIONS

Curriculum Vitae

Antoinette Eyssell-Knox

Personal Information Summary

Name:	Antoinette Eyssell-Knox
Highest qualification:	MSc Environmental Science (2010), University of Pretoria
Professional membership:	SACNASP Pr Sci Nat (400019/11) Ecological Science
Company:	Dimela Eco Consulting
Contact details:	Antoinette@dimela-eco.co.za
	Tel 083 642 6295

Professional Experience

1. Environmental Management:

I have been working in the field of environmental management as a vegetation specialist since the year 2007 (11 years). I have been self-employed since November 2011.

Nov 2011 – current:	Dimela Eco Consulting
Sep 2007 – Nov 2011:	Strategic Environmental Focus (SEF)

Main field of work and experience include:

- Vegetation assessments, overviews or scans;
- Strategic ecological assessments;
- Ecological management, rehabilitation- and biodiversity action plans (including alien vegetation management);
- Specialist input: Gauteng and North-West Outlook Reports, ecological conditional requirements for Green Star rating;
- Ground-truthing of vegetation related data;
- Review of ecological reports; and
- Mentoring.

2. Environmental Education:

2011 – current:	Writer of the ecology feature for the bimonthly Supernova Kids Magazine
Aug 2003 – Sep 2007:	Snr Environmental Education Officer, South African National Biodiversity Institute (SANBI), Pretoria National Botanical Garden

3. Horticulture

Jun – Jul 2003:	Horticultural Trainer, 7 Shaft Training Centre, Johannesburg
May 1997 – Mar 2002	Horticulturist, Pretoria National Botanical Garden (then NBI, now SANBI)

Qualifications

- M.Sc Environmental Science, University of Pretoria (2010)

Dissertation: *Land cover change and its effect on future land uses*

- B. Sc (Hons) Horticulture, University of Pretoria (1999-2000)

Dissertation: *Horticultural uses of the indigenous Barleria species*

- B. Sc (Agriculture) Horticulture, University of Pretoria (1993-1996)

Memberships and Affiliations

SACNASP: Registered as a Professional Natural Scientist in the field of ecology since 2011 (Reg no 400019/11)

Botsoc: Member of the Botanical Society of Southern Africa since 2013

Course History

2018: Asteraceae Identification Course

2015: SAGIC Invasive Species Consultant Training

2012: Tools for Wetland Assessment (Rhodes University – September 2012)

2012: Landscape Functional Assessment, introductory workshop with David Tongway and Prof Klaus Kellner (North West University)

2012: Soil Classification and Wetland Delineation (Terra Soil)

2007: ISO 14000 Advanced EMS Auditors Course (SGS & University of Pretoria)

2007: Introduction into Forestry Stewardship Council (FSC) (University of Pretoria)

2006: Permaculture training course (S.E.E.D)

2005: Project Management Course (Wildlife and Environment Society of South Africa (WESSA) Umgeni Valley)

2004: Grass and plant identification courses

Presentations

July 2007: Environmental Education in a changing world, World Environmental Education Conference (WEEC), Durban

Sept2006: Environmental Education, BGCI Conference, Oxford England

Selected Project Experience (2011 onwards)

1. <u>Provincial Environmental Outlook Reports</u>

2017-2018: Vegetation input: Gauteng Outlook Report

in process: Vegetation input: North-West Outlook Report

2. <u>Open Space Planning</u>

Nov 2015: The proposed Kaalspruit Open Space Project, Thembisa, Gauteng. Kaalspruit River Rehabilitation Biodiversity Scan: (NuLeaf Planning and Environmental)

2015-2016: City of Johannesburg Open Space Planning – vegetation input for Linbro Park, Bassonia, Kyalami and Ruimsig areas (Iggdrasil)

3. Management- and Rehabilitation Plans

April-May 2012: Vegetation base line study and input into Biodiversity Action Plan for Kumba Iron Ore (Lidwala Consulting Engineers)

Jan 2015: Environmental Management Plan for the Krugersdorp Nature Reserve – vegetation section

Jan 2016: Tharisa Mine Railway Line – Vegetation rehabilitation plan (Limosella Consulting)

Sept 2016: General vegetation rehabilitation plan for the proposed Mezo Kitchens Panel Processing Facility (Shangoni)

Nov 2016: General Ecological Rehabilitation and Monitoring Plan for the N4 additional lane between: R52 Koster offramp & D1325 Marikana Interchange; and The R512 (Brits West Interchange) & K67 (Ga-Rankuwa Interchange) North West and Gauteng Provinces

Nov 2016: Biodiversity Management Plan: Afrisam (Sa) (Pty) Ltd, Dudfield Cement – vegetation input

June 2017: Rehabilitation planning for the Klip- Lower and Upper Rietspruit Water Management Units (Pregio, via Limosella Consulting)

Dec 2017: Eskom underground cable river crossings – vegetation input into rehabilitation plants (Envirolution)

4. Linear Infrastructure

March 2012: Kranspoort road upgrade Protected tree identification (Lidwala Consulting Engineers)

Oct 2012: Eskom: Perseus to Gamma Vegetation assessment (Mokgope Consulting)

March 2013: Diepsloot Eskom line and substation, Johannesburg (Envirolution)

Nov 2013: Masa Ngwedi 750kV and 400kV lines (Limpopo & North-West Provinces) Section D & E Vegetation Input for EMP (Mandara Consulting)

2013-2014 Eskom: Northern Alignments (Perseus in the Northern Cape to Juno in the Western Cape) (Mokgope Consulting)

Feb 2014: Meteor substation, as well as the 88kV line between the Pulsar, Meteor and Sonland substations, Sebokeng, (Nsovo Environmental Consulting)

Dec2014: Upgrading of Internal Roads in Stinkwater, Hammanskraal (Gauteng) (GladAfrica)

Sept 2015: Railway Siding for GCMC Open Cast Mine, Lephalale (Limpopo)

Feb 2016: N4 - Additional lane between Brits and Rustenburg (Environamic)

Nov 2016: Aggeneis-Paulputs 400kV Powerline and Substations Upgrades

Feb 2017: Proposed Lulamisa to Diepsloot East to Blue Hills to Crowthorne 88kv Power Line / Cable and 2 Substations Gauteng (Envirolution)

May 2017: Proposed 132 kV Powerline Between Fochville Municipal Substation and an Existing Line, Gauteng Province (Envirolution)

5. Solar Developments

January 2012: Schmidsdrift, Northern Cape Vegetation Assessment for Solar Panels (Nuleaf)

Aug 2015: Proposed Construction of A 75mw Solar Energy Facility Project, Limpopo Tshikovha Environmental and Communication Consulting

6. Mining

April 2012: Rietfontein Open Cast Vegetation assessment (Cabanga Concepts)
Jan 2013: Vierfontein Colliery Vegetation assessment and EMP input (Cabanga Concepts)
Jan 2017: G&W Base and Industrial Minerals Koppies Betonite Mine Vegetation Assessment & Management Input Report (Cabanga Concepts)

7. Other Development

Dec 2013: Marekele Bush camp – vegetation & fauna assessments (NuLeaf)
May 2013: Komati Power Station – Coal stockyard (Envirolution)
April 2014: Blesboklaagte & Leeupoort Township development (Shangoni)
May 2014: Goldi Farm Composting Site, Section 24G Fauna and Flora assessment and Summary document (Shangoni)
Feb 2015: TOPIGS: Proposed Piggery,Mpumalanga(Shangoni)
May 2015: Kwaggasrant Recycling Facility Upgrade (Shangoni)
Oct 2016: Proposed piggery on portion 139 of the farm Honingnestkrans 269JR Vegetation and Fauna investigation (Methale Environmental Consulting)
Oct 2017: Ongoing Clinic Development & Proposed Emergency Medical Services Facility on Prt 79 of the farm De Wagendrift 417 JR Gauteng Province. (Methale Environmental Consultants)

8. Plant relocation and monitoring

April 2014: Relocation of *C bulbipermum,* overlooked Colliery in Mpumalanga (Cabanga Concepts)
Feb 2017: Monitoring report for the relocated *Crinum bulbispermum* at Overlooked Colliery
May 2017: Relocation of protected plant species: Evander Mine
Feb 2018: Monitor populations of the Critically Endangered *Chlorophytum radula* at the Woodbush Plantation, Limpopo.

9. International:

Oct 2009: Tatu, Nairobi: Vegetation Assessment (Kenya) (Lokisa Environmental Consulting)
Sept 2014: Vegetation input to the Regional Environmental and Social Assessment of Coal-based Energy Projects along the South Africa- Botswana Border (World bank Project, Mott MacDonald)

10. Mentorship:

May 2017: Technical Peer Review of the vegetation section for the Emfuleni Bulk Water Supply Pipelines: Ecological Assessment. GIBB Engineering & Architecture (Pty) Ltd
Nov 2017: Mentorship and Technical Peer Review of the vegetation section for the Merensky-Kennedy Powerline: vegetation assessment GIBB Engineering & Architecture (Pty) Ltd