

**TERRESTRIAL ECOLOGICAL SCAN INVESTIGATION AS
PART OF THE ENVIRONMENTAL AUTHORISATION
PROCESS FOR THE PROPOSED SAB GLASS BOTTLE
MANUFACTURING PLANT, NEAR VEREENIGING
GAUTENG PROVINCE**

Prepared for

SLR Consulting (Pty) Ltd

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EXECUTIVE SUMMARY

During the field assessment a single habitat unit, namely the Secondary Grassland Habitat unit was identified. It was evident that the study area has been historically (prior to 1980) utilized for crop cultivation, and is currently associated with extensive livestock grazing. As such the ecological importance and sensitivity of this habitat unit is to be considered moderately low.

Various artificial water resources and artificial canals were identified within the southern portion of the study area. Although these features were anthropogenically derived and not considered as a separate habitat unit, the features did provide suitable habitat for the floral species of conservation concern (SCC) *Crinum macowanii* (declining according to the GDARD red and orange plant list). As such all individuals situated within the development footprint will have to be rescued by a suitable qualified specialist and either relocated to similar suitable habitat within the study area, but outside the development footprint, utilised within the landscaping plan of the project, or moved to registered nurseries, the Agricultural Research Counsel (ARC) or the South African National Biodiversity Institute (SANBI).

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

Based on the findings of the assessment, it is the opinion of the ecologists that from an ecological perspective, the proposed project be considered favorably. However, all essential mitigation measures and recommendations presented in this report should be adhered to as to ensure that the impact on the receiving environment is minimized.

Scientific Terrestrial Services (STS) was appointed to conduct an investigation into the terrestrial faunal and floral ecology as part of the Environmental Impact Assessment (EIA) and Authorisation process for the proposed development of the SAB Glass Bottle Manufacturing Plant located on Portion 238 of the farm Leeuwkuil 596-IQ, near Vereeniging, within the Gauteng Province, henceforth referred to as the "study area". The assessment was confined to the study area and did not include the neighbouring areas except were bulk service infrastructure associated with the project, such as electrical and sewer infrastructure, were situated outside the study area.

Specific outcomes required from this report include the following:

- To define the Present Ecological State (PES) of the terrestrial ecological resources associated with the study area;
- To determine and describe habitats, communities and the ecological state of the study area;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the study area;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features, if present; and
- To determine the environmental impacts that the development might have on the terrestrial ecology within the study area, and to develop mitigation and management measures accordingly.



Results of the Desktop Analysis

- According to Mucina and Rutherford (2012) the study area is situated within the Soweto Highveld Grassland (Endangered). However during the field assessment it was evident that the study area is no longer representative of this vegetation type, due to historic and ongoing anthropogenic activities.
- The majority (approximately 95%) of the study area as well as the associated service infrastructure, with the exception of a small portion on the northern boundary as well as the northern portion of the outfall sewer and northern sewer substation, is considered to form part of the remaining extent of the vulnerable Soweto Highveld Grassland Ecosystem according to the National Threatened Ecosystems (2012)
- The study area and the associated bulk service infrastructure is not associated with any areas or features of conservation concern, namely Critical Biodiversity Areas (CBAs), Ecological Support areas (ESAs), Wetlands, Rivers or Ridges according to the Gauteng Conservation Plan (2011).

Terrestrial Results

- A single habitat unit was identified during the field assessment, namely the secondary grassland¹ habitat unit, and is considered to be of moderately low ecological importance and sensitivity, due to historic and ongoing anthropogenic activities.
- It is evident that the area has been historically utilised for crop cultivation, prior to the 1980s. Although the area has managed to recover to some extent, the area is not considered to be representative of the Soweto Highveld Grassland vegetation type, despite some species encountered, considered to be indigenous to this vegetation type. The area is also currently further subjected to extensive livestock grazing.
- The study area is dominated by increaser 2 and 3² grass species such as *Sporobolus africanus*, *Eragrostis chloromelas*, and *Aristida congesta*, which are common species often associated with prolonged disturbance. The forb layer was dominated by *Berkheya carlinopsis* and *Haplocarpha lyrata*, as well as alien invasive species such as *Cirsium vulgare*, *Conyza podocephala*, and *Verbena bonariensis*.
- During the field assessment it was further evident that various artificial canals were present within the southern and eastern portion of the study area. The construction and excavation of these canals, has resulted in the formation of small berms adjacent to these canals. This together with additional water runoff from the roads adjacent to the study area, has resulted in ponding of water adjacent to these canals, which has resulted in the formation of artificial water resources (refer to the freshwater feature verification report for an in-depth description, SAS, 2018). These artificial canals and artificial water resources did however provide suitable habitat for the floral Species of Conservation Concern (SCC) *Crinum macowanii* (Declining according to the GDARD red and orange plant list. Least Concern on a National Scale). These features furthermore provide suitable habitat for a larger variety of avifaunal species. Individuals situated within the development footprint will have to be rescued by a suitable qualified specialist, and either relocated to similar suitable habitat within the study area, but outside the development footprint or utilised within the landscaping plan of the project, or moved to registered nurseries, the Agricultural Research Counsel (ARC) or the South African National Biodiversity Institute (SANBI). It should be noted that should any of these individuals be removed from the study area permits might be required (As per personal communication with Calvin Jonhasi Production Scientist: Soil Ecology at GDARD on 04/12/17).
- During the field assessment no faunal SCC, or other floral SCC other than *C. macowanii* were observed, nor are any expected to occur within the study area due to the high levels of anthropogenic activity associated with the area over an extensive period of time.

¹ "Secondary grasslands are those that have undergone extensive modification and a fundamental shift from their original state (e.g. to cultivated areas), but have then been allowed to return to a 'grassland' state (e.g. when old cultivated lands are re-colonised by a few grass species. Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning and the ecosystem services they deliver." (Cadman, 2013)

² Increaser 2: Grasses that are abundant in overgrazed veld. These grasses increase due to the disturbing effect of overgrazing and include mostly pioneer and subclimax species. They produce much viable seed and can thus quickly establish on new exposed ground.

Increaser 3: Grasses commonly found in overgrazed veld. These are usually unpalatable, dense climax grasses.



Terrestrial Impact Assessment:

The tables below summarise the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation, it is assumed that a high level of mitigation takes place, but which does not lead to prohibitive costs. From the tables, it is evident that prior to mitigation the impacts on floral and faunal habitat, diversity and SCC varies from medium to very low significance during the construction phase and very low to insignificant levels during the operational phase of the project. If effective mitigation takes place, all impacts may be reduced to low and insignificant levels during the construction phase, and insignificant levels during the operational phase.

It should be noted that the impact assessment was undertaken considering the current layout plan, where individuals of *Crinum macowanii* are situated within the development footprint. It should be noted that the translocation success of rescued individuals is not guaranteed. Should it however be possible to move the development footprint to an area where no floral SCC were encountered the impact significance post mitigation can be further reduced. It should further be noted that although some individuals will be affected by the current layout, and the impact prior to mitigation being implemented is considered medium, it is not considered as a fatal flaw. This is due to the majority of individuals being situated outside of the development footprint, which allows reproduction and spread of the species within the area. The current land use includes extensive grazing by domestic livestock, as such the survival of these individuals cannot be guaranteed even without the commencement of the project.

Table 5: A summary of the impact significance of the construction phase.

Impact	Unmanaged	Managed
1: Impact on floral habitat and diversity	Medium	Low
2: Impact on floral species of conservation concern	Medium	Low
3: Impact on faunal habitat and diversity	Medium	Low
4: Impact on faunal species of conservation concern	Very Low	Insignificant

Table 6: A summary of the impact significance of the operational phase.

Impact	Unmanaged	Managed
1: Impact on floral habitat and diversity	Very Low	Insignificant
2: Impact on floral species of conservation concern	Very Low	Insignificant
3: Impact on faunal habitat and diversity	Very Low	Insignificant
4: Impact on faunal species of conservation concern	Insignificant	Insignificant

Sensitivity

From an ecological perspective, the secondary grassland habitat is considered to be of moderately low sensitivity, with the artificial canals and artificial water resources associated with the southern portion of the study area considered to be of intermediate importance. This is due to the floral SCC *C. macowanii* being associated with these features. Development within the majority of the study area is unlikely to have a significant impact on floral or faunal species, as a result of the high levels of disturbance associated with the study area. Where the development footprint encroaches on the artificial canals and artificial water resources in the southern portion, individuals of *C. macowanii* will have to be rescued and relocated to suitable similar habitat outside the development footprint (Species can be relocated to the artificial canals situated within the southeastern portion of the property. As the translocation success of individuals are not guaranteed, the impact on these individuals are still considered to be of medium significance with appropriate mitigation implemented.



DOCUMENT GUIDE

The Document Guide below is for reference to the procedural requirements for environmental authorisation applications in accordance to GN267 of 24 March 2017, as it pertains to NEMA.

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix H
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix H
b)	A declaration that the specialist is independent	Appendix H
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.2
cA)	An indication of the quality and age of base data used for the specialist report	Section 2.1 and 3.1
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4.1 and 6
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1.3 and 2.1
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix B and C
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 4 and 5
g)	An identification of any areas to be avoided, including buffers	Section 5
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 5
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.3
j)	A description the findings and potential implication\ of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 4, 5 and 6
k)	Any mitigation measures for inclusion in the EMPr	Section 6
l)	Any conditions for inclusion in the environmental authorisation	Section 6
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 7
(iA)	Regarding the acceptability of the proposed activity or activities	Section 7
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 6
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A



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GLOSSARY OF TERMS

<i>Alien vegetation</i>	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
<i>Biome</i>	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
<i>CBA (Critical Biodiversity Area)</i>	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
<i>ESA (Ecological Support Area)</i>	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation
<i>IBA (Important Bird and Biodiversity Area)</i>	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
<i>Indigenous vegetation</i>	Vegetation occurring naturally within a defined area.
<i>RDL (Red Data listed) species</i>	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
<i>SCC (Species of Conservation Concern)</i>	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed species as well as protected species of relevance to the project.



LIST OF ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CR	Critically Endangered
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Areas
EW	Extinct in the Wild
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature
LC	Least Concern
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
NBA	National Biodiversity Assessment (2011)
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
PES	Present Ecological State
POC	Probability of Occurrence
PRECIS	Pretoria Computer Information Systems
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RDL	Red Data List
RE	Regionally Extinct
SABAP 2	Southern African Bird Atlas 2
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
TSP	Threatened Species Programme
VU	Vulnerable



1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct an investigation into the terrestrial faunal and floral ecology as part of the Environmental Impact Assessment (EIA) and Authorisation process for the proposed development of the South African Breweries (SAB) Glass Bottle Manufacturing Plant located on Portion 238 of the farm Leeuwkuil 596-IQ, near Vereeniging, within the Gauteng Province, henceforth referred to as the “study area”. The assessment was confined to the study area and did not include the neighbouring areas except where bulk service infrastructure associated with the project, such as electrical and sewer infrastructure, were situated outside the study area. (Figure 1 and 2).

The study area is situated immediately north of the R28 (Boy Louw Street), east of Lager Road, and west of the R59 (Sybrand van Niekerk Freeway). The R54 (Houtkop Road) is situated approximately 2.7 km north of the study area. The suburb of Leeuhof is situated approximately 380m to the north east, and Sharpeville 1 km southwest of the study area.

This report, after consideration and the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and developing proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.



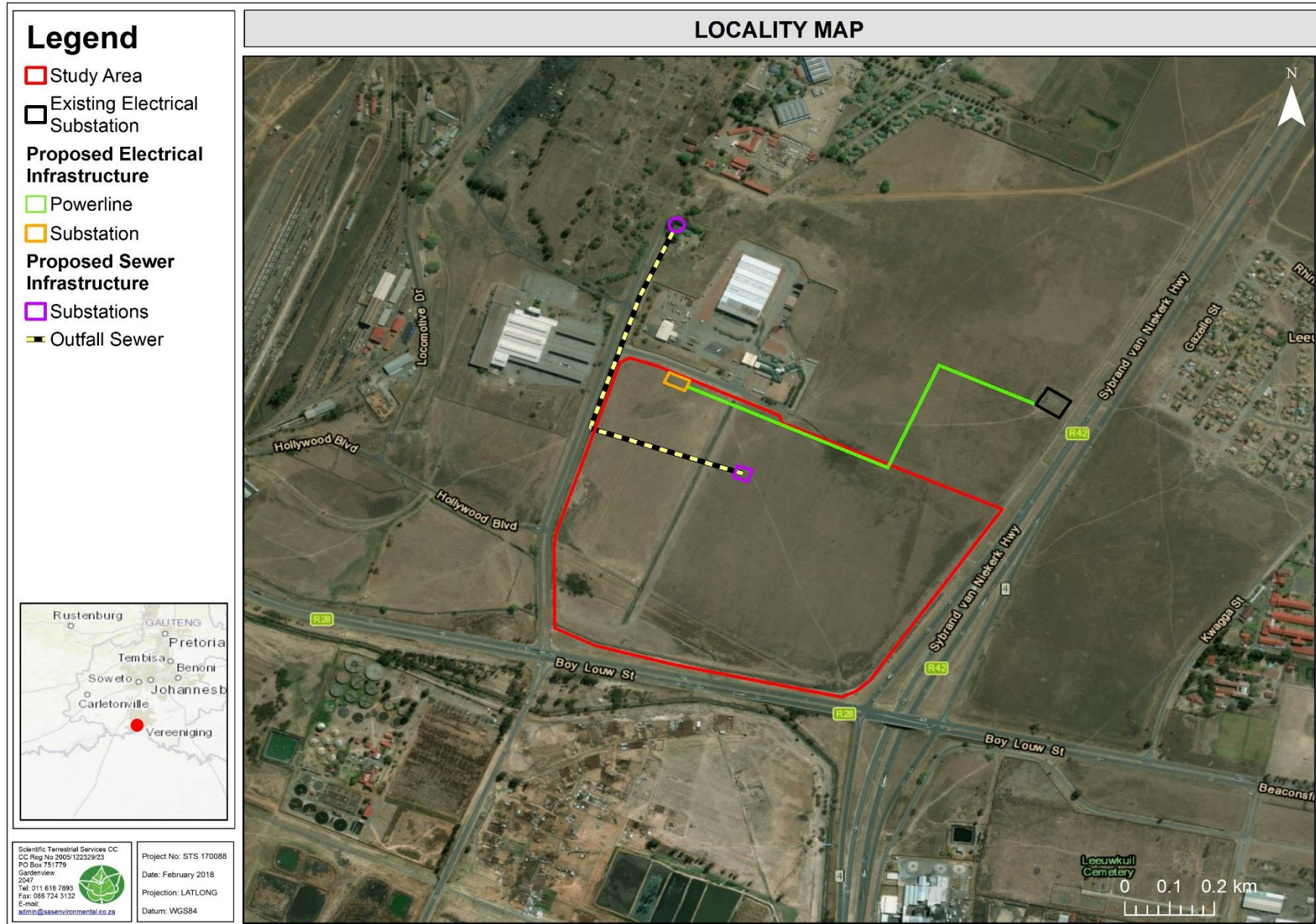


Figure 1: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.



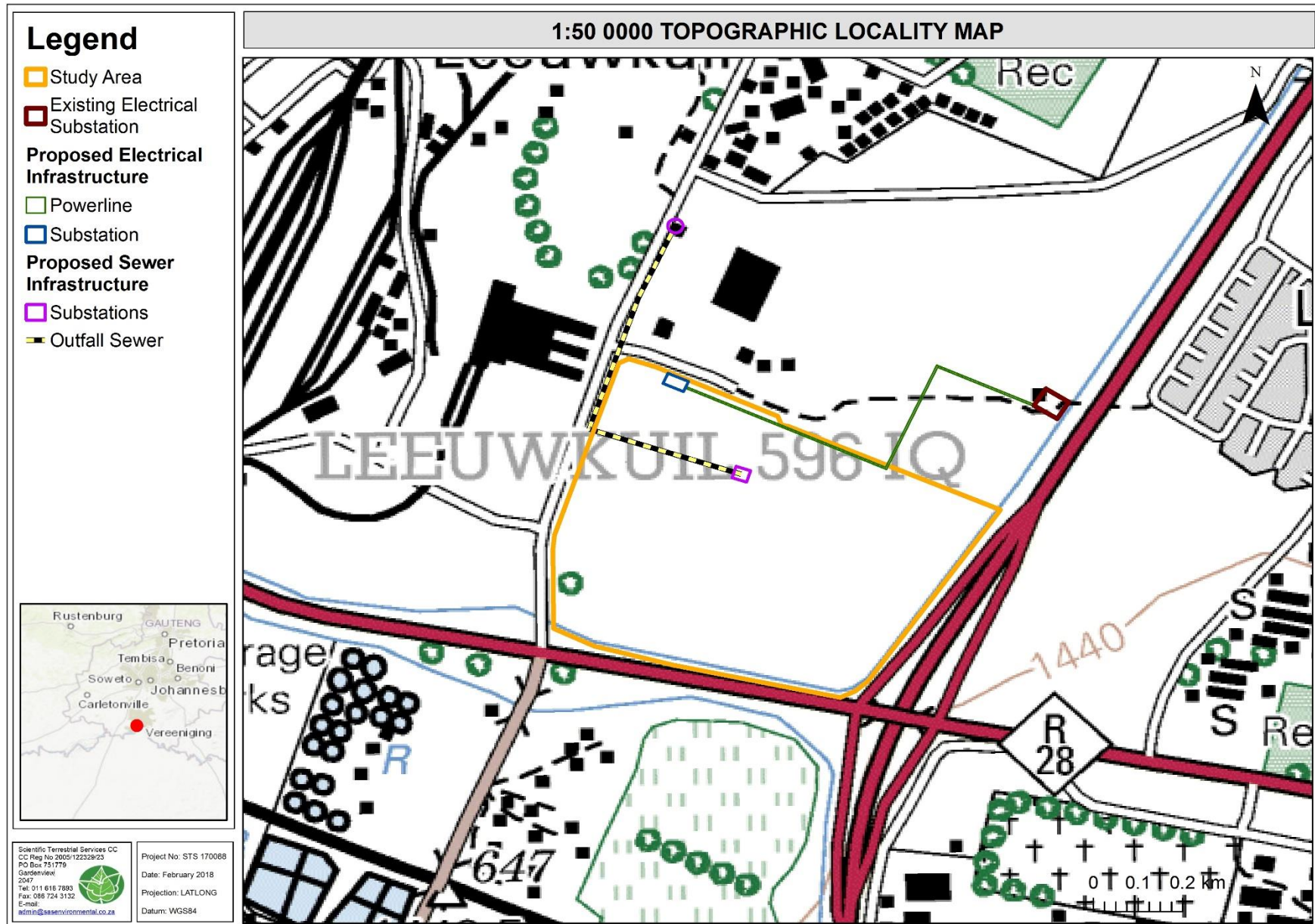


Figure 2: Digital Satellite image depicting the location of the study area in relation to surrounding areas.



1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To define the Present Ecological State (PES) of the terrestrial ecological resources associated with the study area;
- To determine and describe habitats, communities and the ecological state of the study area;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the study area;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features, if present; and
- To determine the environmental impacts that the construction of the proposed development might have on the terrestrial ecology associated with the study area, and to develop mitigation and management measures for all phases of the development.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The ecological assessment is confined to the study area and does not include the neighbouring and adjacent properties; except where bulk service infrastructure associated with the project, such as electrical and sewer infrastructure, were situated outside the study area.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities have been accurately assessed and considered;
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the study area may have been missed during the assessment; and
- The data presented in this report are based on one site visit, undertaken on the 28th of March 2018. A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data and specialist experience in the area, and the findings of this



assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
and
- Conservation of Agricultural Resources Act (CARA, Act No. 43 of 1983);

The following documentation was also considered:

- GDARD Requirements for Biodiversity Assessments Version 3 (GDARD, 2014b).

The details of each of the above, as they pertain to this study, are provided in Appendix A of this report.

2. ASSESSMENT APPROACH

2.1 General Approach

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

- Maps, aerial photographs and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. The results of this analyses were then used to focus the field work on specific areas of concern and to identify areas where target specific investigations were required;
- A literature review with respect to habitats, vegetation types and species distribution was conducted;
- Relevant databases considered during the assessment of the study area included the South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP), the Gauteng Conservation Plan Version 3.3 (C-Plan; 2011), Mucina and Rutherford (2012), National Biodiversity Assessment (NBA), Important Bird Areas (IBA) in conjunction with the South African Bird Atlas Project (SABAP2), International



Union for Conservation of Nature (IUCN) and Pretoria National Herbarium Computer Information Systems (PRECIS);

- A visual on-site assessment of the study area was conducted on the 28th of March 2018 in order to confirm the assumptions made during consultation of the maps and to determine the ecological status of the study area. A thorough ‘walk through’ on foot was undertaken in order to identify the occurrence of the dominant floral species and faunal and floral habitat diversities;
- Specific methodologies for the assessment, in terms of field work and data analysis of faunal and floral ecological assemblages will be presented in Appendices B and C; and
- For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to Appendix D of this report.

2.2 Sensitivity Mapping

All the ecological features of the study area were considered, and sensitive areas were delineated with the use of a Global Positioning System (GPS). In addition, identified locations of SCC and SANBI protected species were also marked by means of GPS. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study Area

The following table contains data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable high-quality data, the various databases do not always provide an entirely accurate indication of the study area’s actual biodiversity characteristics.



Table 1: Summary of the conservation characteristics for the study area.

Details of the study area in terms of Mucina & Rutherford (2012)		Description of the Soweto Highveld Grassland vegetation type	
Biome	The study area is situated within the Grassland Biome .	Vegetation Type	Soweto Highveld Grassland
Bioregion	The study area is located within the Mesic Highveld Grassland Bioregion	Climate	Summer rainfall
Vegetation Type	The study area is situated within the Soweto Highveld Grassland vegetation type.	Altitude (m)	1420-1760
Conservation details pertaining to the study area (Various databases)		MAP* (mm)	662
NBA (2011)	The study area falls within an area that is currently not protected . Ecosystem types are categorised as not protected poorly protected, moderately protected and well protected based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act and compared with the biodiversity target for that ecosystem type. Ecosystems not occurring within any protected area, or where less than 5% of the biodiversity target has been met, the area is considered not protected. The study area does not fall within a focus area as per the National Protected Areas Expansion Strategy (NPAES, 2009), and as such are not earmarked for conservation within the near future.	MAT* (°C)	14,8
		MFD* (Days)	41
		MAPE* (mm)	2060
		MASMS* (%)	75
		Distribution	Mpumalanga & Gauteng Provinces.
National Threatened Ecosystems (2011)	The majority (approximately 95%) of the study area and associated electrical and sewer infrastructure, with the exception of a small portion on the northern boundary and northern portion of the outfall sewer and northern sewer substation falls within a vulnerable ecosystem and is considered to be the remaining extent of the Soweto Highveld Grassland (Figure 3).	Conservation	Endangered. (Target 24%). Very little statutorily conserved.
SAPAD (2017)	The Leeuwkuil Nature Reserve is situated \pm 0,6 km to the south of the study area. There are no other protected or conservation areas situated within 5 km of the study area.	Vegetation & landscape features	Gently to moderately undulating landscape on the Highveld, plateau. Short to medium-high, dense, tufted grassland dominated by <i>Themeda triandra</i> .
IBA (2015)	The study area is not located within or near an IBA (within 5 km)		
Detail of the study area in terms of the Gauteng Conservation Plan (C-Plan V3.3, 2011)			
The study area and the associated bulk service infrastructure is not associated with any areas or features of conservation concern, namely Critical Biodiversity Areas (CBAs), Ecological Support areas (ESAs), Wetlands, Rivers or Ridges according to the Gauteng Conservation Plan. The study area does however fall within the urban area according to the Gauteng C-Plan. Although the Urban Edge was rescinded as a policy document in the Gauteng Spatial Development Framework (2011), it nevertheless remains a useful indicator of where concentration [of development] should occur. Therefore, for the purposes of this report, the Urban Edge boundaries as defined by the C-Plan v3.3 are utilised as a guideline to inform decision making			

SAPAD = South African Protected Areas Database; NPAES = National Protected Areas Expansion Strategy; MAP = Mean annual precipitation; MAT = Mean annual temperature; MAPE = Mean annual potential evaporation; MFD = Mean Frost Days; MASMS = Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply).



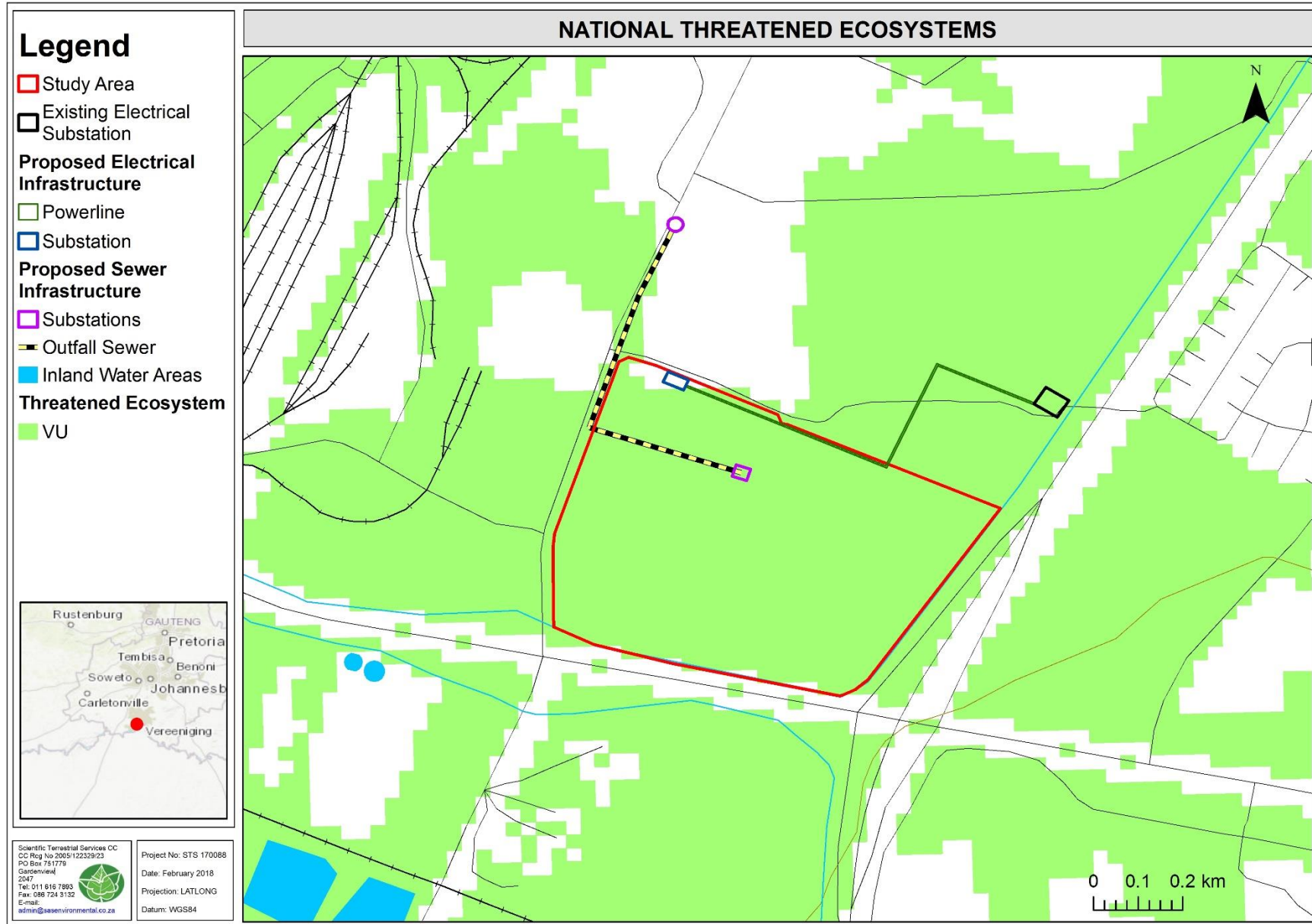


Figure 3: Vulnerable ecosystem, associated with the study area (National Threatened Ecosystem Database, 2011).



4. TERRESTRIAL ECOLOGICAL ASSESSMENT RESULTS

4.1 Terrestrial Habitat Units

During the field investigation it was evident that the study area and associated bulk service infrastructure area comprise of a single habitat unit, namely Secondary Grassland³. It is evident that the area has been historically utilised for crop cultivation, however it has not been utilised in such a capacity since approximately 1980. The area has managed to recover to some extent, although the area is not considered representative of the Soweto Highveld Grassland Vegetation type despite some species, particularly grass species, considered indigenous vegetation as defined by NEMA EIA Regulations Listing Notice 1 of 2014 (amended 2017). The area is also currently subjected to extensive livestock grazing. The study area is dominated by increaser 2 and 3 grass species such as *Sporobolus africanus*, *Eragrostis chloromelas*, and *Aristida congesta*. The forb layer was dominated by *Berkheya carlinopsis* and *Haplocarpha lyrata*, as well as alien invasive species such as *Cirsium vulgare*, *Conyza podocephala*, and *Verbena bonariensis*.

During the field assessment it was further evident that various man-made canals were present within the southern and eastern portion of the study area. The construction and excavation of these canals, has resulted in the formation of small berms adjacent to these canals. This together with additional water runoff from the roads adjacent to the study area, has resulted in ponding of water adjacent to these canals, which has resulted in the formation of artificial water resources (refer to the freshwater resource verification report for an in-depth description, SAS, 2018). These artificial canals and artificial water resources did however provide suitable habitat for the protected species *Crinum macowanii*, as well as for a larger variety of faunal species, particularly avifaunal species.

Furthermore the vegetation associated with the northern portion of the Outfall Sewer and Sewer Substation was associated with a higher abundance of alien invasive species, due to the construction of the road and industrial development.

³ Secondary grasslands are those that have undergone extensive modification and a fundamental shift from their original state (e.g. to cultivated areas), but have then been allowed to return to a 'grassland' state (e.g. when old cultivated lands are re-colonised by a few grass species). Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning and the ecosystem services they deliver." (Cadman, 2013)



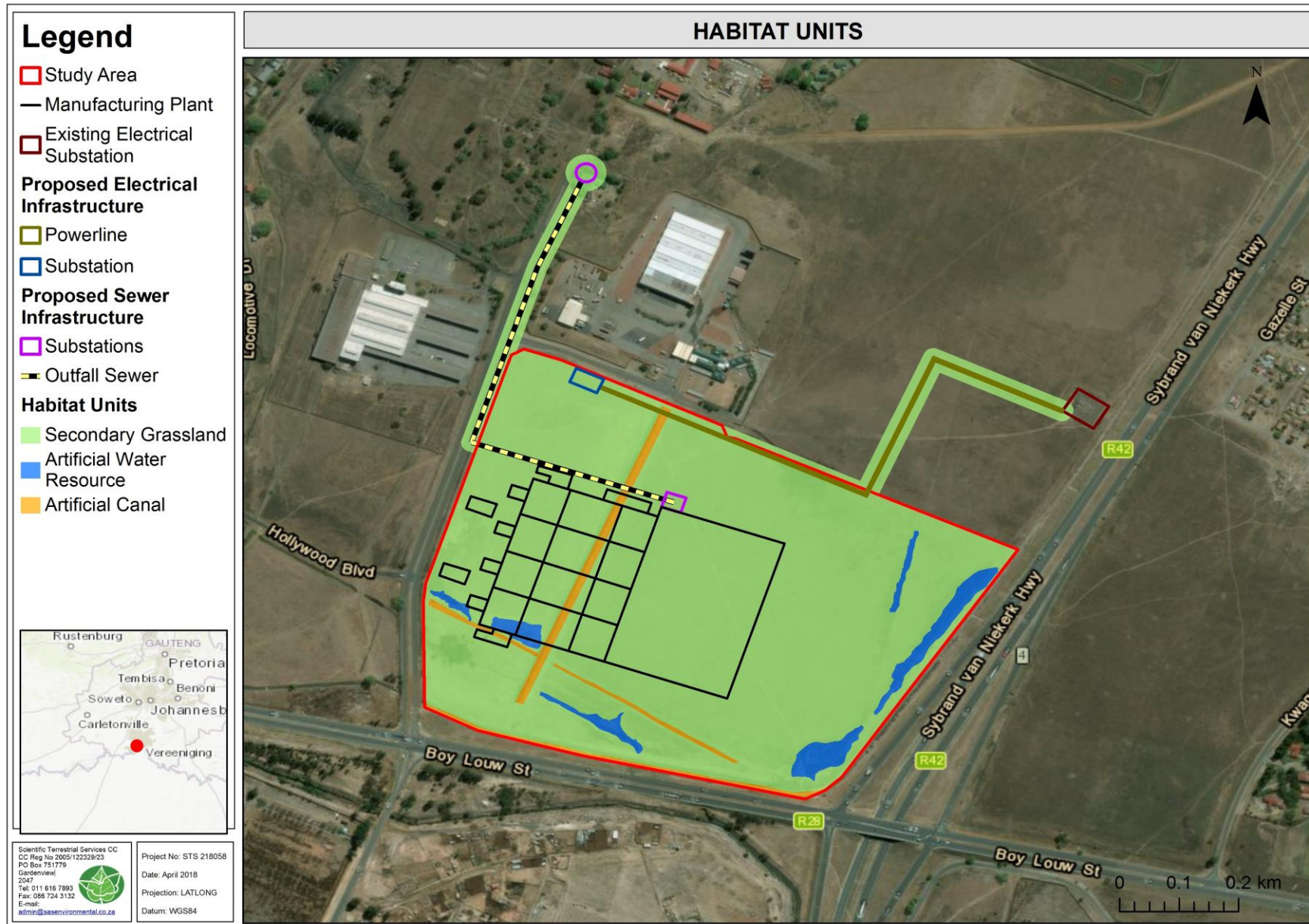

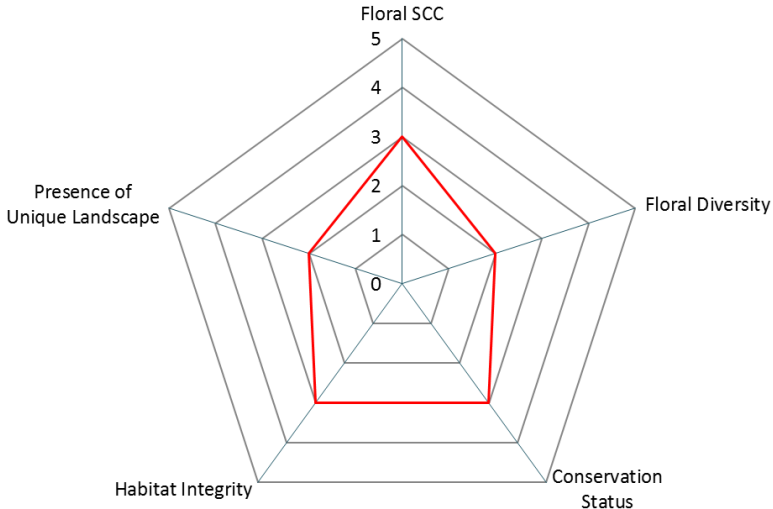


Figure 4: Habitat units encountered within the study area.



4.2 Floral Assessment Results

Table 2: Summary of results of the Floral Assessment

<p>Habitat Unit: Secondary Grassland. The habitat unit was subject to historical agricultural disturbances and is currently subjected to severe cattle grazing and as such dominated by increase 2 and 3 grass species such as <i>Sporobolus africanus</i> and <i>Aristida congesta</i>, which is an indication of overgrazing.</p>	<table border="1"> <tr> <td>Floral Sensitivity</td> <td>Habitat</td> <td>Moderately Low</td> </tr> </table> <p>Notes on Photograph: Top Left: Representative photograph of the Secondary Grassland, Top Right: Artificial Water resource situated within the southwestern portion of the study area, Bottom Left: Artificial Canal within the south western portion of the study area, Bottom Right: <i>Crinum macowanii</i> observed within the artificial canal</p>	Floral Sensitivity	Habitat	Moderately Low		
Floral Sensitivity	Habitat	Moderately Low				
<p>Floral Habitat Sensitivity Graph:</p> 						
<p>Floral Species of Conservation Concern (SCC)</p>	<p>During the field assessment the floral SCC <i>Crinum macowanii</i> (Declining according to GDARD red and orange plant list, Least Concern (LC) on a National level) was observed within the southern portion of the study area, mainly associated with the artificial canals and artificial water resources. Where these species fall within the development footprint, these species should be rescued and either relocated to similar habitat outside of the development footprint or utilised within the landscaping plan.</p>					



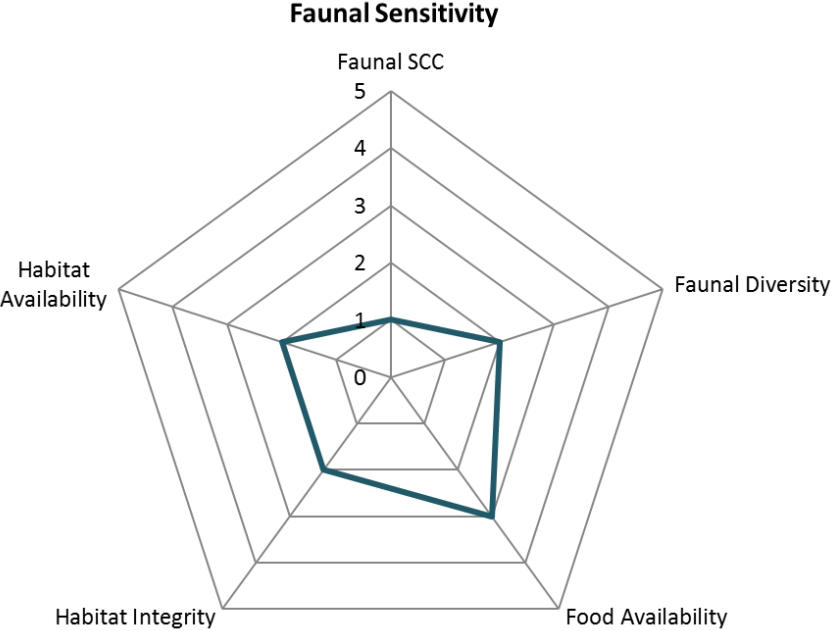




Floral Diversity	The floral diversity of the study area is considered to be moderately low, dominated by increaser grass species such as <i>Sporobolus africanus</i> , and <i>Aristida congesta</i> . The forb layer was dominated by <i>Berkheya carlinopsis</i> and <i>Haplocarpha lyrata</i> , as well as alien invasive species such as <i>Cirsium vulgare</i> , <i>Conyza podocephala</i> , and <i>Verbena bonariensis</i> .	<p>General comments:</p> <p>The study area has historically been utilised for crop cultivation, and although the area has not been cultivated since 1980, the area is still subjected to high levels of anthropogenic activities, these include the construction and operation of the roads surrounding the areas, as well as the construction and excavation of various canals, and extensive grazing by cattle and goats. As such the area has been significantly modified, and although some species encountered during the site assessment is indigenous of the Soweto Highveld Grassland, the area is no longer considered representative of the Soweto Highveld Grassland vegetation type.</p>	<p>Business Case, Conclusion and Mitigation Requirements:</p> <p>The overall floral habitat integrity of the study area is of moderately low ecological importance and sensitivity. However, if the Southern portion of the study area associated with the canals and artificial water resources is to be developed, all individuals of <i>Crinum macowanii</i> that falls within the development footprint should be rescued and relocated to suitable habitat outside the development footprint or kept within a nursery and utilised within the landscaping of the project. The rescue and relocation process should be overseen by a suitable qualified botanist or horticultural specialist. Alien invasive species should also be eradicated during the construction phase, and care should be taken to prevent further spread of these species to areas outside of the development footprint. As such an alien invasive monitoring plan should be implemented to prevent further spread of such species.</p>
Conservation Status of Vegetation Type/Ecosystem	The majority of the study area falls within the vulnerable Soweto Highveld Grassland Vegetation type according to the National Threatened Ecosystem database (2011). Mucina and Rutherford however indicate the Soweto Highveld Grassland to be Endangered. During the field assessment it was evident that the study area is no longer representative of the vegetation type, and as such the study area is considered to be of intermediate conservation importance.		
Habitat integrity/Alien and Invasive species	Although the study area has been utilised historically for crop cultivation the study area has been managed to recover to some extent, with various grass and forb species considered indigenous of the Soweto Highveld Grassland present within the study area. These species include but are not limited to <i>Themeda triandra</i> , <i>Hyparrhenia hirta</i> , <i>Eragrostis chloromelas</i> , <i>Helichrysum nudifolium</i> , <i>Vernonia oligocephala</i> , and <i>Haplocarpha scaposa</i> . The study area however was still associated with a variety of alien invasive species, such as <i>Cirsium vulgare</i> , <i>Conyza podocephala</i> , and <i>Verbena bonariensis</i> and listed in Appendix E. As such the habitat integrity of the study area is considered to be Intermediate.		
Presence of Unique Landscapes	The southern portion of the study area associated with the canals and artificial water resources, provide suitable habitat for the floral SCC <i>Crinum macowanii</i> . It is however unlikely that any other floral SCC will be associated with the study area due to the current and historic anthropogenic activities associates with the area. As such the presence of unique landscapes within the study area is considered to be moderately low.		



4.3 Faunal Assessment Results

Table 3: Summary of results of the faunal assessment

<p>Faunal Class:</p> <p>All classes</p>	<p>Faunal Habitat Sensitivity</p> <p>Moderately Low</p>	<p>Photograph:</p>	
<p>Notes on Photograph: Top Left: Mounds of the <i>Cryptomys hottentotus</i> (Common Mole Rate), Top Left: Male <i>Euplectes orix</i> (Southern Red Bishop), Bottom Right: <i>Junonia orithya madagascariensis</i> (Eyed Pansy), Bottom Left: Colony of nymphs of the species <i>Phymateus morbillosus</i> (Common Milkweed Locust)</p>			
<p>Faunal Sensitivity Graph:</p> 			
<p>Faunal SCC/Endemics/TOPS/</p>	<p>No Faunal SCC were encountered during the field assessment, and the probability of any such species utilising the study area is highly unlikely as the area is no longer connected to a larger open space corridor, as a result of the surrounding infrastructure developments, such as roads, railways, industrial developments, as well as medium to high density urbanisation.</p>		



<p>Faunal Diversity</p>	<p>The faunal diversity associated with the study area is considered to be moderately low and comprised mainly of common faunal species adapted to high levels of anthropogenic activities. Species encountered during the field assessment include avifaunal species such as <i>Vanellus coronatus</i> (Crowned Lapwing), <i>Euplectes orix</i> (Southern Red Bishop), <i>Vanellus armatus</i> (Blacksmith Lapwing), <i>Streptopelia capicola</i> (Cape Turtle Dove) mammal species such as <i>Cryptomys hottentotus</i> (Common Mole Rate) as well as invertebrate species such as <i>Junonia orithya madagascariensis</i> (Eyed Pansy), <i>Danaus chrysippus aegyptius</i> (African Monarch), and <i>Phymateus morbillosus</i> (Common Milkweed Locust)</p>	<p>General comments (dominant faunal species/noteworthy records etc.): The study is considered to be of moderately low ecological sensitivity as a result of current and historic anthropogenic activities associated the area. Although the study area does provide food and suitable habitat for a variety of common faunal species, particularly avifaunal and invertebrate species, it is unlikely that faunal SCC will utilise the area, as the area is surrounded by roads, warehouses, as well as medium to high density urbanisation.</p>	<p>Business Case, Conclusion and Mitigation Requirements: The faunal habitat associated with the study area is considered to be of moderately low ecological sensitivity. As such, construction activities within the study area are not expected to have any significant impacts on faunal conservation within the greater area. Care should however be taken during the construction and operation of the development to prevent further spread of alien invasive species, which will further degrade and limit food availability of various faunal species within the areas excluded from development. As such an alien invasive management plan should be implemented, and frequent monitoring of alien invasive species should take place at least once a year during the operation of the development.</p>
<p>Food Availability</p>	<p>Although the area has been significantly modified as a result of current and historic anthropogenic activities, the majority area has managed to recover to some extent and comprise of a variety of grass and forb species, which serve as a food source for a variety of common faunal species especially invertebrate species As such the food availability of the study area is considered to be of an intermediate level.</p>		
<p>Habitat Integrity</p>	<p>The study area has historically been utilised for crop cultivation, and although the area has managed to re-establish itself to some extent, the area is currently subjected to continuous grazing by domestic livestock. This together with the construction of the roads, surrounding the area, as well as the construction and excavation of the formalised and informalised canals in the southern and eastern portion of the study area, has resulted in degradation of the habitat of the area. As such the habitat integrity is considered to be moderately low.</p>		
<p>Habitat Availability</p>	<p>Habitat availability is considered moderately low within the study area. Although habitat degradation and transformation has occurred, and alien floral species were present, the study area is still capable of providing habitat to a number of faunal species albeit common widespread species. It is however unlikely that the study area will be able to support any faunal SCC due to the area no longer being connected to a larger open space corridor rendering movement of species to and from the area limited</p>		



4.4 Floral Species of Conservation Concern Assessment

An assessment considering the presence of any floral SCC, as well as suitable habitat to support any such species was undertaken. The SANBI PRECIS Red Data Listed plants as well as the GDARD conservation lists were acquired for the Quarter Degree Square (QDS) 2627DB, and are listed in Appendix F.

Threatened species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is a threatened species.

SCC are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare and Declining.

The SCC listed for the area together with their calculated Probability of Occurrence (POC) are tabulated in Appendix G.

Two of the SCC listed in Appendix G are likely to occur within the study area, namely *Crinum bulbispermum* and *Hypoxis hemerocallidea* as the study area falls within the known distribution range of these species as well as provide suitable habitat for these species. Both species are considered to be declining within the Gauteng Province according to the GDARD red and orange plant list, although they are considered to be of least concern (LC) on a National level. These species were not observed during the assessment after detailed surveys, however the species *Crinum macowanii* (LC), also considered to be declining according to the GDARD red and orange listed plants list (updated April 2017) were observed within the southern portion of the study area within the canals and artificial water resources. All individuals of these species situated within the development footprint of the proposed development should be rescued by a suitable qualified specialist, and either relocated to similar suitable habitat within the study area, but outside the development footprint or utilised within the landscaping plan of the project, or moved to registered nurseries, the Agricultural Research Counsel (ARC) or the South African National Biodiversity Institute (SANBI). It should be noted that should any of these individuals be removed from the study area permits might be required (As per personal communication with Calvin Jonhasi Production Scientist: Soil Ecology at GDARD on 04/12/17).



4.5 Faunal Species of Conservation Concern Assessment

During field assessments it is not always feasible to identify or observe all species within the area under investigation, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, and to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of faunal SCC occurrence within the study area. Species listed in Appendix H whose known distribution ranges and habitat preferences include the study area were taken into consideration.

During the site investigation, no faunal SCC were observed. Furthermore, due to the degraded and secluded nature of the study area, specialised habitat requirements of most faunal SCC, distribution ranges and high levels of anthropogenic activity, it is deemed unlikely that any SCC will occur within the study area at present. However, as a level of precaution it is recommended that should any faunal SCC listed in Appendix H of this report be encountered during the construction phase of the proposed development, all operations must be stopped and a biodiversity specialist must be consulted and a species-specific conservation plan designed and implemented.

5. SENSITIVITY MAPPING

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

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

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Secondary Grassland Habitat Unit	Moderately - Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects	The secondary grassland habitat, has historically been utilised for crop cultivation and is currently associated with grazing by domestic livestock. The area is further surrounded by infrastructure such as roads, railways and warehouses, as well as medium to high density urban development, and as such are no longer connected to a larger open space corridor, which limits faunal species movement. As such development within this habitat unit is not expected to have a significant impact on floral and faunal ecology of the area.



Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Canals and Artificial Water resources	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.	Although these features are not considered as a separate habitat unit, as it has been anthropogenically derived, these features did provide suitable habitat for the floral SCC <i>Crinum macowanii</i> , as well as for a larger variety of common avifaunal species. As such it should be ensured that all individuals of <i>C. macowanii</i> situated within the development footprint should be rescued and relocated as stipulated in Section 4.4 above.



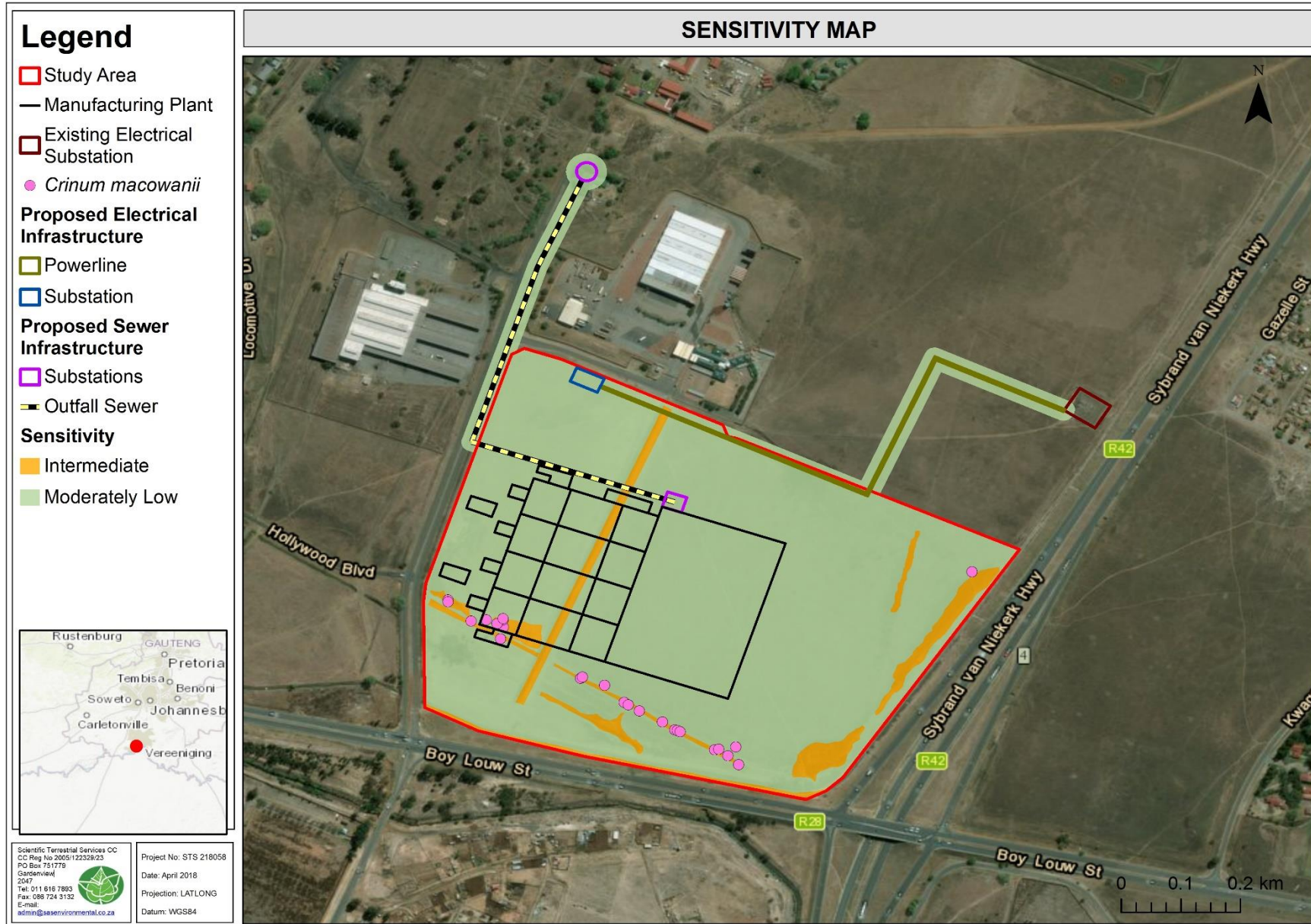


Figure 5: Sensitivity map of the study area.



6. IMPACT ASSESSMENT

The tables below serve to summarise the significance of perceived impacts on the terrestrial ecology of the study area, according to the method described in Appendix C, with each individual impact identified presented in Section 6.1 and 6.2 of this report. All impacts are considered without mitigation taking place as well as with mitigation fully implemented a summary of all potential construction as well as rehabilitation and maintenance impacts is provided in Section 6.3. All the required mitigatory measures needed to minimise the impact is presented in Section 6.4.

6.1 Impacts on the Floral Ecology of the Study Area

Activities and aspects register

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

Construction	Operational
Site clearing and the removal of vegetation for the Manufacturing plant, resulting in the loss of individuals of the floral SCC <i>Crinum macowanii</i> , as well as the spread of alien invasive species to surrounding areas	On-going care and maintenance activities associated with the operation of the manufacturing plant, as well as associated infrastructure leading to altered floral habitat and further loss of floral SCC of the natural habitat surrounding the SAB InBev Manufacturing Plant
Loss of floral diversity as a result of increased invasion of alien plant species	Increased introduction and proliferation of alien plant species and further transformation of surrounding natural habitat
Vehicles accessing the manufacturing plant site through areas excluded from the development footprint, resulting in further loss of vegetation and <i>Crinum macowanii</i> individuals within the area surrounding the development footprint	Poor management and monitoring of rehabilitation measures resulting in alien invasive proliferation.
Dumping of construction waste material outside designated areas leading to loss of floral habitat	Illegal harvesting/ collection of medicinal plants and potential uncontrolled fires impacting on surrounding floral communities
Compaction of soils reducing floral re-establishment	Failure to implement a rehabilitation and alien floral control plan, resulting in a spread of alien invasive plants to areas outside the development footprint.
Illegal harvesting/ collection of medicinal plants and potential uncontrolled fires impacting on floral communities	
Failure to implement a rehabilitation and alien floral control plan, resulting in a spread of alien invasive to areas outside the development footprint.	



6.1.1 IMPACT 1: Impact on Habitat and Diversity for Floral Species

The secondary grassland, although considered to provide suitable habitat for a diversity of floral species, as well as for a variety of grass species indigenous to the Soweto Highveld Grassland vegetation, is not considered representative of the Soweto Highveld Grassland Vegetation Type due to the area historically being cleared for cultivation, and currently being associated with extensive grazing by domestic livestock. As vegetation clearance is inevitable during construction, the impact on floral habitat and diversity is considered to be definite during the construction phase. As the habitat of the area is of moderately low to intermediate sensitivity, the severity of the habitat loss is considered to be moderate. As such the impact associated with the loss of floral habitat is of medium significance during the construction phase of the project prior to the implementation of mitigation measures. With the implementation of mitigation measures, the extent of habitat loss can be limited to the development footprint, and as such lower the severity and extent of the impact. The impact significance of the loss of floral habitat during the construction phase may therefore be reduced to low levels with mitigation fully implemented. During the operational phase general care and maintenance activities such as mowing of vegetation adjacent to the development boundary and servitudes of the power and sewer lines can result in further loss of floral habitat and diversity of the surrounding natural area, although the impact is considered to be very low prior to mitigation taking place. With effective mitigation implemented the impact significance can be reduced to insignificant levels.

Phase	Intensity	Duration	Extent	Consequence	Probability	Significance
Unmanaged						
Construction	M	H	M	Medium	VH	Medium
Operational	L	M	M	Low	L	Very Low
Managed						
Construction	L	M	L	Low	VH	Low
Operational	VL	VL	M	Very Low	L	Insignificant

6.1.2 IMPACT 2: Impact on Floral Species of Conservation Concern

The floral SCC *Crinum macowanii* were observed within canals and artificial water resources associated with the southern area of the study area. As such care should be taken during the construction phase of the development, to prevent the destruction of any of the individuals of these species where possible. Furthermore, during the operational phase it should be ensured that no further destruction of any such individuals occur during care and maintenance activities such as mowing of vegetation surrounding the boundary wall, or continuous harvesting of these individuals for medicinal purposes by operational personal. The impact associated with the loss of the floral SCC *Crinum macowanii* is considered to be of medium significance during



the construction phase and very low during the operational phase prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance of the loss of the floral SCC may be reduced to low levels during the construction phase and insignificant levels during the operational phase.

It should be noted that the impact assessment was undertaken considering the current layout plan, where individuals of *Crinum macowanii* are situated within the development footprint. It should be noted that the translocation success of rescued individuals is not guaranteed. Should it however be possible to move the development footprint to an area where no floral SCC were encountered the impact significance post mitigation can be further reduced. It should further be noted that although some individuals will be affected by the current layout, and the impact prior to mitigation being implemented is considered medium, it is not considered as a fatal flaw. This is due to the majority of individuals being situated outside of the development footprint, which allows reproduction and spread of the species within the area. The current land use includes extensive grazing by domestic livestock, as such the survival of these individuals cannot be guaranteed even without the commencement of the project.

Phase	Intensity	Duration	Extent	Consequence	Probability	Significance
Unmanaged						
Construction	M	H	M	Medium	VH	Medium
Operational	L	M	M	Low	M	Very Low
Managed						
Construction	L	M	L	Low	H	Low
Operational	VL	VL	ML	Very Low	VL	Insignificant



6.2 Impacts of the Faunal Ecology of the Study Area

Activities and aspects leading to impact

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

Construction	Operational and Maintenance
Site clearing and the removal of vegetation leading to habitat loss of faunal species	Loss of potential faunal diversity due to continued habitat loss in the surrounding areas as result of unmanaged care and maintenance activities
Loss of faunal habitat through invasion of alien species in disturbed areas	Increased introduction and proliferation of alien plant species leading to further transformation of surrounding faunal habitat
Erosion as a result of storm water runoff resulting in a loss of faunal habitat	Trapping and or hunting of faunal species
Failure to implement a rehabilitation and alien floral control plan, resulting in a spread of alien invasive species to areas outside the development footprint, and thereby resulting in further habitat loss for faunal species.	Failure to implement a rehabilitation and alien floral control plan, resulting in a spread of alien invasive species to areas outside the development footprint, and thereby resulting in further habitat loss for faunal species.
Possible increased fire frequency during construction leading to a loss of faunal habitat	
Trapping and or hunting of faunal species	

6.2.1 IMPACT 3: Impact on Habitat and Diversity of Faunal Species

The study area is considered to be of moderately low significance in terms of faunal ecology, this is due to the disturbed nature of the area as a result of historic and ongoing anthropogenic activities, limiting faunal habitat and food availability to common faunal species. None the less, the study area and surrounding area provides habitat for a variety of common faunal species. As vegetation will be cleared during the construction phase, the impact on faunal habitat and diversity is definite, albeit of medium significance prior to mitigation taking place, as a result of the transformed nature of the area. With mitigation fully implemented the impact significance is considered to be low. Furthermore without mitigation an impact on the faunal habitat and diversity of surrounding area is possible as a result of care and maintenance activities during the operational phase, although the impact is considered to be very low prior to mitigation taking place, and can be considered insignificant with mitigation fully implemented.



Phase	Intensity	Duration	Extent	Consequence	Probability	Significance
Unmanaged						
Construction	M	M	M	Medium	VH	Medium
Operational	VL	L	M	Low	M	Very Low
Managed						
Construction	L	M	L	Low	VH	Low
Operational	VL	VL	M	Very Low	VL	Insignificant

6.2.2 IMPACT 4: Impact on Faunal Species of Conservation Concern

No faunal SCC were identified within the study area and there is a low probability of such species occurring permanently within this area due to lack of suitable habitat and the area being enclosed and no longer connected to a larger open space area, rendering faunal SCC movement through the area highly unlikely. The impact associated with the loss of faunal SCC is considered to be of very low significance during the construction phase and insignificant during the operational phase of the project prior to the implementation of mitigation measures. With mitigation fully implemented the impact on faunal SCC can be considered insignificant during both phases of the development.

Phase	Intensity	Duration	Extent	Consequence	Probability	Significance
Unmanaged						
Construction	L	M	M	Low	L	Very Low
Operational	VL	L	M	Low	VL	Insignificant
Managed						
Construction	VL	L	L	Very Low	VL	Insignificant
Operational	VL	VL	M	Very Low	VL	Insignificant

6.3 Assessment Summary

The tables below summarise the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation, it is assumed that a high level of mitigation takes place, but which does not lead to prohibitive costs. From the tables, it is evident that prior to mitigation the impacts on floral and faunal habitat, diversity and SCC varies from medium to very low significance during the construction phase and very low to insignificant levels during the operational phase of the project. If effective mitigation takes place, all impacts may be reduced to low and insignificant levels during the construction phase, and insignificant levels during the operational phase.



Table 5: A summary of the impact significance of the construction phase.

Impact	Unmanaged	Managed
1: Impact on floral habitat and diversity	Medium	Low
2: Impact on floral species of conservation concern	Medium	Low
3: Impact on faunal habitat and diversity	Medium	Low
4: Impact on faunal species of conservation concern	Very Low	Insignificant

Table 6: A summary of the impact significance of the operational phase.

Impact	Unmanaged	Managed
1: Impact on floral habitat and diversity	Very Low	Insignificant
2: Impact on floral species of conservation concern	Very Low	Insignificant
3: Impact on faunal habitat and diversity	Very Low	Insignificant
4: Impact on faunal species of conservation concern	Insignificant	Insignificant

6.4 Integrated Impact Mitigation

6.4.1 Mitigation Measures for the SAB Manufacturing Plant

- During construction the development footprint and contractor's laydown areas should be clearly demarcated, and care should be taken to ensure that no activities associated with the construction of the development takes place outside of these demarcated areas. The contractor's laydown area, and access roads should be located where possible within the northern portion of the study area, to prevent potential loss of *C.macowanii* individuals associated with the artificial canals in the southern portion. Upon completion of construction activities, it must be ensured that no bare areas outside the development footprint remain, and all bare areas should be rehabilitated to the pre-development state or an improved ecological state;
- With regards to the *Crinum macowanii* individuals encountered during the site assessment:
 - All individuals situated within the current Manufacturing Plant development footprint should be rescued and either relocated to:
 - Suitable similar habitat within the study area but outside the development footprint,
 - Used within the landscaping plan of the development or
 - Relocated to a registered nursery, the ARC or SANBI;
 - It should be noted that should individuals be removed from the study area to an area not listed above, permits might be required from GDARD, and
 - The rescue and relocation plan should be overseen by a suitably qualified specialist;
 - Should any other floral or faunal SCC however be encountered during the construction of the development all activities should be stopped immediately, and



- a suitable qualified specialist be consulted as to the possibility of rescue and relocation of the species encountered;
- Edge effect control needs to be implemented within construction areas, with specific consideration to erosion control and alien floral species management;
 - All soils compacted outside of the development footprint, as a result of construction activities should be ripped and reprofiled. Special attention should be paid to alien and invasive plant control within these areas;
 - Alien vegetation as listed in Appendix F must be removed from the footprint area during the construction phase, with specific mention of Category 1b, 2 and 3 species in line with the NEMBA Alien and Invasive Species Regulations (2016);
 - Construction vehicles should be restricted to travelling on designated roadways only to limit the ecological footprint of the proposed development activities;
 - Appropriate sanitary facilities must be provided during the construction phase and all waste must be removed to an appropriate waste facility;
 - No dumping of waste on site should take place. As such it is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste.
 - If any spills occur, they should be immediately cleaned up. In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced preventing the ingress of hydrocarbons into the topsoil. It should be ensured that no spills leak into the stormwater runoff canals associated with the southern and eastern boundary of the study area, as these canals convey stormwater runoff into a tributary of the Vaal River, and as such can alter the water quality and biota of the larger system,
 - As far as possible, indigenous grassland species, should be used as part of the landscaping of the project. It is recommended that *Cynodon dactylon* or *Dactyloctenium australe* (LM Grass) be used instead of *Pennisetum clandestinum* (Kikuyu) for any planned lawn areas. However, it should be noted that *C. dactylon* has recently been included in the draft amendments to the alien invasive species list, GN 115 of 16 February 2018 as it relates to NEMBA (2004) and that therefore, a permit may be required to plant it;
 - The width of mowing of natural vegetation surrounding the development boundary should be included and defined within the Environmental Management Programme (EMPR), and should be strictly adhered to during the operational phase. Care should be taken not to extend care and maintenance activities outside this defined area; and
 - Mowed vegetation should be composted or disposed of at a registered waste disposal facility and not left at the mowed site, as this can result in spread of floral alien invasive



species to the surrounding natural area, resulting in further degradation of the floral and faunal ecology of the surrounding area;

- An alien invasive monitoring and control plan should be implemented.

6.4.2 Mitigation Measures for the associated services infrastructure

- Should maintenance of the associated bulk service infrastructure such as the sewer or electrical infrastructure take place during the operational phase, it should be ensured that maintenance related activities are kept strictly within the maintenance servitude;
- All areas that has been excavated for the installation of the various service infrastructures should be compacted, reprofiled and revegetated with indigenous species.
- As far as possible, indigenous grassland species, including grasses, should be used as part of the landscaping of the project. It is recommended that *Cynodon dactylon* or *Dactyloctenium australe* (LM Grass) be used instead of *Pennisetum clandestinum* (Kikuyu) for any planned lawn areas. However, it should be noted that *C. dactylon* has recently been included in the draft amendments to the alien invasive species list, GN 115 of 16 February 2018 as it relates to NEMBA (2004) and that therefore, a permit may be required to plant it;
- The width of mowing of natural vegetation for the servitude of power and sewer lines, should be included and defined within the Environmental Management Programme (EMPR), and should be strictly adhered to during the operational phase. Care should be taken not to extend care and maintenance activities outside this defined area; and
- Mowed vegetation should be composted or disposed of at a registered waste disposal facility and not left at the mowed site, as this can result in spread of floral alien invasive species to the surrounding natural area, resulting in further degradation of the floral and faunal ecology of the surrounding area.

6.4.3 General Mitigation Measures

- No trapping or hunting of any faunal species are to take place during both construction and operational phase;
- Prohibit the collection of any plant material for firewood or medicinal purposes, such as *Crinum macowanii*; *Helichrysum nudifolium*, and *Vernonia oligocephala*
- Informal fires by construction personnel should be prohibited;

Possible latent impacts:

- Permanent loss of and altered floral and faunal species diversity, including the SCC *Crinum macowanii*;
- Alien and invasive floral species invasion.



7. CONCLUSION

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

Based on the terrestrial impact assessment of potential impacts on floral and faunal habitat, diversity and SCC within the study area, it is evident that during the construction phase the impact on floral SCC as well as floral and faunal habitat and diversity is of medium significance, while the impact on faunal SCC is very low prior to the implementation of mitigation measures. With mitigation measures fully implemented the impacts on floral SCC as well as floral and faunal habitat and diversity can be reduced to low significance, while the impact on faunal SCC can be reduced to insignificance.

During the operational phase the impacts on floral SCC, as well as floral and faunal habitat and diversity is considered to be very low, while the impact on faunal SCC is considered insignificant prior to the implementation of mitigation measures. All impacts can be lowered to insignificant levels during the operational phase with mitigation fully implemented.

It is recommended that, from a terrestrial ecological perspective, the proposed development be considered favorably provided that the recommended mitigation measures for the identified impacts (as outlined in Section 6.1 and 6.2) are adhered to.



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APPENDIX A – Legislative Requirements and Indemnity

National Environmental Management Act, 1998

- The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R982 of 2014) and well as listing notices 1, 2 and 3 (GN R983, R984 and R985 of 2014), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.

National Environmental Management Biodiversity Act (NEMBA, Act No. 10 of 2004)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.

Furthermore, a person may not carry out a restricted activity involving either:

- a) A specimen of a listed threatened or protected species;
- b) Specimens of an alien species; or
- c) A specimen of a listed invasive species without a permit.

Conservation of Agricultural Resources Act (CARA, Act 43 of 1983)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.

GDARD Requirements for Biodiversity Assessments Version 3 (GDARD, 2014b).

The biodiversity assessment must comply with the minimum requirements as stipulated by GDARD Version 3 of 2014 and must contain the following information:

- A location and description of the application site and proposed activities;
- Photographic record and description of the site characteristics and inventories of the faunal and floral species observed on site, with special mention to Red Listed species;
- Sensitivity map displaying all sensitive areas and associated buffers as listed in the Sensitivity Mapping Rules for Biodiversity Assessments section of GDARD V3 (2014); and
- A list of recommendations and mitigation measures to reduce the potential environmental impacts that the proposed development might have on the terrestrial ecology associated with the site.



Indemnity and Terms of use of this Report

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. The 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 and STS CC and its staff reserve 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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APPENDIX B – Floral Method of Assessment

Floral Species of Conservation Concern Assessment

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

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

Each factor contributes an equal value to the calculation.

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

$[\text{Distribution} + \text{Habitat availability} + \text{Habitat disturbance}] / 15 \times 100 = \text{POC}\%$

Vegetation Surveys

Vegetation surveys were undertaken by first identifying different habitat units and then analysing the floral species composition that was recorded during detailed floral assessments using the step point vegetation assessment methodology. Different transect lines were chosen throughout the entire study area within areas that were perceived to best represent the various plant communities. Floral species were recorded, and a species list was compiled for each habitat unit. These species lists were also compared with the vegetation expected to be found within the relevant vegetation types as described in Section 4, which serves to provide an accurate indication of the ecological integrity and conservation value of each habitat unit (Evans & Love, 1957; Owensby, 1973).

Floral Habitat Sensitivity

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

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases;



- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and
- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

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

Table B1: Floral habitat sensitivity rankings and associated land-use objectives.

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



APPENDIX C – Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the study area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations. In order to increase overall observation time within the study area, as well as increasing the likelihood of observing shy and hesitant species, camera traps were strategically placed within the study area. Sherman traps were also used to increase the likelihood of capturing and observing small mammal species, notably small nocturnal mammals.

Mammals

Mammal species were recorded during the field assessment with the use of visual identification, spoor, call and dung. Specific attention was paid to mammal SCC as listed by the IUCN, 2015.

Avifauna

The Southern African Bird Atlas Project 2 database (<http://sabap2.adu.org.za/>) was compared with the recent field survey of avifaunal species identified on the study area. Field surveys were undertaken utilising a pair of Bushnell 10x50 binoculars and bird call identification techniques were utilised during the assessment in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Reptiles

Reptiles were identified during the field survey. Suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected and all reptiles encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the study area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Amphibians

Identifying amphibian species is done by the use of direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the study area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Invertebrates

Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken. Furthermore, at suitable and open sites within the study area sweep netting was conducted, and all the insects captured identified. Due to the terrain, and shallow/rocky soil structure pitfall traps were not utilised during the site assessment.

It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the study area at the time of survey. Specific attention was given to insect SCC listed on a



regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Arachnids

Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC scorpions within the study area.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC was determined using the following four parameters:

- Species distribution;
- Habitat availability;
- Food availability; and
- Habitat disturbance.

The accuracy of the calculation is based on the available knowledge about the species in question. Therefore, it is important that the literature available is also considered during the calculation.

Each factor contributes an equal value to the calculation.

Scoring Guideline				
Habitat availability				
No Habitat	Very low	Low	Moderate	High
1	2	3	4	5
Food availability				
No food available	Very low	Low	Moderate	High
1	2	3	4	5
Habitat disturbance				
Very High	High	Moderate	Low	Very Low
1	2	3	4	5
Distribution/Range				
Not Recorded		Historically Recorded		Recently Recorded
1		3		5

[Habitat availability + Food availability + Habitat disturbance + Distribution/Range] / 20 x 100 = POC%

Faunal Habitat Sensitivity

The sensitivity of the study area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and sensitivity of the study area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;
- **Food Availability:** The availability of food within the study area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.



Each of these values contribute equally to the mean score, which determines the suitability and sensitivity of the study area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the study area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table C1: Faunal habitat sensitivity rankings and associated land-use objectives.

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



APPENDIX D – Impact Assessment Methodology

Ecological Impact Assessment Method (as supplied by the SLR Consulting)

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE	Significance = consequence x probability	
Definition of CONSEQUENCE	Consequence is a function of intensity, spatial extent and duration	
Criteria for ranking of the INTENSITY of environmental impacts	VH	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	VL	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	VL	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National



PART B: DETERMINING CONSEQUENCE									
			EXTENT						
			A part of the site/property	Whole site	Beyond the site, affecting neighbours	Local area, extending far beyond site.	Regional/National		
			VL	L	M	H	VH		
INTENSITY = VL									
DURATION	Very long	VH	Low	Low	Medium	Medium	High		
	Long term	H	Low	Low	Low	Medium	Medium		
	Medium term	M	Very Low	Low	Low	Low	Medium		
	Short term	L	Very low	Very Low	Low	Low	Low		
	Very short	VL	Very low	Very Low	Very Low	Low	Low		
INTENSITY = L									
DURATION	Very long	VH	Medium	Medium	Medium	High	High		
	Long term	H	Low	Medium	Medium	Medium	High		
	Medium term	M	Low	Low	Medium	Medium	Medium		
	Short term	L	Low	Low	Low	Medium	Medium		
	Very short	VL	Very low	Low	Low	Low	Medium		
INTENSITY = M									
DURATION	Very long	VH	Medium	High	High	High	Very High		
	Long term	H	Medium	Medium	Medium	High	High		
	Medium term	M	Medium	Medium	Medium	High	High		
	Short term	L	Low	Medium	Medium	Medium	High		
	Very short	VL	Low	Low	Low	Medium	Medium		
INTENSITY = H									
DURATION	Very long	VH	High	High	High	Very High	Very High		
	Long term	H	Medium	High	High	High	Very High		
	Medium term	M	Medium	Medium	High	High	High		
	Short term	L	Medium	Medium	Medium	High	High		
	Very short	VL	Low	Medium	Medium	Medium	High		
INTENSITY = VH									
DURATION	Very long	VH	High	High	Very High	Very High	Very High		
	Long term	H	High	High	High	Very High	Very High		
	Medium term	M	Medium	High	High	High	Very High		
	Short term	L	Medium	Medium	High	High	High		
	Very short	VL	Low	Medium	Medium	High	High		
			VL	L	M	H	VH		
			A part of the site/property	Whole site	Beyond the site, affecting neighbours	Local area, extending far beyond site.	Regional/National		
EXTENT									

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VH
CONSEQUENCE							



PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	Decision guideline
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely to be required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

*VH = very high, H = high, M= medium, L= low and VL= very low and + denotes a positive impact.

Mitigation measure development

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

- *Mitigation and performance improvement measures* and actions that address the risks and impacts⁴ are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation*.

Recommendations

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

⁴ Mitigation measures should address both positive and negative impacts



APPENDIX E – Vegetation Types

Soweto Highveld Grassland

Table D1: Dominant & typical floristic species of Soweto Highveld Grassland (Mucina & Rutherford, 2012)

Grass species	Forb species	Tree/Shrub Species
<i>Andropogon appendiculatus</i> (d)	<i>Hermannia depressa</i> (d)	<i>Anthospermum hispidulum</i>
<i>Brachiaria serrata</i> (d)	<i>Acalypha angustata</i>	<i>Anthospermum rigidum</i> subsp. <i>pumilum</i>
<i>Cymbopogon pospischilii</i> (d)	<i>Berkheya setifera</i>	<i>Berkheya annectens</i>
<i>Cynodon dactylon</i> (d)	<i>Dicoma anomala</i>	<i>Ziziphus zeyheriana</i>
<i>Elionurus muticus</i> (d)	<i>Euryops gilfillanii</i>	
<i>Eragrostis capensis</i> (d)	<i>Geigeria aspera</i> var. <i>aspera</i>	
<i>Eragrostis chloromelas</i> (d)	<i>Graderia subintegra</i>	
<i>Eragrostis curvula</i> (d)	<i>Haplocarpha scaposa</i>	
<i>Eragrostis plana</i> (d)	<i>Helichrysum miconiifolium</i>	
<i>Eragrostis planiculmis</i> (d)	<i>Helichrysum nudifolium</i> var.	
<i>Eragrostis racemosa</i> (d)	<i>nudifolium</i>	
<i>Heteropogon contortus</i> (d)	<i>Helichrysum rugulosum</i>	
<i>Hyparrhenia hirta</i> (d)	<i>Hibiscus pusillus</i>	
<i>Setaria nigrirostris</i> (d)	<i>Justicia anagalloides</i>	
<i>Setaria sphacelata</i> (d)	<i>Lippia scaberrima</i>	
<i>Themeda triandra</i> (d)	<i>Rhynchosia effuse</i>	
<i>Tristachya leucothrix</i> (d)	<i>Schistostephium crataegifolium</i>	
<i>Andropogon schirensis</i>	<i>Selago densiflora</i>	
<i>Aristida adscensionis</i>	<i>Senecio coronatus</i>	
<i>Aristida bipartita</i>	<i>Vernonia oligocephala</i>	
<i>Aristida congesta</i>	<i>Wahlenbergia undulate</i>	
<i>Aristida junciformis</i> subsp. <i>galpinii</i>	<i>Maemanthus humilis</i> subsp.	
<i>Cymbopogon caesius</i>	<i>hirsutus</i>	
<i>Digitaria diagonalis</i>	<i>Haemanthus montanus</i>	
<i>Diheteropogon amplexens</i>	<i>Rhynchosia totta</i>	
<i>Eragrostis micrantha</i>	<i>Felicia muricate</i>	
<i>Eragrostis superba</i>		
<i>Harporchloa falx</i>		
<i>Michrochloa caffra</i>		
<i>Paspalum dilatatum</i>		

*(d) – Dominant species for the vegetation type



APPENDIX F – Species List

Table E1: Dominant floral species encountered in the study area. Alien species are indicated with an asterisk (*). Also indicated are species falling within an alien invasive category as per the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, 2016. Medicinal plant species are underlined.

Grasses and sedges	Forbs and groundcovers	Trees and shrubs
<i>Aristida congesta</i>	* <i>Cirsium vulgare</i> 1b	<i>Crotalaria eremicola</i>
<i>Brachiaria brizantha</i>	* <i>Conyza podocephala</i>	<i>Seriphium plumosum</i>
<i>Chloris pycnothrix</i>	* <i>Cosmos bipinnatus</i>	<i>Vachellia karoo</i>
<i>Cymbopogon plurinoides</i>	* <i>Datura stramonium</i> 1b	
<i>Cynodon dactylon</i>	* <i>Gomphrena celosiodes</i>	
<i>Cyprus esculentus</i>	* <i>Guilleminea densa</i>	
<i>Eragrostis chloromelas</i>	* <i>Hibiscus trionum</i>	
<i>Eragrostis lehmaniana</i>	* <i>Oenothera rosea</i>	
<i>Eragrostis obtuse</i>	* <i>Persicaria serrulata</i>	
<i>Hyparrhenia hirta</i>	* <i>Portulaca oleracea</i>	
<i>Paspalum dilatatum</i>	* <i>Schkuhria pinnata</i>	
<i>Setaria pallide-fusca</i>	* <i>Tagetes minuta</i>	
<i>Sporobolus africanus</i>	* <i>Verbena bonariensis</i> 1b	
<i>Themeda triandra</i>	* <i>Verbena brasiliensis</i> 1b	
<i>Typha capensis</i>	* <i>Vernbena aristigera</i>	
<i>Urochloa panicoides</i>	* <i>Xanthium spinosum</i> 1b	
	<i>Berkheya carlinopsis</i>	
	<i>Bulbine narcissifolia</i>	
	<u><i>Crinum macowanii</i></u>	
	<i>Felicia muricata</i>	
	<u><i>Gomphocarpus fruticosus</i></u>	
	<i>Haplocarpha lyrata</i>	
	<i>Haplocarpha scaposa</i>	
	<u><i>Helichrysum nudifolium</i></u>	
	<i>Mimulus gracilis</i>	
	<i>Monsonia burkeana</i>	
	<i>Nidorella anomala</i>	
	<i>Senecio lydenbergensis</i>	
	<i>Solanum panduriforme</i>	
	<u><i>Vernonia oligocephala</i></u>	
	<i>Walafrida densiflora</i>	

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

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

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

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

Mammal species observed

Scientific name	Common Name	IUCN Red List Status
<i>Cryptomys hottentotus</i>	Common Mole-Rat	LC



Avifaunal species observed

Scientific Name	Common Name	IUCN status
<i>Vanellus coronatus</i>	Crowned Lapwing	LC
<i>Euplectes orix</i>	Southern Red Bishop	LC
<i>Vanellus armatus</i>	Blacksmith Lapwing	LC
<i>Acridotheres tristis</i>	Common Myna	LC
<i>Bostrychia hagedash</i>	Hadedda Ibis	LC
<i>Streptopelia capicola</i>	Cape Turtle Dove	LC
<i>Passer domesticus</i>	House Sparrow	LC
<i>Streptopelia senegalensis</i>	Laughing Dove	LC
<i>Euplectes progne</i>	Long-tailed Widowbird---	LC
<i>Bubulcus ibis</i>	Cattle egret	LC

LC = Least concerned. NT = Near Threatened, NYBA = Not yet been assessed by the IUCN.

Insect species observed

Scientific Name	Common Name	IUCN Status
<i>Danaus chrysippus aegyptius</i>	African Monarch	NYBA
<i>Junonia natalica</i>	Yellow Pansy	LC
<i>Junonia orithya madagascariensis</i>	Eyed Pansy	NYBA
<i>Phymateus morbillosus</i>	Common Milkweed Locust	NYBA
<i>Pontia helice</i>	Meadow White	NYBA
<i>Apis mellifera</i>	Honey Bee	NYBA
<i>Spilostethus pandurus</i>	Milkweed Bug	NYBA
<i>Zizeeria knysna</i>	Sooty Blue	NYBA
<i>Astylus atromaculatus</i>	Spotted Maize Beetle	NYBA
<i>Cheilomenes lunata</i>	Lunate Ladybird	NYBA
<i>Diaphone eumela</i>	Cherry Spot	NYBA
<i>Pantala flavescens</i>	Wandering Glider	LC
<i>Orthetrum julia</i>	Julia Skimmer	LC

NYBA = Not Yet Been Assessed, LC = Least Concern

Reptile species observed

Scientific name	Common Name	IUCN Red List Status
<i>Lamprophis cepensis</i>	Brown House Snake	NYBA

Arachnid species observed

Scientific name	Common Name	IUCN Red List Status
Agelenidae	Funnel-web Spiders	NYBA

NYBA = Not Yet Been Assessed, LC = Least Concern



APPENDIX G – Floral SCC

Table G1: PRECIS and GDARD plant list for the QDS 2627DB (Raimondo *et al.*, 2009; SANBI, www.sanbi.org).

Family	Species	National status	Provincial Status	Habitat description	POC %
Amaryllidaceae	<i>Boophone disticha</i>	LC	Declining	Dry grassland and rocky areas.	50
Amaryllidaceae	<i>Crinum bulbispermum</i>	LC	Declining	Near rivers, streams, seasonal pans and in damp depressions	70
Asteraceae	<i>Gnaphalium nelsonii</i>	NT	NT	Seasonally wet places in grassland and savanna, and along dry watercourses.	20
Hypoxidaceae	<i>Hypoxis hemerocallidea</i>	LC	Declining	Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Appears to be drought and fire tolerant	60
Asteraceae	<i>Cineraria austrotransvaalensis</i>	NT	NT	Amongst rocks on steep hills and ridges, at the edge of thick bush or under trees on a range of rock types: quartzite, dolomite and shale, 1400-1700 m	0
Aizoaceae	<i>Delosperma macellum</i>	EN	EN	In loose gravel in open places near trees.	20
Asphodelaceae	<i>Kniphofia typhoides</i>	NT	NT	Low lying wetlands and seasonally wet areas in climax <i>Themeda triandra</i> grasslands on heavy black clay soils, tends to disappear from degraded grasslands.	40
Aizoaceae	<i>Lithops lesliei</i> subsp. <i>lesliei</i>	NT	NT	Primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses.	0

CR PE = Critically Endangered Potentially Extinct; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern



APPENDIX H – Faunal SCC

Table H1: RDL Mammal Species for the Gauteng Province (GDARD 2014).

Scientific Name	Common name	IUCN Status	GDARD Status
<i>Neamblysomus julianae</i>	Juliana's Golden Mole	EN	VU
<i>Mystromys albicaudatus</i>	White-tailed Mouse	EN	EN
<i>Atelerix frontalis</i>	Southern African Hedgehog	LC	NT
<i>Lutra maculicollis</i>	Spotted-necked Otter	NT	NT
<i>Miniopterus schreibersii</i>	Scheiber's Long-Fingered Bat	NT	NT
<i>Myotis tricolor</i>	Temminck's Hairy Bat	LC	NT
<i>Rhinolophus blasii</i>	Blasius's/Peak-Saddle Horseshoe Bat	LC	VU
<i>Rhinolophus clivosus</i>	Horseshoe Bat	LC	NT
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC	NT
<i>Rhinolophus hildebrandtii</i>	Hildebrandt's Horseshoe Bat	LC	NT

VU = Vulnerable, EN = Endangered, NT = Near Threatened, LC = Least Concern

Table H2: RDL Avifaunal Species for the Gauteng Province (GDARD 2014).

Scientific Name	Common name	IUCN Status	Regional Status	GDARD Status
<i>Gyps coprotheres</i>	Cape Vulture	EN	EN	VU
<i>Anthropoides paradiseus</i>	Blue Crane	VU	NT	VU
<i>Falco naumanni</i>	Lesser Kestrel	LC	Ad mon	-
<i>Tyto capensis</i>	African Grass-Owl	LC	VU	VU
<i>Circus ranivorus</i>	African Marsh-Harrier	LC	EN	VU
<i>Gorsachius leuconotus</i>	White-backed Night Heron	LC	VU	VU
<i>Eupodotis senegalensis</i>	White-bellied Korhaan	LC	VU	VU
<i>Podica senegalensis</i>	African Finfoot	LC	VU	VU
<i>Mirafraga cheniana</i>	Melodious Lark	NT	End and N-end	NT
<i>Sagittarius serpentarius</i>	Secretary bird	VU	VU	NT
<i>Ciconia nigra</i>	Black Stork	LC	VU	-
<i>Eupodotis caerulescens</i>	Blue Korhaan	NT	End and N-end	NT
<i>Polemaetus bellicosus</i>	Martial Eagle	VU	EN	-
<i>Phoenicopterus minor</i>	Lesser Flamingo	NT	NT	-
<i>Phoenicopterus roseus</i>	Greater Flamingo	LC	NT	-
<i>Alcedo semitorquata</i>	Half-collared Kingfisher	LC	NT	NT

VU = Vulnerable, NT = Near Threatened, LC = Least Concern, EN = Endangered, Ad mon = Additional Monitoring, End and N-end = Endemic and Near endemic



Table H3: RDL Invertebrates Species for the Gauteng Province (GDARD 2014)

Scientific Name	Common name	IUCN Status	GDARD Status
<i>Lepidochrysops praeterita</i>	Highveld Blue Butterfly	NYBA	VU
<i>Chrysothrix aureus</i>	Heidelberg Copper	NYBA	VU
<i>Ichneustoma stobbiai</i>	Stobbia's Fruit Chafer Beetle	NYBA	VU
<i>Aloeides dentatis</i>	Roodepoort Copper Butterfly	NYBA	VU

VU = Vulnerable, NYBA = Not yet been assessed

Table H4: RDL Reptile Species for the Gauteng Province (GDARD 2014)

Scientific Name	Common name	IUCN Status	GDARD Status
<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake	NT	NT

NT = Near Threatened

Avifaunal Species for the pentad 2635_2750 and 2640_2750 within the QDS 2627DB.

http://sabap2.adu.org.za/pentad_info.php?pentad=2635_2750§ion=species

http://sabap2.adu.org.za/pentad_info.php?pentad=2640_2750§ion=species



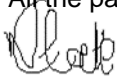
APPENDIX I – Declaration and Specialists CV's

Declaration

Declaration that the specialist is independent in a form as may be specified by the competent authority

I, Nelanie Cloete, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist





**SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT
INFORMATION
CURRICULUM VITAE OF NELANIE CLOETE**

PERSONAL DETAILS

Position in Company	Senior Scientist Botanical Science and Terrestrial Ecology
Date of Birth	6 October 1983
Nationality	South African
Languages	English, Afrikaans
Joined SAS Group of Companies	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP)
Member of the South African Association of Botanists (SAAB)
Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group
Member of the Grassland Society of South Africa (GSSA)
Member of the Botanical Society of South Africa (BotSoc)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State
Africa - Democratic Republic of the Congo (DRC)

SELECTED PROJECT EXAMPLES

Floral Assessments

- Floral assessment as part of the environmental assessment and authorisation process for the proposed Mzimvubu water project at Maclear, Eastern Cape.
- Floral assessment as part of the environmental authorisation process for the proposed Assmang Iron Ore Black Rock, Northern Cape Province.
- Floral assessment as part of the environmental authorisation process for the proposed Bloemwater Knellpoort water project pipeline assessment, Free State Province.
- Terrestrial ecological scan as part of the environmental authorisation process for the proposed Sappi Pipeline, Gauteng.
- Floral assessment as part of the proposed Setlagole Mall development, North West Province.
- Floral assessment as part of the coastal habitat changes in the Brand-se Baai area, Western Cape.



Environmental and Ecological Management Plans

- Biodiversity Action plans for African Exploration, Mining and Finance Corporation in line with the NEMBA requirements.
- Biodiversity Action plans for Twickenham Platinum mining operations in line with the NEMBA requirements, Limpopo Province.
- Biodiversity Action plans for Bokoni Platinum mining operations in line with the NEMBA requirements, Limpopo Province.
- Maintenance and Management Plan for the Gamagara River, Northern Cape.
- Development of the Limpopo Province Environmental Outlook Report.

Permit applications for protected tree and floral species

- Permit application for the removal of protected tree species for the Bushbuckridge Shopping Mall development within the Mpumalanga Province.
- Permit application for the removal and propagation of protected tree species for the Open Cast Operations within Bokoni Platinum Mine in the Limpopo Province.
- Permit application for the removal of protected tree species for Modikwa Mine within the Limpopo Province.
- Permit application for the removal of protected tree species for the Umfolozi Power line within the Kwa-Zulu Natal Province.
- Permit application for the removal of protected tree species for the expansion activities at Black Rock Mining Operations, Northern Cape Province.
- Permit application for the removal of protected tree species for the expansion activities at Assmang Dwars Rivier Mine, Limpopo Province.





**SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT
INFORMATION
CURRICULUM VITAE OF MARELIE MEINTJIES**

PERSONAL DETAILS

Position in Company	Junior Field Biologist
Date of Birth	8 July 1986
Nationality	South African
Languages	English, Afrikaans
Joined SAS	April 2015

EDUCATION

Qualifications

MSc Medicinal Plant Science (University of Pretoria)	2014
BSc (Hons) Medicinal Plant Science (University of Pretoria)	2012
BSc Biotechnology (University of Pretoria)	2011

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, Northern Cape, Western Cape

SELECTED PROJECT EXAMPLES

Terrestrial Assessments

- Floral Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Leslie 2 underground coal mining operation, Gauteng Province.
- Floral Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the proposed development of Zwavelpoort 373-JR Portions 116 and 130, Pretoria, Gauteng Province
- Floral Ecological assessment for the Jeannette Expansion Project at the Taung Gold International Mine near Welkom, Free State Province.
- Terrestrial Sensitivity Scan as part of the Environmental Authorisation Process for the proposed Sagewood Ext 17 development within the Summerset Area, Gauteng
- Terrestrial Sensitivity Scan as part of the Environmental Authorisation Process for the proposed Kyalami X4 development, Midrand, Gauteng Province
- Terrestrial Ecological Sensitivity Scan as part of the Environmental Assessment and Authorisation Process for the proposed development on erf 199, Witfield, Boksburg, Gauteng Province
- Terrestrial Ecological Scan as part of the Environmental Authorisation Process for the proposed development of Witfontein Ext 87, Gauteng province
- Terrestrial Sensitivity Scan as part of the environmental impact assessment and authorisation process for the proposed development of a pipeline in Kriel, Mpumalanga Province.

Wetland Assessments

- Riparian Zone Ecological Assessment as well as a Riparian Rehabilitation and Management Plan for the proposed maintenance activities associated with the LC de Villiers Sports Campus of the University of Pretoria, Gauteng Province.
- Wetland Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Expansion of the Cambrian Cemetery, Gauteng Province
- Wetland Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Expansion of the Kromvlei Cemetery, Gauteng Province



Wetland Rehabilitation and Monitoring Plans

- Wetland Rehabilitation and Management Plan for the wall construction within the Riversands Estate, Midrand, Gauteng Province
- Freshwater Resource Rehabilitation and Management Plan as part of the Water Use Authorisation for the Proposed Belhar Potable Water Pipeline over the Kuils River, Western Cape Province
- Wetland Rehabilitation and Management Plan for the wetland and open space area associated with the Carlswald Valley Residential Development, City of Johannesburg, Gauteng Province.
- Wetland Rehabilitation and Management Plan for the wetland resource within the Carlswald Valley Residential Development, Kyalami, Gauteng Province

Desktop Ecological Assessments

- Aquatic and Wetland Scoping Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Witfontein Mining Project, near Bethal, Mpumalanga Province
- Freshwater Resource Scoping Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Photovoltaic Solar Energy Facility on the Heuningklip Farm near Vredenburg, Western Cape Province
- Desktop Ecological Assessment and Site Sensitivity Report as part of the Environmental Assessment and Authorisation Process prior to Prospecting Activities on the Farm Zeekoebaart 306 Rd, Postmasburg, Northern Cape Province
- Desktop Ecological Assessment as part of the environmental assessment and authorisation process for the Genet Manganese (Pty) Ltd prospecting area on the farm Lemoenkloof No 456, Northern Cape Province.

Screening Assessment

- Desktop Ecological Assessment and Field Verification Report as part of the Screening Assessment for the Proposed Soweto Power Park Ext 3, Gauteng Province

Water Use Applications

- General Authorisation Application Process to obtain authorisation from the Department of Water and Sanitation for the water uses related to the proposed road upgrades associated with the Pearl Valley Phase II Development, Paarl, Western Cape Province

Miscellaneous Projects

- Desktop Ecological Assessment and Site Sensitivity Report as part of the Elikhulu TSF Facility site selection process, Evander, Mpumalanga Province
- Ecological Screening Assessment, Ground Truthing and Site Sensitivity Report for the Proposed Tubatse SEZ. Steelpoort, Limpopo Province
- Identification of Important Medicinal Plant Species to be rescued and relocated as part of the Rescue and Relocation Plan for the area earmarked for surface infrastructure at the Yzermyn Colliery near Dirkiesdorp, Mpumalanga
- Biodiversity Survey for the BMW Group South Africa at the Rosslyn Manufacturing Plant, Rosslyn, Gauteng Province
- Biodiversity and Ecosystem Health for Limpopo Province, South Africa Thematic Chapter as part of Limpopo Environmental Outlook Report
- Literature Review and Initial Assessment on the control of Alien and Invasive Plants associated with aquatic environments within the City of Johannesburg

