TERRESTRIAL ECOLOGICAL HABITAT INTEGRITY INVESTIGATION AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED DEVELOPMENT OF BULK SERVICES ASSOCIATED WITH HAMMANSKRAAL X10, HAMMANSKRAAL, GAUTENG

Prepared for

TGM Environmental Services cc

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EXECUTIVE SUMMARY

It is the opinion of the ecologists that this study provides the relevant information required in order to implement IEM and to ensure that the best long-term use of the ecological resources in the proposed bulk sewer and potable water pipelines will be made in support of the principle of sustainable development. 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 6.4) are adhered to.

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 bulk services, namely bulk sewer and potable water pipelines, for Hammanskraal X10 within the Gauteng Province.

Specific outcomes required from this report include the following:

- To define the Present Ecological State (PES) of the terrestrial ecological resources associated with the bulk service pipelines and 30m road corridor;
- To determine and describe habitats, communities and the ecological state of the bulk service pipelines and 30m road corridor;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the proposed 30m bulk service pipelines corridor;
- 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 and operation of the bulk service pipelines might have on the terrestrial ecology associated with the area, and to develop mitigation and management measures for all phases of the development.

Terrestrial Results

The findings of the field assessment indicate that that study area is characterised by three habitat units, namely Transformed Bushveld Habitat, Transformed Habitat and Watercourses, which have been negatively affected by anthropogenic impacts. Anthropogenic activities associated with the Transformed and Transformed Bushveld includes historic agriculture activities, dumping of building and household rubble and existing pipelines with associated maintenance roads and the sensitivity of the habitat unit is deemed to be low. The anthropogenic activities associated with the Watercourses includes historic and present over grazing of local cattle, dumping of building and household rubble and alien and invasive plant proliferation. However, the sensitivity of the habitat unit is deemed to be high because of the niche habitat the Watercourses creates for floral and faunal species.

The perceived impact significance of the proposed activities during all phases of development before mitigation takes place are medium-high to medium-low impacts. If effective mitigation takes place, all impacts may be reduced to low impacts, as any perceived risks to the floral and faunal ecology are easily mitigated. The objective of this study was to provide sufficient information on the floral and faunal ecology of the area, together with other studies on the physical and socio-cultural environment, in order for the Environmental Assessment Practitioner (EAP) and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The needs for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure economic development of the country.

DOCUMENT GUIDE

The table below provides the NEMA (2017) Requirements for Biodiversity Assessments and also the relevant sections in the reports where these requirements are addressed.

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix G
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix G
b)	A declaration that the specialist is independent	Appendix G
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 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
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
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\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 4 and 6
k)	Any mitigation measures for inclusion in the EMPr	Section 6.4
l)	Any conditions for inclusion in the environmental authorisation	Section 6.4
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6.4
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 6.4
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

Alien vegetation	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.
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
IBA (Important Bird and Biodiversity Area)	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.
Indigenous vegetation	Vegetation occurring naturally within a defined area.
RDL (Red Data listed) species	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
SCC (Species of Conservation Concern)	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 PE	Critically Endangered, Potentially Extinct
CR	Critically Endangered
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EN	Endangered
EW	Extinct in the Wild
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature
LC	Least Concern-
LNG	Liquefied Natural Gas
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)
NT	Near Threatened
PES	Present Ecological State
POC	Probability of Occurrence
POSA	Plants of Southern Africa
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
SACAD	South Africa Conservation Area Database
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Area Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
TOPS	Threatened or Protected Species
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 bulk services, namely bulk sewer and potable water pipelines, for Hammanskraal X10 within the Gauteng Province, henceforth collectively referred to as the "bulk service pipelines" (Figure 1 and 2).

The proposed bulk sewer pipeline is situated approximately 900m west of the R101 (old Warmbad Road) and 2.4km from the N1 Highway. The M21 traverses the southernmost portion of the bulk sewer pipeline, while the bulk potable water pipeline is situated approximately 1.1 km south of the M21. The Apies River is situated approximately 60m east of the bulk sewer pipeline, and 2.4 km east of the bulk potable water pipeline

This report, after consideration and the description of the ecological integrity of proposed bulk sewer and potable water pipelines and the immediate surrounding area (30m corridor), 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.

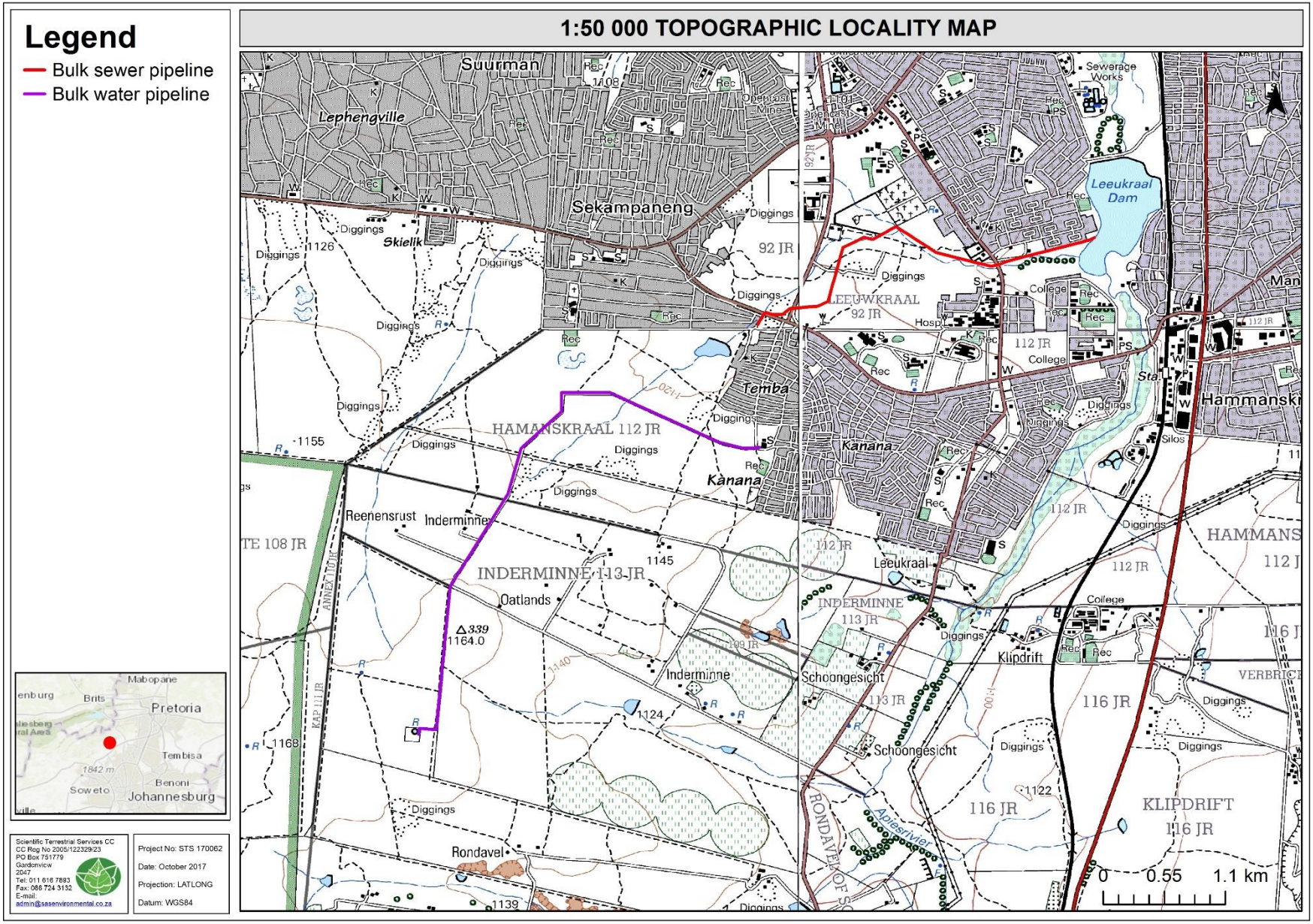


Figure 1: The proposed road depicted on a 1:50 000 topographical map in relation to the surrounding area.

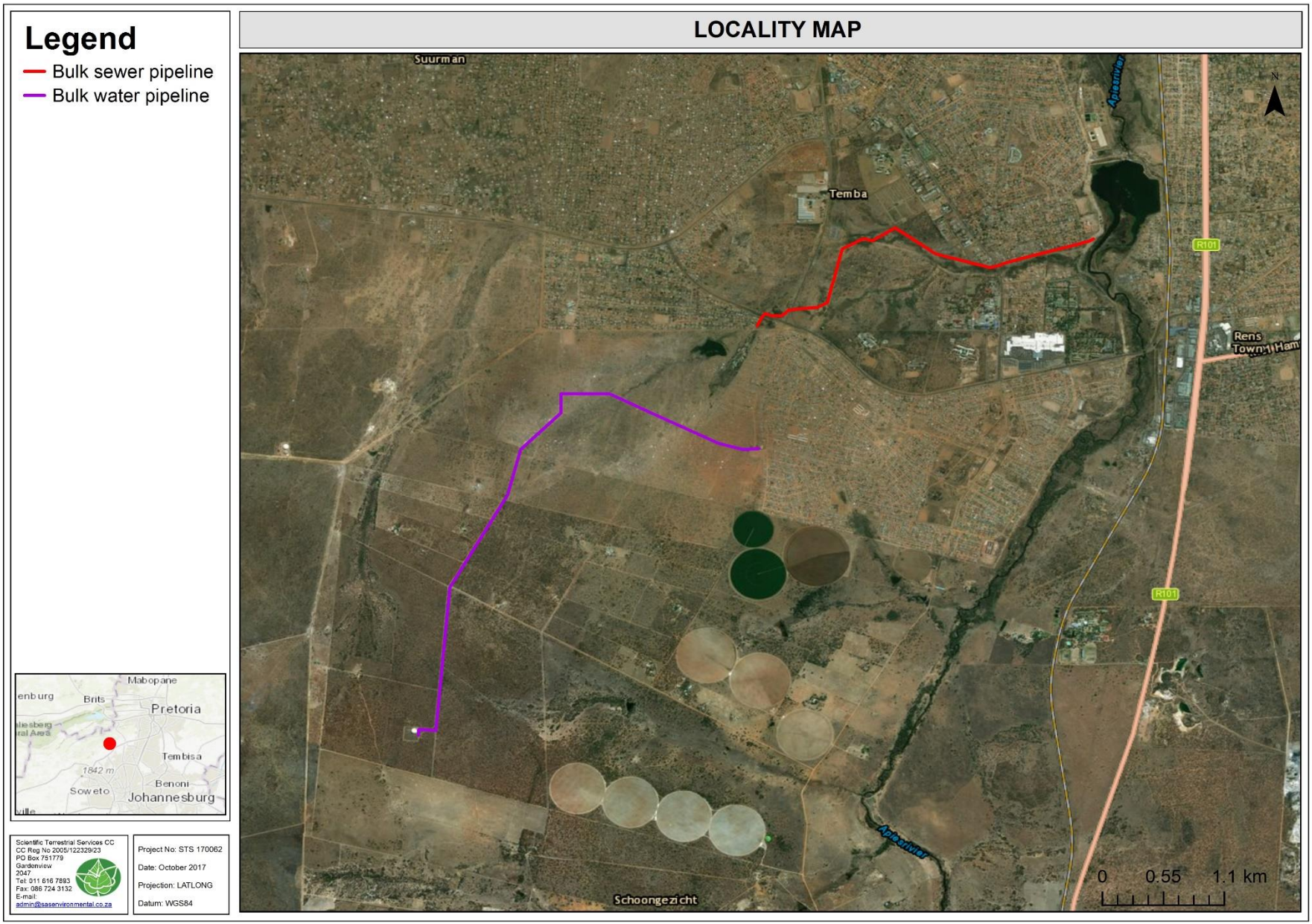


Figure 2: Digital Satellite image depicting the location of the proposed road in relation to surrounding areas.

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 bulk service pipelines and 30m road corridor;
- To determine and describe habitats, communities and the ecological state of the bulk service pipelines and 30m road corridor;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the proposed 30m bulk service pipelines corridor;
- 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 and operation of the bulk service pipelines might have on the terrestrial ecology associated with the 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 bulk service pipelines and 30m corridor and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral 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 30m bulk service pipelines corridor may have been missed during the assessment; and
- The data presented in this report are based on one site visit, undertaken in September 2017 (beginning of spring). 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 previous experience in the

area, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the proposed bulk sewer and potable water pipelines.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

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

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 30m bulk service pipelines corridor 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 bulk service pipelines 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 bulk service pipelines and 30m corridor was conducted during September 2017 in order to confirm the assumptions made during consultation of the maps and to determine the ecological status of the 30m corridor. 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 Appendix B; and
- For the methodologies relating to the impact assessment and development of the mitigation measure, please refer to Appendix C of this report.

2.2 Sensitivity Mapping

All the ecological features of the bulk service pipelines and 30m corridor were considered and sensitive areas were delineated with the use of a Global Positioning System (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 bulk service pipelines

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 bulk service pipelines actual biodiversity characteristics.

Table 1: Summary of the conservation characteristics for the bulk service pipelines.

Details of the bulk service pipelines in terms of Mucina & Rutherford (2006)		Description of the vegetation type(s) relevant to the proposed road (Mucina & Rutherford 2006)		
Biome	The bulk service pipelines fall within the **Savanna** Biome.	**Vegetation Type**	Central Sandy Bushveld	Springbokvlakte Thornveld
Bioregion	The bulk service pipelines fall within the **Central Bushveld** Bioregion	**Climate**	Summer rainfall with very dry winters	Summer rainfall with very dry winters
		Altitude (m)	850–1 450 m	900–1 200 m
Vegetation Type (Figure 3)	The bulk potable water pipeline and the southern portion of the bulk sewer pipeline fall within the **Central Sandy Bushveld** Vegetation type, with the northern portion of the bulk sewer pipeline is situated within the **Springbokvlakte Thornveld** Vegetation type.	**MAP* (mm)**	596	567
		MAT* (°C)	18.0	18.5
		MFD* (Days)	14	11
		MAPE* (mm)	2234	2234
		MASMS* (%)	77	78
Conservation details pertaining to the proposed bulk sewer and potable water pipelines (Various databases)		**Distribution**	Limpopo, Mpumalanga, Gauteng and North-West Provinces:	Limpopo, Mpumalanga, North-West and Gauteng Provinces
NBA (2011)	The bulk service pipelines fall within an area that is currently poorly protected	**Geology & Soils**	The southern and eastern parts of this area are underlain by granite of the Lebowa Granite Suite and some granophyre of the Rashoop Granophyre Suite (both Bushveld Complex, Vaalian). In the north, the sedimentary rocks of the Waterberg Group (Mokolian Erathem) are most important.	Rocks are part of the volcano-sedimentary Karoo Supergroup. Most abundant in the area are the mafic volcanics (tholeitic and olivine basalts and nephelinites) of the Letaba Formation, then the mudstones of the Irrigasie
National Threatened Ecosystems (2011)	The northern portion of the bulk sewer pipeline falls within the **remaining extent of the vulnerable Springbokvlakte** Thornveld Ecosystem. (Figure 4).			
SAPAD (2017) (Figure 5)	The SAPAD (2017) database indicate the Sterkwater Private Nature Reserve (PNR) to be situated ± 1 km west, and the Gelderland PNT ± km southwest of the potable water pipeline. The Brits PNR is situated ± 7.2 km southeast of the bulk service pipelines. The Fana PNR is situated ± 6.4 km east and the Ditholo PNR ± 7.4 km northwest of the bulk sewer pipeline. There are no other protected or conservation areas within 10 km of the bulk service pipelines.	**Conservation**	Vulnerable. Target 19%. Less than 3% statutorily conserved	Endangered. Target 19%. Only 1% statutorily conserved
		Vegetation & landscape features (Dominant Floral Taxa in Appendix F)	Low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on deep sandy soils and low, broad-leaved *Combretum* woodland on shallow rocky or gravelly soils. Species of *Acacia, Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. Grass-dominated herbaceous layer with relatively low basal cover on dystrophic sands.	Open to dense, low thorn savanna dominated by *Acacia* species or shrubby grassland with a very low shrub layer. Occurs on flat to slightly undulating plains.
IBA (2015)	There are no IBAs situated within ± 10 km of the bulk service pipelines.			
Detail of the proposed bulk sewer and potable water pipelines in terms of the Gauteng Conservation Plan (C-Plan V3.3, 2011) (Figure 5)				
Critical Biodiversity Area (CBA) (Figure 5)	The eastern and central portion of the sewer pipeline falls within a CBA, considered important for "Red" and "Orange" listed plant, "Red" listed mammal habitat and for primary vegetation. A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges (GDARD, 2014a)			
Ecological Support Area (ESA) (Figure 5)	The water pipeline traverses two areas considered to be ESAs, while the western most section of the sewer pipeline is also situated within an ESA. An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.			
Wetland Buffer (Figure 6)	According the Gauteng C-Plan the eastern most section of the sewer pipeline falls within a wetland buffer, with a second wetland buffer situated ± 340m southwest of the sewer pipeline. There are no wetland buffers associated with the water pipeline or its associated investigation area			
River Buffer (Figure 6)	The Gauteng C-Plan indicated a non-perennial tributary of the Apies River traversing both the central portion of the sewer pipeline as well as the northern portion of the water pipeline. The Apies River is also indicated to be situated ± 60m east of the sewer pipeline, with another non-perennial tributary of the Apies River situated ± 240m east of the southern portion of the water pipeline.			

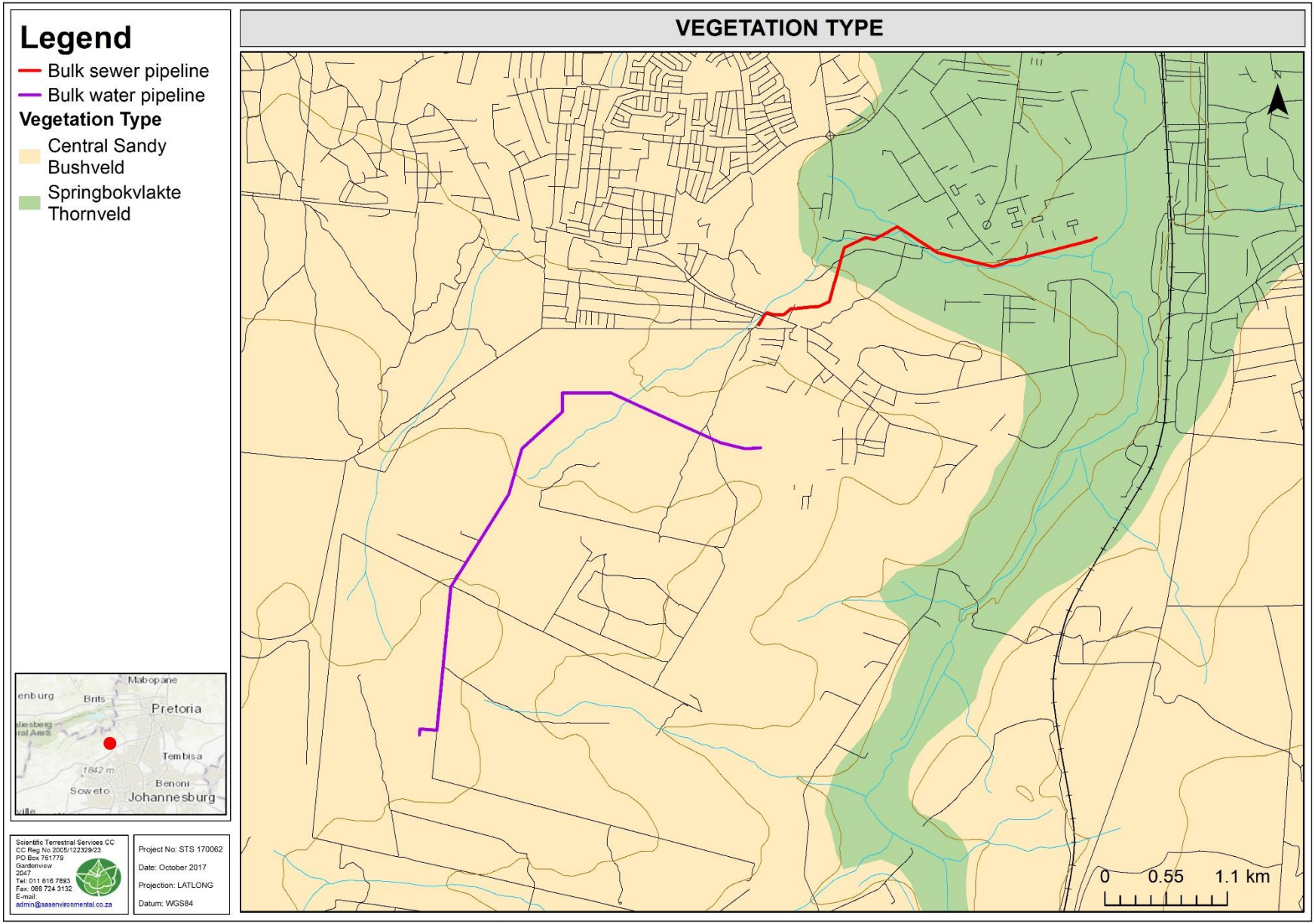


Figure 3: Vegetation types associated with the bulk service pipelines according to Mucina & Rutherford (2012)

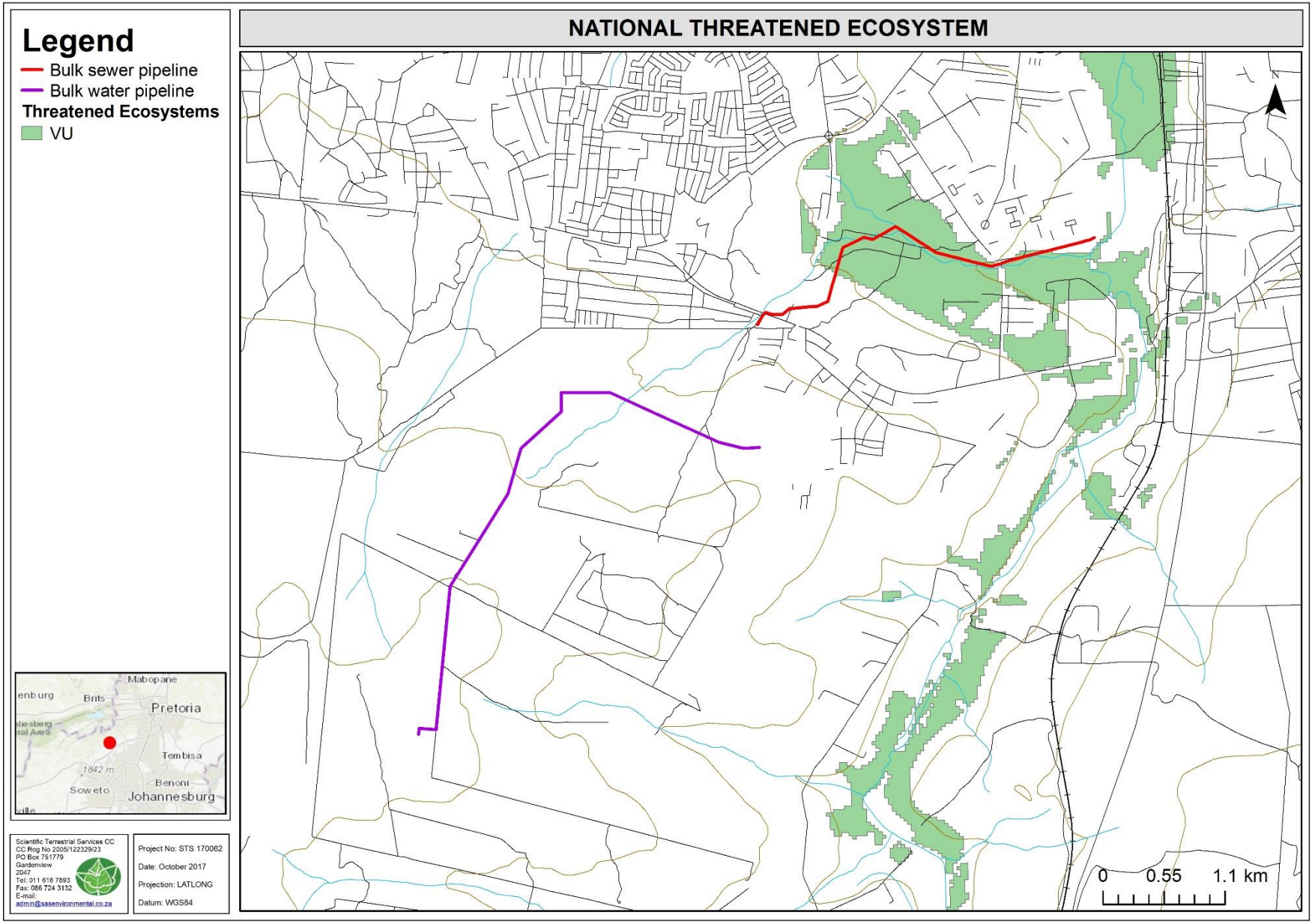


Figure 4: Vulnerable ecosystem, associated with the bulk sewer pipeline (National Threatened Ecosystem Database, 2011).

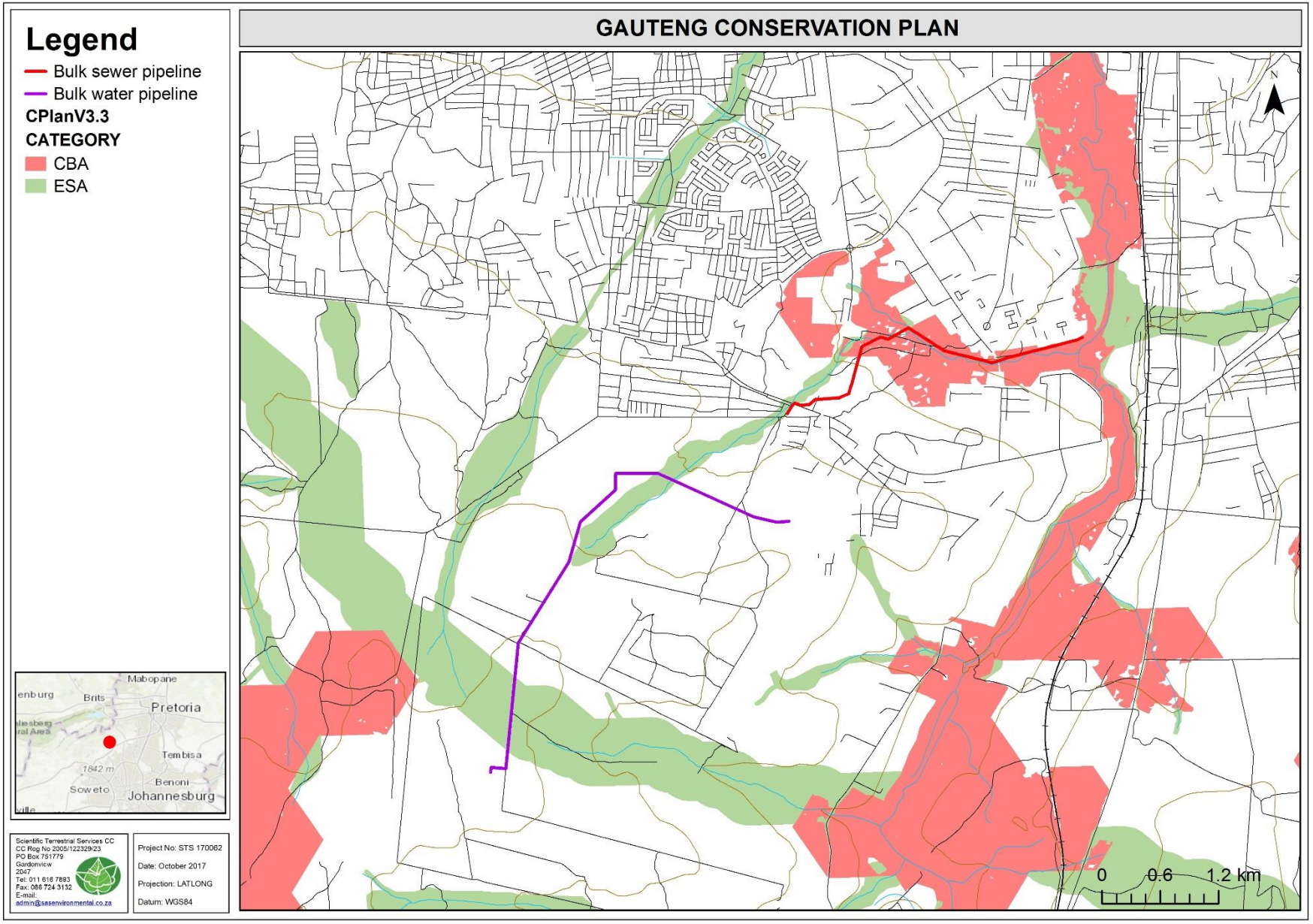


Figure 5: The bulk service pipelines associated with a CBA and ESAs according to the Gauteng C-Plan V3.3 (2011)

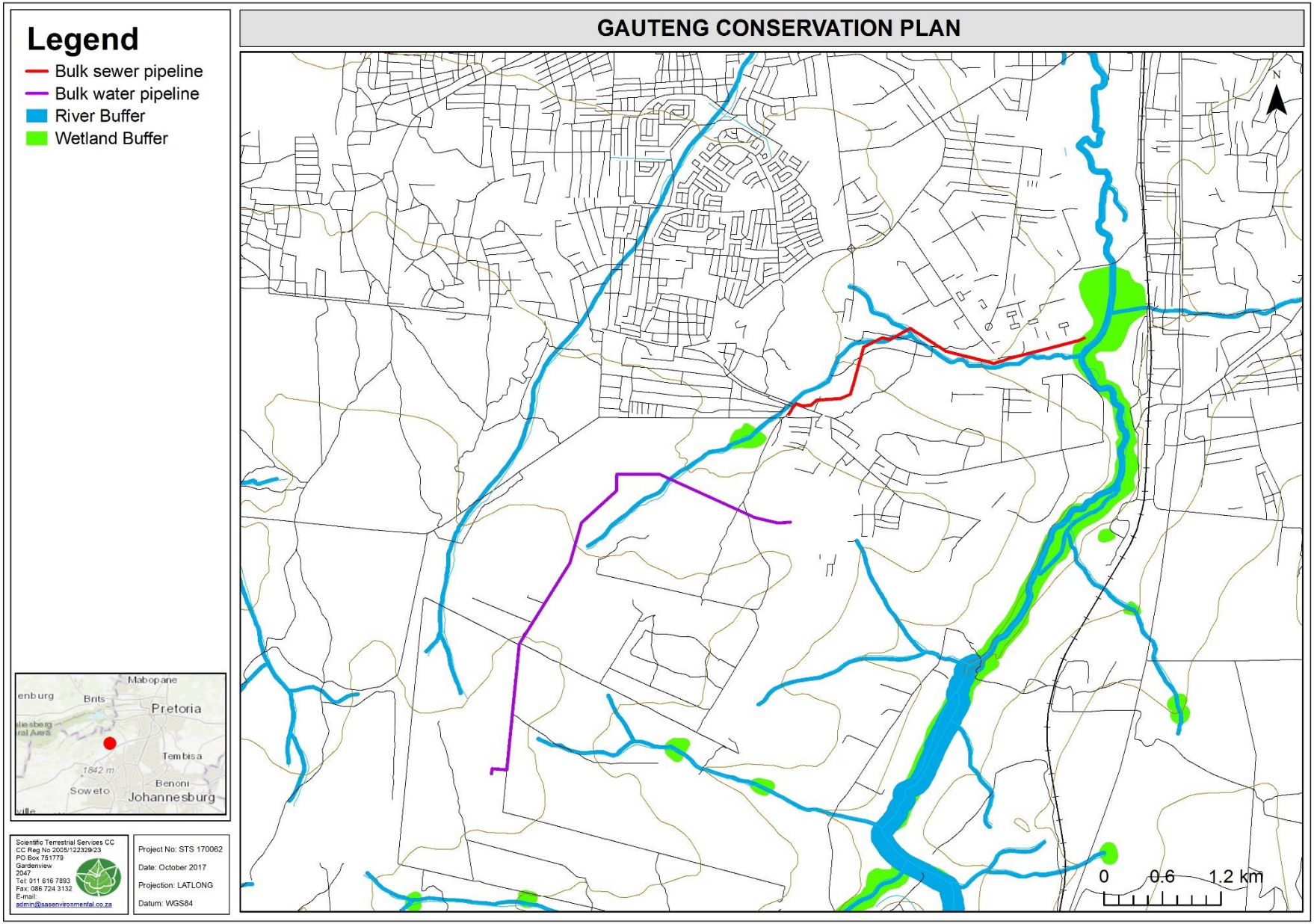


Figure 6: The bulk service pipelines associated with various River and Wetland Buffers according to the Gauteng C-Plan (2011)

4. TERRESTRIAL ECOLOGICAL ASSESSMENT RESULTS

4.1 Terrestrial Habitat Units

Following the assessment of the proposed bulk sewer and potable water pipelines and the immediate surrounding area, it is clear that there are three habitat types associated with the proposed bulk sewer and potable water pipelines. These habitat units are described below:

Transformed Habitat

The transformed habitat unit consists of areas where historical agricultural activities have occurred, and vegetation has been cleared for roads and housing, which has resulted in significant topographic alteration and the complete clearance of vegetation. Additional vegetation transformation has also taken place due to current and historic agricultural activities such as over grazing by local cattle and the establishment of alien and invasive tree communities and dumping of general household waste and building rubble.

Degraded Bushveld

This habitat unit is located along the entire proposed potable water pipelines of the study area, and a small section of the proposed bulk sewer line. The habitat unit is associated with private plots of land which are excluded from the surrounding communal areas, thus the vegetation associated with this habitat unit is less transformed. Forb species found within this habitat unit included *Acalypha angustata, Elephantorrhiza elephantina, Gnidia kraussiana, Hermannia lancifolia* and *Parinari capensis.* The graminoid layer was characterised by *Brachiaria nigropedata, Brachiaria serrata*, *Loudetia simplex*, *Schmidtia pappophoroides* and *Themeda triandra.* Tree species that were encountered throughout this habitat unit, where *Combretum apiculatum, Combretum hereroense, Vachellia karroo, Searsia lancea, Senegalia caffra, Burkea africana, Peltophorum africanum, Sclerocarya birrea subsp. caffra, Terminalia sericea and Grewia bicolor* were dominant within the woody layer.

Watercourses

This habitat unit is associated with the Apies River and associated buffer. The Apies River has been significantly impacted historically as a result of agricultural activities and more recently due to edge effects associated with urban development within the catchment. During the site assessment, it was apparent that the hydrological processes and geomorphology have been altered as a result of sand mining, agriculture and general edge effects associated with anthropogenic activities.These habitat units are discussed in detail below.

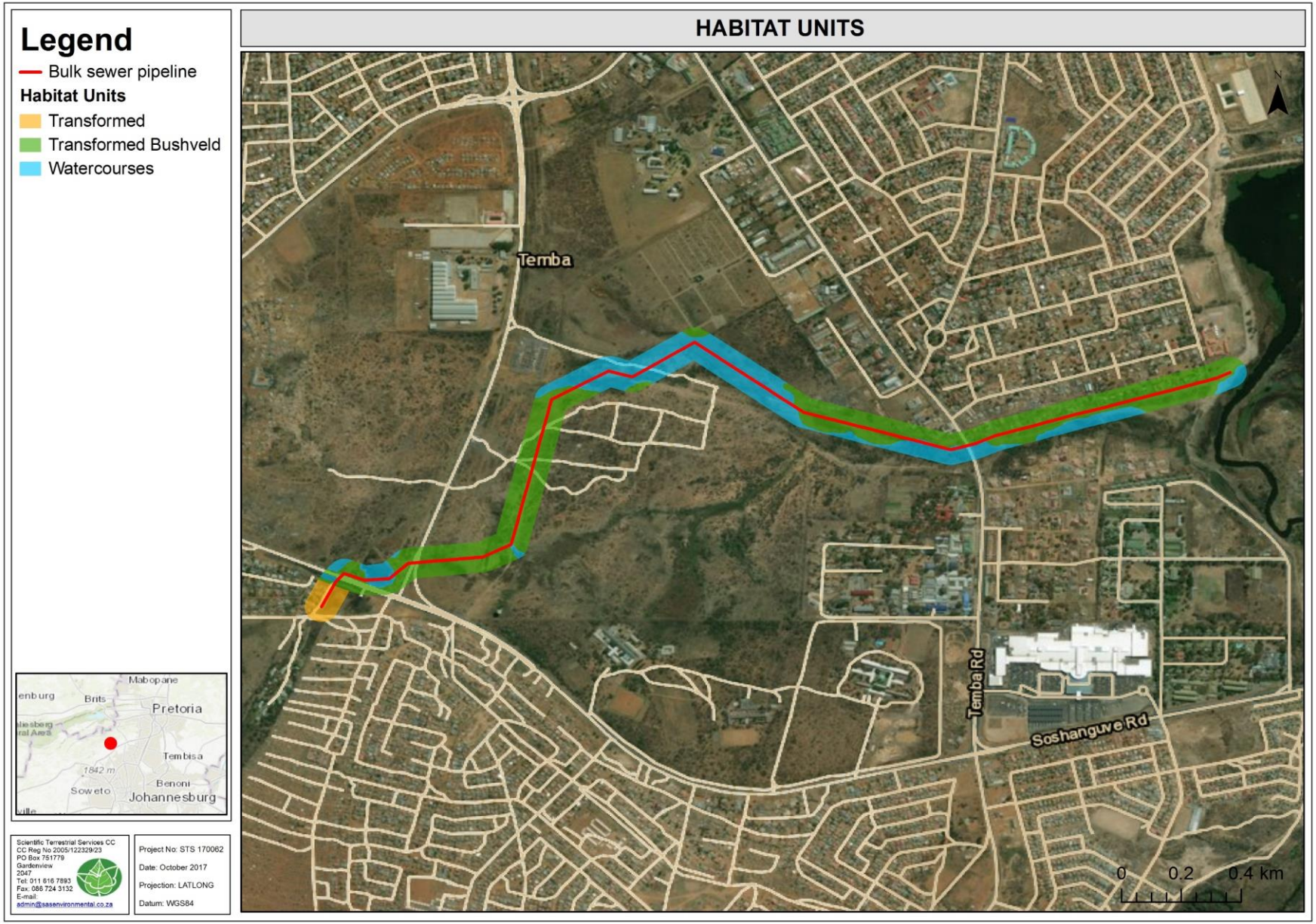


Figure 7: Habitat units associated with the proposed bulk sewer pipeline.

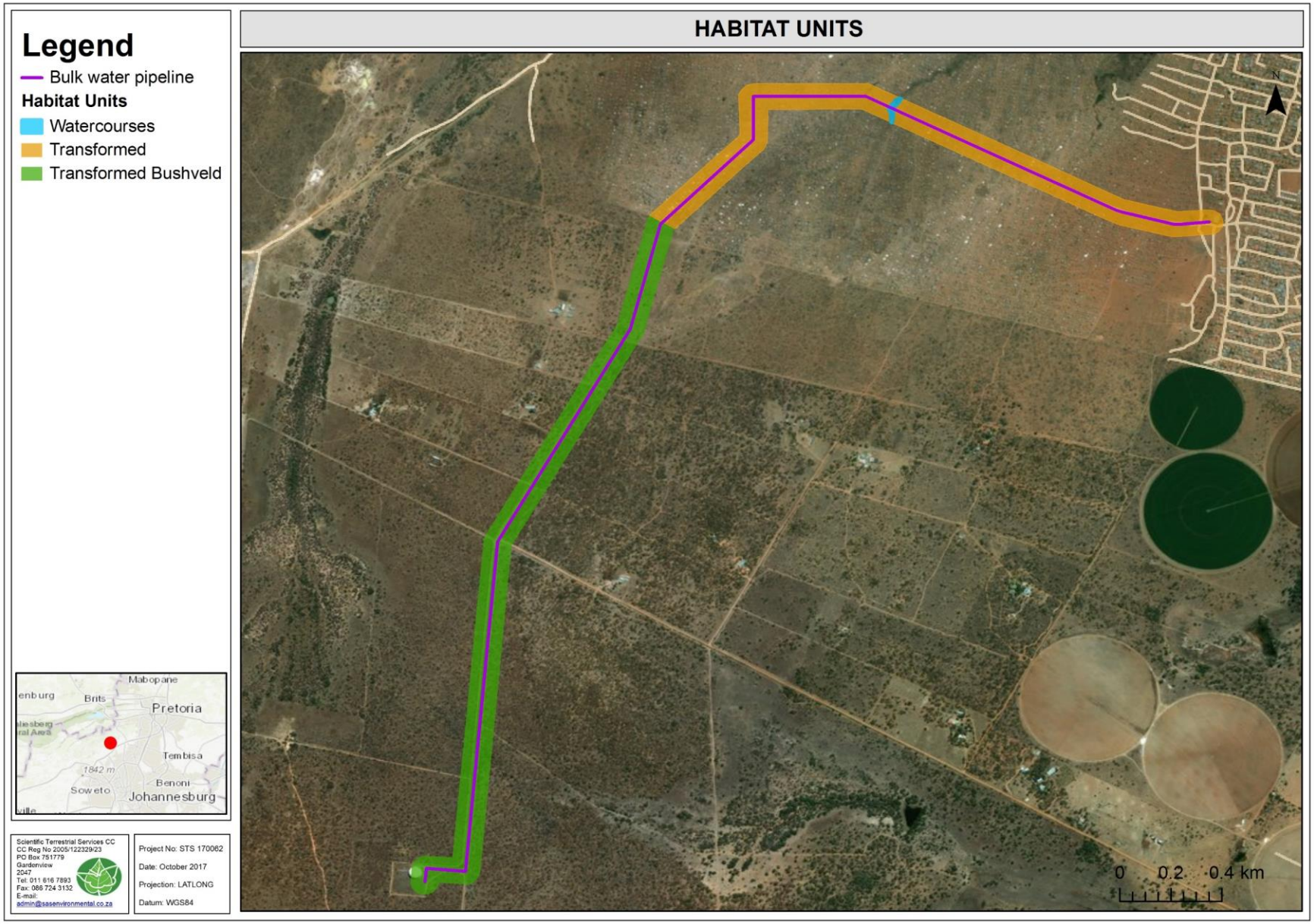


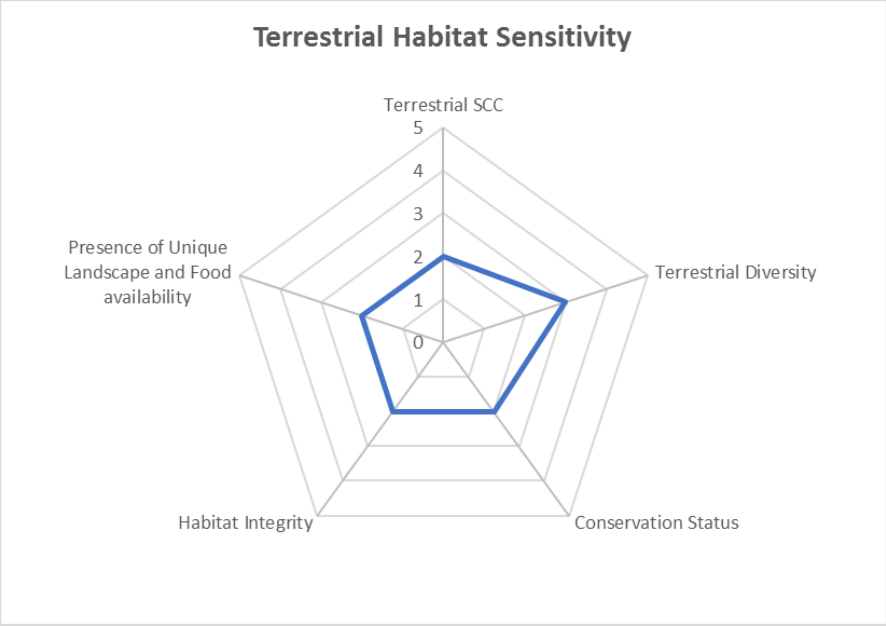
Figure 8: Habitat units associated with the proposed potable water pipeline

Table 2: Summary of results for the Transformed and Transformed Bushveld Habitat Units.

Transformed and Transformed Bushveld Habitat Units	**Terrestrial Sensitivity**	**Low**

Notes on Photograph: Above: Typical view of the proposed bulk sewer and potable water pipelines showing landscaped and vegetation present within the study area.

Faunal Sensitivity Graph:



Photograph:

Species of Conservation Concern (SCC)	*Sclerocarya birrea* subsp. *caffra* (Maroela) was the only floral SCC encountered during the assessment and due to habitat degradation, it is unlikely that any other floral SCC will occur within the study area. Permits from Department of Agriculture, Forestry and Fisheries (DAFF) should be obtained to remove, cut or destroy these tree species before any construction activities may take place.	**Terrestrial Habitat Integrity:** Overall, the habitat integrity of the habitat units are degraded because of historic and current anthropogenic activities associated with the exciting pipelines, over grazing by local cattle and dumping	**Business Case, Conclusion and Mitigation Requirements:** These habitat units are considered to be of low terrestrial ecological sensitivity. Thus, development of the proposed bulk sewer and

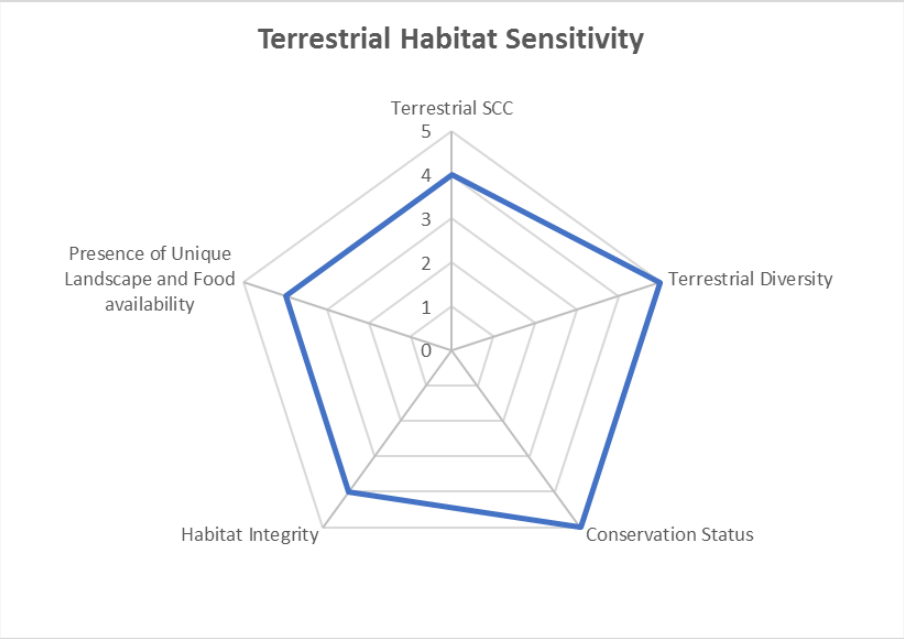
Terrestrial Species Diversity	Terrestrial species diversity associated with the proposed bulk sewer and potable water pipelines is considered to be intermediate, as a high abundance of alien and invasive floral species as well as garden ornamentals such as, *Melia azedarach*, *Tagetes minuta* and *Solanum mauritianum* were observed during the field assessment. Floral species such as *Aristida congesta*, *Cynodon dactylon, Melinis repens* and *Panicum maximum,* considered to be common and wide spread, were present throughout the site. Faunal species observed were primarily of the avifauna class such as *Upupa africana* (African Hoopoe), *Vanellus coronatus* (Crowned Lapwing) and *Bostrychia hagedash* (Hadeda Ibis), considered to be common and widespread species to the area.	of household and building rubble. This has resulted in a decrease in faunal and floral species diversity and abundance. *Sclerocarya birrea* subsp. *caffra* (Maroela) was the only floral SCC encountered during the field assessment, and no other floral and faunal SCC are likely to utilise the habitat unit for breeding, habitation or frequent foraging purposes.	potable water pipelines within the area is supported. However, the development footprint must be contained within the proposed bulk sewer and potable water pipelines footprint area, and edge effects on surrounding natural areas, with special mention of Watercourses, must be managed so that Watercourses are not unnecessarily disturbed. Finally, permits from Department of Agriculture, Forestry and Fisheries (DAFF) should be obtained to remove, cut or destroy *Sclerocarya birrea* subsp. *caffra* before any construction activities may take place.
Presence of Unique Landscapes and food availability	The Transformed and Transformed Bushveld Habitat Unit's ecological integrity has been too significantly degraded to be considered unique. High levels of anthropogenic activities and alien and invasive floral species proliferation have resulted in low levels of food availability within the study area. However, a number of seed bearing floral species are present within the study area, resulting in food resources for various invertebrate, avifaunal and small mammal species, therefore it is expected that common faunal species will be encountered within the study area.		
Conservation Status	The northern portion of the proposed bulk sewer pipeline falls within the remaining extent of the Springbokvlakte Bushveld Ecosystem listed as vulnerable (Mucina & Rutherford, 2006). However, the vegetation associated with the habitat unit is transformed, as the proposed bulk sewer line is utilising the existing sewer line, and is not conservation worthy. Thus, the habitat unit is of moderately low conservation importance.		

Table 3: Summary of results for the Watercourses.

Watercourse Habitat Unit	Terrestrial Sensitivity	Moderately High

Notes on Photograph: Typical views of the Apies river and immediate Watercourses areas.

Terrestrial Sensitivity Graph:



Photograph:

Species of Conservation Concern (SCC)	*Sclerocarya birrea* subsp. *caffra* (Maroela) was the only floral SCC encountered during the assessment and due to habitat degradation, it is unlikely that any other floral SCC will occur within the study area. Permits from Department of Agriculture, Forestry and Fisheries (DAFF) should be obtained to remove, cut or destroy these tree species before any construction activities may take place. The Watercourse areas provide niche habitat for a variety of faunal and floral species, the Watercourses are considered to be of moderately high sensitivity, and disturbance of the Watercourses must be minimised to what is absolutely essential for the proposed project.	**Terrestrial Habitat Integrity**: Disturbances relating to historical agricultural activities as well as the steady urbanisation of the catchment, have resulted in the clearing of vegetation, and proliferation of alien and invasive floral species. The assessment was conducted towards the beginning of spring season and therefore not all floral species present could be identified, disturbances such as informal fires,	**Business Case, Conclusion and Mitigation Requirements:** This habitat unit is considered to be of high terrestrial ecological sensitivity. Development of the proposed bulk sewer pipeline within the study area is supported. However, the development footprint must be contained within the proposed bulk sewer pipeline footprint area, and edge effects on surrounding natural areas, with special

Terrestrial Species Diversity	Dominant herbaceous floral species within the Watercourses include *Sporobolus africanus, Helichrysum kraussii, Imperata cylindrica, Typha capensis* and *Persicaria lapathifolia,* while the woody layer was characterised by *Combretum erythrophyllum, Salix babylonica* and *Vachellia karroo.* In areas where disturbance has occurred such as sand mining, alien and invasive floral species such as *Acacia mearnsii, Populus x canescens and Melia azederach* are abundant. Faunal species observed were primarily of the avifauna class such as *Vanellus armatus* (Blacksmith Lapwing), *Acridotheres tristis* (Common Myna) and *Streptopelia senegalensis* (Laughing Dove), considered to be common and widespread species to the area.	overgrazing of domestic livestock and extensive disposal of solid wastes within the Watercourses area and associated buffer areas were apparent. Even though habitat integrity was negatively impacted by anthropogenic activities, the ecological sensitivity is high because of the Watercourses that act as a niche habitat for several faunal species.	mention of Watercourses, must be managed so that Watercourses are not unnecessarily disturbed. The proposed bulk sewer pipeline must stay within the existing pipeline alignment to minimise the impact on the immediate surrounding area.
Presence of Unique Landscapes and food availability	The Watercourses are significantly congested by *Typha capensis* and *Phragmites australis*, however the extensive reed beds may provide some refugia for less sensitive faunal species, predominantly avifaunal species commonly associated with waterbodies such as *Euplectes orix.* (Southern Red Bishop). However, due to the degree of disturbances and ongoing anthropogenic activity in the area, it is considered unlikely that any faunal SCC will utilise the Watercourses resource on a permanent basis.		
Conservation Status	Although the Watercourses associated with the proposed bulk sewer pipeline are indicated to be a CBA, it is modified and congested by *Phragmites australis* and *Typha capensis*, whilst the vegetation community composition and structure has been significantly transformed from its perceived reference state. The Watercourses will provide niche habitat for a variety of faunal species. Thus, it is considered to be of high conservation importance.		

4.2 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) 2528AC and 2528AD.

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 E.

Due to the extensive habitat transformation associated with the proposed bulk sewer and potable water pipelines and surrounding area, only one protected tree species, namely *Sclerocarya birrea* subsp. *caffra* was encountered scattered throughout the Transformed Bushveld, Transformed habitat units and Watercourse areas. This species is protected in terms of the National Forest Act (NFA) of 1998, and disturbance of the trees must be avoided as far as possible. If no option other than destruction of the trees remains, the necessary permits must be applied for in terms of the National Forest Act (NFA) of 1998. However, should any other SCC floral species be found during development activities within the proposed bulk sewer and potable water pipelines, they are to be relocated to a suitable habitat within the vicinity of the proposed bulk sewer and potable water pipelines after obtaining the relevant permits. All rescue and relocation activities are to be overseen by a qualified botanist.

4.3 Faunal Species of Conservation Concern Assessment

During field assessments, it is not always feasible to identify or observe all species within an area, 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 proposed bulk sewer and potable water pipelines. Species listed in Appendix F whose known distribution ranges and habitat preferences include the proposed bulk sewer and potable water pipelines were taken into consideration.

None of the SCC listed in Appendix F were observed within the area surrounding the proposed bulk sewer and potable water pipelines and immediate surrounding area. *Lutra maculicollis* (Spotted-necked Otter) and *Tyto capensis* (Grass Owl) were of particular concern, however after consulting the relevant databases available, as well as the data gathered during the field assessment, of these species the probability of occurring in the area is deemed very low. The added impact of pollution in the aquatic ecosystems and constant presence of humans and domestic dogs within the study area is a further hindrance to these two species to be present within the study area. Thus, the proposed bulk sewer and potable water pipelines are not considered to be important in terms of faunal SCC conservation.

4.4 Alien and Invasive Plant Species

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

Table 4: Dominant alien vegetation species identified during the field assessment.

Species	English name	Country of Origin	Category*
Tagetes minuta	Tall khaki weed	South America	N/L
Arundo donax	Giant Reed	Mediterranean	1b
Acacia mearnsii	Black wattle	Australia	2
Populus x canescens	Grey Poplar	Europe and Asia	2
Bidens pilosa	Blackjack	South America	N/L
Conyza bonariensis	Hairy Horseweed	North America	N/L
Plantago lanceolata	Ribwort	Europe	N/L
Solanum elaeagnifolium	Silverleaf Nightshade	North America	1b
Sonchus oleraceus	Sow-Thistle	Europe, Asia and North America	4
Salix babylonica	Weeping willow	Asia	N/L
Melia azederach	Syringa	Asia to Australia	1b
Eucalyptus camaldulensis	Red river gum	Australia	2
Taraxacum officinale	Common Dandelion	Eurasia	N/L
Verbena tenuisecta	Fine leaf verbena	South America	N/L
Verbena bonariensis	Purple top	South America	1

N/L = Not Listed and not categorised

*** National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R586 of 2016**

- **Category 1a** – Invasive species that require compulsory control.
- **Category 1b –** Invasive species that require control by means of an invasive species management programme.
- **Category 2** – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
- **Category 3** – Ornamentally used plants that may no longer be planted. Existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

From the table above, it is clear that a high diversity of alien and invasive plant species was recorded. Alien species located within the proposed bulk sewer and potable water pipelines

must be removed according to the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R586 of 2016 during construction activities and at least five years after construction activities or as stipulated within the Alien and Invasive Plant Control Plan. Furthermore, it is recommended that the construction footprint, as far as possible be kept free from alien and invasive vegetation.

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

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Transformed and Transformed Bushveld	Low	Optimise development potential.	These habitat units are considered to be of low terrestrial ecological sensitivity. Thus, development of the proposed bulk sewer and potable water pipelines within the area is supported. However, the development footprint must be contained within the proposed bulk sewer and potable water pipelines footprint area, and edge effects on surrounding natural areas, with special mention of Watercourses, must be managed so that Watercourses are not unnecessarily disturbed. Finally, permits from Department of Agriculture, Forestry and Fisheries (DAFF) should be obtained to remove, cut or destroy *Sclerocarya birrea* subsp. *caffra* before any construction activities may take place.
Watercourses	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.	This habitat unit is considered to be of high sensitivity as the Watercourses area creates niche habitat for faunal species. Assuming that a high level of mitigation takes place, the results of the impact assessment indicate that during construction, impacts are likely to be of medium-low significance, since some proposed activities will take place within the Watercourses buffer area. Thus, strict adherence to the recommended mitigation measures must take place, in order to minimise impacts on the receiving environment. For detailed discussion regarding the impact significance, and recommended mitigation measures, please refer to Section 6 of this report. Finally, permits from Department of Agriculture, Forestry and Fisheries (DAFF) should be obtained to remove, cut or destroy *Sclerocarya birrea* subsp. *caffra* before any construction activities may take place.

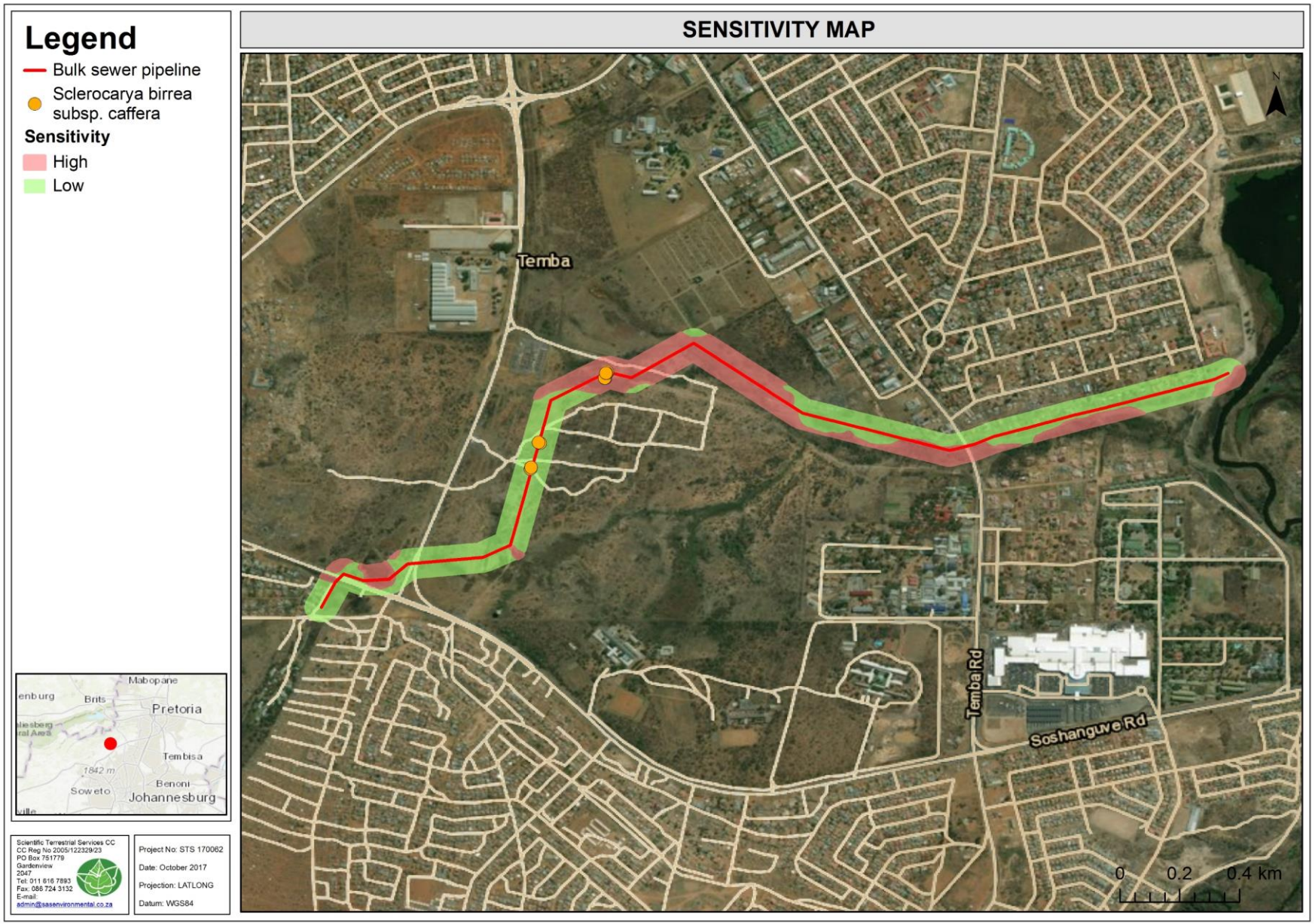


Figure 9: Sensitivity map for the proposed bulk sewer pipeline.

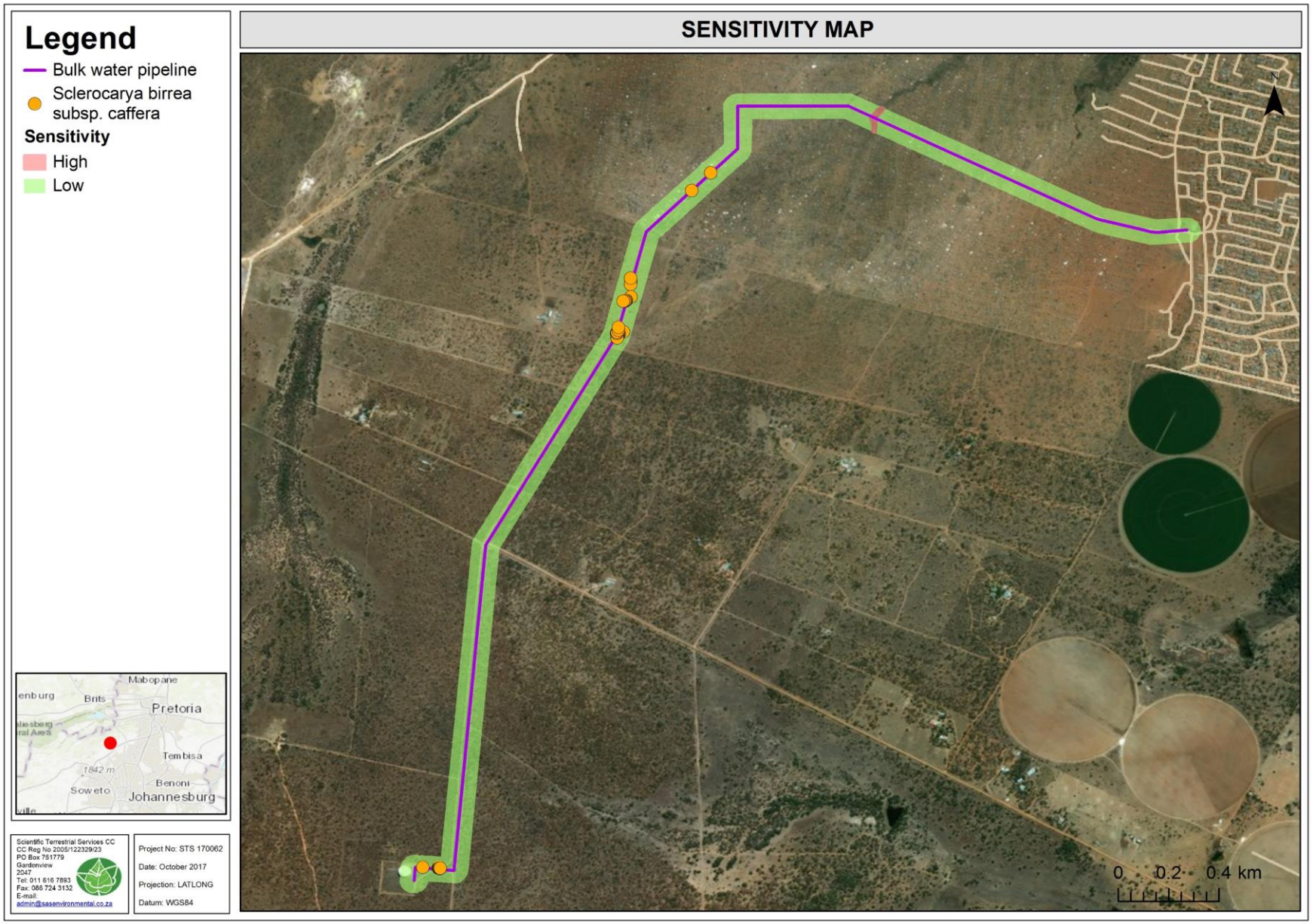


Figure 10: Sensitivity map for the proposed potable water pipeline.

6. IMPACT ASSESSMENT

The tables below serve to summarise the significance of perceived impacts on the terrestrial ecology of the proposed bulk sewer and potable water pipelines, with each individual impact identified presented in Section 6.1 and 6.2 of this report. A summary of all potential pre-construction, construction and operational impacts is provided in Section 6.4.

The tables below present the impact assessment according to the method described in Appendix C. All impacts are considered without mitigation taking place as well as with mitigation fully implemented. All the required mitigatory measures needed to minimise the impact is presented in Section 6.4.

Activities and aspects register

Pre-Construction	Construction	Operational
Inconsiderate planning of infrastructure placement and design leading to floral and faunal habitat loss	Site clearing and the removal of vegetation	On-going disturbance of soils due to general operational activities leading to altered floral and faunal habitat
	Loss of floral and faunal biodiversity through invasion of alien and invasive plant species	Increased introduction and proliferation of alien and invasive plant species and further transformation of natural habitat
	Erosion as a result of improper rehabilitation of disturbed areas resulting in a loss of floral and faunal SCC preferred habitat	On-going disturbance may lead to erosion and sedimentation of the Watercourses
	Movement of construction vehicles through sensitive floral and faunal habitat	Failure to implement a rehabilitation plan and alien and invasive floral control plan during the operational phase
	Dumping of material outside designated areas leading to loss of floral and faunal SCC preferred	
	Compaction of soils reducing floral re-establishment	
	Failure to implement a rehabilitation plan and alien and invasive floral control plan during the construction phase	
	Possible increased fire frequency during construction leading to a loss of sensitive floral and faunal habitat	

6.1 IMPACT 1: Impacts on Floral SCC

The Transformed, Transformed Bushveld habitat units and Watercourses contain floral SCC in the form of *Sclerocarya birrea* subsp. *caffra*, which is protected in terms of the National Forest Act (NFA) of 1998. Thus, placement of infrastructure within these habitat units, will result in permanent removal of floral SCC and habitat likely to support such species. These species are scattered throughout these habitat units, however they are more abundant in the Transformed Bushveld habitat unit, and utilising existing pipeline alignments and associated buffers within this habitat unit will result in a lower significance impact on floral SCC. With the implementation of mitigation measures, the impact significance may be reduced for all habitat units. Prior to mitigation measures, impacts are expected to be medium-high to medium low during the construction and operational phase, decreasing to a low significance impact with the implementation of mitigation measures.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	4	3	3	8	10	80 (Medium-High)
Operational phase	4	3	3	2	4	7	9	63 (Medium-Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	1	1	4	6	6	36 (Low)
Operational phase	3	3	1	1	4	6	6	36 (Low)

6.2 IMPACT 2: Impact on Faunal SCC

The proposed project is unlikely to have any impact on faunal SCC that occur within both the Gauteng Province as well as on a national scale. This is mainly attributed to historic agricultural activities within the study area, as well as the current ongoing anthropogenic activities. Due to the presence of the Apies River and the Bushveld areas, consideration had to be given to the presence of both *Lutra maculicollis* (Spotted-necked Otter) and *Tyto capensis* (Grass Owl), however neither were observed nor is the habitat along the study area considered viable habitat for either of these species. The construction of the proposed bulk sewer and potable water pipelines is unlikely to have a significant impact on faunal SCC; however, all mitigation and rehabilitation measures must be followed strictly. The impact associated with the loss of faunal SCC habitat is considered to be of medium-low to medium-high significance during all phases of the proposed activities prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance of the loss of faunal habitat can be reduced to low significance.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	4	3	3	8	10	80 (Medium-High)
Operational and Maintenance phase	4	3	3	2	4	7	9	63 (Medium-Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	1	1	4	6	6	36 (Low)
Operational and Maintenance phase	3	3	1	1	4	6	6	36 (Low)

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 SCC habitat are of medium-low to medium-high significance impacts. If effective mitigation takes place, all impacts may be reduced to low significance.

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

Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Medium-High	Low
2: Impact on habitat for faunal species	Medium-High	Low

Table 7: A summary of the impact significance of the operational and maintenance phase.

Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Medium-Low	Low
2: Impact on habitat for faunal species	Medium-Low	Low

6.4 Integrated Impact Mitigation

Mitigation Measures

Development footprint

- It must be ensured that, as far as possible, all proposed infrastructure is placed outside of sensitive habitat areas. Where this is not possible, suitable mitigation measures as outlined in this report and the wetland ecological assessment and rehabilitation plan should be adhered to.
- Areas of increased ecological importance and sensitivity, such as Watercourse areas, should be considered during all phases of the development planning and construction activities.
- The boundaries of the development footprint areas are to remain as small as possible, be clearly defined and it should be ensured that all activities remain within defined footprint areas.
- Edge effects of all construction and operational activities, such as erosion and alien plant species proliferation, which may affect floral and faunal habitat, need to be strictly managed in all areas, particularly within areas of increased ecological sensitivity. Alien species should be eradicated and controlled to prevent their spread beyond the proposed development footprint areas.
- All areas of increased ecological sensitivity beyond the development footprint should be designated as No-Go areas and be off limits to all unauthorised vehicles and personnel. Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.
- It must be ensured that storm water is managed on site in a suitable manner.

Flora

- Proliferation of alien and invasive plant species are expected within any disturbed areas. These species should be eradicated and controlled to prevent their spread

beyond the proposed development footprint areas. Alien and invasive plant seed dispersal within the top layers of the soil within footprint areas, has to be controlled.

- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used.
  - Footprint areas should be kept as small as possible when removing alien plant species.
- Informal fires in the vicinity of development area should be prohibited during all development phases.
- One protected tree species, namely *Sclerocarya birrea* subsp. *caffra* was encountered scattered throughout the Transformed Bushveld, Transformed Habitat Units Watercourse areas. This species is protected in terms of the National Forest Act (NFA) of 1998.
- It is recommended that a site-specific walkdown of the proposed bulk sewer and potable water pipelines be performed prior to construction in in order to identify and mark individuals of the protected tree species *Sclerocarya birrea* subsp. *caffra.* Disturbance of the trees must be avoided as far as possible. If no option other than destruction of the trees remains, the necessary permits must be applied for in terms of the National Forest Act (NFA) of 1998.
- Should any other floral SCC species be encountered within study area, the following should be ensured:
  - If any threatened species, or nationally or provincially protected floral will be disturbed, ensure effective relocation of individuals to suitable similar habitat. Arrangement with the relevant authorities needs to take place to rescue and relocate the species.
- All rescue and relocation plans should be overseen by a suitably qualified specialist.

Fauna

- Informal fires in the vicinity of proposed development areas should be prohibited during all development phases.
- Should any SCC or other threatened or protected faunal species be noted within the development footprint areas, area suitable management plan must be determined with the assistance of a suitably qualified specialist.
- No trapping or hunting of fauna is to take place.

Vehicle access

- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

Soils

- It must be ensured that construction related waste or spillage and effluent do not affect the immediate and surrounding habitat boundaries.
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss.
- All soils compacted as a result of construction activities falling outside of development footprint areas should be ripped and profiled.

Rehabilitation

- Incorporate adequate erosion management measures in order to prevent erosion and the associated sedimentation of the Watercourses areas;
- All disturbed habitat areas must be rehabilitated and reseeded with an indigenous seed mixture as soon as possible to ensure that faunal habitat is re-instated.

6.5 Possible Cumulative/Latent Impacts:

- Further loss of floral and faunal habitat;
- Permanent loss of and altered floral and faunal species diversity; and
- Continued alien and invasive floral invasion.

7. CONCLUSION

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 bulk services, namely bulk sewer and potable water pipelines, for Hammanskraal X10 within the Gauteng Province. The objective of this study was to provide sufficient information on the terrestrial ecology of the area, in order for the relevant proponents and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development.

Based on the terrestrial impact assessment of potential impacts on floral and faunal SCC within the study area, it is evident that both impacts are medium-high to medium-low prior to mitigation and low should mitigation measures be put in place. This is due to *Sclerocarya*

birrea subsp. caffra being present within the study area. However, no other floral or faunal SCC were encountered during the field assessment and are considered highly unlikely to occur within the study area.

It is the opinion of the ecologists that, from a terrestrial ecological point of view, the proposed development be considered favorably provided that the recommended mitigation measures for the identified impacts (as outlined in Section 6.4) 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 – Method of Assessment

B1: 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

[Distribution + Habitat availability + Habitat disturbance] / 15 x 100 = 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).

B2: 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

Small mammals are unlikely to be directly observed in the field because of their nocturnal/crepuscular and cryptic nature. A simple and effective solution to this problem is to use Sherman traps. A Sherman trap is a small aluminium box with a spring-loaded door. Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut, thereby capturing the individual. In the event of capturing a small mammal during the night, the animal would be photographed and then set free unharmed early the following morning. Traps were baited with a universal mixture of oats, peanut butter, and fish paste.

Medium to large 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%

B3: Habitat Sensitivity

The habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral and faunal communities and provide an indication of the overall terrestrial 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):

- **Terrestrial SCC:** The confirmed presence or potential for floral and/or faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes and Food Availability:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region, as well as the availability of food within the habitat unit for faunal species;
- **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;
- **Terrestrial Diversity:** The recorded floral and faunal diversity compared to a suitable reference condition such as surrounding natural areas or available floral and faunal 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 terrestrial 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 terrestrial ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table B1: Terrestrial 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 - Impact Assessment Methodology

Ecological Impact Assessment Method

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.
The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[1]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the Table C2. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary[2].
The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.
The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by

[1] The definition has been aligned with that used in the ISO 14001 Standard.

[2] Some risks/impacts that have low significance will however still require mitigation.

increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table C1: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

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

CONSEQUENCE DESCRIPTORS

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

Table C2: Significance Rating Matrix.

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

Table C3: Positive/Negative Mitigation Ratings.

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

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction; and
  - Operation.
- If applicable, transboundary or global effects were assessed.
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

Mitigation measure development

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

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[3] 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.

[3] *Mitigation measures should address both positive and negative impacts*

APPENDIX D – Vegetation Type

Central Sandy Bushveld

Dominant Floral Taxa

Table E1: Dominant & typical floristic species of Central Sandy Bushveld (Mucina & Rutherford, 2006)

Floral Community	Species
Tall Trees	*Acacia burkei* (d), *A. robusta*, *Sclerocarya birrea* subsp. *caffra*. Small Trees: *Burkea africana* (d), *Combretum apiculatum* (d), *C. zeyheri* (d), *Terminalia sericea* (d), *Ochna pulchra*, *Peltophorum africanum*, *Rhus leptodictya*
Small Trees	*Seemannaralia gerrardii* (d), *Cussonia natalensis*, *Faurea rochetiana*, *F. saligna*, *Hippobromus pauciflorus*, *Ozoroa albicans*, *Protea caffra* subsp. *caffra*, *P. roupelliae* subsp. *roupelliae*, *Ozoroa* sp. nov. ('*laetans*') (e)
Tall Shrubs	*Combretum hereroense*, *Grewia bicolor*, *G. monticola*, *Strychnos pungens*
Low Shrubs	*Agathisanthemum bojeri* (d), *Indigofera filipes* (d), *Felicia fascicularis*, *Gnidia sericocephala*. Geoxylic Suffrutex: *Dichapetalum cymosum* (d)
Woody Climber	*Asparagus buchananii*.
Graminoids	*Brachiaria nigropedata* (d), *Eragrostis pallens* (d), *E. rigidior* (d), *Hyperthelia dissoluta* (d), *Panicum maximum* (d), *Perotis patens* (d), *Anthephora pubescens*, *Aristida scabrivalvis* subsp. *scabrivalvis*, *Brachiaria serrata*, *Elionurus muticus*, *Eragrostis nindensis*, *Loudetia simplex*, *Schmidtia pappophoroides*, *Themeda triandra*, *Trachypogon spicatus*.
Herbs	*Dicerocaryum senecioides* (d), *Barleria macrostegia*, *Blepharis integrifolia*, *Crabbea angustifolia*, *Evolvulus alsinoides*, *Geigeria burkei*, *Hermannia lancifolia*, *Indigofera daleoides*, *Justicia anagalloides*, *Kyphocarpa angustifolia*, *Lophiocarpus tenuissimus*, *Waltheria indica*, *Xerophyta humilis*
Geophytic Herbs	*Hypoxis hemerocallidea*.
Succulent Herbs	*Aloe greatheadii* var. *davyana*

***(d) – Dominant species for the vegetation type**

Springbokvlakte Thornveld

Dominant Floral Taxa

Table E1: Dominant & typical floristic species of Springbokvlakte Thornveld (Mucina & Rutherford, 2006)

Floral Community	Species
Tall Trees	*Acacia karroo* (d), *A. luederitzii* var. *retinens* (d), *A. mellifera* subsp. *detinens* (d), *A. nilotica* (d), *Ziziphus mucronata* (d), *Acacia tortilis* subsp. *heteracantha*, *Boscia foetida* subsp. *rehmanniana*
Tall Shrubs	*Euclea undulata* (d), *Rhus engleri* (d), *Dichrostachys cinerea*, *Diospyros lycioides* subsp. *lycioides*, *Grewia flava*, *Tarchonanthus camphoratus*
Low Shrubs	*Acacia tenuispina* (d), *Ptycholobium plicatum*. Succulent Shrub: *Kleinia longiflora*.
Herbaceous Climber	*Momordica balsamina*, *Rhynchosia minima*.
Graminoids	*Aristida bipartita* (d), *Dichanthium annulatum* var. *papillosum* (d), *Ischaemum afrum* (d), *Setaria incrassata* (d), *Aristida canescens*, *Brachiaria eruciformis*.
Herbs	*Aspilia mossambicensis*, *Indigastrum parviflorum*, *Nidorella hottentotica*, *Orthosiphon suffrutescens*, *Senecio apiifolius*

***(d) – Dominant species for the vegetation type**

APPENDIX E – Floral SCC

Table E1: PRECIS and GDARD plant list for the QDS 2528AC and 2528AD (Raimondo *et al*., 2009; SANBI, www.sanbi.org).

Family	Species	Habitat	2016 Threat Status	Provincial Status	POC (%)
APOCYNACEAE	*Brachystelma discoideum*	Gravelly, sandy soils in bushveld.	CE PE	EN	5
ASTERACEAE	*Callilepis leptophylla*	Grassland or open woodland, often on rocky outcrops or rocky hill slopes.	LC	Declining	20
HYACINTHACEAE	*Drimia sanguinea*	Open veld and scrubby woodland in a variety of soil types.	NT	NT	5

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

APPENDIX F – Faunal SCC

Table F1: RDL Mammal Species for the Gauteng Province (GDARD 2014).

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

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

Table F2: RDL Avifaunal Species for the Gauteng Province (GDARD 2014).

Scientific Name	Common name	IUCN Status	Regional Status	GDARD Status
Gyps coprotheres	Cape Vulture	EN	EN	VU
Anthropoides paradiseus	Blue Crane	VU	NT	VU
Falco naumanni	Lesser Kestrel	LC	Ad mon	-
Tyto capensis	African Grass-Owl	LC	VU	VU
Circus ranivorus	African Marsh-Harrier	LC	EN	VU
Gorsachius leuconotus	White-backed Night Heron	LC	VU	VU
Eupodotis senegalensis	White-bellied Korhaan	LC	VU	VU
Podica senegalensis	African Finfoot	LC	VU	VU
Mirafra cheniana	Melodious Lark	NT	End and N-end	NT
Sagittarius serpentarius	Secretary bird	VU	VU	NT
Ciconia nigra	Black Stork	LC	VU	-
Eupodotis caerulescens	Blue Korhaan	NT	End and N-end	NT
Polemaetus bellicosus	Martial Eagle	VU	EN	-
Phoenicopterus minor	Lesser Flamingo	NT	NT	-
Phoenicopterus roseus	Greater Flamingo	LC	NT	-
Alcedo semitorquata	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 F3: RDL Invertebrates Species for the Gauteng Province (GDARD 2014)

Scientific Name	Common name	IUCN Status	GDARD Status
Lepidochrysops praeterita	Highveld Blue Butterfly	NYBA	VU
Chrysoritis aureus	Heidelberg Copper	NYBA	VU
Ichnestoma stobbiai	Stobbia's Fruit Chafer Beetle	NYBA	VU
Aloeides dentatis	Roodepoort Copper Butterfly	NYBA	VU

VU = Vulnerable, NYBA = Not yet been assesses

Table F4: RDL Reptile Species for the Gauteng Province (GDARD 2014)

Scientific Name	Common name	IUCN Status	GDARD Status
Homoroselaps dorsalis	Striped Harlequin Snake	NT	NT

NT = Neat Threatened

Avifaunal Species for the pentads 2520_2815, 2520_2810 and 2525_2810 within the QDS 2528AC and 2528AD.

http://sabap2.adu.org.za/pentad_info.php?pentad=2520_2815&section=species

http://sabap2.adu.org.za/pentad_info.php?pentad=2520_2810&section=species

http://sabap2.adu.org.za/pentad_info.php?pentad=2525_2810&section=species

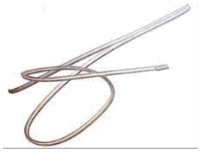
APPENDIX G – Declaration and Specialists CV's

Declaration

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

I, Emile van der Westhuizen, 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 EMILE BASSON VAN DER WESTHUIZEN

PERSONAL DETAILS

Position in Company	Ecologist, Botanist
Date of Birth	30 May 1984
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2008

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Council for Natural Scientific Professions (SACNASP) (Reg. Number 100008/15).

EDUCATION

Qualifications	
BSc (Hons) Plant Science (University of Pretoria)	2012
B.Sc. Botany and Environmental Management (University of South Africa)	2010
Short Courses	
Grass Identification – Africa Land Use Training	2009
Wild Flower Identification – Africa Land Use Training	2009

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Free State, Eastern Cape.
Mozambique (Tete, Sofala and Manica Provinces)
Democratic Republic of the Congo (Katanga and Kivu Provinces)
Ghana (Western and Greater Accra Provinces)
Sierra Leone
Angola
Cabinda

SELECTED PROJECT EXAMPLES

Floral Assessments

- Floral assessment for the proposed Modikwa Platinum Mine South 2 Shaft Project, Burgersfort, Limpopo Province.
- Floral assessment for the proposed New Clydesdale Colliery Stoping Project, Vandyksdrift, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed Harriet's Wish PGM Project, Limpopo Province.
- Floral assessment as part of the environmental authorisation process for the proposed Shanduka Coal Argent Colliery in the vicinity of Argent, Mpumalanga.
- Floral assessment for the Auroch Resources Manica Gold Mining Project, Manica, Mozambique.
- Floral assessment for the Namoya Gold Mine project in Namoya, Democratic Republic of Congo.
- High level floral risk assessment and alternatives analysis for the proposed new Tete Airport, Tete, Mozambique.
- Floral assessment for the proposed Richardsbay Harbour Compactor Slab development, Richardsbay, Kwa-Zulu-Natal Province.
- Site walkdown and floral ecological input prior to the construction of the proposed 180km Mfolozi-Mbewu powerline, Richardsbay, Kwa-Zulu-Natal Province.
- Floral assessment as part of the EIA process for the proposed Peerboom Colliery, Lephalale, Limpopo Province.
- Floral assessment as part of the EIA process for the proposed Overvaal Underground Coal Mine Project, Ermelo, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed King's City Takoradi 3000 hectare development, Takoradi, Ghana
- Floral assessment as part of the EIA process for the proposed Aquarius Platinum Fairway Platinum Mine, Steelpoort, Mpumalanga Province.

- Floral assessment as part of the EIA process for the proposed Geniland Lubumbashi City 4000 hectare development, Likasi, Katanga Province, Democratic Republic of Congo.
- Floral, faunal, aquatic and wetland assessment as part of the EIA process for the proposed Appollonia City Accra 3000 hectare development, Accra, Ghana.
- Floral assessment as part of the EIA process for the proposed Leeuw Colliery, Utrecht, Kwa-Zulu Natal Province.
- Floral assessment as part of the EIA process for the proposed Lubembe Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Kinsenda Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Lonshi Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Jozini Shopping Mall, Jozini, Kwa-Zulu Natal Province.
- Floral assessment as part of the Biodiversity Action Plan for the Assmang Chrome Dwarsrivier Mine, Steelpoort, Mpumalanga Province.

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF HENNIE DE BEER

PERSONAL DETAILS

Position in Company	Ecologist – Focusing on Avifaunal species
Date of Birth	20 October 1986
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2014

EDUCATION

Qualifications

National Diploma Nature Conservation (Tshwane University of Technology) 2008

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape and Free state
Mozambique

SELECTED PROJECT EXAMPLES

Faunal Assessments

- Leandra Colliery (2015) – Faunal assessment as part of the environmental assessment and authorisation process for the proposed the Leandra Coal Project, Gauteng and Mpumalanga Provinces;
- Siyanda Chrome Smelter (2015) - Faunal assessment as part of the environmental assessment and authorisation process for a proposed construction of a ferrochrome smelter, Limpopo province;
- Lace Diamond Mine (2015) – Faunal assessment as part of the environmental assessment and authorisation process for the lace diamond mine near Kroonstad, free state province;
- Duhva Solar Plant (2015) – Avifaunal as part of the Environmental Impact Assessment and authorisation process for the proposed solar photovoltaic power plant with associated infrastructure at the Duvha Coal Fired Power Station, Mpumalanga province;
- Arnot Solar Plant – Avifaunal Assessment as part of the Environmental Impact Assessment and authorisation process for the proposed solar photovoltaic power plant with associated infrastructure at the Arnot coal fired power station, Mpumalanga Province;
- Braakfontein Colliery – Faunal Assessment as part of the Environmental Assessment and authorisation process for the proposed Braakfontein Coal Mine near Newcastle, KwaZulu-Natal Province;
- Kekana Powerline – Faunal Ecological Assessment as part of the Environmental Assessment and authorisation process for the proposed Kekana and Wonderboom 132kv powerlines and substations, Hammanskraal, Gauteng;
- Samrand Phase 3 / Olievenhoutbosch – Floral, Faunal and Wetland Ecological Assessment as part of the Environmental Assessment and authorisation process for the proposed development of the Kosmosdal township on the remainder of portion 2 of the farm Olievenhoutbosch no. 389-jr, Gauteng Province;
- Jeanette Gold Mine – Faunal Assessment as part of the Environmental assessment and authorisation process for Jeanette expansion project at the Taung Gold International mine near Welkom within the Free State Province; and
- PTN 38 Elandspruit Farm – Faunal Assessment as part of the Environmental Assessment and authorisation process for the proposed mining development on portion 38 of the Elandspruit farm. Mpumalanga Province.

Terrestrial scan:

- K77 (2014) - Terrestrial scan Assessment as part of the Environmental Impact Assessment and authorisation process for the proposed development of the Provincial road K77, Gauteng highlands: Elizabeth road to K154; and
- Blue Hills EXT 39 - Biodiversity Assessment Fauna and Flora.

Alien Vegetation Monitoring Plan:

- Bokoni Platinum Mine (2015) - Alien vegetation study.

Maintenance and Management Plans:

- Levendal Pearl Valley Phase 2 Roads Bar – Maintenance and Management Plan;
- Sanbona Wildlife Reserve/Dwyka Lodge – Maintenance and Management Plan;
- Pearl Valley Bulk Services – Maintenance and Management Plan;
- Ariadne Eros Powerline – Maintenance and Management Plan; and
- Rhodes Drive/Constantia – Maintenance and Management Plan.

Wetland:

- R40 Ring Road Bushbuck Ridge – Wetland delineation and field work.

Previous Work Experience

- Eradication of aquatic plants from water canals using chemicals.
- Junior Research Technician National Rangeland Monitoring Program (NRMP) at Agriculture Research Council (ARC) doing Vegetation Condition Assessment for cattle farmers in the Vryheid area. Also did the following work for the Savanna Ecosystem Project: Vegetation Condition Assessments, Carrying Capacity, and annual game counts were done on 24 reserves in the Lowveld area, also at Gorongoza Mozambique. Rehabilitation monitoring of the mine dumps for Phalaborwa Mining Company.
- Assisted in the following programs doing practical year at Timbavati Private Nature Reserve:
    - Ringing of Ground Hornbill chicks on the reserve;
    - Monitoring project on nesting sites of White backed Vultures at Timbavati Private Nature Reserve by using game census data and visiting the sites to see if the nesting sites were still active or not;
    - Burning programs;
    - Anti-poaching;
    - Hunting;
    - Culling;
    - Bush thinning of *Colophospermum mopane (*Mopane); and
    - Started a Lion identification key for all the Male lions on the reserve.