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BOKAMOS
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Wetland Assessment

Zandspruit Bulk Sewer Line

Situated on Various Portions of the Farm Zandspruit 191
IQ, City of Johannesburg

July 2022

Prepared by:

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Declaration of Independence

I, **Lizette Venter**, in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent specialist and will perform the study in an objective manner free of influence and prejudice, even if the resultant findings are unfavourable to the applicant;
- Have the relevant expertise in conducting the report relevant to this application;
- Will comply with all regulations, Acts and other applicable guidelines that are applicable to the activity;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended;
- Do not have any conflicting interests in the preparation of this report;
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision taken with respect to the application by the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended;
- As a registered member of the South African Council for Natural Scientific Professions (SACNASP), will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member; and
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement.

This report has been prepared according to the requirements of Appendix 6 of the Environmental Impact Assessments Regulations, 2014 as amended; and GN 267, 2017 of the National Water Act, 1998 (Act No. 36 of 1998, as amended).



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Indemnity

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

Although the author exercised due care and diligence in rendering services and preparing documents, she accepts no liability, and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document.

Disclaimer

This report is aimed at evaluating site specific conditions as determined in context of relevant legislation and guidelines and to ensure the conservation and management of the water resources found on the site. However, the intention of this study is not to function as one of several attempts made by the proponent in order to gain favourable outcomes for the application. Rather, this report functions as an independent study and not as a comparative study between wetland specialists.

This report may be submitted directly to the competent authority should a prolonged correspondence occur between specialists and the applicant due to delineation comparisons.

Specialists

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1. INTRODUCTION

Bokamoso Landscape Architects and Environmental Consultants cc, Specialist Division was appointed by City Dev (Pty) Ltd to conduct a wetland assessment for the proposed Zandspruit bulk sewer line, situated on various portions of the Farm Zandspruit 191 IQ, Johannesburg.

The site visit was conducted on 23 March 2022

1.1 Terms of Reference

The focus of the investigation is to:

- Delineate and classify the watercourse within the study site according to standardised and accepted methods;
- Undertake the ecological functional assessment, including the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS), of wetland areas (if present) within the area assessed;
- Recommend suitable buffer zones;
- Discuss mitigation and management measures relevant to conserving sensitive areas on the site.

1.2 Assumptions and Limitations

- The assessment is confined to the proposed development and 500m outside the boundary of the study site.
- The GPS used for delineations is accurate to within five meters. Therefore, the delineation plotted digitally may be offset by at least five meters in any direction. It is therefore suggested to measure and peg boundary areas in the field for higher accuracy.
- The on-site assessment is based on environmental indicators such as vegetation that are subjected to seasonal variation as well as factors such as fire and drought. Wherever available, background information was gathered to aid in analysis of the site characteristics. Information provided within this report is based on observations made during the site survey on the specified date.
- Wetlands form transitional areas where vegetation species change from terrestrial to wetland species. Within this transition zone, some variation of opinion on the wetland boundary may

occur, although all assessors should obtain relatively similar results when using the DWS methodology.

1.3 Definitions and Legal Framework

The National Water Act, 1998 (Act No. 36 of 1998, as amended) [NWA] defines a wetland as *“land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”* In addition to water at or near the surface, other distinguishing indicators of wetlands include hydromorphic soils and vegetation adapted to or tolerant of saturated soils (DWS, 2005).

Riparian habitat is described as *“the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas”*. Riparian habitats often perform important ecological and hydrological functions, some similar to those performed by wetlands (DWS, 2005). Riparian habitat is also the accepted indicator used to delineate the extent of a river’s footprint (DWAF, 2005).

This document was prepared according to the Gauteng Department of Agriculture and Rural Development (GDARD) Requirements for Biodiversity Assessments Version 3, February 2014, as well as key legislative requirements and guiding principles of the wetland study and the Water Use Authorisation process. The proponent must also comply with the provisions of the following relevant national legislation, conventions and regulations applicable to wetlands and riparian zones:

- The National Water Act, 1998 (Act No. 36 of 1998, as amended) [NWA]
- Convention on Wetlands of International Importance - the Ramsar Convention and the South African Wetlands Conservation Programme (SAWCP)
- National Environmental Management Act, 1998 (Act No. 107 of 1998, as amended) [NEMA]
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
- National Environment Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
- Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)
- Regulations and Guidelines on Water Use under the NWA

- South African Water Quality Guidelines under the NWA
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002, as amended).

Water uses for which authorisation must be obtained from DWS, are indicated in Section 21 of the NWA.

Section 21 (c) and (i) is applicable to any activity related to a wetland:

Section 21(c): Impeding or diverting the flow of water in a watercourse; and

Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

Wetlands situated within 500 m of proposed activities should be regarded as sensitive features potentially affected by the proposed development (GN 509, 2016). Such an activity requires a Water Use Licence (WUL) from the relevant authority. The regulation of wetlands is normally based on a water use licence, although a general authorisation can be applied for under GN 509. General Authorisation does not apply: (a) to the use of water in terms of section 21(c) or (i) of the Act for the rehabilitation of a wetland as contemplated in General Authorisation 1198 published in Government Gazette 32805 dated 18 December 2009,

(b) to the use of water in terms of section 21(c) or (i) of the Act within the regulated area of a watercourse where the Risk Class is Medium or High as determined by the Risk Matrix.

This Risk Matrix must be completed by a suitably qualified SACNASP professional member;

(c) in instances where an application must be made for a water use license for the authorisation of any other water use as defined in section 21 of the Act that may be associated with a new activity;

(d) where storage of water results from the impeding or diverting of flow or altering the bed, banks, course or characteristics of a watercourse; and

(e) to any water use in terms of section 21(c) or (i) of the Act associated with construction, installation or maintenance of any sewerage pipelines, pipelines carrying hazardous materials and to raw water and wastewater treatment works.

2. METHODOLOGY

An initial desktop study was conducted in order to gather background information on the site. The use of maps, aerial photographs and digital satellite imagery were consulted in order to assess the site

conditions. GIS data was used to create maps describing the receiving environment, such as locality, soils, vegetation, critical biodiversity areas and hydrology.

A hand held GPS was used to capture co-ordinates in the field and a hand held camera for photographs. 1:50 000 cadastral maps and available GIS data were used as reference material for the mapping of the preliminary watercourse boundaries. These were converted to digital images containing delineation lines and buffers according to the field data received.

The delineation method documented by the Department of Human Settlements, Water and Sanitation (DHSWS), in their document “Updated manual for the identification and delineation of wetlands and riparian areas” (DWAF, 2008), and the Minimum Requirements for Biodiversity Assessments (GDACE, 2009) as well as the Classification System for Wetlands and other Aquatic Ecosystems in South Africa User Manual: Inland Systems (SANBI 2013) was followed throughout the field survey. These guidelines describe the use of indicators to determine the outer edge of the wetland and riparian areas.

2.1 Wetland and Riparian Classification and Delineation

2.1.1 Wetland indicators

Wetlands are delineated by means of the DHSWS guideline named ‘A practical field procedure for identification and delineation of wetlands and riparian areas’ (DWAF, 2008).

Wetlands are identified based on one or more of the following characteristic indicators (Figures 1 and 2):

- ***The Terrain Unit Indicator*** helps to identify those parts of the landscape where wetlands are more likely to occur. These include valley bottoms as well as slopes where groundwater discharge may occur.
- ***The Vegetation Indicator*** for the presence of plants adapted to saturated soils (hydrophytes). Vegetation growth helps in identifying the outer boundaries of a wetland since species composition changes dramatically between zones. Emphasis is placed on the group of species that dominate the plant community, and not on individual indicator species.
- ***The Soil Form Indicator*** identifies hydromorphic soils that display characteristics resulting from prolonged and frequent saturation and which are indicative of permanent, seasonal and temporary wetland zones. Gleyed soil has a grey, green or blue colour due to iron being dissolved out of the soil during anaerobic conditions. Seasonal or temporary wetlands generally have a

fluctuating water table which creates alternating aerobic and anaerobic conditions in the soil. This causes iron to deposit over decades as yellow or orange patches, called mottles.

- **The Soil Wetness Indicator** to identify morphological changes due to anaerobic conditions developing in the first 50cm of the soil surface as a result of saturation. Specific soil colours and the presence of mottles are indicative of permanent or temporary saturation. The higher the frequency and duration, the greyer the soil matrix becomes. Hydromorphic soils that are permanently saturated generally do not show mottles.

According to the NWA, vegetation is the primary indicator, which must be present under normal circumstances. However, in practice the soil wetness indicator is used as the primary indicator since it shows long term morphological changes from saturation, whereas vegetation is seasonal and responds quickly to changes in soil moisture, human activities and climate. All other indicators are used to confirm the presence of a wetland.

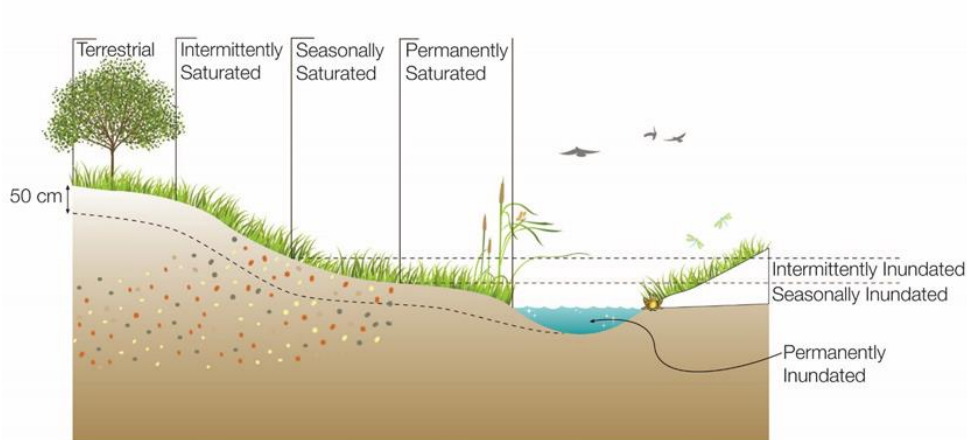


Figure 1: Typical cross-section of a wetland (Ollis, 2013)

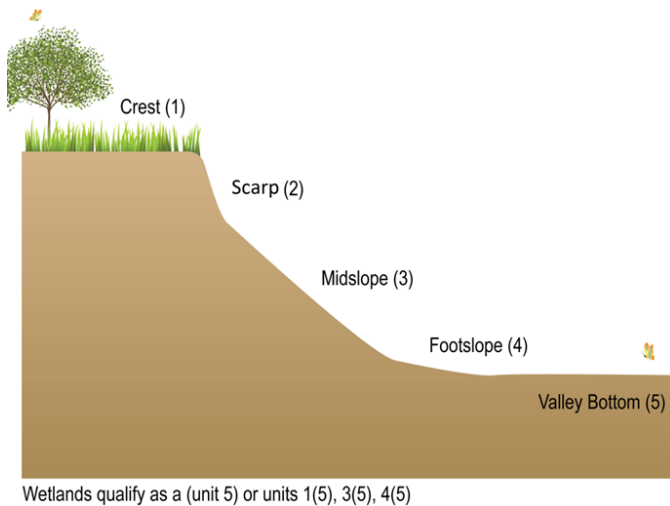


Figure 2. Terrain units (DWAF, 2005).

The boundary of the wetland is defined as the outer edge of the temporary zone of wetness, which is characterised by:

- A minimal grey matrix (<10%)
- Few mottles
- Short periods of saturation of less than 3 months per annum.

2.1.2 Riparian Area

Riparian areas have specific characteristics, namely:

- Are associated with a watercourse
- Contain distinctively different plant species than adjacent areas, exhibiting more vigorous or robust growth
- May have alluvial soils.

River channels flow within a confined valley or within an incised macro-channel. The “river” includes both the active channel (the portion which carries the water) as well as the riparian zone (Kotze, 1999). Riparian habitat is classified primarily by identifying riparian vegetation along the edge of the macro stream channel. Rich alluvial soils deposit nutrients making the riparian area a highly productive zone. This causes a very distinct change in vegetation structure and composition along the edges of the riparian area (DWAF, 2008). Riparian vegetation is supported by perennial and non-perennial streams.

Riparian areas perform valuable functions including:

- store water and help reduce floods
- stabilize stream banks
- improve water quality by trapping sediment and nutrients
- maintain natural water temperature for aquatic species
- provide shelter and food for birds and animals
- provide corridors for movement and migration of species
- act as a buffer between aquatic ecosystems and adjacent land uses
- can be used as recreational sites
- provide material for human use.

It is possible to delineate riparian areas by checking for the presence of specific indicators. Some areas may display both wetland and riparian indicators, and can accordingly be classified as both. The riparian delineation process requires that the following be taken into account:

- Topography associated with the watercourse
- Vegetation
- Alluvial soils and deposited material.

The most important indicator is vegetation, where the outer edge is adjacent to the watercourse where a distinct change in vegetation occurs. Topography and the presence of alluvial soils are the next indicators used to confirm the riparian area.

Riparian areas can be grouped into different categories based on their inundation period per year. Perennial rivers are rivers with continuous surface water flow, intermittent rivers are rivers where surface flow disappears but some surface flow remains, and temporary rivers are rivers where surface flow disappears for most of the channel. Two types of temporary rivers are recognized, namely “ephemeral” rivers that flow for less time than they are dry and support a series of pools in parts of the channel, and “episodic” rivers that only flow in response to extreme rainfall events, usually occurring high in their catchments (Seaman *et al*, 2010).

2.1.3 Wetland Classification

The classification system developed for the National Wetlands Inventory is based on the principles of the hydro-geomorphic (HGM) approach to wetland classification as described by SANBI, 2009 (Figure 3). In general, HGM units encompass three key elements (Semeniuk & Semeniuk 1995; Finlayson *et al.*, 2002; Ellery *et al.*, 2008; Kotze *et al.*, 2008, Kotze *et al.*, 2005), namely:

- Geomorphic setting - This refers to the landform characteristics and processes
- Water source - Precipitation, groundwater flow, stream flow, etc.
- Hydrodynamics – the presence and movement of water through the wetland.

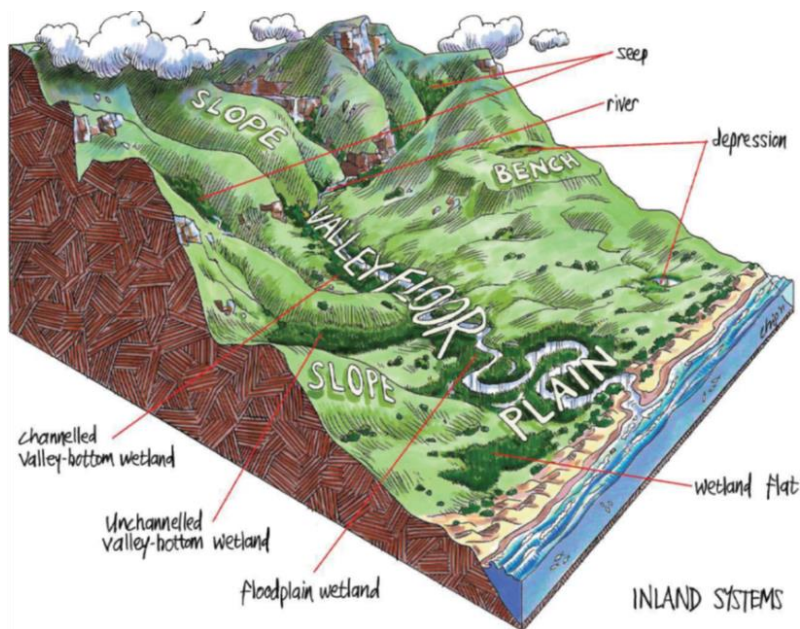


Figure 3: Wetland Units based on hydrogeomorphic types (Ollis *et al.* 2013)

2.2 Buffer Zones

A buffer zone is defined as “a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted” (DWAF, 2005). A development has several impacts on the surrounding environment and on a wetland. The development changes habitats, the ecological environment, infiltration rate, amount of runoff and runoff intensity of the site, and therefore the water regime of the entire site. An increased volume of stormwater runoff, peak discharges, and frequency and severity of flooding is therefore often characteristic of transformed catchments. The buffer zone serves to highlight an ecologically sensitive area in which activities should be conducted with this sensitivity in mind.

Despite limitations, buffer zones are well suited to perform functions such as sediment trapping, erosion control and nutrient retention which can significantly reduce the impact of activities taking place adjacent to water resources. Buffer zones are therefore proposed as a standard mitigation measure to reduce impacts of land uses / activities planned adjacent to water resources. These must however be considered in conjunction with other mitigation measures.

Local government policies require that protective buffer zones be calculated from the outer edge of the temporary zone of a wetland (KZN DAEA, 2002; CoCT, 2008; GDARD, 2012).

Wetland buffer requirements:

- 30 meters from the temporary zone for wetlands occurring inside the urban edge;
- 50 meters from the temporary zone for wetlands occurring outside the urban edge; or
- Larger buffer areas for wetlands supporting sensitive faunal or floral species.

Rivers (non-perennial/perennial) buffer requirements:

- A 100-meter buffer zone from the edge of the temporary zone outside the urban edge;
- A 32-meter buffer zone from the edge of the temporary zone inside the urban edge; or
- Larger buffer areas for aquatic ecosystems supporting sensitive species.

The DHSWS Buffer Guideline (McFarlane *et al.*, 2013) is used to determine the scientific buffer requirements which may be more or less than the generic values.

2.3 Functionality, Status and Sensitivity

Wetland functionality is defined as “a measure of the deviation of wetland structure and function from its natural reference condition.” The natural reference condition is based on a theoretical undisturbed state extrapolated from an understanding of undisturbed regional vegetation and hydrological conditions. The hydrological, geomorphological and vegetation integrity are assessed for the wetland units associated with the study site, to provide a Present Ecological Status (PES) score (Macfarlane *et al.*, 2007) and an Environmental Importance and Sensitivity category (EIS) (DWAF, 1999).

2.3.1 Present Ecological Status (PES) – WET-Health

A summary of the three components of the WET-Health method namely Hydrological, Geomorphological and Vegetation Health assessment for the wetlands found on site is described in Table 1.

Table 1: Health categories used by WET-Health for describing the integrity of wetlands (Macfarlane *et al.*, 2007)

Description	Impact Score Range	PES Score	Summary
Unmodified, natural.	>0.9	A	Very High
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 - 1.9	B	High
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2 - 3.9	C	Moderate
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4 - 5.9	D	Moderate
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 - 7.9	E	Low
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	F	Very Low

2.3.2 Ecological Importance and Sensitivity (EIS)

Ecological importance is an expression of a wetland's importance to the maintenance of ecological diversity and functioning on local and wider spatial scales. Ecological sensitivity refers to the system's ability to tolerate disturbance and its capacity to recover from disturbance once it has occurred (DWAf, 1999). The EIS methodology can also be applied to other water resources such as rivers and lakes.

This classification of water resources allows for an appropriate management class to be allocated to the water resource and includes the following:

- Ecological Importance in terms of ecosystems and biodiversity
- Ecological functions including groundwater recharge, provision of specialised habitat and dispersal corridors
- Basic human needs including subsistence farming and water use.

Explanations of the scores are given in Table 2.

Table 2: Environmental Importance and Sensitivity rating scale used for the estimation of EIS scores (DWAF, 1999)

Ecological Importance and Sensitivity Categories	Rating	Recommended Ecological Management Class
<p>Very High</p> <p>Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water in major rivers</p>	>3 and <=4	A
<p>High</p> <p>Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers</p>	>2 and <=3	B
<p>Moderate</p> <p>Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers</p>	>1 and <=2	C
<p>Low/Marginal</p> <p>Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers</p>	>0 and <=1	D

3. RESULTS

3.1 Locality of the study site

The proposed bulk sewer line is situated in the Zandspruit area of Johannesburg. The sewer line connects to the proposed Zandspruit X93-96 Residential Development (west of Valentines Avenue) at Portion 93 and 94, then runs along the eastern side of the Sandspruit tributary. The sewer line connects to an existing sewer line that is situated along Constantia Street, and west of the Jackal Creek Golf Estate.

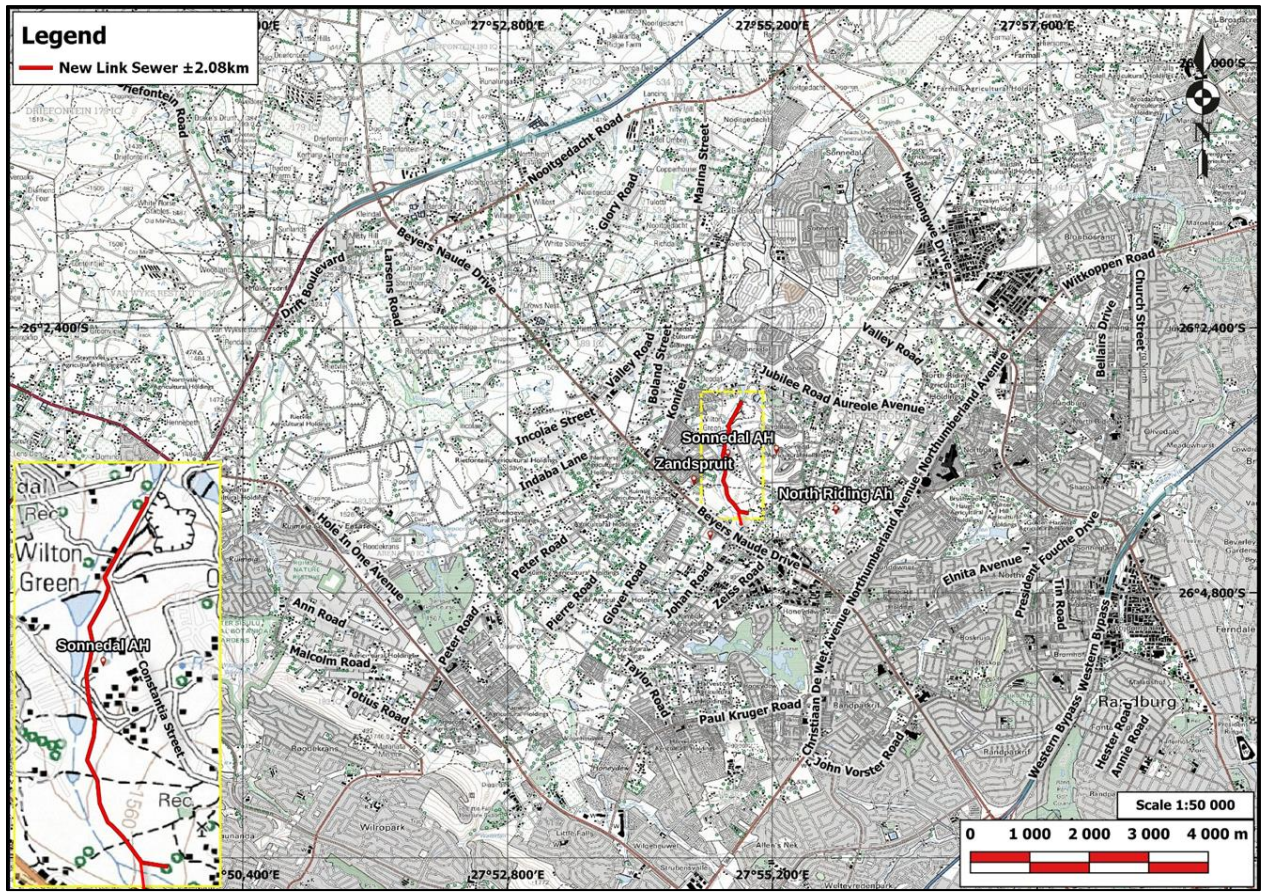


Figure 4: Locality Map

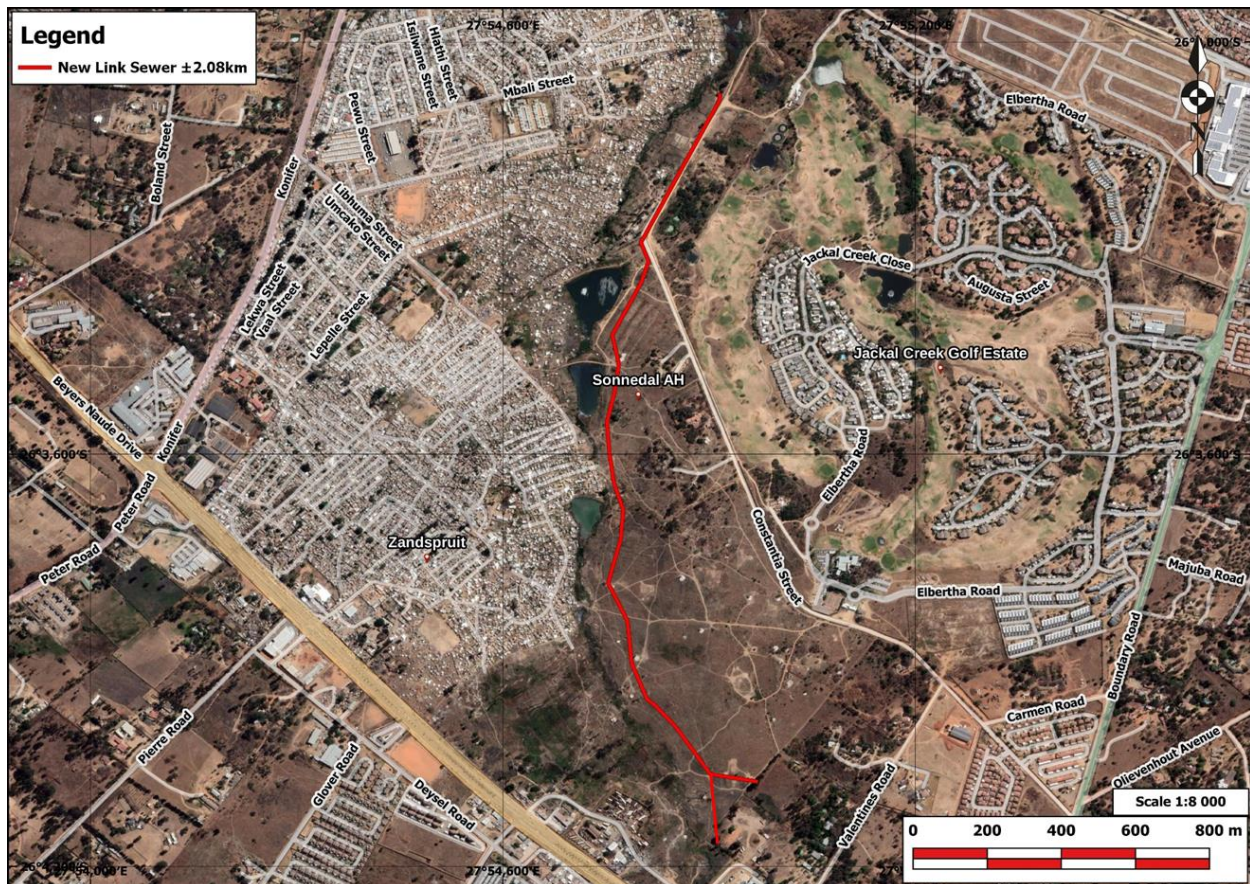


Figure 5: Aerial Map

3.2 Description of the Receiving Environment

3.2.1 Land Use

The surrounding areas are characterised by Jackal Creek Golf Estate, residential developments, small holdings and an informal settlement (west of the river).

3.2.2 Hydrology

The site is situated in quaternary catchment A21C of the Limpopo Water Management Area (WMA). The Sandspruit River runs from south to north from the proposed Zandspruit X93-96 development towards Cosmo City. Multiple dams and wetlands are indicated on the C-Plan maps.

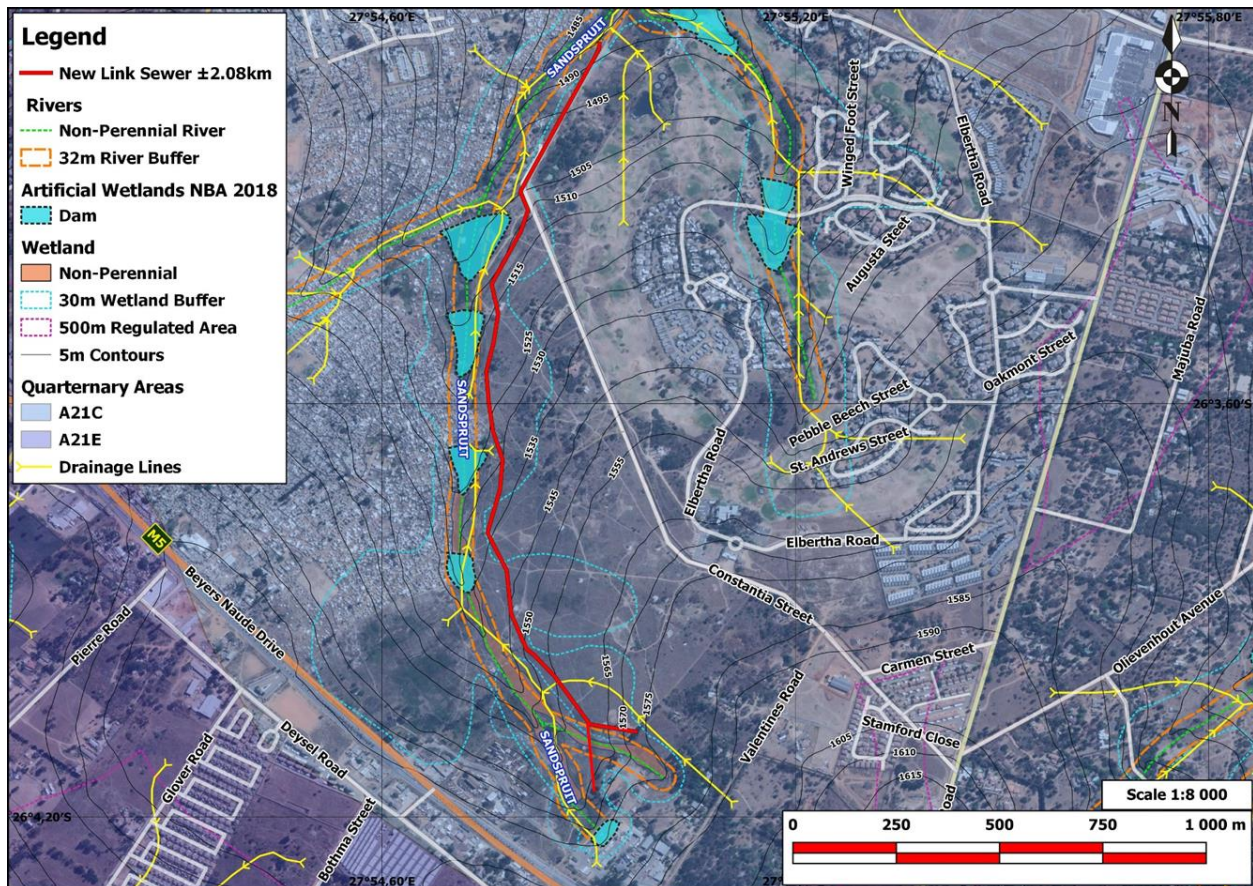


Figure 6: Hydrology map

3.2.3 Regional vegetation

The site is situated in the Egoli Granite Grassland vegetation unit of the Mesic Highveld Grassland Bioregion in the Grassland Biome (Mucina & Rutherford, 2010).

Egoli Granite Grassland vegetation is characterised by moderately undulating plains and low hills. Main vegetation includes tall grasslands dominated by *Hyparrhenia hirta*, and woody vegetation in rocky outcrops. Other dominant grass species include *Aristida canescens* and *A. congesta*, *Cynodon dactylon*, *Eragrostis capensis*, *E. chloromelas*, *E. racemose*, *Heteropogon contortis* and *Melinis repens*. The vegetation unit is classified as endangered with only 3% conserved out of a target of 24%. More than 60% has been transformed by urbanisation, cultivation and roads. The unit consists of primary vegetation but is heavily impacted and degraded by urban development.

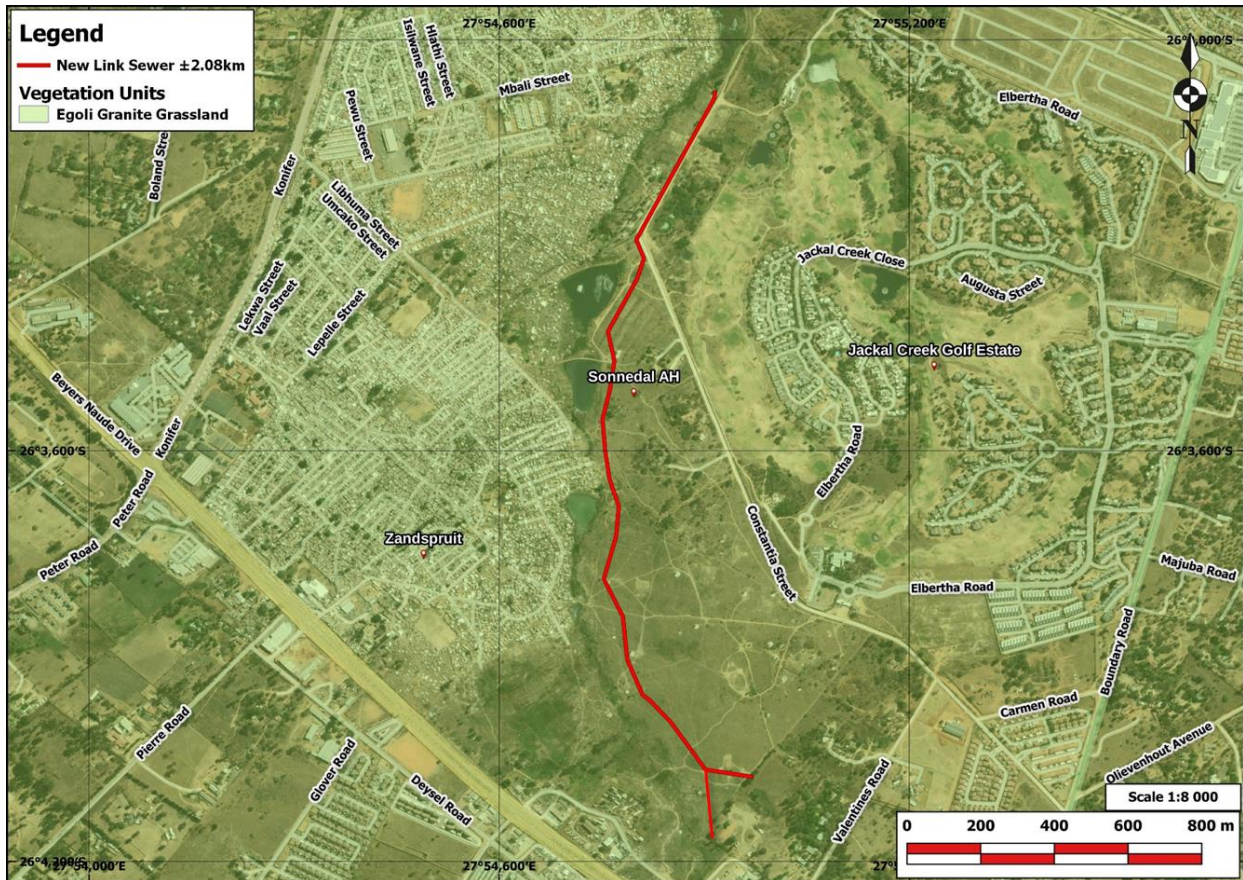


Figure 7: Vegetation of the study area

3.2.4 Geology and Soils

According to available geological maps, the study site is underlain by the Halfway House Granite Dome, with a line of De Banken Gneiss transecting the site along Constantia Street. Soils have a limited depth.

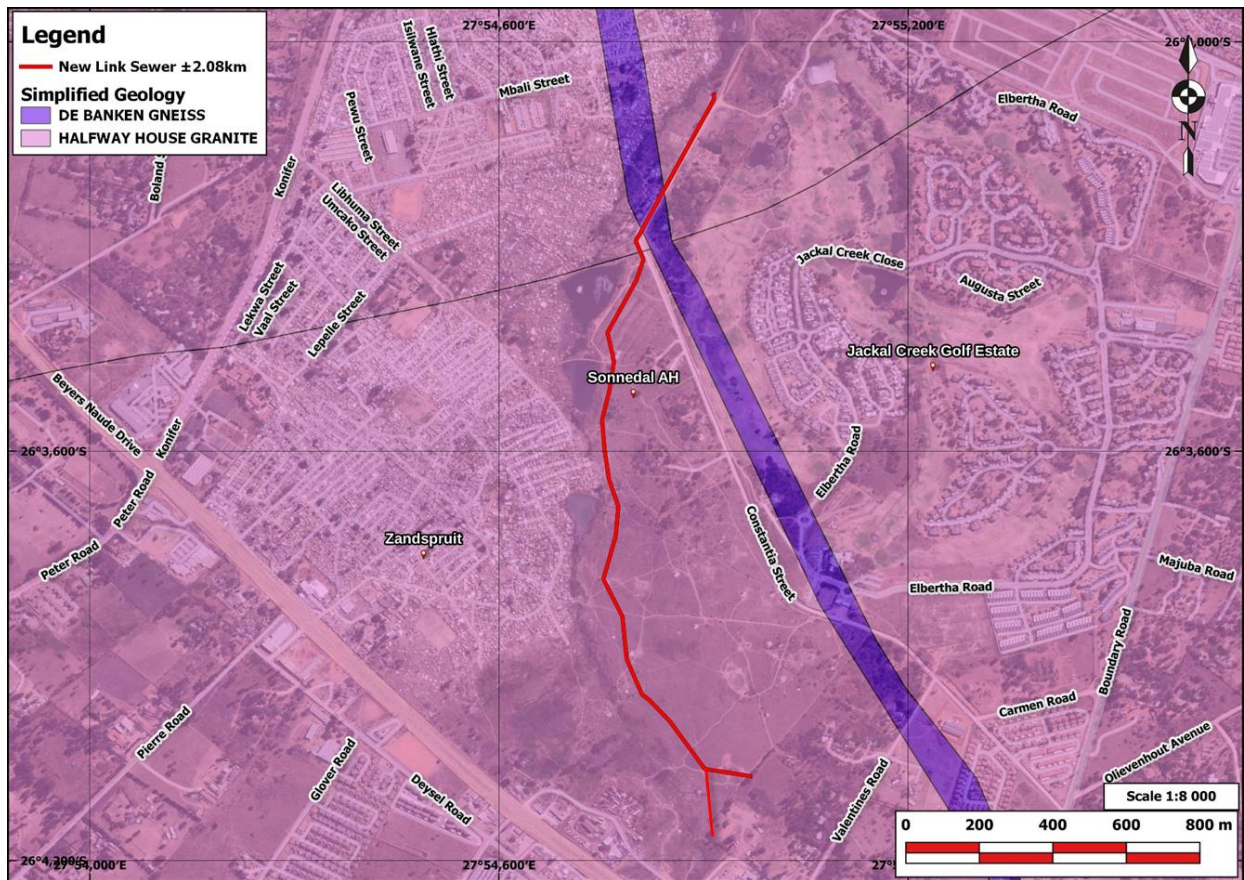


Figure 8: Simplified Geology map

3.2.5 Gauteng Conservation Plan (C-Plan)

The entire alignment of the bulk sewer line is situated within Ecological Support Areas and Important Areas (all associated with the Sandspruit) according to Gauteng C-Plan data.

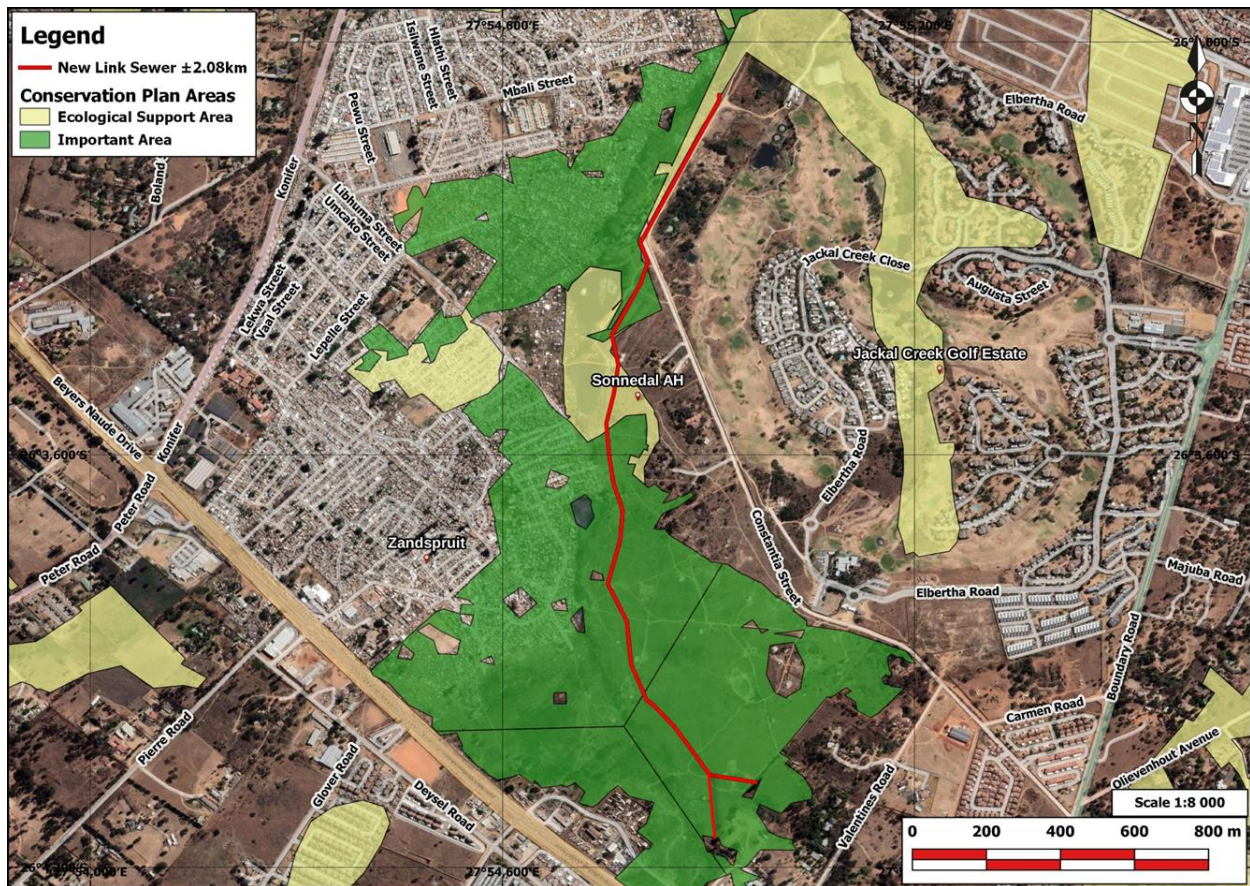


Figure 9: Conservation areas

3.3 Watercourse Classification and Delineation

Two wetland HGM units occur within 500m of the study site, namely a Channelled Valley Bottom wetland associated with the Sandspruit, and extensive Hillslope Seeps. The seep wetlands cover an estimated total area of 29ha. It is not possible to determine the full historic extent of the seeps, as the informal settlement and other developments have replaced large portions of the hillslopes surrounding the river.

Soil Characteristics:

The soils of the seep show the loss of iron due to the presence of gley soil colouring and mottles at less than 40cm depth. Subsurface water is present from 30-40cm at most sampling sites within the seep wetland, with most auger holes reaching rock at less than 60cm depth. The wetland soils indicate temporary wetland conditions, with shallow sub-surface lateral water flow from the hills towards the Sandspruit.

Vegetation Characteristics

Within the shallow river areas are various species of Cyperaceae (sedges), *Typha capensis*, and other rush species.

Invasive species are prominent within the wet areas such as the stream and dam edges, and include *Arundo donax*, *Persicaria lapathifolia*, *Seriphium plumosum* (bankruptbush) and Poplar trees. Terrestrial invasive species include black jack, *Tagetes minuta* and *Verbena bonariensis* but are more concentrated in areas affected by the informal township.

Hillslope vegetation is uniform with low species diversity, although ground cover is generally good. The main species are *Hypphenia hirta*, *Themeda triandra*, and *Eragrostis chloromelas*. Small scattered patches of *Imperata cylindrica* are present near the river.

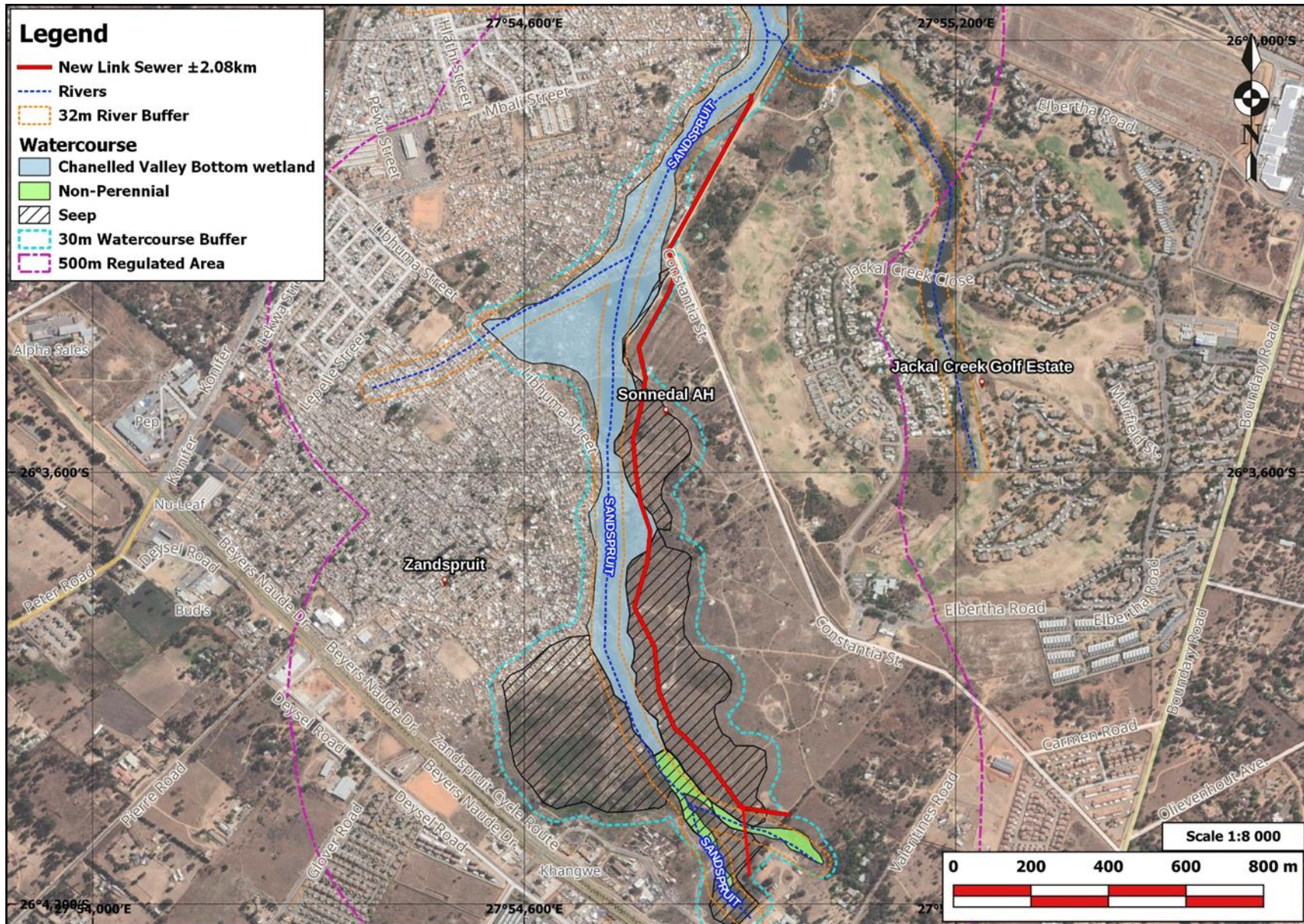


Figure 10: Wetland delineation map with buffers

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3.4 Wetland Impacts

The majority of the impacts to the wetland and river areas are related to the expanding informal settlement west of the river. The settlement has doubled in size since 2016, extending to the edge of the river and within the wetland areas (refer to Figure 11). As a result, impacts to the watercourses in the area include:

- Small scale farming
- Structures within the boundary of the watercourses
- Dumping of refuse
- Pollution from soaps, soils and other chemicals used by residents
- Sand mining
- Informal roads and pathways

The impacts have resulted in the replacement of indigenous vegetation with crops and invasive species. Natural water flow paths have been diverted or impeded by the structures within the wetland and riverine areas. Sand mining also leads to increased turbidity and sedimentation of downstream watercourses, damaging habitat conditions for aquatic organisms. Major changes in the natural wetland state have occurred due to the construction of large dams both upstream and downstream.



Figure 11: Informal settlement expansion since 2016 (2016 extent indicated in yellow)

3.5 Present Ecological Status (PES) and Ecological Importance and Sensitivity (EIS)

The PES and EIS scores were calculated for the wetlands that occur within 500m of the proposed sewer line.

The combined PES score for the Channelled Valley Bottom wetland area is **4.7** and **D - Largely modified**. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural features are still evident. Wetland conditions are expected to deteriorate due to the expanding informal settlement and further planned development in the surrounding areas.

Table 3: The estimated Present Ecological State (PES) of the wetlands

	Hydrology		Geomorphology		Vegetation	
	Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
Channelled Valley Bottom						
Area weighted impact scores	4.0	↓↓	4.7	↓↓	5.3	↓↓
PES Category	D		D		D	
Hillslope Seeps						
Area weighted impact scores	7.0	↓↓	4.7	↓↓	6.6	↓↓
PES Category	E		D		E	

The combined PES score for the Hillslope Seep wetland area is **3.8** and **C - Moderately modified**. The change in ecosystem processes and loss of natural habitat and biota is moderate and loss of natural habitat and biota has occurred. Wetland conditions are expected to deteriorate. Development is planned to increase significantly in the area, which will change flow patterns, increase runoff from hard surfaces and change catchment characteristics.

Table 4: The Ecological Importance and Sensitivity (EIS) of the Channelled Valley Bottom

RIVER IMPORTANCE AND SENSITIVITY		
	Importance	Confidence
ECOLOGICAL IMPORTANCE & SENSITIVITY	1.7	4.6
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	1.4	4.5
DIRECT HUMAN BENEFITS	1.2	5.0

Table 5: The Ecological Importance and Sensitivity (EIS) of the Hillslope Seep

RIVER IMPORTANCE AND SENSITIVITY		
	Importance	Confidence
ECOLOGICAL IMPORTANCE & SENSITIVITY	1.0	4.0
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	1.4	4.5
DIRECT HUMAN BENEFITS	0.0	4.5

The **EIS** scores indicate that both wetlands are classed as **C - Moderate**. The wetlands are ecologically important and sensitive on a local scale. The wetlands play a part in moderating downstream quantity and quality of the Sandspruit. Impacts from development and the expanding informal settlement are a threat to the wetland habitat and ecosystem functions.

3.6 Buffer recommendation

GDARD recommends a 30m buffer for wetlands within urban areas. The DWS Buffer Tool calculation recommends a 24m buffer, however, in order to prevent further degradation of the wetlands, it is recommended to apply the larger **30m buffer**.



Figure 12: Informal settlement and dams within the wetland and river areas



Figure 13: Hillslope Seep and landscape characteristics



Figure 14: Impacts on watercourses including invasive vegetation, dumping and sand mining

4. CONCLUSION

Two wetland HGM units occur within 500m of the study site, namely a Channelled Valley Bottom wetland and Hillslope Seeps. The wetlands are associated with the Sandspruit.

The combined **PES** score for the Channelled Valley Bottom wetland area is **4.7** and **D - Largely modified**. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural features are still evident.

The combined **PES** score for the Hillslope Seep wetland area is **3.8** and **C - Moderately modified**. The change in ecosystem processes and loss of natural habitat and biota is moderate and loss of natural habitat and biota has occurred.

The **EIS** scores indicate that both wetlands are classed as **C - Moderate**. The wetlands are ecologically important and sensitive on a local scale. The wetlands play a part in moderating downstream quantity and quality of the Sandspruit.

Wetland conditions are expected to deteriorate in the short term. Development is planned to increase significantly in the area, which will change flow patterns, increase runoff from hard surfaces and change catchment characteristics. Impacts from development and the expanding informal settlement are a threat to the wetland habitat and ecosystem functions.

A buffer is required around the wetlands to protect the remaining wetland functions from further development. A **30m buffer** is applicable.

The construction of the bulk sewer line is supported provided that the following mitigation measures are included in the Environmental Management Programme (EMPr):

- Sewer line design and installation method to consider subsurface flow in the landscape.
- Excavations and vegetation clearing to be conducted as the sewer is to be installed, in order to avoid large exposed areas for extended periods.

- All excavated soils are to be retained and topsoil stockpiled separately. Importation of soils to be avoided as far as possible, as the existing soil conditions of the site provide suitable conditions for subsurface water flow in the hillslope seeps.
- Silt fences to be erected downhill of the sewer line excavations to prevent pollution of the downstream watercourses.
- Bare areas to be revegetated as soon as possible with indigenous vegetation to keep soil integrity and assist in re-establishment of wetland conditions.

5. GLOSSARY OF TERMS

Activity	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
Buffer	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Duration	the length of time over which the stressor will cause a change in the resource or receptor.
EIS	ecological importance and sensitivity. Key indicators in the ecological classification of water resources. Ecological importance relates to the presence, representativeness and diversity of species of biota and habitat. Ecological sensitivity relates to the vulnerability of the habitat and biota to modifications that may occur in flows, water levels and physico-chemical conditions.
EWR	ecological water requirements. The flow patterns (magnitude, timing and duration) and water quality needed to maintain a riverine ecosystem in a particular condition. This term is used to refer to both the quantity and quality components.
Impacts/ Risks	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.

MC	management class representative of those attributes that the DWA (as the custodian) and society require of different water resources (consultative process). The process requires a wide range of trade-offs to be assessed and evaluated at a number of scales. Final outcome of the process is a set of desired characteristics for use and ecological condition each of the water resources in a given catchment. The WRCS defines three management classes, Class I, II, and III based on extent of use and alteration of ecological condition from the predevelopment condition.
PES	present ecological state. The current state or condition of a water resource in terms of its biophysical components (drivers) such as hydrology, geomorphology and water quality and biological responses viz. fish, invertebrates, riparian vegetation). The degree to which ecological conditions of an area have been modified from natural (reference) conditions.
REC	The Recommended Ecological Category is the future ecological state (Ecological Categories A to D) that can be recommended for a resource unit depending on the EIS and PES. The REC is determined based on ecological criteria and considers the EIS, the restoration potential of the watercourse.
Seepage	A type of wetland occurring on slopes, usually characterised by diffuse (i.e. unchannelled, and often subsurface) flows.
Sedges	Grass-like plants belonging to the family Cyperaceae, sometimes referred to as nutgrasses. Papyrus is a member of this family.
Wetland	“land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.” (National Water Act; Act 36 of 1998).
Wetland delineation	the determination and marking of the boundary of a wetland on a map using the DWAF (2005) methodology. This assessment includes identification of suggested buffer zones and is usually done in conjunction with a wetland functional

assessment. The impact of the proposed development, together with appropriate mitigation measures are included in impact assessment tables

WMA	water management area
WRC	water resource classification

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7. CV OF SPECIALIST

Lizette Venter

South African Wetland Society
Pri. Sci. Nat. (Reg. No. 013713)

Work History

BOKAMOSO LANDSCAPE ARCHITECTS AND ENVIRONMENTAL CONSULTANTS CC

- Environmental Consultant and Wetland Specialist

Wetland delineation and functional assessments
Environmental Impact Assessments
Environmental Compliance

DELTERRA CONSULTING – Environmental Consultant

Wetland delineation
Ecological/ risk and impact assessments
Desktop analysis
Environmental Compliance

WETREST – Research as part of MSc in Aquatic Health

“A Holocene Wetland: Hydrological Response to Rehabilitation at Colbyn Valley Wetland, Pretoria, Gauteng”
Weekly groundwater level and pressure monitoring
Isotope analysis
Water quality monitoring
Vegetation growth mapping

Education

MSC IN AQUATIC HEALTH – University of Johannesburg

BSC HONS IN ENVIRONMENTAL MANAGEMENT (CUM LAUDE) – UNISA

BSC AGRICULTURE – University of the Free State

Projects

Wetland delineation, PES/EIS, functional assessment, Impacts and Mitigation, VEGRAI, QHI, Risk Assessments

Riverwalk Electrical

Lanseria x66 Mixed-use Development, Johannesburg

Lanseria x65 Filling Station, Johannesburg

TUT Ga-Rankuwa Expansion, Ga-Rankuwa, Gauteng. (in progress)

Waterfall Ridge Mixed-use Development, Johannesburg. (in progress)

Glen Vista Residential Development, Gauteng

Nkosi City Mixed-Use Development, Mpumalanga

Slovo Park/ Nancefield Residential Development, Gauteng

Kudube Unit 9 Sewer Outfall, Gauteng

Mooibosch Resort Development, Gauteng

Hartebeeshoek Mixed-use Development, Gauteng

Wheatlands Solar Farm, Gauteng

Thula Mall, Bushbuckridge, Mpumalanga

Mthatha – Bedford City Mixed-use Development, Mthatha, Eastern Cape

Expansion of Transnet Railway Loops at Thabazimbi, Ferrogate and Northam, Limpopo

Riverwalk Electrical Line, Pretoria

Ormonde Residential Development, Johannesburg

Coal mining rights application for Berenice, Limpopo Province.

Ekhuthuleni Roads and Stormwater Upgrades

Proposed Housing Development on the Farm Middbuilt Position 11 and 81 and Eloff Er 675, Delmas.

Kagisa and Environs Integrated Development and Housing Project, West Rand, Gauteng.

Witpoortjie Residential Development, Krugersdorp, Gauteng

Moretele Distribution Powerlines and Substations, Pretoria, Gauteng

Panfontein Access Road for Rand Water in Midvaal Local Municipality, Gauteng

Hawerklip Coal Siding at Brazen Algar, Delmas, Mpumalanga

Eskom Westgate - Ntshona Powerline, Gauteng Province

Ecological Importance and Sensitivity, and Present Ecological Status assessment for water use application for Soweto, Gauteng Province

Diepsloot East Powerline and Substation, Gauteng Province

Gem Valley Residential Development, Pretoria North
Amberfield Residential Development, Centurion
Wetland Rehabilitation Plans
Kameeldrift Feedlot, Cullinan
Thula Mall, Bushbuckridge, Mpumalanga
Waterfall 5IR Wetland Rehabilitation and Action Plan, Gauteng (in progress)
Eagle's Creek Flight Academy, Centurion

Risk Assessments

Hazeldean Bouleavrd Rd amended WUL, Pretoria
Kudube Unit 9 Sewer Pump Station, Shoshanguve
Thema Babelegi Sewer Pump Station and Pipeline, Shoshanguve
Kikuyu/Waterfall Fields Electrical Lines, Johannesburg
Kikuyu/ Waterfall Fields Water Pipelines, Johannesburg
Parkdene x7 Mixed-use Development services and road upgrades, Johannesburg
Reiger Park x19 Mixed-use Development services and road upgrades, Johannesburg
Slovo Park/ Nancefield Informal Settlement, Johannesburg
Waterfall Fields Electrical Line, Johannesburg
Winterveld x5 Residential Development Sewer, Soshanguve
Winterveld North Sewer Outfall, Soshanguve
Winterveld South Sewer Outfall, Soshanguve
Riverwalk Electrical Line, Pretoria
Thula Mall, Bushbuckridge, Mpumalanga
Leeuwpoort South Mixed-use Development, Johannesburg
Kudube Sewer Outfall and Pump Stations, Shoshanguve

Environmental Authorisations (EIA, BAR, Amendments)

DK Pharmaceutical Building, Lesotho - Scoping and EMPr
Peach Tree x21 & 22 Industrial Township, Centurion – BAR, Pt1 amendment
Peach Tree x23 Industrial Township, Centurion – Pt1 amendment
Peach Tree x24 Industrial Township, Centurion– Pt1 amendment

Peach Tree x25 Industrial Township, Centurion - BAR
Varsity College Expansion, Pretoria – Ecological Opinion
Fairlands Interchange, Johannesburg – EIA
PWV17 Freeway, Pretoria – EIA
Hazeldean Boulevard Road – EIA
Lanseria x 66 Mixed-use Development – BAR
La Montagne Reservoirs, Pretoria – BAR
PWV18 Route Determination – Environmental Scan
Welgedacht Filling Station – BAR
Cavalier Abattoir Expansions – Amendment, BAR
Zandspruit X93-96 Residential - BAR
Zandspruit X97&103 Residential - BAR

Water Use Licences

Hebron Mall WWTW
Malekane Mall
Cavalier Abattoir
Peach Tree X25 WWTW
Peach Tree X21-25 Electrical Line
Peach Tree X25 Stormwater

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Landscape Architects & Environmental Consultants CC



Terrestrial Biodiversity Assessment Survey for the Environmental Processes Associated with the Proposed Zandspruit Bulk Sewer Line on Portions 93 - 95 of the Farm Zandspruit 1911Q, City of Johannesburg Metropolitan Municipality, Gauteng Province

July 2022

Prepared by:

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Landscape Architects & Environmental Consultants CC



Report details

Report Details	Rev 0
Report Title	Draft Terrestrial Biodiversity Assessment Survey for the Environmental Processes Associated with the Proposed Zandspruit Bulk Sewer Line on Portions 93 - 95 of the Farm Zandspruit 1911Q, City of Johannesburg Metropolitan Municipality, Gauteng Province
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Declaration	I, Nkoliso Magona, as authorised representative of Bokamoso Landscape Architects and Environmental Consultants CC, hereby confirm my independence in terms of Section 13.(1)(a) of the National Environmental Management Act, 1998 (Act No. 107 of 1998, as amended) 2014 EIA Regulations as amended.
Copyright Warning	Unless otherwise noted, the copyright in all text and other content (including the manner of presentation) is the exclusive property of Bokamoso Landscape Architects and Environmental Consultants CC.

SPECIALIST DECLARATION

I, **Nkoliso Magona**, (SACNASP Cand.Sci. Nat Reg. No. 123830) in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent specialist and will perform the study in an objective manner, free of influence and prejudice, even if the resultant findings are unfavourable to the Applicant;
- Have the relevant expertise in conducting the report relevant to this Application;
- Will comply with all regulations, acts and other applicable guidelines that are applicable to the activity;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended;
- Do not have any conflicting interests in the preparation of this report;
- Undertake to disclose, to the Competent Authority, any material information that has or may have the potential to influence the decision taken with respect to the Application by the Competent Authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended;
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgment.

The approach has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 30 October 2020: "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation".



Nkoliso Magona

Ecologist

Declaration of Independence

I, Avhafarei Phamphe, declare that I –

- act as the independent external peer-review specialist;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations 2014;
- 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;
- there are no circumstances that may compromise my objectivity in performing such work;
- have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- will comply with the Act, regulations and all other applicable legislation;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake that the report adheres to Appendix 6 of GN No. R 982 of 4 December 2014 (as amended), and
- will provide the Competent Authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

Avhafarei Phamphe:

- Holds a M. Sc in Botany from the University of the Pretoria;
- Is registered with South African Council for Natural Scientific Professions (SACNASP) as a Professional Natural Scientist (Pr.Sci.Nat) Ecological Science, (Registration No.: 400349/12), with expertise in floral and faunal ecology;
- Has been actively involved in the environmental consultancy field for over 18 years;
- Is a Professional Member of South African Institute of Ecologists and Environmental Scientists (SAEES) and
- Is a member of the South African Association of Botanists (SAAB).

Avhafarei Phamphe

Name of Specialist

Mboneni Ecological Services (Pty) Ltd

Name of Company

03 July 2022

Date

A handwritten signature in blue ink, appearing to read 'Avhafarei Phamphe', written over a horizontal line.

Signature

Executive Summary

Bokamoso Landscape Architects and Environmental Consultants CC: Specialist Division was commissioned to conduct a Terrestrial Biodiversity Assessment Survey for the Environmental Processes Associated with the Proposed Terrestrial Biodiversity Assessment Survey for the Proposed Zandspruit Bulk Sewer Line on Portions 93 - 95 of the Farm Zandspruit 191IQ, City of Johannesburg Metropolitan Municipality, Gauteng Province. The site visit was conducted on the 30th of April 2020 and 23rd March 2022.

The bigger part of the vegetation on the study site is highly disturbed and comprises of alien invasive species. The wetland vegetation should be properly managed throughout the lifespan of the project to ensure continuous biodiversity. Alien plant species, especially Category 1 and 2, must be eradicated as a matter of urgency to preclude their spreading during the construction phase. Orange List plant species (*Hypoxis hemerocallidea*) was observed on site and they will be affected by the proposed construction activities. Orange Listed plant species needs to be relocated to a suitable place *in situ* or a nursery and after the construction activities, they can be used as landscape plants. After construction, the indigenous plant species occurring on the site and surrounding areas should be incorporated into the rehabilitation plan in order to improve the growth of natural vegetation.

There is no valid reason, from an ecological perspective, to prevent the proposed External Services from being constructed on site. Recommendations and mitigation measures made in this report should be included in an Environmental Management Programme.

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Abbreviations

AIS - Alien and Invasive Species

C-Plan – Conservation Plan

DFFE - Department of Forestry, Fisheries and the Environment

EMPr - Environmental Management Programme

GDARD – Gauteng Department of Agriculture and Rural Development

IUCN - International Union for Conservation of Nature

NEMBA - National Environmental Management: Biodiversity Act

POO - Probability of Occurrence

QDS - Quarter Degree Square

SANBI – South African National Biodiversity Institute

SCC - Species of Conservation Concern

SABAP - Southern African Bird Atlas Project

Glossary of Terms

Alien species: A plant or animal species which do not occur naturally within the area but have been introduced either intentionally or unintentionally.

Biodiversity: The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part.

Conservation of Agricultural Resources Act (Act No. 43 of 1983): This Act provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.

C-Plan: The GDARD's C-Plan focuses on the mapping and management of biodiversity priority units within Gauteng Province. The C-plan includes protected areas, irreplaceable, important sites and Ecological Support Areas due to the presence of Red Data species, endemic species and potential habitat for these species to occur. GDARD C- Plan Version 3.3, 2014.

Ecology: The study of the interrelationships between organisms and their environments.

Environment: All physical, chemical and biological factors and conditions that influence an object and/or organism. Also defined as the surroundings within which humans exist and are made up of the land, water, atmosphere, plant and animal life (micro and macro), interrelationship between the factors and the physical or chemical conditions that influence human health and well-being.

Environmental Impact Assessment: Assessment of the effects of a development on the environment.

Indigenous Vegetation: Vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

Species of Conservation Concern: are species that have a high conservation importance and include not only Red List species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).

1. INTRODUCTION

Bokamoso Landscape Architects and Environmental Consultants CC: Specialist Division was commissioned to conduct a Terrestrial Biodiversity Assessment Survey for the Environmental Processes Associated with the Proposed Terrestrial Biodiversity Assessment Survey for the Proposed Zandspruit Bulk Sewer Line on Portions 93 - 95 of the Farm Zandspruit 1911Q, City of Johannesburg Metropolitan Municipality, Gauteng Province. The site visit was conducted on the 23rd March 2022.

The aim of this survey was to determine which fauna and flora species occur on the study site. Special attention was given to possible habitats of Red and Orange List plant species that may occur on the study site. Red and Orange Listed species include Critically Endangered, Endangered and Vulnerable species (<http://redlist.sanbi.org/redcat.php>), and Species of Conservation Concern (SCC) occurring on or near the study site. The survey/assessment also includes mammals, reptiles, amphibians and avifauna. This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations 2014 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The approach has taken cognizance of the recently published Government Notice 320 in terms of NEMA dated 30 October 2020: "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation". The National Web based Environmental Screening Tool has characterised the terrestrial Biodiversity Theme for the project area as "Very high sensitivity".

2. OBJECTIVES OF THE STUDY

The objectives of this survey were:

- To determine flora and fauna – including any plants, mammals, birds, reptiles, and amphibians – that are present on site;

- To determine the impacts of the proposed activity on flora and fauna on site;
- To identify and list the plant species occurring on the site and determine the presence or possible presence of threatened species;
- To indicate ecological sensitive areas and connectivity of the study site; and
- To assess faunal species and habitats occurring on the study site.

3. SCOPE OF THE STUDY

This survey report includes:

- Lists of all plant species, including alien plant species, recorded during the site visit;
- Comments on ecologically sensitive areas and connectivity with natural vegetation on adjacent sites;
- Comments on impacts affecting the flora and fauna of the study site;
- Evaluation of the conservation importance and significance of the study site with special emphasis on the status of threatened species; and
- Recommendations to mitigate negative impacts.

4. LIMITATIONS OF THIS STUDY

Even though considerable care is taken to ensure accuracy and professionalism of this ecological assessment, Environmental Assessment studies are limited in scope, time and budget. Several years are needed to derive a 100% accurate report based on intensive field collections and observations where all seasons are considered to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage.

The desktop study made up the largest part of the data used to conclude the distribution of Threatened species which were sourced by making use of the South African National Biodiversity Institute (SANBI) species list

(<http://posa.sanbi.org/sanbi/Explore>) and Animal Demography Unit: Virtual Museum (<http://vmus.adu.org.za/>). Any limitations in the above-mentioned databases will in effect have implications on the findings and conclusion of this assessment.

Therefore, Bokamoso Environmental: Specialist Division cannot accept responsibilities for conclusions and mitigation measures made in good faith with the available information at the time of the directive. This report should be viewed and acted upon considering these limitations.

5. STUDY AREA

5.1 The Study Site

The study site is situated immediate west of Jackal Creek Golf Estate in Johannesburg. The site is situated north of Main Road (M5), Marina Street occurs about 800m to the west and Contantia Street occurs along the eastern boundary (Figures 1 and 2). The study site is located at 26° 4'5.03"S and 27°54'57.76"E (starting point, southern section); 26° 3'33.20"S and 27°54'45.34"E (Mid-point); and 26° 3'5.37"SS and 27°54'55.01"E (end-point, northern section). Access to the site is from Contantia Street.

Zandspruit Bulk Sewer Line – Terrestrial Biodiversity Survey

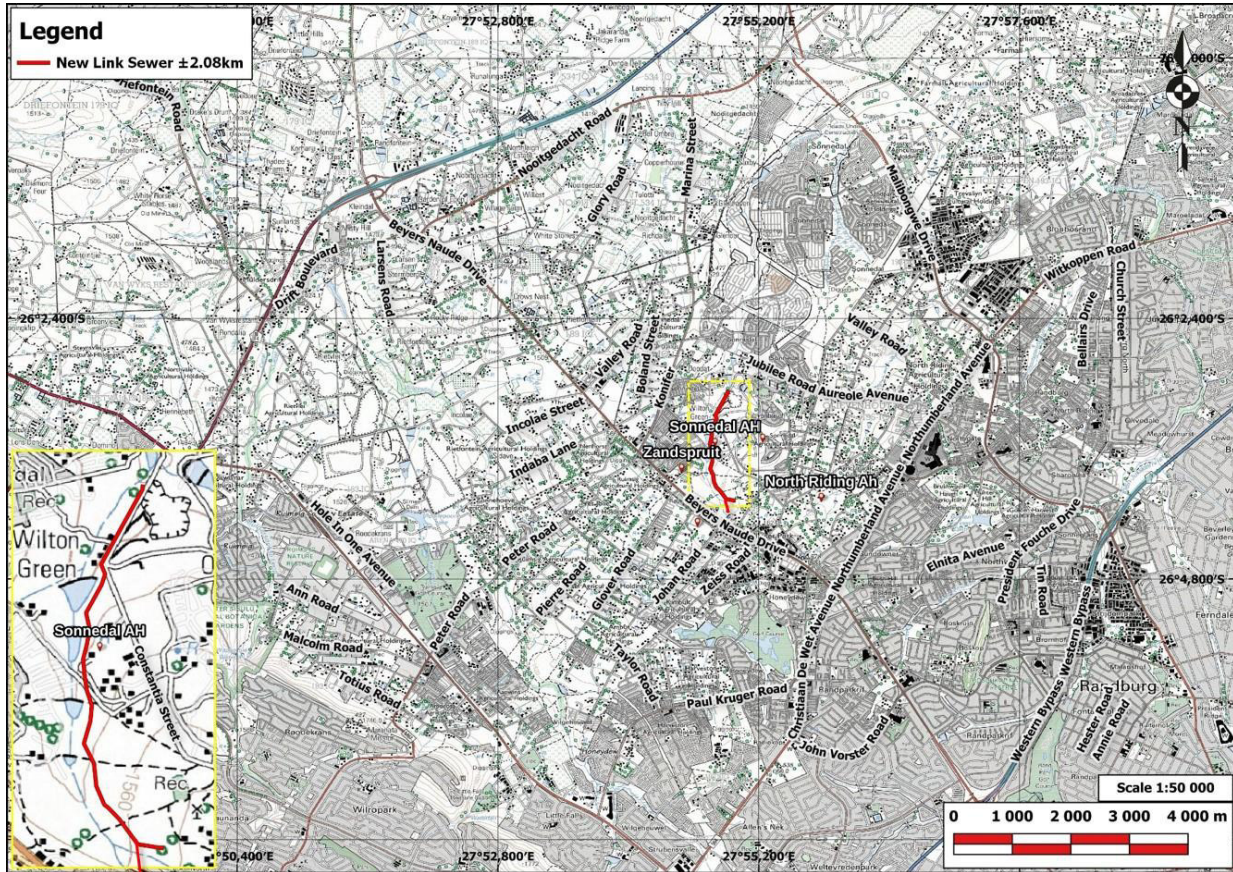


Figure 1: Locality Map of the Study Site

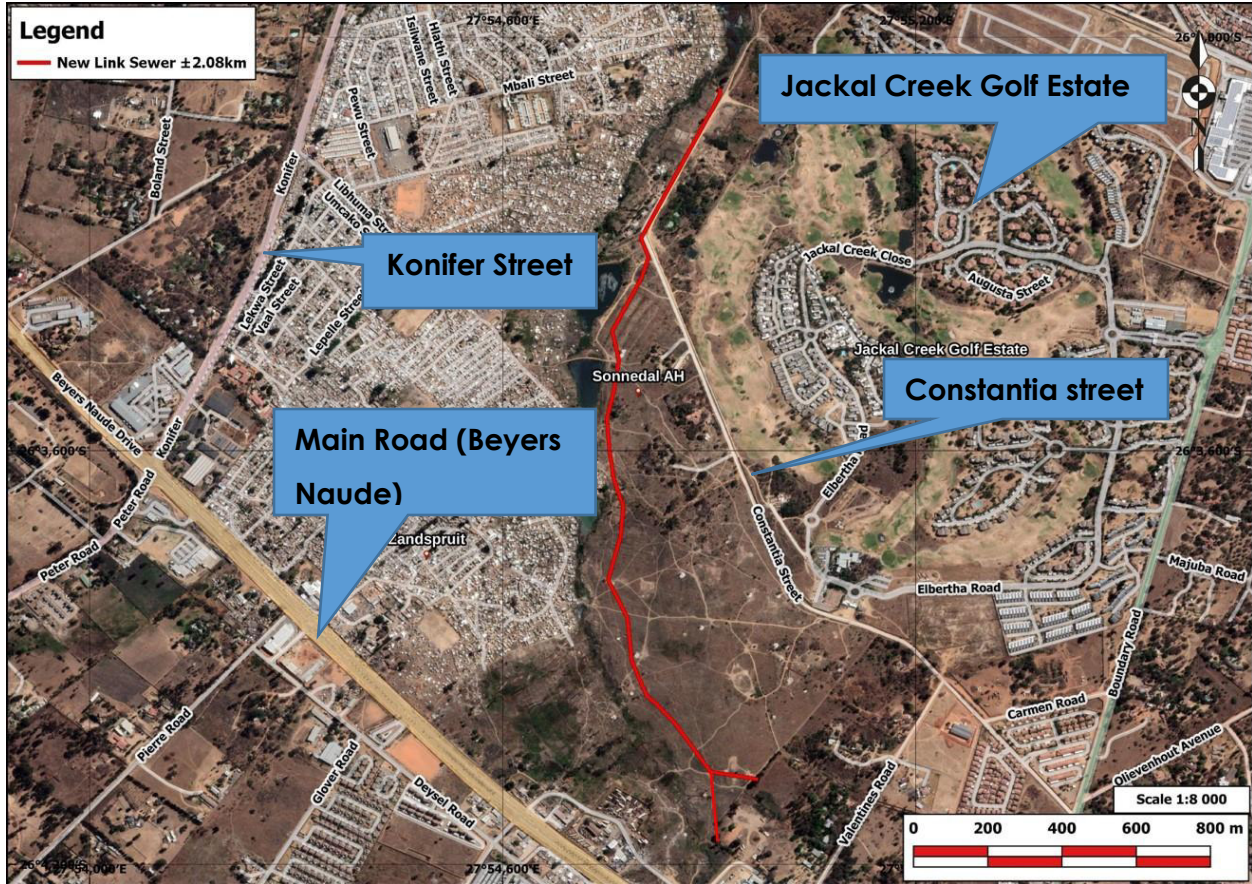


Figure 2: Aerial Map of the Study Site

5.2 Regional Vegetation

The study site is situated in the 2627BB Quarter Degree Square (QDS) and falls within the Egoli Granite Grassland vegetation type its national conservation status is regarded as Endangered (Figure 3) (SANBI, 2018).

The landscape features moderately undulating plains and low hills, supporting *Hyparrhenia hirta* dominated grassland, with some woody species on rocky outcrops. The soil is shallow, leached, coarsely grained sandy and poor in nutrients. The conservation target is 24% and only 3% is conserved in statutorily Reserves (Diepsloot and Melville Koppies Nature Reserves) and a number of private conservation areas.

Current rates of transformation threaten most of the remaining un-conserved areas (Mucina & Rutherford, 2011).

According to Mucina & Rutherford (2011), the following species are listed as important taxa in the Egoli Granite Grassland vegetation type:

Trees: *Senegalia caffra*, *Diospyros lycioides* subsp. *lycioides* and *Celtis africana*.

Shrubs: *Asparagus larycinus*, *Asparagus suaveolens* and *Teucrium trifidum*.

Grasses: *Eragrostis curvula*, *Hyparrhenia hirta*, *Setaria sphacelata*, *Themeda triandra*, *Cymbopogon pospischillii*, *Digitaria eriantha*, *Elionurus muticus*, *Eragrostis racemosa*, *Eragrostis superba* and *Panicum maximum*.

Herbs: *Commelina africana*, *Vernonia galpinii*, *Hilliardiella oligocephala* and *Aloe greatheadii* var. *davyana*.

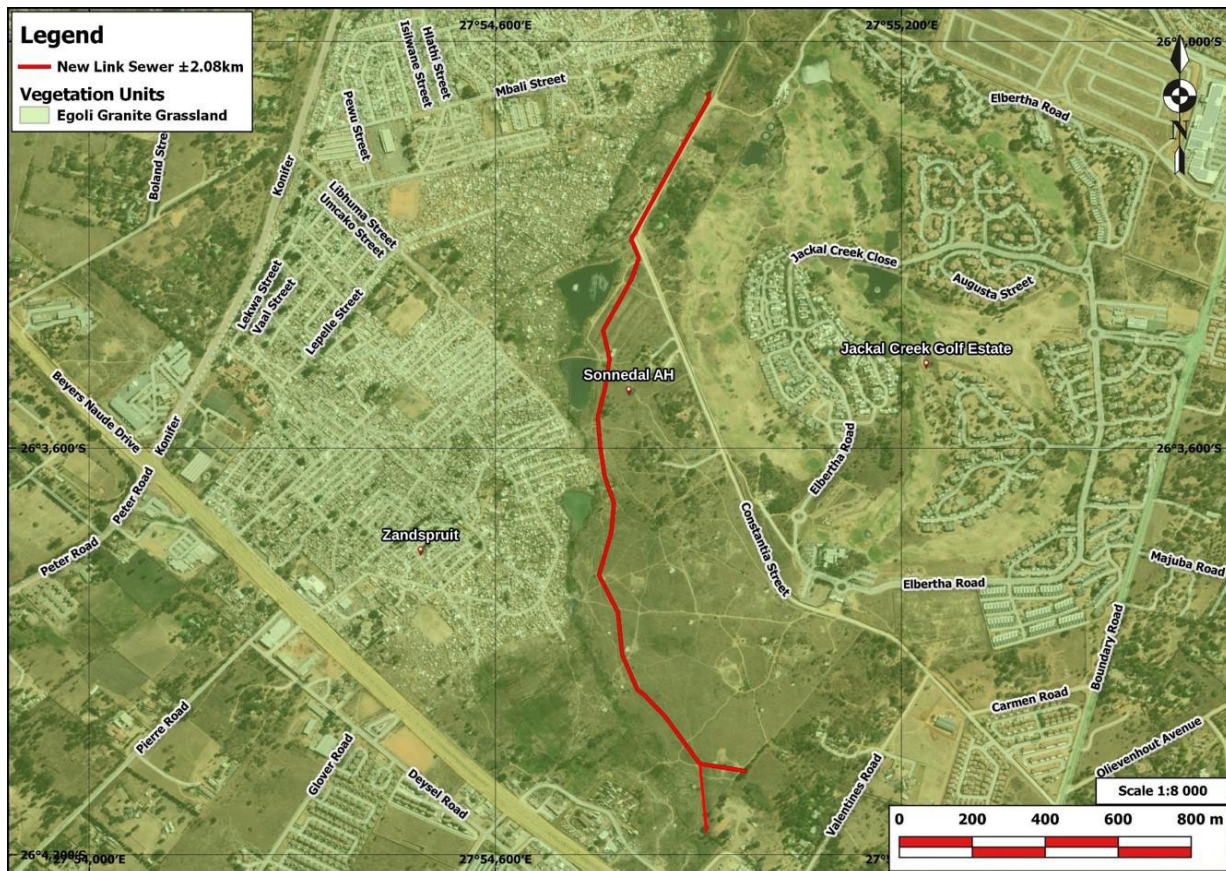


Figure 3: Distribution of the Egoli Granite Grassland Vegetation unit in the study site

The study site is located in the Endangered Egoli Granite Grassland Ecosystem (Figure 4) (National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA).

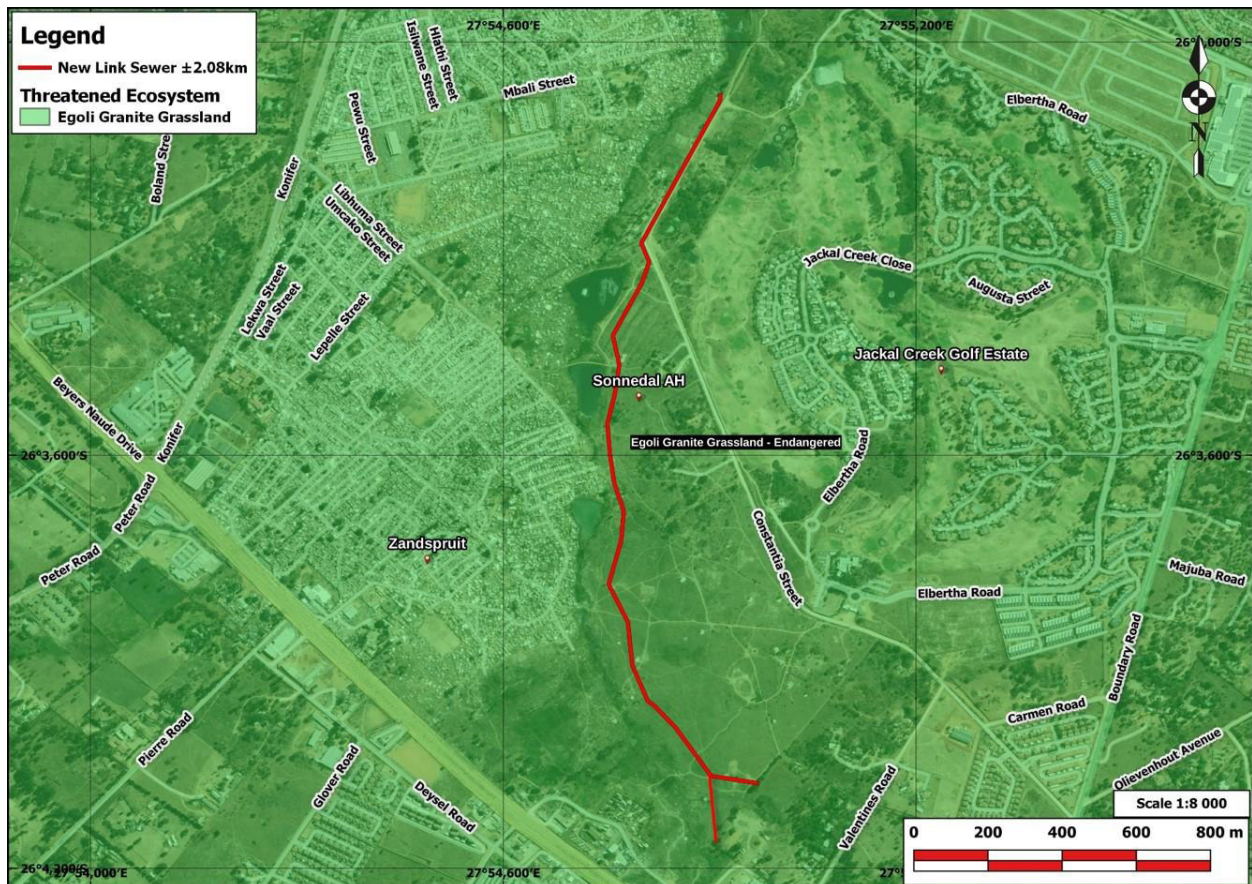


Figure 4: Threatened Ecosystem map

5.3 Important Bird and Biodiversity Areas

The Important Bird and Biodiversity Areas (IBAs) identify and work to conserve a network of sites critical for the long-term survival of bird species that are globally threatened, have a restricted range and are restricted to specific biomes/vegetation types. The proposed Sewer Line does not occur on any of the protected IBAs (Figure 5). According to Birdlife International (2022), the selection of IBAs is achieved through the application

of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels. In 2002, the world's governments made a commitment to reduce the rate of biodiversity loss by 2010 (<http://datazone.birdlife.org/>). State of the world's birds provides a progress report, based on birds. The Birdlife Partnership strives to conserve birds, their habitats and global biodiversity, working with people towards sustainability in the use of natural resources. BirdLife already supports and coordinates work by several Asian Partners to protect the Helmeted Hornbill, Asian songbirds and parrots threatened by the pet trade.

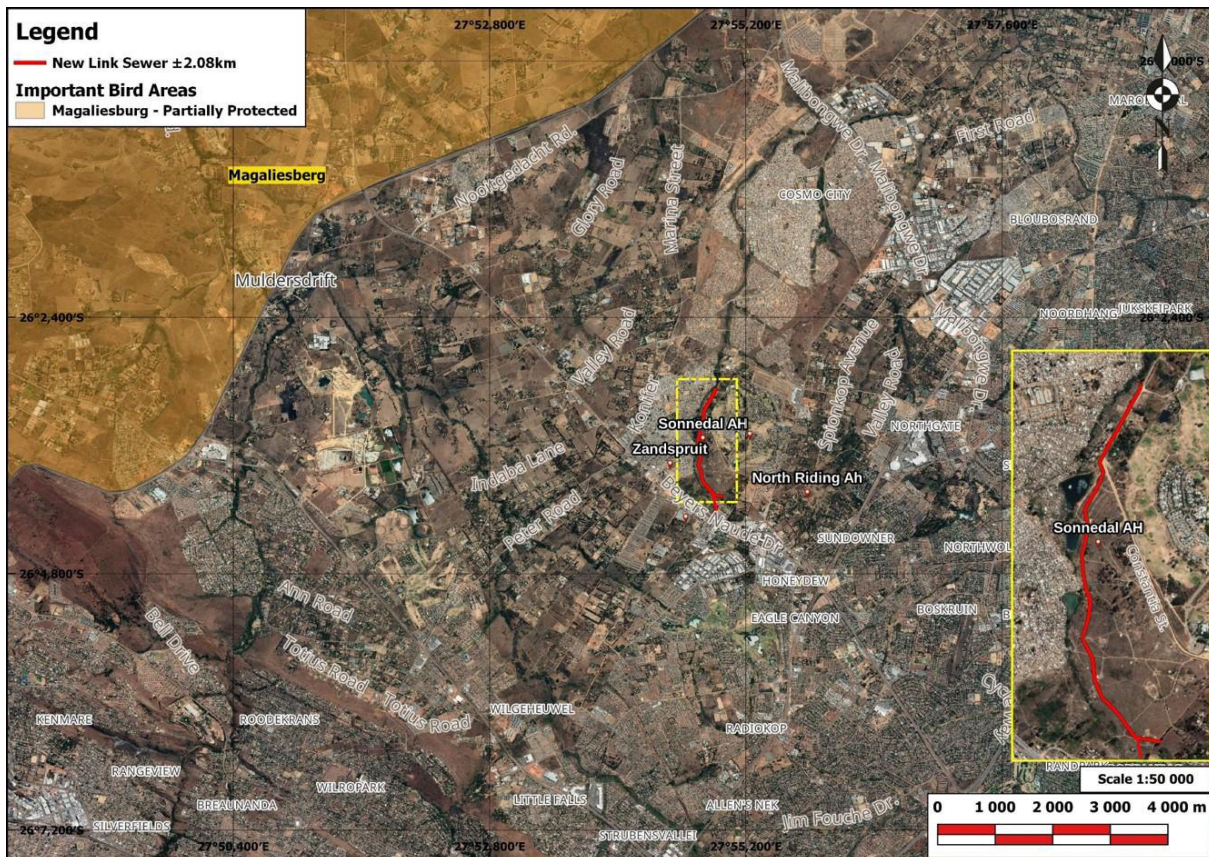


Figure 5: Important Bird and Biodiversity Areas Map

6. METHODOLOGY

6.1 Desktop Study

6.1.1 Plant Species List

Prior to the site visit, a desktop study was conducted in order to generate lists of species historically recorded at or near the site, or that are likely to occur at the site. Plant species recorded in the 2627BB QDS were obtained from SANBI (<http://posa.sanbi.org/sanbi/Explore>) and a total of 4841 of plant species have been recorded (this plant list is available on request). This list was consulted to verify the record of occurrence of the plant species seen on the site. The SANBI plant species list was sufficiently detailed to provide an indication of species composition, diversity and the presence of Threatened Species and/or Species of Conservation Concern (SCC) on the study site.

According to the South African Red Data list categories compiled by SANBI (Figure 6), Threatened Species are species that are facing a high risk of extinction. Species classified in the International Union for Conservation of Nature (IUCN) categories Critically Endangered, Endangered or Vulnerable are threatened species whereas Species of Conservation Concern 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, Declining and Data Deficient - Insufficient Information (DDD).

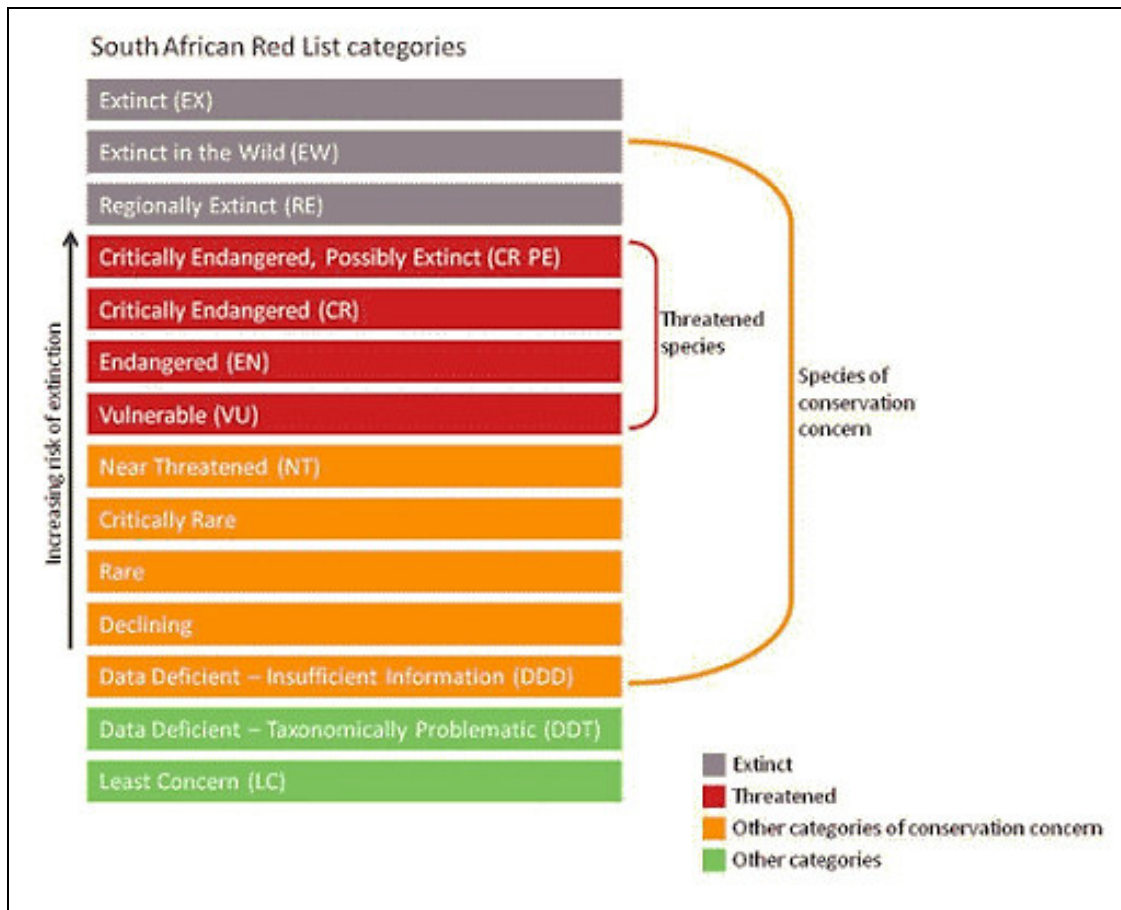


Figure 6: South African Red Data list categories (SANBI)

6.1.2 Red and Orange List species

A list of Red data plant species collected or which could potentially occur in the 2627BB QDS was obtained from Lorraine Mills (GDARD) (Annexure A). The updated list was then evaluated to determine which species were likely to occur in the available habitats on the study site. No Red and Orange List plant taxa are likely to be present on the actual study site or in the near vicinity of the study site. The Red List of South African Plants website (SANBI, 2017) was utilized to provide the most current account of the national status of flora.

6.1.3 Gauteng Conservation Plan (C - Plan)

Gauteng Conservation Plan (C-Plan) map (Figure 7) (GDARD, 2014) was used for biodiversity features in the province in order to determine the conservation status and habitat use of the province in order to identify biodiversity features important to the study site. The study site has potential habitat for Red and Orange List flora and fauna species. The study site is located within an *Important Area* and *Ecological Support Area* (ESA).

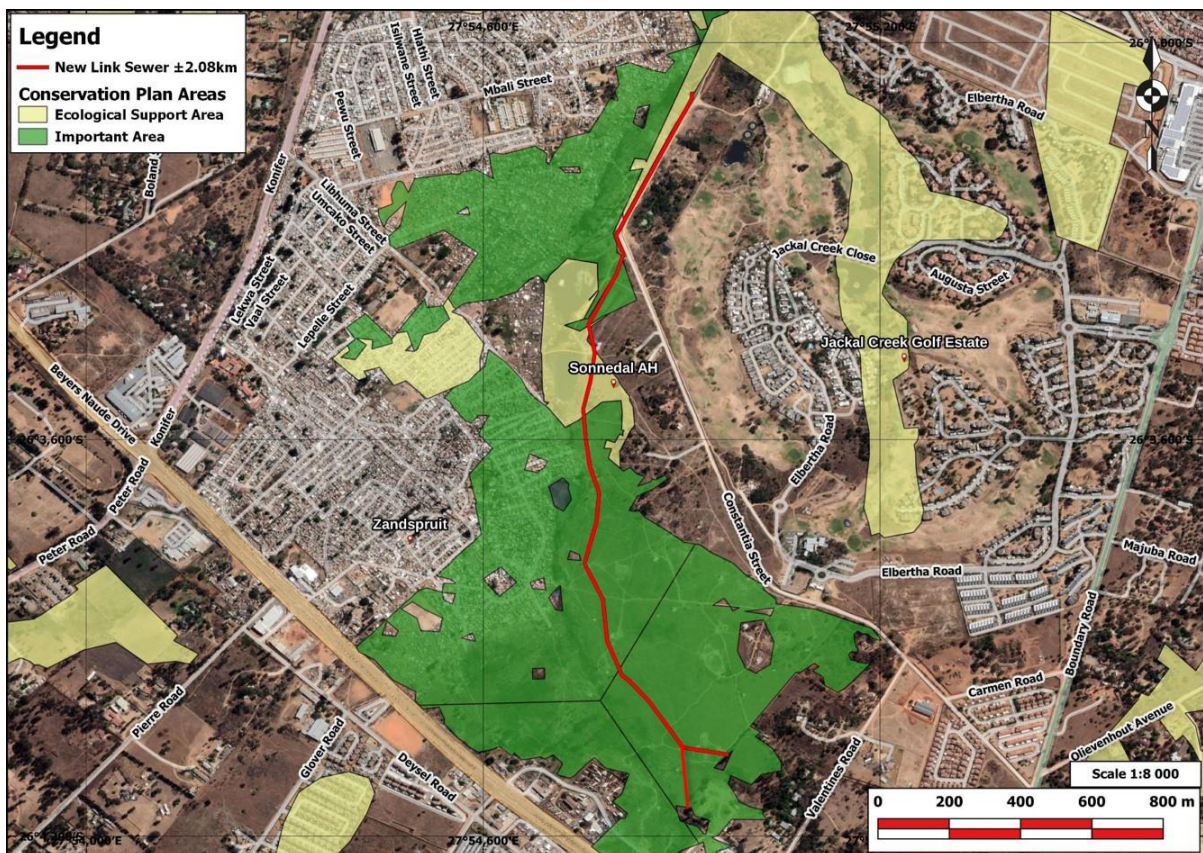


Figure 7: Gauteng Conservation Plan Areas within the study site

6.1.4 Protected Trees

A desktop study was conducted to determine the possible presence of protected tree species on the study site to be marked in accordance with the legislation. In terms of the National Forests Act, 1998 (Act No. 84 of 1998), certain tree species are declared as

protected by the Department of Forestry, Fisheries and the Environment (DFFE). No person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Refer to Annexure B for protected trees in Gauteng Province.

6.1.5 Alien invasive plant species

NEMBA Alien and Invasive Species List (2016) was used to determine invasive categories of plant species that were found on the study site. Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of these systems (NEMBA Alien and Invasive Species List, 2016). Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species.

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to Alien Invasive Plant Species (AIS). In September 2020, the list of AIS was updated in terms of the NEMBA (Act No 10 of 2004) (Government Gazette No 43726 of 2020). The AIS Regulations were updated in the Government Gazette No. 43726, 29 September 2020. The legislation calls for the removal and control of AIS (Category 1 species). In addition, unless authorized thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998, as amended), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse.

For each alien species, the category is indicated according to the amended Alien and Invasive Species (AIS) lists (NEMBA Alien and Invasive Species Lists, 2016) in Government Notice 40166 in terms of the National Environmental Management: Biodiversity Act,

2004 (Act No. 10 of 2004). The AIS Regulations list four different categories of invasive species that must be controlled, managed or eradicated:

Category 1a: Invasive species which must be combatted and eradicated. Any form of trade or planting is strictly prohibited.

Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form of trade or planting is strictly prohibited.

Category 2: Invasive species or species deemed to be potentially invasive, in that a permit is required to carry out a restricted activity. Species include commercially important species such as Pines (*Pinus* spp.), Wattles (*Acacia* spp.) and Gum (*Eucalyptus* spp.) trees.

Category 3: Invasive species which may remain in prescribed areas and provinces. Further planting, propagation or trade is however prohibited.

6.1.6 Mammals

A list of mammalian species was compiled on account of the documented distributions of mammals in South Africa (Table 3), Animal Demography Unit (ADU) - MammalMap Category (MammalMAP, 2022) (mammalmap.adu.org.za). Child *et al.* (2016) was used to determine the conservation status of each mammal species. The Probability of Occurrence (POO) of mammal species was assigned in accordance with a species' distribution and habitat preferences. Where a species' distribution range was found to overlap with the study site and its preferred habitat was present, the applicable species was deemed to have a high POO on or near the study site. In the case where the preferred habitat of a species was found to be sub-optimal on the study site, but its distribution range still overlapped the study site, the applicable species POO was deemed to be medium. When the preferred habitat of a species was absent from the study site, the applicable species was deemed to have a low POO regardless of its distribution range. For the identification of species, Stuart's field guide to Mammals of Southern Africa (2015) was used.

6.1.7 Reptiles

A reptile species list was compiled that has been recorded in the 2627BB QDS (Table 4), Animal Demography Unit (ADU) – (ReptileMAP, 2022) (reptilemap.adu.org.za) and probability of presence of reptile species on the study site was determined. Bates *et al.* (2014) was used to determine the conservation status of each reptile species. The survey involved searching for reptile species that shelter in their particular habitats.

6.1.8 Amphibians

A species list was compiled of the amphibian species that have been recorded in the 2627BB QDS (Table 5), Animal Demography Unit (ADU) – (FrogMAP, 2022) (frogmap.adu.org.za). Minter *et al.* (2004) and Measey (2011) were used to determine the conservation status of each amphibian species. Amphibians were noted as sight records in the field.

6.1.9 Avifauna

The study site does not fall within an Important Bird and Biodiversity Area (IBA). Threatened avifaunal species and Species of Conservation Concern are listed in Table 6. Data from SABAP2 indicate that 309 bird species have already been recorded from the pentad 2615_2800 in which the study site is situated (sabap2.adu.org.za). A pentad covers an area of approximately 77km², which is considerably smaller than a quarter-degree grid (approximately 694km²) and thus a better indication of which species occur on the study site. The probability of occurrence is based on the presence of suitable habitat where the species is likely to occur. In this case many of the potential species are likely to occur at the site due to availability of suitable microhabitats.

6.2 Site Visit

The field survey was planned to include all the different habitat types and to target threatened plant and faunal species that may occur on site, to determine the likelihood of their presence and how the proposed activities will impact upon them.

Sites have been surveyed in a crisscross fashion, covering as many habitats as possible. During the field survey, attention was paid to note any signs of potential occurrence of Red List species as well as other species with conservation importance.

The site visit was conducted on the 30th of April 2020 and 23rd March 2022. Field guides such as those by Pooley (1998), van Oudtshoorn (2014), and van Wyk & van Wyk (2013) were used to identify the plant species. For the identification of faunal species, Stuart's field guide to Mammals of Southern Africa (2015), Skinner & Chimimba (2005) were used; Alexander & Marais (2008) and Bates *et al.* (2014) were used for reptiles, Taylor *et al.* (2015) was used for birds and Du Preez & Carruthers (2009) was used for Amphibians.

The SANBI website (<http://posa.sanbi.org/sanbi/Explore>) was consulted for the list of plant species that have been collected in the 2627BB QDS. The study site was further scrutinized for the occurrence of alien invasive plant species and any form of disturbance (Bromilow, 2010). Alien plant species are included in the species lists. For each alien species, the invasive category is indicated according to the Alien and Invasive Species lists (NEMBA Alien and Invasive Species Lists, 2020).

For each plant species, van Wyk *et al.* (2013) was consulted to derive medicinal uses. Medicinal plants are highlighted in bold in the respective tables. Harvesting of medicinal plants causes a decline in the numbers of the particular species and therefore, threatens the conservation of these species (van Wyk *et al.* 2013).

7. RESULTS

7.1 Study Units

Two study units were identified on the study site (Figure 8), namely:

- Alien study unit;
- Built up area;
- Lever Creek Golf Estate; and
- Wetland Area.

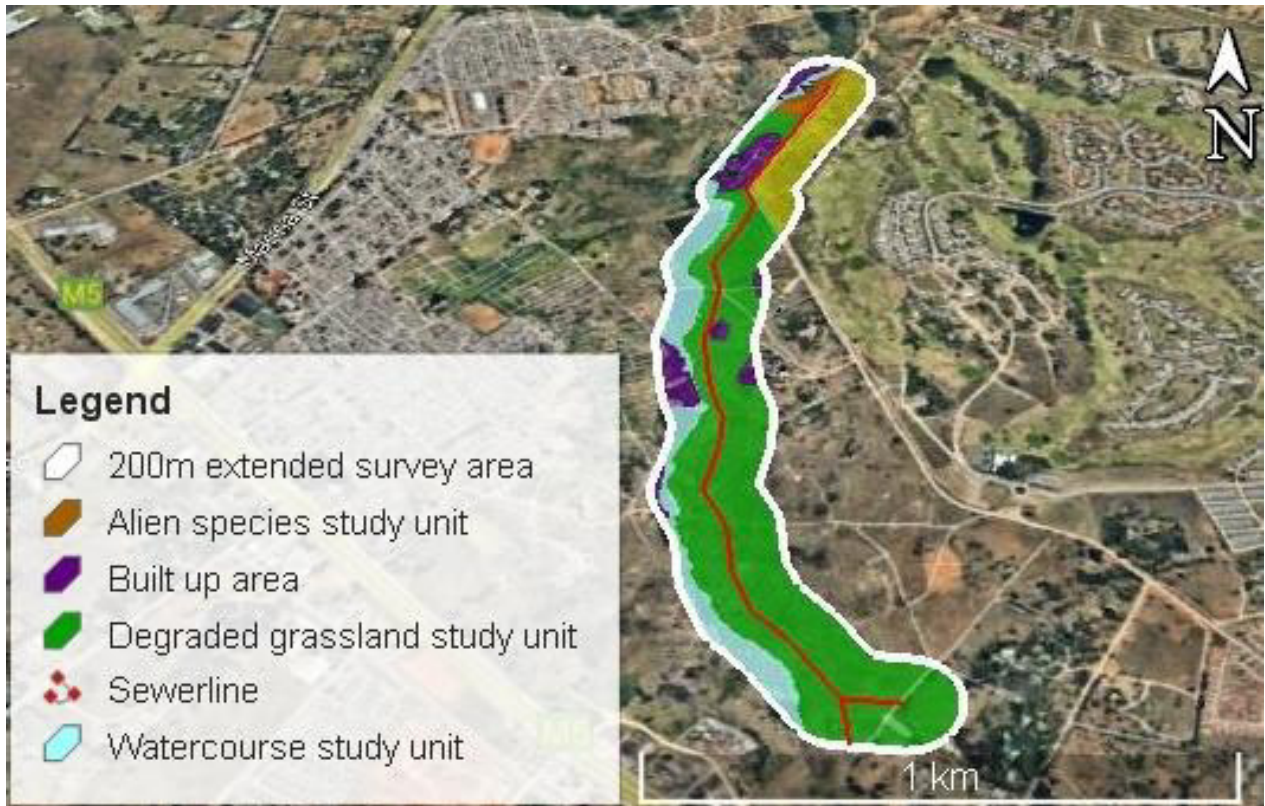


Figure 8: Study units on site

7.2 Medicinal and Alien Plant Species

The total number of plant species, medicinal species and alien species recorded per study unit are listed in Table 1 below.

Table 1: The total number of plant species, medicinal species and alien species recorded in study units

Study unit	Total number of species	Number of medicinal Species	Number of alien species
Alien study unit	50	5	24
Built up area	Species list not compiled		
Degraded grassland study unit	46	5	17
Lever Creek Golf Estate	No plant species on this unit		
Wetland Area	41	5	18

The number of alien species and their categories in each study unit are indicated in Table 2.

Table 2: Number of alien plant species in study units

Study unit	CAT 1a	CAT 1b	CAT 2	CAT 3	Not declared invasive
Alien study unit	0	18	1	1	4
Built up area	Species list not compiled				
Degraded grassland study unit	0	11	1	1	4
Lever Creek Golf Estate	No plant species on this unit				
Wetland Area	0	11	1	1	5

7.3 Threatened Species and Species of Conservation Concern

Fourteen Red and Orange List species are known to occur in the 2627BB QDS (Annexure A). No Red and Orange List species were found during these surveys.

7.4 Mammals

A total of 70 species are expected to occur or have been recorded in the 2627BB QDS (Table 3). Species on the list with incomplete naming (only genus) were removed from the expected species list. No mammal species was observed on site. The list of potential SCC includes:

- One (1) that is listed as Vulnerable (VU) on a regional basis;
- One (1) that is listed as Endangered (E) on a regional basis; and
- Eight (8) that are listed as Near Threatened (NT) on a regional scale.

All of the species are expected to have a low moderate/medium of occurrence due to availability of their habitat on study site.

It is Important to note that the mammal list is based on VMUS data and that the distribution data for mammals, although useful, is incomplete in that many QDSs simply

have not been surveyed very well and many species that do occur are still lacking from the VMUS records due to sampling inadequacy. Species highlighted in blue, indicate that they are not likely to be found naturally on site but rather as game animals.

Table 3: Mammal species recorded in the 2627BB QDS. Red List category indicated as defined in Child *et al.* (2016)

Scientific name	Common name	Red list category	Probability of Occurrence
<i>Aepyceros melampus</i>	Impala	Least Concern	1
<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	Least Concern	1
<i>Antidorcas marsupialis</i>	Springbok	Least Concern	1
<i>Aonyx capensis</i>	African Clawless Otter	Near Threatened	3
<i>Atelerix frontalis</i>	Southern African Hedgehog	Near Threatened	3
<i>Atilax paludinosus</i>	Marsh Mongoose	Least Concern	3
<i>Canis mesomelas</i>	Black-backed Jackal	Least Concern	1
<i>Caracal caracal</i>	Caracal	Least Concern	1
<i>Chlorocebus pygerythrus pygerythrus</i>	Vervet Monkey (subspecies pygerythrus)	Least Concern	1
<i>Cloeotis percivali</i>	Percival's Short-eared Trident Bat	Endangered	1
<i>Connochaetes gnou</i>	Black Wildebeest	Least Concern	2
<i>Crocidura maquassiensis</i>	Makwassie Musk Shrew	Vulnerable	3
<i>Crocidura mariquensis</i>	Swamp Musk Shrew	Near Threatened	3
<i>Cryptomys hottentotus</i>	Southern African Mole-rat	Least Concern	3
<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern	3
<i>Dama dama</i>	Fallow Deer	Introduced	1
<i>Damaliscus pygargus phillipsi</i>	Blesbok	Least Concern	1
<i>Dendromus melanotis</i>	Gray African Climbing Mouse	Least Concern	1
<i>Dendromus mystacalis</i>	Chestnut African Climbing Mouse	Least Concern	1
<i>Elephantulus brachyrhynchus</i>	Short-snouted Elephant Shrew	Least Concern	1
<i>Elephantulus myurus</i>	Eastern Rock Elephant Shrew	Least Concern	1
<i>Elephantulus sp.</i>	Elephant Shrews	Least Concern	1
<i>Equus quagga</i>	Plains Zebra	Least Concern	1
<i>Felis catus</i>	Domestic Cat	Introduced	5
<i>Felis silvestris</i>	Wildcat	Least Concern	1
<i>Genetta genetta</i>	Common Genet	Least Concern	2
<i>Genetta maculata</i>	Common Large-spotted Genet	Least Concern	1
<i>Genetta tigrina</i>	Cape Genet (Cape Large-spotted Genet)	Least Concern	1
<i>Gerbilliscus brantsii</i>	Highveld Gerbil	Least Concern	1
<i>Graphiurus (Graphiurus) platyops</i>	Flat-headed African Dormouse	Data deficient	3
<i>Herpestes sanguineus</i>	Slender Mongoose	Least Concern	1
<i>Hippopotamus amphibius</i>	Common Hippopotamus	Least Concern	1
<i>Hydrictis maculicollis</i>	Spotted-necked Otter	Least Concern	3
<i>Hystrix africaeaustralis</i>	Cape Porcupine	Least Concern	1
<i>Kobus ellipsiprymnus</i>	Waterbuck	Least Concern	1

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Scientific name	Common name	Red list category	Probability of Occurrence
<i>Leptailurus serval</i>	Serval	Near Threatened	3
<i>Lepus saxatilis</i>	Scrub Hare	Least Concern	3
<i>Malacothrix typica</i>	Large-eared African Desert Mouse	Least Concern	3
<i>Mastomys natalensis</i>	Natal Mastomys	Least Concern	3
<i>Mellivora capensis</i>	Honey Badger	Least Concern	3
<i>Miniopterus fraterculus</i>	Lesser Long-fingered Bat	Least Concern	3
<i>Miniopterus natalensis</i>	Natal Long-fingered Bat	Least Concern	1
<i>Mus musculus musculus</i>	House mouse	Least concern	1
<i>Myosorex varius</i>	Forest Shrew	Least Concern	4
<i>Myotis tricolor</i>	Temminck's Myotis	Least Concern	1
<i>Neoromicia capensis</i>	Cape Serotine	Least Concern	2
<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	Least Concern	2
<i>Oryx gazella</i>	Gemsbok	Least Concern	1
<i>Otocyon megalotis</i>	Bat-eared Fox	Least Concern	2
<i>Otomys angoniensis</i>	Angoni Vlei Rat	Least Concern	3
<i>Otomys auratus</i>	Southern African Vlei Rat	Near Threatened	3
<i>Panthera leo</i>	Lion	Least Concern	1
<i>Panthera pardus</i>	Leopard	Vulnerable	1
<i>Papio ursinus</i>	Chacma Baboon	Least Concern	3
<i>Pipistrellus (Pipistrellus) rusticus</i>	Rusty Pipistrelle	Least Concern	1
<i>Poecilogale albinucha</i>	African Striped Weasel	Near Threatened	3
<i>Procavia capensis</i>	Cape Rock Hyrax	Least Concern	3
<i>Raphicerus campestris</i>	Steenbok	Least Concern	3
<i>Rattus rattus</i>	Roof Rat	Least Concern	3
<i>Rhabdomys pumilio</i>	Xeric Four-striped Grass Rat	Least Concern	3
<i>Rhinolophus blasii</i>	Blasius's Horseshoe Bat	Near Threatened	1
<i>Rhinolophus clivus</i>	Geoffroy's Horseshoe Bat	Least Concern	3
<i>Scotophilus dinganii</i>	Yellow-bellied House Bat	Least Concern	3
<i>Steatomys krebsii</i>	Kreb's African Fat Mouse	Least Concern	3
<i>Steatomys pratensis</i>	Common African Fat Mouse	Least Concern	3
<i>Suncus infinitesimus</i>	Least Dwarf Shrew	Least Concern	2
<i>Sylvicapra grimmia</i>	Bush Duiker	Least Concern	1
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	Least Concern	33
<i>Taurotragus oryx</i>	Common Eland	Least Concern	1
<i>Tragelaphus strepsiceros</i>	Greater Kudu	Least Concern	1

The POO of mammal species listed above are indicated as follows: Not likely to occur - 1, Low POO - 2, Medium POO - 3, High POO – 4, Confirmed occurrence – 5.

Atelerix frontalis (South African Hedgehog) has a tolerance of a degree of habitat modification and occurs in a wide variety of semi-arid and sub-temperate habitats (IUCN, 2017). Based on the Red List of Mammals of South Africa, Lesotho and Swaziland (2016), *A. frontalis* populations are decreasing due to the threats of electrocution, veld fires, road collisions, predation from domestic pets and illegal harvesting. Although the species is cryptic and therefore not often seen, there is suitable habitat in the project area and therefore the likelihood of occurrence is rated as moderate/medium.

Leptailurus serval (Serval) occurs widely through sub-Saharan Africa and is commonly recorded from most major national parks and reserves (IUCN, 2017). The Serval's status outside reserves is not certain, but they are inconspicuous and may be common in suitable habitat as they are tolerant of farming practices provided there is cover and food available. In sub-Saharan Africa, they are found in habitat with well-watered savanna, long-grass environments and are particularly associated with reedbeds and other riparian vegetation types. With the presence of the wetlands and grassland areas, there is a moderate likelihood of occurrence.

Crocidura mariquensis (Swamp Musk Shrew) has a wide distribution across the assessment region and occurs in many protected areas, but is restricted to wetlands and waterlogged areas. With the presence of the wetlands, there is a moderate/medium likelihood of occurrence.

Aonyx capensis (Cape Clawless Otter) is the most widely distributed otter species in Africa (IUCN, 2017). This species is predominantly aquatic, and it is seldom found far from water. Based on the presence of a perennial river within the project area which provides suitable habitat but the presence of nearby urban development, the likelihood of occurrence of this species occurring in the project area is considered to be moderate/medium.

Otomys auratus (Southern African Vlei Rat) is associated with mesic grasslands and wetlands within alpine, montane and sub-montane regions, occurring in dense vegetation in close proximity to water (Taylor PJ *et al*, 2016). The likelihood of occurrence of this species occurring in the project area is considered to be moderate/medium.

Poecilogale albinucha (African Striped Weasel) is a specialist predator of small mammals and has a high metabolic rate, which means it can only exist in habitats containing adequate numbers of prey. Because of its secretive nature it has probably been overlooked in many areas, especially in light of records from sites that were previously considered unsuitable. The likelihood of occurrence of this species occurring in the project area is considered to be moderate/medium.

Crocidura maquassiensis – (Maquassie Musk Shrew) are rare species endemic to South Africa, Swaziland and Zimbabwe, existing in moist grassland habitats in the Savannah and Grassland biomes. The likelihood of occurrence of this species occurring in the project area is considered to be moderate/medium.

Rhinolophus blasii – (Peak-saddle Horseshoe Bat) occur in savannah woodlands and are dependent on the availability of daylight roosting sites such as caves, mine adits or boulder piles (Skinner & Chimimba 2005). The likelihood of occurrence of this species occurring in the project area is considered to be low.

Cloeotis percivali – (Short-eared Trident Bat)

Occurs in savannah and woodland areas where there is sufficient cover in the form of caves and mine tunnels for day roosting (Balona J, *et al.* 2016). It feeds exclusively on moths (Chimimba 2005), and appears to be very sensitive to disturbance. The likelihood of occurrence of this species occurring in the project area is considered to be low.

7.5 Reptiles

Fifty reptile species have been previously recorded in the 2627BB QDS (Table 4). Under Gauteng C-plan version 3.3, no specialist studies for any species of reptile are requested for consideration in the review of a development application. A Common Variable Skink was observed on the study site. The Near Threatened Coppery Grass Lizard, Vulnerable Nile Crocodile and Cape Sand Snake have been recorded in the 2627BB QDS.

Table 4: Reptile species recorded in the 2627BB QDS. Red List category indicated as defined in Bates *et al.* (2014)

Scientific name	Common name	Red list category	Probability of Occurrence
<i>Afrotyphlops bibronii</i>	Bibron's Blind Snake	Least Concern	2
<i>Agama aculeata distantii</i>	Distant's Ground Agama	Least Concern	2
<i>Agama atra</i>	Southern Rock Agama	Least Concern	2
<i>Aparallactus capensis</i>	Black-headed Centipede-eater	Least Concern	3
<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	Least Concern	3
<i>Bitis arietans arietans</i>	Puff Adder	Least Concern	2
<i>Boaedon capensis</i>	Brown House Snake	Least Concern	3
<i>Causus rhombeatus</i>	Rhombic Night Adder	Least Concern	2
<i>Chamaeleo dilepis</i>	Common Flap-neck Chameleon	Least Concern	2

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Scientific name	Common name	Red list category	Probability of Occurrence
<i>Chamaesaura aenea</i>	Coppery Grass Lizard	Near Threatened	3
<i>Cordylus vittifer</i>	Common Girdled Lizard	Least Concern	2
<i>Crocodylus niloticus</i>	Nile Crocodile	Vulnerable	1
<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	Least Concern	2
<i>Dasypeltis scabra</i>	Rhombic Egg-eater	Least Concern	3
<i>Dispholidus typus viridis</i>	Northern Boomslang	Not evaluated	2
<i>Elapsoidea sundevallii media</i>	Highveld Garter Snake	Least Concern	1
<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	Least Concern	2
<i>Hemachatus haemachatus</i>	Rinkhals	Least Concern	3
<i>Hemidactylus mabouia</i>	Common Tropical House Gecko	Least Concern	2
<i>Homoroselaps lacteus</i>	Spotted Harlequin Snake	Least Concern	3
<i>Kinixys lobatsiana</i>	Lobatse Hinged Tortoise	Least Concern	3
<i>Lamprophis aurora</i>	Aurora House Snake	Least Concern	1
<i>Leptotyphlops distantii</i>	Distant's Thread Snake	Least Concern	3
<i>Leptotyphlops scutifrons</i>	Peters' Thread Snake	Least Concern	3
<i>Lycodonomorphus inornatus</i>	Olive House Snake	Least Concern	2
<i>Lycodonomorphus rufulus</i>	Brown Water Snake	Least Concern	4
<i>Lycophidion capense capense</i>	Cape Wolf Snake	Least Concern	3
<i>Lygodactylus capensis</i>	Common Dwarf Gecko	Least Concern	3
<i>Lygodactylus ocellatus</i>	Spotted Dwarf Gecko	Least Concern	2
<i>Naja annulifera</i>	Snouted Cobra	Least Concern	3
<i>Naja mossambica</i>	Mozambique Spitting Cobra	Least Concern	3
<i>Nucras holubi</i>	Holub's Sandveld Lizard	Least Concern	2
<i>Nucras lalandii</i>	Delalande's Sandveld Lizard	Least Concern	3
<i>Pachydactylus affinis</i>	Transvaal Gecko	Least Concern	3
<i>Pachydactylus capensis</i>	Cape Gecko	Least Concern	3
<i>Panaspis wahlbergii</i>	Wahlberg's Snake-eyed Skink	Least Concern	1
<i>Pelomedusa galeata</i>	South African Marsh Terrapin	Not evaluated	1
<i>Philothamnus semivariegatus</i>	Spotted Bush Snake	Least Concern	3
<i>Prosymna sundevallii</i>	Sundevall's Shovel-snout	Least Concern	3
<i>Psammophis brevirostris</i>	Short-snouted Grass Snake	Least Concern	3
<i>Psammophis crucifer</i>	Cross-marked Grass Snake	Least Concern	1
<i>Psammophis leightoni</i>	Cape Sand Snake	Vulnerable	1
<i>Psammophylax rhombeatus</i>	Spotted Grass Snake	Least Concern	2
<i>Pseudaspis cana</i>	Mole Snake	Least Concern	2
<i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	Least Concern	3
<i>Smaug vandami</i>	Van Dam's Girdled Lizard	Least Concern	3
<i>Stigmochelys pardalis</i>	Leopard Tortoise	Least Concern	3
<i>Trachylepis capensis</i>	Cape Skink	Least Concern	3
<i>Trachylepis punctatissima</i>	Speckled Rock Skink	Least Concern	3
<i>Trachylepis varia sensu lato</i>	Common Variable Skink	Least Concern	3

Scientific name	Common name	Red list category	Probability of Occurrence
	Complex		

The POO of reptile species listed above are indicated as follows: Not likely to occur - 1, Low POO - 2, Medium POO - 3, High POO – 4, Confirmed occurrence – 5.

The Coppery Grass Lizard (*Chamaesaura aenea*) is restricted to the Grassland biome. It is found on grassy slopes and plateau of the eastern escarpment and Highveld (Bates *et al.* 2014). Based on the unsuitable habitat, it has a low likelihood to occur on the study site.

Nile crocodile has low likelihood to occur on site. *Psammophis leightoni* (Cape Sand Snake) is restricted to the Western Cape. Its favored habitats are Renosterveld and fynbos (Bates *et al.* 2014) and the study site does not provide suitable habitat for this species, hence it has a low to non-likelihood to occur on site.

Psammophis leightoni (Cape Sand Snake) can be identified by its slender body, large eyes and strictly diurnal lifestyle. It grows to an average length of 75 cm and a maximum length of 1m. This snake species is restricted to the Western Cape. Its favoured habitats are renosterveld and fynbos. Based on the unsuitable habitat, it has a low likelihood to occur on the study site.

7.6 Amphibians

Fourteen amphibian species (Table 5) have previously been recorded in the QDS 2627BB. Under the Gauteng C-plan Version 3.3, no specialist studies for any species of amphibians are requested for consideration in the review of a development application. No Red Listed amphibians were observed on site but Common Caco (*Cacosternum boettgeri*) and Guttural Toad (*Sclerophrys gutturalis*) were observed.

Table 5: Amphibian species recorded in the 2627BB QDS. Red List category indicated as defined in Minter *et al.* (2004)

Scientific name	Common name	Red list category	Probability of Occurrence
<i>Amietia delalandii</i>	Delalande's River Frog	Least Concern	3

Scientific name	Common name	Red list category	Probability of Occurrence
<i>Amietia fuscigula</i>	Cape River Frog	Least Concern	3
<i>Cacosternum boettgeri</i>	Common Caco	Least Concern	5
<i>Kassina senegalensis</i>	Bubbling Kassina	Least Concern	5
<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	Least Concern	3
<i>Ptychadena anchietae</i>	Plain Grass Frog	Least Concern	3
<i>Pyxicephalus adspersus</i>	Giant Bull Frog	Near Threatened	2
<i>Schismaderma carens</i>	Red Toad	Least Concern	3
<i>Sclerophrys capensis</i>	Raucous Toad	Least Concern	4
<i>Sclerophrys gutturalis</i>	Guttural Toad	Least Concern	2
<i>Strongylopus fasciatus</i>	Striped Stream Frog	Least Concern	2
<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	Least Concern	3
<i>Tomopterna natalensis</i>	Natal Sand Frog	Least Concern	3
<i>Xenopus laevis</i>	Common Platanna	Least Concern	5

The POO of amphibian species listed above are indicated as follows: Not likely to occur - 1, Low POO - 2, Medium POO - 3, High POO – 4, Confirmed occurrence – 5.

7.7 Avifauna

Bird species were observed on site. Threatened List species for avifauna recorded in the pentad 2600_2750 are listed in Table 6. There are micro-habitats on site which consisted of secondary grasses and patches of alien trees which are not suitable for these species and not all would be expected to be found there. A total of nine SCC have been recorded during SABAP2 surveys within the pentad 2600_2750 (SABAP2, 2022). However, none of these species are considered likely to occur within the focus area. Only one SCC has medium chances to occasionally occur on site for foraging purposes but not residents. African Grass-Owl has medium chance to forage along the proposed alignment although extremely limited suitable roosting and foraging habitat occurs along the proposed sewer line. Half-collared Kingfisher, will not occur within the focus area due to a lack of clear riverine habitat surrounded by dense riparian vegetation.

Table 6: List of Threatened Avifaunal Species recorded in the pentad 2600_2750

Scientific name	Common name	Red List category	Suitable habitat	Probability of Occurrence
<i>Alcedo</i>	Half-collared	Near	Fast-flowing streams	1

Scientific name	Common name	Red List category	Suitable habitat	Probability of Occurrence
<i>semitorquata</i>	Kingfisher	Threatened	with clear water and well-wooded banks	
<i>Aquila verreauxii</i>	Verreaux's eagle	Vulnerable	Occur in hilly and mountainous terrain with cliffs, rocks ledges and caves	1
<i>Ciconia Abdimii</i>	Abdim's Stork	Near Threatened	It generally prefers savanna woodland, grassland, pastures, pan edges, cultivated land and suburban areas.	1
<i>Falco biarmicus</i>	Lanner Falcon	Vulnerable	Open grassland, woodland	1
<i>Falco peregrinus</i>	Peregrine Falcon	Vulnerable	It generally favours open grassland, cleared or open woodland and agricultural land	1
<i>Gyps coprotheres</i>	Cape Vulture	Endangered	Grassland, Savanna, Hills and Ridges	1
<i>Mycteria ibis</i>	Yellow-billed Stork	Near Threatened	Associated with water – dams, wetlands, rivers, marshes, even small pools	1
<i>Phoenicopterus ruber</i>	Greater Flamingo	Near Threatened	Large bodies of shallow water, both inland and coastal; saline and brackish waters preferred	1
<i>Tyto capensis</i>	African Grass-Owl	Vulnerable	Found in rank grass adjacent to wetlands	3

The POO of bird species listed above are indicated as follows: Not likely to occur - 1, Low POO - 2, Medium POO - 3, High POO – 4, Confirmed occurrence – 5.

7.8 Alien study unit

7.8.1 Compositional aspects

The vegetation in this unit comprises of alien invasive trees and graminoids (Figure 9). The soil is clay and whitish in colour. Dominant indigenous plant species include *Hyparrhenia hirta*, *Berkheya radula* and *Themeda triandra*. Dominant exotic species include *Populus x canescens*, *Melia azedarach* and *Robinia pseudoacacia*. A total of 49 species have been recorded and grouped according to their growth form (Table 7).



Figure 9: Variety of alien invasive species dominated by *Populus x canescens*

Table 7: Species recorded in the Alien study unit

Growth form	Species name	Invasive category
Graminoid	<i>Arundo donax</i> * <i>Cynodon dactylon</i> <i>Cyperus congestus</i> <i>Eragrostis chloromelas</i> <i>Eragrostis curvula</i> <i>Eragrostis lehmanniana</i> var.	1b

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Growth form	Species name	Invasive category
	<i>lehmanniana</i> <i>Heteropogon contortus</i> <i>Hyparrhenia hirta</i> <i>Setaria sphacelata</i> var. <i>sphacelata</i> <i>Sporobolus africanus</i> <i>Sporobolus fimbriatus</i> <i>Themeda triandra</i>	
Herbs/ Geophytic herbs	<i>Amaranthus hybridus</i> subsp. <i>hybridus</i> * <i>Argemone ochroleuca</i> * <i>Berkheya radula</i> <i>Bidens pilosa</i> * <i>Cirsium vulgare</i> * <i>Helichrysum rugulosum</i> <i>Hibiscus trionum</i> * Hilliardiella elaeagnoides Hypoxis hemerocallidea Hypoxis rigidula var. <i>rigidula</i> <i>Ipomoea purpurea</i> * <i>Ledebouria revoluta</i> <i>Ledebouria zebrina</i> <i>Tagetes minuta</i> * <i>Verbena bonariensis</i> * <i>Pseudognaphalium luteo-album</i>	 1b 1b 1b 1b
Shrubs and dwarf shrubs	<i>Datura stramonium</i> * <i>Elephantorrhiza elephantina</i> <i>Lantana camara</i> * <i>Solanum retroflexum</i> <i>Solanum sisymbriifolium</i> * <i>Solanum mauritianum</i> *	1b 1b 1b 1b
Trees	<i>Acacia mearnsii</i> * <i>Celtis africana</i> <i>Eucalyptus camaldulensis</i> * <i>Jacaranda mimosifolia</i> * <i>Melia azedarach</i> * <i>Robinia pseudoacacia</i> * <i>Searsia lancea</i> <i>Sesbania punicea</i> * <i>Populus x canescens</i> * <i>Tecoma stans</i> * <i>Tipuana tipu</i> * <i>Vachellia karroo</i>	2 1b 3 1b 1b 1b 1b 1b 1b

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Growth form	Species name	Invasive category
Succulent shrubs	<i>Aloe transvaalensis</i>	
	<i>Canna indica</i> *	1b
	<i>Cussonia paniculata</i>	
	<i>Opuntia stricta</i> *	1b

Alien and invasive species indicated with (*). Medicinal species indicated in **bold**.

7.8.2 Medicinal and Alien Plant Species

Five medicinal and 24 alien plant species have been recorded in the study unit. Eighteen of the alien plant species have been listed as Category 1b, one species as Category 2 and one species as Category 3 invasive species (Table 7).

7.8.3 Red List, Orange List and Protected Tree Species

The study unit has no suitable habitat for Red and Orange List species, protected trees and provincial protected plants.

7.8.4 Sensitivity and Connectivity

The vegetation in this unit has low sensitivity (Figure 14) because it is highly disturbed. Connectivity does not exist.

7.8.5 Mammals

No mammals were spotted in the study unit.

7.8.6 Reptiles

No reptile species were spotted in the study unit.

7.8.7 Amphibians

No amphibians were spotted in the study unit.

7.8.8 Avifauna

The study unit provides suitable habitat for bird species and there were a lot of Southern Masked Weaver (*Ploceus velatus*) nests found on the study unit. Bird species that were observed such as the House Sparrow (*Passer domesticus*), Laughing Dove (*Streptopelia senegalensis*), Red-chested Cuckoo (*Cuculus solitarius*), Pied Crow (*Corvus albus*), Red Bishop (*Euplectes orix*), Common Fiscal (*Lanius collaris*), Rufous Naped-lark (*Mirafra africana*), Willow Warbler (*Phylloscopus trochilus*), Southern Masked Weaver (*Ploceus velatus*), Dark-capped Bulbul (*Pycnonotus tricolor*).

7.9 Built up areas

This unit has been modified and cultivated with maize and squatter camps. Because the unit is built up, cultivated and devoid of indigenous vegetation, a list of plants occurring in the study unit was not compiled.

7.10 Degraded grassland study unit

7.10.1 Compositional aspects

The area comprises open grassland with loamy to clayey soil and the soil surface is gravelly while some termite mounds are present in some areas (Figure 10 and 11). The vegetation is characterized by the presence of a variety of natural grass species of which *Hyparrhenia hirta* and *Themeda triandra* are the most prominent. Dominant exotic species include *Acacia mearnsii*. Various foot paths and informal roads are present on the site. A total of 46 species has been recorded and grouped according to their growth form (Table 8).



Figure 10: Nature of the study unit



Figure 11: A couple of *Habenaria nyikana* subsp. *nyikana* was recorded on the study unit

Table 8: Plant species recorded in the Degraded grassland study unit

Growth form	Plant species	Invasive category
Graminoid	<i>Aristida congesta</i> subsp. <i>congesta</i> <i>Aristida diffusa</i> <i>Cynodon dactylon</i> <i>Eragrostis chloromelas</i> <i>Eragrostis curvula</i> <i>Eragrostis lehmanniana</i> var. <i>lehmanniana</i> <i>Heteropogon contortus</i> <i>Hyparrhenia hirta</i> <i>Melinis repens</i> subsp. <i>repens</i> <i>Sporobolus africanus</i> <i>Sporobolus festivus</i> <i>Themeda triandra</i>	
Herbs/Geophytic herbs	<i>Amaranthus hybridus</i> subsp. <i>hybridus</i> *	

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Growth form	Plant species	Invasive category
	<i>Berkheya radula</i> <i>Bidens pilosa</i> * <i>Campuloclinium macrocephalum</i> * <i>Cirsium vulgare</i> * <i>Conyza podocephala</i> <i>Eriosema burkei</i> <i>Habenaria nyikana</i> subsp. <i>nyikana</i> Helichrysum nudifolium var. nudifolium Hilliardiella elaeagnoides Hypoxis hemerocallidea Hypoxis rigidula var. rigidula <i>Ipomoea purpurea</i> * <i>Ledebouria revoluta</i> <i>Ledebouria zebrina</i> <i>Stoebe vulgaris</i> <i>Tagetes minuta</i> * <i>Vernonia natalensis</i> <i>Verbena bonariensis</i> *	1b 1b 1b 1b 1b
Shrubs and dwarf shrubs	Datura stramonium * <i>Solanum mauritianum</i> * <i>Solanum panduriforme</i>	1b 1b
Trees	<i>Acacia mearnsii</i> * <i>Celtis africana</i> <i>Eucalyptus camaldulensis</i> * <i>Jacaranda mimosifolia</i> * <i>Melia azedarach</i> * <i>Robinia pseudoacacia</i> * <i>Searsia lancea</i> <i>Sesbania punicea</i> * <i>Tecoma stans</i> * <i>Tipuana tipu</i> * Vachellia karroo	2 1b 3 1b 1b 1b 1b
Succulent shrubs	Aloe davyana	

Weeds and AIS are indicated with (*) and Medicinal species in **bold**.

7.10.2 Medicinal and Alien Plant Species

Five medicinal and 17 alien plant species have been recorded in the study unit. Eleven of the alien plant species has been listed as a Category 1b, one as a Category 2 and one as a Category 3 invasive species (Table 2 and 8).

7.10.3 Red List, Orange List and Protected Tree Species

The study unit has suitable habitat for Red and Orange List species, protected trees and provincial protected plants. During the survey, high numbers of Orange List species (*Hypoxis hemerocallidea*) was found.

7.10.4 Sensitivity and Connectivity

The vegetation in this unit has low-medium sensitivity (Figure 14) because of the presence of Orange List species. Connectivity is limited to all directions as the study site is surrounded by built up areas and farms.

7.10.5 Mammals

No mammal species were observed in the study unit.

7.10.6 Reptiles

No reptile species were observed in the study unit.

7.10.7 Amphibians

No amphibian species were observed in the study unit.

7.10.8 Avifauna

The study unit provides suitable habitat for bird species and there were a lot of Southern Masked Weaver (*Ploceus velatus*) nests found on the study unit. Bird species that were observed such as the House Sparrow (*Passer domesticus*), Laughing Dove (*Streptopelia senegalensis*), Red-chested Cuckoo (*Cuculus solitarius*), Pied Crow (*Corvus albus*), Red Bishop (*Euplectes orix*), Common Fiscal (*Lanius collaris*), Rufous Naped-lark (*Mirafra*

africana), Willow Warbler (*Phylloscopus trochilus*), Southern Masked Weaver (*Ploceus velatus*), Dark-capped Bulbul (*Pycnonotus tricolor*).

7.11 Wetland study unit

7.11.1 Compositional aspects

The vegetation in this study unit is transformed and it comprises of *Typha capensis* (Figure 12 and 13). The wetland feature has been impacted due to the surrounding residential developments and associated edge effects such as subsistence agriculture and illegal refuse dumping. These impacts have led to transformation of the overall wetland floral community integrity. The slope of the study unit dips to the north and the soil is sandy, brownish to whitish. Dominant species include *Hyparrhenia hirta*, *Phragmites australis* and *Typha capensis*. Dominant exotic species include *Amaranthus hybridus* subsp. *hybridus* and *Populus x canescens*. A total of 36 species have been recorded and grouped according to their growth form (Table 9).



Figure 12: Rubbish dumped on the Wetland study unit



Figure 13: *Typha capensis* and alien invasive *Populus x canescens*

Table 9: Species Recorded in the Wetland study unit

Growth form	Species name	Invasive Category
Graminoid	<i>Arundo donax</i> *	1b
	<i>Cynodon dactylon</i>	
	<i>Cyperus congestus</i>	
	<i>Cyperus marginatus</i>	
	<i>Kyllinga melanosperma</i>	
	<i>Melinis repens</i>	
	<i>Paspalum dilatatum</i>	
	<i>Paspalum notatum</i>	
	<i>Pennisetum clandestinum</i> *	1b
	<i>Phragmites australis</i>	
Herbs/ Geophytic herbs	<i>Amaranthus hybridus</i> subsp. <i>hybridus</i> *	1b
	<i>Araujia sericifera</i> *	1b
	<i>Argemone ochroleuca</i> *	1b
	<i>Berkheya radula</i>	
	<i>Bidens pilosa</i> *	
	<i>Helichrysum nudifolium</i> var. <i>nudifolium</i>	
	<i>Hibiscus trionum</i> *	
	<i>Hilliardiella elaeagnoides</i>	
	<i>Plantago lanceolata</i>	
	<i>Plantago longissima</i>	
	<i>Plantago major</i>	
	<i>Richardia brasiliensis</i> *	
	<i>Solanum panduriforme</i>	
	<i>Typha capensis</i>	
<i>Xysmalobium undulatum</i>		
Shrubs and dwarf shrubs	<i>Datura stramonium</i>*	1b
	<i>Solanum lichtensteinii</i>	
	<i>Solanum mauritianum</i> *	1b
	<i>Solanum panduriforme</i>	
	<i>Xysmalobium undulatum</i>	
Trees	<i>Acacia mearnsii</i> *	2
	<i>Celtis africana</i>	
	<i>Eucalyptus camaldulensis</i> *	1b
	<i>Jacaranda mimosifolia</i> *	3
		1b
	<i>Melia azedarach</i> *	1b
	<i>Robinia pseudoacacia</i> *	1b
	<i>Searsia lancea</i>	1b
<i>Sesbania punicea</i> *		

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Growth form	Species name	Invasive Category
	<i>Tecoma stans</i> * <i>Tipuana tipu</i> * Vachellia karroo	

Alien and invasive species indicated with (*). Medicinal species indicated in **bold**.

7.11.2 Medicinal and Alien Plant Species

Five medicinal and 18 alien plant species have been recorded on the study site. Eleven of the alien plant species have been listed as Category 1b, one species has been listed as Category 2, and one species has been listed as Category 3 invasive species.

7.11.3 Red List, Orange List and Protected Tree Species

The study unit has suitable habitat for Red List, Orange List or protected tree species.

7.11.4 Sensitivity and Connectivity

The study unit is considered to be of high sensitivity because it is a watercourse (Figure 14). Connectivity to the north-east and south-east exist.

7.11.5 Mammals

No mammal species were observed in the study unit.

7.11.6 Reptiles

No reptile species were observed in the study unit.

7.11.7 Amphibians

Common Caco and Common Platanna were observed in the study unit.

7.11.8 Avifauna

Bird species that were observed are the House Sparrow (*Passer domesticus*), Laughing Dove (*Streptopelia senegalensis*), Red-chested Cuckoo (*Cuculus solitarius*), Pied Crow (*Corvus albus*), Red bishop (*Euplectes orix*), Southern Masked Weaver (*Ploceus velatus*), Dark-capped Bulbul (*Pycnonotus tricolor*).

8. SENSITIVITY AND FINDINGS

The ecological function describes the intactness of the structure and function of the vegetation communities which in turn support faunal communities. It also refers to the degree of ecological connectivity between the identified vegetation communities and other systems within the landscape. Therefore, systems with a high degree of landscape

connectivity among each other are perceived to be more sensitive (Kimberly *et al.* 1997).

The Terrestrial biodiversity theme sensitivity as indicated in the screening report was derived to be very high. The completion of this assessment disagrees with the very high sensitivity of the screening report as the habitat has been infested by alien invasive species and no Red Listed species were found. However, where the wetland area is regarded as high sensitive area. As per the terms of reference for the project, GIS sensitivity maps are required in order to identify sensitive features within the study area. The sensitivity scores identified during the field survey for terrestrial habitat are mapped. The habitat sensitivity is classed based on the following categories/scores (Table 10).

Table 10: Sensitivity criteria

Sensitivity	Criteria
Very High	<ul style="list-style-type: none"> • Habitat is occupied by a Red-listed species. • Red-listed vegetation type exhibiting natural integrity. • Provides critical ecosystem services. • Protected by national or provincial legislation. • Low resilience to disturbance • Area overlaps with intact CBA • Overlap with NBA classified wetlands.
High	<ul style="list-style-type: none"> • Possesses a high diversity of protected species but does not possess Red-listed species • Habitats that provide important ecosystem services but not necessarily possess high species richness. • Corridors and wetland buffer zones. • Natural habitats that are unique within the landscape • Natural habitats that possess a relatively high species richness in comparison to the rest of the landscape. • Area overlaps with intact CBA (small areas of disturbed habitat)
Moderate	<ul style="list-style-type: none"> • Natural areas that although listed as not threatened, are regarded as Not Protected or Poorly Protected. • Degraded areas that provide some ecosystem services. • Area overlaps with intact Ecological Support Area (ESA) or Other Natural Area (ONA). • Such habitat is considered to have a strong chance of recovering if left undisturbed to restore through natural succession processes, even more so if successfully rehabilitated <p>Species diversity is considered moderate</p>
Low	<ul style="list-style-type: none"> • Transformed areas. • Insignificant amounts of natural habitat or vegetation present. • Area does not overlap with any areas of ecological significance (also datasets). • Natural or degraded areas that are not Red-listed vegetation types and Moderately Protected or Well Protected.

The dominance of the stand of Poplar trees negatively impacts on the wetland's ability to enhance water quality. The wetland is impacted upon by invasion of alien trees, resulting in significant loss of habitat and biodiversity.

The study site is located within an Endangered ecosystem – Egoli Granite Grassland meaning, it falls under those systems whose structure, function and composition are at extreme risk of irreversible loss and damage. The greater part of the vegetation on the study site is highly disturbed, comprises of alien invasive species and ornamental species. High levels of grazing on the study site were noticed hence, the study site is highly transformed. The sensitivity varies from high on the wetland vegetation, low-medium due to the presence of Orange List species and the rest of the site is of low sensitivity (Figure 14).

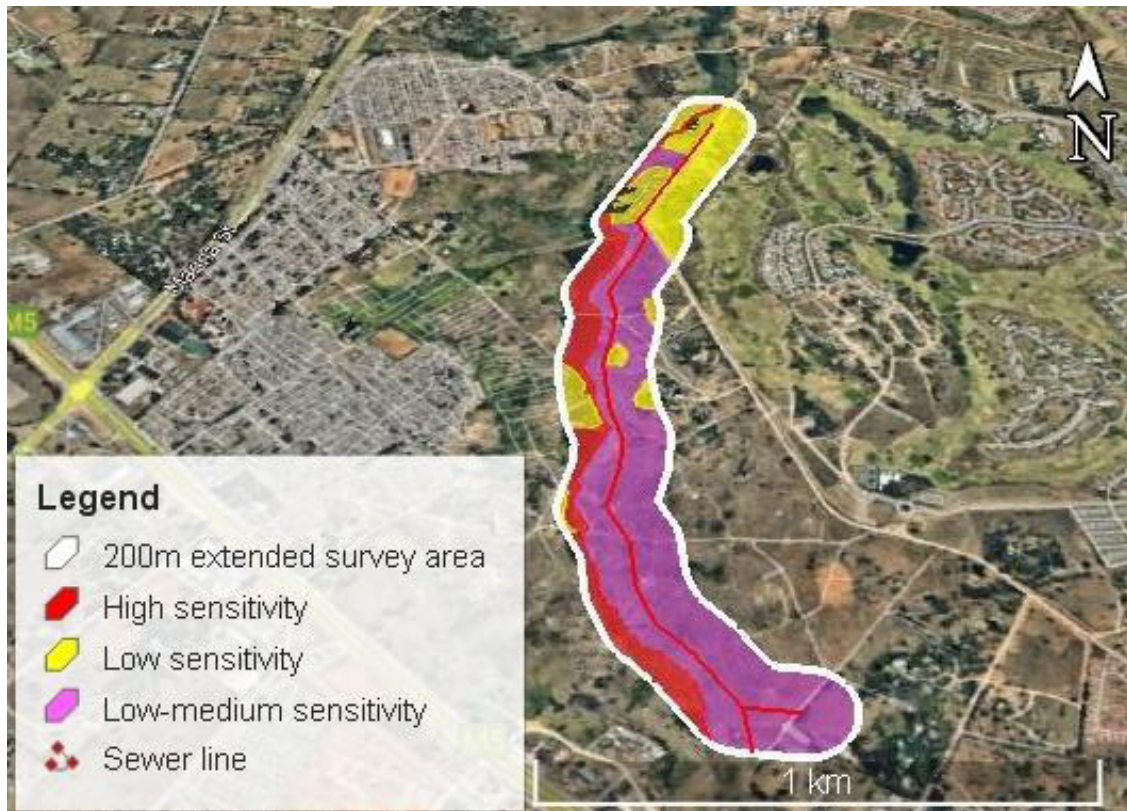


Figure 14: Sensitivity Map of the Study Site

9. ENVIRONMENTAL IMPACT ASSESSMENT

.....
 Anthropogenic impacts, such as clearing of vegetation for agriculture, forestry, building of roads or installing services, may lead to negative effects on the environment. These effects are controlled in large part by their intensity, duration, frequency, timing, and the size and shape of the area affected. Impacts on communities and ecosystems can have surface and sub-surface effects, such as habitat structure, species-diversity and -richness alterations, nutrient cycling and productivity losses, decline in migration patterns and exchange of genetic material. Land-use changes that modify natural disturbance regimes or initiate new disturbances are likely to cause alterations in species richness and distribution, community composition, and ecosystem function (ESA, 2000).

Sensitivity assessment is to specify the location and extent of all sensitive areas on the proposed development that must be protected from transforming land uses.

10. Methodology of Assessing Impacts that have been Identified

The significance of preliminary potential environmental impacts identified, were assessed using the method as described below.

Significance is the product of probability and severity. Probability describes the likelihood of the impact actually occurring, and is rated as follows:

Likelihood	Description	Rating
Improbable	Low possibility of impact to occur either because of design or historic experience	2
Probable	Distinct possibility that impact will occur	3
Highly probable	Most likely that impact will occur	4

Definite	Impact will occur, in the case of adverse impacts regardless of any prevention measures	5
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The **severity factor** is calculated from the factors given to “intensity” and “duration”. Intensity and duration factors are awarded to each impact, as described below.

The Intensity factor is awarded to each impact according to the following method:

Intensity	Description	Rating
Low intensity	Natural and man-made functions not affected.	1
Medium intensity	Environment affected but natural and man-made functions and processes continue.	2
High intensity	Environment affected to the extent that natural or man-made functions are altered to the extent that it will temporarily or permanently cease, or become dysfunctional.	4

Duration is assessed and a factor awarded in accordance with the following:

Duration	Description	Rating
Short term	<1 to 5 years - Factor 2	2
Medium term	5 to 15 years - Factor 3	3
Long term	Impact will only cease after the operational life of the activity, either because of natural process or by human intervention.	4
Permanent	Mitigation, either by natural process or by human intervention, will not way or in such a time span that the impact can be considered transient.	4

The severity rating is obtained from calculating a severity factor, and comparing the severity factor to the rating in the table below. For example:

$$\begin{aligned}
 \text{The Severity factor} &= \text{Intensity factor X Duration factor} \\
 &= 2 \times 3 \\
 &= 6
 \end{aligned}$$

A **Severity factor** of six (6) equals a Severity Rating of Medium severity (Rating 3) as per table below:

Severity Factor	Severity	Rating
Calculated values 2 to 4	Low Severity	2
Calculated values 5 to 8	Medium Severity	3
Calculated values 9 to 12	High Severity	4
Calculated values 13 to 16	Very High severity	5

A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating

Significance	Rating	Influence
Low significance	Rating 4 to 6	Positive impact and negative impacts of low significance should have no influence on the proposed development project.
Medium significance	Rating >6 to 15	Positive impact: Should weigh towards a decision to continue Negative impact: Should be mitigated to a level where the impact would be of medium significance before project can be approved.
High	Rating 16	Positive impact: Should weigh towards a decision to continue,

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Significance	Rating	Influence
significance	and more	should be enhanced in final design. Negative impact: Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to at least medium significance rating.

Table 11. Possible impacts before and after the mitigation measures on the proposed study site (ratings: Orange = Low; Green = Medium and Blue = High)

Adverse Impacts	Significance	Probability Rating	Severity Rating		Severity Factor	Severity Rating	Rating	Mitigation measures
			Intensity	Duration				
CONSTRUCTION PHASE								
Potential loss of plant species of conservation concern	Before Mitigation Measures	4	2	4	8	3	12 Medium	Plant SCC was observed on site. Workers must be educated to recognize markers on plants. A plan on how to search and rescue this species should be developed by suitable personnel.
	After Mitigation Measures	2	2	2	4	2	4 Low	
Potential loss of animals on site	Before Mitigation Measures	4	2	4	8	3	12 Medium	Any fauna threatened by the construction activities should be moved to safety by a suitable qualified ECO or an Ecologist. All personnel should undergo an environmental induction with regards to fauna, in particular awareness about harming or collecting species such as snakes, tortoises. Barricading measures to be utilised should not restrict the movement of the fauna in the area. Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes.
	After Mitigation Measures	2	2	2	4	2	4 Low	
Damage or disturbance of roosting and nesting sites	Before Mitigation Measures	4	2	4	8	3	12 Medium	During site preparation special care must be taken during the clearing of the works area to minimize damage or disturbance of roosting and nesting sites. Barricading measures to be utilised should not restrict the movement of the fauna in the area. Toolbox talks should be provided to contractors regarding disturbance to animals.
	After Mitigation Measures	4	2	2	4	2	8 Medium	
Potential pollution of surface and	Before Mitigation Measures	5	2	2	4	4	20 High	Hazardous waste must be removed by a registered service provider and records of safe-disposal certificates must be maintained. Generators and other

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Adverse	Significance	Probability	Severity Rating		Severity	Severity	Rating	Mitigation measures
groundwater due to construction activities	After Mitigation Measures	2	2	2	4	2	4 Low	machinery operating on site must be placed on drip trays. Cement mixing must be done on mortar boards.
Generation of construction waste	Before Mitigation Measures	4	2	2	4	2	8 Medium	No littering on construction site. Clean and tidy construction site. Maintain records of all waste generated and disposed at waste disposal facilities on a waste register. Valid disposal certificates for all waste disposed of are required to be available for inspection. Provision of adequate containers/skids that are easily accessible and maintained for waste. Waste bins and toilets must be removed and cleaned weekly.
	After Mitigation Measures	3	2	2	4	2	6 Low	
Visibility of construction activities from surrounding land and roads	Before Mitigation Measures	4	2	2	4	2	8 Medium	Barricade the study site with Green Shade Netting which will blend well with the surrounding environment in order to minimise visual impact.
	After Mitigation Measures	3	2	2	4	2	6 Low	
Vegetation and habitat disturbance due to the accidental introduction of alien species	Before Mitigation Measures	5	2	2	4	4	20 High	Encroachment of alien vegetation should be monitored regularly and controlled; the area must be kept clear of all invader plants. Rehabilitation measures must be employed until such a time as indigenous species are established. If herbicides are to be used, then correct licenses and permits must be acquired prior to use.
	After Mitigation Measures	4	2	2	4	2	8 Medium	
Damage to plant life outside of the proposed development site	Before Mitigation Measures	3	1	2	2	2	6 Medium	Avoid indiscriminate damage of natural habitats outside of the footprint of the study site. Removal of vegetation should be limited to designated areas only. Any plant accidentally removed outside the proposed site should be replaced or rehabilitated at the expense of the contractor.
	After Mitigation Measures	2	1	2	2	2	4 Low	

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Adverse	Significance	Probability	Severity Rating		Severity	Severity	Rating	Mitigation measures
OPERATIONAL PHASE								
Encroachment of exotic vegetation following soil disturbance	Before Mitigation Measures	5	2	2	4	4	20 High	Encroachment of alien vegetation should be monitored regularly and controlled; the area must be kept clear of all invader plants. Rehabilitation measures must be employed until such a time as indigenous species are established. If herbicides are used then correct licenses and permits must be acquired prior to use.
	After Mitigation Measures	4	2	2	4	2	8 Medium	
Disturbance of faunal species	Before Mitigation Measures	3	2	4	8	3	9 Medium	Use the existing road and look out for animals on the road. Speed limits must be maintained with the use of signs and speed bumps. Animals have right of way.
	After Mitigation Measures	2	2	2	4	2	4 Low	
Potential of surface and groundwater pollution due to associated infrastructure	Before Mitigation Measures	5	2	2	4	4	20 High	Line to be inspected frequently to ensure no leaks exist.
	After Mitigation Measures	2	1	2	2	2	4 Low	

From the scores obtained, the impact on the proposed development will be minimal and can be mitigated to ensure that development will have a low impact on the surrounding environment.

11. RECOMMENDATIONS AND MITIGATION MEASURES

The following recommendations need to be applied if the proposed infrastructure is approved.

- An Environmental Management Programme (EMPr) must be developed for the construction and operational phase of the proposed External Services.
- An appropriate management authority (e.g., the body corporate or Environmental Control Officer) that must be contractually bound to enforce the Environmental Management Programme (EMPr) and Environmental Authorisation (EA) during the construction and operational phase of the development should be appointed.
- The contractor must ensure that no faunal species are trapped, killed or in any way disturbed during the constructional and operational phases.
- During the installation of the External Services, measures are required to ensure that it has minimal effect on the flow of water.
- As far as possible, indigenous and medicinal plants naturally growing on the study site should be incorporated into landscaped areas. It is advised that destruction of indigenous trees should be kept minimal.
- GDARD should be contacted to make an arrangement for the relocation of the Orange List species *Hypoxis hemerocallidea*.
- The alien invasive plant species, especially in Category 1b, must be eradicated in order to prevent their spreading during the construction phase as well as a clean-up programme after construction.
- Disturbance to the wetland during services installations should be minimized. A plan for the immediate rehabilitation of damage caused to the wetland should be compiled by a specialist registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science. This rehabilitation plan should form part of the EMPr and a record book should be maintained on site to monitor and report on the implementation of the plan.

12. CONCLUSION

It is recommended that highly sensitive area be excluded from construction for the proposed development, but that it be incorporated as natural features providing aesthetic appeal and habitat for fauna and flora already occurring on site. A wetland assessment was done which established the extent of the drainage line and associated watercourses. The buffers recommended in such assessments should be implemented.

Dumping of builders' rubble and other waste must be prevented, especially in an ecological sensitive areas. This area should be properly managed throughout the lifespan of the project to ensure continuous biodiversity. Alien invasive plant species, especially Category 1 and 2 must be eradicated as a matter of urgency to preclude their spreading during the construction phase.

In addition, this is a linear activity with small footprint thus there will be minor disturbance to the environment over short duration during the construction phase. No fauna of conservation concern species were recorded on site.

Overall, the Terrestrial Biodiversity Assessment report have met requirements detailed in published Government Notice 320 in terms of NEMA dated 30 October 2020: "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998". No obvious biases as a result of the Report Compiler's being employed by the Environmental Assessment Practitioner (EAP) were found.

It is therefore concluded that no valid reason, from an ecological perspective, to disapprove the proposed infrastructure as long as the necessary precautions are taken during the installation of the services, on condition that the recommendations and mitigation measures are followed.

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Annexure A: Red and Orange List plant information for QDS 2627BB (GDARD)

Species	Flowering season	IUCN status	Suitable habitat	Presence on the study site
<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	October-January	Near threatened	South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld in the south.	No
<i>Argyrobium campicola</i>	October-January	Near threatened	Highveld grassland	No
<i>Argyrobium megarrhizum</i>	October-January	Near threatened	Mixed bushveld	No
<i>Boophone disticha</i>	October-January	Least Concern	Dry grassland and rocky areas.	No
<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	September-April	Vulnerable	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	No
<i>Callilepis leptophylla</i>	August-January & May	Declining	Grassland or open woodland, often on rocky outcrops or rocky hillslopes	No
<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	November-April	Critically endangered	Associated with ridges and quartzitic rocky outcrops in pockets of soil among rocks in direct sunshine or shaded areas	No
<i>Crinum macowanii</i>	October-January	Least Concern	It grows in many habitats, such as vleis, mountain grassland, seasonally flooded grassland, savanna, deciduous woodland, beside rivers and along the coast, and in various soils, such as gravelly soil, shale or sandy flats	No
<i>Delosperma gautengense</i>	August-January	Vulnerable	Amongst rocks on hillslopes of Magaliesberg, south	No

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Species	Flowering season	IUCN status	Suitable habitat	Presence on the study site
			facing slopes	
<i>Delosperma leendertziae</i>	February-April	Near threatened	Steep, south-facing slopes of quartzite in mountain grassland.	No
<i>Drimia sanguinea</i>	August-December	Near threatened	Open veld and scrubby woodland in a variety of soil types	No
<i>Gunnera perpensa</i>	October-March	Least Concern	In cold or cool, continually moist localities, mainly along upland stream banks.	No
<i>Habenaria bicolor</i>	February-March	Near threatened	Well-drained grasslands at around 1600 m in South Africa	No
<i>Habenaria kraenzliniana</i>	February-April	Near threatened	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m	No
<i>Hypoxis hemerocallidea</i>	September-March	Least Concern	Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland; also grows on dry, stony, grassy slopes, mountain slopes and plateaux; appears to be drought and fire tolerant	No
<i>Ilex mitis</i> var. <i>mitis</i>	October-December	Least Concern	Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes	No
<i>Lithops lesliei</i> subsp. <i>lesliei</i>	March-June	Near threatened	Primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses	No
<i>Searsia gracillima</i> var. <i>gracillima</i>	September-May	Near threatened	Rocky quartzitic outcrops in bushveld	No
<i>Stenostelma umbelluliferum</i>	December-April	Near threatened	Deep black turf in open woodland mainly in the vicinity of drainage lines.	No

The Red List of South African Plants website (SANBI, 2017) was utilized to provide the most current account of the national status of flora

Annexure B: Protected Tree Species in Gauteng Province

Species	Conservation status	Resident at the site
<i>Vachellia erioloba</i>	Protected	No
<i>Boscia albitrunca</i>	Protected	No
<i>Sclerocarya birrea subsp. caffra</i>	Protected	No
<i>Prunus africana</i>	Protected	No
<i>Warburgia salutaris</i>	Protected	No
<i>Combretum imberbe</i>	Protected	No
<i>Erythrophysa transvaalensis</i>	Protected	No

Annexure C: CV of Specialist

NKOLISO MAGONA

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012 346 3810

Work history

BOKAMOSO ENVIRONMENTAL CONSULTANTS - Ecologist and ECO

- Conduct Flora and Fauna Assessments
- Compiling Flora and Fauna Reports
- Serving as Environmental Control Officer

NATIONAL RESEARCH FOUNDATION - Research intern

- Manage Biosecurity Enforcement for Ants introduced to SA
- Compile national status of Ants in SA
- Conduct site visits

SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE – Research intern

- Provide biodiversity input into the appeal process related to Environmental Authorizations
- Conduct site visits
- Compile site visit reports and incorporate the site visit findings into the recommendations

NATIONAL RESEARCH FOUNDATION - Laboratory Technician

- Preparing specimens and samples; constructing
- Maintaining and operating standard laboratory equipment
- Ensuring the laboratory is well-stocked and resourced
- Contribute to the development and implementation of Capacity Development Programme

Education

MSc IN BOTANY – Stellenbosch University

BSc HONS IN ZOOLOGY – Walter Sisulu University

BSc BIOLOGICAL SCIENCES – Walter Sisulu University

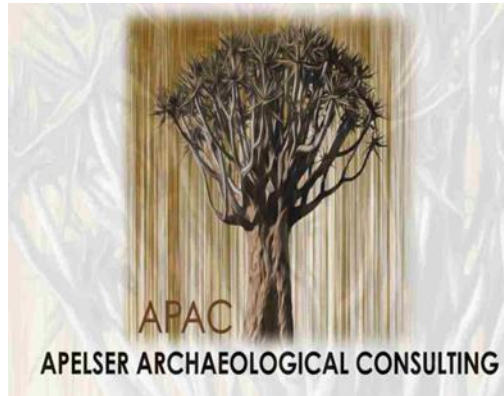
Projects

Fauna and Flora survey

- Cavalier New Parking Area and Solar Panels on Portion 83 of the farm Tweefontein, City of Tshwane
- Ecological Opinion for the Proposed Lotus Gardens X9, situated on Erven 7547 and 7548, City of Tshwane
- Ecological Scan for the Proposed Hidden Hills Golf Estate on Various Portions of the Farm Nooitgedacht 534 JQ, Lanseria.
- Flora and Fauna survey for the Proposed Hidden Hills Golf Estate on Various Portions of the Farm Nooitgedacht 534 JQ, Lanseria.
- Garsfontein Filling station on ERF 1657 Garsfontein X8, City of Tshwane
- Groblersdal filling station Portion 1 of the farm Loskop Suid 53 JS. Ecological potential opinion
- Hazyview filling station Portion 204 of the farm De Rust 12JU, Remainder of Portion 109 of the Farm De Rust 12JU
- Hazyview Phase 2 Mall expansion Portion 204 of the farm De Rust 12JU, Remainder of Portion 109 of the Farm De Rust 12JU
- Hazyview Residential Development Portion 204 of the farm De Rust 12JU, Remainder of Portion 109 of the Farm De Rust 12JU
- Majesty Oil Mills development ecological opinion, Remaining Extent of Portion 88 (a portion of Portion 1) of the Farm Luipaardsvlei 246 IQ and Erven 125, 126, 127, 128, 129 and 131
- Malekane Mall on part of Portion 7 of the Farm Steelpoortdrift 365 KT, Limpopo
- Mnandi Filling station on Holding 140, Mnandi Agricultural Holdings, Tshwane, Gauteng Province.
- Mooikloof Retail Park for the development on part of portion 54 of the farm Rietfontein 375 JR, City of Tshwane
- Munyaka Crystal lagoons for the approval of the x2 lagoons to be implemented in Midrand, South Africa
- N4 and Solomon Mahlangu Drive (M10) roads and storm water infrastructure construction and upgrading from the N4 interchange to the R104
- New proposed Hatchery farm on various portions of the farm Hartebeesfontein 445 JQ
- Onderstepoort Wholesale Diesel storage area on a portion of portion 99 of the farm De Onderstepoort 300-JR, Gauteng Province
- Paledi mall expansion Mankweng, Polokwane, 0727
- Peach Tree x20 Bulk Water Pipeline situated on portions 72 & 73, Remainder of Portion 332 of the Farm Knoppieslaagte 385-JR
- Peach Tree x21-25 Electrical situated on portions 20, 815 and the Remainder of Portion 332 of the Farm Knopjeslaagte 385 JR

Zandspruit Bulk Sewer Line – Terrestrial Biodiversity Survey

- Peach Tree x21-25 New alignment Electrical situated on portions 20, 815 and the Remainder of Portion 332 of the Farm Knopjeslaagte 385 JR
- Proposed Development on Portions 287 to 295 of the Farm Mooiplaats 367 JR, City of Tshwane
- Environmental scan for the proposed Filling Station on Holding 171 of Raslow Agricultural Holdings, Gauteng Province
- Rietvlei filling station situated on portion 1 of the Farm Witkoppies 393-JR
- Rietvlei Waste Water Treatment Works situated on portion 1 of the Farm Witkoppies 393-JR
- Secunda X13 filling station on Portion 5 of Erf 84
- Standerton X10 Mixed Used Development on Portion of the Remainder of Portion 2, a Portion of the Remainder of Portion 7 and Portion 4 of the Farm Grootverlangen 409 IS
- Standerton X10 Residential Development on part of the Remainder of Portion 7 of the Farm Grootverlangen 409 IS. Mpumalanga
- Sunderland Ridge Portion 87 industrial 1 Township on Remainder of Portion 29 of the Farm Mooiplaats 355 JR
- Thulamahashe B Sewer Line on Erf 63 in the Township Thulamahashe B
- Waterfall Estate situated on the farm Waterfall 5IR, Midrand, South Africa
- Proposed Residential 1 Township Development on Portion 483 of the Farm Hartebeesthoek 303JR, Pretoria
- Environmental Application Process Associated with the Proposed Poultry Farm to be situated on Portion 17 of the farm Schietfontein 437 JQ, North West Province
- Fauna and Flora Survey for the proposed Malekane Bridge on Road D2219 and Expansion of a Portion of Roads D2219, D1392 and the R555 in Steelpoort, Limpopo Province
- Ridges Studies for the proposed Residential 1 Township Development on Portion 483 of the Farm Hartebeesthoek 303JR, Pretoria



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**A PHASE 1 HERITAGE IMPACT ASSESSMENT & REPORT FOR THE
ZANDSPRUIT BULK SEWERLINE WULA ON PORTIONS OF THE FARM
ZANDSPRUIT 191IQ, GAUTENG**

For:

***Bokamoso Landscape Architects & Environmental Consultants CC
PO Box 11375
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REPORT: **APAC022/33**

Project Reference: FP184

by:

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April 2022

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DISCLAIMER:

Although all efforts are made to identify all sites of cultural heritage (archaeological and historical) significance during an assessment of study areas, the nature of archaeological and historical sites are as such that it is always possible that hidden or subterranean sites, features or objects could be overlooked during the study. APELSE Archaeological Consulting can't be held liable for such oversights or for costs incurred as a result thereof.

Clients & Developers should not continue with any development actions until SAHRA or one of its subsidiary bodies has provided final comments on this report. Submitting the report to SAHRA is the responsibility of the Client unless required of the Heritage Specialist as part of their appointment and Terms of Reference

A handwritten signature in black ink, appearing to be 'A. El' or similar, located at the bottom center of the page.

SUMMARY

APelser Archaeological Consulting (APAC cc) was appointed by Bokamoso Landscape Architects & Environmental Consultants CC to conduct a Phase 1 Heritage Impact Assessment for the establishment of the Zandspruit Bulk Sewerline Line on portions of the farm Zandspruit 191IQ in Gauteng. The study area is located in the Sonnedal Agricultural Holdings area and adjacent to the Jackal Creek Golf Estate. The study forms part of the Water Use License Application (WULA) for the Sewerline.

Background research indicates that there are some cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls. The April 2022 assessment of the specific study area did not identify any sites, features or material of cultural heritage (archaeological and/or historical) origin or significance, with previous work in the same area by APAC cc (**see Reports APAC020/13 & 14**) having similar results. This report discusses the results of both the background research and physical assessment and provides recommendations on the way forward at the end.

From a Cultural Heritage point of view it is recommended that the Zandspruit Bulk Sewerline establishment be allowed to continue, taking into consideration the recommendations put forward at the end of the report.

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1. INTRODUCTION

APelser Archaeological Consulting (APAC cc) was appointed by Bokamoso Landscape Architects & Environmental Consultants CC to conduct a Phase 1 Heritage Impact Assessment for the establishment of the Zandspruit Bulk Sewerline Line on portions of the farm Zandspruit 191IQ in Gauteng. The study area is located in the Sonnedal Agricultural Holdings area and adjacent to the Jackal Creek Golf Estate. The study forms part of the Water Use License Application (WULA) for the Sewerline.

Background research indicates that there are some cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls. The April 2022 assessment of the specific study area did not identify any sites, features or material of cultural heritage (archaeological and/or historical) origin or significance, with previous work in the same area by APAC cc.

The client indicated the location and boundaries of the study area and the assessment concentrated on this portion.

2. TERMS OF REFERENCE

The Terms of Reference for the study was to:

1. Identify all objects, sites, occurrences and structures of an archaeological or historical nature (cultural heritage sites) located on the portion of land that will be impacted upon by the proposed development;
2. Assess the significance of the cultural resources in terms of their archaeological, historical, scientific, social, religious, aesthetic and tourism value;
3. Describe the possible impact of the proposed development on these cultural remains, according to a standard set of conventions;
4. Propose suitable mitigation measures to minimize possible negative impacts on the cultural resources;
5. Review applicable legislative requirements;

3. LEGISLATIVE REQUIREMENTS

Aspects concerning the conservation of cultural resources are dealt with mainly in two Acts. These are the National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998).

3.1. The National Heritage Resources Act

According to the Act the following is protected as cultural heritage resources:

- a. Archaeological artifacts, structures and sites older than 100 years
- b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
- c. Objects of decorative and visual arts
- d. Military objects, structures and sites older than 75 years
- e. Historical objects, structures and sites older than 60 years
- f. Proclaimed heritage sites
- g. Grave yards and graves older than 60 years
- h. Meteorites and fossils
- i. Objects, structures and sites of scientific or technological value.

The National Estate includes the following:

- a. Places, buildings, structures and equipment of cultural significance
- b. Places to which oral traditions are attached or which are associated with living heritage
- c. Historical settlements and townscapes
- d. Landscapes and features of cultural significance
- e. Geological sites of scientific or cultural importance
- f. Sites of Archaeological and palaeontological importance
- g. Graves and burial grounds
- h. Sites of significance relating to the history of slavery
- i. Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.)

A Heritage Impact Assessment (HIA) is the process to be followed in order to determine whether any heritage resources are located within the area to be developed as well as the possible impact of the proposed development thereon. An Archaeological Impact Assessment (AIA) only looks at archaeological resources. An HIA must be done under the following circumstances:

- a. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300m in length
- b. The construction of a bridge or similar structure exceeding 50m in length
- c. Any development or other activity that will change the character of a site and exceed 5 000m² or involve three or more existing erven or subdivisions thereof
- d. Re-zoning of a site exceeding 10 000 m²
- e. Any other category provided for in the regulations of SAHRA or a provincial heritage authority

Structures

Section 34 (1) of the Act states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

Alter means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means.

Archaeology, palaeontology and meteorites

Section 35(4) of the Act deals with archaeology, palaeontology and meteorites. The Act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial)

- a. destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- b. destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
- c. trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
- d. bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- e. alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned may only be disturbed or moved by an archaeologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

- a. ancestral graves
- b. royal graves and graves of traditional leaders
- c. graves of victims of conflict
- d. graves designated by the Minister
- e. historical graves and cemeteries
- f. human remains

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

- a. destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
- b. destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- c. bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to the standards set out in the **Ordinance on Excavations (Ordinance no. 12 of 1980)** (replacing the old Transvaal Ordinance no. 7 of 1925).

Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated to) before exhumation can take place.

Human remains can only be handled by a registered undertaker or an institution declared under the **Human Tissues Act (Act 65 of 1983 as amended)**.

3.2. The National Environmental Management Act

This Act states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made.

Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

4. METHODOLOGY

4.1. Survey of literature

A survey of available literature was undertaken in order to place the development area in an archaeological and historical context. The sources utilized in this regard are indicated in the bibliography.

4.2. Field survey

The field assessment section of the study was conducted according to generally accepted HIA practices and aimed at locating all possible objects, sites and features of heritage significance in the area of the proposed development. The location/position of all sites, features and objects is determined by means of a Global Positioning System (GPS) where possible, while detail photographs are also taken where needed.

4.3. Oral histories

People from local communities are sometimes interviewed in order to obtain information relating to the surveyed area. It needs to be stated that this is not applicable under all circumstances. When applicable, the information is included in the text and referred to in the bibliography.

4.4. Documentation

All sites, objects, features and structures identified are documented according to a general set of minimum standards. Co-ordinates of individual localities are determined by means of the Global Positioning System (GPS). The information is added to the description in order to facilitate the identification of each locality.

5. DESCRIPTION OF THE AREA

The proposed Zandspruit Bulk Sewerline establishment is located on portions of the original farm Zandspruit 191IQ in Gauteng. The study area is situated in the Sonnedal Agricultural Holdings area and adjacent to the Jackal Creek Golf Estate.

The topography of the study area is relatively flat and open, with no significant rocky outcrops or ridges present. Vegetation cover was very dense during the assessment and visibility on the ground was limited in sections. In the past the area was utilized for agricultural purposes and small-scale residential settlement. Recent informal settlement in the larger and surrounding areas has impacted on the original landscape and is rapidly moving closer to the study area. As a result of this and the earlier agricultural activities any cultural heritage sites, features and material that did exist here in the past would have been disturbed or destroyed to a large degree. The proposed sewerline crosses sections that in the past would have been utilized for agricultural purposes, while parts of the line follow existing (dirt) roads & servitudes.

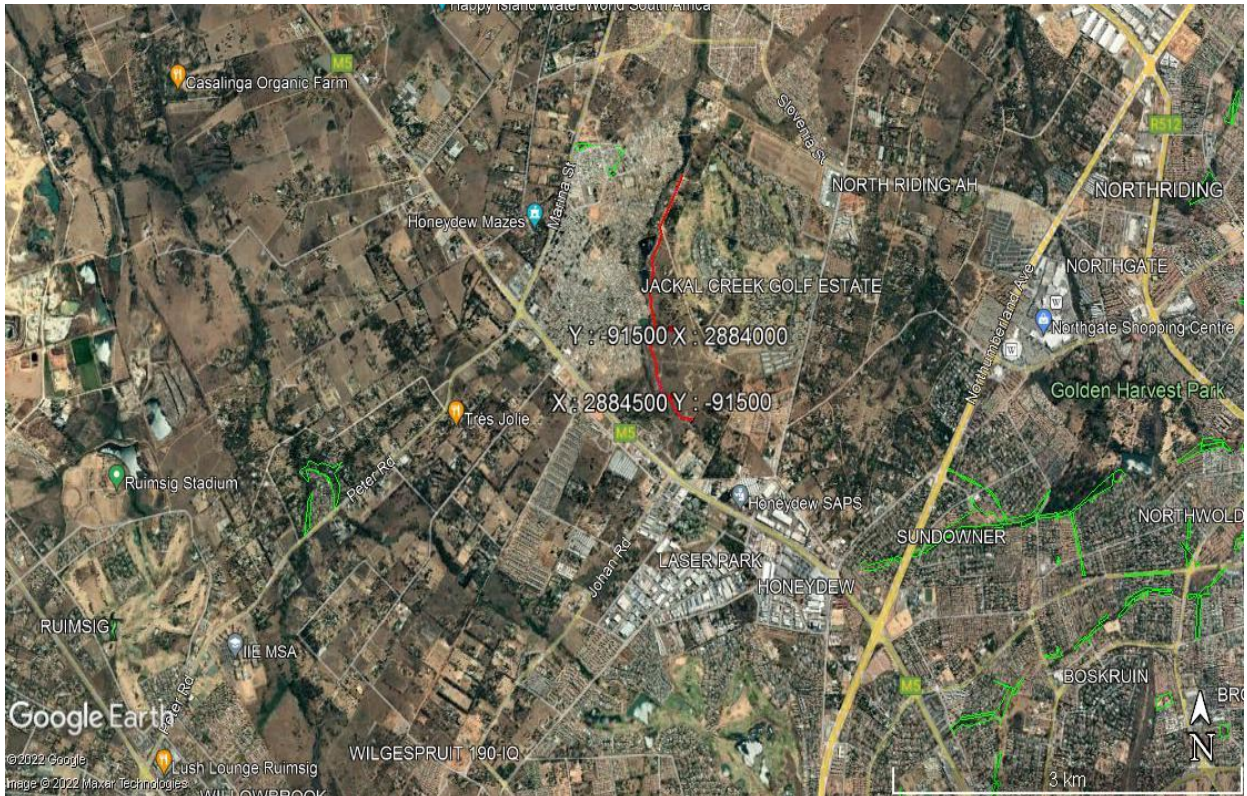


Figure 1: General location of study area & the Sewerline route (Google Earth 2022).



Figure 2: Closer view of the study area and proposed sewerline route (Google Earth 2022).

6. DISCUSSION

The Stone Age is the period in human history when lithic (stone) material was mainly used to produce tools. In South Africa the Stone Age can be divided in basically into three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation. A basic sequence for the South African Stone Age (Lombard et.al 2012) is as follows:

Earlier Stone Age (ESA) up to 2 million – more than 200 000 years ago
Middle Stone Age (MSA) less than 300 000 – 20 000 years ago
Later Stone Age (LSA) 40 000 years ago – 2000 years ago

It should also be noted that these dates are not a neat fit because of variability and overlapping ages between sites (Lombard et.al 2012: 125).

According to Bergh (1999: p.4) no Stone Age sites or occurrences are known in the direct area, although Later Stone Age sites are known in the larger geographical area (including Zwartkops, Hennopsrivier, Uitkomstgrot, Glenferness, Pietkloof and Zevenfontein).

No Stone Age sites or objects (such as stone tools) were identified in the area. If any Stone Age artifacts are to be found in the area then it would more than likely be single, out of context, stone tools.

The Iron Age is the name given to the period of human history when metal was mainly used to produce metal artifacts. In South Africa it can be divided in two separate phases (Bergh 1999: 96-98), namely:

Early Iron Age (EIA) 200 – 1000 A.D
Late Iron Age (LIA) 1000 – 1850 A.D.

Huffman (2007: xiii) however indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

Early Iron Age (EIA) 250 – 900 A.D.
Middle Iron Age (MIA) 900 – 1300 A.D.
Late Iron Age (LIA) 1300 – 1840 A.D.

As with the Stone Age, Bergh (1999) does not indicate any known Early (EIA) Iron Age sites in the specific or larger geographical area, although stone-walled Late Iron Age sites are known to exist in the much larger geographical area (e.g. at Melvillekoppies and Bruma)[Bergh 1999: 6].

Based on Tom Huffman's research it is possible that LIA sites, features or material could be present in the larger area. This will include the Ntsuanatsatsi facies of the Urewe Tradition, dating to between AD1450 and AD1650 (Huffman 2007: 167); the Uitkomst facies of the same tradition (AD1700 to AD1820) [p.171]; Olifantspoort facies of Urewe (AD1500 –

AD1700) [p.191], as well as the Buispoort facies of Urewe, dating to around AD1700 – AD1840 (p.203).

No Iron Age sites, features or cultural material was identified during the assessment of the study area.

The historical age started with the first recorded oral histories in the area. It includes the moving into the area of people that were able to read and write. The first Europeans travelling close to this area were the early travelers Cornwallis Harris in 1836 & Livingstone in 1847. These groups were closely followed by the Voortrekkers after 1844 (Bergh 1999: 12-13). The larger area also saw some activity during Anglo-Boer War (1899-1902) (Bergh 1999: 51; 54).

No historical sites, features or material were identified in the study area during the assessment. During an 2020 assessment in the area one of the owners of many of the properties here), Mr. Pedri van Zyl, indicated that he is not aware of any sites or structures older than 60 years of age in the area. This includes farm houses and graves. According to him a large part of the area used to be farmed and owned by the Van Zyl family (Personal Communication: Mr. Pedri van Zyl – 2020-02-24).

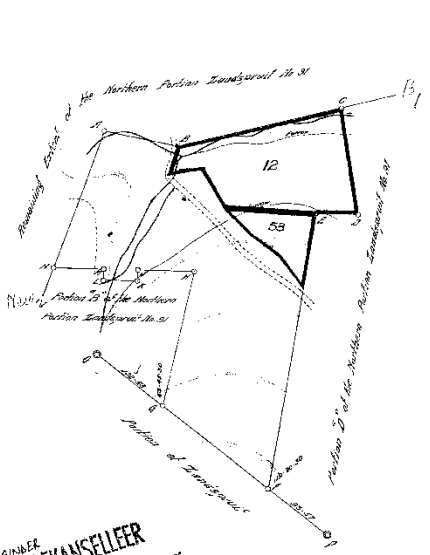
The oldest map for the farm Zandspruit 191IQ (for Portion 7) that could be obtained from the database of the Chief Surveyor General dates to 1911(www.csg.dla.gov.za – CSG Document 10JH9101). It shows that the farm was then known as Zandspruit No.91 and that it was located in the District of Krugersdorp, Ward of Krugersdorp and Province of Transvaal Portion 7 was surveyed in June 1911. The map also indicates that the farm was granted by deed to one Jan Stephanus Botha on the 14th of August 1878.

Form B2.—Diagram Form for a Sub-Division of a Farm or Portion of a Farm.

Full 154 9/11

S.G. No. A. 4311//

SIDES		ANGLES		(Y) CO-ORDINATES (x)	
C.A.		C.A.		C.A.	
AB	92.01	A	58.3.55	A	+581.4.00
BC	206.10	B	200.24.00	B	+5900.20
CD	138.94	C	85.16.30	C	+5852.436
DE	51.09	D	78.47.10	D	+5702.00
EF	350.03	E	262.55.10	E	+5723.21
FG	165.84	F	60.53.30	F	+5376.059
GH	171.36	G	116.16.30	G	+5225.330
HU	68.59	H	201.29.50	H	+5642.828
UV	18.32	V	270.0.0	V	+5642.165
WZ	41.90	W	50.0.0	W	+5624.108
LM	14.52	L	50.0.0	L	+5627.253
NO	60.50	M	270.0.0	M	+5621.57
OP	182.65	N	71.27.30	N	+5690.334
		O		O	+5153.70
		P		P	+5320.05



REMAINDER
 CANCELLED/GEKANSLEER
 Section 203
 12.002.1004
 15.07.70
 2004.12.11

For Geographical
 Details of Farm
 and Portion
 See Over

This geographical order
 was registered under
 No. 191
 REGISTRAR'S OFFICE
 REGISTRATION DIVISION IQ

The above figure lettered A B C D E F G H I J K L M N represents
 165 Morgen Square Rods of land, being Portion 7 of the Northern Portion 7
ZANDSPRUIT N^o 91.

as appears on the Diagram S.G. No. A 3624/11 framed by Surveyor J.K. Webber in June 1911
 relating to Deed of Transfer No. 1274/1878 dated 14/5/1878 made in favour of Jesu Stephaan, Bethe
 Situate in the District of Krugersdorp Ward Krugersdorp Province of Transvaal. Bounded as indicated above.
 The Beacons were pointed out by L. Goldschmidt, F. LaRoux, F. Dethlefs, P.S. van Wyk & J.K. Webber and have been properly erected according to law.
 Surveyed in June 1911 by me J.K. Webber
 Land-Surveyor.

No. 6017 Examined. The numerical data of this Diagram are sufficiently consistent.
F. Maxwell Edwards
 Examiner of Diagrams.
 Surveyor-General's Office
 Pretoria.

Approved.
J.K. Webber
 Land-Surveyor-General.

This Diagram belongs to Deed of Transfer No. made this day in favour of
Jesu Stephaan, Bethe
 Registrar of Deeds.
 Deeds Office
 Pretoria.
1828-4

Published by authority, Grout & Sherr, P.O. Box 246, Johannesburg—10711.

Figure 3: A 1911 map of Portion 7 of the farm Zandspruit 1911Q (www.csg.dla.gov.za).

Results of the April 2022 study area assessment

No sites, features or material of cultural heritage (archaeological and/or historical) origin or significance were identified in the study area during the physical assessment. The existence of any known sites was also not found in the background research. If any sites did exist here

in the past it would have been largely disturbed or destroyed by recent historical agricultural and earlier development activities in the study and larger area around it.



Figure 4: A view of a section of the area. Note the dense vegetation and the neighboring Informal Zandspruit residential settlement.



Figure 5: A view of a section of the area (taken in 2020).



Figure 6: Another section of the area (also taken in 2020).



Figure 7: A section of the sewerline route follows existing roads and servitudes.



Figure 8: Another view of a section of the study & development area.



Figure 9: General view of the study area and the Zandspruit Informal settlement.



Figure 10: View of the area showing the close proximity of the informal settlement to the sewerline route.



Figure 11: Another section of the study & development area.

Based on the desktop research, previous assessments in the area and the current physical assessment of the Zandspruit Bulk Sewerline there is should be no objection from a Cultural Heritage perspective to the proposed development and WULA.

It should be noted that although all efforts are made to cover a total area during any assessment and therefore to identify all possible sites or features of cultural (archaeological and/or historical) heritage origin and significance, that there is always the possibility of something being missed. This will include low stone-packed or unmarked graves. This aspect should be kept in mind when development work commences and if any sites (including graves) are identified then an expert should be called in to investigate and recommend on the best way forward.

7. CONCLUSIONS AND RECOMMENDATIONS

APelser Archaeological Consulting (APAC cc) was appointed by Bokamoso Landscape Architects & Environmental Consultants CC to conduct a Phase 1 Heritage Impact Assessment for the establishment of the Zandspruit Bulk Sewerline Line on portions of the farm Zandspruit 191IQ in Gauteng. The study area is located in the Sonnedal Agricultural Holdings area and adjacent to the Jackal Creek Golf Estate. The study forms part of the Water Use License Application (WULA) for the Sewerline.

Background research indicates that there are some cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls.

No sites, features or material of cultural heritage (archaeological and/or historical) origin or significance were identified in the study area during the physical assessment in April 2022. The existence of any known sites was also not found in the background research. If any sites did exist here in the past it would have been largely disturbed or destroyed by recent historical agricultural and earlier development activities in the study and larger area around it.

It should be noted that although all efforts are made to locate, identify and record all possible cultural heritage sites and features (including archaeological remains) there is always a possibility that some might have been missed as a result of grass cover and other factors. The subterranean nature of these resources (including low stone-packed or unmarked graves) should also be taken into consideration. Should any previously unknown or invisible sites, features or material be uncovered during any development actions then an expert should be contacted to investigate and provide recommendations on the way forward.

Based on the current Heritage assessment of the Zandspruit Bulk Sewerline study area and proposed route there is should be no objection from a Cultural Heritage perspective to the proposed development and WULA.

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General and closer views of study area location & proposed Zandspruit Sewerline route: Google Earth 2022.

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Personal Communication: Mr. Pedri van Zyl – 2020-02-24.

APPENDIX A: DEFINITION OF TERMS:

Site: A large place with extensive structures and related cultural objects. It can also be a large assemblage of cultural artifacts, found on a single location.

Structure: A permanent building found in isolation or which forms a site in conjunction with other structures.

Feature: A coincidental find of movable cultural objects.

Object: Artifact (cultural object).

(Also see Knudson 1978: 20).

APPENDIX B: DEFINITION/ STATEMENT OF HERITAGE SIGNIFICANCE

Historic value: Important in the community or pattern of history or has an association with the life or work of a person, group or organization of importance in history.

Aesthetic value: Important in exhibiting particular aesthetic characteristics valued by a community or cultural group.

Scientific value: Potential to yield information that will contribute to an understanding of natural or cultural history or is important in demonstrating a high degree of creative or technical achievement of a particular period

Social value: Have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.

Rarity: Does it possess uncommon, rare or endangered aspects of natural or cultural heritage.

Representivity: Important in demonstrating the principal characteristics of a particular class of natural or cultural places or object or a range of landscapes or environments characteristic of its class or of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province region or locality.

APPENDIX C: SIGNIFICANCE AND FIELD RATING:

Cultural significance:

- Low: A cultural object being found out of context, not being part of a site or without any related feature/structure in its surroundings.
- Medium: Any site, structure or feature being regarded less important due to a number of factors, such as date and frequency. Also any important object found out of context.
- High: Any site, structure or feature regarded as important because of its age or uniqueness. Graves are always categorized as of a high importance. Also any important object found within a specific context.

Heritage significance:

- Grade I: Heritage resources with exceptional qualities to the extent that they are of national significance
- Grade II: Heritage resources with qualities giving it provincial or regional importance although it may form part of the national estate
- Grade III: Other heritage resources of local importance and therefore worthy of conservation

Field ratings:

- i. National Grade I significance: should be managed as part of the national estate
- ii. Provincial Grade II significance: should be managed as part of the provincial estate
- iii. Local Grade IIIA: should be included in the heritage register and not be mitigated (high significance)
- iv. Local Grade IIIB: should be included in the heritage register and may be mitigated (high/medium significance)
- v. General protection A (IV A): site should be mitigated before destruction (high/medium significance)
- vi. General protection B (IV B): site should be recorded before destruction (medium significance)
- vii. General protection C (IV C): phase 1 is seen as sufficient recording and it may be demolished (low significance)

APPENDIX D: PROTECTION OF HERITAGE RESOURCES:

Formal protection:

National heritage sites and Provincial heritage sites – Grade I and II

Protected areas - An area surrounding a heritage site

Provisional protection – For a maximum period of two years

Heritage registers – Listing Grades II and III

Heritage areas – Areas with more than one heritage site included

Heritage objects – e.g. Archaeological, palaeontological, meteorites, geological specimens, visual art, military, numismatic, books, etc.

General protection:

Objects protected by the laws of foreign states

Structures – Older than 60 years

Archaeology, palaeontology and meteorites

Burial grounds and graves

Public monuments and memorials

APPENDIX E: HERITAGE IMPACT ASSESSMENT PHASES

1. Pre-assessment or Scoping Phase – Establishment of the scope of the project and terms of reference.
2. Baseline Assessment – Establishment of a broad framework of the potential heritage of an area.
3. Phase I Impact Assessment – Identifying sites, assess their significance, make comments on the impact of the development and makes recommendations for mitigation or conservation.
4. Letter of recommendation for exemption – If there is no likelihood that any sites will be impacted.
5. Phase II Mitigation or Rescue – Planning for the protection of significant sites or sampling through excavation or collection (after receiving a permit) of sites that may be lost.
6. Phase III Management Plan – For rare cases where sites are so important that development cannot be allowed.

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19 July 2022

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SPECIALIST OPINION FOR THE CHANGE OF THE ALIGNMENT FOR THE PROPOSED BULK SEWER LINE ON PORTIONS OF THE FARM ZANDSPRUIT 191iq, GAUTENG PROVINCE

In May 2022, APelser Archaeological Consulting (APAC aa) undertook a Phase 1 heritage impact assessment for the construction of a bulk sewer pipeline on portions of the farm Zandfontein 191IQ, Gauteng Province (Pelser 2022).

In his report Mr Pelser indicated that he did not find any sites, features or objects of cultural significance in the proposed alignment or its immediate vicinity. He also indicate that the area has been subjected to illegal dumping of rubbish and that excessive plant growth obscured ground visibility.

However, the alignment for the proposed sewer pipeline has changed somewhat and the author of the current report was commissioned to review it, at desktop level, to determine if these changes would have an impact on heritage resources.

The approach followed was to review all available resources. This included various databases – see list of references below – as well as available topographic maps and aerial photographs – see the different image below.

From this desktop review, it can be said that the area originally served as agricultural fields, located close to the Sandspruit where the alluvial soils could be exploited. These activities would have altered or destroyed any pre-colonial sites and objects that might have been located here in the past.

No formal structures can be seen on the early photograph. Later topographic maps indicated what is commonly referred to as farm labourer homesteads in the region. However, over time these disappear from the maps, an action that is probably the result of a more formal urban development, as well as the implementation of separated development, as instituted by the previous government. These features normally have a very low footprint as they were normally, although not always, built from organic such as mud bricks and wood.

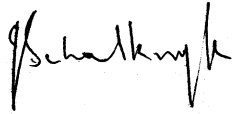
What remains is seemingly an empty landscape in which the main land use is one of the installation of various pipeline routes, some informal soccer pitches and, lately some informal settlement by homeless people.

We hereby confirm with a great deal of certainty that the proposed amendment to the pipeline route will not result in any additional impacts and will not increase the level or nature of the impact, which was initially assessed and considered when application was made for an EA. The significance ratings will remain unchanged and the proposed mitigation and management measures proposed as part of the EIA process will still suffice.

- However, it should be considered that archaeological remains, by its very nature, usually occur below ground level and cannot always be detected, even less so by means of a desktop assessment.

We trust you find the above in order. If there are any uncertainties or additional information required, please feel free to contact the undersigned.

Yours sincerely



J A van Schalkwyk (D Litt et Phil)

- Heritage Consultant: ASAPA Registration No.: 164 - Principal Investigator for Iron Age, Colonial Period, Industrial Heritage.



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Brodie, N. (ed.) 2008. *The Joburg Book. A guide to the city's history, people and places*. Northlands: Pan Macmillan South Africa.

Mason, R.J. 1986. *The origins of black people of Johannesburg and the southern western central Transvaal, AD 350-1880*. Occasional Paper No. 16. Johannesburg. University of the Witwatersrand Archaeological Research Unit.

Pelser, A. 2022. *A Phase 1 heritage impact assessment and report for the Zandspruit bulk sewerline WULA on Portions of the farm Zandspruit 1911Q, Gauteng Province*. Pretoria: Unpublished report.

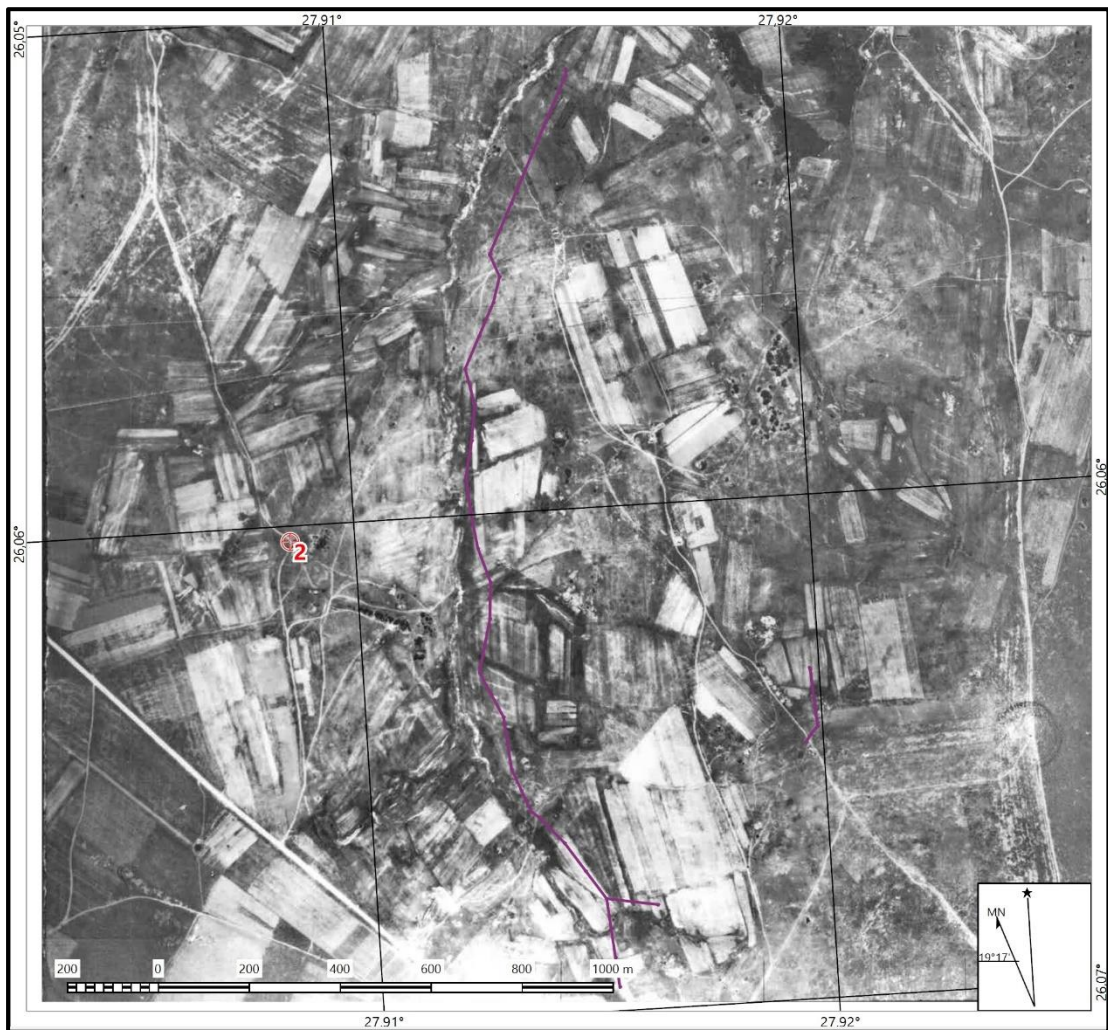
<http://www.artefacts.co.za>

<http://www.heritageregister.org.za>

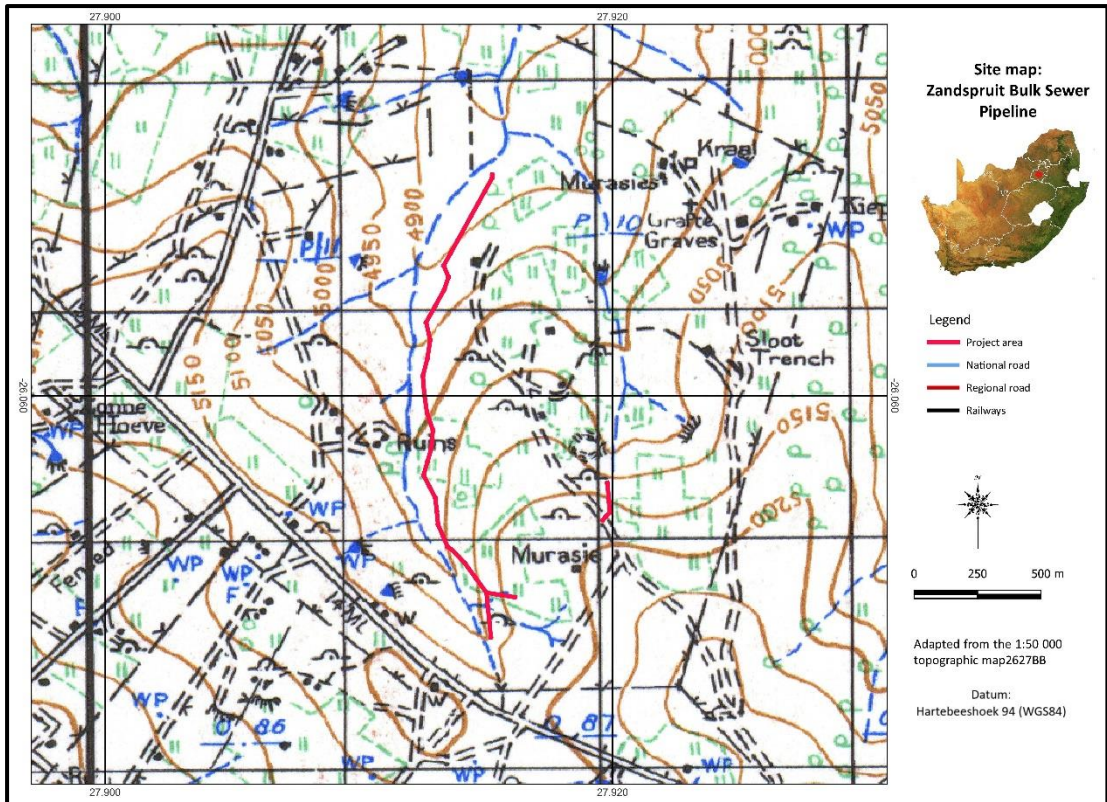
Heritage Atlas Database

SAHRIS Database

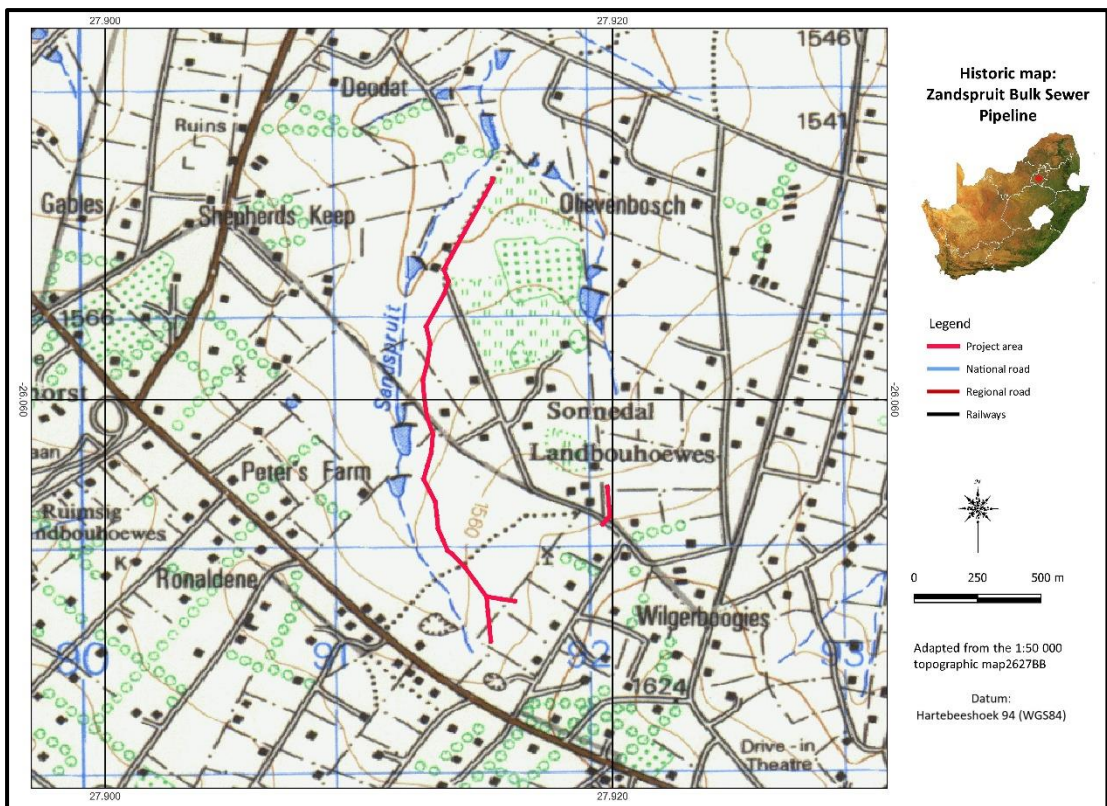
Images



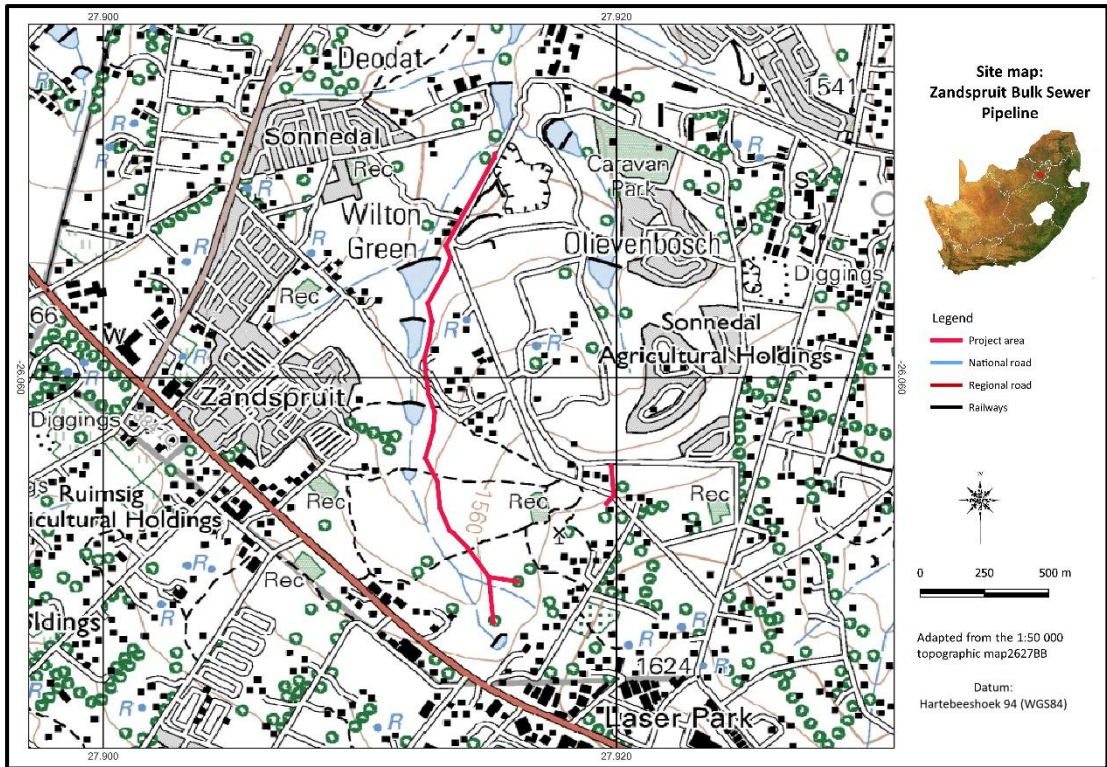
Aerial photograph dating to 1938 (CS-G Photograph 129_006_73762)
(Red wheel-crosses = calibration points)



The 1943 version of the 1:50 000 topographic map (2627BB)



The 1971 version of the 1:50 000 topographic map (2627BB)



The 2007 version of the 1:50 000 topographic map (2627BB)



Google Earth image of the project area dating to 2007



Google Earth image of the project area dating to 2007