

# **BIODIVERSITY IMPACT ASSESSMENT REPORT FOR THE KWATHEMA TO GRUNDLINGH WWTW BULK OUTFALL SEWER, GAUTENG PROVINCE, SOUTH AFRICA**



31/08/2018



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Date Issued :	31 August 2018

## DECLARATION OF INDEPENDENCE

I, Mpho Ramalivhana, declare that I:

- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP).
- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in professional capacity.
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being a member of the general public.
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- I do not have any influence over decisions made by the governing authorities.
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**Mpho Ramalivhana Pri Sci. Nat (Hons. Bot.; SAAB; SACNASP)**

## DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

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### INDEMNITY

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

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## ABBREVIATIONS

BGIS	Biodiversity Geographical Information System
CARA	Conservation of Agricultural Resources
CBA	Critical Biodiversity Area
CR	Critically Endangered
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EN	Endangered
ESA	Ecological support area
MM	Millimetres
NEMA	National Environmental Management Act, 107 of 1998
NEMBA	National Environmental Management Biodiversity Act, 10 of 2004
NES	Naledzani Environmental Services
ONA	Other Natural Area
PA	Protected Area
PRECIS	Pretoria Computerised Information System
QDGC	Quarter Degree Grid Cell
SANBI	South African National Biodiversity Institute
VU	Vulnerable



## GLOSSARY

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

**Azonal** - Water-logged and salt-laden habitats require specially adapted plants to survive in these habitats. Consequently, the vegetation deviates from the typical surrounding zonal vegetation and are considered to be of azonal character (Mucina & Rutherford, 2006)

**Biodiversity** - Biodiversity is the variability among living organisms from all sources including interalia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems

**Biome** - A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.

**Buffer zone** - A collar of land that filters edge effects.

**Conservation** - The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity.

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

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

**Community** - Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.

**Critically** - A taxon is Critically Endangered when it is facing an extremely high risk of extinction

Endangered - in the wild in the immediate future.

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

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

Ecological Corridors are roadways of natural habitat providing connectivity of various patches Corridors of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible

Ecosystem - Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space

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

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

Endemic - Naturally only found in a particular and usually restricted geographic area or region

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

Forb - An herbaceous plant other than grasses.

Habitat - Type of environment in which plants and animals live

Indigenous - Any species of plant, shrub or tree that occurs naturally in South Africa

In Situ - "In the place" In Situ conservation refers to on-site conservation of a plant species where it occurs. It is the process of protecting an endangered plant or animal species in its natural habitat. The plant(s) are not removed, but

conserved as they are. Removal and relocation could kill the plant and therefore in situ conservation is preferred/enforced.

Invasive species - Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas

Mitigation - The implementation of practical measures to reduce adverse Impacts

Near Threatened - A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo et al, 2009).

Plant Community - A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance. In many cases there are several soil types within a given plant community (Gobbat et al, 2004)

Protected Plant - According to Provincial Nature Conservation Ordinances or Acts, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.

Threatened - Species that have naturally small populations, and species which have been reduced to small (often unsustainable) population by man's activities

Red Data - A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. Now termed Plants of Conservation Concern

Species diversity - A measure of the number and relative abundance of species

Species richness - The number of species in an area or habitat

Suffrutex - Low-growing woody shrub or perennial with woody base, sometimes referred to as underground trees

Threatened - Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo et al, 2009)

Transformation - The removal or radical disturbance of natural vegetation, for example by crop agriculture, plantation forestry, mining or urban development. Transformation mostly results in a serious and permanent loss of biodiversity

and fragmentation of ecosystems, which in turn lead to the failure of ecological processes. Remnants of biodiversity may survive in transformed landscapes

Vegetation - A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes

Vulnerable - A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future(Raimondo et al, 2009)

## 1. INTRODUCTION

Muny Consultants has been appointed as an Independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment for the proposed Kwa-Thema to Grundlingh WWTW bulk outfall sewer in the Gauteng Province, South Africa. As part of the requirements of the EIA processes, specific biodiversity surveys were recommended by the environmental consultant. Naledzani Environmental Services cc (herein after referred to as 'NES') has then been appointed to conduct the biodiversity impact assessment for the proposed application.

### 1.1. Terms of reference

The terms of reference for this investigation are limited to a Terrestrial Biodiversity Assessment with the following objectives:

- To assess the proposed development in order to determine the general ecological state of the proposed project area;
- To survey and delineate environmentally sensitive areas;
- To assess the proposed development in terms of faunal and floral taxa including the potential for species to occur;
- To provide mapping of the environmentally sensitive and critical areas with respect to the proposed development;
- To assess and identify the potential impacts that may arise from the proposed project on the fauna and flora taxa;
- To provide mitigation measures to prevent and/or mitigate identified environmental impacts that may occur due to the proposed project; and
- The provision of an assessment report, indicate findings, recommendations and maps indicating sensitivities and/or no-go areas.

### 1.2. Assumptions and limitations

Ecological studies should be conducted during the growing season of all plant species that may potentially occur. This may require more than one season's survey with two visits undertaken preferably from November to February. However, due to the urgency of the project, this assessment was conducted in August 2018 before the rainfall and as such many plant species including grasses were still not yet in their growing period.

The entire site (pipeline route) was walked on foot and sampled by the specialist. All species included in the plant species list (Appendix A) were observed and recorded in the study area and any comments or observations made in this regard are based on observations, literature review, the expert knowledge and relevant professional experience of the specialist. Naledzani Environmental Services reserves the right to amend this report, recommendations and/or conclusions at any stage should any additional or otherwise significant information come to light

## 2. LEGISLATIVE REQUIREMENTS

A summary of the relevant sections of the acts that govern the activities and potential impacts to the environment associated with the development are listed below. It should be noted that these acts are listed below only with specific reference to biodiversity studies.

Table 1: Acts and regulations relating to the project

Legislation/Policy	Description
<p><b>National Environmental Management: Biodiversity Act No 10 of 2004</b></p>	<p>The Biodiversity Act provides listing threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected (Government Gazette, 2011). The main purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction and includes the prevention of further degradation and loss of structure, function and composition of threatened ecosystems.</p>
<p><b>South African Constitution 108 of 1996</b></p>	<p>The Constitution is the supreme law of the land and includes the Bill of rights which is the cornerstone of democracy in South Africa and enshrines the rights of people in the country. It includes the right to an environment which is not harmful to human health or well-being and to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures.</p>

<p><b>The Convention of Biological Diversity (Rio de Janeiro, 1992).</b></p>	<p>The purpose of the Convention on Biological Diversity is to conserve the variability among living organisms, at all levels (including diversity between species, within species and of ecosystems). Primary objectives include (i) conserving biological diversity, (ii) using biological diversity in a sustainable manner and (iii) sharing the benefits of biological diversity fairly and equitably.</p>
<p><b>National Environmental Management Act 107 of 1998</b></p>	<p>This is a fundamentally important piece of legislation and effectively promotes sustainable development and entrenches principles such as the 'precautionary approach', 'polluter pays' principle, and requires responsibility for impacts to be taken throughout the life cycle of a project NEMA provides the legislative backing (Including Impact Assessment Regulations) for regulating development and ensuring that a risk-averse and cautious approach is taken when making decisions about activities.</p>
<p><b>Strategic Framework for Sustainable Development in South Africa</b></p>	<p>The development of a broad framework for sustainable development was initiated to provide an overarching and guiding National Sustainable Development Strategy. The Draft Strategic Framework for Sustainable Development (SFSD) in South Africa (September 2006) is a goal orientated policy framework aimed at meeting the Millennium Development Goals. Biodiversity has been identified as one of the key crosscutting trends in the SFSD. The lack of sustainable practices in managing natural resources, climate change effects, loss of habitat and poor land management practices were raised as the main threats to biodiversity.</p>
<p><b>Environmental Impact Assessment (EIA) regulations</b></p>	<p>New regulations have been promulgated in terms of Chapter 5 of NEMA and were published on 07 April 2017 in Government Notice No. R. 326. Development and land use activities which require Environmental Authorisation in terms of the NEMA EIA Regulations, 2017, are in Listing Notice 3 (GG No. R.324, LN3) identified via geographic areas with the intention being that activities only require Environmental Authorisation when</p>

	located within designated sensitive areas. These sensitive/geographic areas were identified and published for each of the nine (9) Provinces.
<b>Conservation of Agricultural Resources Act 43 of 1967</b>	The intention of this Act is to control the over-utilization of South Africa's natural agricultural resources, and to promote the conservation of soil and water resources and natural vegetation. The CARA has categorised a large number of invasive plants together with associated obligations of the land owner, including the requirement to remove categorised invasive plants and taking measures to prevent further spread of alien plants.
<b>National Forest Act 84 of 1998</b>	The protection, sustainable management and use of forests and trees within South Africa are provided for under the National Forests Act (Act 84 of 1998).
<b>National Environmental Management: Protected Areas Act 57 of 2003</b>	This Act provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. It also seeks to provide for the sustainable utilization of protected areas and to promote participation of local communities in the management of protected areas.
<b>The protected Areas Act 57 of 2003</b>	The Act provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.
<b>Gauteng Ridge Policy (2006)</b>	Ridges are protected environments within Gauteng (GDACE, 2006). The term ridge refers to hills, koppies, mountains, kloofs and gorges and/or a landscape type or topographic feature that is characterized by two or more of the following features: a crest, plateau, cliff or footslope. Ridges are further characterized by high spatial heterogeneity due to the range of differing,



	<p>slopes and altitudes all resulting in differing soil, light and hydrological conditions. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. Many threatened species of plants and animals inhabit ridges. As such, the conservation of ridges in Gauteng will contribute significantly to the future persistence of these species. It follows that protection of the ridges of Gauteng from development pressures will significantly contribute to the conservation of 65% of threatened or protected plant species and 71% of Gauteng plant endemics. Similarly, 50% of all Near Threatened plant species (those species that are close to qualifying as Vulnerable) will be protected through the protection of ridge environments.</p>
<p><b>Gauteng Conservation Plan (2011)</b></p>	<p>The Gauteng Conservation Plan (Version 3.3) (GDARD, 2011) classified areas within the province on the basis of its contribution to reach the conservation targets within the province. These areas are grouped as Critical Biodiversity Areas (CBAs) or Ecological Support Corridors (ESAs). The CBAs comprise 'Irreplaceable' areas that must be conserved and areas classified as 'Important' to reach the conservation targets of the Province. ESA's are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. (ESAs) to ensure sustainability in the long term.</p>

### 3. GENERAL DESCRIPTION OF THE RECEIVING ENVIRONMENT

#### 3.1. Study area

The proposed sewer pipeline runs parallel to the existing sewer pipelines from Sharon Park and divert to follow the servitude of the Dunnottar Aerodrome Road towards the east, facing the army base. At the intersection of R 51 Road and Dunnottar Aerodrome Road, the proposed pipelines would then follow the servitude R51 Road towards the south till the CE Grundlingh WWTW.

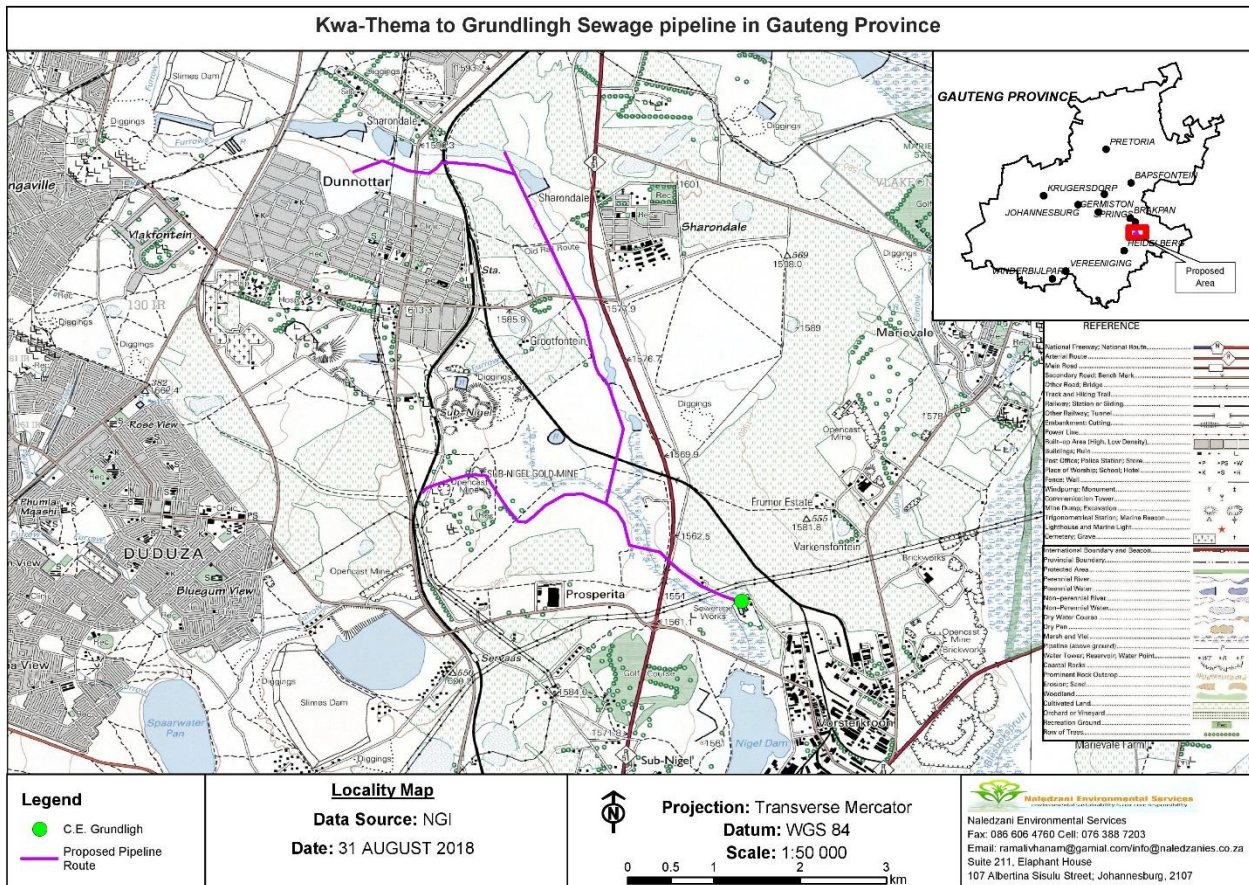


Figure 1: Locality map for the proposed pipeline route

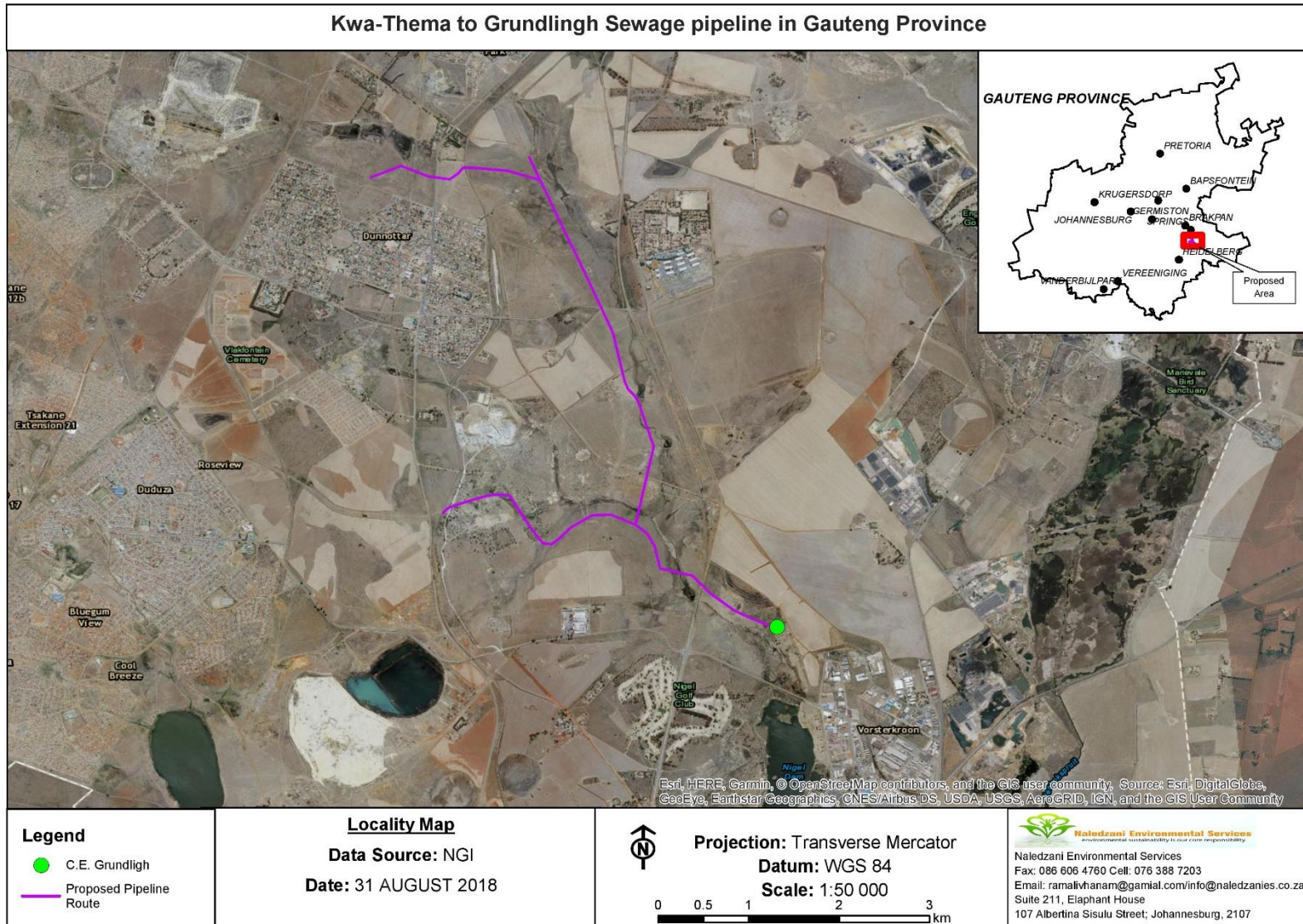


Figure 2: Google earth view of the proposed pipeline route

### 3.2. Climatic conditions

Within the study area, daily average summer temperatures ranged between ~ 20 °C and ~ 18 °C, while winter temperatures range between ~13°C and ~ 15°C. The relative humidity is lowest during the winter and highest in summer and spring. Frost can occur from middle April to early October.

The predominant wind direction within the study area is mainly from the north and north western region. Secondary winds are noted from the south western and north eastern region. During the summer months (Dec, Jan and Feb) the winds originate predominantly from the north-north-west and north-east. During the spring months (Sep, Oct and Nov), the winds originate from the north-north-west. A similar pattern in wind field occurs during the autumn (Mar, Apr and May) and winters months (Jun, Jul and Aug), with winds originating predominantly from the north-west, south-west and south- easterly sectors.

In the study area, 1.2 % of the time, calm conditions existed over the area. The highest frequency of wind speeds lie between 2.1 – 3.6 m/s and 3.6 - 5.7 m/s which occurred for 33 % of the time respectively. The study area experiences very stable conditions which are characteristic of low winds, clear skies and cold night-time conditions.

The highest average of rainfall (mm) was recorded during the summer and spring months, while the lowest rainfall average occurred during the winter and autumn months. Intense thunderstorms can be experienced in the late afternoons, periodically with hail. Frequent lightning strikes 6 – 8 lightning flashes per square kilometre per year (Botha, 2012) occur within the EMM.

### 3.3. Vegetation

The proposed project is located within the Tsakane Clay Grassland (Gm 9) which is part of the Grassland Biome. The Tsakane Clay Grassland occurs on flat to gently undulating plains with low hills. Where not removed by previous storage of gold tailings, clay mining or borrowing of road construction material, the vegetation is short and dense grasslands (refer to Figure 3). The presence of *Hyparrhenia hirta* and *Eragrostis chloromelas* indicates past disturbances in this veld type. The veld type is considered Endangered and only 1.5% of the 24% target is currently under conservation (Mucina & Rutherford, 2006)

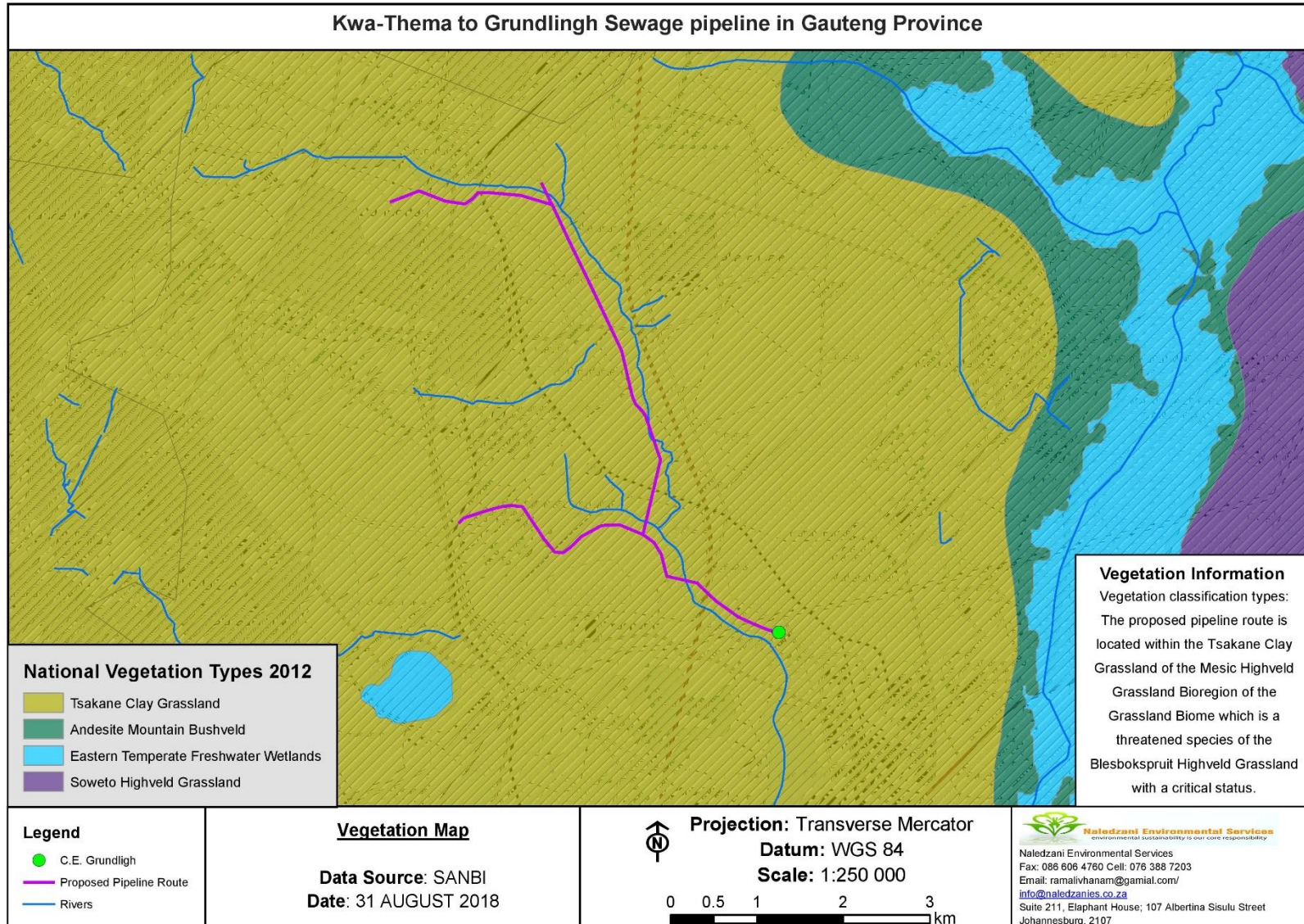


Figure 3: Broad-vegetation map for the site

### 3.4. Terrestrial threatened ecosystem

The South African National Biodiversity Institute (SANBI), in conjunction with the Department of Environmental Affairs (DEA), released a draft report in 2009 entitled “Threatened Ecosystems in South Africa: Descriptions and Maps”, to provide background information on the List of Threatened Ecosystems (SANBI, 2009). The purpose of this report was to present a detailed description of each of South Africa’s ecosystems and to determine their status using a credible and practical set of criteria. The following criteria were used in determining the status of threatened ecosystems:

- Irreversible loss of natural habitat;
- Ecosystem degradation and loss of integrity;
- Limited extent and imminent threat;
- Threatened plant species associations;
- Threatened animal species associations; and
- Priority areas for meeting explicit biodiversity targets as defined in a systematic conservation plan.

In terms of section 52 (1) (a), of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), a new national list of ecosystems that are threatened and in need of protection was gazetted on 9 December 2012 (Government Notice 1002 (Driver *et. al.*, 2004). The list classified all threatened or protected ecosystems in South Africa in terms of four categories; *Critically Endangered* (CR), *Endangered* (EN), *Vulnerable* (VU), or *Protected*. The purpose of categorizing these ecosystems is to prioritize conservation areas in order to reduce the rates of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems. It is estimated that threatened ecosystems make up 9.5% of South Africa, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% of the land area. It is therefore vital that Threatened Terrestrial Ecosystems inform proactive and reactive conservation and planning tools, such as Biodiversity Sector Plans, municipal Strategic Environmental Assessments (SEAs) and Environmental Management Frameworks (EMFs), Environmental Impact Assessments (EIAs) and other environmental applications (Mucina *et al.*, 2006). According to data sourced from South African National Biodiversity Institute (SANBI), the area is located within the **Endangered** ecosystem (**Tsakane Clay Grassland**).

## 4. METHODOLOGY AND REPORTING

The information provided in this terrestrial biodiversity report is based mainly on the observations that were made during the field survey of the site as well as desktop information. A wide range of spatial data sets were interrogated and relevant information was extracted for the study site. A basic ecological sensitivity analysis was performed to identify areas of special interest or concern. The various approaches used and aspects taken into account are detailed below:

### 4.1. General

A desktop survey utilising aerial images and photography was undertaken to assemble background information regarding the different features and vegetation type present within the proposed project area. The site was then assessed on the 20<sup>th</sup> of August 2018 to ensure that the true floristic reflection of the site is recorded. A 20 meters transect was surveyed along the pipeline route

### 4.2. Vegetation

The PRECIS list of plants recorded in the quarter degree grid square (*i.e.* 2628AD) was obtained from SANBI. This list was consulted to verify the record of occurrence of the plant species seen on the site. A desk-top study of the habitats of the red-listed and orange-listed species known to occur in the area was done prior to site assessment. Visual assessment was used to assess the abundance of floral and faunal species. The vegetation types of Mucina & Rutherford (2006) were also used as reference but where necessary communities are named according to the recommendations for a standardized South African syntaxonomic nomenclature system (Brown, L.R., Du Preez, P.J., Bezuidenhout, H., Bredenkamp, G.J., Mostert, T.H.C., and Collins, N.B. 2013). By combining the available literature with the survey results, stratification of vegetation communities was possible.

### 4.3. Fauna survey

The majority of mammals and reptiles are either very secretive, nocturnal, hibernate (reptiles), migrate (birds) or prefer specific habitat so sampling and identification was limited.

### 4.4. Mammals

Records of all mammal species recorded in the quarter degree grid squares were obtained from the Virtual Museum (VM) website of the Animal Demographic Unit of University of Cape Town prior to the site visits. The site assessment was conducted for mammal species diversity by direct and indirect methods using mammal sightings, burrows, holes and also verified by mammal book (Skinner and Chimimba, 2005). No trapping was conducted during the field survey.

#### 4.5. Methodology Adapted in Assessing the Impacts

The significance of the impacts will be assessed considering the following descriptors:

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified by use of the Input-Output model. The significance rating process follows the established impact/risk assessment formula given in figure 1 below:

***Significance = consequence of an event x probability of the event occurring***

*where*

***Consequence = Type of impact x (Intensity + Spatial Scale + Duration)***

*and*

***Probability = Likelihood of an impact occurring***

In the formula for calculating **consequence**:

***Type of impact = +1 (for positive impacts) or -1 (for negative impacts)***

Figure 4: Significance Rating Methodology

The matrix calculates the rating out of 147, whereby Severity, Spatial Scale, Duration and Probability is rated out of seven. Please refer to Table 2 for the parameter ratings which will be used to assign a weighting for both positive and negative impacts.

The significance of an impact is determined and categorised into one of eight categories, as indicated in Table 3 which is extracted from Figure 3.



Table 2: Impact Assessment Parameter Ratings

Rating	Severity/Intensity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
7	<p>Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.</p> <p>The positive impact will result in a significant improvement to the initial/post disturbance environmental status and will benefit ecological and natural resources.</p>	<p>Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.</p> <p>The positive impact will be of high significance which will result the improvement of the socio-economic status of a greater area beyond the boundary of the directly affected of the community and/or promote archaeological and heritage awareness and contribute towards research and documentation of sites and artefacts through phase two assessments.</p>	<p>International</p> <p>The effect will occur across international borders</p>	<p>Permanent: No Mitigation</p> <p>No mitigation measures of natural process will reduce the impact after implementation.</p>	<p>Certain/ Definite.</p> <p>The impact will occur regardless of the implementation of any preventative or corrective actions.</p>

Rating	Severity/Intensity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
6	<p>Significant impact on highly valued species, habitat or ecosystem.</p> <p>The positive impact is of high significance which will result in a vast improvement to the environment such as ecological diversification and/or rehabilitation of endangered species</p>	<p>Irreparable damage to highly valued items of cultural significance or breakdown of social order.</p> <p>The positive impact will be of high significance and will result in the upliftment of the surrounding community and/or contribute towards research and documentation of sites and artefacts through phase two assessments</p>	<p>National</p> <p>Will affect the entire country</p>	<p>Permanent:</p> <p>Mitigation measures of natural process will reduce the impact.</p>	<p>Almost certain/Highly probable</p> <p>It is most likely that the impact will occur.</p>
5	<p>Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate</p> <p>The positive impact will be moderately high and will have a long term beneficial effect on the natural environment</p>	<p>Very serious widespread social impacts.</p> <p>Irreparable damage to highly valued items</p> <p>The positive impact will be moderately high and will result in visible improvements on the socio-economic environment of the local and regional community, and/or promote archaeological and heritage awareness through mitigation</p>	<p>Cercle/ Region</p> <p>Will affect the entire Cercle or region</p>	<p>Project Life</p> <p>The impact will cease after the operational life span of the project.</p>	<p>Likely</p> <p>The impact may occur.</p>

Rating	Severity/Intensity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
4	<p>Serious medium term environmental effects. Environmental damage can be reversed in less than a year</p> <p>The positive impact on the environment will be moderate with visible improvement to the natural resources and regional biodiversity</p>	<p>On-going serious social issues. Significant damage to structures / items of cultural significance</p> <p>The positive impact on the socio-economic environment will be of a moderate extent and benefits should be experience across the local extent and/or potential benefits for archaeological and heritage conservation</p>	<p>Commune Area</p> <p>Will affect the whole municipal area</p>	<p>Long term</p> <p>6-15 years</p>	<p>Probable</p> <p>Has occurred here or elsewhere and could therefore occur.</p>
3	<p>Moderate, short-term effects but not affecting ecosystem function.</p> <p>Rehabilitation requires intervention of external specialists and can be done in less than a month.</p> <p>The positive impact will be moderately beneficial to the natural environment, but will be short lived.</p>	<p>Ongoing social issues. Damage to items of cultural significance.</p> <p>The positive impact will be moderately beneficial for some community members and/or employees, but will be short lived and/or there will be a moderate possibility for archaeological and heritage conservation</p>	<p>Local</p> <p>Local extending only as far as the development site area</p>	<p>Medium term</p> <p>1-5 years</p>	<p>Unlikely</p> <p>Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.</p>

Rating	Severity/Intensity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
2	<p>Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants.</p> <p>The positive impacts will be minor and slight environmental improvement will be visible.</p>	<p>Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.</p> <p>Minor positive impacts on the social/cultural and/ or economic environment</p>	<p>Limited</p> <p>Limited to the site and its immediate surroundings</p>	<p>Short term</p> <p>Less than 1 year</p>	<p>Rare/ improbable</p> <p>Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere.</p> <p>The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures</p>

Rating	Severity/Intensity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
1	Limited damage to minimal area of low significance, (e.g. ad hoc spills within plant area). Will have no impact on the environment.  The positive impact on the environment will be insignificant and will not result in visible improvements.	Low-level repairable damage to commonplace structures.  The positive impact on social and cultural aspects will be insignificant	Very limited  Limited to specific isolated parts of the site.	Immediate  Less than 1 month	Highly unlikely/None  Expected never to happen.

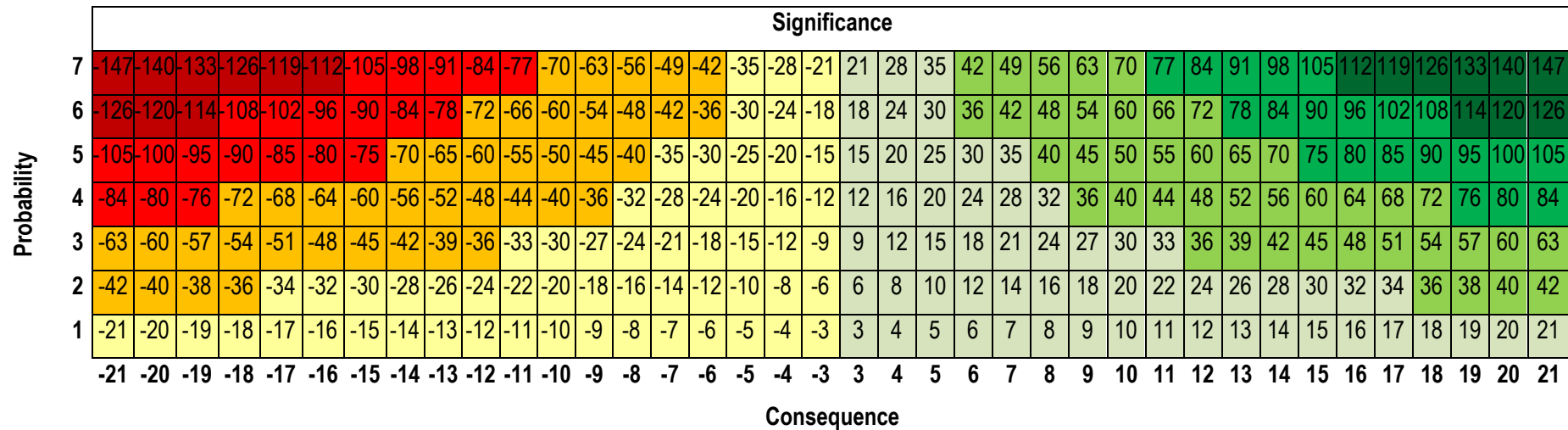


Figure 5: Relationship between Consequence, Probability and Significance Ratings

Table 3: Significance Ratings

Score	Description	Rating
109 to 147	A very beneficial impact which may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive)
36 to 72	An important positive impact. The impact is insufficient by itself to justify the implementation of the project. These impacts will usually result in positive medium to long-term effect on the social and/or natural environment	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the social and / or natural environment	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the social and / or natural environment	Negligible (negative)
-36 to -72	An important negative impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the social and / or natural environment	Minor (negative)

Score	Description	Rating
-73 to -108	A serious negative impact which may prevent the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe effects	Moderate (negative)
-109 to -147	A very serious negative impact which may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects	Major (negative)

## 5. RESULTS OF THE ASSESSMENT

### 5.1. Vegetation Survey

The study area consists of Eucalyptus woodland, ined area, natural grassland, ridge, and vegetation associated with watercourses communities. Dominant transformation agents primarily include cultivation, mining and infrastructure development. Disturbance levels in non-transformed areas vary considerably depending on the nature of current and/or past perturbations. Vegetation throughout the study area is dominated by shrubs, grasses, forbs and herbs. Refer to Appendix A for a list of species in the study area.

#### 5.1.1. Vegetation communities

Five vegetation communities were identified during the site assessment (Figure 6). These were recognised based on physiognomy, moisture regime, and species composition and disturbance characteristics. Vegetation communities include:

- Eucalyptus woodland,
- Mined area,
- Natural grassland,
- Ridge, and
- Vegetation associated with watercourses.

The characteristics of each vegetation community are discussed in the following sections.



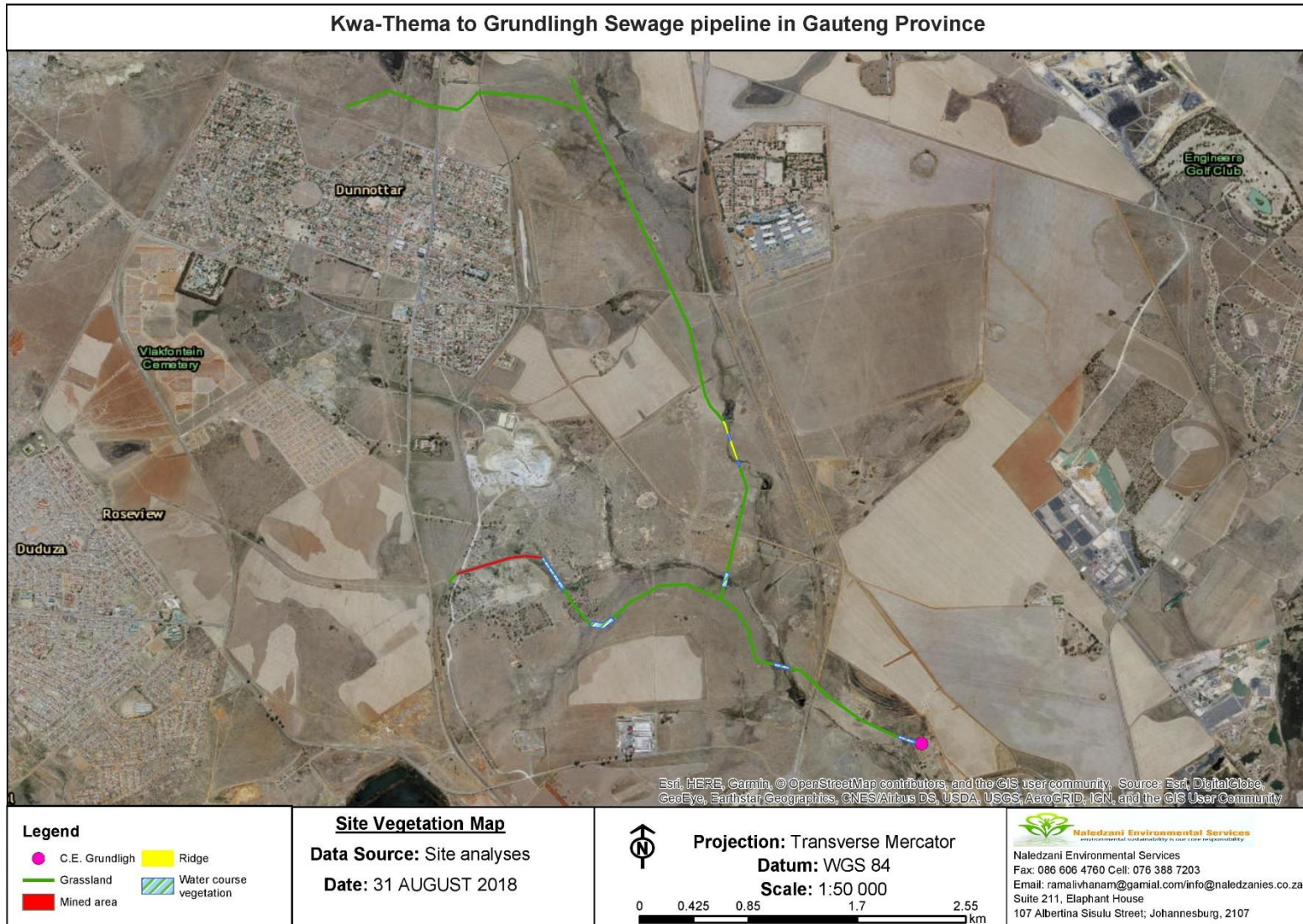


Figure 6: Site vegetation map

#### 5.1.1.1. The Natural grassland

As the assessment was done during the winter season the grass layer was found to be dry and some of the species could not be identified to the species level. This is the most dominating vegetation unit along the pipeline and the dominant floral species in this community include *Andropogon schirensis*, *Eragrostis trichophora*, *Eragrostis racemosa*, *Echinochloa colona*, *Sporobolus fimbriatus*, *Aristida congesta*, *Aristida canescens*, *Themenda triandra*, *Melinis repens*, *Cynodon dactylon* and *Heteropogon contours*. Herbs such as *Verbena bonariensis*, *Xanthium strumarium*, *Conyza podocephala* *Stoebe plumosa* (dominating), *Senecio coronatus* and *Berkheya insignis* were recorded scattered within the grassland

#### Sensitivity aspects

- The natural grassland patch has an ecological functioning of medium;
- The suitability of this community for Red Data/protected species is considered medium but no protected or red-listed species was found during the assessment.



Figure 7: Overview of the natural grassland on site with scattered *Stoebe plumose*

#### 5.1.1.2. Mined area

This section of the pipeline is currently under illegal mining and it was also previously mined before. Plant species dominating this area include *Verbena bonariensis*, *Bidens pilosa*. Other species include *Vachellia tortilis*, *Eucalyptus globulus*, *Agave sisalana*, *Gymnosporia buxifolia*, *Acacia mearnsii*, *Gerbera viridifolia*, *Senecio coronatus*, *Solanum linnaeanum*.

The grass layer has *Heteropogon contortus*, *Hyparrhenia hirta*, *Microchloa caffra*, *Setaria sphacelata*, *Themeda triandra*, *Trachypogon spicatus* and *Cortaderia selloana*

- Due to the previous and some current transformation of this area this area has a negligible or low ecological functioning.
- No endemic, Red Data or protected species was recorded on this area
- Accordingly, the conservation importance of mined is considered low. The sewer line has been damaged and such the waste water is flowing to the drainage line which is destroying the ecological value of the area.



Figure 8: illegal mining taking place along the pipeline route



Figure 9: Sewer flowing from the vandalised pipeline to the nearby drainage line

#### 5.1.1.3. Vegetation associated with water courses

Moist grasslands delineated in this report were classified as vegetation that typically grew in permanently to temporary saturated soils and was dominated by grass and / or sedge species with no or limited indigenous woody (tree) species present. The moist grasslands were characterised as areas where permanent water was observed or where the soils supported plant species with an affinity to grow in permanent, temporary or seasonally saturated conditions. Note that the moist grasslands is an indication of where wetlands could occur, based on plant species that are adapted to growing

in inundated soils, or species that prefers moist soils, but are not necessarily indicative of wetland conditions. The wetland assessment for the project must be consulted for the delineated boundaries and buffers of wetlands.

Species such as *Typha capensis*, *Arundo donax*, *Schoenoplectus corymbosus*, *Setaria incrassata* and *Cyperus species*. Dry *Campuloclinium macrocephalum* was also recorded on this vegetation unit

- The overall ecological functioning of this community is considered high.
- No endemic, Red Data or protected species was recorded on this area
- Accordingly, the conservation importance of the vegetation associated with watercourses is regarded as high due to the association of this area with wetlands and also providing habitat for birds as well as aquatic animals.



Figure 10: Moist grassland on site



Figure 11: *Typha capensis* on the wet area

#### 5.1.1.4. Eucalyptus woodland

As the name says this area is dominated by *Eucalyptus globulus* with other species including *Melia azedarach*, *Argemone Mexicana*, *Gymosporia buxifolia*, much of the grass was found to be dry.

#### Sensitivity aspects

- The open-shrubland has an ecological functioning of medium;
- The suitability of this community for Red Data/protected species is considered medium
- No protected plant species was recorded during site survey.



Figure 12: Overview of the Eucalyptus woodland

#### 5.1.1.5. Ridge

Rocky outcrops are usually characterized by high biodiversity due to the spatial heterogeneity owing to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions (GDACEL, 2001), supporting therefore a higher variety of plant species. Part of the site is situated within a ridge which is characterized by high density of listed plants.

The class 1 ridge comprise a grassy footslope, mid-slope and with patches of woody vegetation. The grass species include *Themeda triandra*, *Hyparrhenia hirta*, *Cynodon dactylon*, *Aristida congesta*, *Monocymbium ceresiliforme*, *Schizachyrium sanguineum* and *Aloe greatheadii*. Two fern species were recorded on the ridge (*Pellaea calomelanos* and *Cheilanthes hirta*).

Sensitivity aspects

- The ridge and outcrop vegetation unit has a high ecological functioning. The ridge provides suitable habitat for a number of plant species of conservation concern that is highly likely to occur, although not recorded within sample plots and walked transects
- The suitability of this community for Red Data/protected species is considered high
- Only two provincial protected plant species (*Pellaea calomelanos* and *Cheilanthes cf hirta*) was recorded during site survey.



Figure 13: Vegetation on the rocky outcrop where the pipeline route will traverse

## 5.2. Alien invasive plants

Declared weeds and invaders have the tendency to dominate or replace the herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that all these transformers be eradicated and controlled by means of an eradication and monitoring programme. Some invader



plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

According to the published Alien and Invasive Species regulations in terms of section 97(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) four categories of problem plants are identified as:

- **Category 1a** plants are high-priority emerging species requiring compulsory control. All breeding, growing, moving and selling are banned.
- **Category 1b** plants are widespread invasive species controlled by a management programme.
- **Category 2** plants are invasive species controlled by area. Can be grown under permit conditions in demarcated areas. All breeding, growing, moving, and selling are banned without a permit.
- **Category 3** plants are ornamental and other species that are permitted on a property but may no longer be planted or sold.

Numerous alien plant species were recorded in the study area at the time of the survey; most notably the extensive invasions by species such as *Argemone Mexicana* and *Datura stramonium* have the potential to form dense stands. Table 4 lists the alien species as well as the various NEMBA categories for the alien species recorded during the survey.

Table 4: Alien species recorded in the study area.

Scientific name	Common name	NEMBA Category
<i>Argemone Mexicana</i>	Mexican prickly poppy	1b
<i>Agave sisalana</i>	Sisal	2
<i>Datura Stramonium</i>	Downy thorn apple	1b
<i>Eucalyptus globulus</i>	Tasmanian blue gum	3
<i>Opuntia ficus-indica</i>	Prickly pear	1b
<i>Acacia mearnsii</i>	Black wattle	1b

<i>Sesbania punica</i>	Red sesbania	1b
<i>Cortaderia selloana</i>	Pampas grass	1b
<i>Eucalyptus globulus</i>	Tasmanian bluegum	
<i>Campuloclinium macrocephalum</i>	Pompom	1b
<i>Melia azedarach</i>	Syringa	1b anywhere but 3 in urban areas

### 5.3. Medicinal Plants

The demand for medicinal plants is increasing while the frequently used species and the communal land that it is harvested from are on the decline. With an increase in the country's population and the high rate of infectious diseases, this will put an even higher strain on the already scarce natural medicinal resources (Emery *et al.*, 2002). Areas of high biodiversity are thus important for the conservation and sustainable use of these resources and should be protected.

Table 5: Medicinal plants recorded in the study areas.

Scientific name	Common name	Conservation Status
<i>Opuntia ficus-indica</i>	Prickly pear	Invader

### 5.4. Description of the CBAs for the Gauteng Province

Critical Biodiversity Areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI, 2007). These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making tools.

The primary purpose of CBA's is to inform land-use planning and the land-use guidelines attached to CBA's aim to promote sustainable development by avoiding loss or degradation of important natural habitat and landscapes in these areas and the landscape as a whole. CBA's can also be used to inform protected area expansion and development

plans. The use of CBA's here follows the definition laid out in the guideline for publishing bioregional plans (Anon, 2008):

- **“Critical biodiversity areas (CBAs)** are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses”.
- **“Ecological support areas (ESA's)** are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.”

The guideline for bioregional plans defines three basic CBA categories based on three high-level land management objectives.

Table 6: A framework for linking spatial planning categories (CBAs) to land-use planning and decision-making guidelines based on a set of high-level land biodiversity management objectives.

CBA category	Land Management Objective
PA & CBA 1	<p><b>Natural landscapes:</b></p> <ul style="list-style-type: none"> <li>• Ecosystems and species fully intact and undisturbed</li> <li>• These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost, then targets will not be met.</li> <li>• These are landscapes that are at or past their limits of acceptable change.</li> </ul>
CBA 2	<p><b>Near-natural landscapes:</b></p> <ul style="list-style-type: none"> <li>• Ecosystems and species largely intact and undisturbed.</li> <li>• Areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are</li> </ul>

CBA category	Land Management Objective
	<p>options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets.</p> <ul style="list-style-type: none"> <li>• These are landscapes that are approaching but have not passed their limits of acceptable change.</li> </ul>
Ecological Support Areas (ESA)	<p><b>Functional landscapes:</b></p> <ul style="list-style-type: none"> <li>• Ecosystems moderately to significantly disturbed but still able to maintain basic functionality.</li> <li>• Individual species or other biodiversity indicators may be severely disturbed or reduced.</li> <li>• These are areas with low irreplaceability with respect to biodiversity pattern targets only.</li> </ul>
Other Natural Areas (ONA) and Transformed	<p><b>Production landscapes:</b> manage land to optimize sustainable utilization of natural resources.</p>

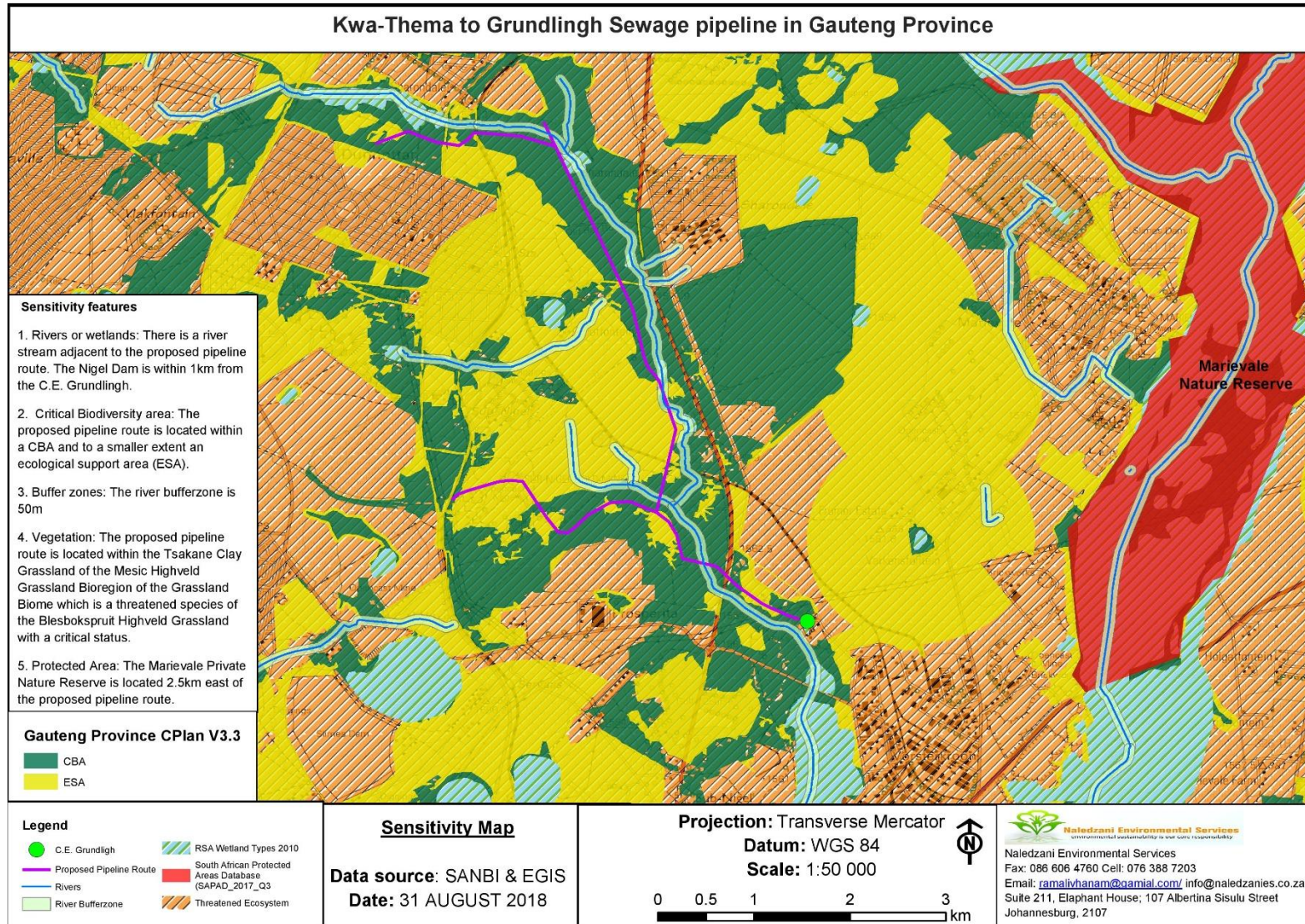


Figure 14: Study area in relation to the Gauteng Conservation Plan

According to the Gauteng Conservation Plan (C-Plan, v3.3), the majority of the study area is located within a critical biodiversity area with a small section only located within an ecological support. It needs to be noted that these areas will be disturbed due to pipeline construction. Section of the study area is highly disturbed and degraded due to past and current mining activities as well as the leak of sewer from the vandalised pipes

#### 5.5. Avi-fauna

Desktop assessment (SABAP 2) showed that a total of 205 bird species have been confirmed within the QDGC. Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation (Harrison *et al.*, 1997). Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. It is the survival of these species that become threatened as they cannot adapt to changes to the habitat. Habitat-specific species are sensitive to environmental change, with destruction of habitat being the leading cause of species decline worldwide (Barnes, 2000).

It is widely accepted that vegetation structure, rather than the actual plant species, influences bird species' distribution and abundance (Harrison *et al.*, 1997). Therefore, the vegetation description used in the Bird Atlas does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. A list of birds on the QDGC is attached as appendix B.

## 6. ASSESSMENT OF IMPACTS

### 6.1. Introduction

The Regulations in terms of Chapter 5 of the National Environmental Management, Act No. 107 of 1998 requires that a description must be given of the potential impacts the proposed development will have on the environment. The details indicated the identified impacts for the area and their proposed mitigation measures.

Table 7: Environmental Impacts assessed by combining the consequences with the probability of occurrence before and after mitigation for the proposed project

Impacts and Mitigation measures relating to the proposed project										
Activity/Aspect	Impact	Stage	Nature	Intensity	Scale	Duration	Probability	Significance before mitigation	Mitigation measures	Significance after mitigation
Vegetation Clearing for the construction activities	Removal of the natural vegetation	Construction	Negative (-1)	Moderate (3)	Site only (2)	Long term (4)	Definite (7)	Minor (negative) (-63)	<ul style="list-style-type: none"> <li>Areas designated for vegetation clearing should be identified and visibly marked off.</li> <li>Exposed areas should be rehabilitated with indigenous plants to the project area as soon as construction is finished.</li> </ul>	Negligible (negative)
	Disturbance to animals on site	Construction	Negative (-1)	Low (2)	Site only (2)	Long term (4)	High (6)	Minor (negative) (-48)	<ul style="list-style-type: none"> <li>Do not disturb nests, breeding sites or young ones (especially along the streams that the pipeline crosses).</li> <li>Do not attempt to kill or capture snakes unless directly threatening the safety of employees.</li> <li>Dogs or other pets are not allowed to the worksite as they are threats to the natural wild animal</li> <li>A low speed limit should be enforced on site to reduce wild animal-vehicle collisions</li> <li>No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted on the site.</li> <li>Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harms remaining faunal species.</li> <li>The ECO must conduct regular site inspections of removing any snares or traps that have been erected.</li> <li>Employees and contractors should be made aware of the presence of, and rules regarding, flora and fauna through suitable induction training and on-site signage.</li> </ul>	Negligible (negative)
	Increased soil erosion, increase in silt loads and sedimentation	Construction	Negative (-1)	High (5)	Local (3)	Long term (4)	Definite (7)	Moderate (negative) (-84)	<ul style="list-style-type: none"> <li>Following construction, rehabilitation of disturbed areas is required; especially next to the drainage lines the loop crosses.</li> <li>Avoid areas with sensitive soils, steep slopes during rain or windy season.</li> <li>Must have rehabilitation strategy as part of EMP such as a clean-up plan/strategy if spills occur and proper facilities</li> </ul>	Negligible (negative)

									(ablation) to ensure no sewerage spills into drainage lines and streams.	
	Establishment and spread of declared weeds	Construction and Maintenance	Negative (-1)	High (5)	Local (3)	Long term (4)	Definite (7)	Moderate (negative) (-84)	<ul style="list-style-type: none"> <li>The best mitigation measure for alien and invasive species is the early detection and eradication of these species which will be ensured with the use of a monitoring programme.</li> <li>An alien invasive management programme should be developed and implemented in order to control alien invasive species</li> </ul>	Negligible (negative)
Waste generation	Pollution due to oil and fuel spills, erosion, and ablation facilities.	Construction and Maintenance	Negative (-1)	High (5)	Local (3)	Long term (4)	Definite (7)	Moderate (negative) (-84)	<ul style="list-style-type: none"> <li>Proper ablation facilities on site must be provided.</li> <li>Regular monitoring of the pipeline to ensure that there are no leaks</li> <li>Proper storage facilities of construction materials.</li> <li>Proper Standard Operating Procedures in place regulating refuelling and other potential polluting activities.</li> </ul>	Negligible (negative)
	Pollution due to construction waste	Construction	Negative (-1)	High (5)	Local (3)	Medium Term (2)	Medium (6)	Minor (negative) (-60)	<ul style="list-style-type: none"> <li>Use a licensed waste contractor to dispose of any waste generated on site</li> <li>Do not bury wastes on-site.</li> </ul>	Negligible (negative)



## 7. CONCLUSION AND RECOMMENDATIONS

Based on Mucina & Rutherford's (2006) classification of South Africa's vegetation, the proposed area falls in the Tsakane Clay Grassland regarded as Endangered. According to the Gauteng Conservation Plan, the entire pipeline route is within a sensitive areas categorised of critical biodiversity area as well as ecological support area.

The ground-thruthing of the site has revealed that the site is comprise of five vegetation units which are,

- Eucalyptus woodland,
- Mined area,
- Natural grassland,
- Ridge, and
- Vegetation associated with watercourses

All the vegetation's were assessed and the ecological functioning of each unit was assigned. Construction activities in semi-natural and natural areas will have direct negative ecological impacts, most notably vegetation clearing leading to habitat loss, degradation and fragmentation. Other noted impacts include inter alia, exotic species encroachment and dust generation. These impacts can similarly be mitigated through correct and active management. Proper rehabilitation and after-care of the mined area need to take place to prevent the colonisation by invader species so as to avoid what the previous mining activities did to the site (along the pipeline route).

It is recommended that the management measures stipulated in this report be included into the proposed projects official EMP and that these are assessed for efficacy during all phases of the project and adapted accordingly to ensure minimal disturbance of the study areas' ecology. Provided that the mitigation measures as suggested can be implemented, then the overall impact of the proposed project would be of low to medium overall significance.

Other specific conclusions and recommendations are listed below.

- All licences must be obtained prior to construction;
- All ablution facilities must be placed far away from the water bodies including their buffer zone;
- Where possible, construction along water bodies should proceed during the dry winter months (low or zero flow periods) in order to limit the potential for erosion linked to high runoff rates;
- An alien and invasive management plan must be adhered to at all times; and
- Ensure active re-vegetation of cleared areas as being important in-order to limit erosion potential.

With all the mitigation measures assigned to each impact Naledzani Environmental Services **does support** the proposed project.

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## APPENDIX A: PLANT SPECIES RECORDED WITHIN THE STUDY AREA

Scientific name	Common name
<i>Acacia mearnsii</i>	Black wattle
<i>Agave sisalana</i>	Sisal
<i>Aloe greatheadii</i>	Spotted aloe
<i>Andropogon schirensis</i>	Stab Grass
<i>Argemone Mexicana</i>	Mexican prickly poppy
<i>Aristida canescens</i>	Pale three awn
<i>Aristida congesta</i>	Buffalo grass
<i>Arundo donax</i>	Giant reed
<i>Berkheya insignis</i>	
<i>Bidens pilosa</i>	Blackjack
<i>Campuloclinium macrocephalum</i>	Pompom
<i>Cheilanthus hirta</i>	Lip fern
<i>Conyza podocephala</i>	Canadian Horseweed
<i>Cortaderia selloana</i>	Pampas grass
<i>Cortaderia selloana</i>	Pampas
<i>Cynodon dactylon</i>	Bermudagrass
<i>Cyperus species</i>	

<i>Datura Stramonium</i>	Downy thorn apple
<i>Echinochloa colona</i>	Jungle rice
<i>Eragrostis racemosa</i>	Narrow heart love grass
<i>Eucalyptus globulus</i>	Tasmanian blue gum
<i>Eucalyptus globulus</i>	Tasmanian bluegum
<i>Gerbera viridifolia</i>	Blushing barberton daisy
<i>Gymnosporia buxifolia</i>	Spike thorn
<i>Heteropogon contours</i>	Tanglehead
<i>Hyparrhenia hirta</i>	Thatch grass
<i>Melia azedarach</i>	Syringa
<i>Melinis repens</i>	Natal grass
<i>Microchloa caffra</i>	Pincushion grass
<i>Monocymbium ceresiliforme</i>	
<i>Opuntia ficus-indica</i>	Prickly pear
<i>Pellaea calomelanos</i>	Hard fern
<i>Schoenoplectus corymbosus</i>	Plume sedge
<i>Senecio coronatus</i>	Woolly grassland senecio
<i>Sesbania punica</i>	Red sesbania
<i>Setaria incrassata</i>	Purple pigeon grass

<i>Setaria sphacelata</i>	South African pigeon grass
<i>Solanum linnaeanum</i>	Apple of Sodom
<i>Sporobulus fimbriatus</i>	Fringed dropseed
<i>Stoebe plumosa</i>	Slangbossie
<i>Themeda triandra</i>	Kangaroo Grass
<i>Trachypogon spicatus</i>	
<i>Typha capensis</i>	Blurush
<i>Vachellia tortilis</i>	
<i>Verbena bonariensis</i>	Tall verbena
<i>Xanthium strumarium,</i>	Cockleur

## APPENDIX B: LIST OF BIRDS SPECIES LIKELY TO INHABIT THE AFFECTED QDGC'S

Common name	Species name
Apalis, Bar-throated	<i>Apalis thoracica</i>
Avocet, Pied	<i>Recurvirostra avosetta</i>
Babbler, Arrow-marked	<i>Turdoides jardineii</i>
Barbet, Acacia Pied	<i>Tricholaema leucomelas</i>
Barbet, Black-collared	<i>Lybius torquatus</i>
Barbet, Crested	<i>Trachyphonus vaillantii</i>
Batis, Chinspot	<i>Batis molitor</i>
Bishop, Southern Red	<i>Euplectes orix</i>
Bishop, Yellow-crowned	<i>Euplectes afer</i>
Bittern, Little	<i>Ixobrychus minutus</i>
Bokmakierie, Bokmakierie	<i>Telophorus zeylonus</i>
Boubou, Southern	<i>Laniarius ferrugineus</i>
Brubru, Brubru	<i>Nilaus afer</i>
Bulbul, African Red-eyed	<i>Pycnonotus nigricans</i>
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>
Bunting, Cape	<i>Emberiza capensis</i>
Bunting, Cinnamon-breasted	<i>Emberiza tahapisi</i>
Buttonquail, Kurrichane	<i>Turnix sylvaticus</i>
Buzzard, Jackal	<i>Buteo rufofuscus</i>
Buzzard, Steppe	<i>Buteo vulpinus</i>
Canary, Black-throated	<i>Crithagra atrogularis</i>
Canary, Cape	<i>Serinus canicollis</i>

Canary, Yellow	<i>Crithagra flaviventris</i>
Canary, Yellow-fronted	<i>Crithagra mozambicus</i>
Chat, Anteating	<i>Myrmecocichla formicivora</i>
Chat, Familiar	<i>Cercomela familiaris</i>
Cisticola, Cloud	<i>Cisticola textrix</i>
Cisticola, Desert	<i>Cisticola aridulus</i>
Cisticola, Lazy	<i>Cisticola aberrans</i>
Cisticola, Levaillant's	<i>Cisticola tinniens</i>
Cisticola, Wailing	<i>Cisticola lais</i>
Cisticola, Wing-snapping	<i>Cisticola ayresii</i>
Cisticola, Zitting	<i>Cisticola juncidis</i>
Cliff-chat, Mocking	<i>Thamnolaea cinnamomeiventris</i>
Cliff-swallow, South African	<i>Hirundo spilodera</i>
Coot, Red-knobbed	<i>Fulica cristata</i>
Cormorant, Reed	<i>Phalacrocorax africanus</i>
Cormorant, White-breasted	<i>Phalacrocorax carbo</i>
Coucal, Burchell's	<i>Centropus burchellii</i>
Coucal, White-browed	<i>Centropus superciliosus</i>
Cursorer, Temminck's	<i>Cursorius temminckii</i>
Crake, Black	<i>Amauornis flavirostris</i>
Crane, Blue	<i>Anthropoides paradiseus</i>
Crombec, Long-billed	<i>Sylvietta rufescens</i>
Crow, Cape	<i>Corvus capensis</i>
Crow, Pied	<i>Corvus albus</i>

Cuckoo, Diderick	<i>Chrysococcyx caprius</i>
Cuckoo, Klaas's	<i>Chrysococcyx klaas</i>
Cuckoo, Red-chested	<i>Cuculus solitarius</i>
Darter, African	<i>Anhinga rufa</i>
Dove, Laughing	<i>Streptopelia senegalensis</i>
Dove, Namaqua	<i>Oena capensis</i>
Dove, Red-eyed	<i>Streptopelia semitorquata</i>
Dove, Rock	<i>Columba livia</i>
Duck, African Black	<i>Anas sparsa</i>
Duck, Fulvous	<i>Dendrocygna bicolor</i>
Duck, Knob-billed	<i>Sarkidiornis melanotos</i>
Duck, Maccoa	<i>Oxyura maccoa</i>
Duck, White-backed	<i>Thalassornis leuconotus</i>
Duck, White-faced	<i>Dendrocygna viduata</i>
Duck, Yellow-billed	<i>Anas undulata</i>
Eagle, Martial	<i>Polemaetus bellicosus</i>
Eagle, Verreaux's	<i>Aquila verreauxii</i>
Eagle-owl, Spotted	<i>Bubo africanus</i>
Egret, Cattle	<i>Bubulcus ibis</i>
Egret, Great	<i>Egretta alba</i>
Egret, Little	<i>Egretta garzetta</i>
Egret, Yellow-billed	<i>Egretta intermedia</i>
Falcon, Amur	<i>Falco amurensis</i>
Falcon, Red-footed	<i>Falco vespertinus</i>



Finch, Red-headed	<i>Amadina erythrocephala</i>
Firefinch, African	<i>Lagonosticta rubricata</i>
Firefinch, Red-billed	<i>Lagonosticta senegala</i>
Fiscal, Common (Southern)	<i>Lanius collaris</i>
Fish-eagle, African	<i>Haliaeetus vocifer</i>
Flamingo, Greater	<i>Phoenicopterus ruber</i>
Flamingo, Lesser	<i>Phoenicopterus minor</i>
Flufftail, Red-chested	<i>Sarothrura rufa</i>
Flycatcher, Fairy	<i>Stenostira scita</i>
Flycatcher, Fiscal	<i>Sigelus silens</i>
Flycatcher, Spotted	<i>Muscicapa striata</i>
Francolin, Grey-winged	<i>Scleroptila africanus</i>
Francolin, Orange River	<i>Scleroptila levaillantoides</i>
Francolin, Red-winged	<i>Scleroptila levaillantii</i>
Go-away-bird, Grey	<i>Corythaixoides concolor</i>
Godwit, Black-tailed	<i>Limosa limosa</i>
Goose, Egyptian	<i>Alopochen aegyptiacus</i>
Goose, Spur-winged	<i>Plectropterus gambensis</i>
Grass-owl, African	<i>Tyto capensis</i>
Grassbird, Cape	<i>Sphenoeacus afer</i>
Grebe, Black-necked	<i>Podiceps nigricollis</i>
Grebe, Great Crested	<i>Podiceps cristatus</i>
Grebe, Little	<i>Tachybaptus ruficollis</i>
Greenshank, Common	<i>Tringa nebularia</i>

Guineafowl, Helmeted	<i>Numida meleagris</i>
Gull, Grey-headed	<i>Larus cirrocephalus</i>
Hamerkop, Hamerkop	<i>Scopus umbretta</i>
Harrier-Hawk, African	<i>Polyboroides typus</i>
Heron, Black	<i>Egretta ardesiaca</i>
Heron, Black-headed	<i>Ardea melanocephala</i>
Heron, Goliath	<i>Ardea goliath</i>
Heron, Green-backed	<i>Butorides striata</i>
Heron, Grey	<i>Ardea cinerea</i>
Heron, Purple	<i>Ardea purpurea</i>
Heron, Squacco	<i>Ardeola ralloides</i>
Honeyguide, Greater	<i>Indicator indicator</i>
Honeyguide, Lesser	<i>Indicator minor</i>
Hoopoe, African	<i>Upupa africana</i>
House-martin, Common	<i>Delichon urbicum</i>
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>
Ibis, Glossy	<i>Plegadis falcinellus</i>
Ibis, Hageda	<i>Bostrychia hagedash</i>
Indigobird, Dusky	<i>Vidua funerea</i>
Jacana, African	<i>Actophilornis africanus</i>
Kestrel, Greater	<i>Falco rupicoloides</i>
Kestrel, Lesser	<i>Falco naumanni</i>
Kestrel, Rock	<i>Falco rupicolus</i>
Kingfisher, Brown-hooded	<i>Halcyon albiventris</i>

Kingfisher, Giant	<i>Megaceryle maximus</i>
Kingfisher, Malachite	<i>Alcedo cristata</i>
Kingfisher, Pied	<i>Ceryle rudis</i>
Kite, Black	<i>Milvus migrans</i>
Kite, Black	<i>Milvus migrans</i>
Kite, Black-shouldered	<i>Elanus caeruleus</i>
Kite, Yellow-billed	<i>Milvus aegyptius</i>
Korhaan, Northern Black	<i>Afrotis afraoides</i>
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>
Lapwing, African Wattled	<i>Vanellus senegallus</i>
Lapwing, Blacksmith	<i>Vanellus armatus</i>
Lapwing, Crowned	<i>Vanellus coronatus</i>
Lark, Agulhas Clapper	<i>Mirafra marjoriae</i>
Lark, Agulhas Long-billed	<i>Certhilauda brevirostris</i>
Lark, Benguela Long-billed	<i>Certhilauda benguelensis</i>
Lark, Cape Clapper	<i>Mirafra apiata</i>
Lark, Cape Long-billed	<i>Certhilauda curvirostris</i>
Lark, Eastern Clapper	<i>Mirafra fasciolata</i>
Lark, Eastern Long-billed	<i>Certhilauda semitorquata</i>
Lark, Karoo Long-billed	<i>Certhilauda subcoronata</i>
Lark, Red-capped	<i>Calandrella cinerea</i>
Lark, Rufous-naped	<i>Mirafra africana</i>
Lark, Spike-heeled	<i>Chersomanes albofasciata</i>
Longclaw, Cape	<i>Macronyx capensis</i>

Marsh-harrier, African	<i>Circus ranivorus</i>
Marsh-harrier, Western	<i>Circus aeruginosus</i>
Martin, Banded	<i>Riparia cincta</i>
Martin, Brown-throated	<i>Riparia paludicola</i>
Martin, Rock	<i>Hirundo fuligula</i>
Martin, Sand	<i>Riparia riparia</i>
Masked-weaver, Southern	<i>Ploceus velatus</i>
Moorhen, Common	<i>Gallinula chloropus</i>
Mousebird, Red-faced	<i>Urocolius indicus</i>
Mousebird, Speckled	<i>Colius striatus</i>
Mousebird, White-backed	<i>Colius colius</i>
Myna, Common	<i>Acridotheres tristis</i>
Neddicky, Neddicky	<i>Cisticola fulvicapilla</i>
Night-Heron, Black-crowned	<i>Nycticorax nycticorax</i>
Nightjar, Freckled	<i>Caprimulgus tristigma</i>
Olive-pigeon, African	<i>Columba arquatrix</i>
Oriole, Black-headed	<i>Oriolus larvatus</i>
Owl, Barn	<i>Tyto alba</i>
Owl, Marsh	<i>Asio capensis</i>
Palm-swift, African	<i>Cypsiurus parvus</i>
Paradise-flycatcher, African	<i>Terpsiphone viridis</i>
Pelican, Pink-backed	<i>Pelecanus rufescens</i>
Pigeon, Speckled	<i>Columba guinea</i>
Pipit, African	<i>Anthus cinnamomeus</i>

Pipit, African Rock	<i>Anthus crenatus</i>
Pipit, Long-billed	<i>Anthus similis</i>
Pipit, Plain-backed	<i>Anthus leucophrys</i>
Pipit, Striped	<i>Anthus lineiventris</i>
Plover, Chestnut-banded	<i>Charadrius pallidus</i>
Plover, Common Ringed	<i>Charadrius hiaticula</i>
Plover, Kittlitz's	<i>Charadrius pecuarius</i>
Plover, Three-banded	<i>Charadrius tricollaris</i>
Pochard, Southern	<i>Netta erythrophthalma</i>
Pratincole, Black-winged	<i>Glareola nordmanni</i>
Prinia, Black-chested	<i>Prinia flavicans</i>
Prinia, Tawny-flanked	<i>Prinia subflava</i>
Quail, Common	<i>Coturnix coturnix</i>
Quail, Harlequin	<i>Coturnix delegorguei</i>
Quailfinch, African	<i>Ortygospiza atricollis</i>
Quelea, Red-billed	<i>Quelea quelea</i>
Rail, African	<i>Rallus caerulescens</i>
Reed-warbler, African	<i>Acrocephalus baeticatus</i>
Reed-warbler, Great	<i>Acrocephalus arundinaceus</i>
Robin-chat, Cape	<i>Cossypha caffra</i>
Rock-thrush, Cape	<i>Monticola rupestris</i>
Rock-thrush, Sentinel	<i>Monticola explorator</i>
Roller, European	<i>Coracias garrulus</i>
Ruff, Ruff	<i>Philomachus pugnax</i>

Rush-warbler, Little	<i>Bradypterus baboecala</i>
Sandpiper, Common	<i>Actitis hypoleucos</i>
Sandpiper, Curlew	<i>Calidris ferruginea</i>
Sandpiper, Marsh	<i>Tringa stagnatilis</i>
Sandpiper, Wood	<i>Tringa glareola</i>
Scimitarbill, Common	<i>Rhinopomastus cyanomelas</i>
Secretarybird, Secretarybird	<i>Sagittarius serpentarius</i>
Seedeater, Streaky-headed	<i>Crithagra gularis</i>
Shelduck, South African	<i>Tadorna cana</i>
Shoveler, Cape	<i>Anas smithii</i>
Shrike, Crimson-breasted	<i>Laniarius atrococcineus</i>
Shrike, Lesser Grey	<i>Lanius minor</i>
Shrike, Magpie	<i>Corvinella melanoleuca</i>
Shrike, Red-backed	<i>Lanius collurio</i>
Snipe, African	<i>Gallinago nigripennis</i>
Sparrow, Cape	<i>Passer melanurus</i>
Sparrow, House	<i>Passer domesticus</i>
Sparrow, Northern Grey-headed	<i>Passer griseus</i>
Sparrow, Southern Grey-headed	<i>Passer diffusus</i>
Sparrow-weaver, White-browed	<i>Plocepasser mahali</i>
Sparrowlark, Chestnut-backed	<i>Eremopterix leucotis</i>
Sparrowlark, Grey-backed	<i>Eremopterix verticalis</i>
Spoonbill, African	<i>Platalea alba</i>
Spurfowl, Swainson's	<i>Pternistis swainsonii</i>

Starling, Cape Glossy	<i>Lamprotornis nitens</i>
Starling, Pied	<i>Spreo bicolor</i>
Starling, Red-winged	<i>Onychognathus morio</i>
Starling, Wattled	<i>Creatophora cinerea</i>
Stilt, Black-winged	<i>Himantopus himantopus</i>
Stint, Little	<i>Calidris minuta</i>
Stonechat, African	<i>Saxicola torquatus</i>
Stork, Abdim's	<i>Ciconia abdimii</i>
Stork, Black	<i>Ciconia nigra</i>
Stork, White	<i>Ciconia ciconia</i>
Stork, Yellow-billed	<i>Mycteria ibis</i>
Sunbird, Amethyst	<i>Chalcomitra amethystina</i>
Sunbird, Malachite	<i>Nectarinia famosa</i>
Sunbird, White-bellied	<i>Cinnyris talatala</i>
Swallow, Barn	<i>Hirundo rustica</i>
Swallow, Greater Striped	<i>Hirundo cucullata</i>
Swallow, Pearl-breasted	<i>Hirundo dimidiata</i>
Swallow, Red-breasted	<i>Hirundo semirufa</i>
Swallow, White-throated	<i>Hirundo albigularis</i>
Swamp-warbler, Lesser	<i>Acrocephalus gracilirostris</i>
Swamphen, African Purple	<i>Porphyrio madagascariensis</i>
Swift, Alpine	<i>Tachymarptis melba</i>
Swift, Common	<i>Apus apus</i>
Swift, Horus	<i>Apus horus</i>

Swift, Little	<i>Apus affinis</i>
Swift, White-rumped	<i>Apus caffer</i>
Tchagra, Black-crowned	<i>Tchagra senegalus</i>
Tchagra, Brown-crowned	<i>Tchagra australis</i>
Teal, Cape	<i>Anas capensis</i>
Teal, Hottentot	<i>Anas hottentota</i>
Teal, Red-billed	<i>Anas erythrorhyncha</i>
Tern, Whiskered	<i>Chlidonias hybrida</i>
Tern, White-winged	<i>Chlidonias leucopterus</i>
Thick-knee, Spotted	<i>Burhinus capensis</i>
Thrush, Groundscraper	<i>Psophocichla litsipsirupa</i>
Thrush, Karoo	<i>Turdus smithi</i>
Thrush, Kurrichane	<i>Turdus libonyanus</i>
Thrush, Olive	<i>Turdus olivaceus</i>
Tit, Ashy	<i>Parus cinerascens</i>
Tit-babbler, Chestnut-vented	<i>Parisoma subcaeruleum</i>
Turtle-dove, Cape	<i>Streptopelia capicola</i>
Unknown, Unknown	N/A N/A
Wagtail, African Pied	<i>Motacilla aguimp</i>
Wagtail, Cape	<i>Motacilla capensis</i>
Wagtail, Yellow	<i>Motacilla flava</i>
Warbler, Garden	<i>Sylvia borin</i>
Warbler, Sedge	<i>Acrocephalus schoenobaenus</i>
Warbler, Willow	<i>Phylloscopus trochilus</i>



Waxbill, Blue	<i>Uraeginthus angolensis</i>
Waxbill, Common	<i>Estrilda astrild</i>
Waxbill, Orange-breasted	<i>Amandava subflava</i>
Weaver, Cape	<i>Ploceus capensis</i>
Weaver, Thick-billed	<i>Amblyospiza albifrons</i>
Weaver, Village	<i>Ploceus cucullatus</i>
Wheatear, Capped	<i>Oenanthe pileata</i>
Wheatear, Mountain	<i>Oenanthe monticola</i>
White-eye, Cape	<i>Zosterops virens</i>
White-eye, Orange River	<i>Zosterops pallidus</i>
Whydah, Pin-tailed	<i>Vidua macroura</i>
Widowbird, Fan-tailed	<i>Euplectes axillaris</i>
Widowbird, Long-tailed	<i>Euplectes progne</i>
Widowbird, Red-collared	<i>Euplectes ardens</i>
Widowbird, White-winged	<i>Euplectes albonotatus</i>
Wood-hoopoe, Green	<i>Phoeniculus purpureus</i>
Woodpecker, Cardinal	<i>Dendropicos fuscescens</i>
Wryneck, Red-throated	<i>Jynx ruficollis</i>

**APPENDIX C: ON-SITE SENSITIVITY MAP**

