The Proposed Construction of a 15ML concrete reservoir, elevated tower and pump station at the existing Masetjaba View reservoir site, located in Nigel, Gauteng Province

Ecological Impact Assessment Report

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EXECUTIVE SUMMARY

The City of Ekurhuleni proposes to develop additional capacity at their existing Masetjaba water reservoir site (Farm Spaartwater 171), by constructing a new 15ML circular water reservoir, along with associated infrastructure (small scale), adjacent to their existing water reservoir. The development therefore primarily involves erecting a concrete water reservoir, which will occupy a surface area of 1 980m^2 (0.198 ha), within a broader development area (including the associated infrastructure) of approximately 6 900m^2 (0.69 ha), all contained within the existing Masetjaba water reservoir site off Springs Road, Masetjaba View. The components of the facility include a 15ML water reservoir, access ladder and cage, inlet and outlet chambers associated with the pipe work, a pump station (12mx18m), a standby generator, stormwater provisions and a single lane gravel access road approximately 170m in length.

The purpose of the project is to improve water supply to certain parts of the community which do not have adequate supply during peak usage periods. The proposed reservoir will also supply the reservoir zone located on the southern boundary of Brakpan and will include most future developments in Tsakane and its extensions excluding Tsakane X17.

The water reservoir facility is located on Portion 107 of the Farm Spaarwater 171, accessible immediately off the tarred Springs Road (R550) situated on the northern boundary of the project site, Masetjaba View. The site is located immediately adjacent Masetjaba View, which is the nearest settlement.

Climate within the broader Johannesburg region is generally subtropical, with mild and sunny winters (and cold nights), and pleasantly warm summers, usually sunny, known for afternoon thunderstorms during the summer. Temperatures generally range from the hottest month (December) of between 14°C and 27 °C, to the coldest month of the year (July) with mean minimum and maximum ranges between 2 °C and 18 °C. Precipitation ranges between 130mm average in December to 3 - 5mm in July.

The overall geology of the site contains mostly Shales, Coal and Arenites derived from the Vryheid Formation, of the Ecca Group and Karoo Supergroup. This formation dates back to the Palaeozoic era (541 to 251 million years ago).

The entire project site is flat with no distinct topographic features, within a broader context of slightly undulating hills with intermittent small valleys in which drainage lines are common (although no drainage lines or surface features are present on site). The elevation of the site is approximately 1 600 m above mean sea level.

The project site is zoned as 'agriculture', but is operated as water supply infrastructure only, having been recently fenced off. Animals were observed to graze immediately adjacent the site (+/- 10m away), the existing fence eliminates current grazing on site, however, historical imagery reveals the site was open for grazing as early as 2016. Apart from the current use of the gravel access road, and reservoir infrastructure, the site is unoccupied. Historical images however show that the existing concrete fencing serving as boundary currently was only erected between the August 2015 and May 2016, prior to which the site was entirely accessible from the road with visible footpaths traversing the site in aerial images prior to August 2015. In addition, illegal dumping in the area is common and occurs at a relatively high level, with dumping sites seen on the aerial imagery in the area (some of which occurred on site) since at least March 2005. Evidence of frequent burning was also observed on site, possibly from the frequent fires associated with burning of the illegally dumped waste adjacent to the site boundaries.

According to the Mucina and Rutherford (2012) classification, the project site is occupied by Tsakane Clay Grassland, which occurs mainly in the Gauteng and Mpumalanga provinces, with patches extending in a narrow band between Springs and Soweto, southwards towards Nigel and as far as Vereeniging. The grassland also occurs north of the Vaal Dam, and between Balfour and Standerton, and preferentially occurs at altitudes ranging from 1 480 – 1 680 m (Mucina and Rutherford, 2012).

This vegetation type occurs predominantly on flat to slightly undulating plains and low hills, and is short and dense in structure. Tsakane Clay Grassland is dominated by a mixture of common highveld grasses such as *Themeda triandra*, *Heteropogon contortus*, *Elionurus muticus* and a variety of *Eragrostis* species (Mucina and Rutherford, 2012). The forbs most common are of the families *Asteraceae*, *Rubiaceae*, *Malvaceae*, *Lamiaceae* and *Fabaceae*. Disturbance in this vegetation group allows for an increase in abundance of *Hyparrhenia hirta* and *Eragrostis chloromelas* (Mucina and Rutherford, 2012).

According to Mucina and Rutherford (2012), the conservation status of Tsakane Clay Grassland is Endangered (EN), with only 1.5% of the 24% conservation target conserved in 2012, mainly in the Suikerbosrand, Olifantsvlei, Klipriviersberg and Marievale Nature Reserves, with some minor patches in private reserves. The main threats to this vegetation type are transformation by cultivation, mining, dam-building and road development and operation. Large portions of Alberton, Springs, Tsakane and part of Soweto (all south and east of Johannesburg) were built in the area of this vegetation unit. Erosion across this vegetation unit is generally very low or low.

Furthermore, according to the Gauteng C-Plan, which delineates Critical Biodiversity Areas (CBA's), and Ecological Support Area (ESA) for the entire province, the project site is partially located within a Critical Biodiversity Area (CBA), while the remainder of the side occurs within an Ecological Support Area (ESA).

Field survey results indicated that only one vegetation unit was identified within the project area, that of "highly degraded Tsakane Clay Grassland".

This vegetation unit covered the entire site uniformly, and consisted of predominantly grass species, with no tree or shrub forms present. The species composition identified onsite conformed to a minor degree to that of the Mucina & Rutherford (2012) descriptions, and therefore represented Tsakane Clay Grassland, albeit in a highly degraded condition. In particular, the relatively high abundance of *Hyparrhenia hirta* (thatching grass) and low species richness indicated the high levels of disturbance experienced on site historically.

At present, the site is fenced (concrete palisading), with one entrance and a small gravel road leading to the existing water infrastructure. Evidence of disturbance was evident throughout the site, with illegal dumping observed adjacent to the site (1-10m away), as well as along the boundary fence. In addition, grazing was observed nearby (approximately 2m away from site). As the fence was only constructed recently, both grazing and illegal dumping would historically have occurred on site contributing to the existing low species diversity and the historical disturbance of the site (visible from the aerial imagery for approximately 10 years leading up to the fence being erected).

Furthermore, evidence of historical construction (set concrete and trench lines visible), with minor invasive plant species occurrence, was also noted near the far north western corner of the site (facing the current water infrastructure), where the laydown areas for the existing water infrastructure may have been. In

addition, the burning of waste adjacent the site contributes to ongoing fires occurring on site, with evidence of recent burning observed during the site assessment.

Species identification indicated that a total of 17 plant species were identified within the proposed project site, consisting mainly of mixed grass species commonly occurring in the highveld region. All of the species observed were classified as Least Concern (LC) and were not considered to be sensitive species, and as such the ecological value as well as the low species diversity present indicated an overall low conservation status for the vegetation present onsite. No plant Species of Conservation Concern were identified on site. Three invasive plant species were observed onsite, mainly adjacent the existing storage unit where evidence of historical construction was present, while five other invasive species were noted nearby (approximately 60m away from the development site).

Due to the small size and highly frequented nature of the site (i.e. plenty of foot and vehicle traffic daily from the nearby Masetjaba View community), very few animal species were observed on site, with only *Trachylepis punctatissima* (speckled rock skink), and *Trachylepis varia sensu lato* (common variable skink) identified on site, both of which are regarded as Least Concern (LC) (SARCA, 2014). Avifaunal species were the exception however, being attracted by the nearby wetland features located further east of the site, and due to their highly mobile nature. Apart from the above two reptiles, 10 bird species were noted on and near the site. None of the bird species observed on site were regarded as sensitive, with all considered as Least Concern (LC) in terms of their conservation status. Along with the small number of observed species on site, the common status for all of the observed species, and the highly disturbed and frequented status of the site, the project area had a low faunal conservation potential. No animal Species of Conservation Concern were identified on site. No animal invasive species were identified on site.

A sensitivity map of the study area was developed based on the site characteristic and results (Figure 7.1 in Chapter 7), which indicated that the entire site was regarded as a low sensitivity zone for floral and faunal species.

The CBA classification of the proposed site was also found to not correspond to the real-world condition of the plant and animal species observed on site, and thus the site contributes poorly to the ecological function of the broader area. As such, the site is not deemed a functional CBA zone, as confirmed by the site assessment results, and thus the proposed development will not significantly impact the overall quantity and quality of the remaining CBA areas in the broader study area, should it be implemented. The project may thus commence with little to no lasting negative impact on the current CBA classification of the immediate site and broader study area.

Furthermore, while the vegetation type deemed to be present on site has a high conservation value, the highly degraded real-world condition of the vegetation unit observed on site confirmed a minimal overall conservation contribution. The vegetation unit on site resembles Tsakane Clay Grassland through the species composition, but is highly degraded, with poor ecological functioning and a low conservation contribution, and as such does not represent a good conservation opportunity and does not currently contribute to the overall health and conservation status of the Tsakane Clay Grassland vegetation type. Should the development proceed, the loss of the highly degraded Tsakane Clay Grassland vegetation unit on site will not significantly reduce the conservation potential and current distribution of the vegetation type as a whole, due primarily to the servery degraded nature of the vegetation unit on site.

The impact assessment identified no impacts for the design phase, six impacts for the construction phase relating predominantly to the clearance of vegetation and the destruction of habitat, as well as one impact for the operational phase, and one for the decommissioning phase. Two impacts were determined for the no-go alternative, and three cumulative impacts determined, all related to the issue of loss of biodiversity. Table 1 below shows the summary of impacts identified before and after mitigation.

Table 1: Summary of impacts identified in this assessment.

IMPACT	PRE-MITIGATION	POST-MITIGATION
DESIGN PHASE		
No impacts were determined for this phase		
CONSTRUCTION PHASE		
Loss of highly degraded Tsakane Clay Grassland	Medium (30)	Low (20)
Loss of Species of Conservation Concern	Low (12)	Low (8)
Loss of floral and faunal biodiversity leading to a disruption of ecosystem function and processes	Low (25)	Low (12)
Poor control of alien plant species during construction leading to increasing invasive species presence	Medium (30)	Low (15)
Increased erosion due to vegetation clearing for infrastructure	Low (24)	Low (10)
Loss of areas classified as CBA due to vegetation clearance.	Low (18)	Low (12)
OPERATION PHASE		
Poor control of alien plant species during construction leading to increasing invasive species presence	Medium (30)	Low (10)
DECOMISSIONING PHASE		
Loss of floral and faunal biodiversity from poor rehabilitation efforts during closure, leading to a disruption of ecosystem function and processes	Low (25)	Low (4)
Increased erosion due to vegetation clearing for infrastructure.	Low (21)	Low (10)
CUMULATIVE IMPACTS		

Reduced ability to meet conservation obligations and targets.	Low (18)	Medium (36)
Impacts on Critical Biodiversity Areas and Broad-Scale Ecological Processes.	Low (18)	Medium (36)
Cumulative impacts due to similar infrastructure developments - Large-scale disturbance of indigenous vegetation.	Medium (30)	Medium (36)
NO-GO ALTERNATIVE		
Control of alien plant species	Medium (40)	
Loss of biodiversity and species richness from frequent fires	Medium (40)	

* Impacts are rated here based on isolation (i.e. project only), or in combination with other projects in the surrounding areas, as opposed to pre-mitigation and post-mitigation.

Based on the results of the site assessment, the sensitivity analysis and the impact assessment, none of the anticipated impacts were deemed insurmountable, as all the pre-mitigation medium impacts were easily mitigated. Ecological areas have been mapped in terms of sensitivity for the project area and recommendations in chapter 8 in this report provide mitigation measures to reduce the severity of the impacts. Overall, it was determined that the identified ecological impacts associated with the facility can be affectively mitigated.

Cumulative impacts were also determined for the project, with medium severity identified for all three cumulative impacts relating to the issue of a loss of biodiversity. Mitigation measures have been provided for the management of these impacts in the context of the broader study region. Considering the existing water infrastructure (i.e., the existing Masetjaba water reservoir), other development infrastructure (Masetjaba View community, roads, power lines), and that this project acts as an expansion of the current facility, the development will not set a further development precedent in the broader Tsakane area. Some loss of biodiversity is inevitable, and cannot be avoided, however the vegetation on site has a low sensitivity and conservation value, and contributes very little to no ecological function (and CBA area) to the broader study area. Cumulative loss of conservation potential is thus regarded as medium taking into account other likely developments within the broader study region. The cumulative impacts are deemed acceptable considering the existing poor condition of the site, and the broader character of the area (i.e. already developed and highly degraded).

The ecological impacts of all aspects for the proposed project were assessed and considered to be ecologically acceptable (i.e. **no fatal flaws** were determined), provided that the mitigation measures provided in this report are implemented. Implementation of recommended mitigation measures is an important element of the mitigation strategy and will reduce all identified impacts to low negative.

No alternatives, apart from the no-go option, were considered for this project. However, the no-go option allows for two ongoing impacts of medium severity, which may be reduced to low via management intervention should this project proceed. As such, this development proposal represents a means to reduce invasive species presence and improve fire management of the site (provided mitigation measures are

strictly and effectively implemented) and may thus serve to preserve the current poor ecological functioning of the site in the long term. Cumulative impacts from this development proposal were all deemed low or negligible in the context of ecological functioning and contribution of the development site.

PROJECT DETAILS

Title	:	Ecological Impact Assessment Report for the Proposed 15ML concrete water reservoir, elevated tower and pump station at the existing Masetjaba View reservoir site, Nigel, Gauteng Province
Authors	:	Savannah Environmental (Pty) Ltd Gideon Raath Jo-Anne Thomas
Client	:	Naidu Consulting Engineers (Pty) Ltd
Report Revision	:	Revision 1.4
Date	:	January 2019

When used as a reference this report should be cited as: Savannah Environmental (2019). Ecological Impact Assessment Report for the Proposed 15Ml concrete water reservoir, elevated tower and pump station at the existing Masetjaba View reservoir site, Nigel, Gauteng Province.

SPECIALIST CONTACT DETAILS AND DECLARATION OF INTEREST

Specialist Company Name:	Savannah Environmental Pty Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	-
Specialist name:	Gideon Raath			
Specialist Qualifications:	M.Sc. Geography and Environmental Studies (SUN), B.Sc. (Hons) Ecology, conservation and the environment (WITS), B.Sc. Environmental Management (UJ)			
Professional affiliation/registration:	Pr.Sci.Nat. (SACNASP) – Member No. 117178			
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I, Gideon Raath, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing – any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- All the particulars furnished by me in this form are true and correct.
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the Act.

Gideon	
Name	Signature
January 2019	Savannah Environmental Pty Ltd
Date	Name of Company

SHORT SUMMARY OF SPECIALIST EXPERTISE

Gideon holds an MSc (Geography and Environmental Management; SU), a BSc Honours (Ecology and Environmental Studies - Cum laude; Wits) and a BSc (Geography and Environmental Management; UJ). His MSc thesis focused on the hydrological impact on the spatial distribution of invasive Eucalyptus trees along the Breede River, while his honours thesis evaluated ethnobotanical relationships around the Rio Tinto copper mine in Phalaborwa. Most recently he has worked as an Environmental Consultant at EOH Coastal and Environmental Services (EOH CES), conducting environmental authorisations applications (NWA, NEMA, MPRDA), Public Participation Processes, GIS specialisation as well as Ecological and Wetland specialist studies. Previously, Gideon worked as the Monitoring & Evaluation Project Manager for the City of Cape Town's invasive species unit (Environmental Resources Management Department).

Gideon's GIS background includes the management of the City of Cape Town invasive species GIS database, involving the storage, management, recall and quality control off all sightings, clearance visits and known infestations. Further experience include mapping for various consulting projects, boundary verification through ground-truthing and the spatial mapping and delineation component of this MSc research. Gideon has further attended public participation workshops, and has been involved with IAP identification, translation, public meetings and engagement for a variety of projects, mainly within the Afrikaans speaking Northern Cape. Gideon is interested in invasion ecology, treatment of groundwater pollution through phytoremediation, botanical and wetland specialist studies, GIS application for ecology and environmental management, and the EIA processes in general. Lastly, Gideon has undertaken several ecological impact assessments for various developments.

A selection of recent specialist ecological studies undertaken, include the following:

Project Name & Location	**Client Name**	**Role**
City of Johannesburg nature reserve proclamation (Phase II), Johannesburg, Gauteng	City of Johannesburg SOC Ltd	Botanical specialist
SANRAL Bierspruit R510 road upgrade Water Use Licence, Basic Assessment, Thabazimbi, Limpopo Province	SANRAL SOC Ltd & Royal Haskoning DHV South Africa	Ecological specialist
Kibler Park Church Development Ecological Assessment, Johannesburg, Gauteng	Riverside Community Church	Ecological specialist
SANRAL Caledon N2 Section 3 road upgrade project Basic Assessment, Water Use Licence and Specialist reports, Caledon, Western Cape Province	JG Afrika Engineering	Ecological specialist
iGas integrated biodiversity screening, Saldanha, Western Cape	Central Energy Fund - iGas (subsidiary)	Faunal specialist (assistant)
Bloekombos (Kraaifontein) botanical baseline and impact assessment, Cape Town, Western Cape	Western Cape Provincial Government (PGWC)	Botanical specialist

A full curriculum vitae (CV) is attached as **Appendix C.**

EIA REGULATIONS: APPENDIX 6 – SPECIALIST REPORT REQUIREMENTS

As per Appendix 6 of the EIA regulations (2017), the following aspects must be addressed in a specialist report. These aspects are indicated in the table below along with the corresponding sections where these are addressed in this report.

Description	Section in report where this aspect has been addressed
(a) details of— (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page vii above, as well as Appendix C
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page vi above
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 2.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2.2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Chapter 8
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2.2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2.2 – 2.5
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Chapter 7
(g) an identification of any areas to be avoided, including buffers;	Section 7.2
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 7.2
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.5
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Chapter 6 (specifically) and Chapter 7
(k) any mitigation measures for inclusion in the EMPr;	Chapter 8, and Section 9.3
(l) any conditions for inclusion in the environmental authorisation;	Section 9.3
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9.3.4
(n) a reasoned opinion— (i) whether the proposed activity, activities or portions thereof should be authorised;	Section 9.3 & Section 9.4

(iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	No formal public participation was conducted for the Ecological Impact Assessment. Please refer to the associated Basic Assessment documentation (which this report will form part of as an Appendix) for a complete
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	
(q) any other information requested by the competent authority.	None requested

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ACRONYMS

ADU	Animal Demography Unit
BA	Basic Assessment
CBA	Critical Biodiversity Areas
CITES	Convention on International Trade in Endangered Species
CoE	City of Ekurhuleni
C-Plan	Gauteng Conservation Plan Version 3
CR	Critically Endangered
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
ESO	Environmental Site Officer
GDARD	Gauteng Department of Agriculture and Rural Development
GN. R	Government Notice Regulation
GPEMF	Gauteng Province Environmental Management Framework
GPS	Global Positioning System
Ha	Hectare
IBA	Important Birding Area
IUCN	International Union for Conservation of Nature
km	Kilometre
LC	Least Concern
LM	Local Municipality
ML	Megalitre
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act (No. 107 of 1998)
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PPP	Public Participation Process
QDS	Quarter Degree Square
RE	Resident Engineer
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African National Biodiversity Institute
SARCA	Southern African Reptile Conservation Assessment
SCC	Species of Conservation Concern
VU	Vulnerable
WWF	Worldwide Fund for Nature

1. INTRODUCTION

Naidu Consulting (Pty) Ltd has been appointed by City of Ekurhuleni (CoE) for the design and construction supervision of a 15ML concrete reservoir, elevated tower and pump station at the existing Masetjaba View reservoir location in Nigel, Gauteng Province. The site falls within an area zoned for public services with a low ecological sensitivity rating (City of Ekurhuleni Bioregional Plan, 2014). However, the site may contain the endangered Tsakane Clay Grassland vegetation, as per the Mucina and Rutherford (2012) classification. Furthermore, based on the Gauteng Conservation Plan (C-Plan), a Critical Biodiversity Area (CBA) is located to the north of the site and this may be impacted should the footprint of the proposed infrastructure be moved to the north of the existing Masetjaba View site.

There is a non-perennial pan about 350m to the north of the proposed development site. There are various other surface water resources to the east and south of the site as well. It is assumed that none of these would be impacted by the proposed development. The area is generally intended for agricultural development land uses.

In terms of the Environmental Impact Assessment (EIA) Regulations, clearance of more than 300m^2 vegetation within a sensitive environment, such as a CBA or endangered vegetation type requires Environmental Authorisation. As the listed activities fall within Listing Notice 3 of the EIA Regulations of 2014, as amended, the application for Environmental Authorisation is required to be supported by a Basic Assessment (BA) process. This report subsequently informs the Basic Assessment report by considering the ecological (faunal and floral) impacts of the proposed development within the environmental authorisation process.

1.1. Project Description

The CoE proposed to develop additional capacity at their existing Masetjaba water reservoir site (Farm Spaartwater 171), by constructing a new 15ML circular water reservoir, along with associated infrastructure (small scale), adjacent to their existing water reservoir. The development therefore primarily involves erecting a concrete water reservoir, which will occupy a surface area of 1 980m^2 (0.198 ha), within a broader development area (including the associated infrastructure) of approximately 6 900m^2 (0.69 ha), all contained within the existing Masetjaba water reservoir site off Springs Road, Masetjaba View.

The components of the facility will include the following:

- 15ML Water Reservoir approximately 8m in height (15 000m^3);
- Cage and ladder attached to the reservoir for ease of access during maintenance;
- Inlet and outlet chambers with associated pipe work;
- 2ML concrete water tower approximately 32m in height (2 000m3);
- Pump Station (12m x 18m);
- Standby Generator;
- Interconnecting pipework and chambers;
- Stormwater provisions;
- A single lane, gravel access road approximately 170m in length.

The purpose of the project is to improve water supply to certain parts of the community that do not have adequate supply during peak usage periods. The proposed reservoir will also supply the reservoir zone

located on the southern boundary of Brakpan and will include planned future developments in Tsakane and its extensions excluding Tsakane X17.

1.2. Project Location

The water reservoir facility will occupy approximately 6 900m^2 (0.69 ha) in extent and will be located on Farm Spaarwater 171, hereafter referred to as the project 'site', accessible immediately off the tarred Springs Road (R550) situated on the northern boundary of the project site, Masetjaba View (Figure 1.1 &

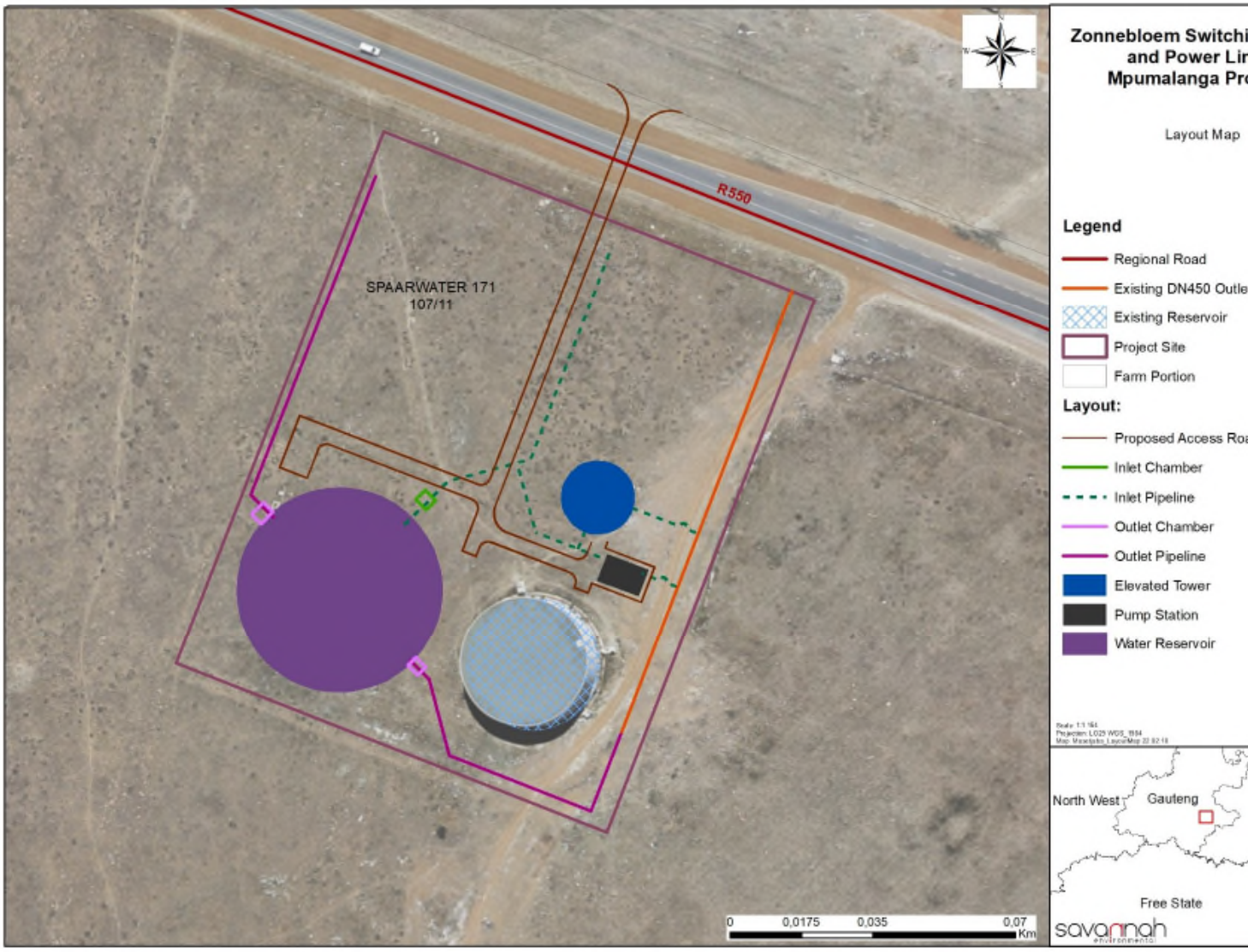

Figure 1.2). The site is located immediately adjacent Masetjaba View, which is the nearest settlement.

1.3. Structure of this report

This Ecological Impact Assessment report has been structured as follows:

» **Chapter 1** provides an introduction to the project long with the location and project description.
» **Chapter 2** provides an overview of the methodology, objectives, approach and limitations and assumptions utilised in preparing this report.

- **Chapter 3** provides an overview of the legislative framework applicable to the proposed development from an ecological perspective.
- **Chapter 4** provides the description of the biophysical environment within which the project occurs.
- **Chapter 5** provides a description of the ecological environment within the project occurs.
- **Chapter 6** provides the biodiversity and sensitivity assessment criteria and results.
- **Chapter 7** provides the impact identification and assessment related to the proposed development.
- **Chapter 8** provides the impact statement, conclusions and recommendations.

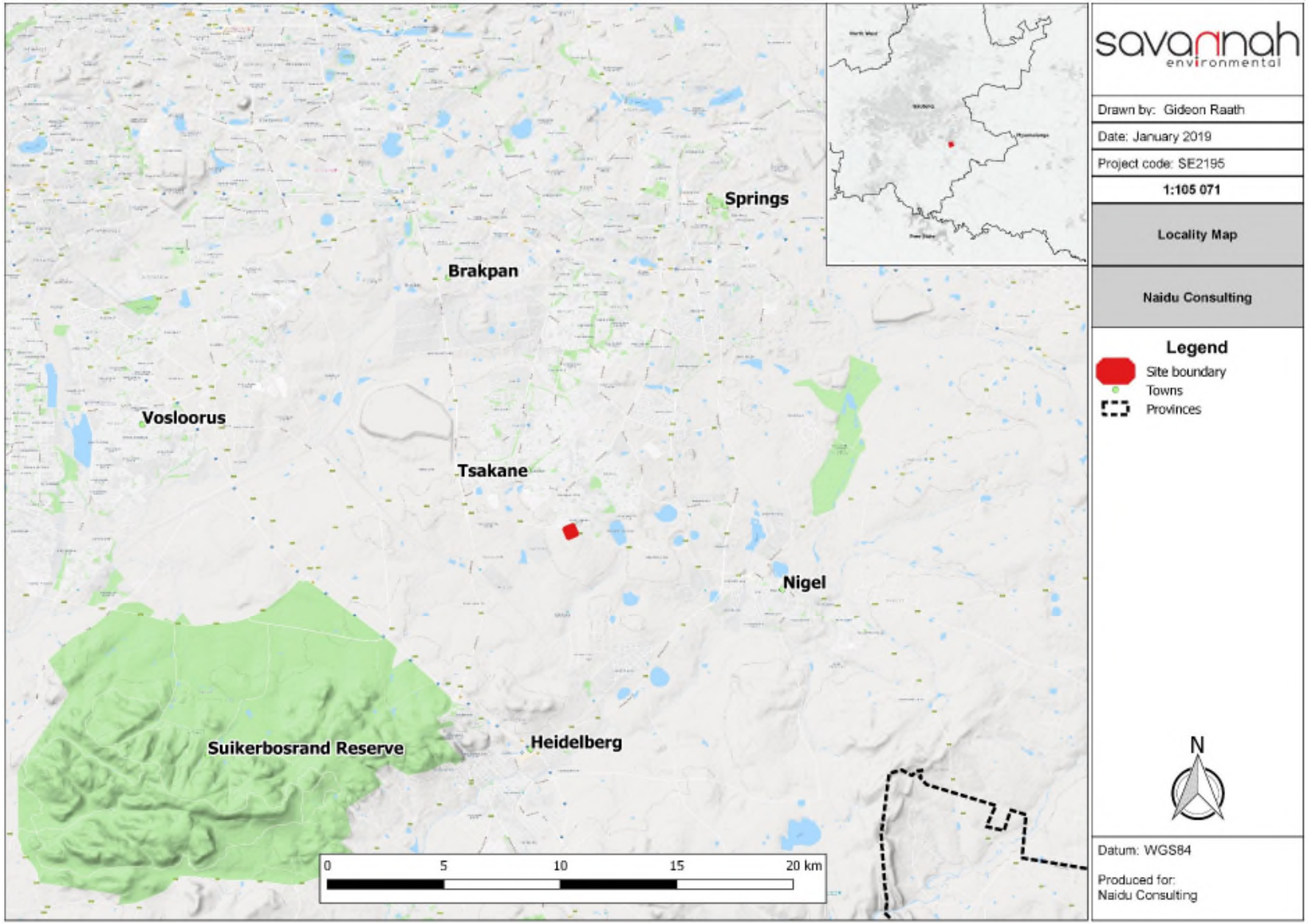

Figure 1.1: Locality map of the Masetjaba water reservoir project site.

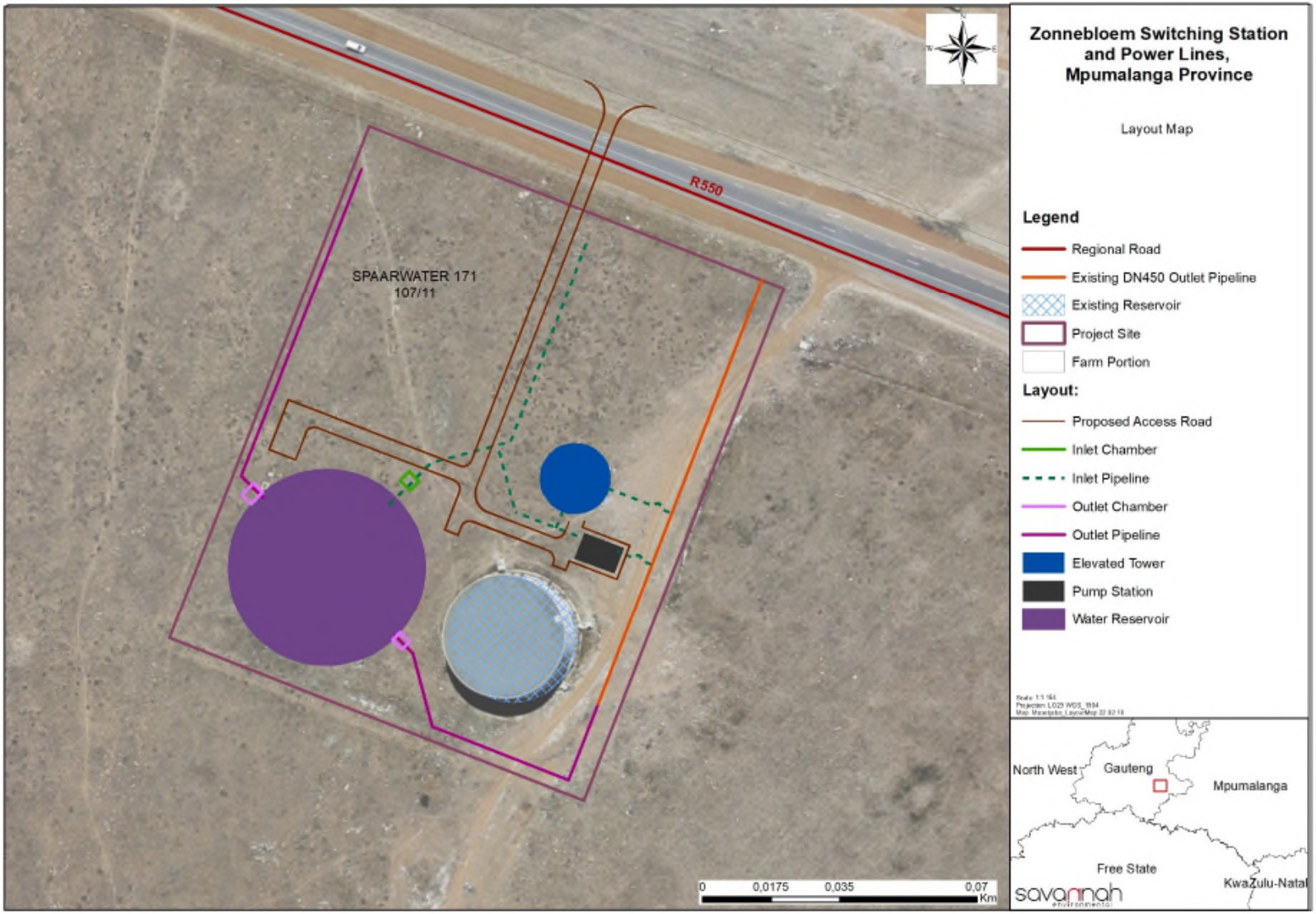

Figure 1.2. Layout map of the proposed development.

2. METHODOLOGY AND APPROACH OF THE STUDY

This Ecological Impact Assessment Report has been prepared at the request of the CoE for the purpose of determining the current ecological condition and sensitivity of the site, as well as the impacts and severity of the proposed development, along with any mitigation measures that emanate from their management.

2.1. Objectives and Terms of Reference

The objectives and terms of reference for this report include:

- An indication of the methodology used in determining the significance of potential environmental impacts;
- A description of all environmental issues that were identified during the environmental impact assessment process;
- An assessment of the significance of direct, indirect and cumulative impacts in terms of the following criteria:
  - the *nature* of the impact, which shall include a description of what causes the effect, what will be affected and how it will be affected
  - the *extent* of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
  - the *duration* of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0–5 years), medium-term (5–15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity) or permanent
  - the *probability* of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood), probable (distinct possibility), highly probable (most likely), or definite (impact will occur regardless of any preventative measures)
  - the *severity/beneficial scale*, indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit, with no real alternative to achieving this benefit), severe/beneficial (long-term impact that could be mitigated/long-term benefit), moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight or have no effect
  - the *significance*, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high
  - the *status*, which will be described as either positive, negative or neutral
  - the *degree* to which the impact can be reversed
  - the *degree* to which the impact may cause irreplaceable loss of resources
  - the *degree* to which the impact can be *mitigated*
- A description and comparative assessment of all alternatives identified during the environmental impact assessment process;
- Recommendations regarding practical mitigation measures for potentially significant impacts, *for inclusion in the Environmental Management Programme (EMPr)*;
- An indication of the extent to which the issue could be addressed by the adoption of mitigation measures;
- A description of any assumptions, uncertainties and gaps in knowledge;
- An environmental impact statement which contains:
  - a summary of the key findings of the environmental impact assessment;

* an assessment of the positive and negative implications of the proposed activity.

2.2. Approach to the Study

The study site and surrounding areas were described using a two-phased approach. Firstly, a desktop assessment of the site was conducted in terms of current vegetation classifications, faunal databases and biodiversity programmes & plans. This included the consideration of:

- The South African Vegetation Map (Mucina and Rutherford, 2012 revision);
- Gauteng Conservation Plan (C-Plan) (2011);
- Grassland Ecosystem Guidelines (2013);
- Ekurhuleni Bioregional Plan (2014);
- Gauteng Environmental Management Framework (2011);
- Faunal databases regarding the presence or absence of Species of Conservation Concern (SCC), including:
    - Animal species listed in the Endangered or Vulnerable categories in the revised South African Red Data Books (Amphibians, du Preez and Carruthers, 2009; Reptiles, Branch 1988; Birds, SA Birding, 2008);
    - Endangered Wildlife Trust mammal red list (2016);
    - Animal Demographic Unit (ADU) databases for frogs, birds, mammals and reptiles (2019);
    - International Union for Conservation of Nature (IUCN) red list of threatened species (2018); and
    - SANBI Threatened Species Programme (red list of threatened species) for South Africa (2017).

Further to the above, one site visit was conducted (Thursday, 22 November 2018) in order to assess the actual ecological state, current land-use, identify potential sensitive ecosystems and identify sensitive plant and animal species associated with the proposed project activities. The site visit also served to identify potential impacts of the proposed project and how significantly it would impact on the surrounding ecological environment. The site visit was conducted within the wet season, with many seasonally flowering plants in full show, and as such was considered a suitable time to conduct the site assessment.

It is not the aim of this study to produce a complete list of all animal and plant species occurring in the region, but rather to examine a representative sample. It is however, important to note that areas of high sensitivity as well as SCC have been identified as far as possible, either from records from the site or a review of their habitat requirements, and whether or not these habitats occur within the site. Species that are afforded special protection, which are protected by CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) are also regarded as SCC (see http://www.cites.org/).

2.3. Sampling protocol

2.3.1. Vegetation

The entire project site was inspected to evaluate the vegetation of the study area and to provide more detailed information on the plant communities present. The site inspection took into account the amount of time available for the study and limitations such as the seasonality of the vegetation.

2.3.2. Animals

The assessment of animals was based on a general observation of species noted onsite during the site assessment, but with particular consideration of known potential animal Species of Conservation Concern (SCC).

2.4. Definitions

Where applicable, the following definitions were used based on the conservation status classification of the SANBI red data list (floral), or IUCN red data list (faunal):

- ***Critically Endangered (CR)*** - A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V of the Red Data List), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
- ***Endangered (EN)*** - A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V of the Red Data List), and it is therefore considered to be facing a very high risk of extinction in the wild.
- ***Vulnerable (VU)*** - A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
- ***Near Threatened (NT)*** - A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
- ***Sensitive species*** - Species not falling in the categories above but listed in: Appendix 1 or 2 of the Convention of International Trade in Endangered Species (CITES).
- ***Endemic species*** - Species endemic to South Africa, and more specifically the province.
- ***Least concern (LC)*** – A taxon is of Least Concern when it does not qualify for any of the other categories. Widespread and abundant taxa are typically listed in this category.

2.5. Limitations and Assumptions

The following assumptions and limitations are applicable:

- The report is based on a project description taken from design specifications for the proposed infrastructure which is likely to undergo a number of further refinements before it can be regarded as definitive;
- Species of Conservation Concern are difficult to find and difficult to identify, thus species described in this report do not comprise an exhaustive list, however this is highly unlikely due to the small size of the proposed development footprint and project site.
- Once-off sampling only was conducted. Consequently, some plant species may therefore have gone undetected.

3. LEGISLATIVE FRAMEWORK

The applicable legislative framework plays an important role in contextualising the proposed development from an ecological perspective. In this regard, a key component of the legislative context is to assess the proposed development in terms of the suitability with regards to key legislation.

The following key pieces of legislation were reviewed as part of this review process:

National Legislative Context:

» Constitution of the Republic of South Africa (1996).
» National Environmental Management Act (No. 107 of 1998) (NEMA); and
» National Environmental Management: Biodiversity Act (No. 10 of 2004);

3.1. Constitution of the Republic of South Africa (1996)

The Constitution of the Republic of South Africa, 1996 is the supreme law of South Africa, and forms the foundations for a democratic society in which fundamental human rights are protected. The Bill of Rights contained in Chapter 2 of the Constitution enshrines the rights of all people in South Africa, and affirms the democratic values of human dignity, equality and freedom. Section 24 of the Constitution pertains specifically to the environment. It states that:

24. Everyone has the right –
(a) To an environment that is not harmful to their health or well-being; and
(b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
(i) Prevent pollution and ecological degradation.
(ii) Promote conservation.
(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The Constitution also however outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in such a manner that it does not infringe on an individual's environmental rights, health, or well-being and to have the environment protected. This is relevant with regards to wetland environments, which are protected under national legislation in South Africa (see section below).

3.2. National Environmental Management Act (No. 107 of 1998) (NEMA)

The National Environmental Management Act (No. 107 of 1998) (NEMA) is South Africa's key piece of environmental legislation, and sets the framework for environmental management in South Africa. It provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights. In accordance with this, it states that:

» *The State must respect, protect, promote and fulfil the social, economic and environmental rights of everyone and strive to meet the basic needs of previously disadvantaged communities.*

- *Sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations.*
- *Everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*

In addition, the National environmental management principles contained within NEMA state that:

- Development must be socially, environmentally and economically sustainable;
- Sustainable development requires the consideration of all relevant factors including the following:
    - That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
    - That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied; and
    - That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.
- The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

Sensitive ecosystems are specifically mentioned with regards to requiring specific attention in management and planning procedures, and therefore need to be identified when planning developments, such that adequate management procedures can be put in please to ensure negative impacts are avoided, minimised or remedied appropriately.

3.3. National Environmental Management: Biodiversity Act (No. 10 of 2004)

The objectives of the National Environmental Management: Biodiversity Act include inter alia, to provide for:

- The management and conservation of biological diversity within the Republic and of the components of such biological diversity;
    - The use of indigenous biological resources in a suitable manner;
    - The fair and equitable sharing of benefits arising from bio-prospecting of genetic material derived from indigenous biological resources; an
    - To give effect to ratified international agreements relating to biodiversity which are binding on the Republic.
- To provide for co-operative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of the Act.

Threatened or protected ecosystems and species

Sections 50 - 62 further provide details relating to the protection of threatened or protected ecosystems and species. A person may not carry out a restricted activity involving a specimen of a listed threatened or

protected species without a permit (Section 56 - 1).

Alien and invasive species
Sections 63 - 77 provide details relating to the alien and invasive species with the purpose of preventing the introduction and spread, managing and controlling, and eradicating alien and invasive species.

The implications of this act for the proposed development include the need to develop an invasive species monitoring, control and eradication plan for land/activities under their control should invasive species be found on site, as part of their environmental plans in accordance with section 11 of NEMA.

4. DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT

4.1. Climate

Climate within the broader Johannesburg region is generally subtropical, with mild and sunny winters and pleasantly warm, sunny summers. The area is known for afternoon thunderstorms during the summer. Due to the high elevation of the broader area, the climate is tempered by altitude, with average temperature ranging from 10 °C in June and July, to 21 °C in January. Figure 4.1 below illustrates the average temperatures and precipitation found within the Tsakane region, which is approximately 5km from the project site.

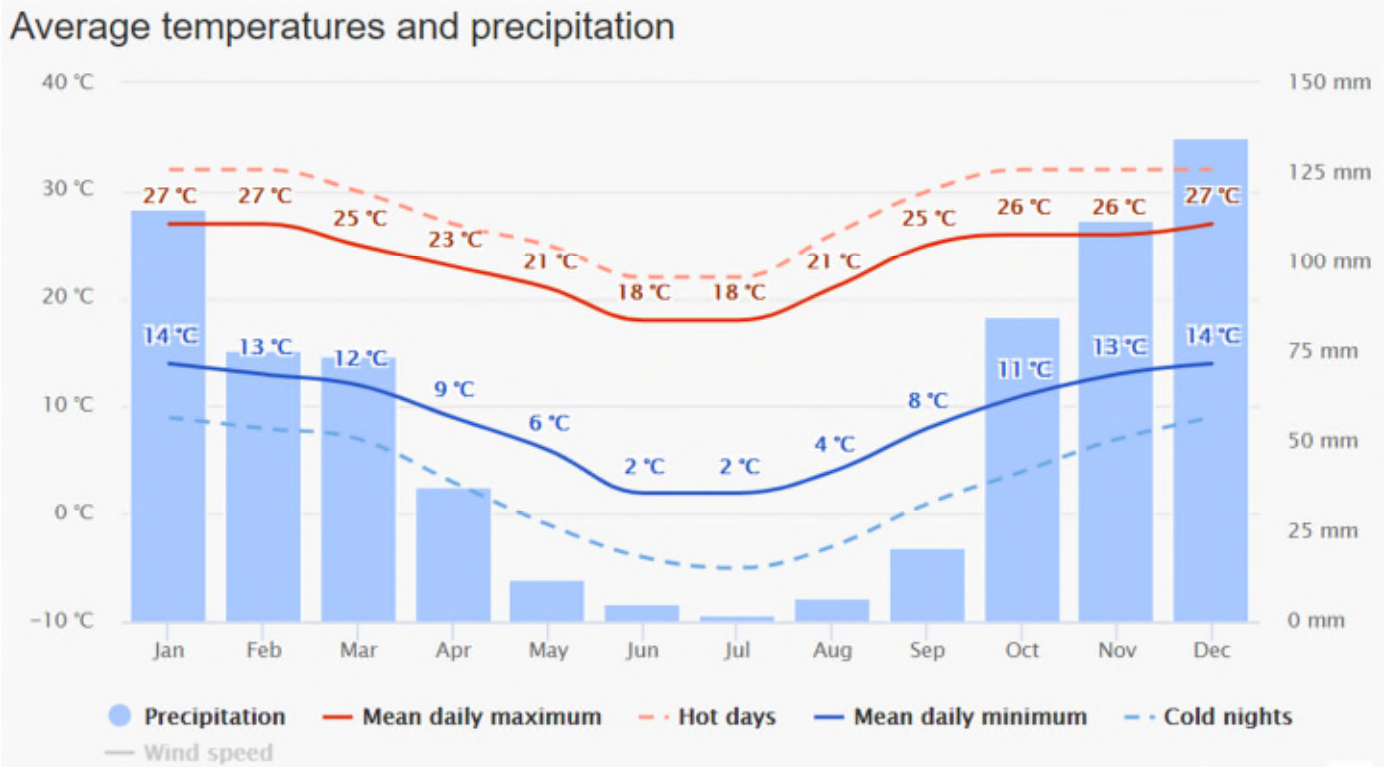

Figure 4.1: Average temperatures and precipitation found within the Tsakane region.
(Source: www.meteoblue.com. Accessed 13 December 2018).

The immediate project site experiences mean daily minimum and maximum temperatures ranging from the hottest month (December) of 14°C and 27 °C, to the coldest month of the year (July) with mean minimum and maximum ranges between 2 °C and 18 °C. Precipitation ranges between 130mm average in December to 3 - 5mm in July.

4.2. Geology

The overall geology of the site contains mostly Shales, Coal and Arenites derived from the Vryheid Formation, of the Ecca Group and Karoo Supergroup. This formation dates back to the Paleozoic era (541 to 251 million years ago).

4.3. Topography

The entire site is flat with no distinct topographical features, within a broader context of slightly undulating hills with intermittent small valleys in which drainage lines are common. Plate 4.1 below illustrates the overall topography of the site. The elevation of the site is approximately 1 600 m above mean sea level.

Plate 4.1: Topography of the project site, showing flat terrain features throughout the project site.

4.4. Zoning and current land use

The entire site is zoned as 'agriculture', however currently the site is entirely fenced and only utilised for the operation of the existing water supply infrastructure. According to the Grand Open Space Plan of the CoE (2013), the entirety of the site is located on "Primary Open Space", which reflects the land use of the site well. Apart from the current use of the gravelaccess road, and reservoir infrastructure, the site is unoccupied. Historical images however show that the existing concrete fencing visible in Plate 1.1 above was only erected between the August 2015 and May 2016, prior to which the site was entirely accessible from the road with visible footpaths traversing the site in aerial images prior to August 2015. In addition, illegal dumping in the area is common and occurs at a relatively high level, with dumping sites seen on the aerial imagery in the area (some of which occurred on site) since at least March 2005. Since the concrete fencing was erected in 2016, no further visible illegal dumping is visible from the aerial imagery on the proposed project site, however ongoing illegal dumping within 2m of the fence line is visible. Evidence of frequent

burning was also observed on site (burn evidence within the proposed development footprint), possibly from the frequent fires associated with burning of the illegally dumped waste adjacent to the site boundaries (within 1m of the proposed project site fence line).

5. DESCRIPTION OF THE ECOLOGICAL ENVIRONMENT

5.1. Regional context

The project occurs entirely within the Grassland Biome (Mucina & Rutherford, 2012) (Figure 5.1), which occurs from just north of Bisho in the Eastern Cape, to the Free-State border near Kimberley, to Pretoria in the north and Pietermaritzburg in the East. The bioregion within this biome – the Mesic Highveld Grassland Bioregion – furthermore occurs mainly in eastern, wetter areas of the Highveld, reaching towards the northern escarpment, straddling the border of the Grassland and Savanna Biome in the north. This Bioregion are comprised of 'sour' grasslands, with the various vegetation units generally distinguished by geology and substrate, elevation, topography and rainfall characteristics.

5.2. SANBI vegetation classification: Tsakane Clay Grassland (GM9)

Mucina and Rutherford (2012) developed the National Vegetation map as part of a South African National Biodiversity Institute (SANBI) funded project, to provide floristically based vegetation units of South Africa, Lesotho and Swaziland at a greater level of detail than was available prior to their work. A national map was developed using large quantities of data from several contributors and has allowed for the best national vegetation map to date, the last being that of Acocks, developed over 50 years ago. The SANBI Vegetation map informs finer scale bioregional plans such as STEP and had two main aims:

- "to determine the variation in and units of southern African vegetation based on the analysis and synthesis of data from vegetation studies throughout the region, and
- to compile a vegetation map. The aim of the map was to accurately reflect the distribution and variation on the vegetation and indicate the relationship of the vegetation with the environment. For this reason, the collective expertise of vegetation scientists from universities and state departments were harnessed to make this project as comprehensive as possible."

The result of the abovementioned work described each vegetation type in detail, showing the most important taxa, endemic species and any species that carry bioregional importance, and represents that most comprehensive dataset for vegetation types in South Africa to date. The Tsakane Clay Grassland occupies the entirety of the site according to the vegetation classification, and is described in greater detail below.

5.2.1. Distribution

Tsakane Clay Grassland occurs mainly in the Gauteng and Mpumalanga provinces, with patches extending in a narrow band between Springs and Soweto, southwards towards Nigel and as far as Vereeniging. The grassland also occurs north of the Vaal Dam, and between Balfour and Standerton, and preferentially occurs at altitude ranging from 1 480 – 1 680 m (Mucina and Rutherford, 2012).

Figure 5.1: Mucina and Rutherford (2012) vegetation map of the study site.

5.2.2. Vegetation & Landscape Features

This vegetation type occurs predominantly on flat to slightly undulating plains and low hills, and is short and dense in structure. Tsakane Clay Grassland is dominated by a mixture of common highveld grasses such as *Themeda triandra*, *Heteropogon contortus*, *Elionurus muticus* and a variety of *Eragrostis* species (Mucina and Rutherford, 2012). The forbs most common are of the families *Asteraceae*, *Rubiaceae*, *Malvaceae*, *Lamiaceae* and *Fabaceae*. Disturbance in this vegetation type allows for an increase in abundance of *Hyparrhenia hirta* and *Eragrostis chloromelas* (Mucina and Rutherford, 2012).

5.2.3. Geology & Soils

This vegetation unit is contained generally on regions where the most dominant rock is basaltic lava of the Klipriviersberg Group (Ventersdorp Supergroup), together with the sedimentary rocks of the Madzaringwe Formation of the Karoo Supergroup. Soils are typical of the Ba and Bb land types (Mucina and Rutherford, 2012).

5.2.4. Climate

Climate within the regions where this vegetation type occurs is strongly seasonal, with summer rainfall and very dry winters. Mean annual precipitation ranges between 630–720 mm, with a mean annual temperature of 15°C indicating the transitional nature between a cool-temperate and warm-temperate climate (Mucina and Rutherford, 2012).

5.2.5. Important Taxa

According to Mucina and Rutherford (2012), the following important taxa are characteristic of this vegetation type (Table 5.1):

Table 5.1: Important Taxa (Mucina and Rutherford, 2012) of the Tsakane Clay Grassland.

Growth Form	Taxon name	Family
Graminoids	*Brachiaria serrata*	POACEAE
Graminoids	*Cynodon dactylon*	POACEAE
Graminoids	*Cynodon hirsutus*	POACEAE
Graminoids	*Digitaria ternata*	POACEAE
Graminoids	*Elionurus muticus*	POACEAE
Graminoids	*Eragrostis chloromelas*	POACEAE
Graminoids	*Eragrostis patentipilosa*	POACEAE
Graminoids	*Eragrostis plana*	POACEAE
Graminoids	*Eragrostis racemosa*	POACEAE
Graminoids	*Heteropogon contortus*	POACEAE
Graminoids	*Hyparrhenia hirta*	POACEAE
Graminoids	*Microchloa caffra*	POACEAE
Graminoids	*Setaria sphacelata*	POACEAE
Graminoids	*Themeda triandra*	POACEAE
Graminoids	*Trachypogon spicatus*	POACEAE
Graminoids	*Abildgaardia ovata*	CYPERACEAE

Graminoids	*Andropogon schirensis*	POACEAE
Graminoids	*Cymbopogon caesius*	POACEAE
Graminoids	*Diheteropogon amplectens*	POACEAE
Graminoids	*Melinis nerviglumis*	POACEAE
Graminoids	*Panicum gilvum*	POACEAE
Graminoids	*Setaria nigrirostris*	POACEAE
Herbs	*Acanthospermum australe*	ASTERACEAE
Herbs	*Ajuga ophrydis*	LAMIACEAE
Herbs	*Eriosema salignum*	FABACEAE
Herbs	*Euryops transvaalensis subsp. transvaalensis*	ASTERACEAE
Herbs	*Gerbera viridifolia*	ASTERACEAE
Herbs	*Helichrysum nudifolium var. nudifolium*	ASTERACEAE
Herbs	*Helichrysum rugulosum*	ASTERACEAE
Herbs	*Hermannia depressa*	MALVACEAE
Herbs	*Lotononis macrosepala*	FABACEAE
Herbs	*Nidorella hottentotica*	ASTERACEAE
Herbs	*Pentanisia prunelloides subsp. latifolia*	RUBIACEAE
Herbs	*Peucedanum caffrum*	APIACEAE
Herbs	*Rotheca hirsuta*	LAMIACEAE
Herbs	*Selago paniculata*	SCROPHULARIACEAE
Herbs	*Senecio coronatus*	ASTERACEAE
Herbs	*Senecio inornatus*	ASTERACEAE
Herbs	*Sonchus nanus*	ASTERACEAE
Herbs	*Vernonia oligocephala*	ASTERACEAE
Geophytic Herbs	*Aspidoglossum ovalifolium*	APOCYNACEAE
Geophytic Herbs	*Hypoxis rigidula var. pilosissima*	HYPOXIDACEAE
Semiparasitic Herb	*Striga asiatica*	OROBANCHACEAE
Low Shrubs	*Anthospermum rigidum subsp. pumilum*	RUBIACEAE
Low Shrubs	*Chaetacanthus setiger*	ACANTHACEAE
Low Shrubs	*Tephrosia capensis var. acutifolia*	FABACEAE
Semiparasitic Shrub	*Thesium impeditum*	SANTALACEAE

5.2.6. Conservation status

According to Mucina and Rutherford (2012), the conservation status of Tsakane Clay Grassland is Endangered (EN), with only 1.5% of the 24% conservation target conserved in 2012, mainly in the Suikerbosrand, Olifantsvlei, Klipriviersberg and Marievale Nature Reserves, with some minor patches in private reserves. The main threats to this vegetation type are transformation by cultivation, which had transformed approximately 60% of the distribution already, along with mining, dam-building and road development and operation. Large portions of Alberton, Springs, Tsakane and part of Soweto (all south and east of Johannesburg) were built in the area of this vegetation unit. Increasing urbanisation, especially in the south of Johannesburg and near the East Rand (Brakpan district) will increase pressure on the remaining vegetation. Erosion across this vegetation unit is generally very low or low.

5.3. Gauteng Conservation Plan (C-Plan)

The Gauteng C-Plan is based on the systematic conservation protocol developed by Margules and Pressey (2000) and is based on the principles of complementarity, efficiency, defensibility and flexibility, irreplaceability, retention, persistence and accountability. Ultimately, the tool resulted in systematic classification and mapping of the Gauteng region, taking a vast array of ecological and land use factors into account.

The main purposes of the C-Plan are:

- To serve as the primary decision support tool for the biodiversity component of the Environmental Impact Assessment (EIA) process;
- To inform protected area expansion and biodiversity stewardship programmes in the province;
- To serve as a basis for development of Bioregional Plans in municipalities within the province.

As such, the plan delineates Critical Biodiversity Areas (CBA's), and Ecological Support Area (ESA) for the entire province, to be used by private and public entities to guide land use decisions within Gauteng.

Critical Biodiversity Areas are areas required to meet biodiversity targets for ecosystems, species and ecological processes, while Ecological Support Areas are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic.

The Gauteng C-Plan shows that the project area partially falls within a Critical Biodiversity Area (Figure 5.2), with the northern portion of the site occurring on the CBA area – approximately 0.9ha in size (75x110m). As such, approximately 50% of the site occurs on CBA. In addition, the C-Plan areas description deem the CBA zone occurring on site as an "Irreplaceable Area" (Figure 5.3).

5.3.1. Critical Biodiversity Areas (CBAs)

CBAs include natural or near-natural terrestrial and aquatic features that were selected based on biodiversity characteristics, spatial configuration and requirement for meeting both biodiversity pattern and ecological process targets. CBAs include irreplaceable sites where no other options exist for meeting targets for biodiversity features, as well as best-design sites which represent an efficient configuration of sites to meet targets in an ecologically sustainable way that is least conflicting with other land uses and activities. These areas need be maintained in the appropriate condition for their category (GDARD C-Plan Technical Report, 2014). Despite the classification of CBA for the northern region of the site, the historical disturbance has severely degraded this area, making it highly degraded and no longer functionally contributing to the critical biodiversity. As such, this area is not deemed as a functioning CBA any. The current on-site condition is expanded upon further below in Chapter 6.

5.3.2. Ecological Support Areas (ESAs)

ESA areas include natural, near-natural, degraded or heavily modified areas that are required to be maintained in an ecologically functional state to support Critical Biodiversity Areas and/or Protected Areas. ESAs maintain the ecological processes on which Critical Biodiversity Areas and Protected Areas depend. Some ESAs are irreversibly modified, but are still required as they still play an important role in supporting

ecological processes (GDARD C-Plan Technical Report, 2014). No areas classified as ESA's were located on the project footprint, and as such ESA's are not applicable to the development proposal.

5.4. Grassland Ecosystem Guidelines

The South African National Biodiversity Institute (SANBI) determined Grassland Ecosystem Guidelines, for land use planning used by both developers and authorities, to inform developments located near or within sensitive grassland regions. Based on the results, only the Blaauwpan and Kaalfontein grassland features are located in the broader region, however both are located at a great distance from the proposed site (in excess of 10km). As such, these grasslands do not contribute to any environmental sensitivity of the proposed site.

5.5. Gauteng Provincial Environmental Management Framework (GPEMF)

The Gauteng Provincial Environmental Management Framework (GPEMF) delineated various environmental management zones throughout the province, which take into account biodiversity sensitivity, land use planning objectives and the current status of these sites as far as possible, and provide clear development instruction regarding the various zones. The GPEMF indicated that the project falls within "Normal Control Zone (Zone 4)" (on the southern portion of the site, approximately 0.8ha or 50%) and the "High Control Zone (outside the urban development zone) (Zone 3)" in the norther portion of the site (covering approximately 50% of the site, or 0.9ha).

5.5.1. Zone 3 – High control zone (outside the urban development zone)

According to the GPEMF, this zone is sensitive to development activities and in several cases also have specific values that need to be protected. Conservation and related tourism and recreation activities should dominate development in this zone.

5.5.2. Zone 4 – Normal Control Zone

This zone is dominated by agricultural uses outside the urban development zone. Agricultural and rural development that support agriculture should be promoted.

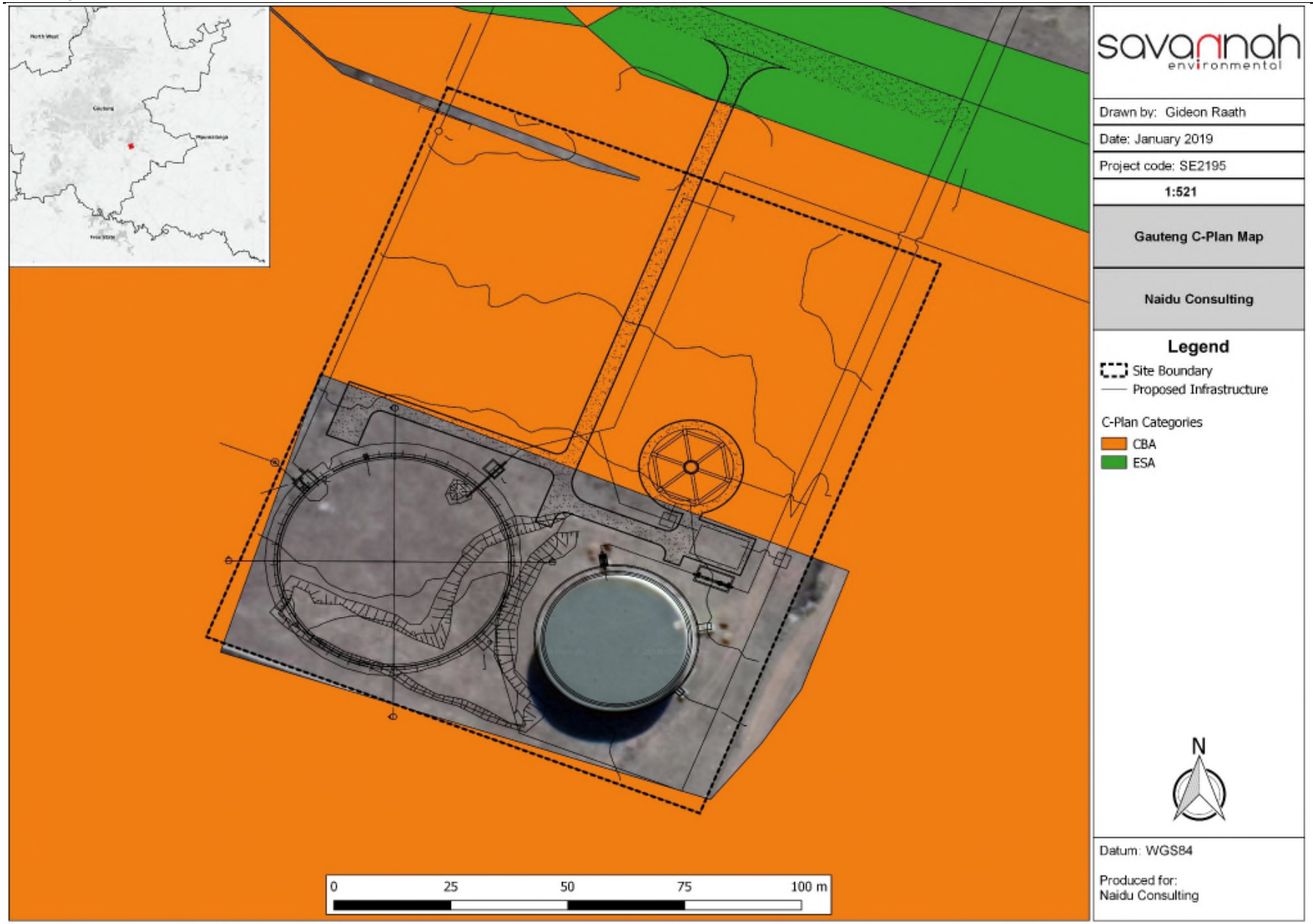

Figure 5.2: Gauteng C-Plan classification of the project site.

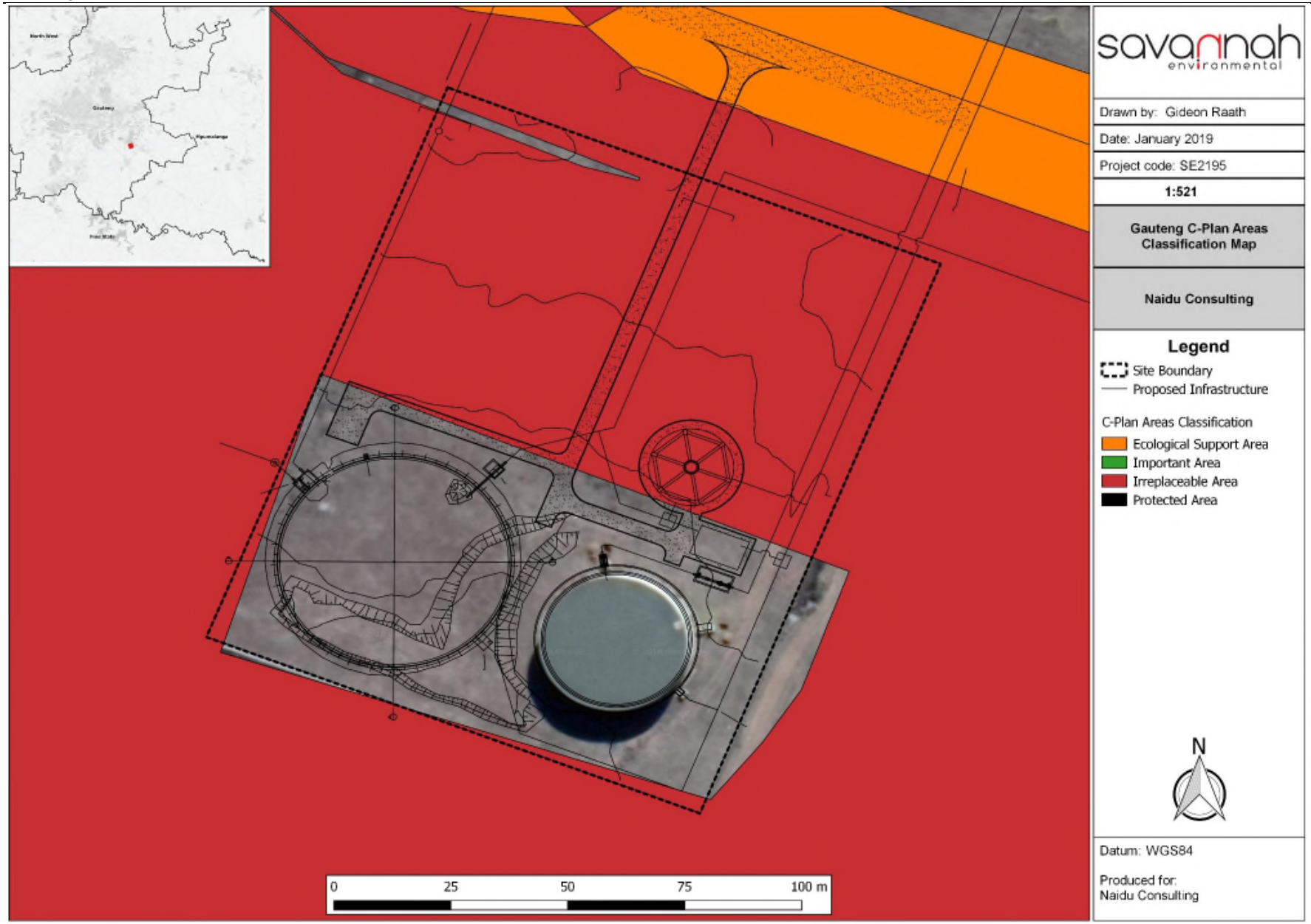

Figure 5.3: Gauteng C-Plan areas description of the project site.

5.6. Animal species that may occur on site

The following list of potential animal SCC were derived from current literature found for the quarter degree square (QDS) surrounding the site, as well as the international IUCN Red Data list, the South African Red Data List, and CITES. The results are summarised (i.e. potential SCC only) in the tables below, while a full species list appears in Appendix A along with conservation status for each species.

5.6.1. Mammals

No potential SCC are expected to occur within the QDS (Table 5.2), with all mammal species expected to occur on site being listed as either Least Concern (LC) or Near-Threatened (NT), neither of which are deemed SCC. The table below indicates the potential Near-Threatened mammal species that may occur on site. None of these species were however observed on site.

Table 5.2: Mammalian species with conservation status other than Least Concern, which may occur within the project region (ADU, 2019).

Family	Scientific name	Common name	Red list category
Muridae	*Otomys auratus*	Southern African Vlei Rat	NT
Mustelidae	*Aonyx capensis*	African Clawless Otter	NT
Mustelidae	*Poecilogale albinucha*	African Striped Weasel	NT
Soricidae	*Crocidura mariquensis*	Swamp Musk Shrew	NT

5.6.2. Reptiles

A wide variety (26 different species) of reptiles are known to occur within the QDS (ADU, 2019), all of Least Concern conservation status (amongst the evaluated ones) (SARCA, 2014), and are thus not considered to be SCC. A full listing is provided in Appendix A. None of these species were however observed on site.

5.6.3. Frogs

Of the ten frog-species that may occur on site (ADU, 2019), all were classified as either Least Concern (9) (IUCN, 2019), with only one being classified as Near-Threatened (Table 5.3), and are thus not regarded as SCC. A full listing is provided in Appendix A. None of these species were however observed on site.

Table 5.3: Frog species that may occur in the project site, with conservation status other than Least Concern.

Family	Scientific name	Common name	Red list category
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bull Frog	NT

5.6.4. Birds

The project site is located halfway between the Suikerbosrand Nature Reserve Important Birding Area (IBA), and the Blesbokspruit IBA, both sub regional IBAs of the Gauteng Province. Approximately 148 different bird species may occur on site (SABAP2, 2007). Although there are no water features on the project site, a large wetland (Spaarwater Pan) exists approximately 1.5km east of the project site, and water birds are thus common in the region. A summary of the species that may be present on site, with a conservation status

other than Least Concern, is shown below in Table 5.4 (Eskom, 2015; IUCN, 2019). Species that were regarded as Least Concern are not included in the table below.

Table 5.4: Bird species that may be present on site, with conservation status other than Least Concern.

Spp.	Taxon Name	Common name	Red List (Eskom, 2015)	IUCN Red List
Flamingo	*Phoenicopterus minor*	Lesser	Not evaluated	NT
Duck	*Oxyura maccoa*	Maccoa	NT	VU
Sandpiper	*Calidris ferruginea*	Curlew	LC	NT
Pratincole	*Glareola nordmanni*	Black-winged	NT	NT

Based on the Red List, all bird species that may be present on site are classified regionally as either Least Concern, with only two Near-Threatened species possible. As such, no bird SCC are expected to occur on site.

6. SITE OBSERVATIONS AND DESCRIPTION

6.1. Vegetation unit and description

Due to the small size of the site (1.6 ha), only one vegetation unit was identified within the project area - highly degraded Tsakane Clay Grassland (Plate 6.1, and Figure 6.1 below).

Plate 6.1: Highly disturbed Tsakane Clay Grassland present onsite.

This vegetation unit covered the entire site uniformly, and consisted of predominantly grass species, with no tree or shrub forms present. The species composition identified onsite conformed to a minor degree to that of the Mucina & Rutherford (2012) descriptions, and thus represented the Tsakane Clay Grassland vegetation type described in the SANBI Vegetation Map, albeit in a highly degraded condition. In particular, the relatively high abundance of *Hyparrhenia hirta* (thatching grass) and low species richness indicated the high levels of disturbance experienced on site historically.

Figure 6.1: Vegetation map of the single vegetation unit present onsite.

6.2. Current land use and site disturbance

The site is fenced (concrete palisading), with one entrance and a small gravel road leading to the existing water infrastructure. Evidence of disturbance (Plate 6.2) was evident throughout the site with illegal dumping observed adjacent to the site as well as along the boundary fence. In addition, grazing was observed nearby (2m away from the existing fence line, and surrounding the proposed site). As the fence was only constructed recently, both grazing and illegal dumping would historically have occurred on site contributing to the low species diversity and the disturbance of the site (visible from the aerial imagery for approximately 10 years leading up to the fence being erected).

Burning and litter along the fencelines

Set concrete, building material and packaging present on site

Illegal dumping adjacent to the site

Grazing adjacent to the site

Plate 6.2: Evidence of current and historic disturbance on site.

Evidence of historical construction (set concrete and trench lines visible), with minor invasive species occurrence, was also noted near the north western corner of the site (facing the current water infrastructure), where the laydown areas for the existing water infrastructure may have been. The burning of waste adjacent the site contributes to ongoing fires occurring on site, with evidence of recent burning observed during the site assessment. As the site is presently fenced, no other land use occurs apart from the operation of the existing water infrastructure.

6.3. Vegetation species observed

A total of 17 species were identified within the proposed site, consisting mainly of mixed grass species commonly occurring in the highveld region. All of the species observed were classified as Least Concern (LC) and were not considered to be sensitive species. Taking into account the small diversity of species occurring on site, and the low conservation classification (LC) of those present, the site was deemed to have an overall low conservation status for the vegetation component. Table 6.1 indicates the plant species observed during the field visit.

Table 6.1: Plant species identified within the proposed project site.

Growth Form	Taxon name	Family	SANBI red data list
Graminoids	*Brachiaria serrata*	POACEAE	LC
Graminoids	*Cynodon dactylon*	POACEAE	LC
Graminoids	*Elionurus muticus*	POACEAE	LC
Graminoids	*Eragrostis chloromelas*	POACEAE	LC
Graminoids	*Hyparrhenia hirta*	POACEAE	LC
Graminoids	*Themeda triandra*	POACEAE	LC
Herbs	*Acanthospermum australe*	ASTERACEAE	LC
Herbs	*Gerbera viridifolia*	ASTERACEAE	LC
Herbs	*Helichrysum rugulosum*	ASTERACEAE	LC
Herbs	*Hermannia depressa*	MALVACEAE	LC
Herbs	*Nidorella hottentotica*	ASTERACEAE	LC
Herbs	*Sonchus nanus*	ASTERACEAE	LC
Herbs	*Vernonia oligocephala*	ASTERACEAE	LC
Geophytic Herbs	*Hypoxis rigidula var. pilosissima*	HYPOXIDACEAE	LC

6.3.1. Plant Species of Conservation Concern

No plant Species of Conservation Concern were identified on site.

6.3.2. Plant alien invasive species observed

Four invasive species were observed onsite (Table 6.2), mainly adjacent the existing storage unit where evidence of historical construction was present, while five other invasive species were noted nearby.

Table 6.2: Invasive plant species observed on site.

Growth Form	Taxon name	Family	NEMBA Category Listing (2016)	CARA Listing (1983)
Herbs	*Sonchus oleraceus*	ASTERACEAE	Not listed	Not listed
Graminoids	*Pennisetum clandestinum*	POACEAE	1b in Protected Areas and wetlands in which it does not already occur.	Not listed
Herbs	*Alternanthera pungens*	AMARANTHACEAE	Not listed	Not listed
Tall tree	*Eucalyptus cladocalyx**	MYRTACEAE	Category 1b in Fynbos, Grassland, Savanna, Albany Thicket,	Category 2

			Forest and Indian Ocean Coastal Belt biomes	
Shrub	*Canna indica**	CANNACEAE	Not listed	Category 1
Tall tree	*Populus × canescens**	SALICACEAE	Not listed	Category 2
Tree	*Salix babylonica**	SALICACEAE	Not listed	Category 2
Tree	*Acacia mearnsii*	FABACEAE	Category 2	Category 2

* found adjacent the project site, not within the proposed development area.

6.4. Animal species observed

Due to the small size and highly frequented nature of the site, very few animal species were observed on site, with only *Trachylepis punctatissima* (speckled rock skink), and *Trachylepis varia sensu lato* (common variable skink) identified on site, both of which are considered as Least Concern (LC) (SARCA, 2014). Avifaunal species were the exception however, being attracted by the nearby wetland located further east of the site (approximately 1.6km), and due to their mobile nature. Apart from the above two reptiles, only birds were noted on and near site, as indicated by Table 6.3 below.

Table 6.3: Bird species observed on or near the project site.

Spp	Taxon Name	Common Name	Red List (ESKOM, 2015)	IUCN Red List
Kite	*Elanus caeruleus*	Black-shouldered	-	LC
Lapwing	*Vanellus coronatus*	Crowned	-	LC
Turtle-dove	*Streptopelia capicola*	Cape	-	LC
Palm-swift	*Cypsiurus parvus*	African	-	LC
Bulbul	*Pycnonotus tricolor*	Dark-capped	-	-
Wagtail	*Motacilla capensis*	Cape	-	LC
Pipit	*Anthus cinnamomeus*	African	-	LC
Myna	*Acridotheres tristis*	Common	-	LC
Sparrow	*Passer melanurus*	Cape	-	LC
Widowbird	*Euplectes progne*	Long-tailed	-	LC

None of the bird species observed on site were regarded as sensitive, with all considered Least Concern (LC) in terms of their conservation status. Along with the small number of observed species on site, the common status for all of the observed species, and the highly disturbed and frequented status of the site, the project site had a low faunal conservation potential.

6.4.1. Animal Species of Conservation Concern

No animal Species of Conservation Concern were identified on site.

6.4.2. Animal alien invasive species observed

No animal invasive species were identified on site.

7. SITE SENSITIVITY ANALYSIS

As no project layout, infrastructure or location alternatives were feasible, only the preferred alternative and the 'no-go' alternative was assessed in the sensitivity analysis and impacts assessment for this study. Please refer to the associated Basic Assessment report (to which this report forms an Appendix) for a detailed motivation regarding the various alternatives and their selection.

7.1. Categorisation

The various biodiversity tools, maps and guidelines available and discussed in the previous chapters, along with the results of the fieldwork was combined to determine the various areas of the site that are deemed sensitive, classified into three categories:

- **High sensitivity** including:
  - Process areas, such as all surface water bodies and drainage areas, including dams, wetlands, drainage systems, rivers and streams;
  - Areas with a high species richness;
  - Areas that are not significantly impacted, transformed or degraded by current land use; and
  - Areas that contain the majority of species of conservation concern and which may contain high numbers of globally important species, or comprise part of a globally important vegetation type.
- **Moderate sensitivity**:
  - Intact natural vegetation with moderate levels of disturbance, and that still provide a valuable contribution to biodiversity and ecosystem functioning despite being degraded;
  - Degraded areas that still have a relatively high species richness; and
  - Degraded areas that still contain species of special concern.
- **Low sensitivity**:
  - Areas that are highly impacted by current or historical land use, including dumping, mowing, frequent fire, ground or surface water alteration, as well as earthworks or soil disturbance, and which thus provide little value to the ecosystem; and
  - Highly degraded areas that are unlikely to harbour any species of special concern.

The combined faunal and floral sensitivity for the site was then categorised into one of those three categories, taking the following aspects into account (Table 7.1):

Table 7.1: Aspects informing the sensitivity analysis for the proposed project (bolded cells applicable to this project).

INDICATOR	**Biodiversity Indicators**				
ASPECT	**Conservation status**	**Species of Conservation Concern**	**Habitat**	**Biodiversity**	**CBA & ESA**
DESCRIPTION	Fauna, flora and habitat conservation status	Presence and quantity of Species of	Viable population size and	Species composition and richness	Presence or absence of Critical Biodiversity and

		Conservation Concern	fragmentation effects	contribution to biodiversity	Ecological Support Areas
SENSITIVITY					
Low	Well conserved, independent of conservation value	**None, although occasional regional endemics may be present.**	**Extensive areas of preferred habitat present elsewhere in region less susceptible to fragmentation.**	**Low diversity or species richness.**	No CBA or ESA within project region
Medium	**Not well conserved, moderate conservation value.**	No endangered or vulnerable species, some indeterminate or rare endemics	Reasonably extensive areas of preferred habitat elsewhere and habitat susceptible to fragmentation	Moderate diversity, and moderately high species richness	ESA found within project region
High	Not conserved – has a high conservation value	One or more endangered and vulnerable species, or more than 2 endemics or rare species	Limited areas of this habitat, susceptible to fragmentation in currently occupied regions	High species diversity, complex plant and animal communities	**CBA zone classified in project region.**
INDICATOR	**Biophysical Indicator**				
ASPECT	**Topography**	**Vegetation**	**Erosion Potential**	**Rehabilitation**	**Disturbance**
DESCRIPTION	The distribution of parts or features	Extent and spatial distribution of habitat type in the broader study area	Soil stability and exposure	Degree to which the site may be rehabilitated	Degree of degradation from anthropogenic or other influences
SENSITIVITY					
Low	**Even**	Extensive	**Very stable, low soil exposure or soil erosion potential.**	**Site is easily rehabilitated.**	**Site is very disturbed or degraded.**
Medium	Undulating; fairly steep slopes	**Restricted to a particular region.**	Some possibility of erosion or change due to episodic events.	There is some degree of difficulty in rehabilitation of the site.	There is some degree of disturbance of the site.
High	Complex and uneven with steep slopes	Restricted to a specific locality	Large possibility of erosion, change to the	Site is difficult to rehabilitate	The site is hardly or very slightly impacted upon

		or site (i.e. 'site specific'	site or destruction due to climatic or other factors.	due to the terrain, type of habitat or species required to reintroduce.	by human disturbance.
INDICATOR	**Hydrological Indicator**				
ASPECT	**Water Bodies***				
DESCRIPTION	Presence or absence of surface water features, including wetlands and rivers, estuaries				
SENSITIVITY					
Low	**No water bodies are present on site.**				
High	Includes one or more of all water bodies (e.g. wetlands, perennial rivers, non-perennial rivers, drainage systems etc.)				

*Water bodies are either Low or High sensitivity, based solely on the presence or absence of hydrological features on site.

Although classified as a CBA, the entire site was deemed to have a **LOW** ecological sensitivity. This was due to the following aspects:

i. The very low ecological function of the site presently;
ii. The highly degraded nature of the site (refer to section 6.2 above);
iii. The low species richness observed on site;
iv. The low conservation classification of plant and animal species that may occur on site;
v. The low conservation classification of plant and animal species that were actually observed on site;
vi. The very small footprint of the site and thus limited habitat types available for faunal groups;
vii. The complete absence of water features on site;
viii. The low erosion potential and ease with which the site may be rehabilitated, and the highly disturbed and degraded nature of the site currently.

The CBA classification for the proposed site thus does not correspond to the real-world condition of the plant and animal species observed on site, and therefore contributes poorly to the ecological function of the broader area. As such, the site is not deemed a functional CBA zone, as confirmed by the site assessment results. Furthermore, while the vegetation type deemed to be present on site has a high conservation value, the highly degraded real-world condition of the vegetation unit observed on site confirmed a minimal overall conservation contribution. The vegetation unit on site resembles Tsakane Clay Grassland through the species composition, but is highly degraded, with poor ecological functioning and a low conservation contribution, and as such does not represent a good conservation opportunity and does not currently contribute to the overall health and conservation status of the Tsakane Clay Grassland vegetation type.

7.2. Sensitivity map

A sensitivity map was developed based on the allocations made in Sections 7.1 above, for the entire project site (Figure 7.1). As indicated, no regions of high or moderate sensitivity was determined for this assessment. As such, no areas are deemed no-go zones, and no buffer zones are required for implementation on site. This is primarily due to the poor ecological condition of the site, and the absence of highly sensitive features such as drainage lines or other surface water features.

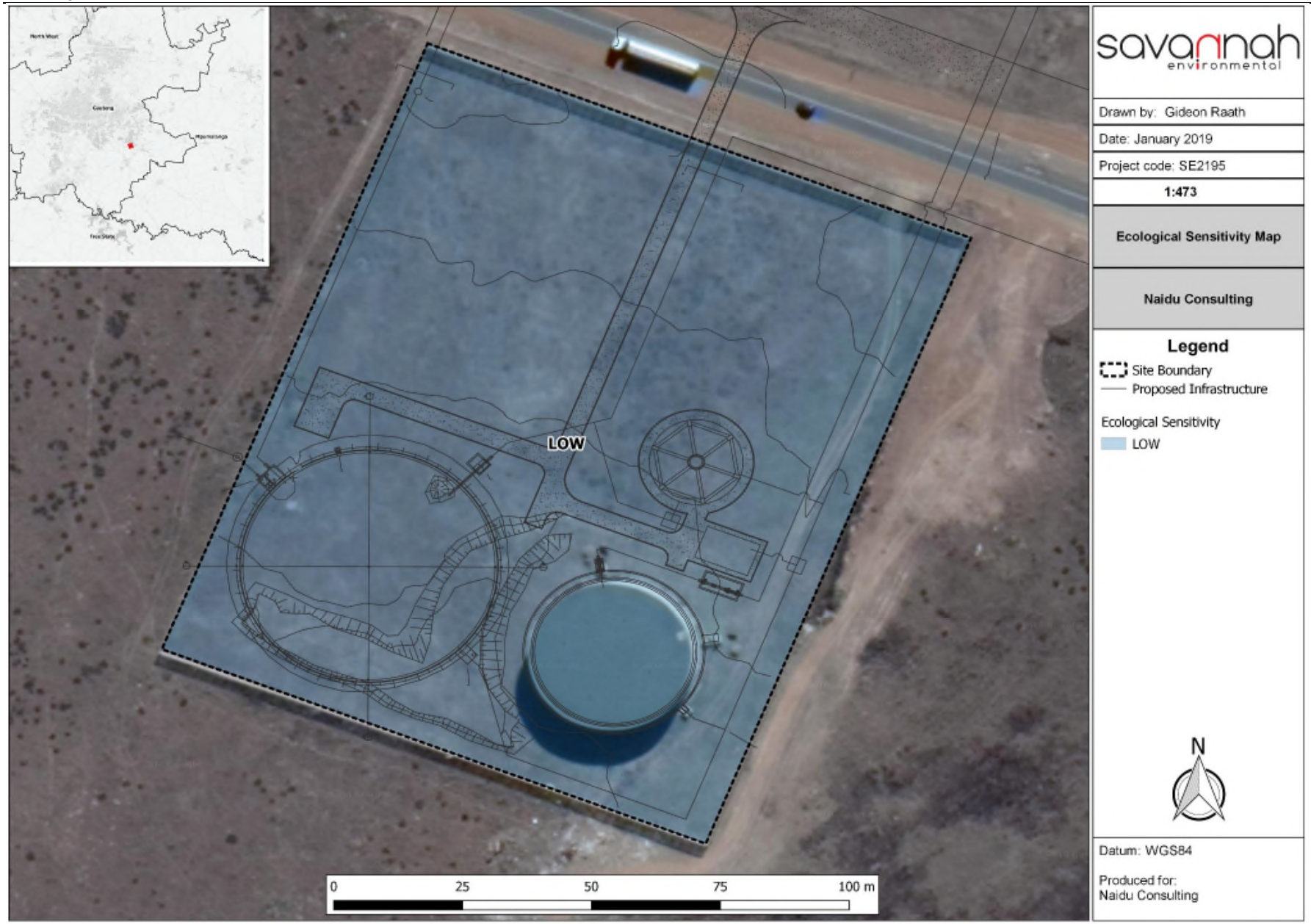

Figure 7.1: Ecological sensitivity map of the project site.

8. IMPACT ASSESSMENT

The study that has been undertaken provides the necessary information to assess the impacts of the project on the fauna and flora at various spatial and temporal scales.

The individual impacts have been grouped together as a series of key environmental issues (Table 8.1). All of the issues relate to the loss of the existing vegetation cover and faunal habitat as a result of project activities. At the spatial scale of the project site the impacts described below will not be considerable, but these need to be considered in the context of the project site as a whole or at a still larger spatial scale. The main issues identified with the existing impacts are discussed below for each phase of the project.

Table 8.1: Issues identified from the sensitivity analysis.

ISSUES IDENTIFIED	DESCRIPTION OF IMPACTS
Loss of vegetation communities	The clearing of natural vegetation will lead to the permanent loss of highly degraded Tsakane Clay Grassland within the project site.
Loss of biodiversity & Ecosystem Function and Process	The clearing of natural vegetation for the proposed development may lead to the destruction of habitats and the loss of unidentified plant SCC, disrupting ecosystem function and processes.
Control of alien plant species	The lack of an effective alien vegetation management plan may lead to alien plant invasion following construction earthworks.
Erosion	During construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion.
Loss of Critical Biodiversity Area	Although small (0.9ha), the region classified as CBA will be partially cleared during construction, resulting in a loss of CBA area.
Rehabilitation of disturbed areas	Poor rehabilitation of disturbed areas after construction may lead to the permanent degradation of ecosystems as well as allow invading alien vegetation species to expand.
Cumulative impacts: loss of biodiversity and conservation potential	Cumulative impacts may result from similar development types in the broader region. These impacts are addressed below in conjunction with their associated impacts.

8.1. Planning and Design Phase

Activities associated with the design and pre-construction phase pertains mostly to a feasibility assessment which is done at a desktop level. As such, no planning and design phase ecological impacts are expected.

8.2. Construction Phase

This section contains the assessment of all impacts associated with the construction phase, as they relate to the proposed development.

8.2.1. Issue 1: Loss of vegetation communities

Impact 1.1: Loss of highly degraded Tsakane Clay Grassland

Nature:
The clearing of natural vegetation within the project footprint will lead to the permanent loss of highly degraded Tsakane Clay Grassland which is considered to be an endangered vegetation type by SANBI.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (30)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

- Since this vegetation type is listed as endangered, impacts must be kept to a minimum through the development and implementation of an EMPr, and the employment of an Environmental Control Officer (ECO) for the duration of construction.
- Laydown areas and turning areas must be located in areas that have already been impacted or show evidence of degradation, such as the far-left corner of the property (facing the existing storage unit). The ECO must identify such areas.
- Vegetation clearing for the establishment of infrastructure must be kept to a minimum, by only clearing what is absolutely needed in order to further construction.
- Vegetation impacted during the construction phase must be restored.
- Topsoil must be stockpiled separately to subsoil. This is done to conserve the existing seedbank and aid in the restoration of natural grasslands during rehabilitation.

Cumulative impacts:
Due to the small extent of this project, the highly degraded nature of the existing site, as well as no other projects known or planned within the area, the cumulative impact of this development is deemed low to negligible.

Residual Risks:
The loss of highly degraded Tsakane Clay Grassland is inevitable for the construction of the proposed infrastructure; however, the highly disturbed and low conservation value on site contribute to a low residual risk remaining following the implementation of mitigation measures.

Impact 1.2: Loss of Species of Conservation Concern

Nature:
Although improbable, SCC that were not identified during the site assessment may still be present on site. As such, the clearing of natural vegetation within the project footprint may lead to the loss of Species of Conservation Concern (SCC).

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)

Duration	Medium-term (3)	Medium-term (3)
Magnitude	Minor (2)	Small (0)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (12)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Should any SCC be identified during excavation, thesemust be relocated or removed from the construction footprint by a qualified specialist prior to commencement of further activities. » In the event that SCC are identified during construction works, the relevant permits must be obtained from the relevant departments in order to remove such species prior to commencement of further activities.		
Cumulative impacts: Due to the small extent of this project, the highly improbable occurrence of SCC within the limited footprint of this project, as well as no other projects known or planned within the region, the cumulative impact from the loss of SCC is deemed negligible.		
Residual Risks: The loss of SCC during the construction of the proposed infrastructure is highly unlikely, and as such the residual risk following the implementation of mitigation measures was deemed low to negligible.		

8.2.2. Issue 2: Loss of biodiversity and ecosystem function

Impact 2.1: Loss of floral and faunal biodiversity leading to a disruption of ecosystem function and processes

Nature: The removal of natural vegetation and faunal habitats within the project footprint may lead to a loss of biodiversity and ecosystem function and processes.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short (2)	Short (2)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Highly probable (4)
Significance	**Low (25)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Prohibit all employees from harvesting wild plants or hunting any animals on site; » Prohibit open fires; » Rehabilitate laydown areas immediately after they are no longer required;		

» Develop a short invasive management plan and implement during construction to ensure alien species do not invade disturbed or cleared areas; » An ECO must be employed during construction; » Laydown areas and turning areas must be located in areas that have already been impacted or show evidence of degradation, such as the far-left corner of the property (facing the existing storage unit). The ECO or EO must identify such areas. » Vegetation clearing for the establishment of infrastructure must be kept to a minimum, by only clearing what is absolutely needed in order to further construction. » Vegetation impacted must be restored and the area rehabilitated. It is likely that this will occur naturally but given the presence of alien species active rehabilitation and the removal of alien species will be required to ensure that only indigenous species remain. » Topsoil must be stockpiled separately to subsoil.
Cumulative impacts: Due to the small extent of this project, the highly degraded nature of the existing site, as well as no other projects known or planned within the region, the cumulative impact of is deemed low to negligible.
Residual Risks: The loss of faunal and floral biodiversity during the construction of the proposed infrastructure is likely, however the small extent of the site, and the low conservation status of each of the identified species on site contribute to a low to negligible residual risk following the implementation of mitigation measures.

8.2.3. Issue 3: Control of alien plant species

Impact 3.1: Poor control of alien plant species during construction leading to increasing invasive species presence

Nature: The lack of an effective alien vegetation management plan may lead to alien plant invasion following construction earthworks.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium (3)	Short (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » An Alien Plant Monitoring and Management Plan must be developed and implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species. » Alien plants must be removed from the site through appropriate methods for the specific species of concern such as hand pulling, application of chemicals, cutting etc., on a regular basis during construction. Removal must occur prior to plants developing seeds.		
Cumulative impacts:		

Due to the already moderately invaded nature of the site and broader project area, the cumulative impact of increasing invasive species abundance in the region is deemed low. Regardless, effective alien invasive species management through the implementation of the alien management plan is required to reduce introduction and establishment of novel invasive species.
Residual Risks: Due to the already moderately invaded nature of the site and broader project region, the residual risk following implementation of mitigation measures is deemed low.

8.2.4. Issue 4: Erosion

Impact 4.1: Increased erosion due to vegetation clearing for infrastructure.

Nature:
During construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium (3)	Short (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (24)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

- Any erosion observed as a result of the construction works should be rectified immediately and monitored thereafter to ensure interventions are successful.
- All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential.
- Reinstate as much of the eroded area to its pre-disturbed, "natural" levels
- The gravel access road and other disturbed areas (laydown areas) should be regularly monitored for erosion occurrences and must receive follow-up monitoring by the EO to assess the success of the erosion management.
- Topsoil should be removed and stored separately from subsoil and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
- Where feasible, phased development and vegetation clearing should be practiced so that cleared areas are not left denuded and vulnerable to erosion for extended periods of time.

Cumulative impacts:
Cumulative impact relating to erosion are regarding as low, due to the limited extent of vegetation clearing proposed and the general level topography of the site.

Residual Risks:
With appropriate avoidance and mitigation, residual impacts will be very low and may be limited little potential to spread beyond the point of origin.

8.2.5. Issue 5: Loss of Critical Biodiversity Area (CBA)

Impact 5.1: Loss of areas classified as CBA due to vegetation clearance.

Nature: Although small (0.9ha), the region classified as CBA will be partially cleared during construction, resulting in a loss of CBA area.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium (3)	Medium (3)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (18)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

- Prohibit all employees from harvesting wild plants or hunting any animals on site or in the surrounding areas;
- Prohibit open fires;
- Rehabilitate laydown areas immediately after they are no longer required;
- Develop a short invasive management plan and implement during construction to ensure alien species do not invade disturbed or cleared areas;
- An ECO must be employed during construction;
- Laydown areas and turning areas must be located in areas that have already been impacted or show evidence of degradation, such as the far-left corner of the property (facing the existing storage unit). The ECO or EO must identify such areas.
- Vegetation clearing for the establishment of infrastructure must be kept to a minimum, by only clearing what is absolutely needed in order to further construction.
- Vegetation impacted must be restored and the area rehabilitated. It is likely that this will occur naturally but given the presence of alien species active rehabilitation and the removal of alien species will be required to ensure that only indigenous species remain.
- Topsoil must be stockpiled separately to subsoil.

Cumulative impacts:

Due to the already highly degraded nature of the project site, the cumulative impact of a loss of CBA area is deemed low.

Residual Risks:

Due to the already moderately invaded nature of the site and broader project region, the residual risk following implementation of mitigation measures is deemed low.

8.3. Operational Phase

This section contains the assessment of all impacts associated with the operational phase, as they relate to the proposed development.

8.3.1. Issue 6: Control of alien plant species

Impact 6.1: Poor control of alien plant species leading to increasing invasive species presence.

Nature: The lack of an effective alien vegetation management plan (and implementation thereof during operation) may lead to increasing alien plant communities on site.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium (3)	Medium (3)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » An Alien Plant Monitoring and Management Plan must be developed and implemented during the operational phase to reduce the establishment and spread of undesirable alien plant species. » Ongoing monitoring should be conducted by the site manager to ensure problem-areas are identified where alien species are proliferating, and to inform the control efforts throughout the operational phase. » Alien plants must be removed from the site through appropriate methods for the species of concern (such as hand pulling, application of chemicals, cutting etc)., on a regular basis during operation. Removal must occur prior to plants developing seeds.		
Cumulative impacts: Due to the already moderately invaded nature of the site and broader project region, the cumulative impact of increasing invasive species abundance in the region is deemed low. Regardless, effective alien invasive species management through the implementation of the alien management plan is required to reduce introduction and establishment of novel invasive species.		
Residual Risks: Due to the already moderately invaded nature of the site and broader project region, the residual risk following implementation of mitigation measures is deemed low.		

8.4. Decommissioning Phase

The decommissioning of the project could have a positive impact on the natural vegetation and faunal habitats on site, if the low sensitivity areas are appropriately rehabilitated to a near-natural state. This section furthermore contains the assessment of all impacts associated with the decommissioning phase, as they relate to the proposed development.

8.4.1. Issue 7: Poor rehabilitation

Impact 7.1: Loss of floral and faunal biodiversity from poor rehabilitation efforts during closure, leading to a disruption of ecosystem function and processes.

Nature: During the decommissioning phase, project infrastructure will be removed. The removal process may result in the clearance of natural vegetation adjacent to the project infrastructure. In addition, there are likely to be large areas of bare ground where the project infrastructure was located. Without vegetation cover, these areas are sensitive to erosion and invasion by alien plant species.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short (2)	Very short (1)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Highly probable (4)
Significance	**Low (25)**	**Low (4)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Design and implement a rehabilitation plan for the decommissioning phase; » Implement an alien invasive monitoring and management plan for the decommissioning phase; » If laydown areas and turning areas are required, these must be sited in areas that have already been impacted or show evidence of degradation;		
Cumulative impacts: Due to the small extent of this project, the highly degraded nature of the existing site, as well as no other projects known or planned within the region, the cumulative impact of is deemed low to negligible.		
Residual Risks: The loss of faunal and floral biodiversity during the decommissioning of the proposed infrastructure is unlikely, and taken into consideration the small extent of the site, and the low conservation status of each of the identified species on site, a low to negligible residual risk following the implementation of mitigation measures was deemed appropriate for the decommissioning phase.		

8.4.2. Issue 8: Erosion

Impact 8.1: Increased erosion due to vegetation clearing for infrastructure.

Nature: During decommissioning, removal of site infrastructure will expose soil and increase the potential for erosion.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short (2)	Short (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)

Significance	**Low (21)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Any erosion observed should be rectified immediately and monitored thereafter to ensure interventions are successful. » All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential. » Reinstate as much of the eroded area to its pre-disturbed, "natural" levels » The gravel access road and other disturbed areas (laydown areas) should be regularly monitored for erosion occurrences and must receive follow-up monitoring by the EO to assess the success of the remediation. » Topsoil should be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas. » Where feasible, phased development and vegetation clearing should be practiced so that cleared areas are not left denuded and vulnerable to erosion for extended periods of time.		
Cumulative impacts: Cumulative impact relating to erosion are regarding as low, due to the limited extent of vegetation clearing proposed and the general level topography of the site.		
Residual Risks: With appropriate avoidance and mitigation, residual impacts will be very low and may be limited little potential to spread beyond the point of origin.		

8.5. Cumulative Impacts

8.5.1. Issue 9: Loss of biodiversity and conservation potential

Impact 9.1: Reduced ability to meet conservation obligations and targets.

Nature: The loss of sensitive vegetation types on a cumulative basis in the broader context impacts the ability to meet stated conservation targets for Tsakane Clay Grassland in particular.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (3)
Duration	Medium (3)	Medium (3)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (18)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	High	Moderate

Irreplaceable loss of resources?	No	Likely
Confidence in findings	High	Moderate
Can impacts be mitigated?	Yes	Yes

Mitigation:

- The development footprints of similar or related facilities in the area must be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.
- Reduce the footprint of facilities within proven sensitive habitat types as much as possible.

Residual Risks:

Considering the existing water infrastructure (existing Masetjaba water reservoir) and that this project acts as an expansion of that facility, the development will not set a further precedent of development in the broader Tsakane area. Some loss of vegetation is inevitable, and cannot be avoided, however the vegetation on site has a low sensitivity and conservation value, and contributes very little to no ecological function to the broader study area. Cumulative loss of conservation potential is thus regarded as medium taking into account other likely developments within the broader study region.

Impact 9.2: Impacts on Critical Biodiversity Areas and Broad-Scale Ecological Processes.

Nature:

Although small (0.9ha), the region classified as CBA will be partially cleared during construction, resulting in a loss of CBA area. This loss will contribute to a loss of conserved CBA's within the broader study region.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (3)
Duration	Medium (3)	Medium (3)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (18)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	No	Probable
Confidence in findings	High	Low
Can impacts be mitigated?	Yes	Yes

Mitigation:

- The development footprints of similar or related facilities in the area must be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.
- Reduce the footprint of facilities within proven sensitive habitat types as much as possible.
- Conserve the aquatic features (Spaarwater pan and riparian zones) in the broader landscape by allocating sufficient buffers to these and reducing development within those buffers as far as possible.

Residual Risks:

Considering the existing water infrastructure (existing Masetjaba water reservoir) and that this project acts as an expansion of that facility, the development will not set a further precedent of development in the broader Tsakane area. Some loss of CBA areas is inevitable, and cannot be avoided, however the vegetation on site has a low sensitivity and conservation value, and contributes very little to no ecological function to the broader

study area. Cumulative loss of CBA regions is thus regarded as medium taking into account other likely developments within the broader study region.

Impact 9.3: Cumulative impacts due to similar infrastructure developments - Large-scale disturbance of indigenous vegetation.

Nature:
The loss of sensitive vegetation types on a cumulative basis in the broader context impacts the ability to meet stated conservation targets for Tsakane Clay Grassland in particular.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Medium-term (3)	Long Term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Definite (5)	Probable (3)
Significance	**Medium (30)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	No	No
Confidence in findings		
Can impacts be mitigated?	Yes	Yes

Mitigation:

- The development footprints of various facilities in the area must be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.
- An open space management plan should be developed for each individual development which must include management of biodiversity within the fenced area, as well as that in the adjacent rangeland.
- Reduce the footprint of facilities within sensitive habitat types as much as possible.

Residual Risks:
Considering the existing water infrastructure (existing Masetjaba water reservoir) and that this project acts as an expansion of that facility, the development will not set a further precedent of development in the broader Tsakane area. Some loss of vegetation is inevitable, and cannot be avoided, however the vegetation on site has a low sensitivity and conservation value, and contributes very little to no ecological function to the broader study area. Cumulative loss of conservation potential is thus regarded as medium taking into account other likely developments within the broader study region.

8.6. 'No-go' option

A viable alternative, the 'no-go' option, which essentially refers to the indefinite continuation of the current land use and operational management of the area, must also be assessed. This section thus assesses the impact of carrying on with the current activities on site, in terms of their ecological impact.

8.6.1. Issue 10: Control of alien plant species

Impact 10.1: Poor control of alien plant species during operation of the existing facility will lead to an increasing invasive species presence on site, as well as regulatory liability for their control

Nature: The lack of an effective alien vegetation management plan (and implementation thereof) will lead to increasing alien plant communities on site.	
	Without mitigation
Extent	Local (1)
Duration	Medium (3)
Magnitude	Moderate (6)
Probability	Highly probable (4)
Significance	**Medium (40)**
Status (positive or negative)	Negative
Reversibility	Moderate
Irreplaceable loss of resources?	No
Can impacts be mitigated?	Yes – provided an alien monitoring and management plan is developed and implemented for the ongoing operation of the facility.
Mitigation: » An Alien Monitoring and Management Plan must be developed and implemented during the operational phase to reduce the establishment and spread of undesirable alien plant species. » Ongoing monitoring should be conducted by the site manager to ensure problem-areas are identified where alien species are proliferating, and to inform the control efforts throughout the operational phase. » Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting etc., on a regular basis during operation. Removal must occur prior to plants developing seeds.	
Cumulative impacts: Due to the already moderately invaded nature of the site and broader project region, the cumulative impact of increasing invasive species abundance in the region is deemed low. Regardless, effective alien invasive species management through the implementation of the alien management plan is required to reduce introduction and establishment of novel invasive species.	
Residual Risks: Not applicable	

8.6.2. Issue 11: Loss of biodiversity and species richness from frequent fires

Impact 11.1: Poor control of fires on site, initiated by the ongoing burning of waste adjacent to the site, will alter the species composition and richness of the existing vegetation and continue to degrade the ecological function and processes on site.

Nature: The lack of an effective fire control mechanisms on site will promote the frequent burning of site (initiated by the adjacent waste burning), which in turn will lead to a loss in species richness and biodiversity represented by the site.	
	Without mitigation
Extent	Local (1)
Duration	Medium (3)

Magnitude	Moderate (6)
Probability	Highly probable (4)
Significance	**Medium (40)**
Status (positive or negative)	Negative
Reversibility	Low
Irreplaceable loss of resources?	No
Can impacts be mitigated?	Yes
Mitigation: » Prepare seasonal firebreaks around the facility to reduce incidences of fire spreading onto the property.	
Cumulative impacts: Due to the high occurrence of fires within the broader Gauteng region in the winter months, and the low likelihood of initiating fires within the project boundaries, poor fire control measures are not anticipated to have a cumulate effect on the nearby ecology (that is not currently present).	
Residual Risks: Not applicable.	

9. IMPACT STATEMENT, CONCLUSION AND RECOMMENDATIONS

9.1. Comparison of impacts

The following table (Table 9.1) summarises the change in impacts from pre- to post- mitigation for proposed development.

Table 9.1: Impact severity summary pre- and post-mitigation for all phases.

SEVERITY	PRE-MITIGATION (or in isolation – for cumulative impacts)					
	Construction	Operational	Decommissioning	Cumulative*	TOTAL	No-go**
LOW	4	0	2	2	8	0
MEDIUM	2	1	0	1	4	2
HIGH	0	0	0	0	0	0
SEVERITY	POST-MITIGATION (or broader context – for cumulative impacts)					
	Construction	Operational	Decommissioning	Cumulative***	TOTAL	
LOW	6	1	2	0	9	
MEDIUM	0	0	0	3	3	
HIGH	0	0	0	0	0	

* Cumulative impacts rated in isolation in this section.
**No-go impacts are represented here for comparison only.
*** Cumulative impacts rated in combination with other projects in the broader region, in this section.

Based on the results of the site assessment, the sensitivity analysis and the impact assessment, none of the anticipated impacts were deemed insurmountable, as all the pre-mitigation medium impacts were easily mitigated, and no high severity impacts were identified. Ecological areas have been mapped in terms of sensitivity for the project area and recommendations in chapter 8 in this report provide mitigation measures to reduce the severity of the impacts. Overall, it was determined that the identified ecological impacts associated with the facility can be affectively mitigated.

9.2. Current status

At present, the site is deemed highly disturbed due to ongoing disturbance through fires, invasive species, adjacent grazing and illegal dumping. The site has only recently been fenced, and has also historically been subject to grazing and frequent fires, as well as footpaths and other impacts due to the close proximity of the site to nearby human settlements. No sensitive Species of Conservation Concern were observed on site, with the remainder of the species observed regarded as Least Concern (LC) in terms of their conservation status. Overall the ecological contribution of the site was deemed to be low, with no sensitive species observed and few ecological process areas and habitat due to the small size and highly disturbed character of the proposed site.

The CBA classification for the proposed site thus does not correspond to the real-world condition of the plant and animal species observed on site, and therefore contributes poorly to the ecological function of the broader area. As such, the site is not deemed a functional CBA zone, as confirmed by the site assessment results, and thus the proposed development will not significantly impact the overall quantity and quality of the remaining CBA areas in the broader study area, should it be implemented. The project may thus

commence with little to no lasting negative impact on the current CBA classification of the immediate site and broader study area.

Furthermore, while the vegetation type deemed to be present on site has a high conservation value, the highly degraded real-world condition of the vegetation unit observed on site confirmed a minimal overall conservation contribution. The vegetation unit on site resembles Tsakane Clay Grassland through the species composition, but is highly degraded, with poor ecological functioning and a low conservation contribution, and as such does not represent a good conservation opportunity and does not currently contribute to the overall health and conservation status of the Tsakane Clay Grassland vegetation type. Should the development proceed, the loss of the highly degraded Tsakane Clay Grassland vegetation unit on site will not significantly reduce the conservation potential and current distribution of the vegetation type as a whole, due primarily to the servery degraded nature of the vegetation unit on site.

There are a number of alien and invasive plant species present onsite, particularly near the existing water facility where vehicle ingress and egress, parking and previous construction activities have degraded the immediate environment. Alien and invasive plant species found on site as well as their category according to the NEMBA Alien and Invasive Species Regulations (published 1 August 2014) are presented in Chapter 6 of this report.

As alien and invasive plants are found onsite, it is advised that an alien and invasive management plan is drafted and implemented during the construction phase and that active management of alien and invasive species is carried out during construction, operation and decommissioning phases.

Cumulative impacts were also determined for the project, with medium severity identified for all three cumulative impacts relating to the issue of a loss of biodiversity. Mitigation measures have been provided for the management of these impacts in the context of the broader study region. Considering the existing water infrastructure (i.e., the existing Masetjaba water reservoir), other development infrastructure (Masetjaba View community, roads, power lines), and that this project acts as an expansion of the current facility, the development will not set a further development precedent in the broader Tsakane area. Some loss of biodiversity is inevitable, and cannot be avoided, however the vegetation on site has a low sensitivity and conservation value, and contributes very little to no ecological function (and CBA area) to the broader study area. Cumulative loss of conservation potential is thus regarded as medium taking into account other likely developments within the broader study region. The cumulative impacts are deemed acceptable considering the existing poor condition of the site, and the broader character of the area (i.e. already developed and highly degraded).

9.3. Conditions for approval and mitigation measures to be included into the EMPr

All mitigation measures as supplied for the construction, operational and decommissioning phases in Chapter 8 of this report must be implemented as a condition of the environmental authorisation. These measures are summarised below for convenience.

9.3.1. Construction phase

- Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting etc., on a regular basis during construction. Removal must occur prior to plants developing seeds.

- All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential.
- An Alien Monitoring and Management Plan must be developed and implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species. The Alien Management Plan must be approved by the ECO prior to implementation.
- An ECO must be employed to demarcate areas for use during construction, and to ensure that the construction activities remain within the designated area and that no unauthorised activities occur.
- Any erosion observed should be rectified immediately and monitored thereafter to ensure interventions are successful.
- Develop a short invasive management plan and implement during construction to ensure alien species do not invade disturbed or cleared areas;
- In the event that SCC are identified during construction works, the relevant permits must be obtained from the relevant departments in order to remove animal SCC prior to commencement of further activities.
- Laydown areas and turning areas must be located in areas that have already been impacted or show evidence of degradation, such as the far-left corner of the property (facing the existing storage unit). The ECO or EO must identify such areas.
- Prohibit all employees from harvesting wild plants or hunting any animals on site;
- Prohibit open fires;
- Rehabilitate laydown and cleared areas immediately after they are no longer required;
- Reinstate as much of the eroded area to its pre-disturbed, "natural" levels;
- Should any SCC be identified during excavation, all animal and plant SCC must be relocated or removed from the construction footprint by a qualified specialist prior to commencement of further activities.
- Since this vegetation type is listed as endangered, impacts must be kept to a minimum through the development and implementation of an EMPr, and the employment of an Environmental Control Officer (ECO) for the duration of construction.
- The gravel access road and other disturbed areas (laydown areas) should be regularly monitored for erosion occurrences and must receive follow-up monitoring by the EO to assess the success of the remediation.
- Topsoil must be stockpiled separately to subsoil. This is done to conserve the existing seedbank and aid in the restoration of natural grasslands during rehabilitation.
- Topsoil should be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
- Vegetation clearing for the establishment of infrastructure must be kept to a minimum, by only clearing what is absolutely needed in order to further construction.
- Vegetation impacted must be restored and the area rehabilitated. It is likely that this will occur naturally but given the presence of alien species active rehabilitation and the removal of alien species will be required to ensure that only indigenous species remain.
- Where feasible, phased development and vegetation clearing should be practiced so that cleared areas are not left denuded and vulnerable to erosion for extended periods of time.

9.3.2. Operational phase

- Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting etc., on a regular basis during operation. Removal must occur prior to plants developing seeds.

- » An Alien Monitoring and Management Plan must be developed and implemented during the operational phase to reduce the establishment and spread of undesirable alien plant species.
- » Ongoing monitoring should be conducted by the site manager to ensure problem-areas are identified where alien species are proliferating, and to inform the control efforts throughout the operational phase.

9.3.3. Decommissioning phase

- » All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential.
- » Any erosion observed should be rectified immediately and monitored thereafter to ensure interventions are successful.
- » Design and implement a rehabilitation plan for the decommissioning phase;
- » If laydown areas and turning areas are required, these must be sited in areas that have already been impacted or show evidence of degradation;
- » Implement an alien invasive monitoring and management plan for the decommissioning phase;
- » Reinstate as much of the eroded area to its pre-disturbed, "natural" levels.
- » The gravel access road and other disturbed areas (laydown areas) should be regularly monitored for erosion occurrences and must receive follow-up monitoring by the EO to assess the success of the remediation.
- » Topsoil should be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
- » Where feasible, phased development and vegetation clearing should be practiced so that cleared areas are not left denuded and vulnerable to erosion for extended periods of time.

9.3.4. Cumulative impacts

Should the project be implemented, the following mitigation measures will reduce the cumulative impact of the project, in combination with all other anticipated projects within the broader study region:

- » An open space management plan should be developed for each individual development which must include management of biodiversity within the fenced area, as well as that in the adjacent rangeland.
- » Conserve the aquatic features (Spaarwater pan and riparian zones) in the broader landscape by allocating sufficient buffers to these and reducing development within those buffers as far as possible.
- » Reduce the footprint of facilities within proven sensitive habitat types as much as possible.
- » The development footprints of similar or related facilities in the area must be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.

9.3.5. Monitoring requirements

Two primary aspects emanating from the impact assessment require monitoring:

- » Invasive alien plant species; and
- » Decommissioning and rehabilitation.

Invasive alien plant species:

The earthworks associated with construction activities, combined with the deposition of cut and fill material (including soil) from various locations allows for the proliferation of invasive species through the spread of seed via transported material into novel environments. In addition, the presence of known invasive species on site further necessitate the monitoring and control of invasive alien plant species, so as to ensure no further spread and establishment of the current populations is allowed. The following monitoring protocol must be employed specifically to (Table 9.2):

i. Identify plant species on site that require control action; and
ii. Identify the location of invasive plant communities on site;

Table 9.2: Monitoring protocol for invasive alien plant species during construction and operation.

PHASE	FREQUENCY	PERSON RESPONSIBLE
CONSTRUCTION		
Monitoring of ongoing construction activities or site condition to ensure no new species have established on site, and to identify effective control measures for such invasive plant communities	Every four months	Site manager (operational manager)
Monitoring of ongoing construction activity and earthworks to identify species and locations of new occurrences of invasive alien plants	Once monthly	Environmental Control Officer/Environmental Site Officer/Resident Engineer
Monitoring of soil stockpiles for Alien Invasive Species growth	Once monthly	Environmental Site Officer/Resident Engineer
OPERATION		
Monitoring of ongoing operational and maintenance activities or site condition to ensure no new species have established on site, and to identify effective control measures for such invasive plant communities	Every four months	Site manager (operational manager)

Decommissioning and rehabilitation:

Rehabilitation measures conducted during rehabilitation of the site must ensure that the low sensitivity areas are appropriately restored to a near-natural state prior to site closure. As such, a rehabilitation plan for the decommissioning phase must be designed and implemented prior to the commencement of decommissioning. The implementation of this plan must be monitored by a suitable representative (Environmental Site Officer, Resident Engineer or Contractors Representative) and in accordance with the frequency and method as determined by the rehabilitation plan.

9.4. Environmental statement and specialist opinion

The ecological impacts of all aspects for the proposed project were assessed and considered to be ecologically acceptable (i.e. **no fatal flaws** were determined), provided that the mitigation measures provided in this report are implemented. Implementation of recommended mitigation measures is an important element of the mitigation strategy and will reduce all identified impacts to low negative.

No alternatives, apart from the no-go option, were considered for this project. However, the no-go option allows for two ongoing impacts of medium severity, which may be reduced to low via management intervention should this project proceed. As such, this development proposal represents a means to reduce invasive species presence and improve fire management of the site (provided mitigation measures are strictly and effectively implemented) and may thus serve to preserve the current poor ecological functioning of the site in the long term. Cumulative impacts from this development proposals were all deemed low or negligible in the context of ecological functioning and contribution of the project site.

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11. APPENDIX A: COMPREHENSIVE SPECIES LISTS FOR FAUNAL AND FLORAL SPECIES THAT MAY OCCUR ON SITE

Table 11.1: Full species list of reptiles that may occur on the project site.

Family	Scientific name	Common name	Red list category (SARCA, 2014)
Agamidae	*Agama aculeata distanti*	Distant's Ground Agama	LC
Agamidae	*Agama atra*	Southern Rock Agama	LC
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped Snake	LC
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	LC
Cordylidae	*Cordylus vittifer*	Common Girdled Lizard	LC
Cordylidae	*Pseudocordylus melanotus melanotus*	Common Crag Lizard	LC
Elapidae	*Hemachatus haemachatus*	Rinkhals	LC
Gekkonidae	*Pachydactylus affinis*	Transvaal Gecko	LC
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	LC
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	LC
Lacertidae	*Nucras lalandii*	Delalande's Sandveld Lizard	LC
Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	LC
Lamprophiidae	*Boaedon capensis*	Brown House Snake	LC
Lamprophiidae	*Lamprophis aurora*	Aurora House Snake	LC
Lamprophiidae	*Lycodonomorphus rufulus*	Brown Water Snake	LC
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	LC
Lamprophiidae	*Prosymna sundevallii*	Sundevall's Shovel-snout	LC
Lamprophiidae	*Psammophis crucifer*	Cross-marked Grass Snake	LC
Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	LC
Lamprophiidae	*Pseudaspis cana*	Mole Snake	LC
Leptotyphlopidae	*Leptotyphlops scutifrons conjunctus*	Eastern Thread Snake	Unlisted
Scincidae	*Panaspis wahlbergi*	Wahlberg's Snake-eyed Skink	LC
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	LC
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	LC
Viperidae	*Bitis arietans arietans*	Puff Adder	LC
Viperidae	*Causus rhombeatus*	Rhombic Night Adder	LC

Table 11.2: Full species list of frogs that may occur on the project site.

Family	Scientific name	Common name	Red list category
Bufonidae	Schismaderma carens	Red Toad	Least Concern
Bufonidae	Sclerophrys capensis	Raucous Toad	Least Concern
Bufonidae	Sclerophrys gutturalis	Guttural Toad	Least Concern
Hyperoliidae	Kassina senegalensis	Bubbling Kassina	Least Concern
Pipidae	Xenopus laevis	Common Platanna	Least Concern
Pyxicephalidae	Amietia delalandii	Delalande's River Frog	Least Concern
Pyxicephalidae	Amietia fuscigula	Cape River Frog	Least Concern

Pyxicephalidae	Cacosternum boettgeri	Common Caco	Least Concern
Pyxicephalidae	Pyxicephalus adspersus	Giant Bull Frog	Near Threatened
Pyxicephalidae	Tomopterna cryptotis	Tremelo Sand Frog	Least Concern

Table 11.3: Full species list of mammals that may occur on the project site.

Family	Scientific name	Common name	Red list category
Bathyergidae	Cryptomys hottentotus	Southern African Mole-rat	Least Concern (2016)
Bovidae	Alcelaphus buselaphus	Hartebeest	Least Concern
Bovidae	Antidorcas marsupialis	Springbok	Least Concern (2016)
Bovidae	Connochaetes gnou	Black Wildebeest	Least Concern (2016)
Bovidae	Damaliscus pygargus phillipsi	Blesbok	Least Concern (2016)
Bovidae	Raphicerus campestris	Steenbok	Least Concern (2016)
Bovidae	Redunca arundinum	Southern Reedbuck	Least Concern (2016)
Bovidae	Sylvicapra grimmia	Bush Duiker	Least Concern (2016)
Bovidae	Taurotragus oryx	Common Eland	Least Concern (2016)
Canidae	Canis mesomelas	Black-backed Jackal	Least Concern (2016)
Emballonuridae	Taphozous (Taphozous) mauritianus	Mauritian Tomb Bat	Least Concern
Equidae	Equus quagga	Plains Zebra	Least Concern (2016)
Hystricidae	Hystrix africaeaustralis	Cape Porcupine	Least Concern
Leporidae	Lepus saxatilis	Scrub Hare	Least Concern
Muridae	Aethomys namaquensis	Namaqua Rock Mouse	Least Concern
Muridae	Gerbilliscus leucogaster	Bushveld Gerbil	Least Concern (2016)
Muridae	Mastomys sp.	Multimammate Mice	
Muridae	Mus (Nannomys) minutoides	Southern African Pygmy Mouse	Least Concern
Muridae	Otomys auratus	Southern African Vlei Rat	Near Threatened (2016)
Muridae	Rhabdomys pumilio	Xeric Four-striped Grass Rat	Least Concern (2016)
Mustelidae	Aonyx capensis	African Clawless Otter	Near Threatened (2016)
Mustelidae	Poecilogale albinucha	African Striped Weasel	Near Threatened (2016)
Soricidae	Crocidura mariquensis	Swamp Musk Shrew	Near Threatened (2016)
Soricidae	Myosorex varius	Forest Shrew	Least Concern (2016)
Vespertilionidae	Myotis welwitschii	Welwitsch's Myotis	Least Concern (2016)

Table 11.4: Full species list of scorpions that may occur on the project site.

Family	Scientific name	Common name	Red list category
BUTHIDAE	Pseudolychas ochraceus	Plain Pygmy-thicktail	unlisted

Table 11.5: Full species list of spiders that may occur on the project site.

Family	Scientific name	Common name	Red list category
Araneidae	Neoscona sp.	Neoscona hairy field spiders	Unlisted

Oxyopidae	Oxyopes sp.	Grass lynx spiders	Unlisted
Philodromidae	FAMILY Philodromidae	Running spiders	Unlisted
Pholcidae	FAMILY Pholcidae	Daddy longlegs spiders	Unlisted
Pisauridae	Rothus sp.	Crowned pisaurids	Unlisted
Scytodidae	Scytodes sp.	spitting spiders	Unlisted
Sparassidae	FAMILY Sparassidae	Huntsman spiders	Unlisted
Sparassidae	Palystes sp.	Rain spiders	Unlisted
Theraphosidae	Harpactira hamiltoni		Unlisted
Theridiidae	Theridion sp.	comb-footed or cobweb spiders	Unlisted
Theridiidae	Theridion purcelli	Common false house button spiders	Unlisted
Thomisidae	Thomisus sp.	Flower crab spiders	Unlisted
Trochanteriidae	Platyoides sp.	scorpion spiders	Unlisted
Uloboridae	FAMILY Uloboridae	Hackled orb-web spiders	Unlisted
Uloboridae	Uloborus sp.	hackled orb-web spiders	Unlisted

Table 11.6: Full species list of birds that may occur on the project site.

Spp	Taxon Name	Common Name	Red List (ESKOM, 2015)	IUCN Red List
Grebe	*Podiceps cristatus*	Great Crested	-	LC
Grebe	*Podiceps nigricollis*	Black-necked	-	LC
Grebe	*Tachybaptus ruficollis*	Little	-	LC
Cormorant	*Phalacrocorax carbo*	White-breasted	-	LC
Cormorant	*Phalacrocorax africanus*	Reed	-	LC
Darter	*Anhinga rufa*	African	-	LC
Heron	*Ardea cinerea*	Grey	-	LC
Heron	*Ardea melanocephala*	Black-headed	-	LC
Heron	*Ardea goliath*	Goliath	-	LC
Heron	*Ardea purpurea*	Purple	-	LC
Egret	*Egretta alba*	Great	-	LC
Egret	*Egretta garzetta*	Little	-	LC
Egret	*Bubulcus ibis*	Cattle	-	LC
Heron	*Ardeola ralloides*	Squacco	-	LC
Heron	*Egretta ardesiaca*	Black	-	LC
Bittern	*Ixobrychus minutus*	Little	-	LC
Night-Heron	*Nycticorax nycticorax*	Black-crowned	-	LC
Hamerkop	*Scopus umbretta*	Hamerkop	-	LC
Ibis	*Threskiornis aethiopicus*	African Sacred	-	LC
Ibis	*Plegadis falcinellus*	Glossy	-	LC
Ibis	*Bostrychia hagedash*	Hadeda	-	LC
Spoonbill	*Platalea alba*	African	-	LC
Flamingo	*Phoenicopterus ruber*	Greater	-	LC
Flamingo	*Phoenicopterus minor*	Lesser	-	NT
Goose	*Plectropterus gambensis*	Spur-winged	-	LC
Goose	*Alopochen aegyptiacus*	Egyptian	-	LC
Shelduck	*Tadorna cana*	South African	-	LC

Shoveler	*Anas smithii*	Cape	-	LC
Duck	*Anas sparsa*	African Black	-	LC
Duck	*Anas undulata*	Yellow-billed	-	LC
Teal	*Anas erythrorhyncha*	Red-billed	-	LC
Teal	*Anas capensis*	Cape	-	LC
Teal	*Anas hottentota*	Hottentot	-	LC
Duck	*Dendrocygna viduata*	White-faced	-	LC
Duck	*Dendrocygna bicolor*	Fulvous	-	LC
Pochard	*Netta erythrophthalma*	Southern	-	LC
Duck	*Oxyura maccoa*	Maccoa	NT	VU
Falcon	*Falco amurensis*	Amur	-	LC
Kite	*Elanus caeruleus*	Black-shouldered	-	LC
Francolin	*Scleroptila levaillantoides*	Orange River	-	LC
Spurfowl	*Pternistis swainsonii*	Swainson's	-	LC
Quail	*Coturnix coturnix*	Common	-	LC
Guineafowl	*Numida meleagris*	Helmeted	-	LC
Rail	*Rallus caerulescens*	African	-	LC
Crake	*Amaurornis flavirostris*	Black	-	LC
Flufftail	*Sarothrura rufa*	Red-chested	-	LC
Swamphen	*Porphyrio madagascariensis*	African Purple	-	-
Moorhen	*Gallinula chloropus*	Common	-	LC
Coot	*Fulica cristata*	Red-knobbed	-	LC
Plover	*Charadrius pecuarius*	Kittlitz's	-	LC
Plover	*Charadrius tricollaris*	Three-banded	-	LC
Lapwing	*Vanellus coronatus*	Crowned	-	LC
Lapwing	*Vanellus armatus*	Blacksmith	-	LC
Lapwing	*Vanellus senegallus*	African Wattled	-	LC
Snipe	*Gallinago nigripennis*	African	-	LC
Sandpiper	*Calidris ferruginea*	Curlew	LC	NT
Stint	*Calidris minuta*	Little	-	LC
Ruff	*Philomachus pugnax*	Ruff	-	LC
Sandpiper	*Actitis hypoleucos*	Common	-	LC
Sandpiper	*Tringa stagnatilis*	Marsh	-	LC
Greenshank	*Tringa nebularia*	Common	-	LC
Sandpiper	*Tringa glareola*	Wood	-	LC
Avocet	*Recurvirostra avosetta*	Pied	-	LC
Stilt	*Himantopus himantopus*	Black-winged	-	LC
Thick-knee	*Burhinus capensis*	Spotted	-	LC
Pratincole	*Glareola nordmanni*	Black-winged	NT	NT
Gull	*Larus cirrocephalus*	Grey-headed	-	LC
Tern	*Chlidonias leucopterus*	White-winged	-	LC
Tern	*Chlidonias hybrida*	Whiskered	-	LC
Pigeon	*Columba guinea*	Speckled	-	LC
Dove	*Streptopelia semitorquata*	Red-eyed	-	LC
Turtle-dove	*Streptopelia capicola*	Cape	-	LC
Dove	*Streptopelia senegalensis*	Laughing	-	LC

Cuckoo	*Chrysococcyx caprius*	Diderick	-	LC
Owl	*Asio capensis*	Marsh	-	LC
Swift	*Apus caffer*	White-rumped	-	LC
Swift	*Apus affinis*	Little	-	LC
Palm-swift	*Cypsiurus parvus*	African	-	LC
Mousebird	*Colius striatus*	Speckled	-	LC
Mousebird	*Urocolius indicus*	Red-faced	-	LC
Kingfisher	*Ceryle rudis*	Pied	-	LC
Hoopoe	*Upupa africana*	African	-	-
Barbet	*Lybius torquatus*	Black-collared	-	LC
Lark	*Mirafra cheniana*	Melodious	-	LC
Lark	*Mirafra africana*	Rufous-naped	-	LC
Lark	*Chersomanes albofasciata*	Spike-heeled	-	LC
Lark	*Calandrella cinerea*	Red-capped	-	LC
Swallow	*Hirundo rustica*	Barn	-	LC
Swallow	*Hirundo albigularis*	White-throated	-	LC
Swallow	*Hirundo cucullata*	Greater Striped	-	LC
Swallow	*Hirundo abyssinica*	Lesser Striped	-	LC
Cliff-swallow	*Hirundo spilodera*	South African	-	LC
Martin	*Hirundo fuligula*	Rock	-	-
Martin	*Riparia riparia*	Sand	-	LC
Martin	*Riparia paludicola*	Brown-throated	-	LC
Martin	*Riparia cincta*	Banded	-	LC
Crow	*Corvus albus*	Pied	-	LC
Bulbul	*Pycnonotus tricolor*	Dark-capped	-	-
Wheatear	*Oenanthe monticola*	Mountain	-	LC
Wheatear	*Oenanthe pileata*	Capped	-	LC
Chat	*Myrmecocichla formicivora*	Anteating	-	LC
Stonechat	*Saxicola torquatus*	African	-	LC
Swamp-warbler	*Acrocephalus gracilirostris*	Lesser	-	LC
Reed-warbler	*Acrocephalus baeticatus*	African	-	LC
Warbler	*Acrocephalus schoenobaenus*	Sedge	-	LC
Rush-warbler	*Bradypterus baboecala*	Little	-	LC
Cisticola	*Cisticola juncidis*	Zitting	-	LC
Cisticola	*Cisticola aridulus*	Desert	-	LC
Cisticola	*Cisticola textrix*	Cloud	-	LC
Cisticola	*Cisticola ayresii*	Wing-snapping	-	LC
Neddicky	*Cisticola fulvicapilla*	Neddicky	-	LC
Cisticola	*Cisticola tinniens*	Levaillant's	-	LC
Prinia	*Prinia subflava*	Tawny-flanked	-	LC
Prinia	*Prinia flavicans*	Black-chested	-	LC
Wagtail	*Motacilla capensis*	Cape	-	LC
Pipit	*Anthus cinnamomeus*	African	-	LC
Pipit	*Anthus leucophrys*	Plain-backed	-	LC
Longclaw	*Macronyx capensis*	Cape	-	LC

Fiscal	*Lanius collaris*	Common (Southern)	-	LC
Bokmakierie	*Telophorus zeylonus*	Bokmakierie	-	LC
Myna	*Acridotheres tristis*	Common	-	LC
Starling	*Creatophora cinerea*	Wattled	-	LC
Starling	*Lamprotornis nitens*	Cape Glossy	-	LC
Starling	*Spreo bicolor*	Pied	-	LC
Sparrow-weaver	*Plocepasser mahali*	White-browed	-	LC
Sparrow	*Passer domesticus*	House	-	LC
Sparrow	*Passer melanurus*	Cape	-	LC
Masked-weaver	*Ploceus velatus*	Southern	-	LC
Weaver	*Amblyospiza albifrons*	Thick-billed	-	LC
Quelea	*Quelea quelea*	Red-billed	-	LC
Bishop	*Euplectes orix*	Southern Red	-	LC
Bishop	*Euplectes afer*	Yellow-crowned	-	LC
Widowbird	*Euplectes ardens*	Red-collared	-	LC
Widowbird	*Euplectes albonotatus*	White-winged	-	LC
Widowbird	*Euplectes axillaris*	Fan-tailed	-	LC
Widowbird	*Euplectes progne*	Long-tailed	-	LC
Waxbill	*Amandava subflava*	Orange-breasted	-	LC
Waxbill	*Estrilda astrild*	Common	-	LC
Quailfinch	*Ortygospiza atricollis*	African	-	LC
Whydah	*Vidua macroura*	Pin-tailed	-	LC
Canary	*Crithagra atrogularis*	Black-throated	-	LC
Canary	*Crithagra flaviventris*	Yellow	-	LC
Dove	*Columba livia*	Rock	-	LC
Korhaan	*Afrotis afraoides*	Northern Black	-	LC
Thrush	*Turdus smithi*	Karoo	-	LC
White-eye	*Zosterops virens*	Cape	-	LC
Coucal	*Centropus burchellii*	Burchell's	-	-
Sparrow	*Passer diffusus*	Southern Grey-headed	-	LC

12. APPENDIX B: IMPACT ASSESSMENT METHODOLOGY

Impact Assessment methodology:

Direct, indirect and cumulative impacts of the issues identified through the EIA process, as well as all other issues identified due to the amendment must be assessed in terms of the following criteria:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - medium-term (5–15 years) – assigned a score of 3;
  - long term (> 15 years) - assigned a score of 4; or
  - permanent - assigned a score of 5;
- The **consequences (magnitude)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the **status**, which will be described as either positive, negative or neutral.
- the degree to which the impact can be reversed.
- the degree to which the impact may cause irreplaceable loss of resources.
- the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:
S = (E+D+M)P
S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

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

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),

» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Assessment of impacts must be summarised in the following table format. The rating values as per the above criteria must also be included. The table must be completed and associated ratings for **each** impact identified during the assessment should also be included.

Example of Impact table summarising the significance of impacts (with and without mitigation):

Nature: **[Outline and describe fully the impact anticipated as per the assessment undertaken]**		
	Without mitigation	**With mitigation**
Extent	High (3)	Low (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: "Mitigation", means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible. Provide a description of how these mitigation measures will be undertaken keeping the above definition in mind.		
Cumulative impacts: "Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[1].		
Residual Risks: "Residual Risk", means the risk that will remain after all the recommended measures have been undertaken to mitigate the impact associated with the activity (Green Leaves III, 2014).		

[1] Unless otherwise stated, all definitions are from the 2014 EIA Regulations (as amended on 07 April 2017), GNR 326.

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13. APPENDIX C: SPECIALIST CV

CURRICULUM VITAE OF GIDEON RAATH

Profession : Environmental and Permitting Consultant

Specialisation: Environmental Impact Assessments, Water Use Licencing, Waste Licencing, Environmental Compliance Officer, Ecological Specialist, Wetland Specialist, GIS, MPRDA permitting

Work Experience: 4.5 years' experience in environmental management, National Water Act, Mineral and Petroleum Resources Development Act, ECO and compliance auditing, wetland and ecological specialist reporting

VOCATIONAL EXPERIENCE

Gideon holds an MSc (Geography and Environmental Management; SU), a BSc Honours (Ecology and Environmental Studies - Cum laude; Wits) and a BSc (Geography and Environmental Management; UJ). His MSc thesis focused on the hydrological impact on the spatial distribution of invasive Eucalyptus trees along the Breede River, while his honours thesis evaluated ethnobotanical relationships around the Rio Tinto copper mine in Phalaborwa. Most recently he has worked as an Environmental Consultant at EOH Coastal and Environmental Services (EOH CES), conducting environmental authorisations applications (NWA, NEMA, MPRDA), Public Participation Processes, GIS specialisation as well as Ecological and Wetland specialist studies. Previously, Gideon worked as the Monitoring & Evaluation Project Manager for the City of Cape Town's invasive species unit (Environmental Resources Management Department).
Gideon's GIS background includes the management of the City of Cape Town invasive species GIS database, involving the storage, management, recall and quality control off all sightings, clearance visits and known infestations. Further experience include mapping for various consulting projects, boundary verification through ground-truthing and the spatial mapping and delineation component of this MSc research. Gideon has further attended public participation workshops, and has been involved with IAP identification, translation, public meetings and engagement for a variety of projects, mainly within the Afrikaans speaking Northern Cape. Gideon is interested in invasion ecology, treatment of groundwater pollution through phytoremediation, botanical and wetland specialist studies, GIS application for ecology and environmental management, and the EIA processes in general.

SKILLS BASE AND CORE COMPETENCIES

- Environmental Management
- GIS data manipulation, storage, management and mapping
- EIA Impact Assessments and Basic Assessment
- Environmental Management Programmes
- Environmental Compliance Monitoring
- Mining Rights, Mining Permits, Prospecting Rights (and renewal) applications (MPRDA & NEMA)
- Public and Stakeholder Engagement (NEMA)
- Ecological/Botanical Specialist Studies

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- Wetland Delineation, Functional and Impact Assessment studies
- Water Use Licence Applications (NWA)
- General Authorisations (NWA)

EDUCATION AND PROFESSIONAL STATUS

Degrees:

- M.Sc. Geography and Environmental Science (2014), Stellenbosch University (2014)
- B.Sc. (Hons) Ecology, Environment and Conservation (Cum Laude), University of the Witwatersrand (2011)
- B.Sc. Life and Environmental Sciences, University of Johannesburg (2010)

Short Courses:

- GroundTruth SASS5 competency course, GroundTruth Aquatic Consulting (2017)
- DWS 21C&I GA training workshop, Department of Water and Sanitation (2016)
- IAIAsa Public Participation Process Workshop, IAIA South Africa (2016)
- EIA Theory and application, EOH Coastal and Environmental Services (2015)
- Water Safety Training, City of Cape Town Environmental Resources Department (2014)
- Herbicide safety and application for weed control, City of Cape Town Environmental Resources Department (2014)
- Snake awareness training, City of Cape Town Environmental Resources Department (2014)
- Habitable Planet Workshop, Applied Centre for Climate & Earth Systems Science, Cape Town (2011)

Professional Society Affiliations:

- Golden Key International Honour Society – University of the Witwatersrand Chapter
- South African Council for Scientific Natural Professionals (SACNASP): Certified Natural Scientist – Pr.Sci.Nat. (Membership No.: 117178)
- IAIAsa (Membership No.: 3619)

Other Relevant Skills:

- GPS use, spatial data capturing and ground truthing

EMPLOYMENT

Date	Company	Roles and Responsibilities
October 2018 - Current:	Savannah Environmental (Pty) Ltd	Environmental and Permitting Consultant Tasks include: Undertaking environmental impact assessments, basic assessments, environmental management programmes (EMPrs), environmental amendments, water use license applications, general authorisations, wetland assessments, botanical/ecological assessments, mining rights and permit applications, prospecting rights applications, environmental compliance officer audits and reporting, Ensuring environmental compliance on permitting processes, client liaison and relationship management.

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Date	Company	Roles and Responsibilities
February 2015 – September 2018	EOH Coastal and Environmental Services (Pty) Ltd	Senior Environmental Consultant Tasks included: Undertaking environmental impact assessments, basic assessments, environmental management programmes (EMPrs), environmental amendments, water use license applications, general authorisations, wetland assessments, botanical/ecological assessments, mining rights and permit applications, prospecting rights applications, environmental compliance officer audits and reporting, Ensuring environmental compliance on permitting processes, client liaison and relationship management, public participation processes for environmental authorisations.
March 2014 – February 2015	Invasive Species Unit (ISU), Environmental Resources Management Department (ERMD), City of Cape Town	Professional Officer Tasks included: Managed the Monitoring & Evaluation project portfolio, entailing the establishment of an invasive species monitoring & evaluation system for the ISU, as well as GIS database management, quality assurance and reporting thereof. Position required managing a small staff compliment (dealing directly with GIS database management), managing time and budgets for the monitoring division, conducting monitoring trials and research, writing species management plans as well as handling the GIS database, quality control, verification and integrity for the ISU.
January 2012 – March 2014	University of Stellenbosch	Departmental Assistant Tasks included: Technical editing of academic reports. Formatting of PhD and MSc reports on a weekly basis, with short turnaround time and good quality feedback.
January 2011 – January 2012	University of the Witwatersrand	Departmental Assistant Tasks included: Responsible for practical tutorials and marking of 1st year medical students. Included zoology and botany.
January 2006 – November 2010 (part time)	Codeon Networking CC	Co-founder and web developer Tasks included: Small business owner, responsible for all facets of the business. Self-taught HTML, CSS,

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Date	Company	Roles and Responsibilities
		PHP and MySQL. Won and produced two medium enterprise websites serving the gaming community. Websites required user profiles & permissions, CMS system and automated payment options as functionality. Development and maintenance of a user database and account management system.

PROJECT EXPERIENCE

Project experience includes project management, EIA, BA and EMPr documentation development, integrated water use license applications, general authorisations, specialist botanical and ecological impact assessments, specialist wetland delineation and impact assessments, GIS applications and mapping, compliance auditing and monitoring, vegetation rehabilitation and monitoring plans, integrated waste management plans and waste licencing, mining right & permits, as well as prospecting rights applications.
Industry experience includes the waste sector (IWMP's and waste licencing), road and rail infrastructure (BAR, S&EIR, WUL/GA, Waste Licence), ports and harbours (management plans), private sector clients across varying industries (various permits), mining sector (BAR, S&EIR, mining permits and rights, prospecting rights), conservation sector (biodiversity plans), renewable energy industry (BAR, S&EIR) as well as the gas and oil industry (biodiversity reports).

RENEWABLE POWER GENERATION PROJECTS: SOLAR ENERGY FACILITIES

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
Enel Paleisheuwel Solar compliance auditing, Paleisheuwel, Northern Cape	Enel Green Power RSA (EGP RSA)	Environmental consultant

RENEWABLE POWER GENERATION PROJECTS: WIND ENERGY FACILITIES

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
G7 Brandvalley S&EIR, Matjiesfontein, Northern Cape	G7 Renewable Energy (Pty) Ltd	Environmental consultant
G7 Rietkloof S&EIR, Matjiesfontein, Northern Cape	G7 Renewable Energy (Pty) Ltd	Environmental consultant

Basic Assessments

Project Name & Location	Client Name	Role
G7 Renewable Energy 132kV BAR & EMPr, Matjiesfontein, Northern Cape	G7 Renewable Energy (Pty) Ltd	Project Manager, Environmental consultant, Public Participation

Compliance Advice and ESAP reporting

Project Name & Location	Client Name	Role

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Biotherm Energy Golden Valley Wind Energy Facility ESAP, Bedford, Eastern Cape	Biotherm Energy Pty Ltd	Environmental consultant

Amendments

Project Name & Location	Client Name	Role
Mosselbay Energy EA Amendment, Mosselbay, Western Cape	Mosselbay Energy IPP (Pty) Ltd	Environmental consultant

GAS PROJECTS

Screening Studies

Project Name & Location	Client Name	Role
iGas integrated biodiversity screening, Saldanha, Western Cape	Central Energy Fund - iGas (subsidiary)	Environmental consultant, Faunal specialist (assistant)

MINING SECTOR PROJECTS

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Triton Minerals Limited Ancuabe and Nicanda Hills EPDA, Ancuabe, Cabo Del Gado Province, Mozambique	Triton Minerals Ltd	Environmental consultant
Ancuabe graphite mine Environmental and Social Impact Assessment (ESIA), Cabo Del Gado Province, Mozambique	Grafex Limitada Mozambique	Environmental consultant

Basic Assessments

Project Name & Location	Client Name	Role
SANRAL material sourcing BAR (DMR), Hendrina, Mpumalanga Province	SANRAL SOC Ltd & Leo consulting engineers	Project Manager, Environmental consultant, Public Participation
SANRAL Bierspruit R510 Borrow Pit authorisation, Thabazimbi, Limpopo Province	SANRAL SOC Ltd & Royal HaskoningDHV South Africa	Project Manager, Environmental consultant, Ecological specialist, Public Participation
Almenar tin prospecting BAR, Carnarvon, Northern Cape	Almenar Property Investments (Pty) Ltd	Environmental consultant

Rehabilitation Studies

Project Name & Location	Client Name	Role
Ancuabe baseline vegetation monitoring assessment and programme, Ancuabe, Cabo Del Gado Province, Mozambique	Grafex Limitada Mozambique	Botanical specialist
Prospecting pit rehabilitation programme, Ancuabe, Cabo Del Gado Province, Mozambique	Grafex Limitada Mozambique	Botanical specialist, Environmental consultant
Mayfield Quarry rehabilitation plan, Grahamstown, Eastern Cape	Mayfield Quarry	Environmental consultant

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Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
Construction monitoring and DMR environmental authorisation, Hendrina, Mpumalanga Province	SANRAL SOC Ltd & Leo consulting engineers	Project Manager, ECO,
SANRAL Caledon N2 Section 3 road upgrade ECO Audits and Reporting, Caledon, Western Cape Province	JG Afrika Engineering	Project Manager, ECO

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
VMC Mining permit renewal application, Rust De Winter, Gauteng	Vergenoeg Mining Company (Pty) Ltd	Environmental consultant
Zirco Resources Kamiesberg heavy mineral sand mine water use licence, Kamiesberg, Northern Cape	Zirco Roode Heuwel (Pty) Ltd	Environmental consultant

INFRASTRUCTURE DEVELOPMENT PROJECTS (BRIDGES, PIPELINES, ROADS, WATER RESOURCES, STORAGE, ETC)

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
S&EIR authorisation for the SANRAL Zandkraal-Windburg N1 road upgrade, Windburg, Free State Province	SANRAL SOC Ltd & SMEC Consulting Engineers	Project Manager, Environmental consultant, Public Participation
Thabazimbi Local Municipality Integrated Waste Management Plan, Thabazimbi, Limpopo Province	Thabazimbi Local Municipality & Anglo American Plc	Environmental consultant, Public Participation

Basic Assessments

Project Name & Location	Client Name	Role
SANRAL Masekwaspoort N1 Road Upgrade BA, Louis Trichardt, Limpopo Province	SANRAL SOC Ltd & Knight Piésold Consulting	Project Manager, Environmental consultant, Public Participation
SANRAL Polokwane N1 Ring Road Upgrade Basic Assessment, Polokwane, Limpopo Province	SANRAL SOC Ltd & KBK Engineers	Environmental consultant
Boshoek Loop Rail Upgrade BAR, Rustenburg, North-West Province	Transnet SOC Ltd	Project Manager, Environmental consultant, Wetland specialist, Public Participation
Heysterkrand Loop Rail Upgrade BAR, Rustenburg, North-West Province	Transnet SOC Ltd	Project Manager, Environmental consultant, Public Participation
SANRAL Bierspruit R510 road upgrade Basic Assessment, Thabazimbi, Limpopo Province	SANRAL SOC Ltd & Royal HaskoningDHV South Africa	Project Manager, Environmental consultant, Ecological specialist, Public Participation

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Barberton IAPS Waste Water Treatment Works development BAR, Barberton, Mpumalanga Province	Umjindi Local Municipality and Rhodes University	Project Manager, Environmental consultant, Public Participation
SANRAL Caledon N2 Section 3 road upgrade project Basic Assessment, Caledon, Western Cape Province	JG Afrika Engineering	Project Manager, Environmental consultant, Ecological specialist, ECO

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
Construction Monitoring and DMR environmental authorisation, Hendrina, Mpumalanga Province	SANRAL SOC Ltd & Leo consulting engineers	Project Manager, Environmental consultant, ECO

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
Water use licence for the SANRAL Zandkraal-Windburg N1 road upgrade and quarrying, Windburg, Free State Province	SANRAL SOC Ltd & SMEC Consulting Engineers	Project Manager, Environmental consultant, Public Participation
SANRAL Masekwaspoort N1 road upgrade water use licence application, Louis Trichardt, Limpopo Province	SANRAL SOC Ltd & Knight Piésold Consulting	Project Manager, Environmental consultant, Public Participation
Boshoek Loop Rail Upgrade water use licence application, Rustenburg, North-West Province	Transnet SOC Ltd	Project Manager, Environmental consultant, Wetland specialist, Public Participation
SANRAL Bierspruit R510 road water use licence, Thabazimbi, Limpopo Province	SANRAL SOC Ltd & Royal HaskoningDHV South Africa	Project Manager, Environmental consultant, Ecological specialist, Public Participation
Barberton IAPS Waste Water Treatment Works water use licence and SASS 5 assessment, Barberton, Mpumalanga Province	Umjindi Local Municipality and Rhodes University	Project Manager, Environmental consultant, Aquatic specialist, Public Participation
SANRAL Caledon N2 Section 3 road upgrade water use licence and specialist reports, Caledon, Western Cape Province	JG Afrika Engineering	Project Manager, Environmental consultant, Ecological specialist, Public Participation

HOUSING AND URBAN PROJECTS

ENVIRONMENTAL IMPACT ASSESSMENTS AND ENVIRONMENTAL MANAGEMENT PROGRAMMES

Project Name & Location	Client Name	Role

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Scoping and EIR authorisation, Water Use Licence, for the Ganspan tourism facility development, Jan Kempdorp, Northern Cape	Frances Baard Local Municipality	Project Manager, Environmental consultant, Public Participation

Basic Assessments

Project Name & Location	Client Name	Role
Basic Assessment for the office complex development within the Pretoria National Botanical Gardens, Pretoria, Gauteng	South African National Biodiversity Institute (SANBI)	Project Manager, Environmental consultant, Public Participation, ECO
Corner Berg and Drooge Street township development BAR, Zeerust, North-West Province	Ramotshere Moiloa Local Municipality	Project Manager, Environmental consultant, Public Participation
Corner Kort and Bree Street township development BAR, Zeerust, North-West Province	Ramotshere Moiloa Local Municipality	Project Manager, Environmental consultant, Public Participation
Hope Village township development BAR, Johannesburg, Gauteng	Door of Hope Charity Organisation	Project Manager, Environmental consultant, Public Participation
ACSA Jones Road Filling Station Basic Assessment, Johannesburg, Gauteng	Airports Company South Africa SOC Ltd	Project Manager, Environmental consultant, Public Participation

Screening Studies

Project Name & Location	Client Name	Role
Kibler Park Church Development ecological assessment, Johannesburg, Gauteng	Riverside Community Church	Project Manager, Ecological specialist
DEA Quoin Point dune specialist assessments, Gansbaai, Western Cape	Department of Environmental Affairs (national)	Project Manager, Environmental consultant

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
Transnet Depot and Siding compliance auditing programme, Johannesburg, Gauteng & Rustenburg, North-West Province	Transnet SOC Ltd	ECO
Environmental compliance monitoring for the office complex development within the Pretoria National Botanical Gardens, Pretoria, Gauteng	South African National Biodiversity Institute (SANBI)	Project Manager, Environmental consultant, Public Participation, ECO

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
Atmospheric Emissions Licence, Section 24G for the ER Galvanizing plant and operations, Johannesburg, Gauteng	ER Galvanizers Pty Ltd	Project Manager, Environmental consultant, Public Participation
City of Johannesburg nature reserve proclamation (Phase II), Johannesburg, Gauteng	City of Johannesburg SOC Ltd	Project Manager, Environmental consultant,

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		Public Participation, Botanical specialist
Hope Village township development water use licence, Johannesburg, Gauteng	Door of Hope Charity Organisation	Project Manager, Environmental consultant, Public Participation
Diamond Park Township Development Section 24G, Kimberley, Northern Cape	Sol Plaatje Local Municipality	Project Manager, Environmental consultant, Public Participation
Boschendal Wine Estate hydro-electric power station Water Use Licence and S24G application, Stellenbosch, Western Cape	Boschendal Wine Estate	Environmental consultant
City of Johannesburg nature reserve proclamation boundary verification (Phase I), Johannesburg, Gauteng	City of Johannesburg SOC Ltd	Environmental consultant
PRDW Cape Town harbour breakwater rehabilitation EMPr, Cape Town, Western Cape	PRDW Engineering	Project Manager, Environmental consultant
PRDW Bushman's Estuary dune encroachment project management, Kenton-on-sea, Eastern Cape	PRDW Engineering	Environmental consultant
Corner Berg and Drooge Street township development water use licence application, Zeerust, North-West Province	Ramotshere Moiloa Local Municipality	Project Manager, Environmental consultant
Corner Kort and Bree Street township development water use licence, Zeerust, North-West Province	Ramotshere Moiloa Local Municipality	Project Manager, Environmental consultant
Bloekombos (Kraaifontein) hospital water use licence application, Cape Town, Western Cape	Western Cape Provincial Government (PGWC)	Project Manager, Environmental consultant, Botanical specialist, Wetland specialist

SPECIALIST STUDIES

Project Name & Location	Client Name	Role
Boshoek Loop Rail Upgrade BAR and Water Use Licence, Rustenburg, North-West Province	Transnet SOC Ltd	Wetland specialist
City of Johannesburg nature reserve proclamation (Phase II), Johannesburg, Gauteng	City of Johannesburg SOC Ltd	Botanical specialist
SANRAL Bierspruit R510 road upgrade Water Use Licence, Basic Assessment, Thabazimbi, Limpopo Province	SANRAL SOC Ltd & Royal HaskoningDHV South Africa	Ecological specialist
Kibler Park Church Development Ecological Assessment, Johannesburg, Gauteng	Riverside Community Church	Ecological specialist
Barberton IAPS Waste Water Treatment Works development BAR, water use licence and SASS 5 assessment, Barberton, Mpumalanga Province	Umjindi Local Municipality and Rhodes University	Aquatic specialist
Wijnberg Trust Dam 2 expansion Aquatic Impact Assessment, Greyton, Western Cape	Wijnberg Trust	Aquatic specialist

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SANRAL Caledon N2 Section 3 road upgrade project Basic Assessment, Water Use Licence and Specialist reports, Caledon, Western Cape Province	JG Afrika Engineering	Ecological specialist
City of Johannesburg nature reserve proclamation boundary verification (Phase I), Johannesburg, Gauteng	City of Johannesburg SOC Ltd	GIS specialist
iGas integrated biodiversity screening, Saldanha, Western Cape	Central Energy Fund - iGas (subsidiary)	Faunal specialist (assistant)
Bloekombos (Kraaifontein) botanical baseline and impact assessment, Cape Town, Western Cape	Western Cape Provincial Government (PGWC)	Wetland specialist Botanical specialist