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Appendix 5:

Specialist reports

Aquatic and Wetland Assessment for a Prospecting Right for the Proposed Welgedacht Project, near Springs, Gauteng Province

for

Wozimart (Pty) Ltd

February 2019

by

Dr. James Dabrowski

Confluent Environmental

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Declaration of Specialist Independence

- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;
- I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;
- I do not have any influence over decisions made by the governing authorities;
- I undertake to disclose 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 a competent authority to such a relevant authority and the applicant;
- I have the necessary qualifications and guidance from professional experts in conducting specialist reports relevant to this application, including knowledge of the relevant Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein is and will remain the intellectual property of Confluent Environmental. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.
- All the particulars furnished by me in this document are true and correct.

Dr. James Dabrowski (Ph.D., Pr.Sci.Nat. Water Resources; SACNASP Reg. No: 114084)

14 February 2019

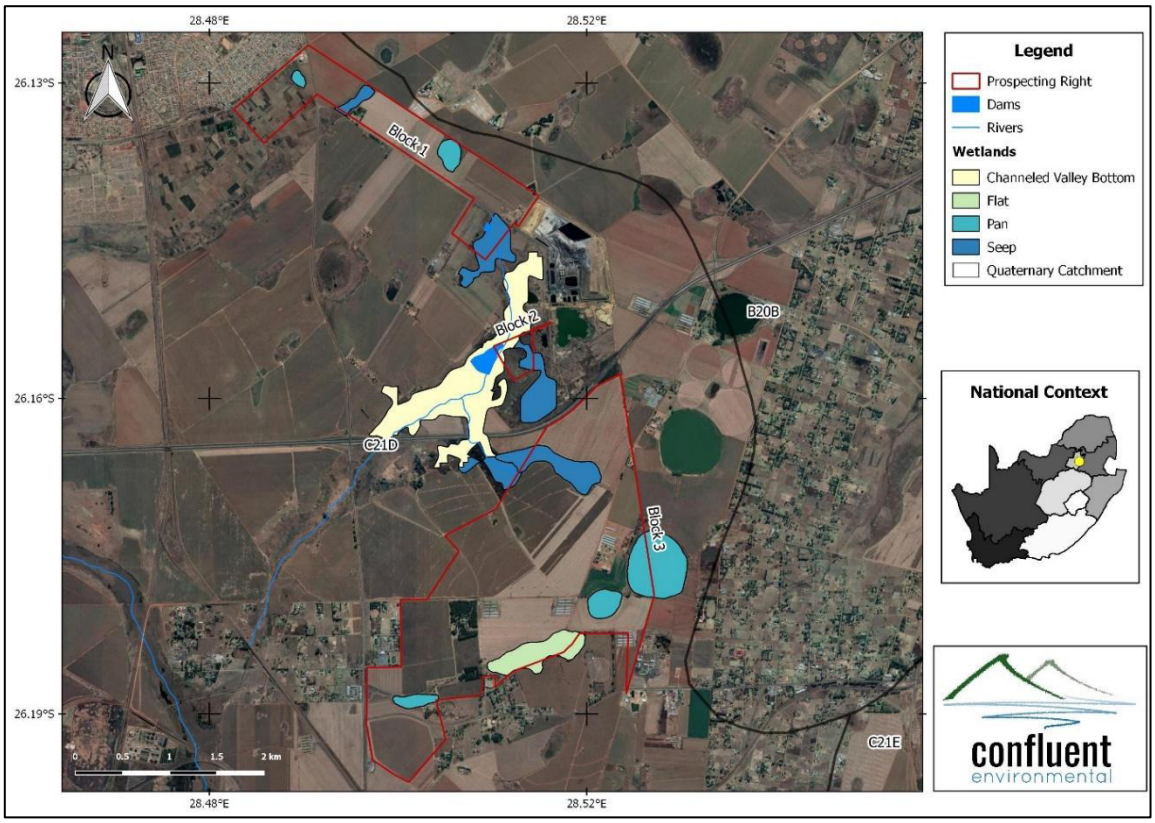
EXECUTIVE SUMMARY

Wozimart (Pty) Ltd (hereafter the applicant) lodged a prospecting right with the DMR (reference number MP30/5/1/1/2 (10553) PR) to prospect for coal on the Farm Holfontein 71 IR Portions 5, 19, 20, 21, 22, 27, 33, 42, 43, 64, 65, 66, 67 and 76 and the Farm Welgedacht 74 IR Portions 26 and 32, Ekurhuleni Metropolitan.

In support of the application to obtain the prospecting right, the applicant is required to conduct a Basic Assessment (BA) process that needs to be submitted to the DMR for adjudication, which includes activities triggered under the Environmental Impact Assessment Regulations of 2014 (as amended) promulgated under the National Environmental Management Act, 1998 (Act 107 of 1998). This report specifically provides specialist inputs with regards to the aquatic ecosystem assessment of the BA. Prospecting will take place within three distinct blocks.

The area of interest falls entirely within quaternary catchment C21D in the Vaal Water Management Area. Several wetlands fall within the prospecting right and form the focus of this assessment. These include:

- Depressions and hillslope seep wetlands that fall within Block 1;
- Sections of a channelled valley bottom wetland and hillslope seep that fall within Block 2; and
- Depressions, hillslope seeps and wetland flats that fall within Block 3.



A non-perennial stream associated with the channelled valley bottom wetland flows through the western most section of Block 2. This stream eventually joins the Blesbokspruit wetland which has been declared as a Ramsar wetland.

The Present Ecological State (PES) of all wetlands ranges from Moderately Modified (C) to Seriously Modified (E). The Ecological Importance and Sensitivity of most wetlands is Moderate (C) while the endorheic pans is High (B). Impacts of drilling activities to water quality, aquatic habitat and erosion for all identified watercourses ranges from Minor to Negligible (assuming the full implementation of mitigation measures).

Given the PES and EIS of wetlands within the prospecting blocks and the relatively low impact of the drilling activities, a minimum recommended buffer distance of 30 m has been applied to all wetlands within the prospecting right. All buffers should be regarded as no-go areas and no drilling activities or access to drill sites should take place within or through wetlands and their associated buffers.

While several wetlands are located throughout the proposed prospecting blocks, given their modified to seriously modified state, the low nature of impacts associated with drilling and easily implementable mitigation measures, it is not anticipated that prospecting activities will have any significant impact on the wetlands that fall within the prospecting right.

Drilling for prospecting purposes should therefore be authorised subject to the implementation of minimum recommended buffer distances for all wetlands identified as part of this study.

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

Wozimart (Pty) Ltd (hereafter the applicant) lodged a prospecting right with the DMR (reference number MP30/5/1/1/2 (10553) PR) to prospect for coal on the Farm Holfontein 71 IR Portions 5, 19, 20, 21, 22, 27, 33, 42, 43, 64, 65, 66, 67 and 76 and the Farm Welgedacht 74 IR Portions 26 and 32, Ekurhuleni Metropolitan.

In support of the application to obtain the prospecting right, the applicant is required to conduct a Basic Assessment (BA) process that needs to be submitted to the DMR for adjudication, which includes activities triggered under the Environmental Impact Assessment Regulations of 2014 (as amended) promulgated under the National Environmental Management Act, 1998 (Act 107 of 1998).

This report specifically provides specialist inputs with regards to the aquatic ecosystem assessment of the BA.

1.2 OBJECTIVES

The objectives of this specialist report are to:

- Characterise the baseline state of aquatic and wetland ecosystems associated with the proposed development;
- Identify sensitive features (i.e. habitats, species of conservation concern, unique features) that may be negatively impacted upon by the proposed development;
- Assess the significance of potential impacts on aquatic ecosystems associated with the prospecting right;
- Identify potential mitigation measures that can be implemented in order to reduce the significance of impacts;
- Reassess the significance of impacts after implementation of mitigation measures; and
- Comment on the ecological sustainability and viability of the prospecting right from the perspective of aquatic and wetland ecosystems.

2 KEY LEGISLATIVE REQUIREMENTS

2.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA, 1998)

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA EIA regulations, the applicant is required to appoint an environmental assessment practitioner (EAP) to undertake the BA, as well as conduct the public participation process.

The objective of the Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the activities that have been identified. The purpose of these procedures is to provide the competent authority with adequate information to make decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorized, and that activities which are authorized are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

In accordance with the provisions of Sections 24 (5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting BAs in order to apply for, and be considered for, the issuing of an Environmental Authorisation (EA). These Regulations provide a detailed description of the BA process to be followed when applying for EA for any listed activity. The Regulations differentiate between a simpler Basic Assessment Process (required for activities listed in GN R. 983 and 985) and a more complete EIA process (activities listed in GN R. 984). In the case of this project there are activities triggered under GN R. 983 and as such a BA process is necessary.

2.2 NATIONAL WATER ACT (NWA, 1998)

The Department of Water & Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (NWA) (Act No. 36 of 1998) aims to protect water resources, through:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be
- A watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem, and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS. For the purposes of this project, a wetland area is defined according to the NWA (Act No. 36 of 1998): "Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and

which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".

Wetlands are generally characterised by one or more of the following attributes (DWAF, 2008):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil;
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils; and
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

3 PROJECT AREA & AFFECTED CATCHMENT

The area of interest falls entirely within quaternary catchment C21D in the Vaal Water Management Area (Figure 1). Several wetlands fall within the prospecting right and form the focus of this assessment (Figure 2). These include:

- Depressions and hillslope seep wetlands that fall within Block 1;
- Sections of a channelled valley bottom wetland and hillslope seep that fall within Block 2; and
- Depressions and wetland flats that fall within Block 3.

A non-perennial stream associated with the channelled valley bottom wetland flows through the western most section of Block 2. This stream eventually joins the Blesbokspruit wetland which has been declared as a Ramsar wetland.

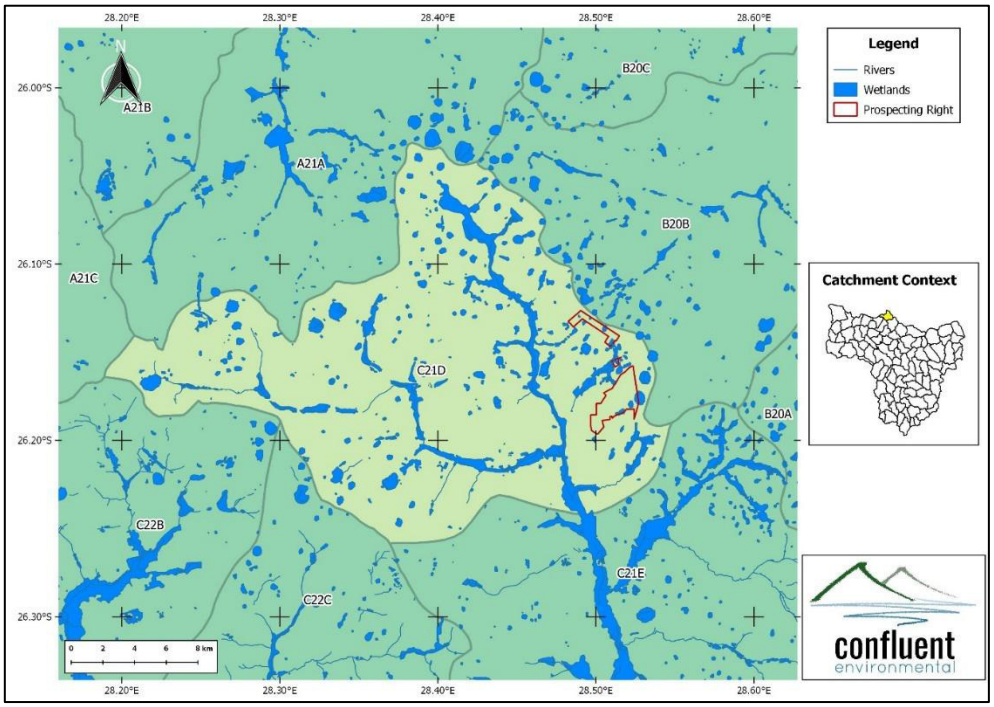

Figure 1: Location of prospecting right within catchment C21D of the Upper Vaal WMA.

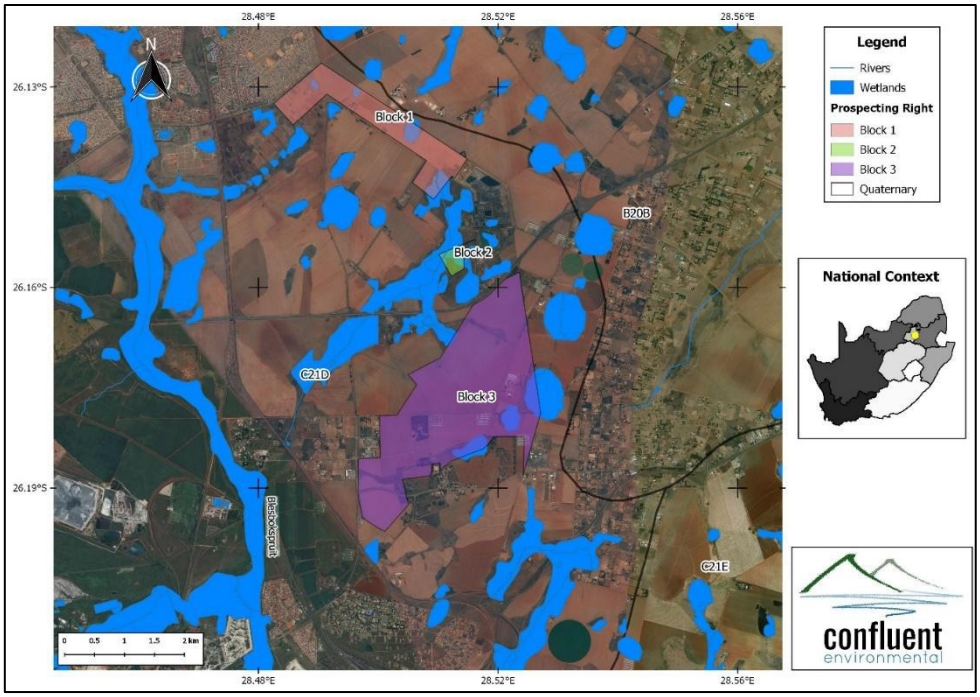

Figure 2: Map illustrating the location of wetlands within the three blocks that make up the prospecting right

4 PROSPECTING ACTIVITIES

The Prospecting Work Program (PWP) is designed to establish the extent of the area of the coal deposit, and all available geological information will be utilized to calculate the *in-situ* coal resource and the economic viability of the project. Diamond core exploration drilling is selected as the primary means of exploration as it provides accurate information on the depth and thickness of the coal seams, the quality and physical properties of the resource and the composition and thickness of the overburden.

Prospecting holes will be drilled in strategic locations to fill the gaps and confirm existing borehole data and information derived from the ground magnetic field survey. Based on the extent of the area, 84 TNW (75mm diameter) diamond core drill holes are planned to be drilled in order to increase the geological accuracy of the resource modelling.

The average depth of these boreholes is expected to vary between 130m and 170m, and will be sealed with a cement plug to one meter below surface upon completion to make it safe for people and animals and allow future access by the exploration team.

The drill rigs are truck-mounted and equipped with diesel driven engines to provide power to drill. Water for the drilling process is provided by a truck fitted with a water tank.

5 METHODS

The approach to this assessment comprised of a combined desktop and field-based assessment of potentially affected watercourses. The site visit was conducted on the 16th of January 2019, with the objective of identifying, classifying and determining the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of potentially affected water resources. Based on this field assessment the impacts associated with the prospecting activities on aquatic ecosystem health have been assessed. This was done according to the impact assessment methodology outlined in the Appendix to this report.

5.1 DESKTOP REVIEW

A variety of sources were consulted in order to gain a broad overview of the PES and biodiversity importance of all wetlands. The approach to the desktop review included, *inter alia*, the following:

- Review of all layout or planning information relevant to the development (including the construction and operational phases);
- Consultation with the relevant authorities, as required, to determine the full scope of freshwater specialist work required by relevant permit/authorisation/licensing processes;
- Desktop identification of any watercourses that may be affected by the proposed development;

- Assessment of all watercourses from the perspective of provincial and regional systematic biodiversity plans;
- Examination of existing maps of the area including historical images;
- Review of existing databases for land use, climatic, water resource and aquatic ecosystem health data; and
- Compilation of sensitivity maps to inform concept footprints and layouts depicting affected and potentially affected watercourses.

5.2 WETLAND ASSESSMENT

5.2.1 Desktop Analysis

The wetland assessment involved a preliminary desktop analysis to identify the possible location of wetlands and important land use activities that may be potentially impacting the wetlands. The desktop analysis was undertaken using 2014 aerial photography for the area (Chief Directorate: National Geo-spatial Information) and was supplemented by recent and historical Google Earth imagery. In addition, historical orthophotos were also interrogated to assess changes to identified wetlands over time.

5.2.2 Site Visit

A site visit was conducted to verify the locations of identified wetlands and describe existing onsite impacts, which were mapped using a hand-held GPS device. All wetlands occurring within the project area were categorised into discrete hydrogeomorphic units (HGMs) based on their geomorphic characteristics, source of water and pattern of water flow through the wetland unit. HGMs were classified according to Ollis et al. (2013). The outer edge of wetlands occurring within and adjacent to the footprint of the proposed mine were delineated according to the following four indicators (DWAF, 2008):

- The presence of wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation such as grey horizons, mottling streaks, hard pans, organic matter depositions, iron and manganese concretion resulting from prolonged saturation (soil indicator);
- The presence of water loving plants (hydrophytes) (vegetation indicator);
- A high-water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil; and
- Topographical location of the wetland in relation to the surrounding landscape (terrain indicator).

The desktop analysis, in combination with vegetation and terrain indicators were primarily used to delineate wetlands in the project area and were verified through inspection of soil cores obtained through use of a hand-held soil auger.

5.2.3 Present Ecological State

5.2.3.1 Channelled Valley Bottom and Hillside Seep Wetlands

Desktop and field data were captured in GIS software and used to populate the Level 1 WET-Health tool (Macfarlane et al., 2008) which was used to derive the PES of the wetland HGM units. The magnitude of observed impacts on the hydrological, geomorphological and vegetation components of the wetland were calculated and combined as per the tool to provide a measure of the overall condition of the wetland on a scale from 1-10. Resultant scores were then used to assign the wetland into one of six PES categories as shown in Table 1 below.

Table 1: Wetland Present Ecological State categories and impact descriptions.

Ecological Category	Description	Impact Score
A	Unmodified, natural.	0 – 0.9
B	Largely natural with few modifications / in good health. A small change in natural habitats and biota may have taken place but the ecosystem functions are still predominantly unchanged.	1 – 1.9
C	Moderately modified / fair condition. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	2 – 3.9
D	Largely modified / poor condition. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	4 – 5.9
E	Seriously modified / very poor condition. The loss of natural habitat, biota and basic ecosystem functions is extensive.	6 – 7.9
F	Critically modified / totally transformed. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota.	8 – 10

5.2.3.2 Endorheic Pans & Wetland Flats

The WET-Health method was not designed for use on depression wetlands such as endorheic pans and wetland flats. Therefore, based on the recommendations of Ollis et al. (2014), the RDM 1999 scoresheet for assessing the Habitat Integrity of Palustrine Wetlands was used to determine the PES for the endorheic pans. This method involves scoring various hydrological, geomorphological, water quality and biotic criteria with a score ranging from 0 (critically modified) to 5 (natural or unmodified). The average score is used to define the overall PES of the pan according to Table 2.

Table 2: Wetland Present Ecological State categories and impact descriptions.

Ecological Category	Description	Impact Score
A	Unmodified, natural.	4 – 5
B	Largely natural with few modifications / in good health. A small change in natural habitats and biota may have taken place but the ecosystem functions are still predominantly unchanged.	3 – 4
C	Moderately modified / fair condition. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	2 – 3
D	Largely modified / poor condition. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	1 – 2
E	Seriously modified / very poor condition. The loss of natural habitat, biota and basic ecosystem functions is extensive.	0 – 1
F	Critically modified / totally transformed. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota.	0

5.2.4 Ecological Importance and Sensitivity

The ecological importance of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales (Duthie, 1999). Ecological sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (Duthie, 1999). The Ecological Importance and Sensitivity (EIS) provide a guideline for determination of the Ecological Management Class (EMC).

According to Rountree et al. (2013) the EIS for wetlands should be based on a combination of three suites of importance criteria, namely:

1. Ecological Importance and Sensitivity (EIS), incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWS (Kleynhans, 1999) and thus enabling consistent assessment approaches across water resource types;
2. Hydro-functional importance, which considers water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide (Kotze et al., 2008); and
3. Importance in terms of basic human benefits – this suite of criteria considers the subsistence uses and cultural benefits of the wetland system (Kotze et al., 2008).

In summary, several determinants representative of each of the three importance criteria (Table 3) are assigned a score ranging from 0 (low importance or sensitivity) to 4 (high importance or sensitivity). The average score for each of the three criteria is calculated, with the highest average score being used to determine the overall EIS category of the wetland system according to (Table 4).

Table 3: Determinants for three different importance criteria that are scored (from 0 to 4) in order to determine the overall EIS category for a wetland system.

Ecological Importance & Sensitivity	Hydro-Functional Importance	Direct Human Benefits
Presence of Red Data Species	Flood attenuation	Water for human use
Populations of Unique Species	Streamflow regulation	Harvestable resources
Migration Sites	Sediment trapping	Cultivated foods
Protections Status of Wetland	Phosphate assimilation	Cultural heritage
Protection Status of Vegetation Type	Nitrate assimilation	Tourism and recreation
Regional Context of Ecological Integrity	Toxicant assimilation	Education and research
Size and Rarity of Wetland Type Present	Erosion control	
Diversity of Habitat Types	Carbon storage	
Sensitivity to Changes in Floods		
Sensitivity to Changes in Low Flows		
Sensitivity to Changes in Water Quality		

Table 4: Ecological importance and sensitivity categories. Interpretation of average scores for biotic and habitat determinants.

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

5.3 BUFFER DETERMINATION

Buffer zones have been defined as a strip of land with a use, function or zoning specifically designed to act as barriers between human activities and sensitive water resources with the aim of protecting these water resources them from adverse negative impacts. Appropriate buffers were estimated based on buffer zone guidelines developed by Macfarlane and Bredin (2017). These guidelines estimate required buffer zone widths based on a combination of input parameters which include, *inter alia*, the nature of the activity and associated impacts, basic climatic and soil conditions, the PES and EIS of potentially affected watercourses and the implementation of appropriate mitigation measures.

For the purposes of sensitivity mapping, the implementation of appropriate mitigation measures has been considered in the determination of buffer zone widths.

6 ASSUMPTIONS & LIMITATIONS

- The field assessment was restricted to those watercourses that are likely to be impacted by the prospecting activities;
- The accuracy of wetland delineations was based primarily on the recording of onsite wetland terrain and vegetation indicators (terrain and vegetation) using a GPS. GPS accuracy will therefore influence the accuracy of the mapped sampling points and therefore water resource boundaries and an error of 1-5m can be expected. All vegetation and terrain sampling points were recorded using a Garmin Montana™ Global Positioning System (GPS) and captured using Geographical Information Systems (GIS) for further processing;
- Wetland soil indicators were used to verify delineated boundaries where necessary but given the scale of the assessment and the number of wetlands present, this was not used as a primary means of delineation. In addition, historical agricultural activities made it very difficult to identify the original delineation of certain wetland types (e.g. wetland flats);
- No wetland fauna sampling or faunal searches were conducted. The assessment was purely habitat focussed;

7 DESKTOP REVIEW

7.1 NFEPA

The National Freshwater Ecosystem Priority Areas (NFEPA) database (Nel et al., 2011) forms part of a comprehensive approach to the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National

Water Act (Act 36 of 1998). This directly applies to the National Water Act, which feeds into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel et al., 2011). The NFEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) (Act 10 of 2004) biodiversity goals, informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel et al., 2011).

The prospecting right falls within sub-quaternary reach 1267, which is not categorised as a Freshwater Ecosystem Priority Area (FEPA). Furthermore, none of the wetlands that fall within the prospecting right have been categorized as Wetland FEPAs.

7.2 GAUTENG CONSERVATION PLAN V3.3 (2011, TECHNICAL REPORT UPDATED 2014)

The Gauteng C-Plan v3.3, commonly known as a Critical Biodiversity Areas Map, delineates biodiversity priority areas called Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA) and Protected Areas (PA). The Critical Biodiversity Areas are comprised of key areas that are required to meet national biodiversity pattern and process targets. Ecological Support Areas are areas required to prevent the degradation of Critical Biodiversity Areas and Protected Areas. Protection of the priority areas identified in Gauteng C-Plan v3.3 would sufficiently contribute (on a proportional basis to ecosystem extent in Gauteng Province) to meeting national biodiversity targets for the South African vegetation types.

Classification of the Biodiversity Classification categories in the study area is as follows:

- CBA: Irreplaceable – sites where no other options exist for meeting targets for biodiversity features
- CBA: Important – 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
- ESA: Natural, near-natural, degraded or heavily modified areas required to be maintained in an ecologically functional state to support Critical Biodiversity Areas and/or Protected Areas.

According to the spatial dataset of the GDARD C-Plan (GDARD, 2011), the majority of wetlands located within the prospecting right are regarded as Important CBAs. Farmland and grassland areas adjacent to these CBAs are regarded as ESAs (Figure 3).

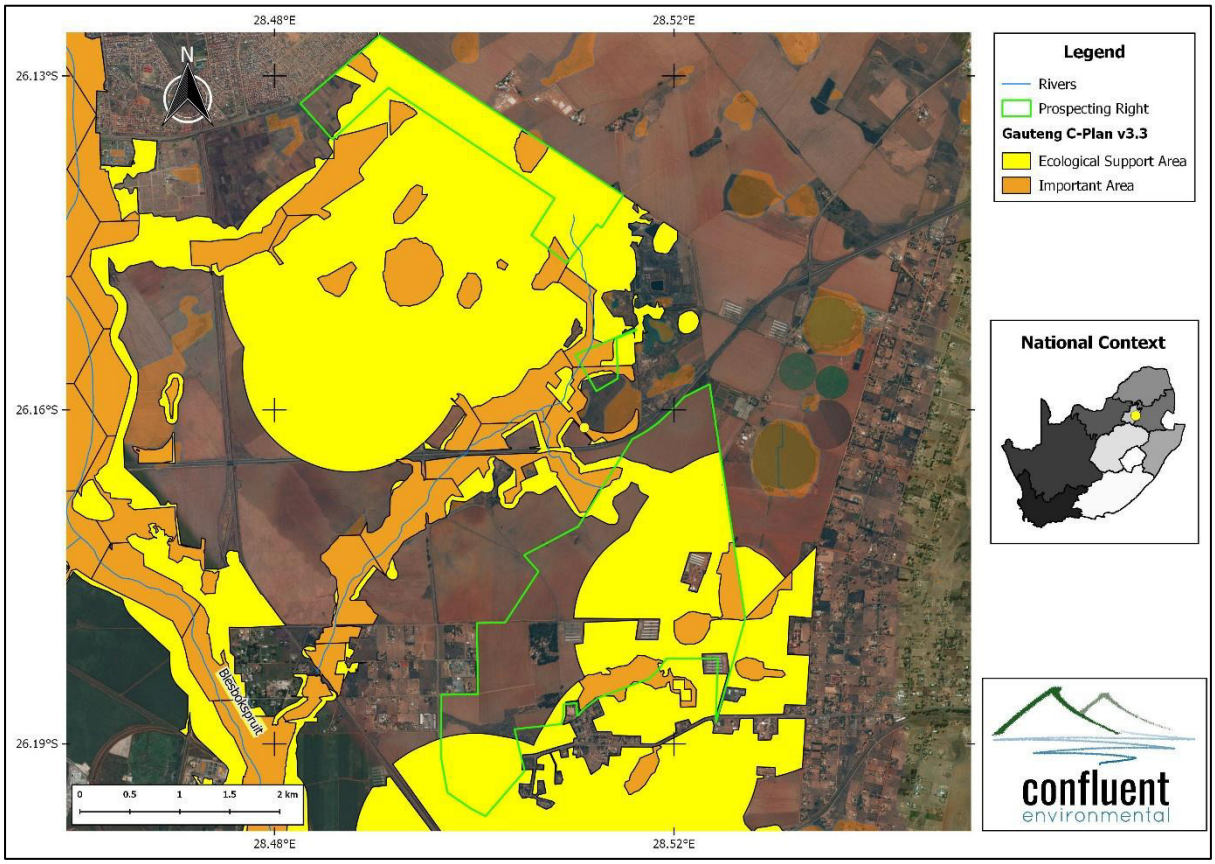

Figure 3: Gauteng C-Plan v3.3 in relation to the prospecting right.

8 WETLAND ASSESSMENT

The potential presence of wetlands was identified through use of desktop resources (e.g. NFEPA Wetlands layer – Nel et al., 2011) and confirmed during the field visit. Several wetland features occur within prospecting area. These wetlands were classified according to Ollis et al. (2013) and delineated using a combination of terrain, vegetation and soil indicators (Figure 4). This was augmented with current and historical Google Earth imagery and orthophotos. The outer most boundary of most wetland features generally coincided with the start of agricultural fields and was confirmed with inspection of soil cores that were obtained using a soil auger.

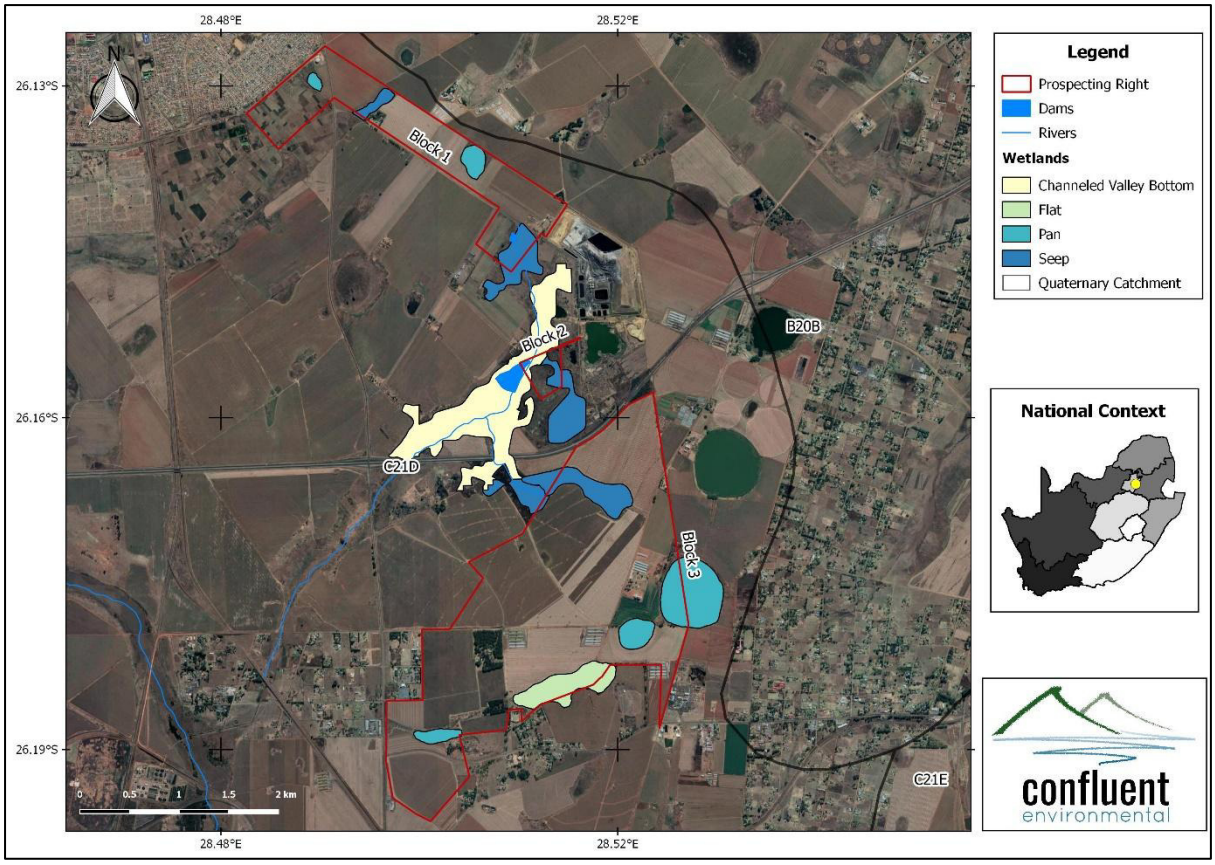

Figure 4: Wetlands that fall within the Welgedacht prospecting right.

The PES scores for each wetland were determined using the most appropriate methodology. These scores are presented in Table 5 and modifications responsible for these scores are described in more detail in the sub-sections below.

Table 5: PES scores for different wetland types potentially affected by the prospecting right.

Wetland	Hydrology	Geomorphology	Vegetation	Overall PES
Endorheic Pans[b]	N/A	N/A	N/A	C
Channeled Valley Bottom Wetland[a]	60 % (C/D)	64 (C)	63 (C)	62 (C/D)
Hillslope Seep – West (Block 1) [a]	65 % (C)	94 % (A)	41 % (D/E)	58 % (C/D)
Hillslope Seep - East (Block 1) [a]	65 % (C)	93 % (A)	60 % (C/D)	72 % (C)
Hillslope Seep (Block 2) [a]	35 % (E)	70 % (C)	41 % (D/E)	53 % (E)
Hillslope Seep (Block3) [a]	65 % (E)	70 % (C)	73 % (D/E)	68 % (C)
Wetland Flat[b]	N/A	N/A	N/A	D

[a]PES assessed according to the WET-Health method (MacFarlane et al., 2008)

[b]PES assessed according to RDM 99 Scoresheet for Palustrine wetlands (Ollis et al., 2014)

8.1 BLOCK 1

The majority of the surface area of Block 1 is covered by subsistence and commercial agriculture. Two depression and two seep wetlands are located within the block. The depression wetlands are endorheic pans and are immediately surrounded by agricultural fields and therefore have no natural buffer or connectivity to any natural, terrestrial vegetation. The main impacts associated with the pans relate primarily to the absence of appropriate buffers, colonization by annual weeds and increased sediment and nutrient loads originating from agricultural runoff. All pans are considered to be Moderately Modified (PES: C) and while loss and change of natural habitat have occurred, basic ecosystem functions remain unchanged.

The hillslope seep to the east of Block 1 covers a large area dominated by grassland and wetland plant species. The channel that leads southwards in the direction of the Blesbokspruit originates from the lower section of the wetland area. Historical imagery indicates that large portions of this wetland have been ploughed in the past and there are two small dams located within the area of the wetland as well as a series of drainage furrows, which were presumably excavated to facilitate drainage of the area (Figure 5). Modifications to the wetland are therefore primarily hydrological as, although agricultural activities do appear to have occurred within the wetland area in the past, grassland and wetland vegetation has re-established. Geomorphological alterations to patterns in the distribution and retention of sediments are limited to minor erosion associated with the drainage canals.

The hillslope seep to the north-west of the block has been intercepted by the road at its downslope end. A dam has also been constructed further up which is likely to capture both surface and sub-surface flows. The road impedes surface flows resulting in an area of inundation to the northern side of the road. The wetland is surrounded by dryland agriculture on all sides. Historical imagery clearly indicates that the majority of the wetland area had been under agricultural cultivation until relatively recently (2005) (Figure 5).

Figure 5: Historical imagery indicating cultivated lands through north-west seep of Block 1 (2005 – left) and drainage canals running through the east seep of Block 1 (2002 – right).

8.2 BLOCK 2

A channeled valley bottom and hillslope seep wetland fall within the perimeter of Block 2. The eastern most portion of the block is highly degraded and consists of several large excavations or pits that have become inundated with water over time (Figure 6 and Figure 7). The valley bottom wetland is traversed by a road with culverts which will influence the hydrological and sediment delivery characteristics of the wetland. The wetland ultimately feeds into a dam (Lushof Dam), which impedes flow to downstream wetland habitat. An excavated channel appears to drain a portion of excavated pits in the direction of the chanelled valley bottom wetland.

The hillslope seep wetland drains in the direction of the valley bottom wetland, however the excavated pits are likely to partly intercept sub-surface flows that originate from the seep. The seep wetland area, which has until very recently been under cultivation (Figure 6), is highly degraded and apart from soil indicators did not show any other typical wetland indicators (e.g. vegetation is dominated by weeds). The PES of this wetland is therefore E, with large modifications having resulted in a loss of natural habitat, biota and ecosystem function.

Figure 6: Historical image indicating the complex of excavated pits (yellow) and centre pivot irrigation covering a large area of the hillslope seep.

8.3 BLOCK 3

Three large endorheic pans, a wetland flat and a hillslope seep are located within Block 3 (Figure 4). The largest of these pans is permanently inundated, while the other two pans are seasonal. These pans experience similar impacts to those located within Block 1 and are all immediately surrounded by agricultural fields.

The hillslope seep wetland has also experienced similar impacts to those in Block 1, with historical imagery indicating that, up until recently, the entire wetland area was under cultivation. While natural vegetation has recovered, the extensive ploughing and disturbance to soil represents a significant modification from natural conditions.

A wetland flat lies along the southern boundary of Block 3. This wetland area is highly degraded and impacts include illegal dumping (Figure 7), a road crossing the entire length of the wetland and relatively high density of annual weeds and alien invasive trees (e.g. *Eucalyptus sp*,).

Figure 7: Eastern most hillslope seep in Block 1 (A); cattle grazing in hillslope seep wetland in Block 1 (B); excavations in Block 2 filled with water (C); dry excavations in Block 2 (D); typical endorheic pan in agricultural landscape (E); highly degraded wetland flats (F)

8.3.1 Importance & Sensitivity

Scores for each determinant for ecological importance and sensitivity (EIS), hydro-functional importance and direct human benefits as well as a brief explanation for the score are provided in Table 6,

Table 7 and

Table **8**, respectively. According to the method by Rountree and Kotze (2013) the highest average score for each one of these three criteria should be used to determine the overall Importance and Sensitivity category. In this respect the Importance and Sensitivity of each wetland type is largely determined by their ecological importance and sensitivity (which generally had the highest average scores out of all three criteria).

The EIS for most of the potentially affected wetland types is Moderate (C) and they are therefore considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications and they play a small role in moderating the quantity and quality of water of major rivers. Given their large size and ability to accumulate large volumes of water on a seasonal basis, the endorheic pans are likely to be quite important from a biodiversity perspective and therefore have a High Importance and Sensitivity (B) (Table 6). While the channelled valley bottom wetland offers a relatively high diversity of habitat, its small size is unlikely to offer significant biodiversity support.

The channelled valley bottom wetland has a relatively high hydro-functional importance (i.e. enhancing water quality and regulating streamflow). In contrast, the other wetland types are largely driven by sub-surface flows (in the case off seeps) or are highly seasonal (in the case of pans and flats) and therefore provide limited ecosystem services.

None of the wetlands assessed offer significant human benefits (

Table **8**).

Table 6: Ecological Importance and Sensitivity importance criteria.

Ecological Importance & Sensitivity	Channelled Valley Bottom Wetland	Endorheic Pans	Hillside Seeps	Wetland Flat
A: Biodiversity Support				
Presence of Red Data Species	**3** – One or more endangered or red data species expected	**3** – One or more endangered or red data species expected	**2** - More than one species/taxon judged to be rare or endangered on a local scale	**2** - More than one species/taxon judged to be rare or endangered on a local scale
Populations of	**2** – Small size limits	**3** - Pans are likely to host	**3** – Large size and unique	**3** – Likely to be seasonally

Ecological Importance & Sensitivity	Channelled Valley Bottom Wetland	Endorheic Pans	Hillside Seeps	Wetland Flat
Unique Species	populations of unique species	unique taxon that are adapted to temporary wet and dry cycles	vegetation likely to host populations of wetland species	important for certain wetland dependent species.
Migration, Breeding or Feeding Sites	**3** – Offers year-round potential for breeding and feeding, although limited by size	**3** – Likely to be important breeding and feeding sites during the wet season	**1** – Flows are generally sub-surface and offer limited potential for wetland species	**2** – Possibly seasonally important for certain wetland dependent species
Average	**2.6**	**3**	**2**	**2**
B: Landscape Scale				
Protection Status	**1** – Not protected	**1** – Not protected	**1** – Not protected	**1** – Not protected
Protection Status of Vegetation Type	**1** - Mesic Highveld Grassland – Group 4 (Least Threatened)	**1** - Mesic Highveld Grassland – Group 4 (Least Threatened)	**1** - Mesic Highveld Grassland – Group 4 (Least Threatened)	**1** - Mesic Highveld Grassland – Group 4 (Least Threatened)
Regional Context of the Ecological Integrity	**2** – Moderately modified from natural	**2 –** Moderately modified from natural	**2 –** Moderately modified from natural	**1 –** Seriously modified from natural
Size and rarity of wetland types present	**2-** Small wetland and relatively abundant wetland type.	**2 -** Large wetlands but relatively common throughout the landscape	**3 –** Relatively large seep areas which are not very common	**3 -** Not common throughout the landscape
Diversity of Habitat Types	**3** – High diversity of vegetation and geomorphological structure.	**1** – Low diversity of vegetation and geomorphological structure.	**2** - Moderate diversity of vegetation and geomorphological structure.	**1** – Low diversity of vegetation and geomorphological structure
Average	**1.8**	**1.4**	**1.8**	**1.4**
C: Sensitivity of Wetland				
Sensitivity to Changes in Low Flows	**3** - The wetland receives regular inflows and is sensitive to modifications in low flow conditions.	**1** - Do not receive regular flow inputs and are not sensitive to modifications in flow	**2**- Flows are likely to be predominantly sub-surface	**1** - Do not receive regular flow inputs and are not sensitive to modifications in flow
Sensitivity to Changes in Water Quality	**2** – Moderately sensitive to changes in water quality.	**1** – Low sensitivity to changes in water quality	**1** – Low sensitivity to changes in water quality	**0** – Very low sensitivity to changes in water quality
Sensitivity to Changes in Floods	**2** – Sensitive to changes in floods	**1** – Low hydrological connectivity and insensitive to changes in floods	**1** – Low hydrological connectivity and insensitive to changes in floods	**1** – Low hydrological connectivity and insensitive to changes in floods
	2.3	**1**	**1.25**	**0.66**
EIS Score	**2.6 (Moderate)**	**3 (High)**	**2 (Moderate)**	**2 (Moderate)**

Table 7: Hydro-functional importance criteria for determining the EIS of affected wetlands

Hydrofunctional Importance	Channelled Valley Bottom Wetland	Endorheic Pans	Hillside Seeps	Wetland Flat
Flood attenuation	3	1	1	1
Streamflow regulation	3	1	2	1
Sediment trapping	3	1	2	1

	Phosphate assimilation	3	1	2	1
	Nitrate assimilation	3	2	2	1
	Toxicant assimilation	3	2	2	1
	Erosion control	2	1	1	1
Carbon storage		2	1	2	2
HYDROFUNCTIONAL IMPORTANCE		**2.75**	**1.25**	**1.75**	**1.125**

Table 8: Direct human benefit importance criteria for determining the EIS of affected wetlands

Direct human benefits		Channelled Valley Bottom Wetland	Endorheic Pans	Hillside Seep	Wetland Flat
Subsistence benefits	Water for human use	3 – Flows into Lushof Dam	2 – Limited potential for abstraction during wet season	0	0
	Harvestable resources/cultivated foods	1 – Reeds	0	2 – Formerly under agriculture	0
Cultural benefits	Cultural heritage	0	0	0	0
	Tourism and recreation	0	0	0	0
	Education & Research	1	0	0	0
DIRECT HUMAN BENEFITS		**1**	**0.4**	**0.4**	**0**

9 IMPACT ASSESSMENT

A summary of identified impacts, the risk of these impacts to aquatic ecosystems and measures designed to mitigate these risks are described in the section below.

9.1 WATER QUALITY IMPACTS

- Hydrocarbon spillage from trucks and vehicles close to wetlands can severely contaminate the associated watercourses.
- Serious spills can seriously affect mortality rates of aquatic and terrestrial fauna that wetland habitats as breeding and foraging habitat.

9.1.1 Mitigation

- All drilling activities must take place outside of the recommended buffer zone for each wetland;
- No vehicles or machinery are allowed within the buffer areas of identified wetlands;
- Designated areas should be indicated where vehicles and machinery are to be stored, repaired and refueled within a bunded area;
- Implementation of rapid response emergency spill procedures to deal with spills immediately, including the provision of a spill kit and training of staff to deal with such instances;

- Driving through wetland areas must be avoided when navigating towards drilling locations;
- Vehicles and equipment must be regularly serviced and maintained;
- Any spillages must be cleaned up immediately to prevent further contamination; and
- All boreholes to be appropriately capped after completion of drilling to prevent deliberate or accidental contamination of groundwater.

Table 9: Impacts to water quality

	Without Mitigation	With Mitigation
Intensity	Moderate	Negligible
Duration	Short term	Brief
Extent	Limited	Very Limited
Probability	Probably	Unlikely
Significance	**Minor (-)**	**Negligible (-)**
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

9.2 AQUATIC HABITAT IMPACTS

- Physical disturbance of wetland habitat when setting up the drill rig and executing drilling activities.

9.2.1.1 Mitigation

- All drilling activities must take place outside of the recommended buffer zone for each wetland;
- No vehicles or machinery are allowed within the buffer areas of identified wetlands.

Table 10: Impacts to aquatic habitats

	Without Mitigation	With Mitigation
Intensity	High	Negligible
Duration	Short term	Brief
Extent	Limited	Very Limited
Probability	Probably	Highly Unlikely
Significance	**Minor (-)**	**Negligible (-)**
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

9.3 EROSION & SEDIMENTATION IMPACTS

- Potential erosion of sites that have been cleared for establishment of the drill rig.

9.3.1.1 Mitigation Measures

- The soil disturbance and clearance of vegetation at drill pad areas must be limited to the absolute minimum required;

Table 11: Impacts on erosion

	Without Mitigation	With Mitigation
Intensity	Low	Very Low
Duration	Short term	Brief
Extent	Limited	Very Limited
Probability	Probably	Unlikely
Significance	**Negligible (-)**	**Negligible (-)**
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

9.4 CUMULATIVE IMPACTS

Drilling activities are unlikely to impact on wetlands within the prospecting blocks or within the larger catchment area. Cumulative impacts are therefore expected to be negligible.

10 SENSITIVITY ANALYSIS, BUFFERS AND NO-GO AREAS

Given the PES and EIS of wetlands within the prospecting blocks and the relatively low impact of the drilling activities (which can be easily mitigated through implementation of no-go buffer areas), a minimum recommended buffer distance of 30 m has been applied to all wetlands within the prospecting right (Figure 8). This can be regarded as a conservative buffer as the buffer calculator developed by Macfarlane and Bredin (2017) recommended a narrower buffer distance of 15 m for endorheic pans (which have a relatively high PES and EIS in comparison to other wetland types included in the prospecting blocks). The wider buffer is recommended as it would ensure negligible impacts (see impact tables above), while still allowing for large areas to be prospected within each block.

All buffers should be regarded as no-go areas and no drilling activities or access to drill sites should take place within or through wetlands and their associated buffers.

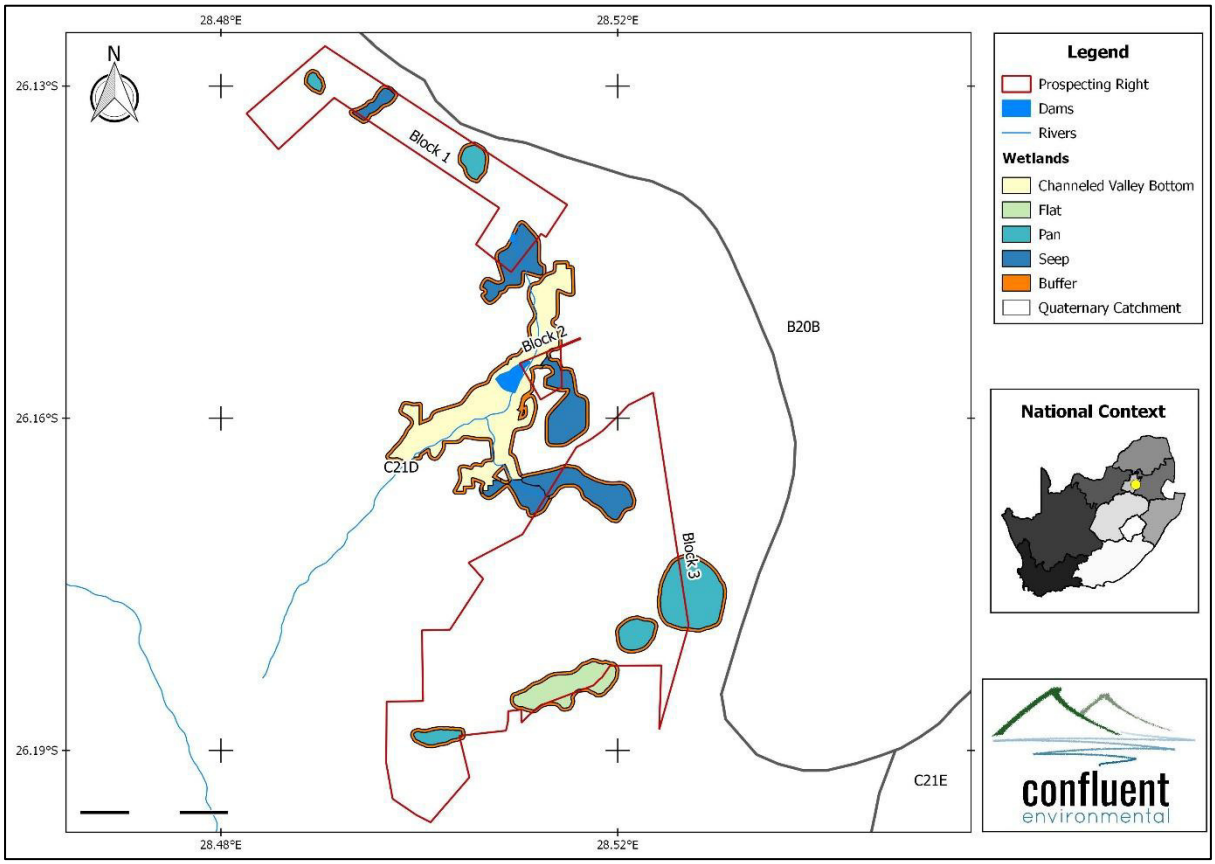

Figure 8: Sensitivity map indicating wetlands and associated buffer zones that should be excluded from any drilling activities.

11 CONCLUSION

While several wetlands are located throughout the proposed prospecting blocks, given their modified to seriously modified state, the low nature of impacts associated with drilling and easily implementable mitigation measures, it is not anticipated that prospecting activities will have any significant impact on the wetlands that fall within the prospecting right.

Drilling for prospecting purposes should therefore be authorised subject to the implementation of minimum recommended buffer distances for all wetlands identified as part of this study.

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13 APPENDICES

Appendix 1: Significance Rating Methodology

Individual impacts for the construction and operational phase were identified and rated according to criteria which include their intensity, duration and extent. The ratings were then used to calculate the consequence of the impact which can be either negative or positive as follows:

Consequence = *type x (intensity + duration + extent)*

where type is either negative (i.e. -1) or positive (i.e. 1). The significance of the impact was then calculated by applying the probability of occurrence to the consequence as follows:

Significance = *consequence x probability*

The criteria and their associated ratings are shown in Table 12.

Table 12: Categorical descriptions for impacts and their associated ratings

Rating	Intensity	Duration	Extent	Probability
1	Negligible	Immediate	Very limited	Highly unlikely
2	Very low	Brief	Limited	Rare
3	Low	Short term	Local	Unlikely
4	Moderate	Medium term	Municipal area	Probably
5	High	Long term	Regional	Likely
6	Very high	Ongoing	National	Almost certain
7	Extremely high	Permanent	International	Certain

Categories assigned to the calculated significance ratings are presented in Table 13.

Table 13: Value ranges for significance ratings, where (-) indicates a negative impact and (+) indicates a positive impact

Significance Rating	Range	
Major (-)	-147	-109
Moderate (-)	-108	-73
Minor (-)	-72	-36
Negligible (-)	-35	-1
Neutral	0	0
Negligible (+)	1	35
Minor (+)	36	72
Moderate (+)	73	108
Major (+)	109	147

Each impact was considered from the perspective of whether losses or gains would be irreversible or result in the irreplaceable loss of biodiversity of ecosystem services. The level of confidence was also determined and rated as low, medium or high (Table 14).

Table 14: Definition of reversibility, irreplaceability and confidence ratings.

Rating	Reversibility	Irreplaceability	Confidence
Low	Permanent modification, no recovery possible.	No irreparable damage and the resource isn't scarce.	Judgement based on intuition.
Medium	Recovery possible with significant intervention.	Irreparable damage but is represented elsewhere.	Based on common sense and general knowledge
High	Recovery likely.	Irreparable damage and is not represented elsewhere.	Substantial data supports the assessment

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Enviro INSIGHT
environmental impact assessments

Terrestrial Ecological Assessment
Proposed Welgedacht C Prospecting Right Application for Coal, Ekurhuleni Municipality, Gauteng Province

January 2019

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1 INTRODUCTION

1.1 PROJECT DETAILS AND BACKGROUND

Enviro-Insight CC was commissioned by Wozimart (Pty) Ltd to perform a Terrestrial Ecological Assessment for the proposed Welgedacht C prospecting right for coal located on Portions 5, 19, 20, 21, 22, 27, 33, 42, 43, 64, 65, 66, 67 and 76 of the farm Holfontein 71 IR and Portions 26 and 32 of the farm Welgedacht 74 IR, Gauteng Province, South Africa. This report was developed to conform to the requirements of an Appendix 6 level specialist assessment (NEMA 2014, as amended on 7 April 2017).

1.2 STUDY AREA

The Applicant wishes to apply for a Prospecting Right (PR) and associated Environmental Authorisation (EA) for the exploration of coal for the proposed Welgedacht C Project on an area of approximately 771 ha in the Ekurhuleni Metropolitan Municipality, Gauteng Province. Pansy Avenue is located to the West, Stofberg Avenue to the South, Laris Street to the North and the N12 runs between the mentioned farm portions. Mandela Park borders the study area to the North, EnviroServ Holfontein to the East, Persida to the South, and Welgedacht SH to the West (Figure 1-1; Figure 1-2). The topography of the area is relatively flat (no presence of ridges on site) and mostly cultivated, with some wetland pans and associated grasslands spread out across the area.

1.3 NATURE OF THE PROPOSED DEVELOPMENT

The proposed prospecting for coal and associated activities include both non-invasive (such as desktop) and invasive methods (core drilling).

Description of planned non-invasive activities:

Desktop studies to be undertaken for the study area would include studying all available geological maps/plans, aerial photographs, topography maps and any other related geological information about this area. Upon completion of the desktop study, field geological mapping of the area will be conducted, and if necessary, a ground magnetic geophysical survey to locate the occurrence of any dolerite sills/dykes that may be present in the area.

Description of planned invasive activities:

This Prospecting Work Program is designed to establish the spatial extent of the coal deposit, and all available geological information will be utilized to calculate the *in-situ* Coal Resource and the economic viability of the Project. Diamond Core Exploration Drilling is selected as the primary means of exploration as it provides accurate information on the depth and thickness of the coal seams, the quality and physical properties of the resource, composition and thickness of the overburden and aids in interpreting possible fault blocks.

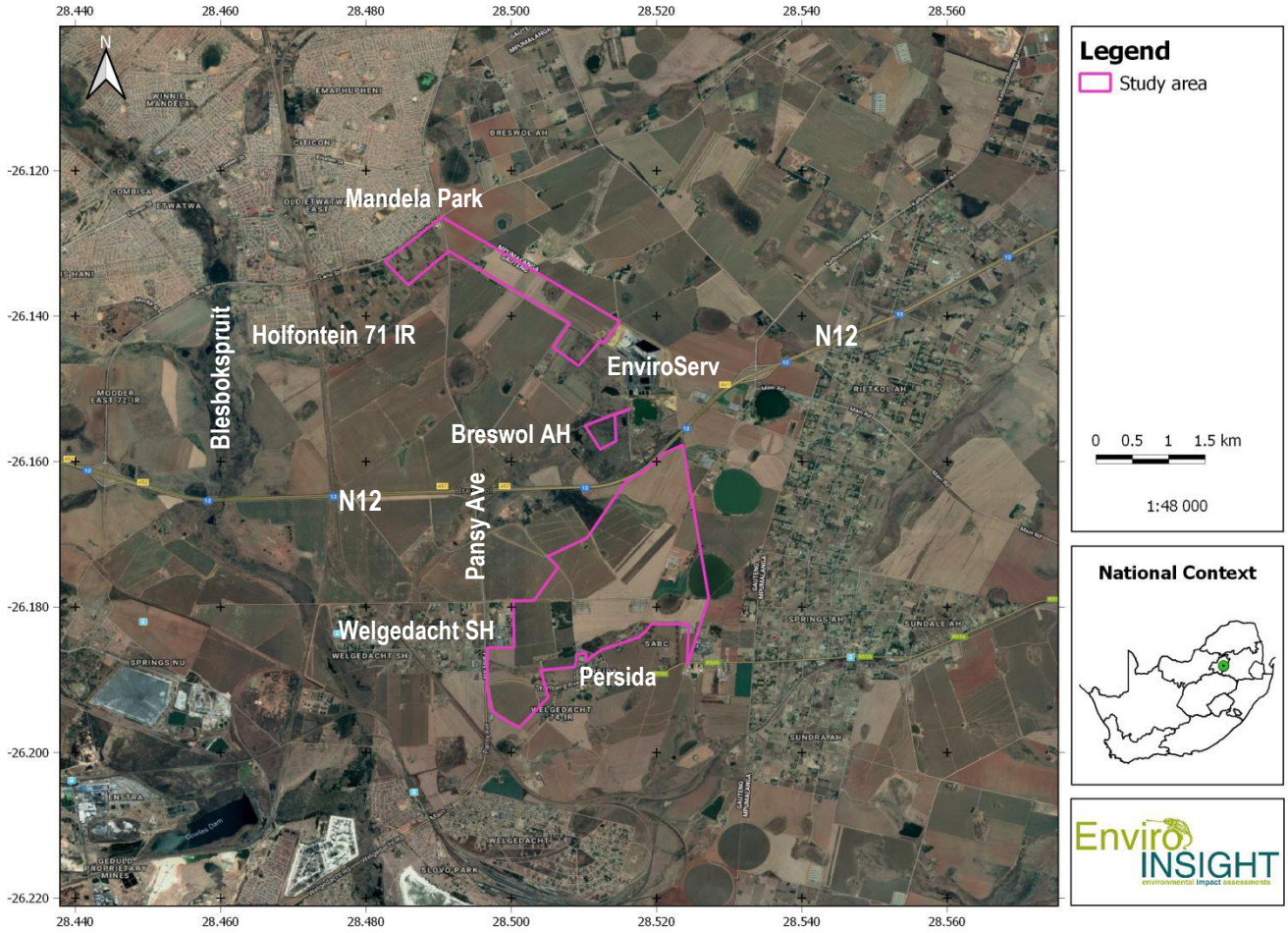

Figure 1-1 Locality of the study area for the proposed prospecting right.

These holes will be drilled in strategic locations to fill the gaps and confirm existing borehole data and information derived from the ground magnetic field survey.

Based on the extent of the area, 84 TNW (75mm diameter) diamond core drill holes are planned to be drilled in order to increase the geological accuracy of the resource modelling to inferred, of which some area may be measured. Please note that practical and geological considerations may however reduce the number of planned boreholes and subsequent budget substantially.

The average depth of these boreholes is expected to vary between 130 m and 170 m, and will be sealed with a cement plug to one meter below surface upon completion to make it safe for people and animals and allow future access by the exploration team. The drill rigs are truck-mounted and equipped with diesel driven engines to provide power to drill. Water for the drilling process is provided by a truck fitted with a water tank.

The recovered core is geologically described and the coal sampled to be analysed at an accredited laboratory to determine the quality of the coal based on proximate analysis, and where required, based on a wash analysis.

Should additional information be required, **Large Diameter Percussion Drilling** will be done where drill chips/rock fragments are blown out of the top of the hole and collected at 1 m intervals and arranged to allow continuous detailed lithological descriptions of the stratigraphic horizons.

Subsequent **Downhole Geophysical Surveying** is done at every completed borehole to produce a number of profiles reflecting rock strength, coal qualities and structural features for the total length of the borehole. A range of specialized geo-physical tools are lowered into the open borehole to record various physical and lithological characteristics of the rock mass and transmitted digitally via a cable to a computer on the surface. A single truck is used which contains all equipment including a mobile generator.

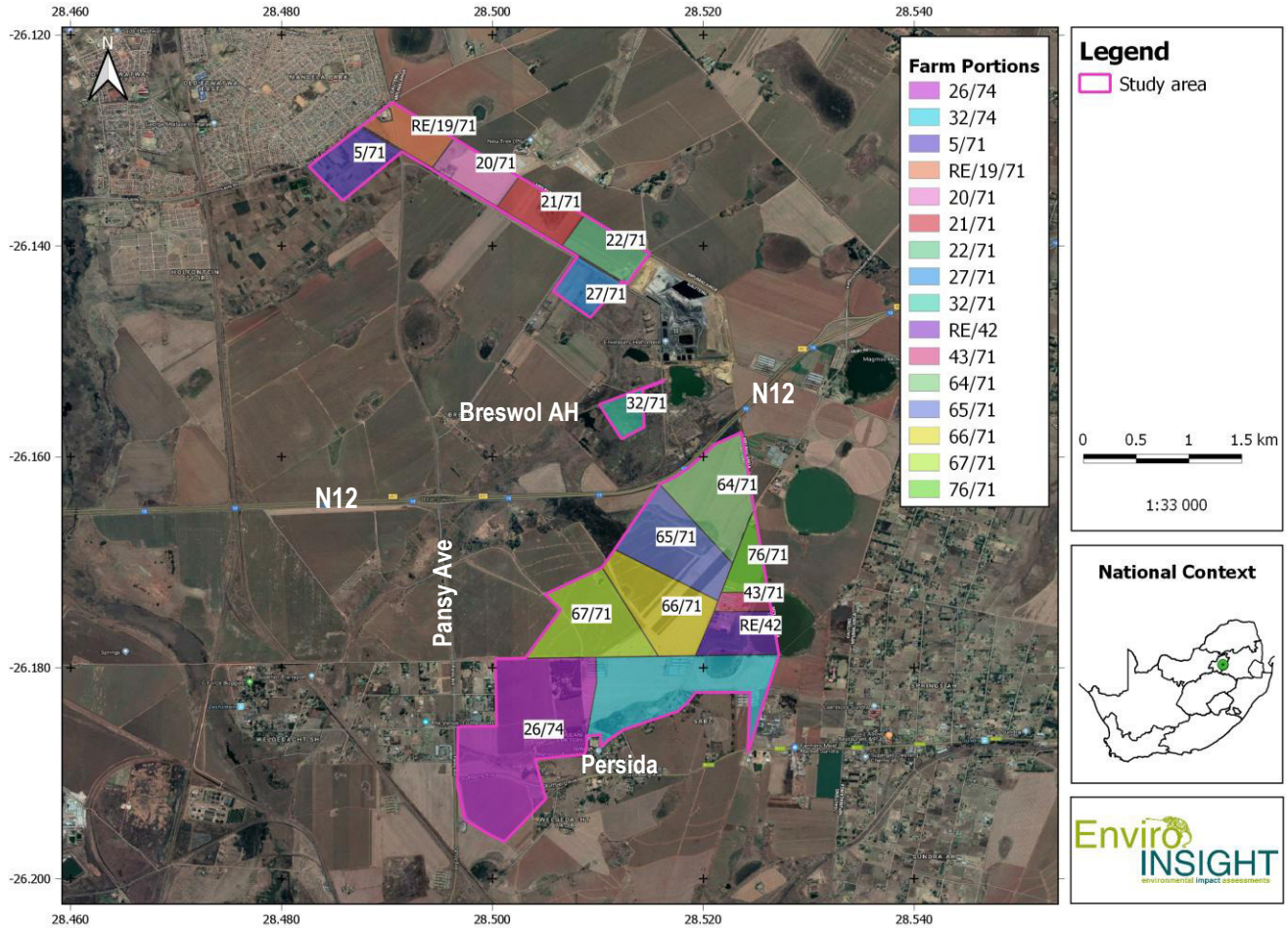

Figure 1-2: Locality of the study area indicating farm portions.

1.4 STUDY LIMITATIONS

- It is assumed that all third party information acquired is correct (e.g. GIS data and scope of work);
- Due to the nature of most biophysical studies, it is not always possible to cover every square metre of a given study area. Due to factors such as thick vegetation stands, it is conceivable that small individual plant species of conservation concern (SCC) may have been overlooked;
- Permission is required to enter properties of landowners, and was not provided in some cases. The desktop assessment and survey results from known localities were used to extrapolate in such cases;
- The exact location of drill points were not available prior to the site visit and report writing; accordingly once these locations have been determined, it should void sensitive areas such as primary vegetation and wetlands and their associated buffer areas.

2 METHODS

2.1 DESKTOP SURVEY

2.1.1 GIS

Existing data layers were incorporated into a GIS to establish how the proposed tstudy areas and associated activities interact with these important terrestrial entities. Emphasis was placed on the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006);
- Gauteng Conservation Plan v3.3 (GDARD, 2011);
- Important Bird Areas (2015);
- Protected and Conservation areas of South Africa (South Africa Protected Areas Database-SAPAD; South Africa Conservation Areas Database-SACAD)[1]; and
- National List of Threatened Ecosystems (SANBI, 2011).

All mapping was performed using open source GIS software (QGIS[2] & SAGA[3]).

2.1.2 Flora Assessment

A literature review was conducted as part of the desktop study to identify the potential habitats and flora species of conservation concern (SCC) present within the study area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA) (SANBI, 2016[4]), to access

1 http://dea.maps.arcgis.com/apps/MapTools/index.html?appid=2367540dd75148e8b6eaeab178a19d3a
2 http://qgis.osgeo.org/en/site/
3 www.saga-gis.org
4 http://newposa.sanbi.org/

distribution records on southern African plants[5]. This is a new database which replaces the old Plants of Southern Africa (POSA) database. The POSA database provided distribution data of flora at the quarter degree grid cell (QDGC) resolution; however, the BODATSA database provides distribution data as point coordinates. The literature study therefore, focussed on querying the database to generate species lists for the xMin, yMin 28.37°,-26.30° : xMax, yMax 28.65°,-26.05° extent (WGS84 datum) in order to increase the likelihood of obtaining a representative species list for the proposed study area. A total of 86 species were recorded for the mentioned location.

The Red List of South African Plants website (SANBI, 2016)[6] was utilized to provide the most current account of the national status of flora. Relevant field guides and texts consulted for identification purposes in the field during the surveys included the following:

- Guide to grasses of Southern Africa (Van Oudtshoorn, 1999);
- Field Guide to the Wild Flowers of the Highveld (Van Wyk & Malan, 1998);
- Field guide to trees of southern Africa (Van Wyk & Van Wyk, 2013);
- Orchids of South Africa: A Field Guide (Johnson & Bytebier, 2015) and
- Problem plants and alien weeds of South Africa (Bromilow, 2010).

Additional information regarding ecosystems, vegetation types, and SCC included the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006); and
- Red List of South African Plants (Raimondo *et al*., 2009; SANBI, 2018).

2.1.3 Avifauna Assessment

A desktop study was undertaken in which bird species that could potentially occur in the vicinity of the Welgedacht C study area were identified using data from the second South African Bird Atlas Project (SABAP 2; [SABAP2, 2019]). SABAP 2 records were developed based on records per pentad (i.e., 5' X 5'). To account for the high mobility of birds (inherent to linked habitats such as linear drainage lines), and the fact that atlas efforts are generally lower in remote areas, particularly away from public roads, a list of species potentially occurring within the study area was developed from SABAP 2 data for the pentads within the quarter degree grid cell (QDGC) 2628AB and 2628BA within which the study are falls, as well as all adjacent QDGCs pentads. This species list is therefore based on an area much larger than the actual study area. This approach was adopted to ensure that all species potentially occurring within the study area, whether resident, nomadic, or migratory, are identified.

The following main literature sources have been consulted for the avifauna study:

5 Data are obtained from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH)
6 http://redlist.sanbi.org/

- Information relating to avifauna species of conservation concern (SCC) was obtained from the Southern Africa Bird Atlas Project (SABAP 2, 2019), Hockey *et al.* (2005) and Taylor *et al.* (2015);
- Hockey *et al.* (2005) were consulted for general information on the life history attributes of relevant bird species; and
- The conservation status of bird species is categorised according to Taylor *et al.* (2015) the IUCN Red List of threatened species (IUCN, 2019), while their bio-geographic affinities were obtained from Parker (2001).

2.1.4 Mammal Assessment

The list of mammal species predicted to occur in the region and their respective likelihood of occurrence within the study area was generated based on known distributions and habitat suitability, sourced from online and literature sources such as MammalMap (2019), Skinner & Chimimba (2005) and Stuart & Stuart (1998). The literature study focussed on querying the MammalMap database to generate species lists for the 2628AB and 2628BA QDGCs. The predicted list is heavily influenced by factors other than just distribution or biome type. Factors such as habitat suitability, current land use, current levels of disturbance and structural integrity of the habitats all influence the potential for a species to occur in the vicinity of study area. The key literature sources used during the mammal literature review included:

- MammalMAP (2019) - The online Virtual Museum (VM) facility of the Animal Demography Unit (ADU) of the University of Cape Town (http://vmus.adu.org.za);
- Mammal SCC information was obtained from Child *et al.* (2017);
- Lists of nationally protected species according to NEMBA (2004, as amended);
- Liebenberg (2005) and Stuart & Stuart (1998) were consulted to aid with identification of tracks and signs;
- Geographic distribution and general data were acquired from MammalMap (2019) and from Skinner & Chimimba (2007); and
- Minimum standards regarding the sampling of mammals were acquired from (Sutherland, 2006).

Finally, the very nature of mammals is that they occupy several different niches and are represented by a vast diversity of body size/ types that perhaps exceed other vertebrate types (birds, reptiles etc). For example, rodents will occupy entirely different niches to apex predators (leopard/ caracals) and must therefore be evaluated in different ways. In addition, there is a high likelihood that not all mammal species known to occur within the study area and surrounding areas will be located during a particular survey. Therefore, a 'Likelihood of Occurrence' (LOO) and a 'Species of Special Consideration' review was applied to any potential omissions in the list of predicted species and specifically in reference to identified habitats. The relevant species of special consideration were addressed separately based on the data collected during the wet season fieldwork studies, in context with the proposed development and the potential effects on the species.

Likelihood of occurrence was based upon:

- Habitat suitability;
- Overlap with known distributions;
- Rarity of the species; and

- Current impacts.

2.1.5 Herpetofauna Assessment

Relevant databases, field guides and texts were consulted for the desktop and literature study included the following:

- The online Virtual Museum (VM) facility of the Animal Demography Unit (ADU) of the University of Cape Town (http://vmus.adu.org.za) was queried for the presence of reptile (ReptileMAP, 2019) and amphibian (FrogMAP, 2019) species within the 2628AB and 2628BA QDGC in which the proposed development resides;
- Reptile SCC information was obtained from Bates *et al.* (2014); and
- Amphibian SCC information was obtained from Du Preez & Carruthers (2017). Minter *et al.* (2004) has been the official reference used to provide the local conservation status of amphibians but because this reference is outdated, Du Preez & Carruthers (2017) was preferentially referenced.

Species nomenclature follows the aforementioned references throughout this document except for herpetofauna where nomenclature for reptiles follows ReptileMAP (2019) as new distribution data and taxonomic changes have already occurred since publication of Bates *et al.* (2014). Similarly, the Frog Atlas of Southern Africa (FrogMAP, 2019) provides information on the geographic distributions of amphibians and keeps current with the latest taxonomic changes. The use of these online facilities is justified as it not only includes the latest verified publicly contributed data but also a complete record of the museum material in South Africa. Drawing expected species lists for the surrounding QDGCs decreases the likelihood of underestimating the number of species present within the focal QDGC but also artificially inflates the total number of species likely to occur within the focal QDGC (some habitats may be present in adjacent QDGCs that are not present in the focal QDGC). Therefore, the resulting species list drawn from the nine QDGCs was heavily refined to exclude those species unlikely to occur within the study area, based on habitat availability and knowledge of habitat selection by particular species. As a precautionary measure, species with a low probability of occurrence within the study area were included in the predicted list. .

2.2 FIELD SURVEYS

Site visits were performed on 16 January and 13 February 2019 (representing the wet season) by an ecologist where the botanical and the faunal aspects of the survey area were rapidly evaluated. The timing of the surveys represented wet season conditions which is optimal as per GDARD minimum requirements for Biodiversity Assessments (GDARD, 2014). During the field surveys performed, the habitats were evaluated on foot and a series of georeferenced photographs were taken of the habitat attributes. The field surveys focused on a classification of the observed fauna and flora, habitats as well as the actual and potential presence of species of conservation concern (either classified as Threatened by the IUCN (2019), protected by NEMBA (2014) or indeed other legislations applicable provincially or nationally). An analysis of the diversity and ecological integrity of the habitats present on site was also performed.

2.3 SPECIES OF CONSERVATION CONCERN

The Red List of threatened species generated by the IUCN (http://www.iucnredlist.org/) provided the global conservation status of terrestrial fauna and flora. However, regional conservation status assessments performed following the IUCN criteria were considered to be the most relevant and sourced for each group as follows:

- Plants: Red List of South African plants version 2017.17 and Raimondo *et al*. (2009);
- Reptiles: Bates *et al.* (2014);
- Amphibians: Du Preez & Carruthers (2017);
- Mammals: Child *et al.* (2016); and
- Avifauna: Taylor *et al*. (2015).

The conservation status categories defined by the IUCN, which are considered here to represent species of conservation concern, are the "threatened" categories defined as follows:

- **Critically Endangered (CR)** - Critically Endangered refers to species facing immediate threat of extinction in the wild.
- **Endangered (EN)** - Endangered species are those facing a very high risk of extinction in the wild within the foreseeable future.
- **Vulnerable (VU)** - Vulnerable species are those facing a high risk of extinction in the wild in the medium-term.
- **Near Threatened (NT)** – Near Threatened species are those facing the risk of upgrade to Vulnerable;

Other measures of conservation status include species listed under the following:

- Trade in Protected Species (TOPS; National)
- Convention on International Trade in Endangered Species (CITES; International)

2.4 IMPACT ASSESSMENT

The following lists of impacts were evaluated against the data captured during the fieldwork to identify relevance to the study area. The relevant impacts were then subjected to a prescribed Impact Analysis methodology which is also described below. Mitigation measures were only developed for impacts deemed relevant on the basis of the Impact Analysis.

2.4.1 Potential Flora Impacts

1. Loss, destruction and/or eradication of critically endangered/endangered plant species;
2. Impact on plant communities of particular scientific, conservation or education value;
3. Impact on sensitive plant ecological systems;

7 http://redlist.sanbi.org/index.php

4. Decrease in diversity of natural plant communities;
5. Possibility to enhance the spread of invasive and/or alien plants and declared weeds;
6. Threat to the ecological functioning of natural plant communities due to:
    - Isolation of plant communities by destruction of habitat;
    - Reduction in the effective size of habitat/community; and
    - Physical destruction of the habitat.
7. Degradation of plant habitat through:
    - Compaction of the topsoil through trampling, vehicles, machinery etc.;
    - Introduction and/or spread of invasive alien species - creation of dispersal sites; and
    - Potential for bush encroachment through disturbance of topsoil.

2.4.2 Potential Fauna Impacts

1. Loss and/or displacement of critically endangered/endangered animal species;
2. Impact on natural communities of particular scientific, conservation or education value;
3. Impact on natural movement of species (flight pathways etc.);
4. Disturbance of non-resident or migrant species (birds over-wintering, breeding);
5. Decrease in diversity of natural animal communities;
6. Decrease in availability and reliability of food sources for animal communities;
7. Possibility to introduce and/or enhance the spread of alien animal species;
8. Threat to the ecological functioning of natural terrestrial communities due to:
    - Isolation of animal communities by destruction of habitat; and
    - Physical destruction of the habitat.
    - Construction of barriers to animal movement or migration.

2.4.3 Impact Analysis

Direct, indirect and cumulative impacts of the issues identified during the specialist investigations were assessed in terms of these six standard rating scales to determine their significance. The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on five criteria, namely:

- **Status of impacts** (Table 2-1) – determines whether the potential impact is positive (positive gain to the environment), negative (negative impact on the environment), or neutral (i.e. no perceived cost or benefit to the environment). Take note that a positive impact will have a low score value as the impact is considered favourable to the environment;
- **Extent of impacts** (Table 2-2) – determines the spatial scale of the impact on a scale of localised to global effect. Potential impact is expressed numerically on a scale of 1 (site-specific) to 5 (global);

- **Duration of impacts** (Table 2-3) – determines the extent of the impact in terms of timescale and longevity. Potential impact is expressed numerically on a scale of 1 (project duration) to 5 (permanent);
- **Magnitude of impacts** (Table 2-4) – quantifies the impact in terms of the magnitude of effect on environment (receptor) and is derived by consideration of points 1, 2 and 3 above. For this particular study, a conservative approach is adopted for severity (e.g. where spatial impact was considered to be 2 and temporal impact was considered to be 3, a value of 3 would be adopted as a conservative estimate for severity of impact); and
- **Probability of impacts** (Table 2-5) – quantifies the impact in terms of the likelihood of the impact occurring on a percentage scale of <5% (improbable) to >95% (definite).

Table 2-1: Status of Impacts

Rating	Description	Quantitative Rating
Positive	A benefit to the receiving environment (positive impact)	+
Neutral	No determined cost or benefit to the receiving environment	N
Negative	At cost to the receiving environment (negative impact)	-

Table 2-2: Extent of Impacts

Rating	Description	Quantitative Rating
Very Low	**Site Specific** – impacts confined within the project site boundary	1
Low	**Proximal** – impacts extend to within 1 km of the project site boundary	2
Medium	**Local** – impacts extend beyond to within 5 km of the project site boundary	3
High	**Regional** – impacts extend beyond the site boundary and have a widespread effect - i.e. > 5 km from project site boundary	4
Very High	**Global** – impacts extend beyond the site boundary and have a national or global effect	5

Table 2-3: Duration of Impacts

Rating	Description	Quantitative Rating
Very Low	**Project duration** – impacts expected only for the duration of the project or not greater than 1 year	1
Low	**Short term** – impacts expected on a duration timescale of 1 to 2 years	2
Medium	**Medium term** – impacts expected on a duration timescale of 2-5 years	3
High	**Long term** – impacts expected on a duration timescale of 5-15 years	4
Very High	**Permanent** – impacts expected on a duration timescale exceeding 15 years	5

Table 2-4: Severity of Impacts

Rating	Description	Quantitative Rating
Very Low	Negligible – zero or very low impact	1
Low	Site specific and short term impacts	2
Medium	Local scale and / or short term impacts	3
High	Regional and / or long term impacts	4
Very High	Global scale and / or permanent environmental change	5

Table 2-5: Probability of Impacts

Rating	Description	Quantitative Rating
Highly Improbable	Likelihood of the impact arising is estimated to be negligible; <5%.	1
Improbable	Likelihood of the impact arising is estimated to be 5-35%.	2
Possible	Likelihood of the impact arising is estimated to be 35-65%	3
Probable	Likelihood of the impact arising is estimated to be 65-95%.	4
Highly Probable	Likelihood of the impact arising is estimated to be > 95%.	5

These five criteria are combined to describe the overall significance rating (Table 2-6). Calculated significance of impact – determines the overall impact on (or risk to) a specified receptor and is calculated as: the product of the probability (P) of the impact occurring and the severity (S) of the impact if it were to occur (Impact = P × S). This is a widely accepted methodology for calculating risk and results in an overall impact rating of Low (L), Low/Medium (LM), Medium (M), Medium/High (MH) or High (H). The significance of a particular impact is depicted in Table 2-7 and assigned a particular colour code in relation to its severity.

Table 2-6: Significance of Impacts

Rating	Description		Quantitative Rating
Low	P x S = 1-3	(low impact significance)	**L**
Low/Medium	P x S = 4-5	(low/medium impact significance)	**LM**
Medium	P x S = 6-9	(medium impact significance)	**M**
Medium/High	P x S = 10-14	(medium/high impact significance)	**MH**
High	P x S = 15-25	(High impact significance)	**H**

Table 2-7: Perceived Significance of Impacts

Probability (P)	Severity (S)				
	1	2	3	4	5
1	L	L	L	LM	LM
2	L	LM	M	M	MH
3	L	M	M	MH	H
4	LM	M	MH	H	H
5	LM	MH	H	H	H

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

- **Insignificant**: the potential impact is negligible and will not have an influence on the decision regarding the proposed development;
- **Low**: the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed development;
- **Low/Medium**: the potential impact may not have any meaningful influence on the decision regarding the proposed activity/development;
- **Medium**: the potential impact should influence the decision regarding the proposed activity/development;
- **Medium/High**: the potential impact will affect the decision regarding the proposed activity/development; and
- **High**: the proposed activity should only be approved under special circumstances.

Practicable mitigation and optimisation measures are recommended and impacts are rated in the prescribed way both without and with the assumed effective implementation of the recommended mitigation (and/or optimisation) measures. Mitigation and optimisation measures are either:

- Essential: measures that must be implemented and are non-negotiable; or
- Best Practice: recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the proponent if not implemented.

3 RESULTS

3.1 REGIONAL VEGETATION

The study area is located predominantly in the **Eastern Highveld Grassland (Gm 12)** vegetation type which occurs on plains in the Mpumalanga and Gauteng Provinces and is regarded as Endangered (Mucina & Rutherford, 2006) (Table 3-1; Figure 3-1). This vegetation type extends from Johannesburg in the West to Belfast in the East and Bethal and Ermelo in the South. The topography consists of slightly too moderately undulating plains with some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual Highveld grass composition such as species from the genera *Aristida, Digitaria, Eragrostis, Themeda* and *Tristachya*, with small, scattered rocky outcrops with wiry, sour grasses and some woody species such as *Senegalia caffra, Celtis africana, Protea caffra* and *Searsia magalismontanum* (Table 3-2).

This vegetation type is classified as Endangered with only a small fraction conserved in statutory (such as Nooitgedacht Dam) and in private reserves (Holkrans, Kransbank). The national target for conservation protection for this vegetation type is 24%. Some 44% of this vegetation type was classified as transformed primarily by cultivation, plantations, mining, urbanisation and building of dams (Mucina & Rutherford, 2010), of which cultivation had a more extensive impact. *Acacia mearnsii*, an invasive species, can become dominant in disturbed areas.

Table 3-1: Attributes of the Eastern Highveld Grassland vegetation type.

Name of vegetation type	Eastern Highveld Grassland
Code as used in the Book - contains space	Gm 12
Conservation Target (percent of area) from NSBA	24%
Protected (percent of area) from NSBA	0.3%
Remaining (percent of area) from NSBA	56%
Description of conservation status from NSBA	Endangered
Description of the Protection Status from NSBA	Hardly protected
Area (km^2) of the full extent of the Vegetation Type	12669.037
Name of the Biome	Grassland Biome

Table 3-2: Important Plant Taxa characteristic of the Eastern Highveld Grassland vegetation type.

Plant form	Species
Low shrubs	*Anthospermum rigidum subs. pumilum, Seriphium plumosum*
Succulent herbs	*Aloe ecklonis*
Geophytic bulbs	*Gladiolus crassifolius, Haemanthus humilis, Hypoxis rigidula, Ledebouria ovatifolia*
Graminoids (grasses and sedges)	*Aristida aequiglumis, A. congesta, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, Elionurus muticus, Eragrostis chloromelas, E. curvula, E. plana, E. racemosa, Heteropogon contortus, Sporobolus africanus, Loudetia simplex, Microchloa caffra, Setaria sphacelata, Sporobolus africanus, Themeda triandra, Trachypogon spicatus and Tristachya leucothrix.*
Herbs	*Berkheya setifera, Haplocarpha scaposa, Justicia anagalloides, Pelargonium luridum, Acalypha angustata, Dicoma anomala, Euryops gilfillanii, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.*

A small portion of the study area falls in the **Eastern Temperate Freshwater Wetlands** (**AZf 3)** located on Portions 42 and 43 of the farm Holfontein 71 IR towards the east of the study area (Figure 3-1). This vegetation unit is embedded within the Grassland Biome and can best be described as wetland vegetation surrounding bodies of water and periodically flooded areas. It occurs in the Northern Cape, Eastern Cape, Free State, North-West, Gauteng, Mpumalanga and KwaZulu-Natal Provinces as well as in neighbouring Lesotho and Swaziland around water bodies with stagnant water (lakes, pans, periodically flooded vleis, edges of calmly flowing rivers) with altitudes ranging from 750–2 000 m.

The wetlands vegetation primarily comprises of grasses and sedges with very few trees and no shrubs present. Vegetation covers 85 % of the total land cover with bare soil comprising ~15% of the total cover. Soils are humus-rich black turf. The topography or slope is between 1~4° and drainage is good along the channelled and unchannelled valley bottoms. Dominant grass and sedge species are *Phragmites australis, Typha capensis, Schoenoplectus corymbosus, Cyperus margaritaceus, Leersia hexandra* and *Mariscus dregeanus*. Indigenous herbs include hydrophilic or moisture-loving species *Persicaria lapathifolia* and *Persicaria attenuata* together with the *Rumex lanceolatus*. Common alien species encountered in this type of wetland include: *Bidens bidentata*, *Cirsium vulgare*, *Conyza bonariensis*, *Oenothera rosea*, *Physalis viscosa*, *Plantago lanceolata*, *Rumex crispus*, *Sesbania punicea*, *Schkuhria pinnata*, *Stenotaphrum secundatum* (native on South African coast, alien on Highveld), *Trifolium pratense*, *Verbena bonariensis*, *V. brasiliensis*, and *Xanthium strumarium.*

This vegetation type is classified as least threatened with a conservation target of 24% but only 4.6% is protected in the Blesbokspruit (Ramsar site), Marievale, Olifantsvlei, Seekoeivlei (a Ramsar site), Wakkerstroom Wetland and other areas. Some 15% has been transformed to cultivated land, urban areas or plantations. In places intensive grazing and use of lakes and freshwater pans as drinking pools for cattle or sheep cause major damage to the wetland vegetation.

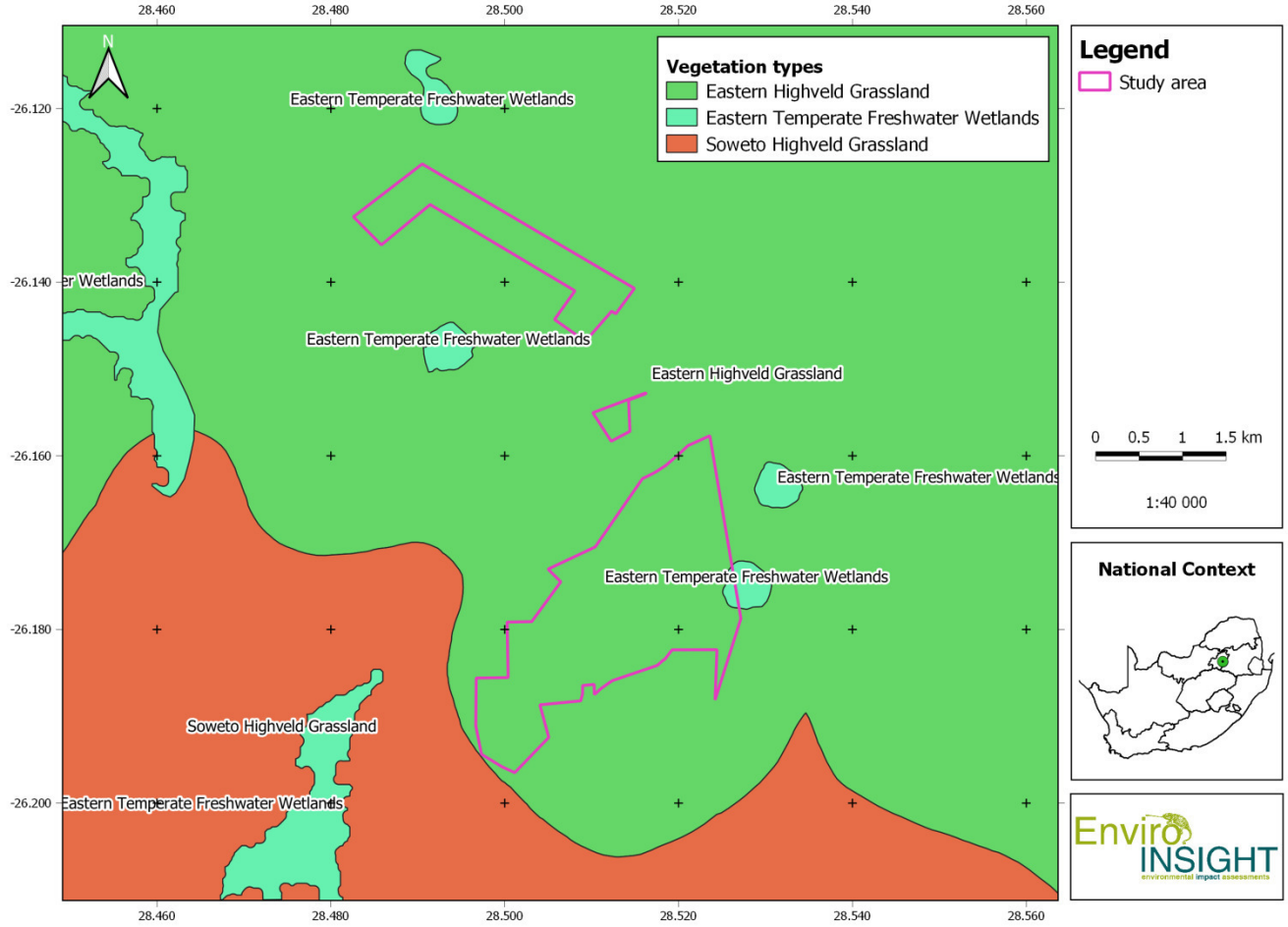

Figure 3-1: Regional vegetation types in relation to the study area (Mucina & Rutherford, 2006).

3.2 THREATENED ECOSYSTEM

The majority of the study area is located in the Critically Endangered (CR) Blesbokspruit Highveld Grassland and a small section in the Vulnerable Eastern Highveld Grassland towards the East of the study area (Figure 3-2).

The Blesbokspruit Highveld Grassland is geographically located on the East Rand of Gauteng including Endicott, Springs, and Benoni (QDGCs 2628BC, 2628AD, and 2628AB respectively). The ecosystem is delineated by the Blesbokspruit and its tributaries together with associated wetlands and pans. River, wetlands and pans in the ecosystem include the Blesbokspruit, Klein-Blesbokspruit, Verdrietlaagte, Karringmelkpan, Riet Pan, Spaarwater Pan, University Pan, Varkfontein Pan, and various other unnamed wetlands and pans. Currently only 1% is protected in the Marievale Bird Sanctuary of the remaining 85% of its original area. Species of conservation concern include 26 threatened or endemic plant and animal species. Key biodiversity

features include Red or Orange Listed plants for example *Delosperma leendertziae* and *Khadia beswickii*; Red or Orange Listed mammals include the Spotted necked Otter and Brown Hyena; Red or Orange Listed birds include the African Grass-Owl, Greater Flamingo, Lesser Flamingo, African Marsh-Harrier, Secretarybird, Yellow-billed Stork, Caspian Tern, Melodious Lark, Lesser Kestrel, White-bellied Korhaan, and Corncrake; Red or Orange Listed amphibians are limited to the Giant Bullfrog; Red Listed reptiles include the Coppery Grass Lizard and the Striped Harlequin Snake; Red or Orange Listed or priority invertebrates include the Heidelberg Copper Butterfly, and the Golden Starburst Baboon Spider.

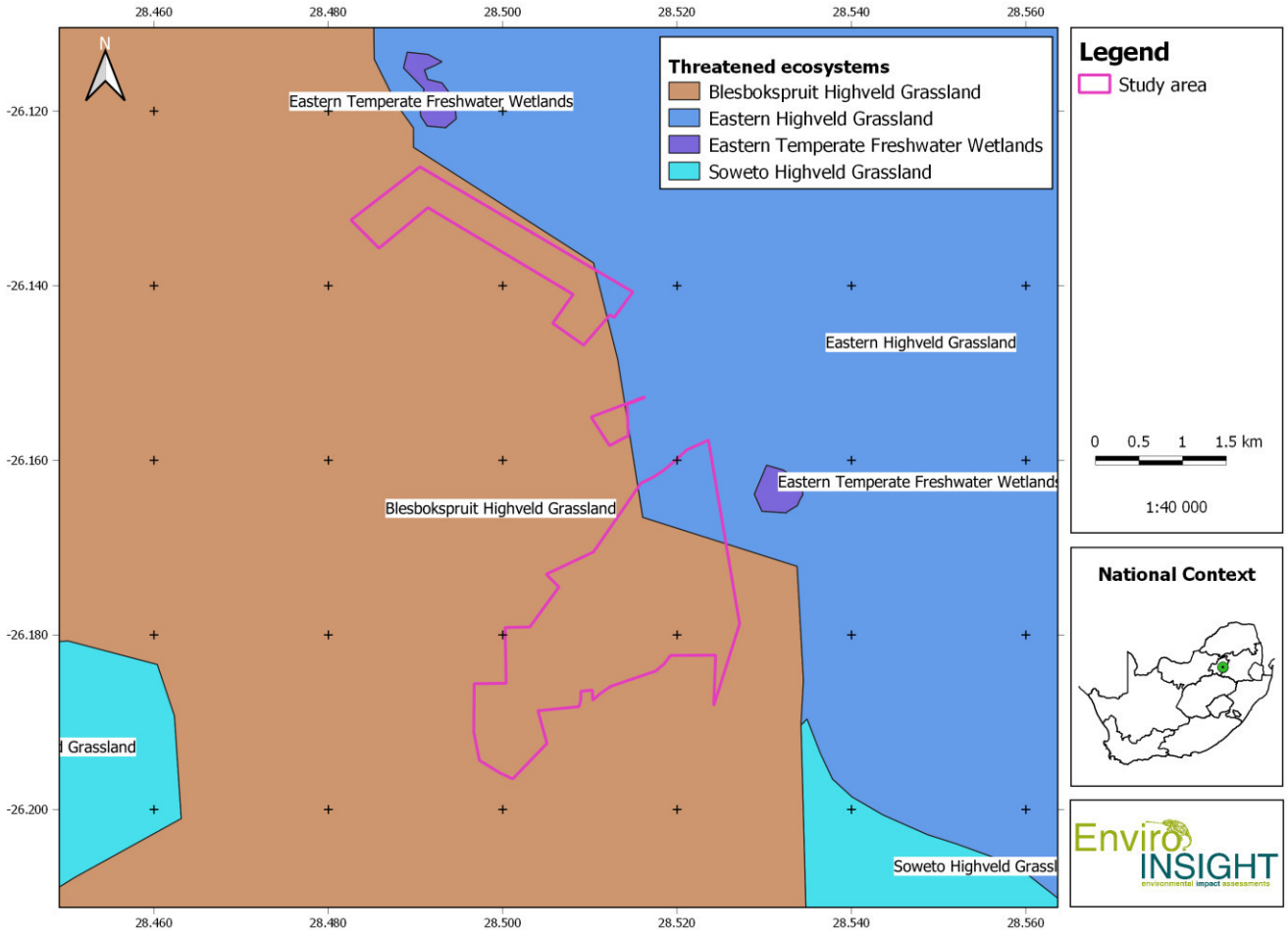

Figure 3-2: The study area in relation to threatened ecosystems.

3.3 THE GAUTENG CONSERVATION PLAN

The main aims of Gauteng Conservation Plan Version 3.3 (GDARD, 2014[a] – Technical report) are to:

- Serve as the basis for biodiversity inputs into land use planning processes in the province.
- Serve as the basis for biodiversity inputs into bioregional plans for municipalities within the province.
- Serve as the primary informant for the biodiversity component of the Basic Assessment and Environmental Impact Assessment (EIA) processes.
- Guide protected area expansion and biodiversity stewardship programmes in the province.

The Gauteng C-Plan v3.3 (2011), commonly known as a Critical Biodiversity Areas Map, delineates biodiversity priority areas called Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA) and Protected Areas (PA). The map is designed to be used at approximately 1:50 000 scale. The Critical Biodiversity Areas are comprised of key areas that are required to meet national biodiversity pattern and process targets. Ecological Support Areas are areas required to prevent the degradation of Critical Biodiversity Areas and Protected Areas.

Input layers into Gauteng C-Plan v3.3 (2011) included a new land cover map, a new vegetation map, a range of revised threatened species data, data on important aquatic features including pans, unique aquatic biodiversity features and best-condition quaternary catchments, and priority areas for climate change adaptation. The Ecological Support Areas included comprised of dolomite areas, aquatic features which were not included as CBAs (rivers, floodplains, and wetlands), as well as additional areas important for climate change adaptation such as ridges. The analysis process avoided areas of high conflict with other land uses, and favoured inclusion of areas best aligned with local planning instruments (e.g. identified Metropolitan Open Space Systems).

Protection of the priority areas identified in Gauteng C-Plan v3.3 would sufficiently contribute (on a proportional basis to ecosystem extent in Gauteng Province) to meeting national biodiversity targets for the South African vegetation types. Further, although nationally identified Freshwater Ecosystem Priority Areas (Nel *et al.*, 2011) are not included as features in the analysis, these areas are sufficiently represented in the CBA and ESA areas.

CBAs include both terrestrial and aquatic habitats, including threatened species and their habitat requirements, as well as important ecological process that ensure the persistence of biodiversity.

The Biodiversity Classification categories in the study area are defined as follows:

- **CBA: Important** – 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.
- **ESA**: Natural, near-natural, degraded or heavily modified areas required to be maintained in an ecologically functional state to support Critical Biodiversity Areas and/or Protected Areas.

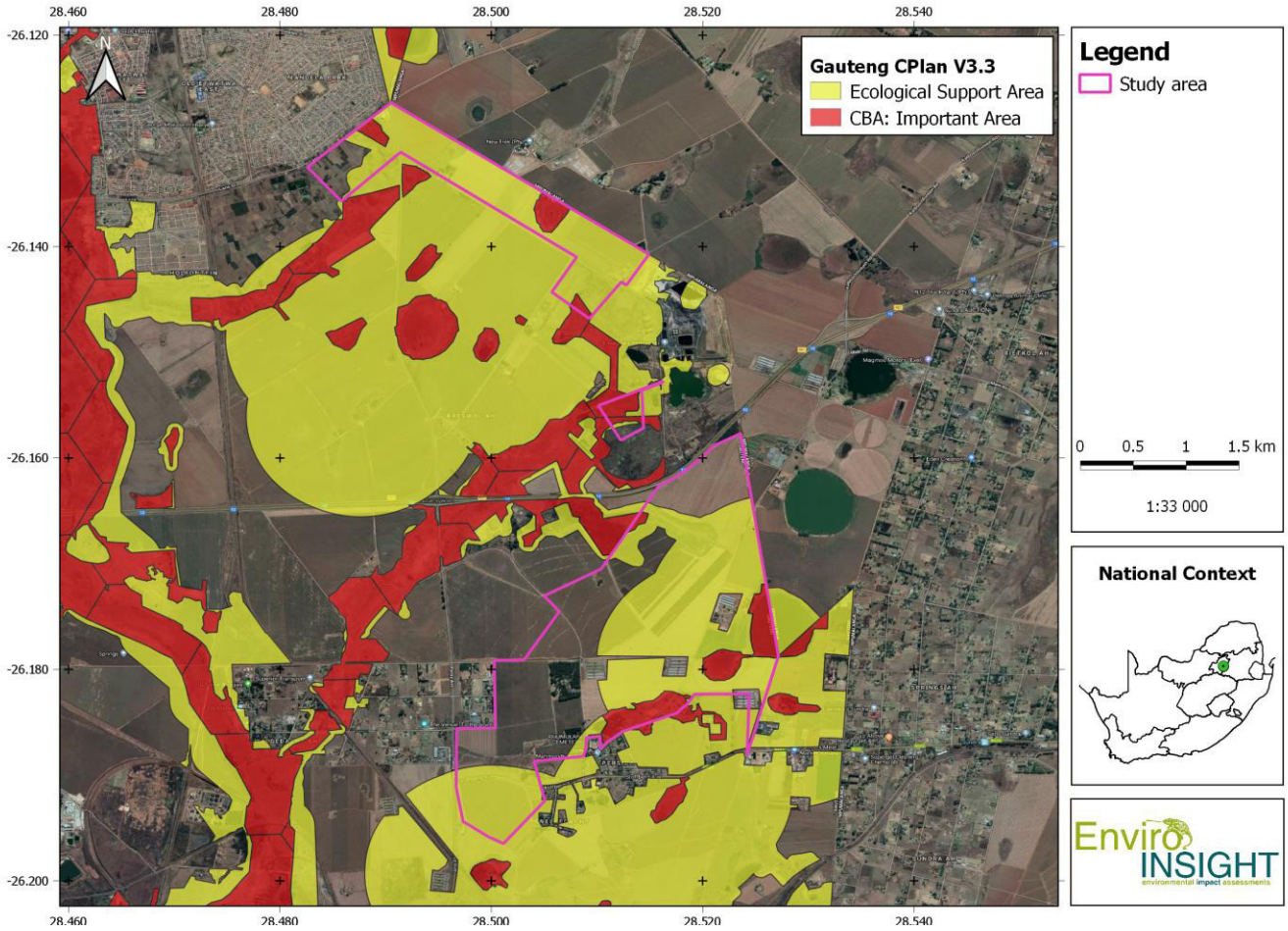

Figure 3-3: The study area in relation to the Gauteng Conservation Plan (2011).

According to the spatial dataset of the GDARD C-Plan (GDARD, 2011), the study area is located in CBA: Important and ESA (Figure 3-3).

Biodiversity features in terms of fauna and flora included for the CBA's in and surrounding the study area are (Figure 3-4):

- Primary vegetation; and
- Red Listed Bird Habitat.

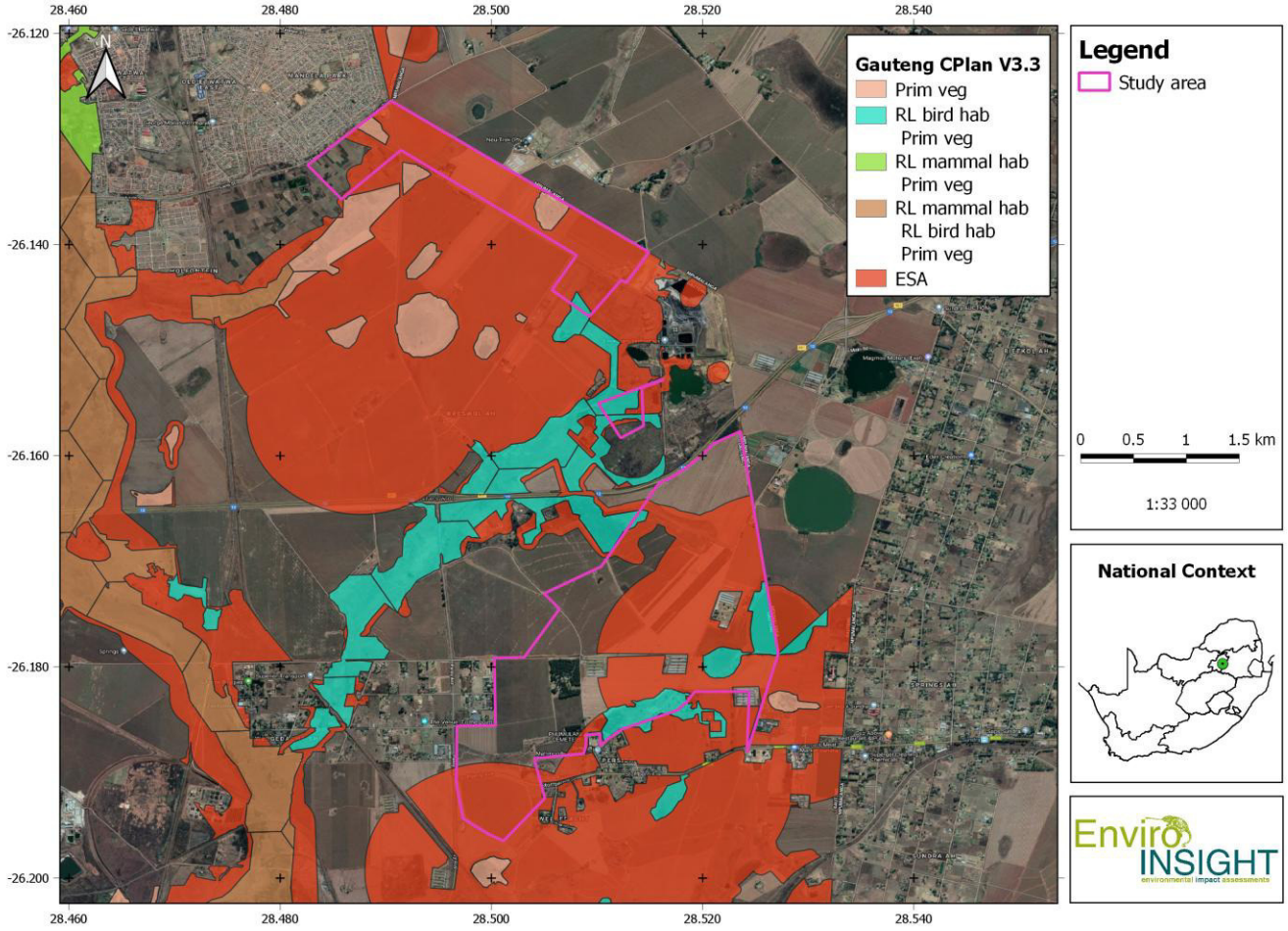

Figure 3-4: The study area in relation to the Gauteng Conservation Plan V3.3 (2011): Biodiversity features.

3.4 IMPORTANT BIRD AREAS

Located approximately 2.6 km south-west of the study area is the Blesbokspruit IBA which has also been proclaimed as a RAMSAR[8] site. The Blesbokspruit IBA is a large, highly modified, high-altitude wetland with a narrow fringe of degraded grassland. It extends along the Blesbokspruit, one of the Vaal River's larger tributaries, from the Grootvaly Wetland Reserve (R555) in the North to the Marievale Bird Sanctuary (R42) in the South. More than 220 species have been recorded for the IBA (SABAP2, 2019). The Blesbokspruit, which in the past regularly supported 20 000 waterbirds, was designated a Ramsar Wetland of International Importance for waterbirds in 1986.

[8] The Convention on Wetlands, called the Ramsar Convention, is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources

The water is highly productive, providing ample food for Lesser Flamingo (*Phoeniconaias minor*) and Greater Flamingo (*Phoenicopterus roseus*). African Marsh Harrier (*Circus ranivorus*), which has been displaced from much of the surrounding veld as a result of intense industrialisation, urbanisation and habitat modification, is a breeding resident. African Grass Owl (*Tyto capensis*) is considered to be rarely recorded along the Blesbokspruit owing to its local population decline being attributed to a reduction in its preferred rank grassland habitat adjacent to the wetland. Large volumes of water discharged upstream have increased the extent and permanence of flooded ground, while reed encroachment, unplanned fires, uncontrolled grazing by cattle and invasion by alien forbs contribute to the degradation of the remaining terrestrial habitat (Figure 3-5).

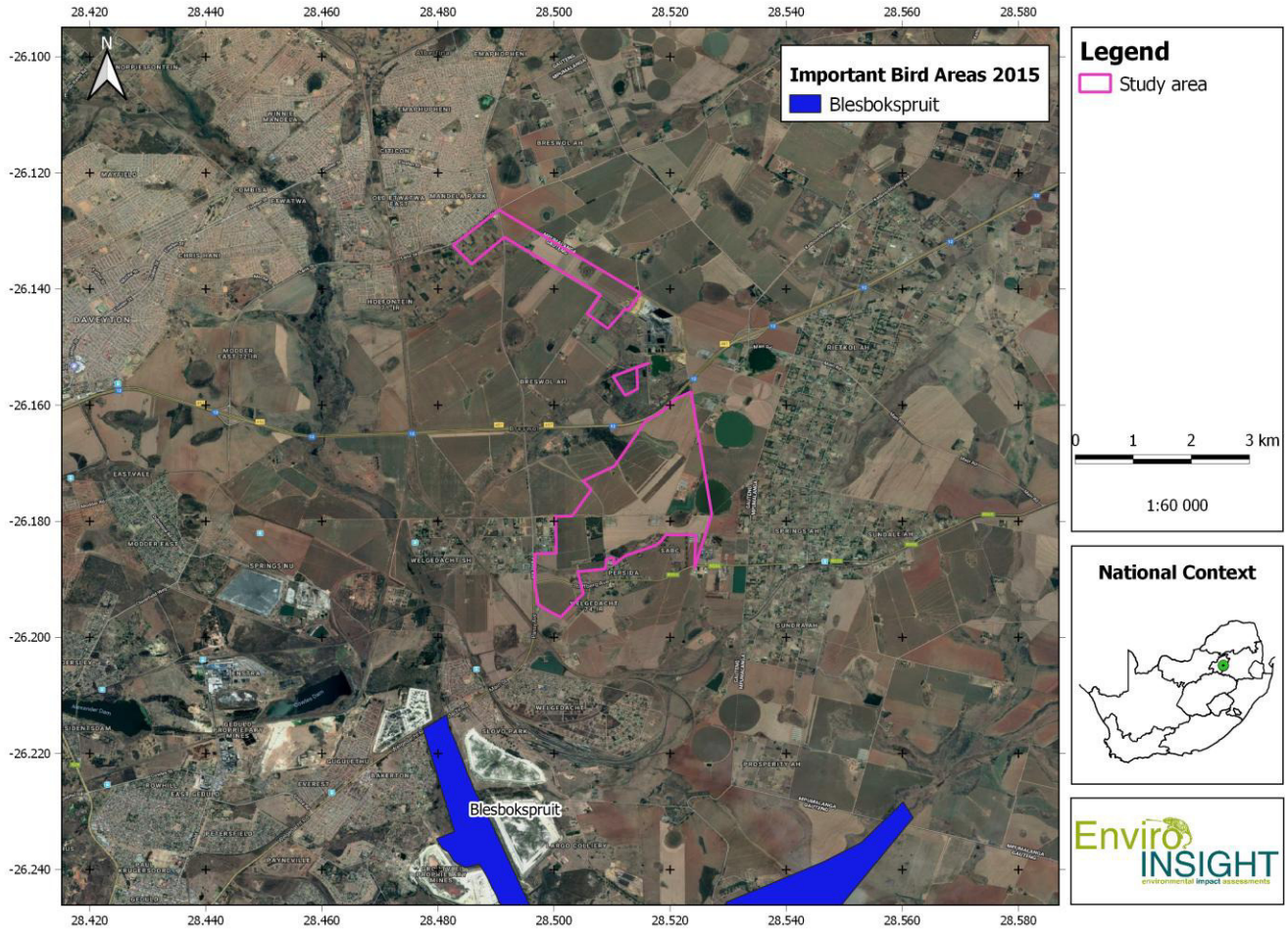

Figure 3-5: The study area in relation to Important Bird Areas.

3.5 MINING AND BIODIVERSITY

In 2012, South African Mining and Biodiversity Forum in partnership with the Department of Environmental Affairs and the Department of Mineral Resources, and with technical input and coordination of South African National Biodiversity Institute (SANBI), produced a guideline to highlight areas of high biodiversity risk in relation to mining for South Africa (Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector;(DEA *et al*., 2013; SANBI, 2012). This study was very comprehensive at the time of publication but could not benefit from key datasets that were developed thereafter e.g. the updated National landcover (2013/2014) dataset. The Mining and Biodiversity Guideline (SANBI, 2012) used "biodiversity priority areas" to develop their final dataset and defined these as follows:

- Protected areas;
- World heritage sites and their legally proclaimed buffers;
- Critically endangered and endangered ecosystems;
- Critical biodiversity areas;
- River and wetland freshwater ecosystem priority areas (FEPAs), and 1 km buffer of river and wetland FEPAs;
- RAMSAR sites;
- Protected area buffers;
- Transfrontier Conservation Areas (remaining areas outside of formally proclaimed PAs);
- High water yield areas;
- Coastal protection zone;
- Estuarine functional zones; and
- Ecological support areas.

The Mining and Biodiversity Guideline (SANBI, 2012) shows that large sections of the study area are located in category B (Highest Biodiversity Importance), and D (Moderate Biodiversity Importance), which indicate that there is a high to moderate risk to biodiversity from mining activities (Figure 3-6). The high risk category (B) is predominantly due to the critically endangered ecosystems, Critical Biodiversity Areas, the presence of NFEPA wetlands and primary vegetation (Figure 3-8). If these biodiversity features are confirmed, the likelihood of a fatal flaw for new mining projects is very high because of the significance of the biodiversity features in these areas and the associated ecosystem services. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being. If an Environmental Authorisation is granted, limits may be set on allowed activities and impacts, and may specify biodiversity offsets that would be written into license agreements and/or authorisations. For prospecting activities, these areas should be avoided and areas with moderate to low biodiversity sensitivity should be considered.

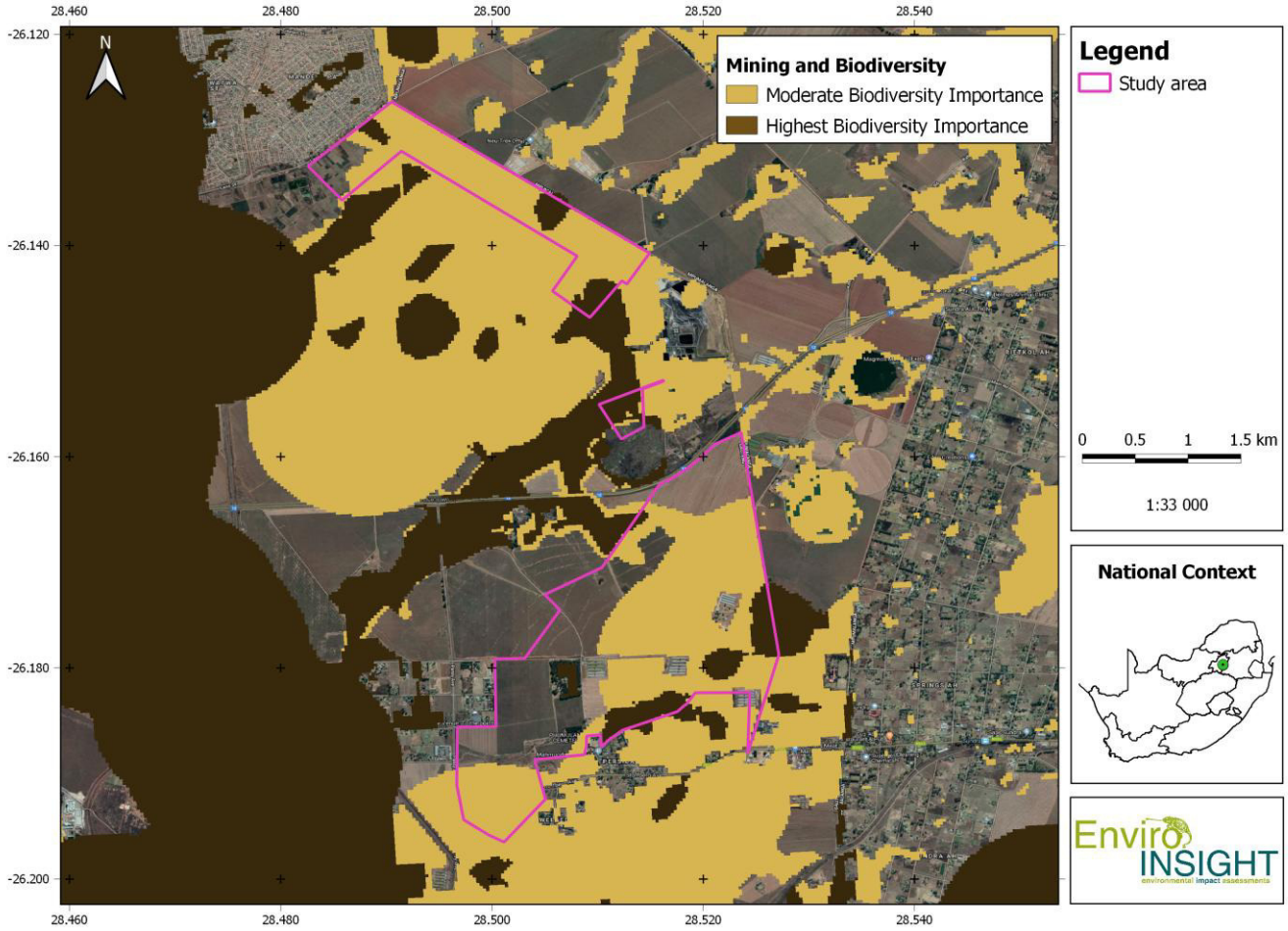

Figure 3-6: The study area in relation to Mining and Biodiversity Areas (SANBI, 2012).

3.6 OVERVIEW AND CURRENT IMPACTS

The specialist GPS tracks as well as the location of the georeferenced photos taken during the field survey are shown in Figure 3-7. The georeferenced photographs (Appendix 1) serve to assist in both the site characterisation as well as the sensitivity analysis and provide lasting evidence for future queries. The specialist coverage was considered to be complete and all areas of the study area were clearly visible and accessible. Four macro habitats were identified of which three are natural and all remaining areas including agricultural lands and infrastructure are grouped together (Figure 3-8).

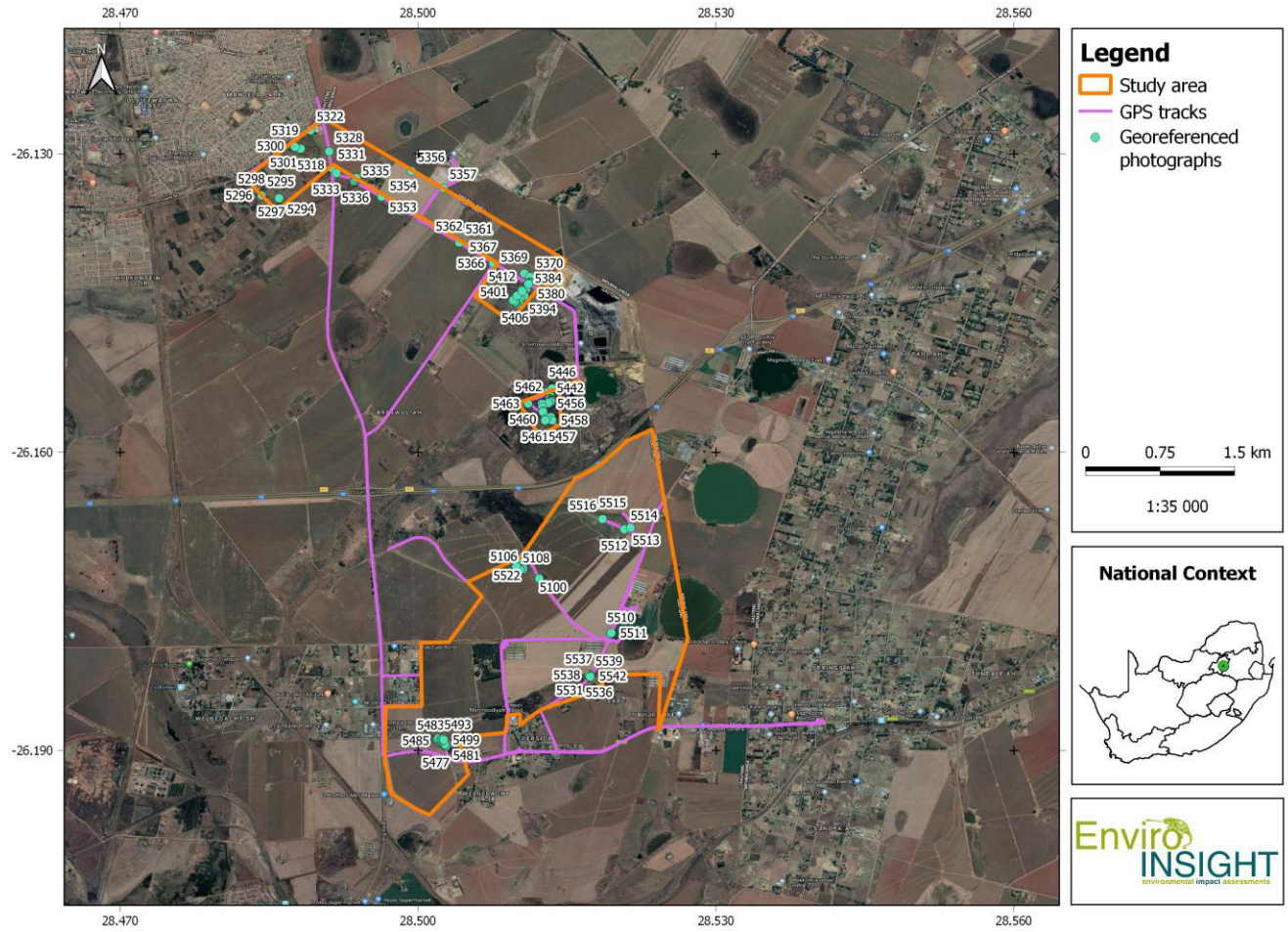

Figure 3-7: Specialist coverage (GPS tracks) and location of georeferenced photographs taken during the field surveys.

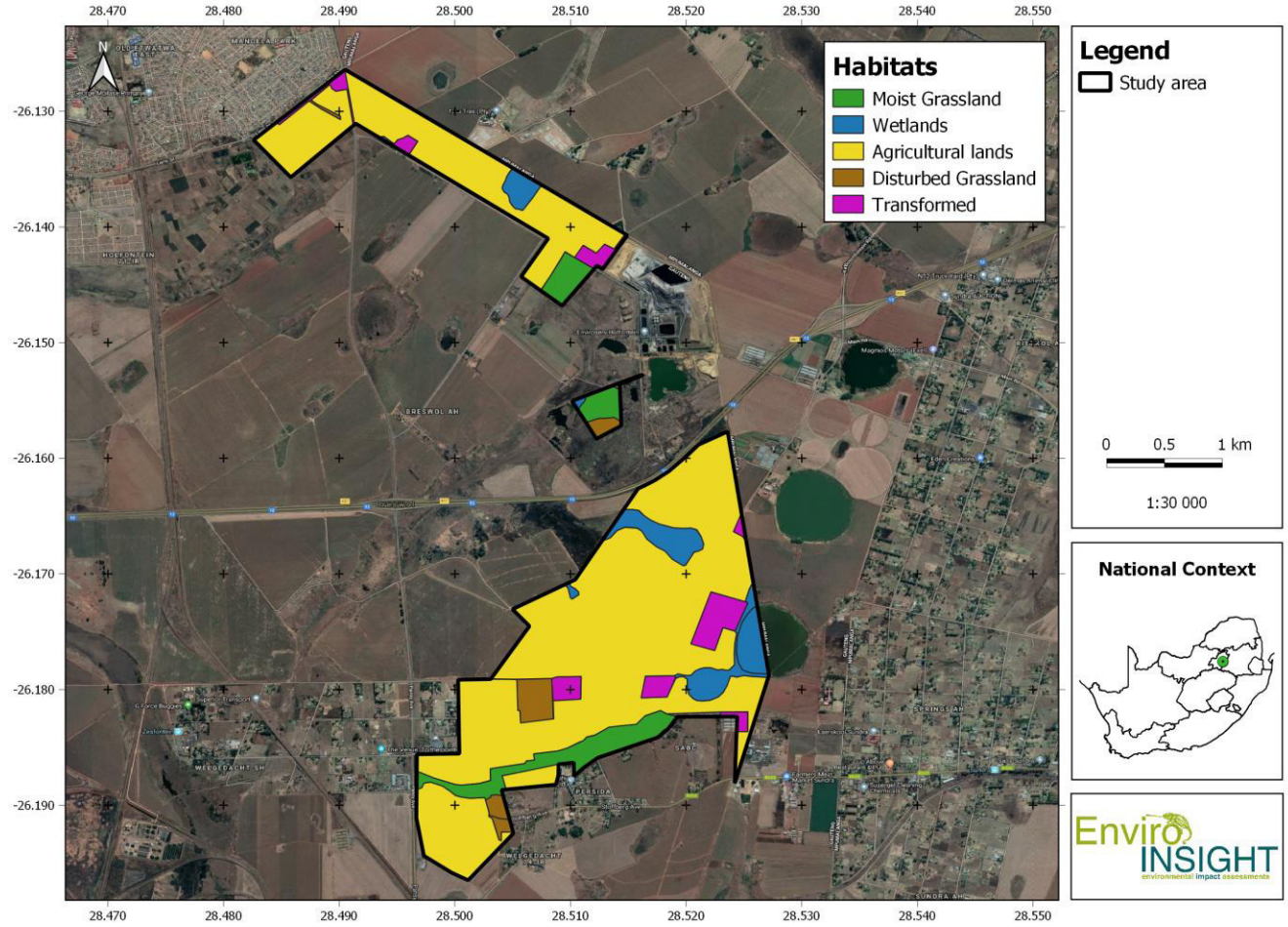

Figure 3-8: Habitats identified for the study area.

3.6.1 Moist Grassland

Moist Grassland patches are associated with wetland pans that occur in a mosaic of agricultural lands throughout the study area. The Moist Grassland has been negatively impacted on by agricultural practices, cattle grazing and alien invasive species (Figure 3-9). Despite limitations regarding site access and the current impacts, areas that were left intact showed a moderate diversity of grasses and forbs. About 50 individuals of the Orange List species *Hypoxis hemerocallidea* was recorded in this habitat.

Figure 3-9: Current impacts and features of the Moist Grassland.

Table 3-3: Plant species recorded in the Moist Grassland during the site visit.

Growth form	*Species*
Shrubs and dwarf shrubs	*Ziziphus zeyheriana**
Graminoids	*Cynodon dactylon, Cymbopogon caesius, Digitaria diagonalis var. diagonalis, Diheteropogon amplectens, Eragrostis curvula, Eragrostis chloromelas, Hyparrhenia hirta, Heteropogon contortus, Leersia hexandra, Setaria sphacelata, Sporobolus africanus, Themeda triandra, Urelytrum agropyroides*
Herbs and creepers	*Albuca sp., Arctotis arctotoides, Berkheya radula,* ***Campuloclinium macrocephalum****, Chlorophytum cooperi,* ***Cirsium vulgare****, Commelina africana, Cyanotis speciosa,* ***Cuscuta campestris****, Gerbera sp., Gladiolus crassifolius, Haplocarpha scaposa, Helichrysum nudifolium, Hermannia depressa, Hermannia grandistipula, Hermannia cf. transvaalensis, Hibiscus sp., Hibiscus microcarpus, Hypoxis hemerocallidea*, Hypoxis rigidula, Jamesbrittenia aurantiaca, Ledebouria ovatifolia, Ledebouria revoluta, Lobelia flaccida, Monsonia angustifolia, Nidorella anomala****, Nothoscordum gracile****, Oenothera rosea****, Ornithogalum tenuifolium, Pelargonium luridum, Senecio erubescens,* ***Tagetes minuta****, Trachyandra* sp., *Tulbaghia cf. acutiloba,* ***Verbena bonariensis, Verbena brasiliensis,*** *Wahlenbergia undulata*

*Medicinal plants; Species indicated in bold are alien invasive species.

3.6.2 Disturbed Grassland

The Disturbed Grassland is severely negatively impacted on by agricultural activities and alien invasive species resulting in extensive habitat loss and fragmentation (Figure 3-10). Illegal rubbish dumping is taking place along some dirt roads that are easily accessible, which destroys the grassland and promotes the spread of alien invasive species as some material is from gardens. In some areas, the presence of *Eucalyptus* spp. has completely transformed the landscape. Historical excavations and stockpile dumping transformed some grassland areas and promoted the spread of alien species (Figure 3-10 bottom right). A graveyard (Images 5474-6 in Appendix 1: Georeferenced photographs taken during the fieldwork survey.) was also noted in this habitat. A list of species recorded in this habitat is provided in Table 3-4.

Figure 3-10: Current impacts and features of the Disturbed Grassland habitat.

Table 3-4: Plant species recorded in the Disturbed Grassland during the site visit.

Growth form	Species
Trees, shrubs and dwarf shrubs	***Eucalyptus camaldulensis, Solanum mauritianum***
Graminoids	*Cynodon dactylon, Digitaria diagonalis var. diagonalis, Eragrostis curvula, Eragrostis sp., Hyperthelia dissoluta, Melinis repens, Paspalum dilatatum,* ***Pennisetum clandestinum****, Setaria sphacelata, Themeda triandra, Urochloa panicoides*
Herbs and creepers	***Bidens bipinnata, Campuloclinium macrocephalum****,* ***Canna x generalis, Cirsium vulgare,*** *Commelina africana,* ***Conyza bonariensis****, Conyza podocephala,* ***Cosmos bipinnatus****, Helichrysum nudifolium, Helichrysum rugulosum, Hermannia sp., Lotononis sp.,* ***Mirabilis jalapa****, Nidorella anomala,* ***Tagetes minuta****,* ***Verbena bonariensis, Verbena brasiliensis***

*Medicinal plants; Species indicated in bold are alien invasive species.

3.6.3 Wetlands

Several wetlands were identified within the study area, situated mainly between agricultural lands. These pans have been subjected to various edge effects from the surrounding environment, including agriculture activities, alien species and weed infestation as well physical disturbances such as cattle grazing and vehicles driving through them. Typical wetland species are indicated in Table 3-5. The ecological integrity of some of these wetlands is in an acceptable condition and the vegetation creates favourable habitat for birds, amphibians, reptiles and small mammals (Figure 3-11); however, some have been impacted to such an extent that indigenous biodiversity is low and ecosystem functioning might have been altered.

Table 3-5: Plant species recorded in the Wetland habitat during the site visit.

Growth form	Species
Trees, shrubs and dwarf shrubs	***Salix babylonica, Solanum mauritianum***
Graminoids and Sedges	*Agrostis lachnantha,* ***Cortaderia selloana****, Cymbopogon caesius, Cynodon dactylon, Cyperus esculentus, Eragrostis chloromelas, Imperata cylindrica, Melinis repens,* ***Pennisetum clandestinum****, Phragmites australis, Sporobolus africanus, Sporobolus* cf. *festivus, Schoenoplectus* cf. *corymbosus, Setaria sphacelata, Themeda triandra, Urochloa panicoides*

Herbs	***Amaranthus hybridus***, *Berkheya setifera,* ***Bidens pilosa***, *Bulbostylis sp.,* ***Campuloclinium macrocephalum***, ***Cirsium vulgare***, *Commelina africana,* ***Cosmos bipinnatus***, ***Conyza bonariensis***, *Cyanotis speciosa, Dipcadi viride, Helichrysum nudifolium, Hibiscus microcarpus, Hypoxis hemerocallidea, Monopsis decipiens,* ***Oenothera rosea***, *Persicaria attenuata, Persicaria* ***lapathifolia***, *Polygala hottentotta,* ***Pseudognaphalium luteoalbum***, *Schizocarphus nervosus, Selago densiflora, Senecio microglossus, Typha capensis,* ***Verbena bonariensis, Verbena brasiliensis,*** *Wahlenbergia undulata*

*Medicinal plants; Species indicated in bold are alien invasive species.

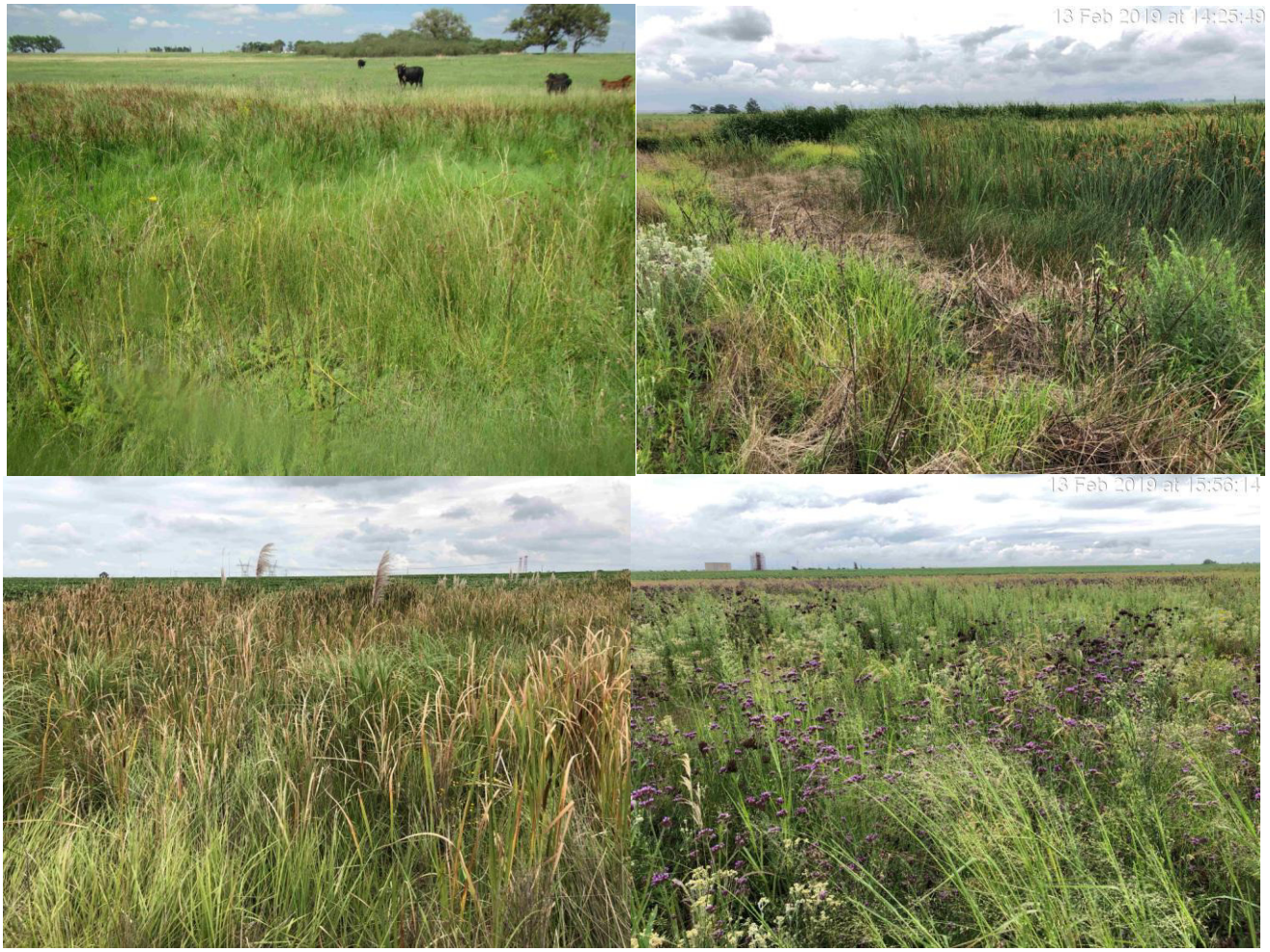

Figure 3-11: Current impacts and features of the Wetlands habitat type.

3.6.4 Agriculture lands and Transformed areas

Agricultural crop production is the main land use within the study area, and consists mostly of maize crops. Several alien species and weeds are present in this habitat type due to agricultural practices, which include *Tagetes minuta*, *Campuloclinium macrocephalum, Conyza* spp., *Pennisetum clandestinum* and *Verbena brasiliensis.* Transformed areas include infrastructure associated with agricultural practices and includes storerooms, farm houses, offices, feedlots etc. as well as a wedding venue (Figure 3-12). *Eucalyptus* spp., occur mostly in transformed areas with some smaller alien species. The ecological integrity of these areas is low and can even be homogenous.

Figure 3-12: Agricultural fields and transformed areas within the study area.

3.7 OBSERVED AND EXPECTED FAUNA

3.7.1 Mammals

The study area resides on the 2628BA and 2628AB quarter degree grid cells (QDGCs). These QDGCs along with adjacent cells were considered to represent similar habitats and therefore the predicted species list was derived from observation records from these QDGCs.

The mammal species list derived from records collected for the QDGCs is presented in Appendix 3: Mammal species list. Five species of conservation concern could be expected to occur within the study area and are discussed in detail in section 3.9: Faunal Species of Conservation Concern.

Given the fact that the vast majority of the surface area of the study area is dominated by agricultural activity, the number of mammal species observed and expected is low. The system within the study area is not conducive to high mammal density and diversity, with the exception of the watercourse and wetland habitats combined with moist grasslands, where signs of a small rodent network (possibly that of *Otomys auratus*) were observed during the site visit in the moist grassland (Figure 3-13). All species of conservation concern discussed in detail subscribe to the Precautionary Principle where it is assumed that they are present on site, with appropriate mitigation measures suggested.

Figure 3-13: Signs of a small rodent network in the moist grassland.

3.7.2 Herpetofauna

The study area resides on the 2628BA and 2628AB QDGCs. These QDGCs along with the adjacent cells were considered to represent similar habitats and therefore the predicted species list was derived from observation records from these QDGCs. Expected species lists derived in this manner may therefore represent an overestimation of the diversity expected as very specific habitat types may be required by a species which may be present in a QDGC but not necessarily on the study site within the QDGC. Conversely, many large areas in South Africa are poorly sampled for herpetofauna and expected species lists derived from a single QDGC may therefore underestimate the species diversity. Drawing expected species from surrounding QDGCs therefore increases the likelihood of obtaining a species list that suffers less from poor sampling in the area but it also artificially inflates the expected number of species because many different habitats in the surrounding QDGCs may not be present on the study site. To counteract this, all possible attempts were made to refine the expected species list based on species-specific habitat requirements and a good understanding of the habitat types and quality of the study site. Species that are unlikely to occur on the study site but that do occur in the surrounding QDGCs were kept in the expected species list (precautionary principle) and species with a high probability of occurrence on the study site were added to the list even if ReptileMAP and FrogMAP did not have a record for the selected QDGCs.

The herpetofauna species list derived from records collected for the QDGCs is presented in 9.4 Appendix 4: Herpetofauna species list. A total of 47 reptile and 16 amphibian species is expected to occur within the study area, representing relatively low herpetofauna diversity, characteristic of the Highveld grassland habitats. Three species of conservation concern could be expected to occur within the study area namely the Striped Harlequin Snake (*Homoroselaps dorsalis*; Near-Threatened), Coppery Grass Lizard (*Chamaesaura aenea*; Near-Threatened) and Giant Bull Frog (*Pyxicephalus adspersus*; Near-Threatened). These species are discussed in detail in section 3.9: Faunal Species of Conservation Concern.

3.7.3 Avifauna

The study area is located in the 2605_2825, 2605_2830, 2610_2830 and 2610_2825 pentads (Figure 3-14). Common species recorded during the site visit include: *Hirundo albigularis* (White-throated Swallow), *Bubulcus ibis* (Cattle Egret), *Euplectes orix* (Southern Red Bishop), *Anas platyrhynchos* (Mallard Duck), *Vanellus armatus* (Blacksmith Lapwing) and *Ploceus capensis* (Cape Weaver).

The avifauna species list derived from SABAP2 records is presented in Appendix 5: Avifauna Expected species list. Species of Conservation Concern are discussed in section 3.9: Faunal Species of Conservation Concern.

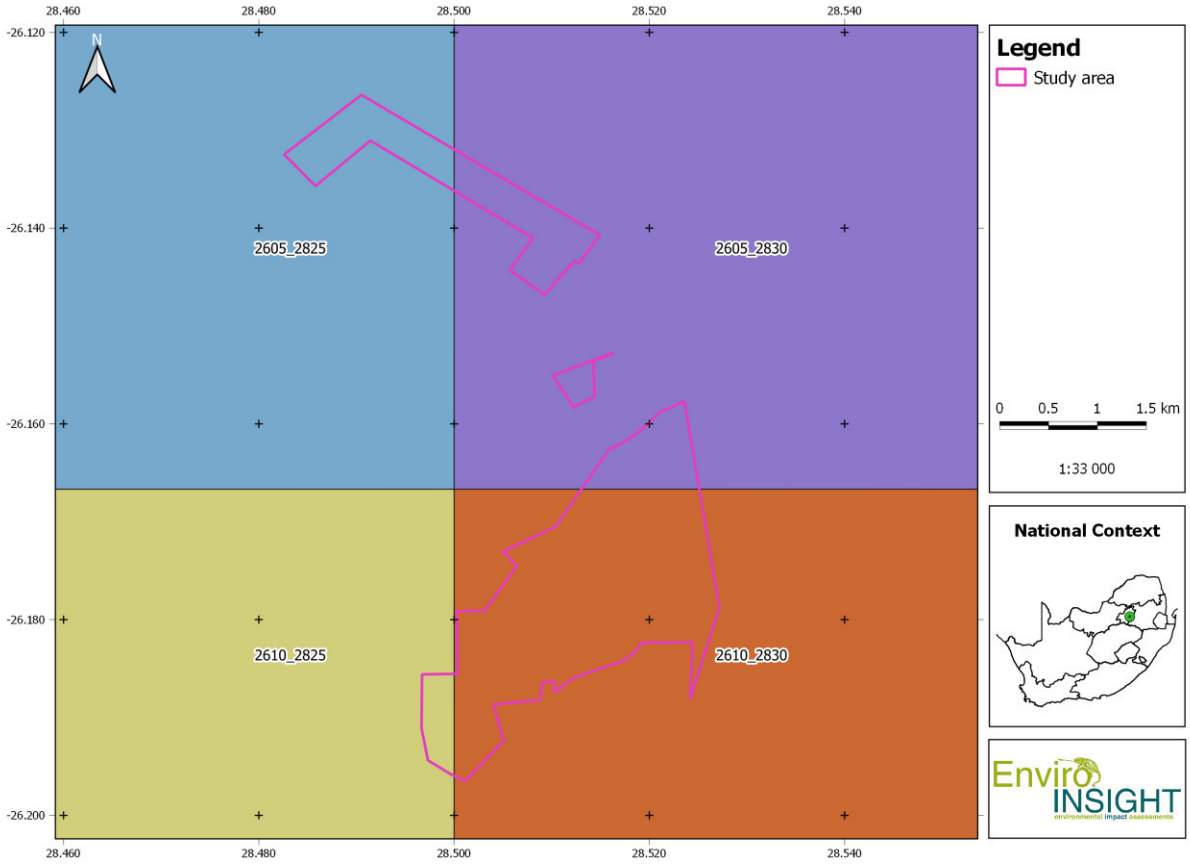

Figure 3-14: The study area in relation to the SABAP2 pentads.

3.8 FLORAL SPECIES OF CONSERVATION CONCERN

Hypoxis hemerocallidea was observed during the site visit (Figure 3-15). About 50 individuals of this species occur within the temporary zone of the watercourse. *H. hemerocallidea* is a medicinal plant which makes it popular in the muthi shops/markets across the country as the corm is consistently heavily harvested. Land transformation and habitat loss in Gauteng is also a threat to the species. The species population trend is decreasing across the country, especially in Gauteng were it has been indicated as Declining.

The Gauteng C-Plan (v3.3) regards large portions of the study area to be suitable habitat for Red and Orange Listed plant species, specifically *Kniphofia typhoides* (Bulrush poker), *Khadia beswickii (*Khadiwortel*),* and *Nerine gracillis* (Nerine). All potential Red and Orange Listed plant species are indicated in Table 3-6.

Table 3-6: Potential plant species of conservation concern.

Species	Conservation Status	Habitat Description	Present on site
Boophone disticha	Declining - loss of habitat in Gauteng and harvesting for medicinal purposes	Dry grassland and rocky areas. (Flowering period: October-January)	No
Crinum bulbispermum	Declining - Threatened by harvesting for the medicinal plant trade	Near rivers, streams, seasonal pans and in damp depressions. (Flowering period: September-November)	No
Habenaria bicolor	Near Threatened - decline in habitat due to urban expansion in Gauteng	Well-drained grasslands at around 1600 m in South Africa. (Flowering period: January-April)	Unlikely – Were not recorded during the site visit
Hypoxis hemerocallidea	Declining - Threatened by harvesting for the medicinal plant trade	Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Appears to be drought and fire tolerant. (Flowering period: September-March)	Yes – recorded on site
Kniphofia typhoides	Near Threatened – extensive declining due to habitat loss to coal mining, overgrazing by cattle, urban expansion (especially in Gauteng), crop cultivation	Low-lying wetlands and seasonally wet areas in climax Themeda triandra grasslands on heavy black clay soils, tends to disappear from degraded grasslands. (Flowering period: February - March)	Possible – Were not recorded during the site visit but has been recorded in the area
Nerine gracillis	Vulnerable - currently threatened by ongoing degradation and habitat loss due to overgrazing and urban development.	Terrestrial, including the Soweto Highveld Grassland. Undulating grasslands in damp, moist areas; the plants grow in full sun in damp depressions, near pans or on the edges of streams; grassland, riverbanks, vleis. (Flowering period: February - March)	Unlikely - Were not recorded during the site visit
Pachycarpus suaveolens	Vulnerable - Threatened by agriculture, mining and aliens. Urban expansion may have led to the local extinction of this species in Gauteng	Terrestrial, including Eastern Highveld Grassland. Short or annually burnt grasslands, 1400-2000 m.	Possible - Were not recorded during the site visit

Kniphofia typhoides was recorded within 14.67 km south of the study area. The species occurs in low lying wetlands and seasonally wet areas in climax *Themeda triandra* grasslands on heavy black clay soils, and tends to disappear from degraded grasslands. The dense, brown inflorescence appears in late summer (February-March). Individual flowers are quite small and

faintly aromatic. The leaves are broad and fan-shaped. It is one of three species of *Kniphofia* that occur in Gauteng and is listed as Near-Threatened. A survey of the range of this species by C. Craib reported extensive declines in the population in the last 30 years as a result of habitat loss to coal mining, overgrazing by cattle, urban expansion (especially in Gauteng), crop cultivation in the eastern North West Province and alien plant invasion in western Mpumalanga and North West Province. The full extent of the decline is unknown, but is suspected to be over 25%. If the wetland areas are excluded from development, this species will not be impacted on.

Figure 3-15: Hypoxis hemerocallidea recorded in the study area.

3.9 FAUNAL SPECIES OF CONSERVATION CONCERN

3.9.1 Mammals

3.9.1.1 White-tailed Rat (*Mystromys albicaudatus*) Endangered

This species is a low density colonising, nocturnal, burrowing rodent that favours mesic grassland habitats present within the study area. The study area represents its core area of distribution where undisturbed grassland occurs and the species is unlikely to occur in regions where current impacts such as heavy disturbances from human activities or indeed high densities of feral predators persist. In light of this and by employing the Precautionary Principle (assuming that white-tailed rat is present in the area), it is concluded that trapping assessments such as Sherman trapping and scat analysis (jawbones of predators such as owls, dogs and jackals) are not warranted due to the rarity and temporary colonisation habits of the species. Instead, simple mitigation measures could be employed by ensuring that primary grassland habitat is buffered as much as possible, thereby avoiding all direct impact and maintaining the existing integrity of the rodent's habitat. However, as the species does exhibit migratory colonising behaviour, it is not likely to suffer catastrophic population declines due to the proposed prospecting activities.

3.9.1.2 South African Hedgehog (*Atelerix frontalis*) Near Threatened

Hedgehogs are listed as Near Threatened and although the species is common in urban environments and is affected by development, it is also found on grasslands of varying degrees of quality, especially in the absence of dogs and other feral predators. With a loss of grassland habitat, it is likely that local hedgehog populations will be displaced or eradicated. The best course of action will be to mitigate against roadkills, to which this species is very susceptible as well as to allow for worker induction, which will report hedgehog presence and allow individuals to be safely relocated to more undisturbed areas.

3.9.1.3 Serval (*Leptailurus serval*) Near Threatened

This meso-predator cat species has frequently been recorded in the area and it is anticipated that a significant resident population persists within the study area, given the predicated high density of rodents and the suitable habitat. The species is a relatively common wetland associate in grassland areas and although the Near Threatened status warrants due consideration, the species is not considered to be a fatal flaw given adequate avoidance and mitigation (especially of wetland environments).

3.9.1.4 Cape fox (*Vulpes chama*) TOPS Protected

Although this species is TOPS protected, its presence within the study is not considered to be of great concern due to the penchant for the species to colonise areas in association with humans.

3.9.1.5 Grassland Vlei Rat (*Otomys auratus*) Near Threatened

This species was until recently included in *Otomys irroratus* and the two cannot be distinguished on morphological grounds; however, *O. auratus* is closely associated with the Grassland Biome in South Africa, whilst *O. irroratus* is closely associated with the Fynbos and Thicket biomes of the Western Cape and Eastern Cape provinces of South Africa (Monadjem *et al*. 2015). The species is widely distributed throughout the Highveld grasslands and associated with mesic grasslands and wetlands within alpine, montane and sub-montane regions (Monadjem *et al*. 2015), typically occurring in dense vegetation in close proximity to water. This near-endemic grassland species is becoming increasingly threatened by grassland contraction and wetland loss, with niche modelling showing that it will undergo a 47–61% reduction in suitable habitat between 1975 and 2050 from climate change. Grassland and wetland habitat loss from agricultural expansion, human settlement sprawl and mining are currently the greatest threats to this species' habitat (Taylor *et al*. 2016). It is a relatively common wetland associate in grassland areas and although the Near Threatened status warrants due consideration, the species is not considered to be a fatal flaw given adequate avoidance and mitigation (especially of wetland environments).

3.9.1.6 Highveld Golden Mole (*Amblysomus septentrionalis*) Near Threatened

The "turned" earth of much of the study area is ideal for burrowing by this species. Its Near-Threatened status does not warrant a fatal flaw and mitigation of agricultural areas is considered to be impossible.

3.9.2 Herpetofauna

3.9.2.1 Giant Bullfrog (*Pyxicephalus adspersus*) – Least Concern/ Near Threatened

The Giant Bullfrog is listed by Minter *et al*. (2004) as Near Threatened. However, the IUCN (2019) considers this species to be of Least Concern across its global distribution but Du Preez & Carruthers (2017) mention that this species is still of conservation concern in Gauteng, despite GDARD having removed this species from their list of trigger species. This species will likely undergo an escalation in conservation status soon and must pre-emptively be considered to be of conservation importance. This species has been recorded in the 2628AB QDGC on which the study area resides (FrogMAP, 2019) and is very likely to breed within the study area in the wetland pans habitats. Mitigation of potential impacts will need to occur and will include appropriate education of staff for the detection and relocation of encountered specimens, prevention of roadkills and avoidance of breeding habitats.

3.9.2.2 Coppery Grass Lizard (*Chamaesaura aenea*) – Near Threatened

This species favours grassland associated with mountain tops, escarpments and the Highveld (Branch, 1998; Bates *et al.,* 2014). It is considered a species of conservation concern due to the loss of habitat experienced across its range, mostly due to the transformation of its habitat for crop farming and plantations, overgrazing by livestock, infrastructural development, frequent anthropogenic fires and the use of pesticides (Bates *et al.,* 2014). This species has been recorded from both of the QDGCs on which the study area resides.

3.9.2.3 Striped Harlequin Snake (*Homoroselaps dorsalis*) – Near Threatened

This small, shy and secretive snake species is rarely seen but most often found in disused termitaria where it preys on thread snakes of the genus *Leptotyphlops* (Branch, 1998; Marais, 2004). This snake species has not been recorded from the QDGCs on which the study area resides but has been observed in adjacent QDGCs (ReptileMAP, 2019) and the author considers it possible that they may occur within the study area, albeit at a low probability.

3.9.3 Avifauna

A list of avifauna species of conservation concern previously recorded in the study area pentads is provided in Table 3-7. A total of eleven species of conservation concern could occur on site, of which six species are listed as regionally Near-Threatened, four species are listed as regionally Vulnerable, and one species is listed as regionally Endangered. Specific species are discussed in detail below.

Table 3-7: Avifauna species of conservation concern previously recorded in the study area pentads

Species	Common Name	Global Conservation Status*	National Conservation Status**	Average SABAP2 Reporting rate	Preferred Habitat	Potential Likelihood of Occurrence on study area
Alcedo semitorquata	(Half-collared Kingfisher)	Near threatened	Near threatened	0	Prefers fast-flowing and well-vegetated streams	Low given limited suitable habitat
Ciconia abdimii	(Abdim's Stork)	Least Concern	Near threatened	0	Open stunted grassland, fallow land and agricultural fields.	An uncommon summer visitor.
Circus ranivorus	(African Marsh Harrier)	Least Concern	Endangered	0	Restricted to permanent wetlands with extensive reed beds.	Likely to be present in wetland habitat
Falco biarmicus	(Lanner Falcon)	Least Concern	Vulnerable	41.06%	Varied, but prefers to breed in mountainous areas.	A highly irregular foraging visitor.
Falco vespertinus	(Red-footed Falcon)	Near-threatened	Near-threatened	0	Open arid savanna and grassland.	A very rare summer visitor. Probably absent.
Mycteria ibis	(Yellow-billed Stork)	Endangered	Endangered		Reasonably common in wetlands, open shallow water generally free of vegetation	Likely to be present in wetland habitat
Oxyura maccoa	(Maccoa Duck)	Near threatened	Near threatened	0	Large saline pans and shallow impoundments.	Likely to be present in wetland habitat
Phoenicopterus minor	(Lesser Flamingo)	Near threatened	Near threatened	0	Open, eutrophic, shallow saline and alkaline wetlands, such as salt pans	Low probability within shallow wetlands
Phoenicopterus ruber	(Greater Flamingo)	Least Concern	Near threatened	0	Restricted to large saline pans and other inland water bodies.	Low probability to occur

Sagittarius serpentarius	(Secretarybird)	Vulnerable	Vulnerable	0	Prefers open grassland or lightly wooded habitat.	Regular to uncommon foraging visitor.
Tyto capensis	(African Grass-owl)	Least Concern	Vulnerable	0	Prefers rank moist grassland that borders drainage lines or wetlands.	Unlikely – limited suitable habitat

3.9.3.1 African Marsh Harrier (*Circus ranivorus*) Endangered

Due to its Endangered conservation status, the African Marsh Harrier requires discussion. The species is expected to forage on the permanent wetlands within the study area which, along with reed beds (breeding requirements) represents the species' core habitat. According to Barnes (2000), all smaller wetlands will be utilised for foraging and possibly breeding. The population is highly fragmented and declining due to loss of breeding habitat, which is optimal at more than 100 hectares of reed beds over permanent to semi-permanent water. Within the study area, these criteria are not met although multiple smaller foraging habitats are present.

3.9.3.2 Secretarybird (*Sagittarius serpentarius*) Vulnerable

This species is often observed in open areas, including cultivated and old agricultural lands. It is not an irregular foraging resident as two breeding pairs have been recorded within the vicinity of the study area. The prospecting activities should avoid nesting sites (if found on site) and should not disturb the species while foraging or breeding within the vicinity of the proposed development.

3.9.3.3 Great Painted-snipe (*Rostratula benghalensis*) Vulnerable

The species is expected to breed on the permanent wetlands within the study area which along with moist grassland, represents the species' core habitat. The population is highly fragmented and declining due to loss of breeding habitat and has not been previously recorded (SABAP2) for the pentads within the study area. Within the study area, all breeding and foraging criteria are met.

3.9.3.4 Maccoa Duck (*Oxyura maccoa*) Near-threatened

The species may be a permanent resident within the suitable dams within the study area, albeit in very small numbers. The species is in decline due to water pollution and loss of habitat, which is axiomatic to Highveld grasslands influenced by agriculture and mining. The species has been observed in the surrounding area and thus mitigations and buffering are required as pans and wetlands are considered to be optimal breeding habitat.

3.10 CURRENT IMPACT DESCRIPTION

Photographic evidence of a selection of current impacts are shown in Figure 3-16. The current impacts observed during the field survey and their major effects on biodiversity were:

- Large scale commercial agricultural crop production – loss of habitat for fauna and flora, establishment of alien and invasive species;
- Existing infrastructure such as farmsteads and houses – loss of habitat for fauna and flora, establishment of alien and invasive species;
- Cattle grazing in wetlands– loss of habitat for fauna and flora, compaction of soil, eutrophication of aquatic habitats;
- Historical dismantled buildings – loss of habitat for fauna and flora, establishment of alien and invasive species;
- Alien Invasive Plants – loss of habitat for fauna and flora; and
- Illegal refuse dumping – loss of habitat for fauna and flora, establishment of alien and invasive species.

The current impacts prevailing within the study area are ongoing in the absence of activities related to the proposed prospecting activities and should therefore be described appropriately to make sure that impacts from the proposed prospecting activities can be quantified separately as well as combined for a cumulative impact analysis. The abovementioned obvious current impacts directly affect the faunal and floral assemblages and do not necessarily include all possible current impacts within the study area.

Figure 3-16: A selection of current impacts recorded within the study area and surroundings[9].

[9] Left to right, top to bottom: Demolished buildings and alien vegetation; Current monoculture agricultural practices; Gravel roads and dumping sites and alien vegetation; Recreational facilities and housing; EnviroServ operations facility at Holfontein; Agricultural infrastructure including Jojo tanks; Cattle grazing in wetlands; Farming infrastructure.

3.11 HABITAT SENSITIVITY

Based on the fauna and flora observations during the fieldwork as well as the current impacts described above, ecological sensitivity of each habitat type was identified. This sensitivity is rated as either low, medium or high, where low sensitivity is considered ideal for prospecting activities and high sensitivity areas are to be avoided (Figure 3-17). A 30 m buffer around all sensitive wetland pans that is likely to have suitable habitat for *Tyto capensis* and serve as breeding habitat for *Pyxicephalus adspersus* are included and should be avoided by the proposed prospecting activities.

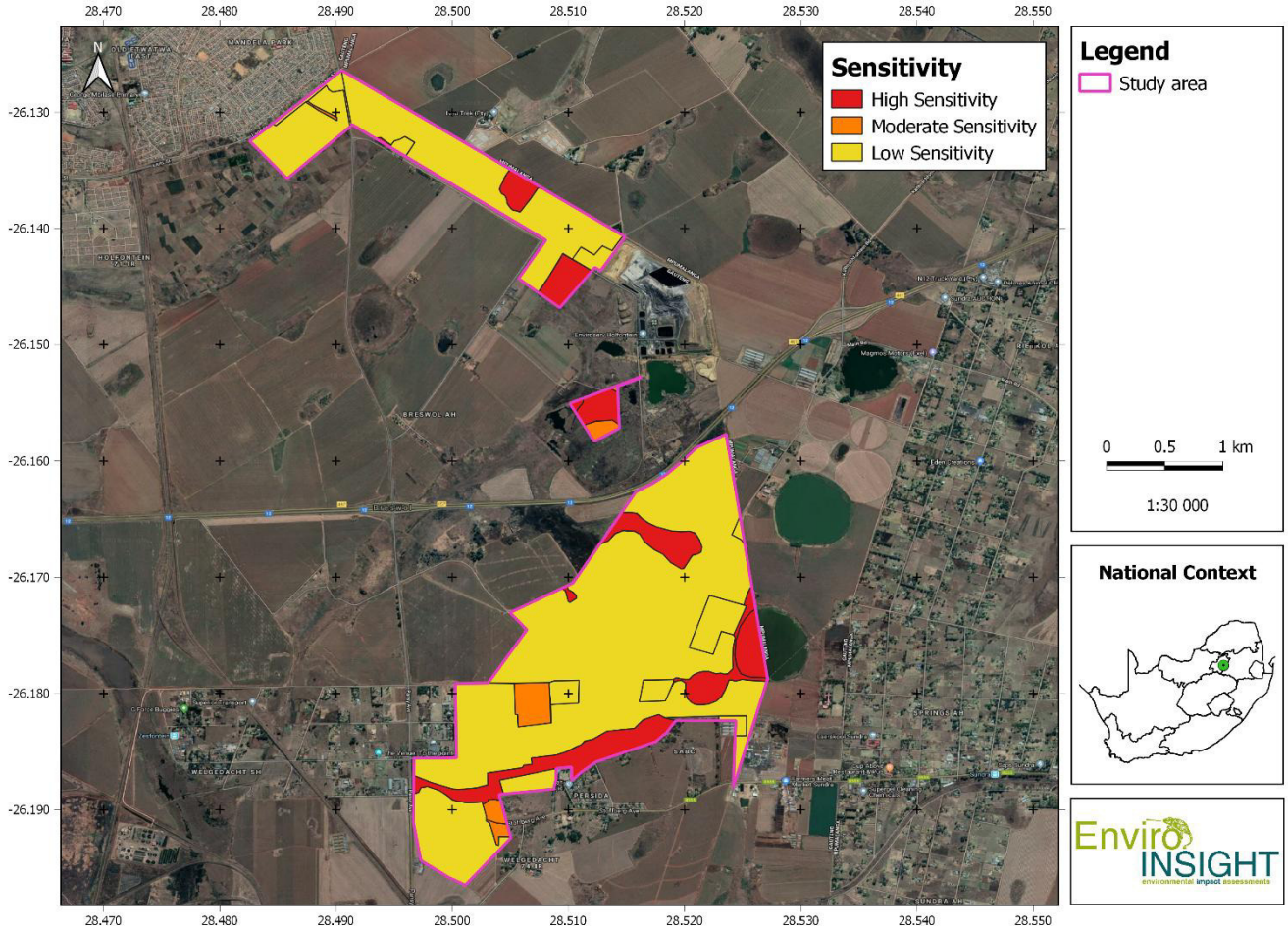

Figure 3-17: Habitat sensitivity of the study area.

4 IMPACT ASSESSMENT

1. Habitat and vegetation loss, including loss of flora SCC

a. Physical removal of vegetation
   i. Core drilling and associated activities [Construction & Operation] – *Core drilling during the prospecting phase will cause direct habitat loss as vegetation and soil is removed. In addition, loss or damage of flora and fauna SCC could occur;*
   ii. Construction of temporary infrastructure (site camps & laydown areas) and roads [Construction & Operation] – *Physical removal of vegetation and disturbance of soil for infrastructure construction. The proposed prospecting activities require temporary erection of machinery and site camps, and consequently increase the impact on the threatened ecosystem and vegetation type. Available habitat for terrestrial fauna species will be reduced.*
   iii. Direct loss of flora species endemic to the vegetation type and threatened ecosystem - *The vegetation type and threatened ecosystem have a unique floral species composition and the potential destruction of portions of the remaining natural grasslands could lead to a significant loss of biodiversity.*
   iv. Stochastic events such as fire (e.g. cooking fires or cigarettes of workers) [Construction & Operation] - *careless discarding of lit cigarette butts and/or glowing embers from cooking fires being blown into surrounding vegetation may cause runaway fires to remove habitat for terrestrial fauna species that would otherwise have been available. Also a human risk if out of control.*

b. Secondary impacts associated with the loss of habitat and removal of vegetation
   i. Displacement/loss of flora & fauna (including rare or endangered species and important habitats) - *the removal of habitat, in particular vegetation, will directly result in the loss of flora species, and indirectly affect fauna reliant on this vegetation for foraging and/or refugia;*
   ii. Habitat fragmentation & disruption of habitat corridors – *removal of vegetation leading to fauna habitat loss and fragmentation preventing migration and dispersal.*
   iii. Establishment of alien and invasive vegetation – *alien and invasive flora are usually pioneer species capable of establishing and spreading across drilling sites where the natural vegetation has been disturbed. This further reduces available natural habitat and habitat quality for flora and fauna.*

c. Impact Assessment (Pre-mitigation) – Refer to Table 4-1.

d. Mitigation and Enhancement Measures
   i. Clearings associated with core drilling should occur in as small a footprint as possible. The layout design needs to specify the areas where core drilling will take place, including roads that will be utilised and the location of the site camp. The surrounding natural area that is not part of the layout design may not be disturbed or damaged;
   ii. The site camps and laydown areas should be located in low sensitivity areas and should be demarcated. No unauthorised activities may take place outside of the demarcated fenced areas. Alternatively, existing storerooms and landowners yards can be utilised for storing of equipment and machinery. This can be organised with landowners directly;
   iii. Core drilling should be planned in order to avoid loss of or damage to SCC as well as primary habitat. Core drilling should occur within disturbed areas or areas indicated as low sensitivity;
   iv. No vehicles may drive off existing roads and create new roads in natural vegetation;
   v. The wetlands and its buffer areas should be demarcated and indicated on a map prior to initiation

of drilling activities to exclude these areas from all activities. No vehicles or personal are allowed to enter these areas;

vi. Buffer zones are allocated to sensitive or important habitat features to alleviate the effect of habitat loss, habitat fragmentation, disturbances, increased isolation and edge effects. It is suggested that at least a 30 m buffer zone from the wetlands must be implemented where no prospecting activity may take place;

vii. Earthworks and vegetation clearing should be left open for as short a time as possible. Temporary erosion control measures during the construction phase should be implemented to limit erosion where applicable;

viii. Re-vegetation where required after clearance should commence immediately after drilling activities or removal of camp site;

ix. Alien vegetation control should take place during all phases of the proposed prospecting activities to limit the likelihood of seed dispersal;

x. An environmental induction for all staff members must be mandatory in which specific issues related to the potential of fire are addressed e.g. only smoking in designated areas, no open cooking fires etc.

e. Impact Assessment (Post-mitigation) – Refer to Table 4-2.

f. Residual impacts –

i. The spread of alien species is likely to occur and should be continuously controlled.

g. Uncertainty – The location of the drilling sites have not been determined as yet.

2. Direct mortality of fauna

a. Project components that can cause direct mortality of fauna

i. Staff or construction workers poaching and hunting [Construction & Operation] - *Several fauna species could be hunted and consumed by staff during the prospecting activities*;

ii. Direct mortality due to collisions with vehicles (roadkill) [Construction & Operational phase] - *Vehicles are defined as support vehicles (e.g. bakkies / pickups), staff vehicles (light passenger vehicles), large and slow moving construction vehicles (such as earth moving equipment/trucks, drill) that will be either self-propelled or towed (construction phase). As this is a restricted area with low traffic volumes vehicle presence throughout the prospecting phase of the project is expected to be low and consequently collisions would be minimal. Reptiles, amphibians, small mammals and avifauna are particularly prone to collisions with fast moving vehicles as they do not move out of the way upon approach by a vehicle. Furthermore, vehicle drivers rarely see small fauna on the road surface or avifauna flying across, and cannot avoid collisions with these animals while travelling at high speed;*

iii. Intentional killing of fauna [Construction & Operation] - *In general people are either superstitious or extremely fearful of snakes which usually results in the death of the snake when it is encountered. Despite the beneficial ecological functions of snakes such as rodent control, snakes are usually considered to be dangerous (despite the many non-venomous species) and are therefore killed;*

iv. Loss of Species of Conservation Concern [Construction & Operation] – *If present on site, vehicles and heavy machinery will kill any individuals that might reside or forage on the study area where suitable habitat exists*;

v. Direct mortality due to vegetation clearing and ground preparation for construction [Construction] - *The clearing of vegetation with machinery followed by the preparation of ground surfaces for*

prospecting activities is expected to result in the direct mortality of fauna, especially for burrowing fauna.

b. Secondary impacts associated with direct mortality of fauna
    i. Changes in fauna population dynamics (e.g. rodent population explosion) – *for example, prolonged mortality of predacious species such as snakes could significantly reduce the population density of these predators and allow prey species to undergo localised population explosions. This in turn can have major negative impacts on the surrounding ecology*.
c. Impact Assessment (Pre-mitigation) – Refer to Table 4-1.
d. Mitigation and Enhancement Measures
    i. All vehicle speeds associated with the project should be monitored and should be limited to 40 km/h (maximum) during the construction and operation phases;
    ii. Road mortalities should be monitored by vehicle operators via a logbook system where staff take note of the date, time and location of the sighting/incident. This will allow determination of the locations where the greatest likelihood exists of causing road mortality and allow mitigation against it (e.g. additional speed reductions). Finally, mitigation should be adaptable to the onsite situation which may vary over time;
    iii. All staff operating motor vehicles must undergo an environmental induction training course that includes instruction on the need to comply with speed limits, to respect all forms of wildlife (especially reptiles and amphibians) and, wherever possible, prevent accidental road kills of fauna. Drivers not complying with speed limits should be subject to penalties;
    iv. An environmental induction for all staff members must be mandatory in which specific issues related to the killing and/or disturbance of faunal species should be avoided. Several staff members should complete a snake handling course in order to safely remove snakes from drill rigs and other operational areas. Snakes should only be handled after inductions have taken place due to the risks of envenomation;
    v. Should large holes or burrows be located at the drilling sites, it is suggested to either avoid these areas, or if this is not possible, to contact a zoological specialist to investigate and possibly remove any species located within them.
e. Impact Assessment (Post-mitigation) – Refer to Table 4-2.
f. Residual impacts
    - It is not possible to avoid all faunal deaths but proper mitigation will reduce the residual impacts to acceptable levels.
g. Uncertainty – None.

3. Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust and lighting [Construction & Operation]

a. Project components that can result in increased noise, dust and lighting
    i. Access roads and construction works [Construction & Operation] – *Noise, dust and lighting generated from moving vehicles operating on access roads and from machinery on site can disrupt fauna populations by interfering with their movements and/or breeding activities. In particular, lighting at night is expected to attract insects which will attract geckos and amphibians which in turn can attract snakes (which might be venomous). Lighting at night may also disrupt flight paths of migrating birds and bats foraging at night which could cause collisions.*

ii. Prospecting activities – *Noise and dust generated from core drilling can disrupt fauna populations by interfering with their movements and/or breeding activities.*

b. Secondary impacts associated with disruption/alteration of ecological lifecycles

i. Increased probability of interaction with reptiles – *As described above, snakes may be attracted to potential prey due to lights and represent a potential health and safety threat. In addition, reptiles attracted to site such as snakes could be killed by staff on site.*

c. Impact Assessment (Pre-mitigation) – Refer to Table 4-1.

d. Mitigation and Enhancement Measures

i. Equipment with low noise emissions must be used or silencers should be fitted on all engines;
ii. A dust monitoring system should be implemented during the construction and operational phase;
iii. Reduce exterior lighting to that necessary for safe operation, and implement operational strategies to reduce spill light. Use down-lighting from non-UV lights where possible, as light emitted at one wavelength has a low level of attraction to insects. This will reduce the likelihood of attracting insects and their predators at night;
iv. Keep noise levels suppressed as per the local municipality or national standards. Do not unnecessarily disturb faunal species, especially during the breeding season and those with juveniles;
v. All staff should be subjected to an induction training program where appropriate conservation principles, safety procedures, snake bite avoidance and first aid treatment are taught. Several staff members should complete a snake handling course in order to safely remove snakes from construction areas.

e. Impact Assessment (Post-mitigation) – Refer to Table 4-2

f. Residual impacts – None

g. Uncertainty – None.

4. Introduction of alien and/or invasive flora affecting native flora and faunal assemblages

a. Project components that can result in increased densities of alien flora

i. Vehicles and machinery [Construction & Operation] – *Vehicles and machinery can spread alien plant seeds throughout the study area which could potentially spread into the adjacent natural and agricultural areas. Alien plants can cause alterations to the environment which could affect local flora and fauna, especially since the study area is located within a threatened ecosystem and vegetation type;*
ii. Soil Disturbance [Construction & Operation] – *Seeds lying dormant for years could germinate when the soil is disturbed, especially since Category 1 and 2 alien invasive species occur in the study area;*

b. Secondary impacts associated with increased alien flora and fauna species

i. Displacement of native species due to competition and/or unfavourable habitats due to alien establishment.

c. Impact Assessment (Pre-mitigation) – Refer to Table 4-1.

d. Mitigation and Enhancement Measures

i. Disturbance of natural areas should be avoided and the spread of alien flora into natural areas should be controlled.
ii. Continuous monitoring of the growth and spread of alien flora coupled with an adaptive

management approach to identify suitable control mechanisms, preferably mechanical for such a small area. No chemical control should take place in close proximity of wetlands unless authorised;

iii. Rehabilitation post-prospecting operations should include an Alien and Invasive species eradication action plan, in order to ensure that the spread and establishment of Alien and Invasive species are controlled and that disturbances post-prospecting are minimal and mitigated where necessary. The drilling sites need to be restored to their original condition/ land-use, which exclude Alien and Invasive species.

e. Impact Assessment (Post-mitigation) – Refer to Table 4-2.
f. Residual impacts
   - The management of alien flora remains a global issue with the success of control measures highly dependent on the management strategy as well as resources available (e.g. financial and intellectual).
   - Numerous alien invasive species exist due to current impacts such as agricultural practices.
g. Uncertainty – The types of alien species that might be dormant within the soils.

5. Increase in erosion reduces habitat quality

a. Project components that can cause increase in erosion
   i. Vegetation clearing and earthworks [Construction and Operation] –*Vegetation clearing (drill sites, camp sites and roads) throughout the site will lead to erosion caused by wind and rain. Such erosion undermines the stability of the habitat and reduces overall habitat quality for fauna and flora.*
b. Secondary impacts associated with increased erosion
   i. Establishment of alien and invasive vegetation – *as alien and invasive flora establish and spread across the site it reduces available natural habitat and habitat quality for fauna*
c. Impact Assessment (Pre-mitigation) – Refer to Table 4-1
d. Mitigation and Enhancement Measures
   i. Drilling activities and vegetation clearing should be left open for as short a time as possible. Erosion control methods during the construction phase should be implemented to limit erosion where applicable.
   ii. Revegetation in natural areas after clearance should commence directly after drilling activities.
   iii. Heavy vehicles should preferably not operate in the wet season as gravel roads can be disturbed and lead to erosion if not managed.
e. Impact Assessment (Post-mitigation) – Refer to Table 4-2
f. Residual impacts – None.
g. Uncertainty – None.

Table 4-1: The proposed development impacts on fauna and flora pre-mitigation.

Impact	Impacts Status	Spatial scale	Temporal scale	Probability (P)	Severity (S)	Significance value (P × S)	Significance rating
Loss of existing habitat due to loss of vegetation							
Core drilling and associated activities	Negative	1	3	4	2	8	Medium
Loss of sensitive areas due to prospecting activities	Negative	1	4	4	3	12	Medium/High
Construction of infrastructure	Negative	1	3	4	2	8	Medium
Stochastic events such as fire	Negative	3	3	4	4	16	High
Direct mortality of fauna							
Staff or construction workers poaching and hunting	Negative	1	3	4	2	8	Medium
Collisions with vehicles	Negative	1	3	4	2	8	Medium
Intentional killing of fauna	Negative	1	3	3	2	6	Medium
Vegetation and ground clearing	Negative	1	3	4	2	8	Medium
Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust and lighting							
Access roads and construction works	Negative	1	3	4	2	8	Medium
Prospecting activities	Negative	1	3	4	2	8	Medium
Introduction of alien flora affecting native floral and faunal assemblages							
Vehicles and machinery	Negative	3	3	4	3	12	Medium/High
Soil Disturbance	Negative	1	3	4	3	12	Medium/High
Increase in erosion reduces habitat quality							
Vegetation clearing and drilling	Negative	1	3	3	3	9	Medium

Table 4-2: The proposed development impacts on fauna and flora post-mitigation.

Impact	Impacts Status	Spatial scale	Temporal scale	Probability (P)	Severity (S)	Significance value (P × S)	Significance rating
Loss of existing habitat due to loss of vegetation							
Core drilling and associated activities	Negative	1	3	2	2	4	Low/Medium
Loss of sensitive areas due to prospecting activities	Negative	1	4	1	1	1	Low
Construction of infrastructure	Negative	1	3	1	1	1	Low

Stochastic events such as fire	Negative	3	3	1	2	2	Low
Direct mortality of fauna							
Staff or construction workers poaching and hunting	Negative	1	3	1	2	2	Low
Collisions with vehicles	Negative	2	3	1	2	2	Low
Intentional killing of fauna	Negative	1	3	1	2	2	Low
Vegetation and ground clearing	Negative	1	3	2	2	4	Low/Medium
Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust and lighting							
Access roads and construction works	Negative	1	1	2	2	4	Low/Medium
Prospecting activities	Negative	1	1	2	2	4	Low/Medium
Introduction of alien flora affecting native faunal assemblages							
Vehicles and machinery	Negative	2	4	3	2	6	Medium
Soil disturbance	Negative	2	4	3	2	6	Medium
Increase in erosion reduces habitat quality							
Vegetation clearing and drilling	Negative	1	5	1	2	2	Low

5 CONCLUSION AND PROFESSIONAL OPINION

The study area is located in the Eastern Highveld Grassland which is regarded as Endangered, and within the Critically Endangered Blesbokspruit Highveld Grassland threatened ecosystem. According to the GDARD C-Plan (GDARD, 2011), the study area is located in CBA: Important and ESA, as well as Primary vegetation and Red Listed Bird Habitat. ESA areas consist mostly of agricultural fields with wetland pans and associated moist grassland (CBA: Important areas) interspersed between these fields. Accordingly, no drilling must take place within natural areas identified as CBA: Important areas (wetlands) and a suitable buffer area of at least 30 m from these areas should be implemented in order to account for edge, indirect and cumulative effects. Post-prospecting operations should rehabilitate the land to its original state as far as possible with no net loss of wetland areas.

According to the Mining and Biodiversity Guideline (SANBI, 2012), large sections of the study area are located in category B (High Biodiversity Risk), and D (moderate Biodiversity Risk) The high risk category B is predominantly due to the presence of wetlands on site and should be avoided at all cost. Correlation is evident between the high biodiversity important areas and those demarcated as CBA: Important according to GDARD C-Plan.

No SCC have been observed within the study area, although the presence of SCC is likely in wetland and primary vegetation areas. These natural areas (highly sensitive) are to be avoided by all prospecting activities. The Orange List Plant *Hypoxis hemerocallidea* has been recorded within the wetland buffer area and should be protected *in situ* from prospecting activities. A Search and Rescue Plan should be drafted by a fauna and flora specialist in order for the relocation of medicinal plant species

and Species of Conservation Concern. Most flora and fauna impacts are medium pre-mitigation in sensitive areas. After mitigation measures have been applied (mostly avoidance of natural vegetation and wetland areas), most impacts are reduced to medium/low or low. All expected impacts from prospecting activities can be mitigated.

The proposed prospecting impacts on fauna and flora, are considered to be of medium to low significance, and can be mitigated to acceptable levels. It should be noted that this is not based on a layout and location of the drilling sites. It is therefore required by the drilling pan to avoid sensitive area such as primary vegetation and wetlands, and to strictly adhere to the proposed mitigation measures. Should environmental authorisation be granted, an Environmental Management Programme (EMPr) should be compiled to highlight pre-prospecting and post-prospecting impacts (including rehabilitation), incorporating all mitigation measures and recommendations as outlined in the specialist investigations conducted to date for the study area

In conclusion, it is unlikely with strict implementation of the proposed mitigation measures that the proposed prospecting operations could have severe, lasting negative effects on the ecology of the sensitive habitats. Rehabilitation of drilling holes as well as any impacts on the natural environment must take place immediately after prospecting operations, and should strive to return the land back to its original natural condition.

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7 APPENDIX

7.1 APPENDIX 1: GEOREFERENCED PHOTOGRAPHS TAKEN DURING THE FIELDWORK SURVEY.

				
5287	5288	5289	5290	5294
				
5295	5296	5297	5298	5299
				
5300	5301	5302	5303	5304
				
5305	5306	5307	5308	5309
				
5310	5311	5312	5313	5314

				
5315	5316	5317	5318	5319
				
5322	5327	5328	5329	5330
				
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5492	5493	5494	5495	5496

				
5497	5498	5499	5510	5511
				
5512	5513	5514	5515	5516
				
5529	5530	5531	5532	5533
				
5534	5535	5536	5537	5538
				
5539	5540	5541	5542	5543

7.2 APPENDIX 2: EXPECTED FLORA SPECIES LIST

Plant species recorded on the BODATSA database for the xMin, yMin 28.37°,-26.30°: xMax, yMax 28.65°,-26.05° extent (WGS84 datum). Species of Conservation Concern are indicated in Red.

Scientific name	Conservation Status	Ecology
Alloteropsis semialata	LC	Indigenous
Helichrysum aureonitens	LC	Indigenous
Ipomoea crassipes	LC	Indigenous
Hibiscus trionum		Not Indigenous; Naturalised
Eriosema nutans	LC	Indigenous
Fingerhuthia sesleriiformis	LC	Indigenous
Cirsium vulgare		Not Indigenous; Naturalised; Invasive
Schistostephium crataegifolium.	LC	Indigenous
Senecio inornatus	LC	Indigenous
Crassula lanceolata	LC	Indigenous
Kniphofia typhoides	NT	Indigenous; Endemic
Cuscuta campestris		Not Indigenous; Naturalised; Invasive
Tephrosia semiglabra	LC	Indigenous
Eragrostis micrantha	LC	Indigenous
Linderniella nana		Indigenous
Andropogon eucomus	LC	Indigenous
Babiana bainesii	LC	Indigenous
Pseudopegolettia tenella		Indigenous; Endemic
Ipomoea oenotherae	LC	Indigenous
Ischaemum fasciculatum	LC	Indigenous
Crotalaria distans	LC	Indigenous
Diandrochloa namaquensis	LC	Indigenous
Amaranthus hybridus		Not Indigenous; Naturalised
Eragrostis tef	NE	Not Indigenous; Naturalised
Indigofera dimidiata	LC	Indigenous
Chenopodium album		Not Indigenous; Naturalised
Paspalum distichum	LC	Indigenous
Riccia angolensis		Indigenous
Huernia stapelioides	LC	Indigenous
Berkheya pinnatifida	LC	Indigenous; Endemic
Paspalum dilatatum	NE	Not Indigenous; Naturalised
Hyparrhenia hirta	LC	Indigenous

Brachystelma barberae	LC	Indigenous
Haplocarpha scaposa	LC	Indigenous
Symphyotrichum squamatum		Not Indigenous; Naturalised
Eragrostis curvula	LC	Indigenous
Trifolium africanum	NE	Indigenous
Graderia subintegra	LC	Indigenous
Senecio madagascariensis	LC	Indigenous
Eragrostis chloromelas	LC	Indigenous
Acrotome hispida	LC	Indigenous
Hilliardiella elaeagnoides		Indigenous
Gladiolus elliotii	LC	Indigenous
Wolffia arrhiza		Indigenous
Indigofera evansiana	LC	Indigenous
Gazania sp.		
Cordylogyne globosa	LC	Indigenous
Dimorphotheca caulescens	LC	Indigenous
Agrostis avenacea	NE	Not Indigenous; Naturalised
Pseudognaphalium luteoalbum	LC	Not Indigenous; Naturalised
Galium capense	NE	Indigenous
Senecio sp.		
Ledebouria ovatifolia		Indigenous; Endemic
Ledebouria revoluta	LC	Indigenous
Salvia reflexa		Not Indigenous; Naturalised; Invasive
Senecio achilleifolius	LC	Indigenous
Agrostis lachnantha	LC	Indigenous
Pachycarpus suaveolens	VU	Indigenous
Bryum sp.		
Eragrostis planiculmis	LC	Indigenous
Leobordea foliosa	LC	Indigenous
Hibiscus sabdariffa		Not Indigenous; Naturalised
Rumex crispus		Not Indigenous; Naturalised; Invasive
Linum thunbergii	LC	Indigenous
Senecio othonniflorus	LC	Indigenous
Carex acutiformis		Not Indigenous; Naturalised
Eragrostis gummiflua	LC	Indigenous
Avena sp.		
Crinum bulbispermum	LC	Indigenous
Riccia albovestita		Indigenous

Gomphocarpus fruticosus subsp. *fruticosus*	LC	Indigenous
Senegalia caffra	LC	Indigenous
Geigeria aspera	LC	Indigenous
Phalaris arundinacea	NE	Not Indigenous; Naturalised
Ledebouria cooperi		Indigenous
Senecio erubescens var. *erubescens*	NE	Indigenous; Endemic
Riccia stricta		Indigenous
Gerbera ambigua	LC	Indigenous
Gladiolus sericeovillosus subsp. *calvatus*	LC	Indigenous
Panicum stapfianum	LC	Indigenous
Conyza bonariensis		Not Indigenous; Naturalised
Moraea pallida	LC	Indigenous
Bryum argenteum		Indigenous
Veronica anagallis-aquatica	LC	Indigenous

7.3 APPENDIX 3: MAMMAL SPECIES LIST

Mammals predicted to potentially occur within the study area. Species of conservation concern are highlighted in red.

Family	Scientific name	Common name	Conservation status[10]
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	Least Concern
Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern
Bovidae	*Connochaetes gnou*	Black Wildebeest	Least Concern
Bovidae	*Damaliscus pygargus phillipsi*	Blesbok	Least Concern
Bovidae	*Kobus ellipsiprymnus*	Waterbuck	
Bovidae	*Ourebia ourebi*	Oribi	Endangered
Bovidae	*Redunca arundinum*	Southern Reedbuck	Least Concern
Bovidae	*Sylvicapra grimmia*	Bush Duiker	Least Concern
Bovidae	*Taurotragus oryx*	Common Eland	Least Concern
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern
Canidae	*Vulpes chama*	Cape Fox	Least Concern
Cervidae	*Dama dama*	Fallow Deer	Introduced
Emballonuridae	*Taphozous (Taphozous) mauritianus*	Mauritian Tomb Bat	Least Concern
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	Near Threatened
Equidae	*Equus quagga*	Plains Zebra	Least Concern
Felidae	*Leptailurus serval*	Serval	Near Threatened
Giraffidae	*Giraffa camelopardalis camelopardalis*	Nubian Giraffe	Least Concern
Herpestidae	*Atilax paludinosus*	Marsh Mongoose	Least Concern
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern
Muridae	*Gerbilliscus brantsii*	Highveld Gerbil	Least Concern
Muridae	*Mastomys coucha*	Southern African Mastomys	Least Concern
Muridae	*Otomys auratus*	Grassland Vlei Rat	Near Threatened
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern
Mustelidae	*Aonyx capensis*	African Clawless Otter	Near Threatened
Nesomyidae	*Dendromus mystacalis*	Chestnut African Climbing Mouse	Least Concern
Nesomyidae	*Mystromys albicaudatus*	African White-tailed Rat	Vulnerable
Soricidae	*Crocidura mariquensis*	Swamp Musk Shrew	Near Threatened
Suidae	*Potamochoerus larvatus koiropotamus*	Bush-pig	Least Concern
Thryonomyidae	*Thryonomys swinderianus*	Greater Cane Rat	Least Concern
Vespertilionidae	*Neoromicia capensis*	Cape Serotine	Least Concern

[10] Child *et al.* (2016)

9.4 APPENDIX 4: HERPETOFAUNA SPECIES LIST

Herpetofauna predicted to potentially occur within the study area. Species of conservation concern are highlighted in red.

Group	Family	Scientific name	Common name	IUCN status
Reptiles	Agamidae	*Agama atra*	Southern Rock Agama	Least Concern
	Agamidae	*Agama aculeata distanti*	Distant's Ground Agama	Least Concern
	Chamaeleonidae	*Chamaeleo dilepis*	Common Flap-neck Chameleon	Least Concern
	Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern
	Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped Snake	Least Concern
	Colubridae	*Philothamnus hoplogaster*	South Eastern Green Snake	Least Concern
	Cordylidae	*Chamaesaura aenea*	Coppery Grass Lizard	Near Threatened
	Cordylidae	*Cordylus vittifer*	Common Girdled Lizard	Least Concern
	Cordylidae	*Pseudocordylus melanotus*	Common Crag Lizard	Least Concern
	Elapidae	*Elapsoidea sundevallii media*	Highveld Garter Snake	Least Concern
	Elapidae	*Hemachatus haemachatus*	Rinkhals	Least Concern
	Gekkonidae	*Lygodactylus capensis capensis*	Common Dwarf Gecko	Least Concern
	Gekkonidae	*Pachydactylus affinis*	Transvaal Gecko	Least Concern
	Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern
	Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern
	Lacertidae	*Nucras lalandii*	Delalande's Sandveld Lizard	Least Concern
	Lacertidae	*Pedioplanis burchelli*	Burchell's Sand Lizard	Least Concern
	Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	Least Concern
	Lamprophiidae	*Atractaspis bibronii*	Bibron's Stiletto Snake	Least Concern
	Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern
	Lamprophiidae	*Homoroselaps dorsalis*	Striped Harlequin Snake	Near Threatened
	Lamprophiidae	*Homoroselaps lacteus*	Spotted Harlequin Snake	Least Concern
	Lamprophiidae	*Lamprophis aurora*	Aurora House Snake	Least Concern
	Lamprophiidae	*Lycodonomorphus inornatus*	Olive House Snake	Least Concern
	Lamprophiidae	*Lycodonomorphus rufulus*	Brown Water Snake	Least Concern
	Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern
	Lamprophiidae	*Prosymna sundevallii*	Sundevall's Shovel-snout	Least Concern
	Lamprophiidae	*Psammophis brevirostris*	Short-snouted Grass Snake	Least Concern
	Lamprophiidae	*Psammophis crucifer*	Cross-marked Grass Snake	Least Concern
	Lamprophiidae	*Psammophis trinasalis*	Fork-marked Sand Snake	Least Concern
	Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	Least Concern
	Lamprophiidae	*Psammophylax tritaeniatus*	Striped Grass Snake	Least Concern
	Lamprophiidae	*Pseudaspis cana*	Mole Snake	Least Concern
	Leptotyphlopidae	*Leptotyphlops incognitus*	Incognito Thread Snake	Least Concern
	Leptotyphlopidae	*Leptotyphlops scutifrons conjunctus*	Eastern Thread Snake	Least Concern

	Leptotyphlopidae	*Leptotyphlops scutifrons scutifrons*	Peters' Thread Snake	Least Concern
	Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	Least Concern
	Scincidae	*Acontias gracilicauda*	Thin-tailed Legless Skink	Least Concern
	Scincidae	*Panaspis wahlbergi*	Wahlberg's Snake-eyed Skink	Least Concern
	Scincidae	*Trachylepis capensis*	Cape Skink	Least Concern
	Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern
	Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	Least Concern
	Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	Least Concern
	Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Least Concern
	Varanidae	*Varanus niloticus*	Water Monitor	Least Concern
	Viperidae	*Bitis arietans*	Puff Adder	Least Concern
	Viperidae	*Causus rhombeatus*	Rhombic Night Adder	Least Concern
Amphibians	Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	Least Concern
	Bufonidae	*Schismaderma carens*	Red Toad	Least Concern
	Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern
	Bufonidae	*Sclerophrys garmani*	Olive Toad	Least Concern
	Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern
	Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern
	Hyperoliidae	*Semnodactylus wealii*	Rattling Frog	Least Concern
	Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	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	*Strongylopus fasciatus*	Striped Stream Frog	Least Concern
	Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	Least Concern
	Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	Least Concern

*Regional conservation status

9.5 APPENDIX 5: AVIFAUNA EXPECTED SPECIES LIST

Avifauna predicted to potentially occur within the study area according to SABAP1 and SABAP2. Species of conservation concern are highlighted in red.

Scientific name	Common name	Conservation status
Accipiter badius	Shikra, Shikra	Least Concern
Accipiter melanoleucus	Sparrowhawk, Black	Least Concern
Accipiter minullus	Sparrowhawk, Little	Least Concern
Accipiter ovampensis	Sparrowhawk, Ovambo	Least Concern
Acridotheres tristis	Myna, Common	Least Concern
Acrocephalus arundinaceus	Reed-warbler, Great	Least Concern
Acrocephalus baeticatus	Reed-warbler, African	Least Concern
Acrocephalus gracilirostris	Swamp-warbler, Lesser	Least Concern
Acrocephalus palustris	Warbler, Marsh	Least Concern
Acrocephalus schoenobaenus	Warbler, Sedge	Least Concern
Actitis hypoleucos	Sandpiper, Common	Least Concern
Actophilornis africanus	Jacana, African	Least Concern
Afrotis afraoides	Korhaan, Northern Black	Least Concern
Aix galericulata	Duck, Mandarin	Least Concern
Alcedo cristata	Kingfisher, Malachite	Least Concern
Alcedo semitorquata	Kingfisher, Half-collared	Near Threatened
Alopochen aegyptiacus	Goose, Egyptian	Least Concern
Amadina erythrocephala	Finch, Red-headed	Least Concern
Amandava subflava	Waxbill, Orange-breasted	Least Concern
Amaurornis flavirostris	Crake, Black	Least Concern
Amblyospiza albifrons	Weaver, Thick-billed	Least Concern
Anas capensis	Teal, Cape	Least Concern
Anas erythrorhyncha	Teal, Red-billed	Least Concern
Anas hottentota	Teal, Hottentot	Least Concern
Anas hybrid	Duck, Hybrid	Least Concern
Anas hybrid	Duck, Hybrid Mallard	Least Concern
Anas platyrhynchos	Duck, Domestic	Least Concern
Anas platyrhynchos	Duck, Mallard	Least Concern
Anas smithii	Shoveler, Cape	Least Concern
Anas sparsa	Duck, African Black	Least Concern
Anas undulata	Duck, Yellow-billed	Least Concern
Anhinga rufa	Darter, African	Least Concern

Anser anser	Goose, Domestic	Least Concern
Anthus cinnamomeus	Pipit, African	Least Concern
Anthus leucophrys	Pipit, Plain-backed	Least Concern
Anthus similis	Pipit, Long-billed	Least Concern
Anthus vaalensis	Pipit, Buffy	Least Concern
Apalis thoracica	Apalis, Bar-throated	Least Concern
Apus affinis	Swift, Little	Least Concern
Apus apus	Swift, Common	Least Concern
Apus barbatus	Swift, African Black	Least Concern
Apus caffer	Swift, White-rumped	Least Concern
Apus horus	Swift, Horus	Least Concern
Ardea cinerea	Heron, Grey	Least Concern
Ardea goliath	Heron, Goliath	Least Concern
Ardea melanocephala	Heron, Black-headed	Least Concern
Ardea purpurea	Heron, Purple	Least Concern
Ardeola ralloides	Heron, Squacco	Least Concern
Asio capensis	Owl, Marsh	Least Concern
Batis molitor	Batis, Chinspot	Least Concern
Bostrychia hagedash	Ibis, Hadeda	Least Concern
Bradypterus baboecala	Rush-warbler, Little	Least Concern
Bubo africanus	Eagle-owl, Spotted	Least Concern
Bubulcus ibis	Egret, Cattle	Least Concern
Burhinus capensis	Thick-knee, Spotted	Least Concern
Buteo rufofuscus	Buzzard, Jackal	Least Concern
Buteo vulpinus	Buzzard, Steppe	Least Concern
Butorides striata	Heron, Green-backed	Least Concern
Calandrella cinerea	Lark, Red-capped	Least Concern
Calidris alba	Sanderling, Sanderling	Least Concern
Calidris ferruginea	Sandpiper, Curlew	Least Concern
Calidris minuta	Stint, Little	Least Concern
Callonetta leucophrys	Teal, Ringed	Least Concern
Campephaga flava	Cuckoo-shrike, Black	Least Concern
Centropus burchellii	Coucal, Burchell's	Least Concern
Cercomela familiaris	Chat, Familiar	Least Concern
Certhilauda semitorquata	Lark, Eastern Long-billed	Least Concern
Ceryle rudis	Kingfisher, Pied	Least Concern
Chalcomitra amethystina	Sunbird, Amethyst	Least Concern
Charadrius hiaticula	Plover, Common Ringed	Least Concern

Charadrius pecuarius	Plover, Kittlitz's	Least Concern
Charadrius tricollaris	Plover, Three-banded	Least Concern
Chlidonias hybrida	Tern, Whiskered	Least Concern
Chlidonias leucopterus	Tern, White-winged	Least Concern
Chrysococcyx caprius	Cuckoo, Diderick	Least Concern
Ciconia abdimii	Stork, Abdim's	Near Threatened
Ciconia ciconia	Stork, White	Least Concern
Cinnyricinclus leucogaster	Starling, Violet-backed	Least Concern
Cinnyris talatala	Sunbird, White-bellied	Least Concern
Circaetus pectoralis	Snake-eagle, Black-chested	Least Concern
Circus ranivorus	Marsh-harrier, African	Endangered
Cisticola aberrans	Cisticola, Lazy	Least Concern
Cisticola aridulus	Cisticola, Desert	Least Concern
Cisticola ayresii	Cisticola, Wing-snapping	Least Concern
Cisticola fulvicapilla	Neddicky, Neddicky	Least Concern
Cisticola juncidis	Cisticola, Zitting	Least Concern
Cisticola lais	Cisticola, Wailing	Least Concern
Cisticola textrix	Cisticola, Cloud	Least Concern
Cisticola tinniens	Cisticola, Levaillant's	Least Concern
Clamator jacobinus	Cuckoo, Jacobin	Least Concern
Clamator levaillantii	Cuckoo, Levaillant's	Least Concern
Colius striatus	Mousebird, Speckled	Least Concern
Columba arquatrix	Olive-pigeon, African	Least Concern
Columba guinea	Pigeon, Speckled	Least Concern
Columba livia	Dove, Rock	Least Concern
Corvus albus	Crow, Pied	Least Concern
Corvus capensis	Crow, Cape	Least Concern
Corythaixoides concolor	Go-away-bird, Grey	Least Concern
Cossypha caffra	Robin-chat, Cape	Least Concern
Coturnix coturnix	Quail, Common	Least Concern
Creatophora cinerea	Starling, Wattled	Least Concern
Crecopsis egregia	Crake, African	Least Concern
Crex crex	Crake, Corn	Least Concern
Crithagra atrogularis	Canary, Black-throated	Least Concern
Crithagra flaviventris	Canary, Yellow	Least Concern
Crithagra gularis	Seedeater, Streaky-headed	Least Concern
Crithagra mozambicus	Canary, Yellow-fronted	Least Concern
Cuculus gularis	Cuckoo, African	Least Concern

Cuculus solitarius	Cuckoo, Red-chested	Least Concern
Cursorius temminckii	Courser, Temminck's	Least Concern
Cygnus atratus	Swan, Black	Least Concern
Cypsiurus parvus	Palm-swift, African	Least Concern
Delichon urbicum	House-martin, Common	Least Concern
Dendrocygna bicolor	Duck, Fulvous	Least Concern
Dendrocygna viduata	Duck, White-faced	Least Concern
Dendropicos fuscescens	Woodpecker, Cardinal	Least Concern
Dicrurus adsimilis	Drongo, Fork-tailed	Least Concern
Dryoscopus cubla	Puffback, Black-backed	Least Concern
Egretta alba	Egret, Great	Least Concern
Egretta ardesiaca	Heron, Black	Least Concern
Egretta garzetta	Egret, Little	Least Concern
Egretta intermedia	Egret, Yellow-billed	Least Concern
Elanus caeruleus	Kite, Black-shouldered	Least Concern
Emberiza tahapisi	Bunting, Cinnamon-breasted	Least Concern
Eremopterix leucotis	Sparrowlark, Chestnut-backed	Least Concern
Estrilda astrild	Waxbill, Common	Least Concern
Euplectes afer	Bishop, Yellow-crowned	Least Concern
Euplectes albonotatus	Widowbird, White-winged	Least Concern
Euplectes ardens	Widowbird, Red-collared	Least Concern
Euplectes axillaris	Widowbird, Fan-tailed	Least Concern
Euplectes capensis	Bishop, Yellow	Least Concern
Euplectes orix	Bishop, Southern Red	Least Concern
Euplectes progne	Widowbird, Long-tailed	Least Concern
Falco amurensis	Falcon, Amur	Least Concern
Falco biarmicus	Falcon, Lanner	Vulnerable
Falco naumanni	Kestrel, Lesser	Vulnerable
Falco peregrinus	Falcon, Peregrine	Least Concern
Falco rupicoloides	Kestrel, Greater	Least Concern
Falco rupicolus	Kestrel, Rock	Least Concern
Falco vespertinus	Falcon, Red-footed	Near Threatened
Fulica cristata	Coot, Red-knobbed	Least Concern
Gallinago nigripennis	Snipe, African	Least Concern
Gallinula chloropus	Moorhen, Common	Least Concern
Glareola nordmanni	Pratincole, Black-winged	Least Concern
Halcyon albiventris	Kingfisher, Brown-hooded	Least Concern
Halcyon senegalensis	Kingfisher, Woodland	Least Concern

Haliaeetus vocifer	Fish-eagle, African	Least Concern
Himantopus himantopus	Stilt, Black-winged	Least Concern
Hirundo abyssinica	Swallow, Lesser Striped	Least Concern
Hirundo albigularis	Swallow, White-throated	Least Concern
Hirundo cucullata	Swallow, Greater Striped	Least Concern
Hirundo dimidiata	Swallow, Pearl-breasted	Least Concern
Hirundo fuligula	Martin, Rock	Least Concern
Hirundo rustica	Swallow, Barn	Least Concern
Hirundo spilodera	Cliff-swallow, South African	Least Concern
Indicator indicator	Honeyguide, Greater	Least Concern
Indicator minor	Honeyguide, Lesser	Least Concern
Ixobrychus minutus	Bittern, Little	Least Concern
Jynx ruficollis	Wryneck, Red-throated	Least Concern
Lagonosticta rubricata	Firefinch, African	Least Concern
Lamprotornis nitens	Starling, Cape Glossy	Least Concern
Laniarius atrococcineus	Shrike, Crimson-breasted	Least Concern
Laniarius ferrugineus	Boubou, Southern	Least Concern
Lanius collaris	Fiscal, Common (Southern)	Least Concern
Lanius collurio	Shrike, Red-backed	Least Concern
Lanius minor	Shrike, Lesser Grey	Least Concern
Larus cirrocephalus	Gull, Grey-headed	Least Concern
Larus dominicanus	Gull, Kelp	Least Concern
Larus fuscus	Gull, Lesser Black-backed	Least Concern
Larus hartlaubii	Gull, Hartlaub's	Least Concern
Limosa lapponica	Godwit, Bar-tailed	Least Concern
Lophaetus occipitalis	Eagle, Long-crested	Least Concern
Lybius torquatus	Barbet, Black-collared	Least Concern
Macronyx capensis	Longclaw, Cape	Least Concern
Megaceryle maximus	Kingfisher, Giant	Least Concern
Melierax gabar	Goshawk, Gabar	Least Concern
Merops apiaster	Bee-eater, European	Least Concern
Merops bullockoides	Bee-eater, White-fronted	Least Concern
Milvus aegyptius	Kite, Yellow-billed	Least Concern
Mirafra africana	Lark, Rufous-naped	Least Concern
Mirafra fasciolata	Lark, Eastern Clapper	Least Concern
Motacilla aguimp	Wagtail, African Pied	Least Concern
Motacilla capensis	Wagtail, Cape	Least Concern
Muscicapa striata	Flycatcher, Spotted	Least Concern

Mycteria ibis	Stork, Yellow-billed	Endangered
Myrmecocichla formicivora	Chat, Anteating	Least Concern
Nectarinia famosa	Sunbird, Malachite	Least Concern
Netta erythrophthalma	Pochard, Southern	Least Concern
Netta rufina	Pochard, Red-crested	Least Concern
Nilaus afer	Brubru, Brubru	Least Concern
Numida meleagris	Guineafowl, Helmeted	Least Concern
Nycticorax nycticorax	Night-Heron, Black-crowned	Least Concern
Oena capensis	Dove, Namaqua	Least Concern
Oenanthe monticola	Wheatear, Mountain	Least Concern
Oenanthe pileata	Wheatear, Capped	Least Concern
Onychognathus morio	Starling, Red-winged	Least Concern
Ortygospiza atricollis	Quailfinch, African	Least Concern
Oxyura maccoa	Duck, Maccoa	Near Threatened
Passer diffusus	Sparrow, Southern Grey-headed	Least Concern
Passer domesticus	Sparrow, House	Least Concern
Passer melanurus	Sparrow, Cape	Least Concern
Pavo cristatus	Peacock, Common	Least Concern
Pernis apivorus	Honey-buzzard, European	Least Concern
Phalacrocorax africanus	Cormorant, Reed	Least Concern
Phalacrocorax capensis	Cormorant, Cape	Least Concern
Phalacrocorax carbo	Cormorant, White-breasted	Least Concern
Philomachus pugnax	Ruff, Ruff	Least Concern
Phoenicopterus minor	Flamingo, Lesser	Near Threatened
Phoenicopterus ruber	Flamingo, Greater	Near Threatened
Phoeniculus purpureus	Wood-hoopoe, Green	Least Concern
Phylloscopus trochilus	Warbler, Willow	Least Concern
Platalea alba	Spoonbill, African	Least Concern
Plectropterus gambensis	Goose, Spur-winged	Least Concern
Plegadis falcinellus	Ibis, Glossy	Least Concern
Plocepasser mahali	Sparrow-weaver, White-browed	Least Concern
Ploceus capensis	Weaver, Cape	Least Concern
Ploceus cucullatus	Weaver, Village	Least Concern
Ploceus intermedius	Masked-weaver, Lesser	Least Concern
Ploceus velatus	Masked-weaver, Southern	Least Concern
Podiceps cristatus	Grebe, Great Crested	Least Concern
Podiceps nigricollis	Grebe, Black-necked	Least Concern
Polyboroides typus	Harrier-Hawk, African	Least Concern

Porphyrio madagascariensis	Swamphen, African Purple	Least Concern
Prinia flavicans	Prinia, Black-chested	Least Concern
Prinia subflava	Prinia, Tawny-flanked	Least Concern
Prodotiscus regulus	Honeybird, Brown-backed	Least Concern
Psittacula krameri	Parakeet, Rose-ringed	Least Concern
Psophocichla litsipsirupa	Thrush, Groundscraper	Least Concern
Pternistis swainsonii	Spurfowl, Swainson's	Least Concern
Pycnonotus nigricans	Bulbul, African Red-eyed	Least Concern
Pycnonotus tricolor	Bulbul, Dark-capped	Least Concern
Quelea quelea	Quelea, Red-billed	Least Concern
Rallus caerulescens	Rail, African	Least Concern
Recurvirostra avosetta	Avocet, Pied	Least Concern
Riparia cincta	Martin, Banded	Least Concern
Riparia paludicola	Martin, Brown-throated	Least Concern
Riparia riparia	Martin, Sand	Least Concern
Rostratula benghalensis	Painted-snipe, Greater	Least Concern
Sagittarius serpentarius	Secretarybird, Secretarybird	Vulnerable
Sarkidiornis melanotos	Duck, Knob-billed	Least Concern
Sarothrura rufa	Flufftail, Red-chested	Least Concern
Saxicola torquatus	Stonechat, African	Least Concern
Scleroptila levaillantoides	Francolin, Orange River	Least Concern
Scopus umbretta	Hamerkop, Hamerkop	Least Concern
Serinus canicollis	Canary, Cape	Least Concern
Sigelus silens	Flycatcher, Fiscal	Least Concern
Spermestes cucullatus	Mannikin, Bronze	Least Concern
Sphenoeacus afer	Grassbird, Cape	Least Concern
Spreo bicolor	Starling, Pied	Least Concern
Streptopelia capicola	Turtle-dove, Cape	Least Concern
Streptopelia semitorquata	Dove, Red-eyed	Least Concern
Streptopelia senegalensis	Dove, Laughing	Least Concern
Struthio camelus	Ostrich, Common	Least Concern
Sturnus vulgaris	Starling, Common	Least Concern
Tachybaptus ruficollis	Grebe, Little	Least Concern
Tachymarptis melba	Swift, Alpine	Least Concern
Tadorna cana	Shelduck, South African	Least Concern
Telophorus zeylonus	Bokmakierie, Bokmakierie	Least Concern
Terpsiphone viridis	Paradise-flycatcher, African	Least Concern
Thalassornis leuconotus	Duck, White-backed	Least Concern

Threskiornis aethiopicus	Ibis, African Sacred	Least Concern
Tockus nasutus	Hornbill, African Grey	Least Concern
Trachyphonus vaillantii	Barbet, Crested	Least Concern
Treron calvus	Green-pigeon, African	Least Concern
Tricholaema leucomelas	Barbet, Acacia Pied	Least Concern
Tringa glareola	Sandpiper, Wood	Least Concern
Tringa nebularia	Greenshank, Common	Least Concern
Tringa stagnatilis	Sandpiper, Marsh	Least Concern
Turdoides jardineii	Babbler, Arrow-marked	Least Concern
Turdus libonyanus	Thrush, Kurrichane	Least Concern
Turdus smithi	Thrush, Karoo	Least Concern
Turnix sylvaticus	Buttonquail, Kurrichane	Least Concern
Tyto alba	Owl, Barn	Least Concern
Tyto capensis	Grass-owl, African	Vulnerable
Upupa africana	Hoopoe, African	Least Concern
Urocolius indicus	Mousebird, Red-faced	Least Concern
Vanellus armatus	Lapwing, Blacksmith	Least Concern
Vanellus coronatus	Lapwing, Crowned	Least Concern
Vanellus senegallus	Lapwing, African Wattled	Least Concern
Vidua macroura	Whydah, Pin-tailed	Least Concern
Zosterops virens	White-eye, Cape	Least Concern

9.6 APPENDIX 6: SPECIALISTS PROOF OF QUALIFICATION

Specialist: Corné Niemandt

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Corné Niemandt
Registration number: 116598

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science

Effective 13 December 2018 Expires 31 March 2019

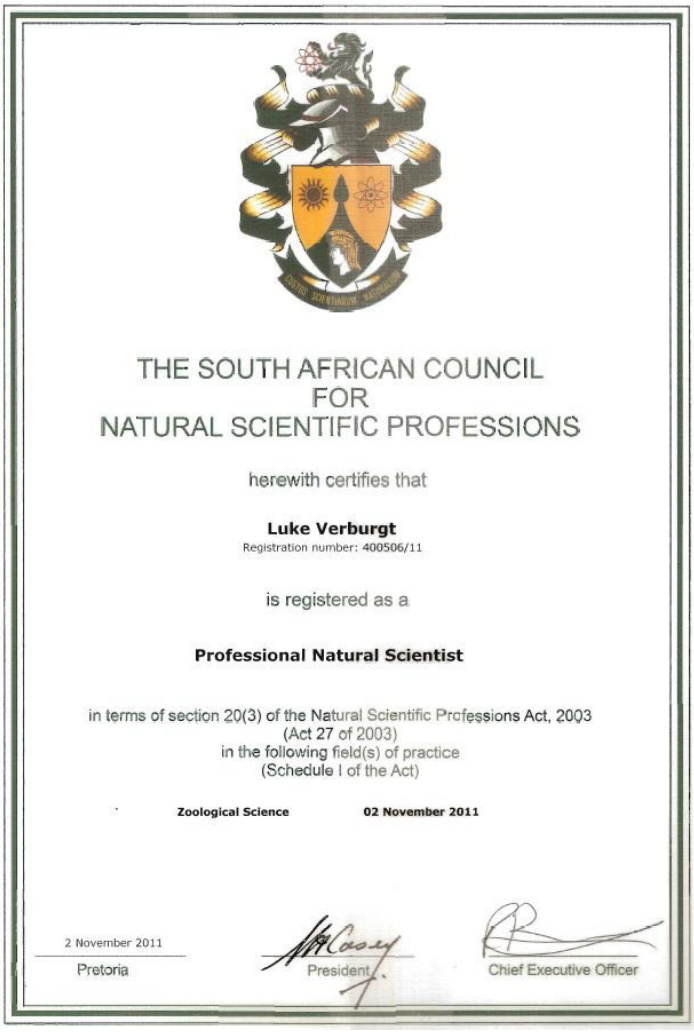
President Executive Director

Disclaimer

I Corné Niemandt *Pr. Sci. Nat. (Ecological Science)* declare that the work presented above is my own and has not been influenced in any way by the client. At no point has the client asked me as a specialist to manipulate my results and the above methods has been carried out to the highest ecological standards.

Corné Niemandt (*Pr. Sci. Nat.*)

Specialist: Luke Verburgt



THE SOUTH AFRICAN COUNCIL
FOR
NATURAL SCIENTIFIC PROFESSIONS

herewith certifies that

Luke Verburgt
Registration number: 400506/11

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice
(Schedule I of the Act)

Zoological Science **02 November 2011**

2 November 2011
Pretoria

President

Chief Executive Officer

Disclaimer

I Luke Verburgt *Pr. Sci. Nat. (Zoology)* declare that the work presented above is my own and has not been influenced in any way by the client. At no point has the client asked me as a specialist to manipulate my results and the above methods has been carried out to the highest ecological standards.

Luke Verburgt (*Pr. Sci. Nat.*)

HERITAGE IMPACT ASSESSMENT

REQUIRED UNDER SECTION 38(8) OF THE NHRA (No. 25 OF 1999)

FOR THE PROPOSED WELGEDACHT COAL PROSPECTING, GAUTENG PROVINCE, SOUTH AFRICA

Type of development:

Prospecting Application

Client

Enviro-Insight CC

Client information:

Corné Niemandt

Applicant:

Wozimart (Pty) Ltd

HCAC - Heritage Consultants
Private Bag X 1049
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0510
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Report Author:
Mr. J. van der Walt

Project Reference:
HCAC Project number 21902

Report date:
March 2019

APPROVAL PAGE

Project Name	Welgedacht Coal Prospecting Right and Environmental Authorisation Application, Gauteng Province, South Africa
Report Title	Heritage Impact Assessment for the proposed Welgedacht Coal Prospecting Right and Environmental Authorisation Application, Gauteng Province, South Africa
Authority Reference Number	TBC
Report Status	Draft Report
Applicant Name	Wozimart (Pty) Ltd

	Name	**Qualifications and Certifications**	**Date**
Archaeologist	Jaco van der Walt	MA Archaeology PhD Candidate ASAPA #159 APHP # 114	Feb 2019
Archival Specialist	Liesl Bester	BHCS Honours	Feb 2019
Palaeontology	Prof Marion Bamford	Ph.D. Paleobotany	Feb 2019

DOCUMENT PROGRESS

Distribution List

Date	Report Reference Number	Document Distribution	Number of Copies
4 March 2019	21902	Enviro Insight CC	Electronic Copy

Amendments on Document

Date	Description of Amendment

INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

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

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- The results of the project;
- The technology described in any report; and
- Recommendations delivered to the client.

Should the applicant wish to utilise any part of, or the entire report, for a project other than the subject project, permission must be obtained from HCAC to do so. This will ensure validation of the suitability and relevance of this report on an alternative project.

REPORT OUTLINE

Appendix 6 of the GNR 982 EIA Regulations, 2014 [as amended] provides the requirements for specialist reports undertaken as part of the environmental authorisation process. In line with this, Table 1 provides an overview of Appendix 6 together with information on how these requirements have been met.

Table 1. Specialist Report Requirements.

Requirement from Appendix 6 of GNR 982 EIA Regulations, 2014 [as amended]	Chapter
(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	Section a Section 12
(b) Declaration that the specialist is independent in a form as may be specified by the competent authority	*Declaration of Independence*
(c) Indication of the scope of, and the purpose for which, the report was prepared	Section 1
(cA)an indication of the quality and age of base data used for the specialist report	Section 3.4 and 7.1.
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	9
(d) Duration, Date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.4
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3
(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 alternative;	Section 8 and 9
(g) Identification of any areas to be avoided, including buffers	Section 9
(h) 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 8
(I) Description of any assumptions made and any uncertainties or gaps in knowledge	Section 3.7
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity **including identified alternatives on the environment** or activities;	Section 9
(k) Mitigation measures for inclusion in the EMPr	Section 9 and 10
(l) Conditions for inclusion in the environmental authorisation	Section 9 and 10
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 9 and 10
(n) Reasoned opinion - (i) as to whether the proposed activity, activities or portions thereof should be authorised; (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	Section 10.2
(o) Description of any consultation process that was undertaken during the course of preparing the specialist report	Section 6
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Refer to BA report
(q) Any other information requested by the competent authority	Section 10

Executive Summary

Heritage Contracts and Archaeological Consulting CC was contracted by Enviro Insight CC to conduct a Heritage study for the proposed Welgedacht Prospecting Right (PR) application. The study area is located on Portions 5, 19, 20, 21, 22, 27, 33, 42, 43, 64, 65, 66, 67 and 76 of the farm Holfontein 71 IR and Portions 26 and 32 of the farm Welgedacht 74 IR, north-east of Springs, Gauteng Province.

The aim of the Heritage Impact Assessment of the project footprint (study area) is to determine the presence of cultural heritage sites and the impact of the proposed project on these non-renewable resources. The study area was assessed both on desktop level and by a field survey. The field survey was conducted as a non-intrusive pedestrian survey, but it should be noted that access was restricted due to land owners refusing access and that the locations of the drill points were not determined at the time of the survey.

The study area is under cultivation from prior to 1957 and currently characterised by intensive agricultural activities, these activities would have impacted on surface indicators of heritage sites. Open areas not under cultivation are impacted on by earthmoving activities and other farming activities like roads and chicken coops. Based on archival maps of the study area five burial sites used to occur in the study area, in addition dwellings older than 60 years is indicated on the 1957 map of the study area, of which one (Structure 1) is confirmed to be intact on Portion 19 of the Farm Holfontein 71 IR. Additional farm portions where structures older than 60 years can occur, if they are still standing are:

- Portion 22 of the Farm Holfontein 71 IR
- Portion 71 of the Farm Holfontein 71 IR
- Portion 26/74 of the Farm Welgedacht 74 IR

The structures' potential to contribute to aesthetic, historic, scientific and social aspects are low and they are therefore of low heritage significance.
Based on archival maps of the study area four burial sites used to occur in the study area and the approximate location of these sites were determined based on archival maps overlain on Google Earth and recent 1:50 000 maps of the study area. These areas were visited during the field work and no grave dressings were noted. Cemetery 2 and 3 are located in an area where brick works used to occur and the area is characterised by extensive earthworks. Cemetery 4 and 5 are located in areas currently used as agricultural fields. Cemetery 1 is located in an area where no access was available, but the Environmental Assessment Practitioner (EAP), Corne Niemandt, confirmed that Cemetery 1 is still intact, consisting of approximately 8 – 10 graves with stone and cement grave dressings.
No public monuments are located within or close to the study area. The study area is rural in character with an emphasis on agriculture with several mining operations in the greater area the prospecting development is not expected to have a negative impact on the sense of place. During the public participation process conducted for the project no heritage concerns were raised.

The impact of the proposed project on heritage resources is considered low and impacts can be mitigated to an acceptable level. The greatest risk to the project is the location of known and unknown graves. It is therefore recommended that the proposed project can commence (from a heritage perspective) on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA:

- A 150 meter buffer should be kept around the cemetery locations where no drilling can occur;
- Drilling should be located as close to existing roads as possible;
- No structures should be impacted on by the drilling;
- When the mining footprint is determent the impact areas should be subjected to a heritage walkthrough;
- Implementation of a chance find procedure that includes fossils chance find protocol should be added to the EMPr.

Declaration of Independence

Specialist Name	Jaco van der Walt
Declaration of Independence	I declare, as a specialist appointed in terms of the National Environmental Management Act (Act No 108 of 1998) and the associated 2014 Environmental Impact Assessment (EIA) Regulations, that I: • 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; and • 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.
Signature	
Date	4/ 03/ 2019

a) Expertise of the specialist

Jaco van der Walt has been practising as a CRM archaeologist for 15 years. He obtained an MA degree in Archaeology from the University of the Witwatersrand focussing on the Iron Age in 2012 and is a PhD candidate at the University of Johannesburg focussing on Stone Age Archaeology with specific interest in the Middle Stone Age (MSA) and Later Stone Age (LSA). Jaco is an accredited member of ASAPA (#159) and have conducted more than 500 impact assessments in Limpopo, Mpumalanga, North West, Free State, Gauteng, KZN as well as he Northern and Eastern Cape Provinces in South Africa.

Jaco has worked on various international projects in Zimbabwe, Botswana, Mozambique, Lesotho, DRC Zambia and Tanzania. Through this he has a sound understanding of the IFC Performance Standard requirements, with specific reference to Performance Standard 8 – Cultural Heritage.

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ABBREVIATIONS

AIA: Archaeological Impact Assessment
ASAPA: Association of South African Professional Archaeologists
BGG Burial Ground and Graves
BIA: Basic Impact Assessment
CFPs: Chance Find Procedures
CMP: Conservation Management Plan
CRR: Comments and Response Report
CRM: Cultural Resource Management
DEA: Department of Environmental Affairs
EA: Environmental Authorisation
EAP: Environmental Assessment Practitioner
ECO: Environmental Control Officer
EIA: Environmental Impact Assessment*
EIA: Early Iron Age*
EMP: Environmental Management Programme
EMPR: Environmental Management Programme Report
ESA: Early Stone Age
ESIA: Environmental and Social Impact Assessment
GIS Geographical Information System
GPS: Global Positioning System
GRP Grave Relocation Plan
HIA: Heritage Impact Assessment
LIA: Late Iron Age
LSA: Late Stone Age
MEC: Member of the Executive Council
MIA: Middle Iron Age
MPRDA: Mineral and Petroleum Resources Development Act
MSA: Middle Stone Age
NEMA National Environmental Management Act, 1998 (Act No. 107 of 1998)
NHRA National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NID Notification of Intent to Develop
NoK Next-of-Kin
PRHA: Provincial Heritage Resource Agency
SADC: Southern African Development Community
SAHRA: South African Heritage Resources Agency

**Although EIA refers to both Environmental Impact Assessment and the Early Iron Age both are internationally accepted abbreviations and must be read and interpreted in the context it is used.*

GLOSSARY

Archaeological site (remains of human activity over 100 years old)
Early Stone Age (~ 2.6 million to 250 000 years ago)
Middle Stone Age (~ 250 000 to 40-25 000 years ago)
Later Stone Age (~ 40-25 000, to recently, 100 years ago)
The Iron Age (~ AD 400 to 1840)
Historic (~ AD 1840 to 1950)
Historic building (over 60 years old)

1 Introduction and Terms of Reference:

HCAC has been contracted by Enviro Insight CC to conduct a heritage impact assessment of the proposed Welgedacht PR. The study area is located on Portions 5, 19, 20, 21, 22, 27, 33, 42, 43, 64, 65, 66, 67 and 76 of the farm Holfontein 71 IR and Portions 26 and 32 of the farm Welgedacht 74 IR, north-east of Springs, Gauteng Province (Figure 1 -3). The report forms part of the Basic Assessment (BA) Report and Environmental Management Programme Report (EMPR) for the proposed project.

The aim of the study is to survey the proposed development footprint to identify cultural heritage sites, document, and assess their importance within local, provincial and national context. It serves to assess the impact of the proposed project on non-renewable heritage resources, and to submit appropriate recommendations with regard to the responsible cultural resources management measures that might be required to assist the developer in managing the discovered heritage resources in a responsible manner. It is also conducted to protect, preserve and develop such resources within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999). The report outlines the approach and methodology utilized before and during the survey, which includes: Phase 1, review of relevant literature; Phase 2, the physical surveying of the area on foot and by vehicle; Phase 3, reporting the outcome of the study.

During the survey, a structure older than 60 years were recorded and based on archival maps of the area 5 cemeteries are located in the study area. General site conditions and features on sites were recorded by means of photographs, GPS locations, and site descriptions. Possible impacts were identified, and mitigation measures are proposed in the report. SAHRA as a commenting authority under section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) require all environmental documents, compiled in support of an Environmental Authorisation application as defined by NEMA EIA Regulations section 40 (1) and (2), to be submitted to SAHRA. As such the Environmental Impact Report and its appendices must be submitted to the case officer as well as the EMPr, once it's completed by the Environmental Assessment Practitioner (EAP).

1.1 Terms of Reference

Field study
Conduct a field study to: (a) locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources affected by the proposed development.

Reporting
Report on the identification of anticipated and cumulative impacts the operational units of the proposed project activity may have on the identified heritage resources for all 3 phases of the project; i.e., construction, operation and decommissioning phases. Consider alternatives, should any significant sites be impacted adversely by the proposed project. Ensure that all studies and results comply with the relevant legislation, SAHRA minimum standards and the code of ethics and guidelines of ASAPA.
To assist the developer in managing the discovered heritage resources in a responsible manner, and to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999).

Project description

The project comprises an application for a prospecting right and proposed activities include drilling.

Description of planned non-invasive activities:

Desktop studies to be undertaken over the area would include studying of all available geological maps/plans, aerial photographs, topography maps and any other related geological information about this area. Upon completion of the desktop study, field geological mapping of the area will be conducted, and if necessary, a ground magnetic geophysical survey to locate the occurrence of any dolerite sills/dykes that may be present in the area.

Description of planned invasive activities:

This Prospecting Work Program is designed to establish the extent of the area of the coal deposit, and all available geological information will be utilized to calculate the in-situ Coal Resource and the economic viability of the Project. **Diamond Core Exploration Drilling** is selected as the primary means of exploration as it provides accurate information on the depth and thickness of the coal seams, the quality and physical properties of the Resource, composition and thickness of the overburden and aid in interpreting possible fault blocks.

These holes will be drilled in strategic locations to fill the gaps and confirm existing borehole data and information derived from the ground magnetic field survey.

Based on the extent of the area, 84 TNW (75mm diameter) diamond core drill holes are planned to be drilled in order to increase the geological accuracy of the Resource modelling to inferred, of which some area may be measured. Please note that practical and geological considerations may however reduce the number of planned boreholes and subsequent budget substantially.

The average depth of these boreholes is expected to vary between 130m and 170m, and will be sealed with a cement plug to one meter below surface upon completion to make it safe for people and animals and allow future access by the exploration team. The drill rigs are truck-mounted and equipped with diesel driven engines to provide power to drill. Water for the drilling process is provided by a truck fitted with a water tank.

The recovered core is geologically described and the coal sampled to be analysed at an accredited laboratory to determine the quality of the coal based on proximate analysis, and where required, based on a wash analysis.

Should additional information be required, **Large Diameter Percussion Drilling** will be done where drill chips/rock fragments are blown out of the top of the hole and collected at 1m intervals and arranged to allow continuous detailed lithological descriptions of the stratigraphic horizons.

Subsequent **Downhole Geophysical Surveying** is done at every completed borehole to produce a number of profiles reflecting rock strength, coal qualities and structural features for the total length of the borehole. A range of specialized geo-physical tools are lowered into the open borehole to record various physical and lithological characteristics of the rock mass and transmitted digitally via a cable to a computer on the surface. A single truck is used which contains all equipment including a mobile generator.

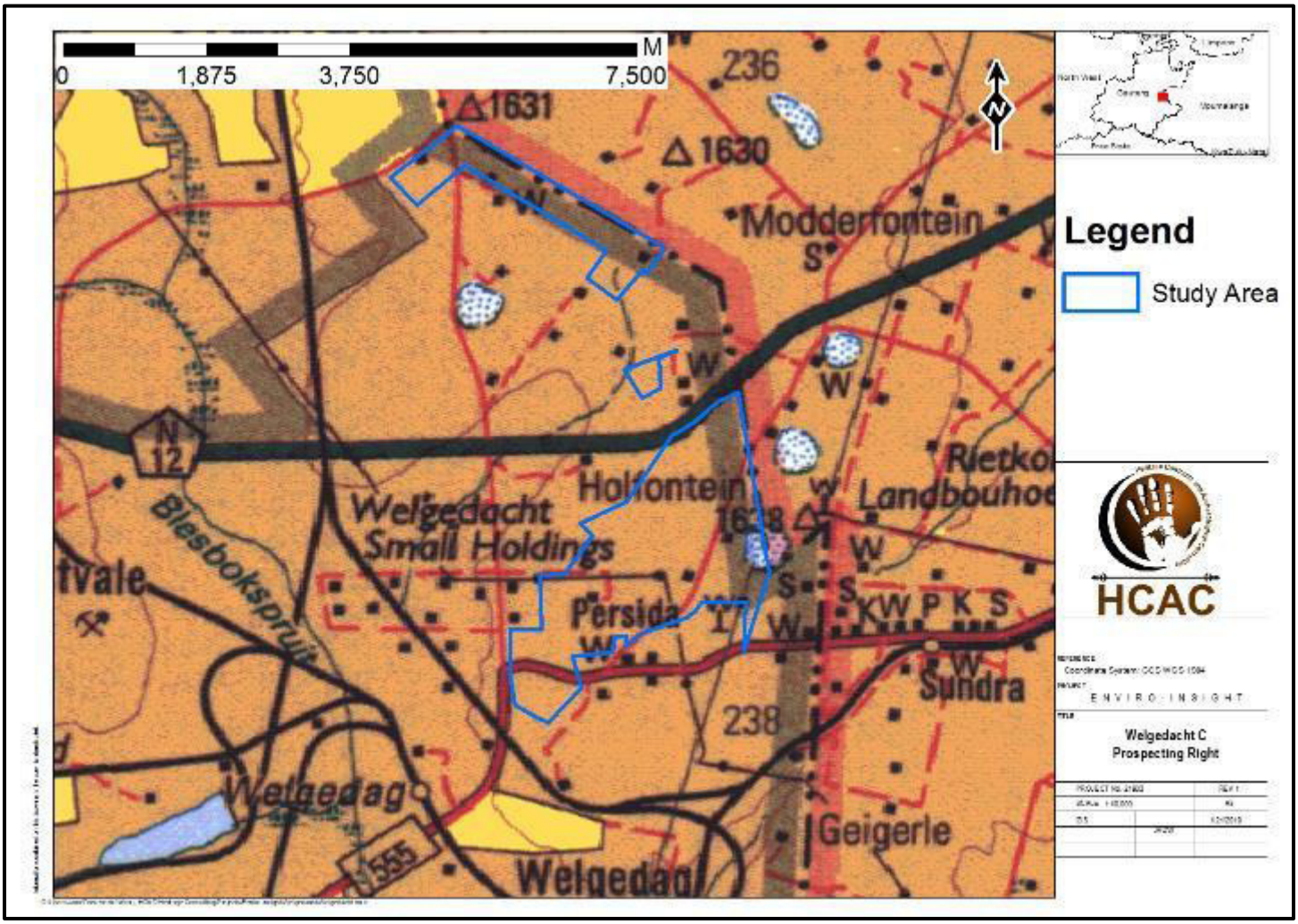

Figure 1. Provincial locality map (1: 250 000 topographical map).

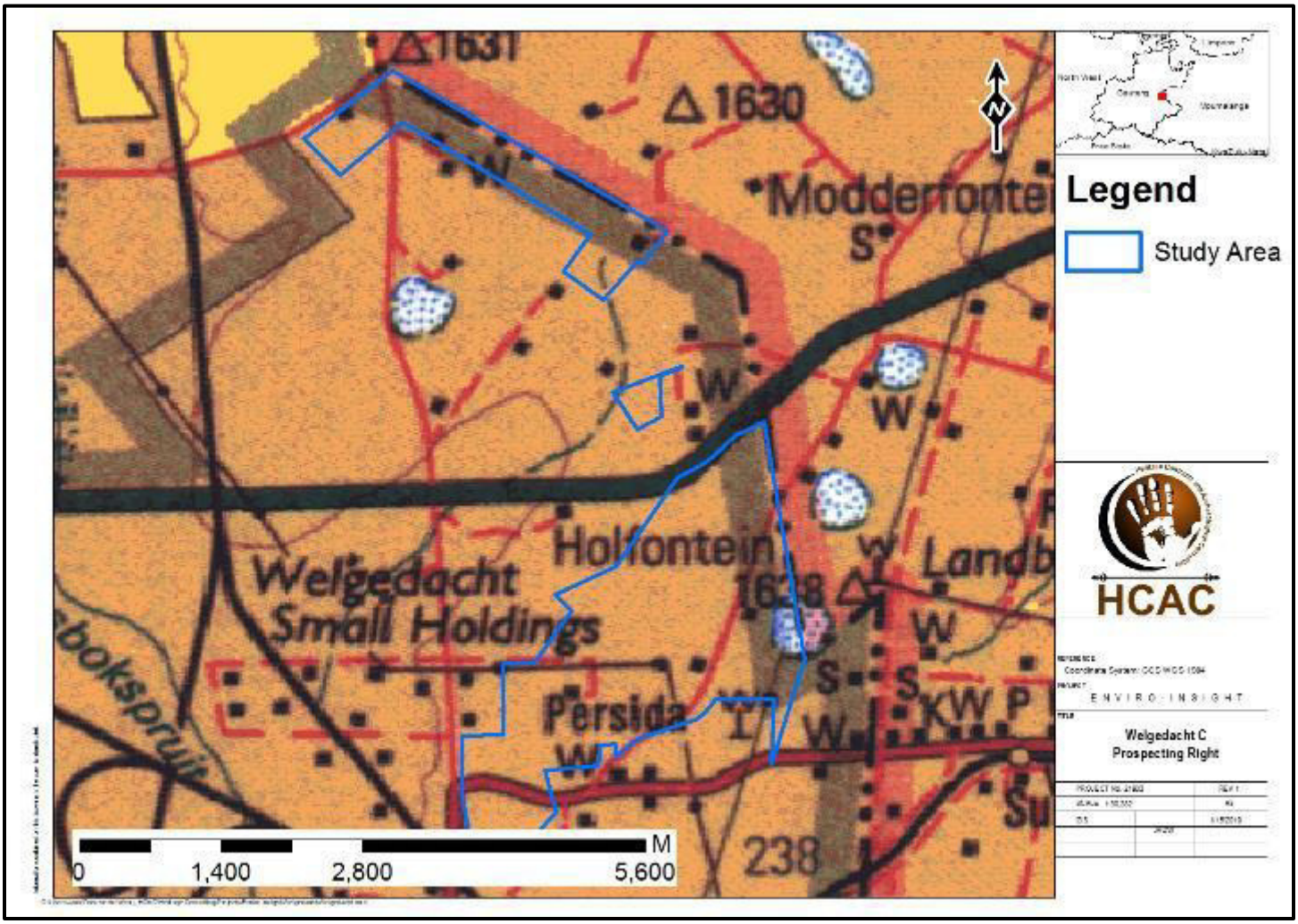

Figure 2.Regional locality map (1:50 000 Topographic map).

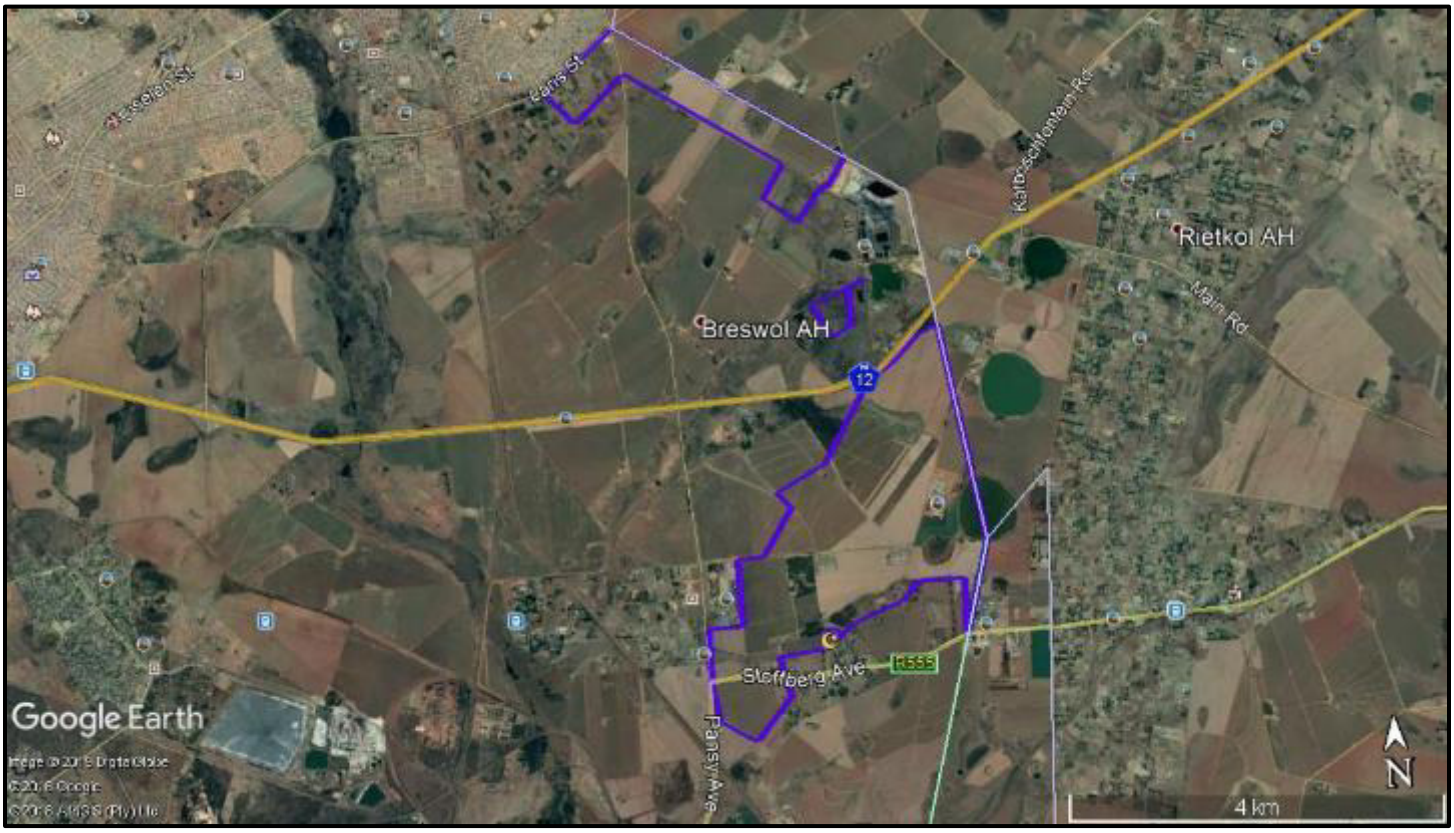

Figure 3. Google image of the mining right area.

2 Legislative Requirements

The HIA, as a specialist sub-section of the EIA, is required under the following legislation:

- National Heritage Resources Act (NHRA), Act No. 25 of 1999)
- National Environmental Management Act (NEMA), Act No. 107 of 1998 - Section 23(2)(b)
- Mineral and Petroleum Resources Development Act (MPRDA), Act No. 28 of 2002 - Section 39(3)(b)(iii)

A Phase 1 HIA is a pre-requisite for development in South Africa as prescribed by SAHRA and stipulated by legislation. The overall purpose of heritage specialist input is to:

- Identify any heritage resources, which may be affected;
- Assess the nature and degree of significance of such resources;
- Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance;
- Assess the negative and positive impact of the development on these resources; and
- Make recommendations for the appropriate heritage management of these impacts.

The HIA should be submitted, as part of the impact assessment report or EMPr, to the PHRA if established in the province or to SAHRA. SAHRA will ultimately be responsible for the professional evaluation of Phase 1 reports upon which review comments will be issued. 'Best practice' requires Phase 1 reports and additional development information, as per the impact assessment report and/or EMPr, to be submitted in duplicate to SAHRA after completion of the study. SAHRA accepts Phase 1 AIA reports authored by professional archaeologists, accredited with ASAPA or with a proven ability to do archaeological work.

Minimum accreditation requirements include an Honours degree in archaeology or related discipline and 3 years post-university CRM experience (field supervisor level). Minimum standards for reports, site documentation and descriptions are set by ASAPA in collaboration with SAHRA. ASAPA is based in South Africa, representing professional archaeology in the SADC region. ASAPA is primarily involved in the overseeing of ethical practice and standards regarding the archaeological profession. Membership is based on proposal and secondment by other professional members.

Phase 1 AIA's are primarily concerned with the location and identification of heritage sites situated within a proposed development area. Identified sites should be assessed according to their significance. Relevant conservation or Phase 2 mitigation recommendations should be made. Recommendations are subject to evaluation by SAHRA.

Conservation or Phase 2 mitigation recommendations, as approved by SAHRA, are to be used as guidelines in the developer's decision-making process.

Phase 2 archaeological projects are primarily based on salvage/mitigation excavations preceding development destruction or impact on a site. Phase 2 excavations can only be conducted with a permit, issued by SAHRA to the appointed archaeologist. Permit conditions are prescribed by SAHRA and includes (as minimum requirements) reporting back strategies to SAHRA and deposition of excavated material at an accredited repository.

In the event of a site conservation option being preferred by the developer, a site management plan, prepared by a professional archaeologist and approved by SAHRA, will suffice as minimum requirement.

After mitigation of a site, a destruction permit must be applied for with SAHRA by the applicant before development may proceed.

Human remains older than 60 years are protected by the National Heritage Resources Act, with reference to Section 36. Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act), as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36[5]) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in this age category, located inside a formal cemetery administrated by a local authority, require the same authorisation as set out for graves younger than 60 years, in addition to SAHRA authorisation. If the grave is not situated inside a formal cemetery, but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws, set by the cemetery authority, must be adhered to.

Human remains that are less than 60 years old are protected under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance No. 7 of 1925), as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning; or in some cases, the MEC for Housing and Welfare. Authorisation for exhumation and reinternment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. To handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

3 METHODOLOGY

3.1 Literature Review

A brief survey of available literature was conducted to extract data and information on the area in question to provide general heritage context into which the development would be set. This literature search included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS).

3.2 Genealogical Society and Google Earth Monuments

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where sites of heritage significance might be located; these locations were marked and visited during the field work phase. The database of the Genealogical Society was consulted to collect data on any known graves in the area.

3.3 Public Consultation and Stakeholder Engagement:

Stakeholder engagement is a key component of any BA process, it involves stakeholders interested in, or affected by the proposed development. Stakeholders are provided with an opportunity to raise issues of concern (for the purposes of this report only heritage related issues will be included). The aim of the public consultation process was to capture and address any issues raised by community members and other stakeholders during key stakeholder and public meetings. The process involved:

- Placement of advertisements and site notices;
- Stakeholder notification (through the dissemination of information and meeting invitations);
- Stakeholder meetings undertaken with I&APs;
- Authority Consultation;
- The compilation of a Basic Assessment Report and opportunity for I&APs to comment on the draft reports.
- The compilation of a Comments and Response Report (CRR).

3.4 Site Investigation

Conduct a field study to: a) systematically survey the proposed project area to locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources recorded in the project area.

Table 2: Site Investigation Details

	Site Investigation
Date	Week of 13 February 2019
Season	Summer - The area has been extensively cultivated hampering archaeological visibility. Access to several properties were refused (Figure 4) however the area was sufficiently covered to adequately assess the range of heritage resources to be expected in the study area (Figure 5) .

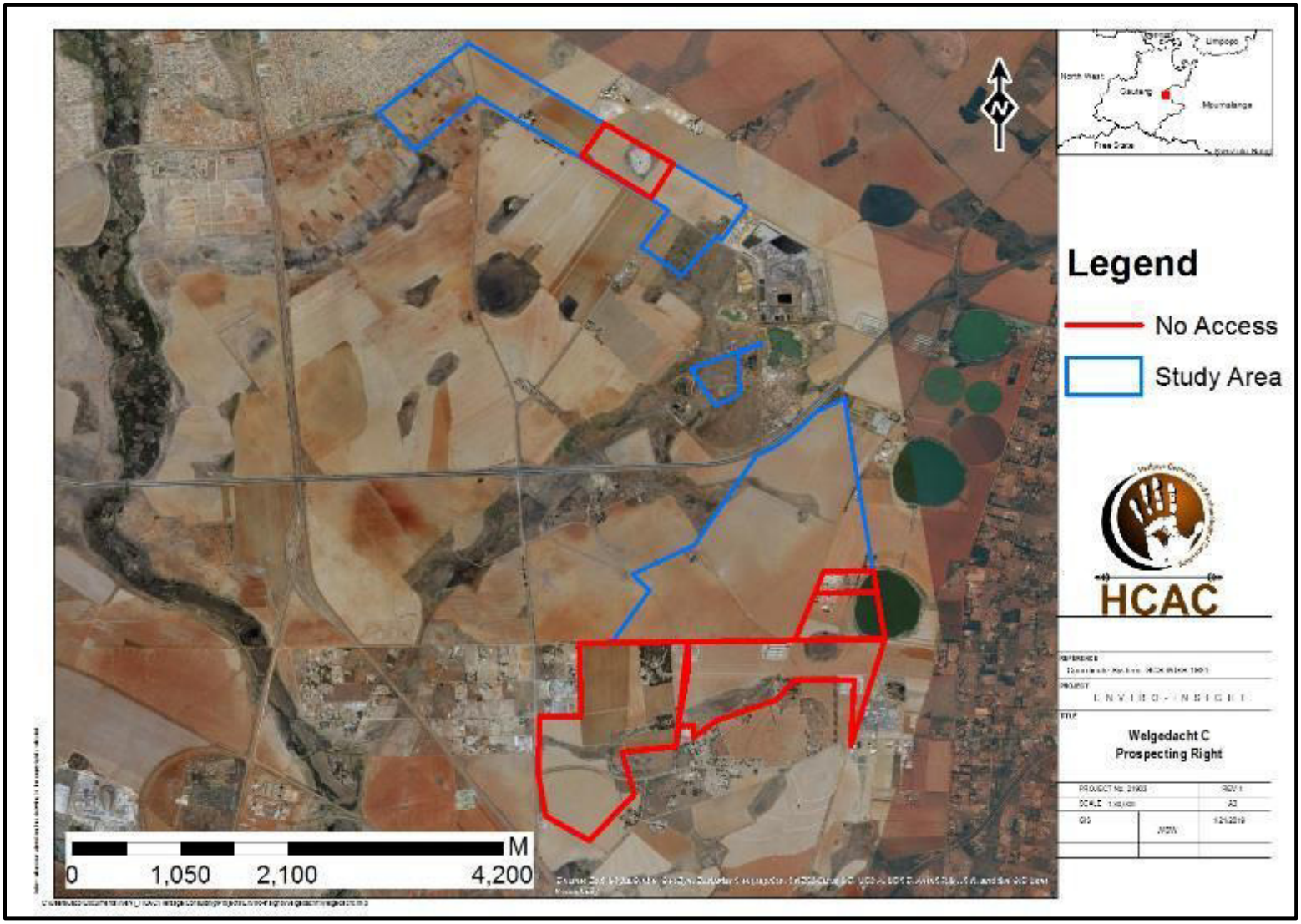

Figure 4. Properties where the access was denied.

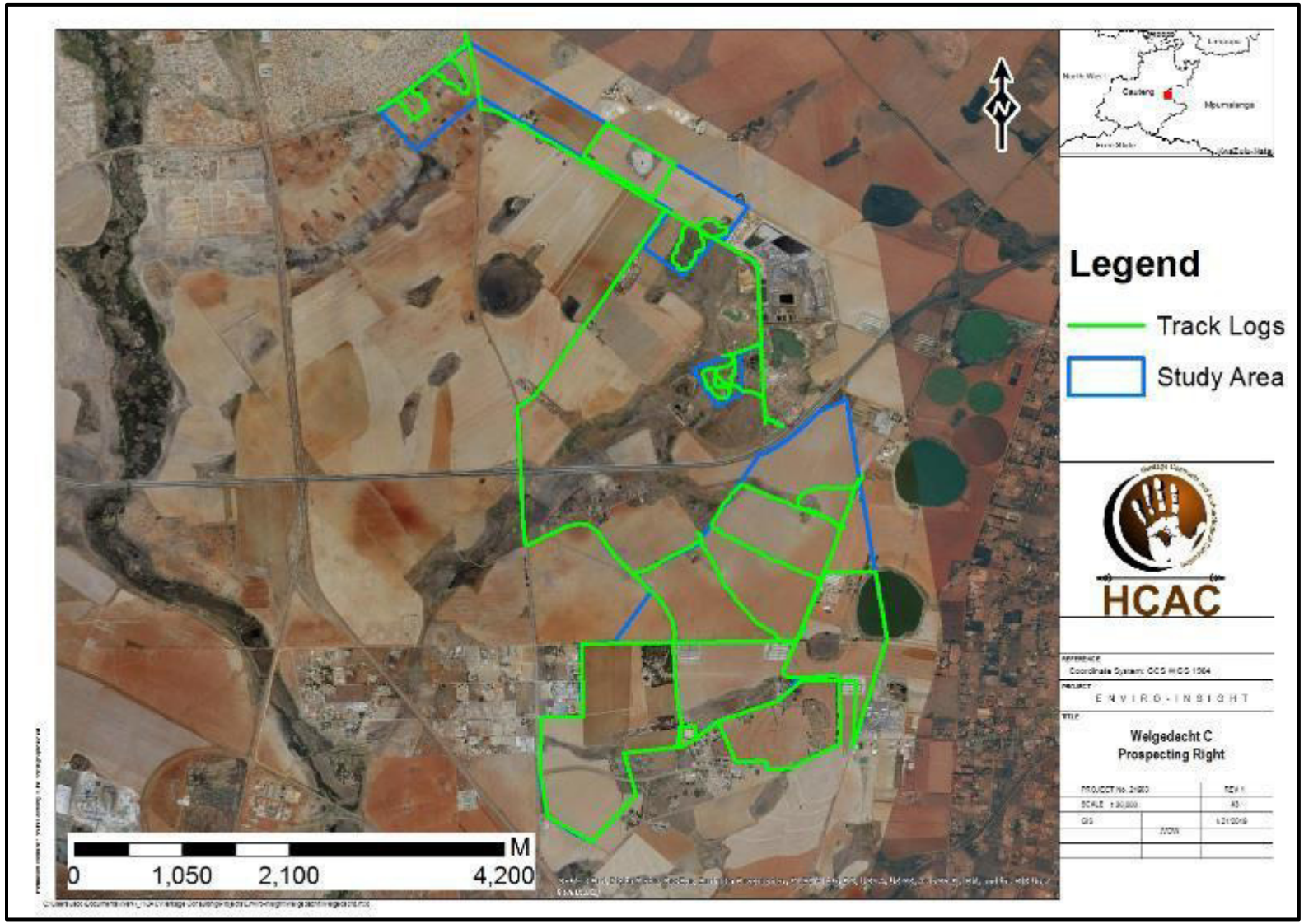

Figure 5: Track logs of the survey in green.

3.5 Site Significance and Field Rating

Section 3 of the NHRA distinguishes nine criteria for places and objects to qualify as 'part of the national estate' if they have cultural significance or other special value. These criteria are:

- Its importance in/to the community, or pattern of South Africa's history;
- Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
- Sites of significance relating to the history of slavery in South Africa.

The presence and distribution of heritage resources define a 'heritage landscape'. In this landscape, every site is relevant. In addition, because heritage resources are non-renewable, heritage surveys need to investigate an entire project area, or a representative sample, depending on the nature of the project. In the case of the proposed project the local extent of its impact necessitates a representative sample and only the footprint of the areas demarcated for development were surveyed. In all initial investigations, however, the specialists are responsible only for the identification of resources visible on the surface. This section describes the evaluation criteria used for determining the significance of archaeological and heritage sites. The following criteria were used to establish site significance with cognisance of Section 3 of the NHRA:

- The unique nature of a site;
- The integrity of the archaeological/cultural heritage deposits;
- The wider historic, archaeological and geographic context of the site;
- The location of the site in relation to other similar sites or features;
- The depth of the archaeological deposit (when it can be determined/is known);
- The preservation condition of the sites; and
- Potential to answer present research questions.

In addition to this criteria field ratings prescribed by SAHRA (2006), and acknowledged by ASAPA for the SADC region, were used for the purpose of this report. The recommendations for each site should be read in conjunction with section 10 of this report.

FIELD RATING	***GRADE***	***SIGNIFICANCE***	***RECOMMENDED MITIGATION***
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP. A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP. B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

3.6 Impact Assessment Methodology

The criteria below are used to establish the impact rating on sites:

- 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 **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).

3.7 Limitations and Constraints of the study

The authors acknowledge that the brief literature review is not exhaustive on the literature of the area. Due to the subsurface nature of archaeological artefacts, the possibility exists that some features or artefacts may not have been discovered/recorded during the survey and the possible occurrence of unmarked graves and other cultural material cannot be excluded. Similarly, the depth of the deposit of heritage sites cannot be accurately determined due its subsurface nature. This report only deals with the footprint area of the proposed development and consisted of non-intrusive surface surveys. This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components would have been highlighted through the public consultation process if relevant. It is possible that new information could come to light in future, which might change the results of this Impact Assessment. It should also be noted that access in the study area was restricted due to landowners' consent issues.

4 Description of Socio-Economic Environment

The 2012 – 2013 Integrated Development Plan highlighted the following Socio-Economic issues in the Ekurhuleni Metropolitan Municipality, the poverty rate was at 28.3% and the unemployment rate was at 30.7%. Reports also suggest that only 8% of Ekurhuleni's population has a post-matric qualification. This suggests a mismatch between the demand for labour and the skills available in the economy. Basic services such as water and sanitation as well as the provision of housing will provide much needed improvement of conditions as well as create employment opportunities.

5 Description of the Physical Environment:

The study area is located in a rural setting where current land use consists of agriculture. The site is bordered by Pansy Avenue to the West, Stofberg Avenue to the South, Laris Street to the North and the N12 running between the mentioned farm portions. Mandela Park borders the study area to the North, Holfontein to the East, Persida to the South, and Welgedacht SH to the West. The area is extensively cultivated with open access resulting in illegal dumping in vacant areas, open areas are also marked by large scale earth moving (Figure 6 – 9). These activities impacted on surface indicators of heritage resources.

Figure 6. General site conditions – cultivated area.

Figure 7. General site conditions

Figure 8. General site conditions.

Figure 9. Dumping in the study area

6 Results of Public Consultation and Stakeholder Engagement:

Adjacent landowners and the public at large were informed of the proposed activity as part of the BA process. Site notices and advertisements notifying interested and affected parties were placed at strategic points and in local newspapers as part of the process.

7 Literature / Background Study:

7.1 Literature Review

The following CRM reports were conducted in the vicinity and were consulted for this report:

Author	Year	Project	Findings
Van der Walt, J.	2018	Heritage Impact Assessment HBP Hatchery and Layer Farm Expansion on Portion 6/43 Of Farm Holfontein	Isolated Stone Age finds and a possible cemetery
Pelser, A.	2015	Baseline Study & Heritage Assessment Report for The Proposed Gold One International Holfontein Project, Near Springs, Gauteng	Historical gold mining features
Hemming, M	2013	Motivation for Exemption from Heritage Assessment: 24G Application for Rectification, Holfontein Stockpile	No features

7.1.1 Genealogical Society and Google Earth Monuments

No known grave sites are on record close to the impact areas.

7.2 General History of the area

The Stone Age can be divided in three main phases as follows;

- Later Stone Age; associated with Khoi and San societies and their immediate predecessors. Recently to ~30 thousand years ago
- Middle Stone Age; associated with Homo sapiens and archaic modern humans. 30-300 thousand years ago.
- Earlier Stone Age; associated with early Homo groups such as Homo habilis and Homo erectus. 400 000-> 2 million years ago.

Although there are no well-known Stone Age sites located on or around the study area there is evidence of the use of the larger area by Stone Age communities for example along the Kliprivier where ESA and MSA tools where recorded. LSA material is recorded along ridges to the south of the current study area (Huffman 2008). Petroglyphs occur at Redan as well as along the Vaal River (Berg 1999).

Extensive Stone walled sites are recorded at Klipriviers Berg Nature reserve 20 km to the south west belonging to the Late Iron Age period. A large body of research is available on this area. These sites (Taylor's Type N, Mason's Class 2 & 5) are now collectively referred to as Klipriviersberg (Huffman 2007). These settlements are complex in that aggregated settlements are common, the outer wall sometimes includes scallops to mark back courtyards, there are more small stock kraals, and straight walls separate households in the residential zone. These sites date to the 18th and 19th centuries and was built by people in the Fokeng cluster.

In this area the Klipriviersberg walling would have ended at about AD 1823, when Mzilikazi entered the area (Rasmussen 1978). This settlement type may have lasted longer in other areas because of the positive interaction between Fokeng and Mzilikazi.

J. S. Bergh's historical atlas of the four northern provinces of South Africa is a very useful source for researching local and regional history. This source serves as a helpful tool in plotting where certain events had taken place in the past.

In Southern Africa the domestication of the environment began only a couple of thousands of years ago, when agriculture and herding were introduced. At some time during the last half of the first millennium BC, people living in the region where Botswana, Zambia and Angola are today, started moving southward, until they reached the Highveld and the Cape in the area of modern South Africa. Over the centuries, as the sub-continent became fully settled, these agro-pastoralists, who spoke Bantu languages, started dominating all those areas which were ecologically suitable for their way of life. This included roughly the eastern half of modern South Africa, the eastern fringe of Botswana and the north of Namibia. There are no signs that Stone Age or Iron Age communities had been active in the modern-day Springs area in the past, and at the beginning of the 19th century no prominent black tribe had settled in this area yet. This would soon change. The Difaqane (Sotho), or Mfekane ("the crushing" in Nguni) was a time of bloody upheavals in Natal and on the Highveld, which occurred around the early 1820's until the late 1830's. It came about in response to heightened competition for land and trade, and caused population groups like gun-carrying Griquas and Shaka's Zulus to attack other tribes. By 1827 Mzilikazi's Ndebele were moving through the area where Johannesburg is located today. This group went on raids to various other areas in order to expand their area of influence.

By 1832 Zulu raiders however travelled close by the Springs area to attack the Ndebele tribe (Ross 1995: 6, 7; Packard 2001: 594; Bergh 1999: 4-8, 10, 11, 14, 116-119). During the time of the Difaqane, a northwards migration of white settlers from the Cape was also taking place. Some travellers, missionaries and adventurers had gone on expeditions to the northern areas in South Africa, some already as early as the 1720's. One Hume travelled through the area north of Springs in 1830, but it does not seem that any of the early travellers visited this specific area (Bergh 1999: 13).

It was only by the late 1820's that a mass-movement of Dutch speaking people in the Cape Colony started advancing into the northern areas. This was due to feelings of mounting dissatisfaction caused by economical and other circumstances in the Cape. This movement later became known as the Great Trek. This migration resulted in a massive increase in the extent of that proportion of modern South Africa

dominated by people of European descent. Between 1839 and 1840, farm boundaries were drawn up in an area that includes the present-day Springs. As can be expected, the migration of whites into the northern provinces would have a significant impact on the black people who populated the land (Ross 2002: 39; Bergh 1999: 15).

The area of interest for this report is located approximately 30 kilometers east of Johannesburg, in a region formerly known as the Far East Rand, within the larger Witwatersrand gold mining area. The first gold discovered in this part of the Witwatersrand was on the farm Varkensfontein in 1888, only two years after gold was first discovered in the Witwatersrand. The discovery of diamonds and gold in the northern provinces had very important consequences for South Africa. After the discovery of these resources, the British, who at the time had colonized the Cape and Natal, had intensions of expanding their territory into the northern Boer republics. This eventually led to the Anglo-Boer War, which took place between 1899 and 1902 in South Africa, and which was one of the most turbulent times in South Africa's history (Till 1992: 1).

The situation in the Witwatersrand also served as a trigger for the commencement of the Anglo-Boer War. The rush of *uitlanders* (foreigners) that followed the discovery of gold in the Witwatersrand, and the resultant fear of the Afrikaners of being overwhelmed, caused President Kruger to resist the granting of the franchise to incomers. Increased resentment towards Kruger fuelled Cecil Rhodes' plot to oust Kruger's government. At the outbreak of the war in October 1899, Johannesburg provided a commando under Commandant B. J. Viljoen, whilst the *uitlanders* left for Lourenco Marques to join the British troops at Durban. To the south of the Magaliesberg range, between Johannesburg and Mafeking, stands the Witwatersrand range of hills. These hills were skilfully exploited by Boers during the guerrilla phase of the war, and especially by Assistant Commandant-general Koos de la Rey and Chief-commandant Christiaan de Wet (Marix Evans 2000: 128-129, 163).

Some skirmishes were recorded near Springs. The Johannesburg Mounted Rifles British corps was founded in December 1900, and the greater portion of these troops was stationed in the Springs district in the early part of 1901. Here the Boer enemy was always in the vicinity, and opportunities for confrontation often came up. On 17 January 1901, Lieutenant S. A. Anderson and Captain D. W. Talbot ambushed Boer troops near Springs. (Angloboerwar.com 1999)

By the late 1940s mining was booming on the East Rand. There were 22 mines in operation working the Main and Kimberley reefs from more than 90 shafts. The area's prosperity however did not last; during the 1950's and 1960's many of the mines closed because their ore reserves had become depleted. The mines that stayed in operation started to mine their second reef low grade ore because the high-grade ore had been depleted. By 1992 only four operating mines were left in the East Rand

7.3 Cultural Landscape

The cultural landscape of the study area is characterised by extensive cultivation and associated developments including roads and homesteads from prior to 1957 (Figure 10 and 11).

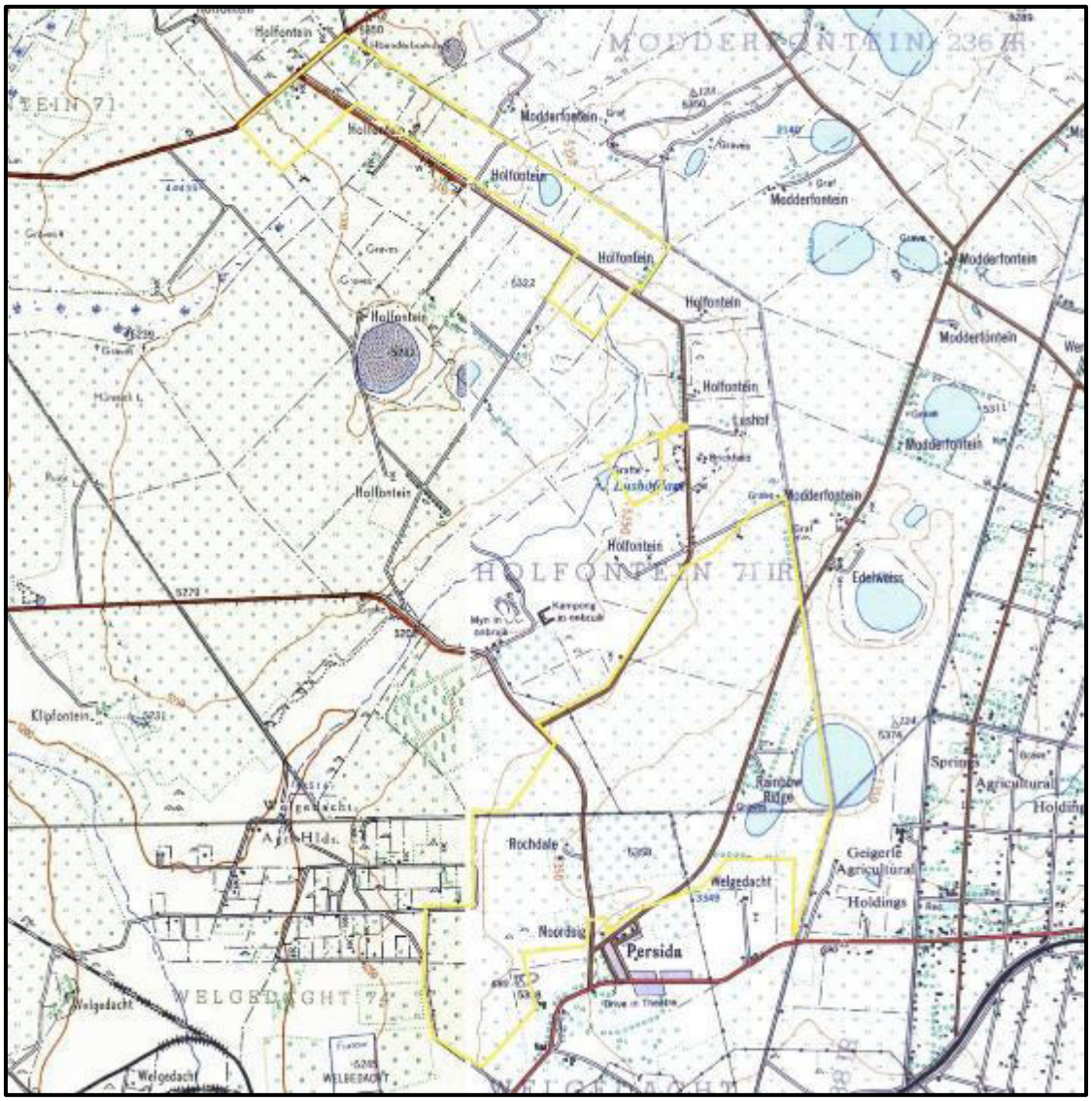

Figure 10. 1957-1965 Topographical map of the site under investigation. The approximate study area is indicated with yellow borders. The sites under investigation were located on the farms Holfontein 71 IR and Welgedacht 74 IR. Northern site: Secondary roads can be seen along the north western and southern borders of this site, and the entire area was used as cultivated lands. Other developments on the property included a dam, a chicken farm with various buildings and a windmill, as well as a traditional hut / kraal and four other settlement sites with between two and three buildings. Small, central site: A section of cultivated land and two graves are visible. The Lusthof Dam can be seen to the west of the site. Southern site: A number of secondary roads went through the area, and almost the entire property was used as cultivated lands. Other developments included two dams, some individual buildings and huts at various locations, a power line, an excavation site and two graves. (Topographical Map 1957; Topographical Map 1965)

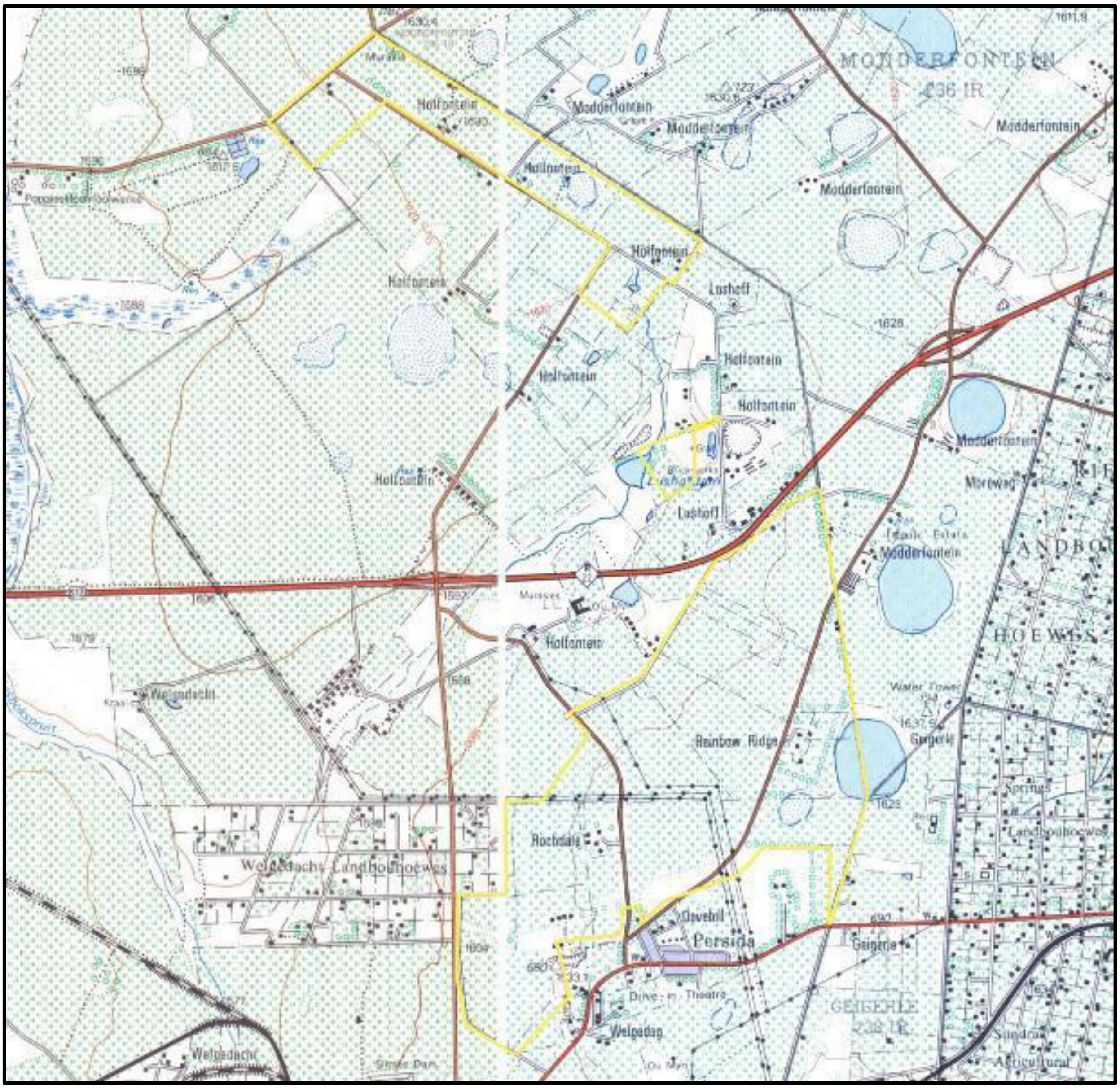

Figure 11.1976-1977 Topographical map of the site under investigation. The approximate study area is indicated with a yellow border. The sites under investigation were located on the farms Holfontein 71 IR and Welgedacht 74 IR. <u>Northern site:</u> Secondary roads can be seen along the north western and southern borders of this site, and the entire area was used as cultivated lands. Other developments on the property included two dams, a ruin, as well as six settlement sites with between one and four buildings. <u>Small, central site:</u> A section of cultivated land and a grave are visible. The Lusthof Dam can be seen to the west of the site, and a brickworks was located close by. <u>Southern site:</u> A number of secondary roads went through the area, and almost the entire property was used as cultivated lands. Other developments included two dams, six sites with between one and five buildings, an excavation site and three power lines. (Topographical Map 1976; Topographical Map 1977)

8 Findings of the Survey

The study area is under cultivation from prior to 1957 (Figure 10 & 11) and currently characterised by intensive agricultural activities (Figure 12 – 14), these activities would have impacted on surface indicators of heritage sites. Open areas not under cultivation are impacted on by earthmoving activities and other farming activities like roads and chicken coops (Figure 15). Based on archival maps (Figure 10 & 11) of the study area five burial sites used to occur in the study area, in addition dwellings older than 60 years is indicated on the 1957 map of the study area, of which one is confirmed to be intact (Figure 16 and Table 2). Below is a short description of heritage resources as protected by the NHRA Section 34 - 36.

Figure 12: Cultivation in the study area

Figure 13: Cultivation in the study area

Figure 14: Cultivation in the study area

Figure 15: Chicken coops

Table 3. Estimated locations of heritage resources.

Site No	Longitude	Latitude	Significance
Cemetery 1	28° 30' 09.9021" E	26° 11' 22.2418" S	High Social significance
Cemetery 2	28° 30' 46.6031" E	26° 09' 21.4493" S	High Social significance
Cemetery 3	28° 30' 51.4227" E	26° 09' 16.6936" S	High Social significance
Cemetery 4	28° 31' 09.3406" E	26° 10' 45.9347" S	High Social significance
Cemetery 5	28° 31' 11.9264" E	26° 10' 38.2663" S	High Social significance
Structure 1	28°29'43.07211"E	26° 7'58.7701"S	Low Significance

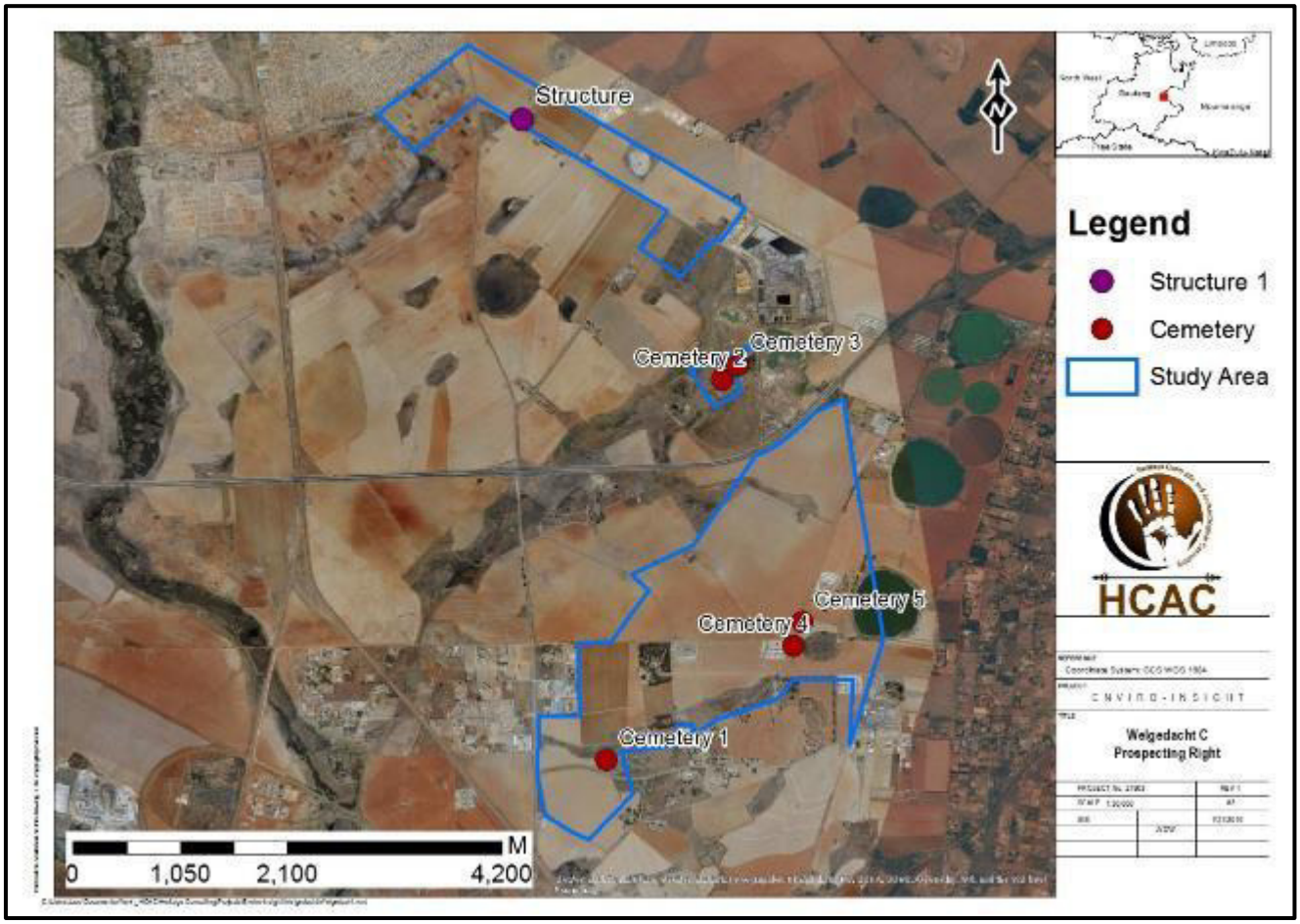

Figure 16: Distribution of sites in the study area.

8.1.1 Built Environment (Section 34 of the NHRA)

Several farm labourer dwellings and farm homesteads occur in the study area. These structures have not been recorded individually as it was not possible to get access to these areas.

From the archival maps the following portions could have structures older than 60 years if they are still standing:

- Portion 19 of the Farm Holfontein 71 IR
- Portion 22 of the Farm Holfontein 71 IR
- Portion 71 of the Farm Holfontein 71 IR
- Portion 26/74 of the Farm Welgedacht 74 IR

It was confirmed that the dwelling on portion 19/71 is still standing (Figure 17) but it was not possible to take diagnostic photographs due to access restrictions. The structures' potential to contribute to aesthetic, historic, scientific and social aspects are low and it is therefore of low heritage significance.

Figure 17. Location of existing structure older than 60 years on Portion 19 of the Farm Holfontein

Heritage Significance: Low Heritage Significance Field Rating: GP C

8.1.2 Archaeological and paleontological resources (Section 35 of the NHRA)

No archaeological sites were recorded during the survey. An independent palaeontological study found that:" *The site is on shales, sandstones, mudstones and coals of the Vryheid Formation (Ecca Group, Karoo Supergroup) and contains coals that will be exploited and could potentially also contain plants of the Glossopteris flora in the shales between the coal seams. Fossils are not visible in the coal itself and no vertebrates are likely to occur. The uppermost coal seam in this part of the Witbank coalfield is about 80m below the land surface. Since there is a small chance that fossils could occur below the surface a Fossil Chance Find Protocol should be added to the EMPr for when excavations commence.* (Bamford 2019).

8.1.3 Burial Grounds and Graves (Section 36 of the NHRA)

Based on archival maps (Figure 10 & 11) of the study area four burial sites used to occur in the study area and the approximate location of these sites were determined based on archival maps overlain on Google earth and recent 1:50 000 maps of the study area. These areas were visited during the field work and no grave dressings were noted. Cemetery 2 and 3 are located in an area where brick works used to occur and the area is characterised by extensive earthworks. Cemetery 4 and 5 are located in areas currently used as agricultural fields. Cemetery 1 is located in an area where no access was available, but the EAP, Corne Niemandt, confirmed that the Cemetery 1 is still intact. He identified and photographed Cemetery 1 with approximately 8 – 10 graves with stone and cement grave dressings (Figure 18, 19 and 20). More graves can be expected anywhere on the landscape. Grave are of high social significance.

Figure 18. Graves

Figure 19. General site conditions

Figure g

Heritage Significance: High Social Significance - Field Rating: GP A

8.2 Cultural Landscapes, Intangible and Living Heritage.

The study area is rural in character surrounded by agricultural and mining developments and although it is not a significant cultural landscape the proposed prospecting activities and mining can have a negative impact on the sense of place. From a heritage point of view the area has been extensively disturbed and this would have impacted on heritage resources. Visual impacts to scenic routes and sense of place are also considered to be low due to the existing developments in the area.

8.3 Battlefields and Concentration Camps

There are no battlefields or related concentration camp sites located in the study area.

9 Potential Impact

The chances of impacting unknown archaeological sites in the study area is considered to be negligible. If the correct mitigation measures are implemented, impacts on the potential location of graves can be avoided or mitigated to an acceptable level. Structures older than 60 years are protected by the NHRA and should be mitigated prior to development. For this assessment it is assumed that no structures will be impacted on during prospecting activities.

Any direct impacts that did occur would be during the invasive prospecting activities only with secondary impacts on sites that will be retained and preserved. Cumulative impacts occur from the combination of effects of various impacts on heritage resources. The importance of identifying and assessing cumulative impacts is that the whole is greater than the sum of its parts. In the case of the development, it will, with the recommended mitigation measures and management actions, not impact any significant heritage resources directly. However, this and other projects in the area could have an indirect impact on the heritage landscape.

9.1.1 Planned invasive activities – preparation

It is assumed that this phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure needed for the drilling phase. These activities can have a negative and irreversible impact on heritage sites. Impacts include destruction or partial destruction of non-renewable heritage resources.

9.1.2 Invasive activities – Drilling

During this phase, the impacts and effects are similar in nature but more extensive than the preparation phase. These activities can have a negative and irreversible impact on heritage sites. Impacts include destruction or partial destruction of non-renewable heritage resources.

9.1.3 Operation Phase

No impact is envisaged for the recorded heritage resources during this phase.

9.1.3.1 Impact on structures older than 60 years

Table 4. Impact assessment on structures older than 60 years.

Nature: During drilling activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position heritage material or objects.		
	Without mitigation	**With mitigation (Preservation/ excavation of site)**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Not Probable (2)
Significance	**24 (Low)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Structures older than 60 years in the study area is expected to be of low heritage significance, but is protected by the heritage act due to their age. It is recommended that if impacted on, structures older than 60 years should be assessed by a conservation architect after which a destruction permit can be applied for adhering to all legal requirements. A chance find procedure should be implemented for the		

project.
Cumulative impacts: Since the surrounding area is characterised by agricultural developments and due to the lack of significant heritage resources that will be impacted on in the study area cumulative impacts are considered to be low.
Residual Impacts: If sites are destroyed this results in the depletion of heritage record of the area. However, if sites are recorded and preserved or mitigated this adds to the record of the area.

9.1.3.2 Impact on cemeteries in the study area

Table 5 Impact Assessment on graves

Nature: During drilling activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position graves and burial sites.		
	Without mitigation	**With mitigation (Preservation/ excavation of site)**
Extent	Local (3)	Local (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (4)	Low (2)
Probability	Probable (3)	Not probable (2)
Significance	**36 (Medium)**	**20 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Graves and cemeteries are of high social significance, it is recommended that the cemeteries should be demarcated and preserved *in situ*. As the exact location of cemeteries is unknown and surface indicators have been destroyed a 150 m buffer zone should be kept around the approximate locations. A chance find procedure should be implemented for the project.		

Table 6. EMPR management measures

OBJECTIVE: To preserve and mitigate non-renewable heritage resources in the study area.

Project component/s	Heritage resources can be impacted on during drilling activities by the project.
Potential Impact	Irreplaceable loss of heritage resources and accidental damage to burial sites in the study area as well as depletion of the archaeological database of the area.
Activity/risk source	Activities such as vegetation clearing and drilling activities could destroy recorded resources.
Mitigation: Target/Objective	A heritage site development plan incorporated into the environmental management plan that considers heritage resources in the event of any future extensions of infrastructure or identification of heritage resources in current operations. *In situ* preservation of known graves.

Mitigation: Action/control	Responsibility	Timeframe
• A Consultation process to determine if any graves or still born burials exist in and around the structures must be conducted	Social team/ Community Liaison officer	Prior to earth works
• Implement a Chance Finds Procedure to ensure that if any heritage resources are uncovered that these are reported and correctly mitigated.	ECO	Daily
• The historic structures should be assessed by a conservation architect if they are to be impacted on by the development who will make suitable recommendations for mitigation, after which a destruction permit can be applied for from the relevant heritage authority.	Project Manager	Prior to development
• Implementation of a heritage site development plan to ensure the protection of heritage resources within the mining area;	Project Manager	Prior to development
• Implementation of a chance find procedure	Project Manager	Life of Mine
• Implementation of paleontological protocols (Bamford 2019)	ECO	Life of Mine

Performance Indicator	• Graves should be retained *in situ/* relocated adhering to legal requirements. • Heritage impacts should be considered in any future development in the area. • Ongoing preservation of retained sites. • Implementation of a chance find procedure i.e. immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility.
Monitoring	The ECO should monitor the known heritage resources during drilling and the possible occurrence of subsurface heritage resources regularly.

10 Recommendations and conclusion

The location of drilling points was not available at the time of the field survey and the study area was assessed both on desktop level and by a field survey. It should be noted that access to the study area was severely restricted due to land owners not permitting it.

The study area is under cultivation from prior to 1957 and currently characterised by intensive agricultural activities, these activities would have impacted on surface indicators of heritage sites.

In terms of the built environment (Section 34 of the NHRA), based on archival maps the following portions could have structures older than 60 years if they are still standing:

- Portion 19 of the Farm Holfontein 71 IR
- Portion 22 of the Farm Holfontein 71 IR
- Portion 71 of the Farm Holfontein 71 IR
- Portion 26/74 of the Farm Welgedacht 74 IR

It was confirmed that the dwelling on portion 19/71 is still standing but it was not possible to take diagnostic photographs due to access restrictions. It is not anticipated that buildings will be impacted on by the proposed prospecting; however structures older than 60 years are protected by legislation and must be assessed by a conservation architect before any impact occurs.

No archaeological sites were identified during the survey. This can be attributed to extensive cultivation throughout the study area. An independent paleontological study (Bamford 2019) found that the site is on shales, sandstones, mudstones and coals of the Vryheid Formation (Ecca Group, Karoo Supergroup) and contains coals that will be exploited and could potentially also contain plants of the *Glossopteris* flora in the shales between the coal seams. Fossils are not visible in the coal itself and no vertebrates are likely to occur. The uppermost coal seam in this part of the Witbank coalfield is about 80m below the land surface. Since there is a small chance that fossils could occur below the surface a Fossil Chance Find Protocol should be added to the EMPr for when excavations commence (Bamford 2019).

Based on archival maps four burial sites used to occur in the study area (Section 36 of the NHRA) and the approximate location of these sites were determined based on archival maps overlain on Google earth and recent 1:50 000 maps of the study area. These areas were visited during the field work and no grave dressings were noted. Cemetery 2 and 3 are located in an area where brick works used to occur and the area is characterised by extensive earthworks. Cemetery 4 and 5 are located in areas currently used as agricultural fields. Cemetery 1 is located in an area where no access was available, but the EAP, Corne Niemandt, confirmed that the Cemetery 1 is still intact.

No public monuments are located within or close to the study area. The study area is rural in character with an emphasis on agriculture with several mining operations in the grater area the prospecting development is not expected to have a negative impact on the sense of place. During the public participation process conducted for the project no heritage concerns were raised.

The impact of the proposed project on heritage resources is considered low and impacts can be mitigated to an acceptable level. The greatest risk to the project is the location of known and unknown graves. It is therefore recommended that the proposed project can commence (from a heritage perspective) on the condition that the following recommendations are implemented as part of the EMPr together with site specific recommendations and based on approval from SAHRA:

- A 150 meter buffer should be kept around the cemetery locations where no drilling can occur;
- Drilling should be located as close to existing roads as possible;
- No structures should be impacted on by the drilling;
- When the mining footprint is determent the impact areas should be subjected to a heritage walkthrough;
- Implementation of a chance find procedure that includes a fossil chance find protocol should be added to the EMPr as outlined below.

10.1 Chance Find Procedures

The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during drilling any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find and therefor chance find procedures should be put in place as part of the EMP. A short summary of chance find procedures is discussed below.

This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below.

- If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
- It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area.
- The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

10.2 Reasoned Opinion

From a heritage perspective, the proposed project is acceptable. If the above recommendations are adhered to and based on approval from SAHRA, HCAC is of the opinion that the development can continue as the development will not impact negatively on the heritage record of the area.

11 References

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Appendix A
Curriculum Vitae of Specialist

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Archaeologist

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Education:

Particulars of degrees/diplomas and/or other qualifications:

Name of University or Institution:		University of Pretoria
Degree obtained	**:**	BA Heritage Tourism & Archaeology
Year of graduation	**:**	2001
Name of University or Institution:		University of the Witwatersrand
Degree obtained	**:**	BA Hons Archaeology
Year of graduation	**:**	2002
Name of University or Institution	**:**	University of the Witwatersrand
Degree Obtained	**:**	MA (Archaeology)
Year of Graduation	:	2012
Name of University or Institution	**:**	University of Johannesburg
Degree	**:**	PhD
Year	:	Currently Enrolled

EMPLOYMENT HISTORY:

2011 – Present:	**Owner – HCAC (Heritage Contracts and Archaeological Consulting CC)**.
2007 – 2010 :	**CRM Archaeologist,** Managed the Heritage Contracts Unit at the University of the Witwatersrand.
2005 - 2007:	**CRM Archaeologist**, Director of Matakoma Heritage Consultants
2004:	**Technical Assistant**, Department of Anatomy University of Pretoria
2003:	**Archaeologist**, Mapungubwe World Heritage Site
2001 - 2002:	**CRM Archaeologists,** For R & R Cultural Resource Consultants, Polokwane
2000:	**Museum Assistant**, Fort Klapperkop.

Countries of work experience include:

Republic of South Africa, Botswana, Zimbabwe, Mozambique, Tanzania, The Democratic Republic of the Congo, Lesotho and Zambia.

SELECTED PROJECTS INCLUDE:

Archaeological Impact Assessments (Phase 1)

Heritage Impact Assessment Proposed Discharge Of Treated Mine Water Via The Wonderfontein Spruit Receiving Water Body Specialist as part of team conducting an Archaeological Assessment for the Mmamabula mining project and power supply, Botswana

Archaeological Impact Assessment Mmamethlake Landfill

Archaeological Impact Assessment Libangeni Landfill

Linear Developments

Archaeological Impact Assessment Link Northern Waterline Project At The Suikerbosrand Nature Reserve

Archaeological Impact Assessment Medupi – Spitskop Power Line,

Archaeological Impact Assessment Nelspruit Road Development

Renewable Energy developments

Archaeological Impact Assessment Karoshoek Solar Project

Grave Relocation Projects

Relocation of graves and site monitoring at Chloorkop as well as permit application and liaison with local authorities and social processes with local stakeholders, Gauteng Province.

Relocation of the grave of Rifle Man Maritz as well as permit application and liaison with local authorities and social processes with local stakeholders, Ndumo, Kwa Zulu Natal.

Relocation of the Magolwane graves for the office of the premier, Kwa Zulu Natal

Relocation of the OSuthu Royal Graves office of the premier, Kwa Zulu Natal

Phase 2 Mitigation Projects

Field Director for the Archaeological Mitigation For Booysendal Platinum Mine, Steelpoort, Limpopo Province. Principle investigator Prof. T. Huffman

Monitoring of heritage sites affected by the ARUP Transnet Multipurpose Pipeline under directorship of Gavin Anderson.

Field Director for the Phase 2 mapping of a late Iron Age site located on the farm Kameelbult, Zeerust, North West Province. Under directorship of Prof T. Huffman.

Field Director for the Phase 2 surface sampling of Stone Age sites effected by the Medupi – Spitskop Power Line, Limpopo Province

Heritage management projects

Platreef Mitigation project – mitigation of heritage sites and compilation of conservation management plan.

MEMBERSHIP OF PROFESSIONAL ASSOCIATIONS:

- Association of Southern African Professional Archaeologists. Member number 159

  Accreditation:
  - Field Director Iron Age Archaeology
  - Field Supervisor Colonial Period Archaeology, Stone Age Archaeology and Grave Relocation
- Accredited CRM Archaeologist with SAHRA
- Accredited CRM Archaeologist with AMAFA
- Co-opted council member for the CRM Section of the Association of Southern African Association Professional Archaeologists (2011 – 2012)

PUBLICATIONS AND PRESENTATIONS

- A Culture Historical Interpretation, Aimed at Site Visitors, of the Exposed Eastern Profile of K8 on the Southern terrace at Mapungubwe.
  - J van der Walt, A Meyer, WC Nienaber
  - Poster presented at Faculty day, Faculty of Medicine University of Pretoria 2003
- 'n Reddingsondersoek na Anglo-Boereoorlog-ammunisie, gevind by Ifafi, Noordwes-Provinsie. South-African Journal for Cultural History 16(1) June 2002, with A. van Vollenhoven as co-writer.
- Fieldwork Report: Mapungubwe Stabilization Project.
  - WC Nienaber, M Hutten, S Gaigher, J van der Walt
  - Paper read at the Southern African Association of Archaeologists Biennial Conference 2004
- A War Uncovered: Human Remains from Thabantšho Hill (South Africa), 10 May 1864.
  - M. Steyn, WS Boshoff, WC Nienaber, J van der Walt
  - Paper read at the 12th Congress of the Pan-African Archaeological Association for Prehistory and Related Studies 2005
- Field Report on the mitigation measures conducted on the farm Bokfontein, Brits, North West Province .
  - J van der Walt, P Birkholtz, W. Fourie
  - Paper read at the Southern African Association of Archaeologists Biennial Conference 2007
- Field report on the mitigation measures employed at Early Farmer sites threatened by development in the Greater Sekhukhune area, Limpopo Province. J van der Walt
  - Paper read at the Southern African Association of Archaeologists Biennial Conference 2008
- Ceramic analysis of an Early Iron Age Site with vitrified dung, Limpopo Province South Africa.
  - J van der Walt. Poster presented at SAFA, Frankfurt Germany 2008

- Bantu Speaker Rock Engravings in the Schoemanskloof Valley, Lydenburg District, Mpumalanga (*In Prep)*
    - J van der Walt and J.P Celliers
- Sterkspruit: Micro-layout of late Iron Age stone walling, Lydenburg, Mpumalanga. W. Fourie and J van der Walt. A Poster presented at the Southern African Association of Archaeologists Biennial Conference 2011
- Detailed mapping of LIA stone-walled settlements' in Lydenburg, Mpumalanga. J van der Walt and J.P Celliers
    - Paper read at the Southern African Association of Archaeologists Biennial Conference 2011
- Bantu-Speaker Rock engravings in the Schoemanskloof Valley, Lydenburg District, Mpumalanga. J.P Celliers and J van der Walt
    - Paper read at the Southern African Association of Archaeologists Biennial Conference 2011
- Pleistocene hominin land use on the western trans-Vaal Highveld ecoregion, South Africa, Jaco van der Walt.
    - J van der Walt. Poster presented at SAFA, Toulouse, France. Biennial Conference 2016

REFERENCES:

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   University of the Witwatersrand
3. Alex Schoeman University of the Witwatersrand
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