APPENDIX G: SPECIALIST STUDIES

Appendix G1: Door of Hope Village Development: Aquatic and Wetland Impact Assessment
Appendix G2: Door of Hope Village Development: Ecological Impact Assessment
Appendix G3: Door of Hope Village Development: Archaeological Impact Assessment
Appendix G4: Door of Hope Village Development: Palaeontological Desktop Study

APPENDIX G1: AQUATIC AND WETLAND SPECIALIST STUDY

DOOR OF HOPE VILLAGE DEVELOPMENT, GAUTENG

DRAFT AQUATIC AND WETLAND IMPACT ASSESSMENT

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Name	Responsibility	Date
Ms Jaclyn Smith	Report writing	September 2018
Dr Cherie-Lynn Mack	Reviewer	September 2018

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1 THE PROJECT TEAM AND EXPERTISE

In terms of Appendix 6 of the 2014 NEMA EIA Regulations (2014) (as amended) a specialist report must contain-

(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;

(b) A declaration that the specialist is independent in a form as may be specified by the competent authority;

1.1 Details of specialist

Ms Jaclyn Smith BSc (Hons) (Lead Report Writer)
Jaclyn is an environmental consultant. She holds a BSc with majors in Environmental Science and Geology from Rhodes University, as well as a BSc (Hons) in Geology from Nelson Mandela Metropolitan University. Jaclyn's honours dissertation looked at the sediment disturbance depth over two beaches in the Port Elizabeth. Jaclyn has over four years experience as an environment consultant and has undertaken various environmental impact studies. She has undertaken and assisted aquatic specialists with a number of aquatic and wetland impact assessments.

Wetland Training: Rhodes University, Tools for Wetland Assessment (certified competent).

Dr Cherie-Lynn Mack, *Pr.Sci.Nat.* (Reviewer)
Cherie-Lynn holds a PhD and MSc (with distinction) degree in Environmental Biotechnology, with a BSc degree in Microbiology and Biochemistry. She has postgraduate research experience in industrial and domestic wastewater treatment technologies, with particular emphasis on the coal and platinum mining industries. Her interests lie in the water sector, with experience in ecological reserve determination and water quality monitoring and analysis. She has experience in water quality analysis and industrial wastewater treatment research.

1.2 Expertise

Some of the aquatic projects EOH CES has completed include:

Name of project	Description of responsibility	Date completed
Fort Cox Agricultural College Water and Sanitation Upgrades	Aquatic Assessment	2017
DAFF Qolora Aquaculture Development Zone	Wetland Study	2016
Buffalo City Metropolitan Municipality: Haven Hills Cemetery	Wetland Study	2016
SANRAL R56 Road Upgrade between Matatiele and the KZN Border	Aquatic and Wetland Study	2016
Element Molteno Sewerage Infrastructure	Aquatic Impact Assessment	2015
Lusikisiki Regional Water Supply Scheme	Aquatic Impact Assessment	2015
Element Kwatshatshu Pedestrian Bridge	Aquatic and Botanical Assessment	2016
Element Becclesfarm Bridge	Aquatic and Wetland Study	2016
Senqu Pedestrian Bridge	Aquatic Impact Assessment	2016
Earth Free Kei Road Housing Development	Aquatic and Wetland Study	2017

1.3 Declaration – Jaclyn Smith

- I, Jaclyn Smith, declare that, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amended Environmental Impact Assessment Regulations, 2017;
- 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 report 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.

2 INTRODUCTION

In terms of Appendix 6 of the 2014 NEMA EIA Regulations (2014) (as amended) a specialist report must contain-

(c) An indication of the scope of, and the purpose for which, the report was prepared;
(cA) An indication of the quality and age of the base data used for the specialist report;
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;
(o) A description of any consultation process that was undertaken during the course of preparing the specialist report;
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto

2.1 Project overview and location

Door of Hope Children's Mission are proposing to construct a village development on the remaining extent of portion 19 of the farm Harzenbergfontein 332 IQ, approximately 25,55 ha in extent in the Midvaal Local Municipality, Gauteng Province (Figure 2.1). The development will entail the construction of the following (Figure 2.2 and Figure 2.3):

- Office space;
- Educational areas;
- Kitchen/Dining Halls;
- Medical facility;
- Baby House;
- Early Childhood area; and
- Residential.

EOH Coastal and Environmental Services (EOH CES) was appointed by Door of Hope Children's Mission to complete an Aquatic and Wetland Impact Assessment. This report provides input into the Environmental Impact Assessment and Water Use Licencing Process.

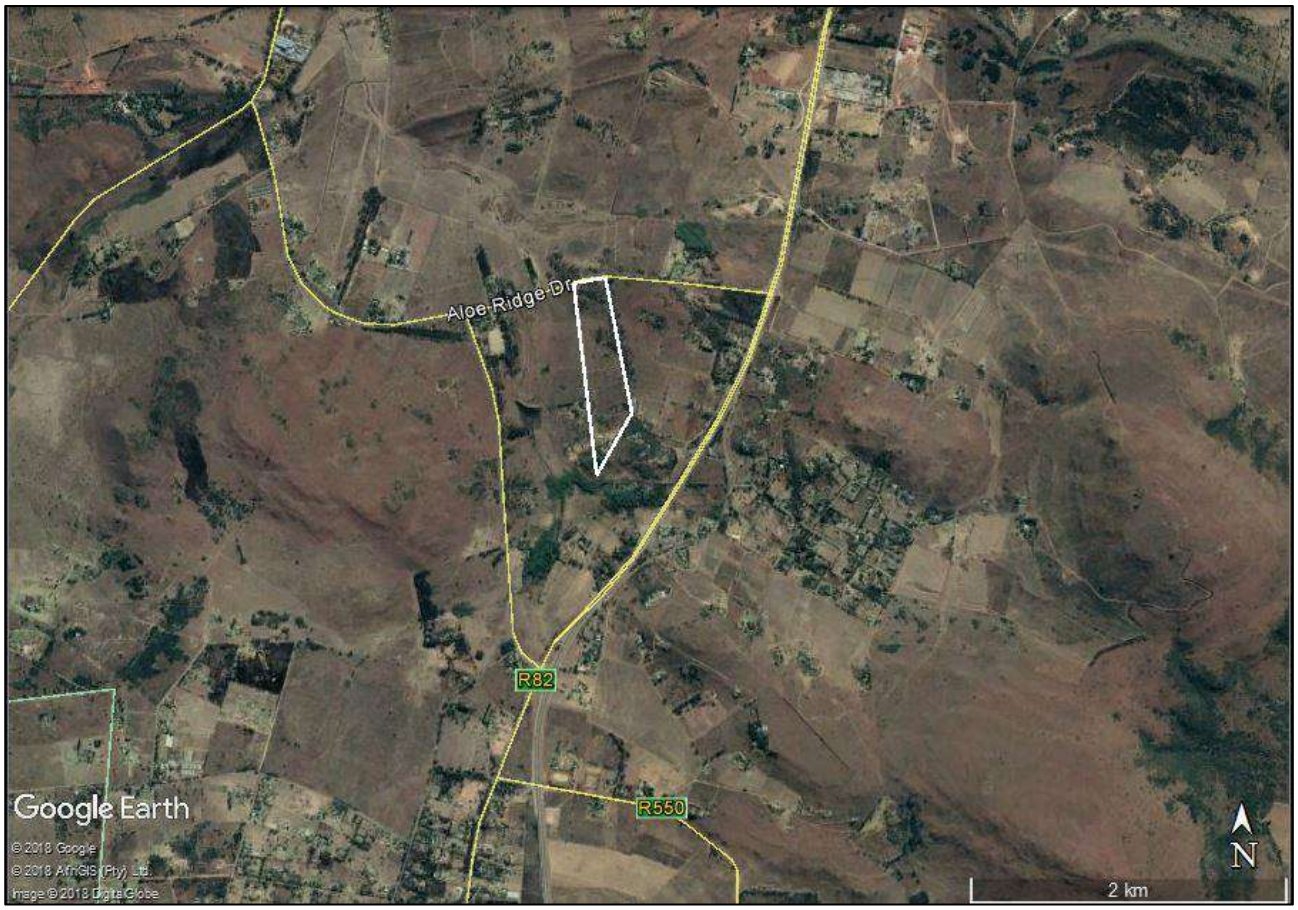

Figure 2.1. Locality map of the property boundary of the Door of Hope Village Development (coordinates: 26°22'45.44"S, 27°57'56.55"E).

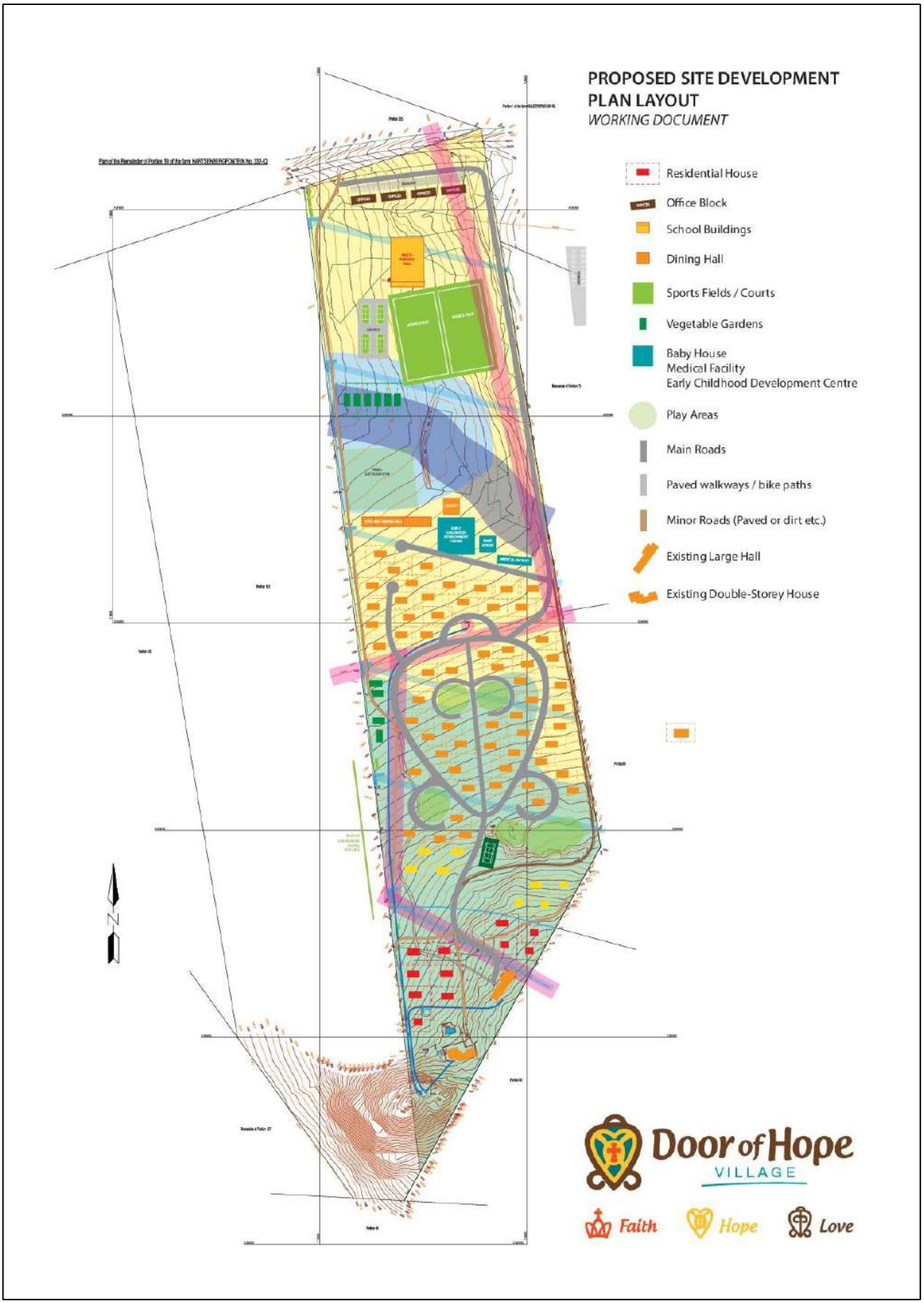

Figure 2.2: Layout of the proposed development.

2.2 Alternatives

There are no location or layout alternatives for the proposed Door of Hope Village Development. The only alternative assessed for the proposed Door of Hope Village Development is the status quo "No-go" alternative which has been assessed in this report.

2.3 Public Participation

No consultation requirements were identified during the drafting of this specialist report. The finding should be presented to stakeholders and I&AP's during a public meeting or public review as part of the Environmental Impact Assessment (EIA) Public Participation Process (PPP). Any comments received on this report will be included in the EIA report.

2.4 Objectives and Terms of Reference (ToR)

The ToR of this assessment is the following:

- Identify the presence of wetlands and riparian habitats within the general project area;
- Delineate wetlands and the riparian habitat in areas affected by the development;
- Provide a general description of the status of the surface water resources of the area according to published literature;
- Assess the state and sensitivity of nearby watercourses (including wetlands);
- Provide Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) information of affected and nearby watercourses (based on desktop PES and EIS data, if available);
- Provide a sensitivity map and define and map No-Go areas;
- Provide an assessment of the potential direct, indirect and cumulative impacts resulting from the proposed development on any watercourses during construction and operation. This includes the scope, scale and significance of impacts;
- Provide recommendations and mitigation measures that may be applied to reduce impacts;
- Identify rehabilitation measures that can be applied at completion of construction;
- Describe the implications of the No-Go option;
- Identify any fatal flaws associated with the project;
- Describe any assumptions made and any uncertainties or gaps in knowledge; and
- Provide any recommendations on any future specialist inputs required.

The quality of the base data used for this specialist report has been described in Table 2.1 below. It should be noted that only datasets and base data relevant to the study area and affected environmental features have been discussed below.

Table 2.1: Base data used and quality thereof

BASE DATASET	DATA AGE	DATA QUALITY
CBA and Ecological Support Areas (ESA) classification according to the Gauteng Conservation Plan (GCP)	2011	CBAs were defined using a number of biodiversity features. Features used to identify features include land cover map, Gauteng vegetation map, threatened species, aquatic features and climate change related features. Features used to identify ESA's include dolomite areas, rivers, wetlands, pans, corridors for climate change and species migration, ridges and biodiversity priority areas aligned with existing Metropolitan Open Space. The data was compiled by Compaan, P. et al. (2014) for the Gauteng Department of Agriculture and Rural Development.

Department of Water and Sanitation Desktop Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) Model.	2014	A combination of expert knowledge and available information on SQR level were used to derive the Desktop PES and EIS model. The objective of the PESEIS is to provide desktop level information on ecological issues as it relates to the protection and management of SQRs. For management purposes this refers specifically to the consideration of ecological reserve issues, water use licensing issues and EWRM (including the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP) activities) and the determination of priorities for monitoring. The PESEIS relates specifically to Rivers (Instream & Riparian aspects) and limited aspects of Valley Bottom Wetlands. Endorheic Wetlands are not addressed. The DWS model has been compiled by the RQIS-RDM; a Planning and Information Branch of the Department of Water and Sanitation and is the most up to date data set available.
Department of Water Affairs and Forestry: Level 2 River Ecoregional Classification System for South Africa, Lesotho and Swaziland.	2007	The delineation of Ecoregions for SA has been derived from terrain and vegetation data, with altitude, rainfall, runoff variability, air temperature, geology and soil data. The data has been compiled by the RQIS; a Planning and Information Branch of the Department of Water and Sanitation (DWS). DWS will not accept any responsibility for the accuracy of this data -- the outlines may change as the owner incorporates more data sets. Note that transition zones between regions are about 5km wide. The Ecoregions Level 2 document is still in draft form.
The National Freshwater Ecosystem Priority Areas (NFEPA) project	2011-2014	NFEPA was originally completed in 2011 and has recently (2014) been updated. FEPAs were determined through a process of systematic biodiversity planning and involved collaboration of over 100 freshwater researchers and practitioners. FEPAs were identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries, described in detail in the NFEPA Technical Report. The data was compiled by a large number of authors/specialists for the Water Research Commission of SA and is the most recent data available.
National Spatial Biodiversity Assessment (NSBA) – River Ecosystems	2004	The River component of the NSBA was based on the work conducted by the DWAF, CSIR and WRC in the National Freshwater Biodiversity Initiative. The status of river ecosystems was assessed based on the river signatures and the integrity of the main rivers. The NSBA was commissioned by the Department of Environmental Affairs and Tourism as part of the National Biodiversity Strategy and Action Plan. The NSBA was the first ever

		comprehensive spatial assessment of biodiversity throughout the country. This data is old and should only be used as a baseline to show the change in river conditions over time.
The National Wetland Classification System (NWCS)	2013	The NWCS uses hydrological and geomorphological traits to distinguish the direct factors that influence wetland function. This is presented as a 6 tiered structure with four spatially nested primary levels that are applied in a hierarchical manner between different wetland types on the basis of these direct factors. This Classification system has been commissioned by Freshwater Consulting Group (through SANBI). This data is the most recent data available.

On completion of the desktop assessment a site visit was undertaken on 27 and 28 August 2018 (winter) to determine the actual condition of the surface water features within the study area.

2.5 Approach

- The study site and surrounding areas were assessed using a two-phased approach. Firstly, a desktop assessment of the site was conducted in terms of current biodiversity programmes and plans. Desktop water quality data was also obtained from the Department of Water and Sanitation (DWS).
- Further to the above, a site visit was conducted in August 2018. The site visit served to inform potential impacts of the proposed project and how significantly it would impact on the surrounding aquatic environment.

2.6 Assumptions and Limitations

The following limitations and assumptions are implicit:

- The report is based on a project description provided by the client;
- Descriptions of the natural environments are based on limited fieldwork and available literature; and
- The site visit was undertaken in winter, where most of the vegetation present on site was dry and/or dead making identification of plant species challenging.

3 RELEVANT LEGISLATION

Environmental legislation relevant to the proposed activity is summarised in Table 3.1 below.

Table 3.1: Environmental legislation considered in the preparation of this report

Title of Environmental legislation, policy or guideline	Implications for the project
Constitution Act (108 of 1996)	Obligation to ensure that the proposed development will not result in pollution and ecological degradation; and Obligation to ensure that the proposed development is ecologically sustainable, while demonstrating economic and social development.
National Environmental Management Act (NEMA) (107 of 1998)	The developer must apply NEMA principles, the fair decision-making and conflict management procedures that are provided for in NEMA. The developer must apply the principles of Integrated Environmental Management and consider, investigate and assess the potential impact of existing and planned activities on the environment, socio-economic conditions and the cultural heritage.
National Environmental Management: Biodiversity Act (Act 10 of 2004), and its subsequent amendments. NEMBA Alien and Invasive Species List (Government Notice 599 of 2014)	The proposed development must conserve endangered ecosystems and protect and promote biodiversity; Must assess the impacts of the proposed development on endangered ecosystems; No protected species may be removed or damaged without a permit; The proposed site must be cleared of alien vegetation using appropriate means.
National Water Act (36 of 1998)	Provides details of measures intended to ensure the comprehensive protection of all water resources, including the water reserve and water quality. All necessary Water Use Licence Applications must be submitted to the Department of Water and Sanitation for approval.

4 ASSESSMENT METHODOLOGY

In terms of Appendix 6 of the 2014 NEMA EIA Regulations (2014) (as amended) a specialist report must contain-

(e) A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;

4.1 Aquatic Assessment approach

The aim of this assessment is to identify the aquatic importance of the rivers affected by the project and to evaluate the sensitivity of these features.

A desktop assessment of the project area was conducted in terms of current surface water classifications and biodiversity programmes and plans. This included the consideration of:

- Critical Biodiversity Classification according to the Gauteng Conservation Plan (March 2014);
- Department of Water and Sanitation Desktop Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) Model (2014);
- Department of Water Affairs and Forestry: Level 2 River Ecoregional Classification System for South Africa, Lesotho and Swaziland (2005);
- The National Freshwater Ecosystem Priority Areas (NFEPA) project (2011 - 2014); and
- National Spatial Biodiversity Assessment (NSBA) – River Ecosystems (2004).

Thereafter a site visit was conducted on 27 and 28 August 2018 in order to determine the actual condition of the rivers within the proposed study area.

4.2 Wetland Assessment

"*Wetland*" is a name given to a variety of ecosystems ranging from rivers, springs, seeps and mires in upper catchments, to midland marshes, pans and floodplains, coastal lakes, mangrove swamps and estuaries at the bottom of a catchment. These ecosystems all share the common primary driver of water and its prolonged presence is a fundamental determinant of soil characteristics, vegetation and animal life (DWAF, 2005).

The National Water Act (Act No. 36, 1998 as amended in 2013) defines wetlands as:

"*Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*."

Thus wetlands must have one or more of the following characteristics:

- **Hydromorphic soils**: characteristic soils of prolonged saturation;
- **Hydrophytes**, at least occasionally: highly saturated plants; and
- **High water table**: a high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.

Wetlands are formed from a combination of geology, hydrology and topography. These landforms form in parts of a catchment where the movement of water is slowed down or obstructed, causing soil to become temporarily, seasonally or permanently waterlogged.

Wetland Importance

South Africa is a Contracting Party to the Ramsar Convention on Wetlands and has thus committed itself to the intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. The Ramsar Convention is the only global environmental treaty that deals with a particular ecosystem. The treaty was adopted in the Iranian city of Ramsar in 1971 and the Convention's member countries cover all geographic regions of the planet. Wetland conservation in South Africa is now driven by SANBI under the requirements of the National Environmental Management: Biodiversity Act (NEMBA, 10, 2004).

In natural capital terms, wetlands may be seen as a significant economic investment. This monetary value is rooted to the fact that the primary tasks of a wetland are to process water and regulate runoff. This is important as the South African economy is heavily dependent on water and yet the climatic variability of the country has meant that for the most part rainfall occurs as intermittent, high intensity storms. The inherent value of wetlands is that they protect and regulate this water source by acting like sponges, soaking up water during flood events and releasing it during dry periods (DWAF, 2005). By regulating water flows during floods, wetlands may reduce flood damage and help prevent soil erosion. As natural filters wetlands help to purify water by trapping pollutants such as heavy metals and disease causing organisms.

The most common ecosystem services provided by wetlands (in general) are:

- Improved water quality;
- Flood attenuation;
- Sediment trapping;
- Reduce number of water borne diseases;
- Herbal medicine; and
- Water storage.

These ecosystem services are provided at very little cost but with significant payback for the South African economy.

Despite being classified as the third most significant life support system on earth (IUCN, 1980), wetlands are some of the most threatened habitats in the world today. Breen & Begg (1989) reported that more than 50% of the wetland inventory in South Africa had disappeared. The main issues have been draining wetlands for crops and pastures, poorly managed burning and grazing resulting in headcut and donga erosion, planting alien invasive vegetation, mining, pollution and urban development. These have been significant as they alter the natural flow of water in wetlands and as water is the driver of wetland formation it follows that any changes would be damaging. A buffer around a wetland is usually recommended in order to protect the wetland from development in close proximity to it.

Aside from the negative impacts of construction in the vicinity of a watercourse or wetland, a major impact that needs to be considered should be the geotechnical competence of soil which is often waterlogged and prone to flooding. Wetland soils are usually high in clay and prone to wet and dry periods, allowing for expansion and contraction of soils. The wetland and watercourse buffers are therefore also important with regards to the demarcation of areas that are not suitable for construction due to the high soil moisture content and unstable soils. Developing solutions to these problems would be expensive and may not be sustainable in the long term.

4.3 Tools available to define wetlands and watercourses

4.3.1 National Freshwater Ecosystem Priority Areas (NFEPA)

The NFEPA programme provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supports sustainable use of water resources. These priority areas are called Freshwater Ecosystem Priority Areas, or FEPAs. The system comprises a hierarchical classification process of defining a wetland based on the principles of the hydro-geomorphic (HGM) approach at higher levels, with structural features being included at the finer levels (SANBI, 2009).

Wetland ecosystem types were used by NFEPA for representing natural examples of the diversity of wetland ecosystem types across South Africa. Wetlands of the same ecosystem type are expected to share similar functionality and ecological characteristics. The biodiversity target for freshwater ecosystems in South Africa is 20%, which means that we should keep at least 20% of each wetland ecosystem type in a natural or near-natural condition. This serves to conserve many common species and communities, and the habitats in which they evolve. Information used to classify wetlands as FEPAs included:

- Ramsar status;
- Known threatened frog and waterbird occurrences; and
- Expert knowledge on biodiversity importance.

For the purposes of this study Version 4 of the National Wetland Classification System (NWCS) was used as baseline information, as per SANBI's BGIS interactive tool.

The NWCS uses hydrological and geomorphological traits to distinguish the direct factors that influence wetland function. This is presented as a 6 tiered structure with four spatially nested primary levels that are applied in a hierarchical manner between different wetland types on the basis of these direct factors (SANBI, 2009).

- **Level 1:** Distinguishes between marine, estuarine and inland ecosystems based on the degree of connectivity the systems have with the ocean.
- **Level 2:** Categorises the regional wetland setting using a combination of biophysical attributes at the landscape level.
- **Level 3:** Assesses the topographical position of inland wetlands.
- **Level 4:** Concerns the hydrogeomorphic (HGM) units as defined as follows:
  - *Landform* - considering the shape and localised setting of the wetland;
  - *Hydrological characteristics* - nature of water movement into, through and out of the wetland; and
  - *Hydrodynamics* - the direction and strength of flow through the wetland.

The HGM unit is considered the focal point for NWCS as the upper levels mean to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, whilst the lower levels provide more descriptive detail.

As wetlands are formed under the influence of geology, hydrology and topography it is necessary to note these features when delineating a wetland.

- **Geology:** Geology influences the formation of a wetland by geological obstructions such as erosion resistant rock or impervious material close to the surface forcing groundwater to move close to or onto the soil surface.
- **Hydrology*:*** The water transfer mechanisms such as source, movement and exit are important features of a wetland.
- **Topography:** The topography of the landscape influences the likelihood of whether a wetland will form. For instance, under the right conditions wetlands may form in floodplains, valley bottoms, hillslopes, depressions and coastal flats.

A range of 'hydro-geomorphic' types can be defined by considering the above features. Six HGM units are defined for South African inland wetlands (SANBI, 2009):

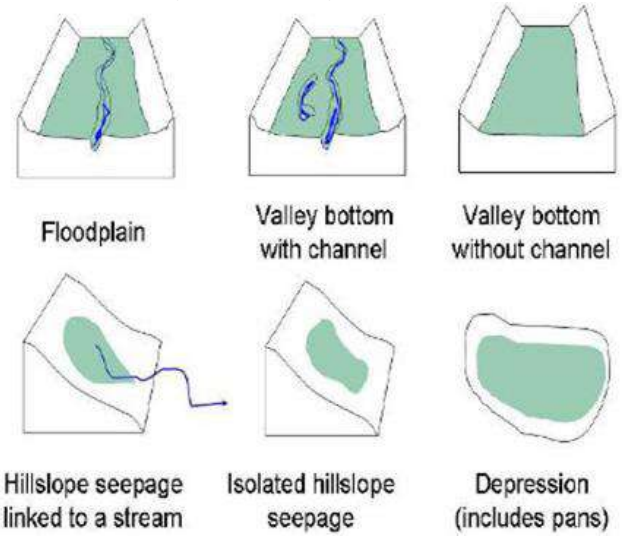

Figure 4.1: The HGM types for South African Inland wetlands (SANBI, 2009).

Important rivers are also classified according to the NFEPA rivers maps. These rivers are considered Freshwater Ecosystem Priority Areas (FEPAs). FEPAs are strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources. FEPAs are an essential part of an equitable and sustainable water resource strategy meaning that they need to stay in a good condition to manage and conserve freshwater ecosystems, and to protect water resources for human use. This means that the areas should be supported by good planning, decision-making and management to ensure that human use does not impact on the aquatic ecosystem.

4.3.2 WET-Health and Present Ecological State

Incorporation of the HGM approach in this system is significant as it has been adopted throughout aquatic assessment with regards to Present Ecological State and WET-Health assessments. These systems can then be easily integrated using the HGM approach in-line with Eco-classification process of river and wetland reserve determinations used by the Department of Water and Sanitation (DWS). The Ecological Reserve of a river or wetland is used by DWS to assess the water resource allocations when assessing water use licence applications (WULAs).

The WET- range of tools were developed to assist those wishing to undertake wetland rehabilitation, in terms of current and future human activities in Environmental Impact Assessments (EIA) or to determine the Present Ecological State (PES) of a wetland in an Ecological Reserve Determination (ERD). These tools were developed as part of a nine-year research programme on wetland management which was initiated in 2003 by the Water Research Commission (WRC) and a range of partners that examines wetland rehabilitation, wetland health and integrity and the sustainable use of wetlands (WRC Project No. K5/1408).

As wetlands are formed under the influence of geology, hydrology and topography it is necessary to note these features when delineating a wetland. The HGM unit is then classified using these features (Figure 4.1).

The materials and methods of WET-Health Wetland Management Series (Macfarlane et al., 2007) establish the current ecological health of a wetland. This assessment defines wetland health "as a measure of the deviation of wetlands structure and function from the wetland's natural reference condition" (Macfarlane et al., 2007).

A Level 1 Rapid Assessment would involve evaluating specific indicators pertaining to three categories of hydrological, geomorphological and vegetation health (Figure 4.2). The purposes of WET-Health are to aid users in understanding the ecological condition of the wetland and to identify the causes of degradation. The assessment criteria and information are specific to South Africa. The three categories (hydrological, geomorphological and vegetation) are assessed by taking into account the extent, intensity and magnitude of an impact which then produces a health score. Evaluation scores within each category are then combined to produce an overall impact of activities on the wetland system which corresponds to a Present State health category that provides an impact score scale of 0-10 and associated health category (ecological state) from A-F (Table 4.1), based on Kleynhans (1996, 1999). Such categories represent natural, largely natural, moderately modified, largely modified, extensively modified, and critically modified.

The WET-Health Assessment also considers the likely trajectory of change based on the threats to or vulnerability of a wetland. Five categories of the Trajectory of Change include: large improvement, slight improvement, remains the same, slight decline and rapid decline. Overall health of the wetland is then presented by the calculated Present Ecological State scores and the most likely Trajectory of Change.

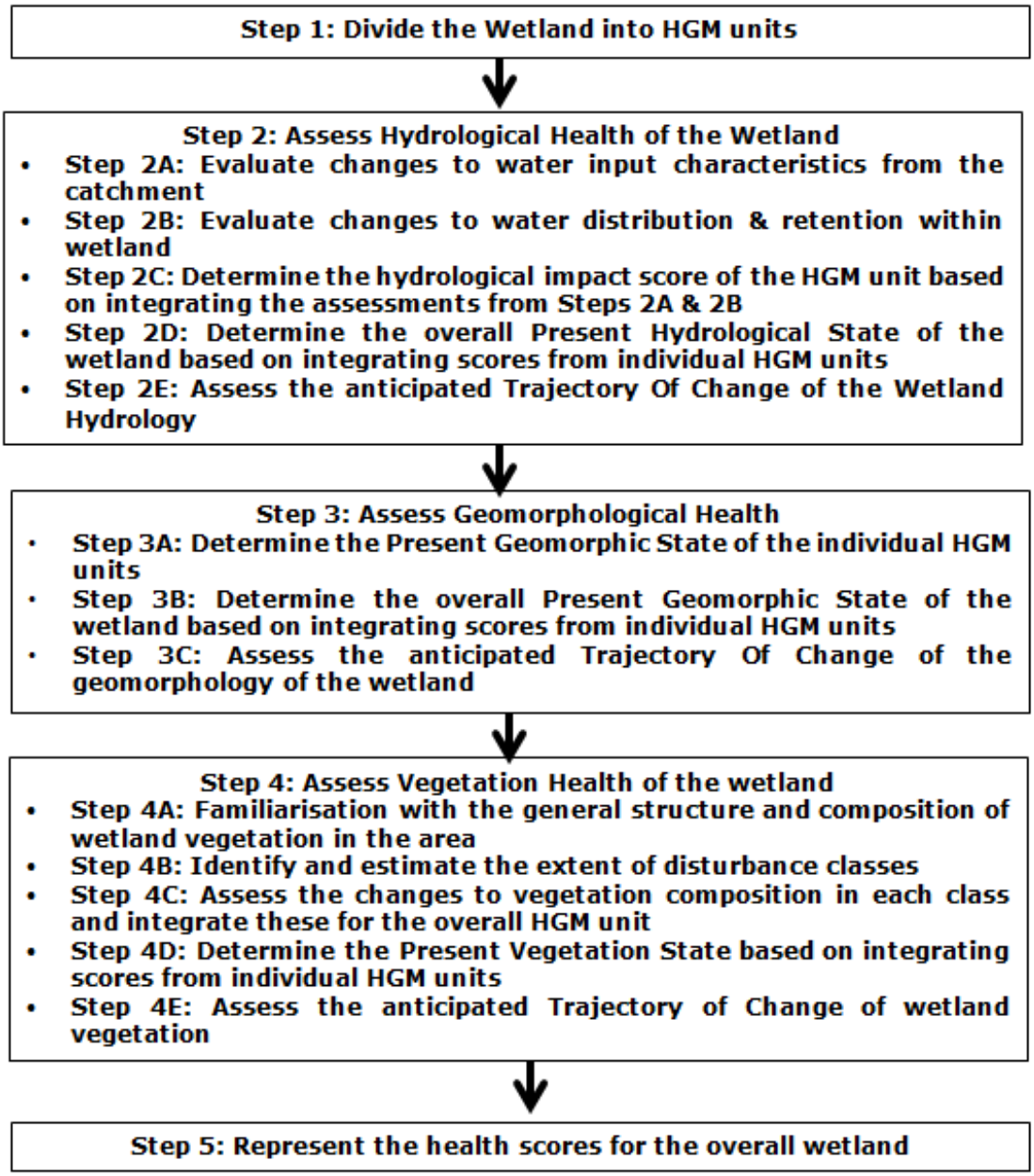

Figure 4.2: The steps involved in the WET-Health Level 1 rapid assessment (MacFarlane et al. 2007).

Table 4.1: Description of A-F ecological categories based on Kleynhans (1996, 1999).

PES Description	Combined impact score	PES Category	Level of disturbance
Unmodified, natural.	0-0.9	**A**	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1-1.9	**B**	Some human-related disturbance, but mostly of low impact potential
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	**C**	Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	**D**	
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	**E**	Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	**F**	

4.4 Tools available for wetland delineation

4.4.1 DWAF (2005) wetland delineation

The DWAF (2005) guidelines for "a practical field procedure for delineation of wetlands and riparian areas" are recommended in Gazette No. 19182, Notice No. 1091 of the National Water Act, 1998. This guideline explains the field indicators and methods for determining whether an area is a wetland or a riparian area, and how to find its boundaries. Although the primary driver of a wetland is water, due to its dynamic nature water is not a very useful parameter for identifying the outer boundary of a wetland. What is needed is a method of identifying the indirect indicators of prolonged saturation by water. This includes wetland plants (hydrophytes) and wetland (hydromorphic) soils. Their presence or absence implies the frequency and duration of saturation and is a satisfactory indicator to classify the area as a wetland (DWAF, 2005).

In wetland delineation there are three zones which are distinguished according to a changing frequency of saturation. These are the **permanent, seasonal** and **temporary** zone. The primary objective of wetland delineation is usually to define the outer edge of the temporary zone as it marks the boundary between the wetland and the adjacent terrestrial zone. There are four important indicators that are used to define the boundaries of a wetland. The most important one is the soil wetness indicator with terrain unit, soil form and vegetation acting as confirmation. The point where wetland indicators are not present is regarded as the edge of the wetland.

The **permanently wet zone** is characterised by dark grey, clay soil, caused by a lack of oxygen required for the oxidation of minerals such as iron in the soil. The **seasonally wet zone** is characterised by grey soils with lots of orange and black mottles. It is generally recommended that there should be a 100m buffer zone between the edge of the delineated **temporary zone** and any development. Important indicators of each zone are as follows:

- ***Wetland vegetation***
  In order to tolerate the anaerobic conditions of seasonal or permanent flooding, hydrophytes (water loving plants) have evolved a number of adaptations. Their presence can therefore indicate a moist soil habitat and thus provide a potential boundary of a wetland's seasonally flooded or permanent flooded zones (Macfarlane et al., 2007).

    - The ***temporary zone*** of a wetland will show mainly grasses, some woody species and some sedges.
    - The **seasonal zone** will begin to show more hydrophytic (or water loving) sedges with tall grasses (over 1m).
    - The **permanent zone** will be noticeable by emergent reeds and sedges, bulrushes or floating and submerged plants. Woody species will have adaptations for permanent wetness such as prop roots (Mangroves).

- ***Wetland soils***
  Low oxygen levels result in a reduced rate of organic matter decomposition within the soil, where sulphur tends to exist in its reduced form, hydrogen sulphide (H_2S), noticeable by its tell-tale rotten-egg smell. These conditions also serve as a catalyst for the metals in the soil to become soluble and begin leaching (DWAF, 2005). The metals produce rich colours of yellow, orange and reds.

    - The ***temporary*** or ***seasonal zone*** of a wetland, where there is more seasonal flooding, produces mottling of colours, as the metals are still in the process of precipitating. These mottles occur within a grey matrix where the metals have already leached.
    - The ***permanent zone*** of a wetland, where there is more permanent flooding of the soil, produces leaching of metals, with soils remaining a grey ("gleyed") colour.
    - It is recommended by DWAF (2005) that soils be sampled on the surface (0-10cm) and between 40 and 50cm.

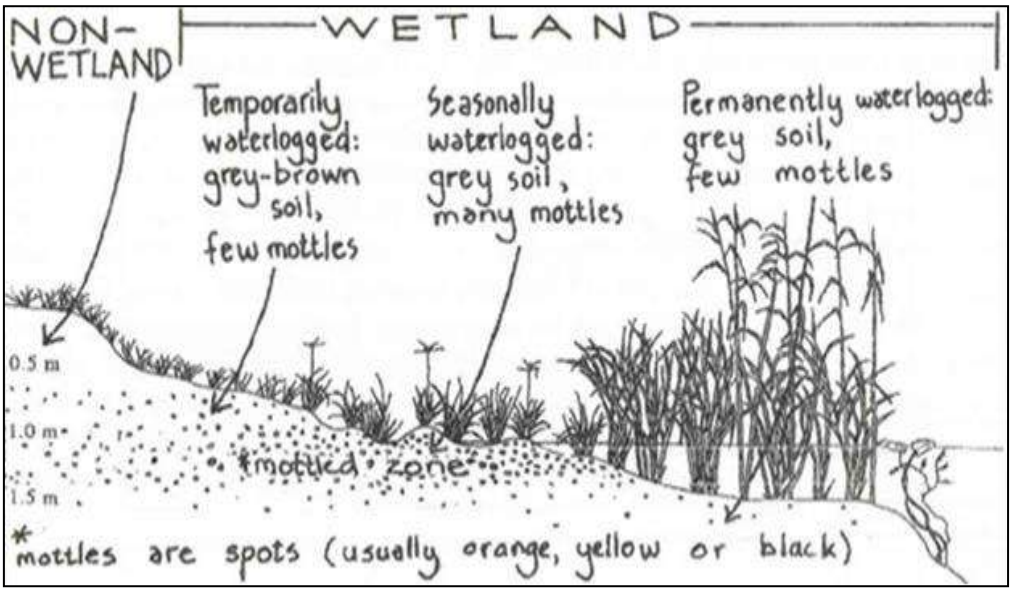

Figure 4.2: A cross-section through a wetland, indicating how the soil wetness and vegetation indicators change as one moves along a gradient of decreasing wetness, from the middle to the edge of the wetland (DWAF, 2005).

4.5 WET-Ecoservices

WET-Ecoservices (Kotze et al., 2008) is used to assess the goods and services that individual wetlands provide, thereby aiding informed planning and decision making. The tool provides guidelines for scoring the importance of a wetland in delivering each of 15 different ecosystem services. The first step is to characterise wetlands according to their hydrogeomorphic setting. Ecosystem service delivery is then assessed either at Level 1, based on existing knowledge or at Level 2, based on a field assessment of key descriptors.

Where there are characteristics relating to effectiveness and opportunity WET-Ecoservices calculates an average for each of the groups and an overall score is calculated from these averages. The overall score is then rated according to the table below. The Ecoservices that are assessed are illustrated in Table 4.2.

Table 4.2 Classes for determining the likely extent to which a benefit is being supplied based on the overall score of that benefit

Score	<0.5	0.5-1.2	1.3-2.0	2.1-2.8	>2.8
Rating of the likely extent to which a benefit is being supplied	Low	Moderately low	Intermediate	Moderately high	High

Table 4.3 Ecosystem services included in, and assessed by, WET-Ecoservices (Kotze et al., 2008)

Ecosystem services supplied by wetlands	Indirect benefits	Regulating and supporting benefits	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
			Streamflow regulation		Sustaining streamflow during low flow periods
			Water quality enhancement benefits	Sediment trapping	The trapping and retention in the wetland of sediment carried by runoff waters
				Phosphate assimilation	Removal by the wetland of phosphates carried by runoff waters
				Nitrate assimilation	Removal by the wetland of nitrates carried by runoff waters
				Toxicant assimilation	Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters
				Erosion control	Controlling of erosion at the wetland site, principally through the protection provided by vegetation.
			Carbon storage		The trapping of carbon by the wetland, principally as soil organic matter
	Direct benefits	Biodiversity maintenance[2]			Through the provision of habitat and maintenance of natural process by the wetland, a contribution is made to maintaining biodiversity
		Provisioning benefits	Provision of water for human use		The provision of water extracted directly from the wetland for domestic, agriculture or other purposes
			Provision of harvestable resources		The provision of natural resources from the wetland, including livestock grazing, craft plants, fish, etc.
			Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
		Cultural benefits	Cultural heritage		Places of special cultural significance in the wetland, e.g. for baptisms or gathering of culturally significant plants
			Tourism and recreation		Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
			Education and research		Sites of value in the wetland for education or research

4.6 Impact assessment

4.6.1 Impact rating methodology

To ensure a direct comparison between various specialist studies, a standard rating scale has been defined and will be used to assess and quantify the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

- Relationship of the impact to **temporal scales** - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.

- Relationship of the impact to **spatial scales** - the spatial scale defines the physical extent of the impact.

- The severity of the impact - the **severity/beneficial scale** is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party.

The **severity** of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

- The **likelihood** of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

- Each criterion is ranked with scores assigned as presented in the tables below to determine the **overall significance** of an activity. The criterion is then considered in two categories, viz. effect of the activity and the likelihood of the impact. The total scores recorded for the effect and likelihood are then read off the matrix presented in the tables below, to determine the overall significance of the impact. The overall significance is either negative or positive.

  The significance scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of a social nature need to reflect the values of the affected society.

Cumulative Impacts

Cumulative impacts affect the significance ranking of an impact because the impact is taken in consideration of both onsite and offsite sources. For example, pollution making its way into a river from a development may be within acceptable national standards. Activities in the surrounding area may also create pollution which does not exceed these standards. However, if both onsite and offsite activities take place simultaneously, the total pollution level may exceed the standards. For this reason it is important to consider impacts in terms of their cumulative nature.

Seasonality

Although seasonality is not considered in the ranking of the significance, if may influence the evaluation during various times of year. As seasonality will only influence certain impacts, it will only be considered for these, with management measures being imposed accordingly (i.e. dust suppression measures being implemented during the dry season).

Table 4.4. Significance Rating Table.

Temporal Scale (The duration of the impact)	
Short term	Less than 5 years (many construction phase impacts are of a short duration).
Medium term	Between 5 and 20 years.
Long term	Between 20 and 40 years (from a human perspective almost permanent).
Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
Spatial Scale (The area in which any impact will have an affect)	
Individual	Impacts affect an individual.
Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
Project Level	Impacts affect the entire project area.
Surrounding Areas	Impacts that affect the area surrounding the development

Municipal	Impacts affect either the Local Municipality, or any towns within them.
Regional	Impacts affect the wider District Municipality or the province as a whole.
National	Impacts affect the entire country.
International/Global	Impacts affect other countries or have a global influence.
Degree of Confidence or Certainty (The confidence with which one has predicted the significance of an impact)	
Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.

Table 4.5 Impact Severity Rating.

Impact severity (The severity of negative impacts or how beneficial positive impacts would be on a particular affected system or affected party)	
Very severe	Very beneficial
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.
Severe	Beneficial
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.
Moderately severe	Moderately beneficial
Medium to long term impacts on the affected system(s) or party(ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.
Slight	Slightly beneficial
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect	Don't know/Can't know
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.

Table 4.6 Overall Significance Rating.

Overall Significance **(The combination of all the above criteria as an overall significance)**	
VERY HIGH NEGATIVE	**VERY BENEFICIAL**

These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in **severe** or **very severe** effects, or **beneficial** or **very beneficial** effects.
Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.
Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.

HIGH NEGATIVE	**BENEFICIAL**

These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light.
Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.
Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.

MODERATE NEGATIVE	**SOME BENEFITS**

These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial.
Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.

LOW NEGATIVE	**FEW BENEFITS**

These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect.
Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.
Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.

NO SIGNIFICANCE

There are no primary or secondary effects at all that are important to scientists or the public.
Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.

DON'T KNOW

In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information.
Example: The effect of a particular development on people's psychological perspective of the environment.

5 DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT

In terms of Appendix 6 of the 2014 NEMA EIA Regulations (2014) (as amended) a specialist report must contain-

(f) Details of an assessment of a 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 alternatives;
(g) An identification of any areas to be avoided, including buffers;
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.

5.1 Desktop Investigation

5.1.1 Quaternary catchment and Water Management Area

The study area is located within Water Management Area 5 (Vaal Major) and quaternary catchment C22D (Figure 5.1).

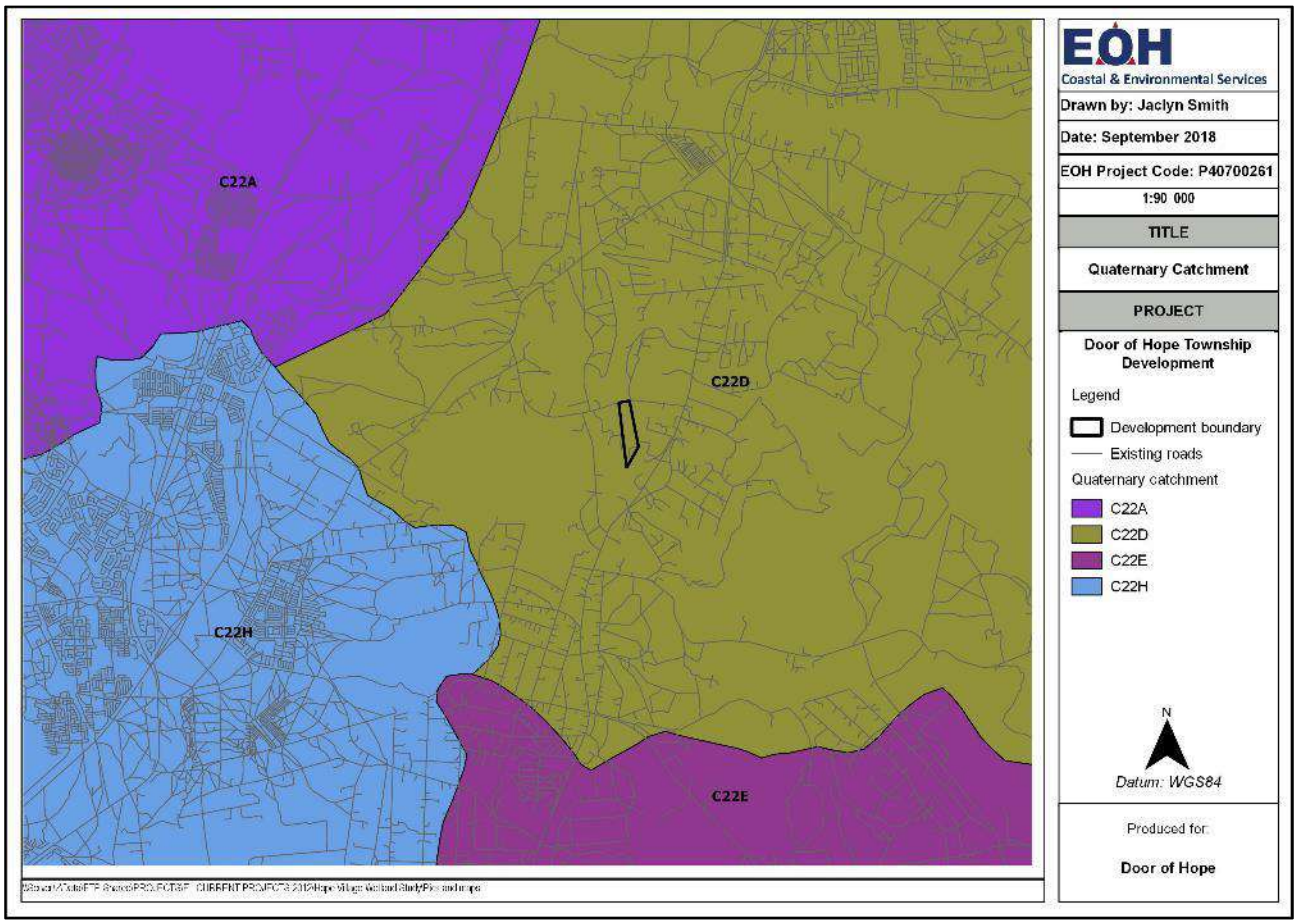

Figure 5.1: Quaternary catchment locality.

5.1.2 Rivers

There is a non-perennial river which runs through the site which connects to another non-perennial river bordering the eastern boundary of the site. This non-perennial river ultimately runs into the Klip River approximately 6,5 km north of the site (Figure 5.2).

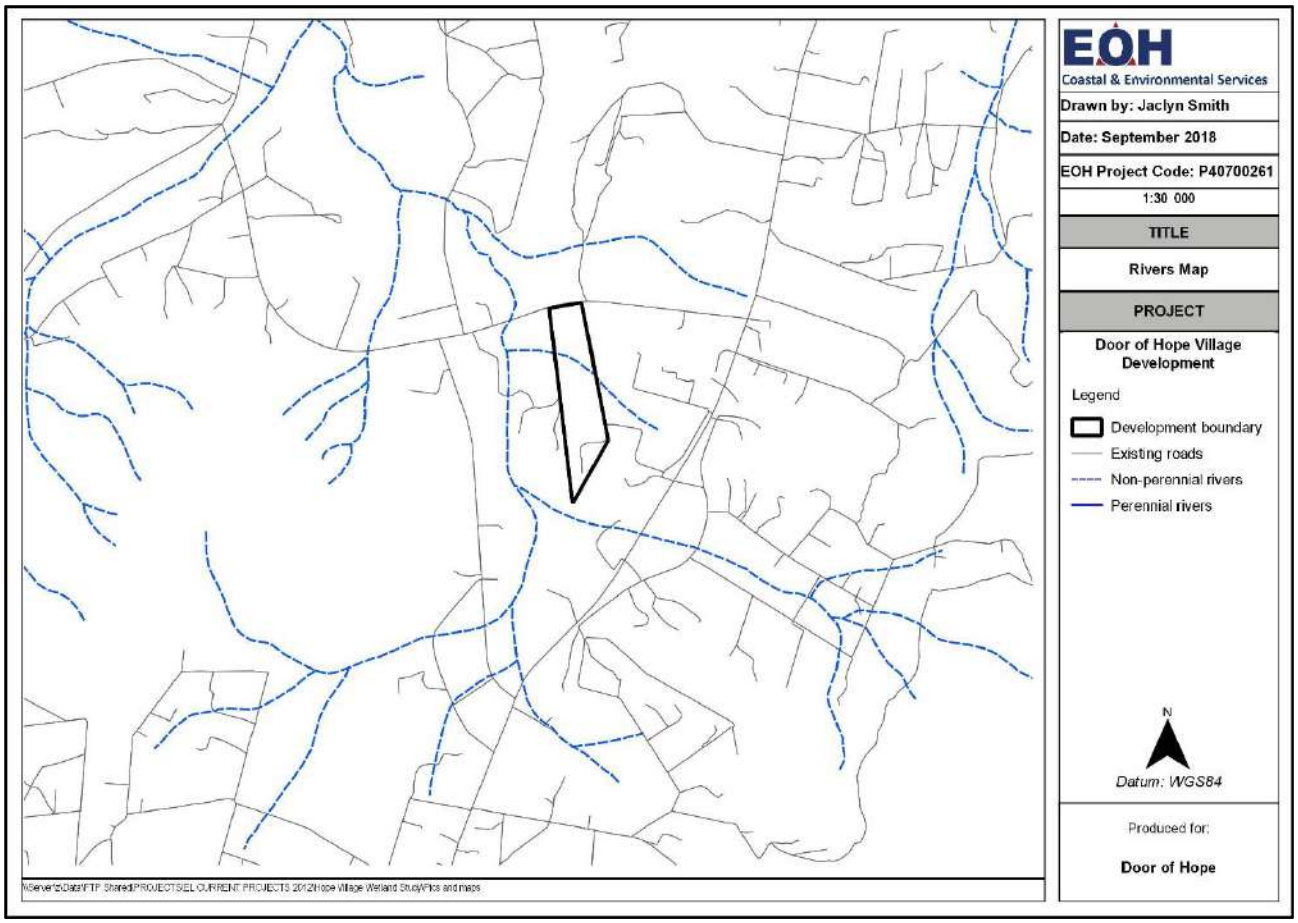

Figure 5.2. Rivers surrounding the study area.

i. The National Spatial Biodiversity Assessment (2004)

The National Spatial Biodiversity Assessment of 2004 is a framework document within which fine-scale conservation planning in identified priority areas should occur. The NSBA integrates terrestrial, river, marine, estuarine and wetland ecosystems using available spatial data, relevant conservation planning software and a series of expert and stakeholder workshops. It is important to note that the NSBA was conducted at a national scale (1:250 000), and thus can only provide a general context for biodiversity assessments at a local level.

An important tool used in the NSBA is conservation status. Conservation status aims at identifying threatened ecosystems, and is based on the classification scheme developed by the IUCN to categorise species. Of the 120 rivers in South Africa that have been classified using this categorisation, 44 % are critically endangered, 27 % are endangered, 11 % are vulnerable and 18 % are least threatened.

The Klip River, which is located to the north and approximately 6.5km from the study site is listed as **CRITICALLY ENDANGERED** (Figure 5.3). Critically endangered ecosystems have very little of their original extent left in natural or near-natural conditions. Most of these ecosystems types have been severely or moderately-modified from its natural state and have lost much of their natural structure and functioning. Any further loss of natural habitation or deterioration in condition of remaining examples of theses ecosystem types must be avoided and should be and the focus of urgent conservation action.

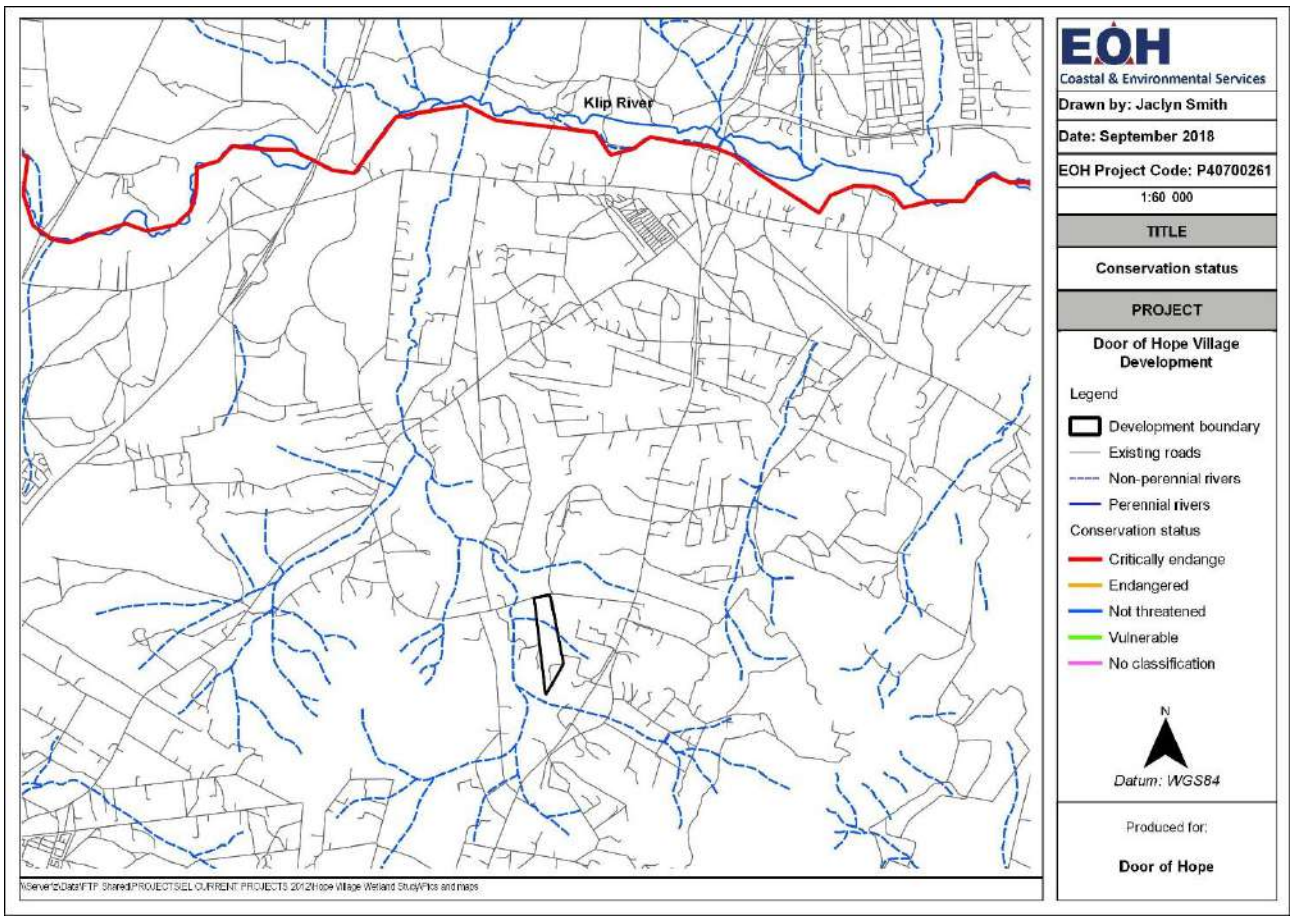

Figure 5.3: Conservation status of the rivers in the study area (NSBA, 2004).

ii. National Freshwater Ecosystem Priority Areas (NFEPA), 2011-2014

The National Freshwater Ecosystem Priority Areas (NFEPA) project provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supports sustainable use of water resources. These priority areas are called Freshwater Ecosystem Priority Areas, or 'FEPAs'.

FEPAs were identified based on:

- Representation of ecosystem types and flagship free-flowing rivers;
- Maintenance of water supply areas in areas with high water yield;
- Identification of connected ecosystems;
- Representation of threatened and near-threatened fish species and associated migration corridors; and
- Preferential identification of FEPAs that overlapped with:
    - Any free-flowing river
    - Priority estuaries identified in the National Biodiversity Assessment 2011
    - Existing protected areas and focus areas for protected area expansion identified in the National Protected Area Expansion Strategy.

The Klip River has not been assigned a NFEPA classification, and the subquaternary catchments potentially affected by the development also have no classification (Figure 5.4).

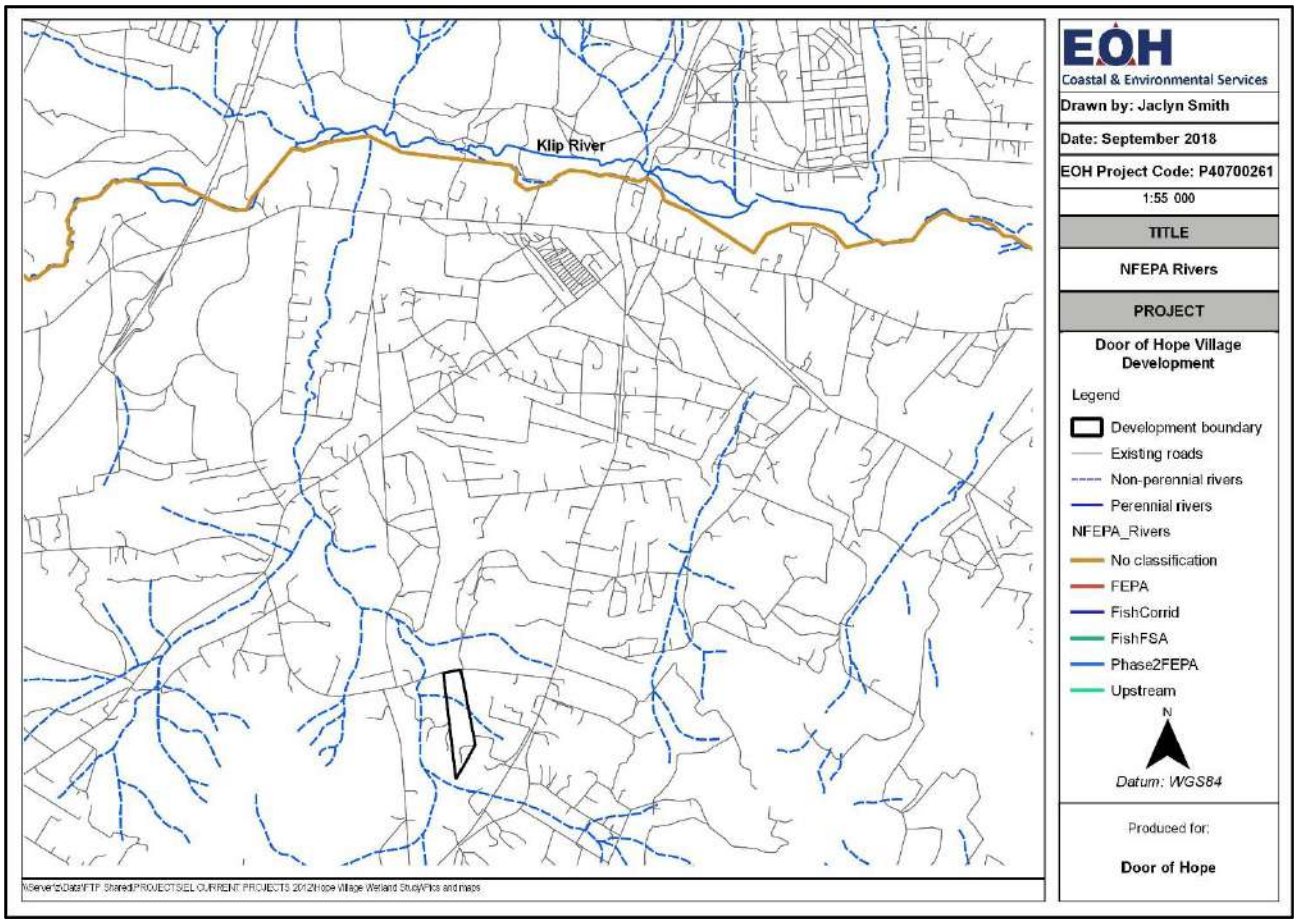

Figure 5.4. Freshwater Ecosystem Priority Area status of the rivers in the study area (NFEPA, 2011-2014).

iii. Present Ecological State

The only river surrounding the study area with Present Ecological State (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) data is the Klip River. The tables provided in Appendix A indicate the Present Ecological State, Ecological Importance and Ecological Sensitivity classification of the reaches of the Klip River assessed by the DWS as part of the Desktop PESEIS (2014).

The PES of the reach of the Klip River that runs north of the study site is classified as **E: Seriously Modified** (the change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable) while the EI is rated as **moderate** and the ES is rated as **moderate**.

5.1.3 Ecoregions

South Africa is a geologically, geomorphologically, climatically and ecologically complex country, and this has resulted in a diverse range of ecosystems, including rivers. River ecoregional classification or typing allows the grouping of rivers according to similarities based on a top-down nested hierarchy. The principle of river typing is that rivers grouped together at a particular level of the typing hierarchy will be more similar to one another than rivers in other groups. Ecological regions are regions within which there is relative similarity in the mosaic of ecosystems and ecosystem components (biotic and abiotic, aquatic and terrestrial).

According to Department of Water Affairs and Forestry (2005) Level 2 River Ecoregional Classification System, the study area falls within **Ecoregion 11.01: Highveld.**

This ecoregion has the following characteristics:

- Mean annual precipitation: Rainfall varies from low to moderately high, with an increase from west to east.
- Coefficient of variation of annual precipitation: Moderately high in the west, decreasing to low in the east.
- Drainage density: mostly low, but medium in some areas.
- Stream frequency: Low to medium.
- Slopes <5%: >80%, but 20-50% in a few hilly areas.
- Median annual simulated runoff: Moderate low to moderate.
- Mean annual temperature: Hot in west and moderate in the east.

Table 5.1. Attributes of the Highveld.

Main Attributes	**Highveld 11.01**
Terrain Morphology: Broad division	Plains; low relief; Plains; moderate relief; Open Hills, Lowlands, Mountains; moderate to high relief; Closed Hills, Mountains; moderate and high relief
Terrain Morphology	Plains; Plains and pans; Slightly undulating plains Slightly irregular undulating plains; few hills; Moderately undulating plains and pans; Strongly undulating plains Hills and lowlands Hills; Parallel hills
Vegetation types (dominant types in bold) (Primary)	Rocky Highveld Grassland Mixed Bushveld
Altitude (m a.m.s.l.)	1300 to 1900
MAP (mm)	500 to 700
Coefficient of variation (% of annual precipitation)	20 to 34
Rainfall concentration index	55 to 64
Rainfall seasonality	Early to mid-summer
Mean annual temp (°C)	14 to 18
Mean daily max temp (°C) February	24 to 30
Mean daily max temp (°C) July	14 to 20
Mean daily min temp (°C) February	12 to 17
Mean daily min temp (°C) July	0 to 3
Median annual simulated runoff (mm) for quaternary catchment	20 to 60

5.1.4 Gauteng Conservation Plan (GCP)

The GCP is a systematic conservation plan which maps biodiversity priority areas called CBA's, Ecological Support Areas and Protected Areas. The key objective of this plan is to identify sites that are critical for maintaining biodiversity and the purpose of this plan is to provide input into land use planning and decision making.

The GCP produces a map with the following categories:

- Protected Areas;
- CBA's
  - Irreplaceable Areas;
  - Important Areas; and
- Ecological Support Areas (ESA's).

It should be noted that the CBA's categorised under the GCP do not differentiate between aquatic and terrestrial CBA's. The CBA's are however, separated into irreplaceable areas and important areas.
The study site falls within a CBA (important area) and ESA according to the GCP (Figure 5.5). According to GCP area is classified as a CBA based on the plant habitat, bird habitat and primary vegetation. The identified ESA's include the non-perennial which runs through the site and surrounding non-perennial rivers.

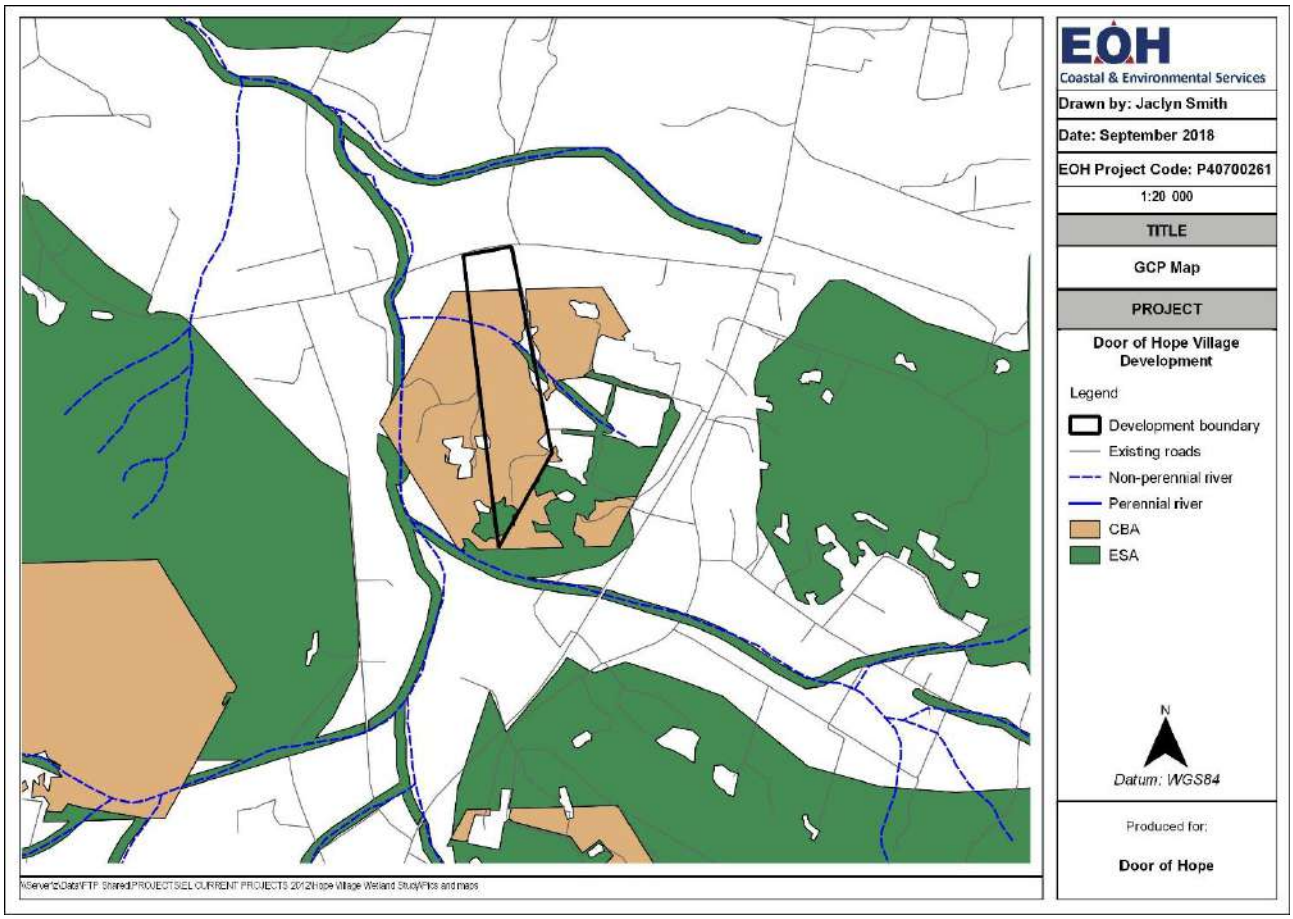

Figure 5.5 GCP map of the study area.

5.1.5 Wetlands

Wetlands in South Africa have been mapped on a broad-scale by various stakeholders and have been included in the National Freshwater Ecosystem Priority Assessment (NFEPA, 2011-2014). Due to the broad-scale nature of the NFEPA map it is not spatially accurate and therefore some error is expected. The location of NFEPA wetlands was derived from the National Land Cover 2000 (Van Den Berg et al., 2008) and inland water features from the Department of Land Affairs' Chief Directorate: Surveys and Mapping (DLA-CDSM). All wetlands are classified as either 'natural' or 'artificial' water bodies.

The NFEPA wetland map identifies important or sensitive wetlands and wetland clusters. A wetland cluster is a group of wetlands all within 1 km of each other and which are surrounded by relatively natural vegetation. Wetland clusters allow for important ecological processes such as the migration of insects and frogs between the wetlands.

A wetland cluster has been mapped within the study site (Figure 5.6).

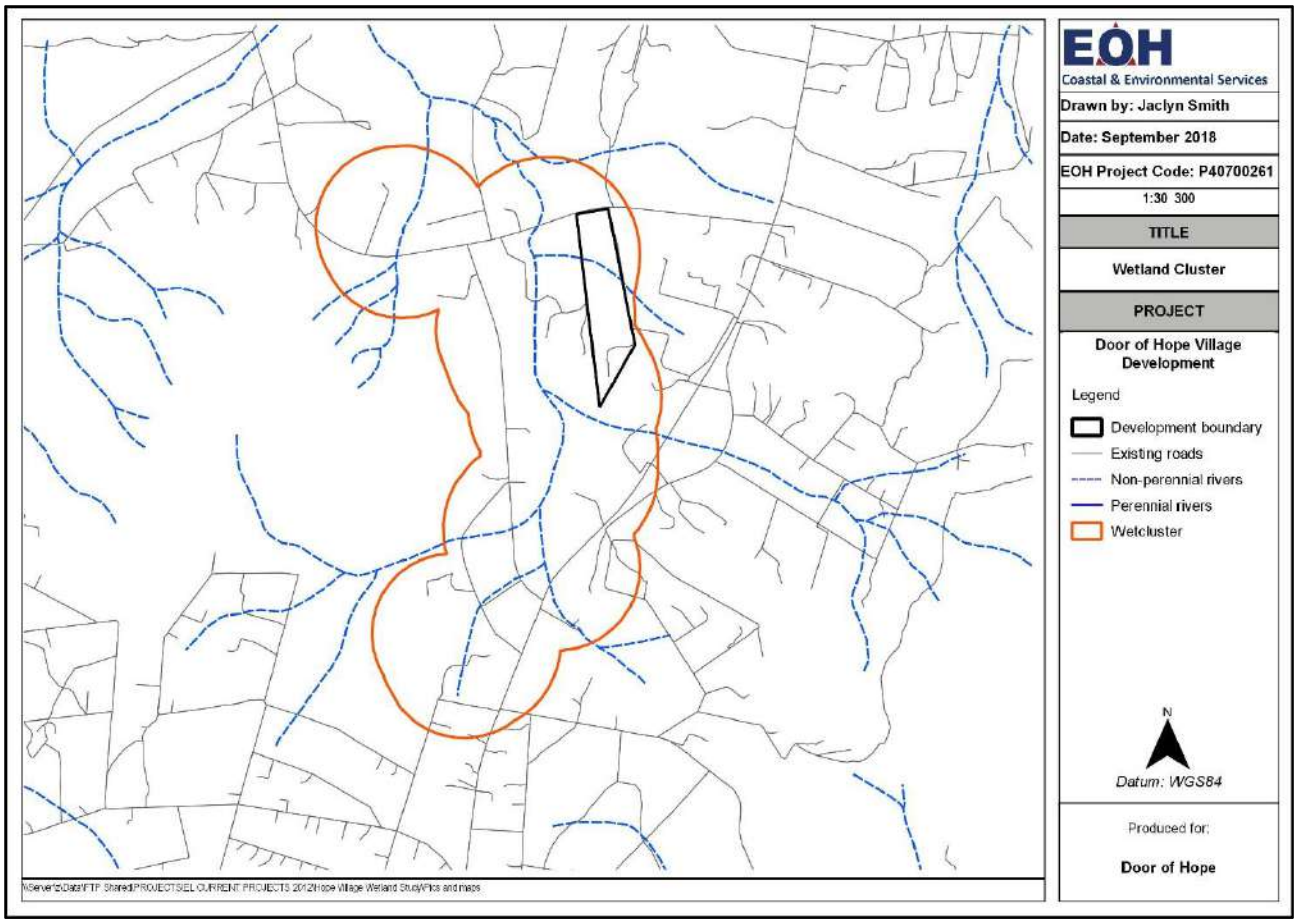

Figure 5.6 Map of wetland clusters within the study area.

Figure 5.7 below and Table 5.2 indicates the wetlands listed in the inventory surrounding the study area. There are a number of artificial wetlands and natural wetlands surrounding the site with only one natural wetland within 500m of the site. The wetlands occur along the drainage system from north to south with two artificial wetlands (water storage dams) that have been created along the river and wetland systems. All the NFEPA wetlands occur on the neighbouring adjacent private property and occur within approximately 150m from the site property boundary. None of the wetlands were classified as Final FEPA wetlands.

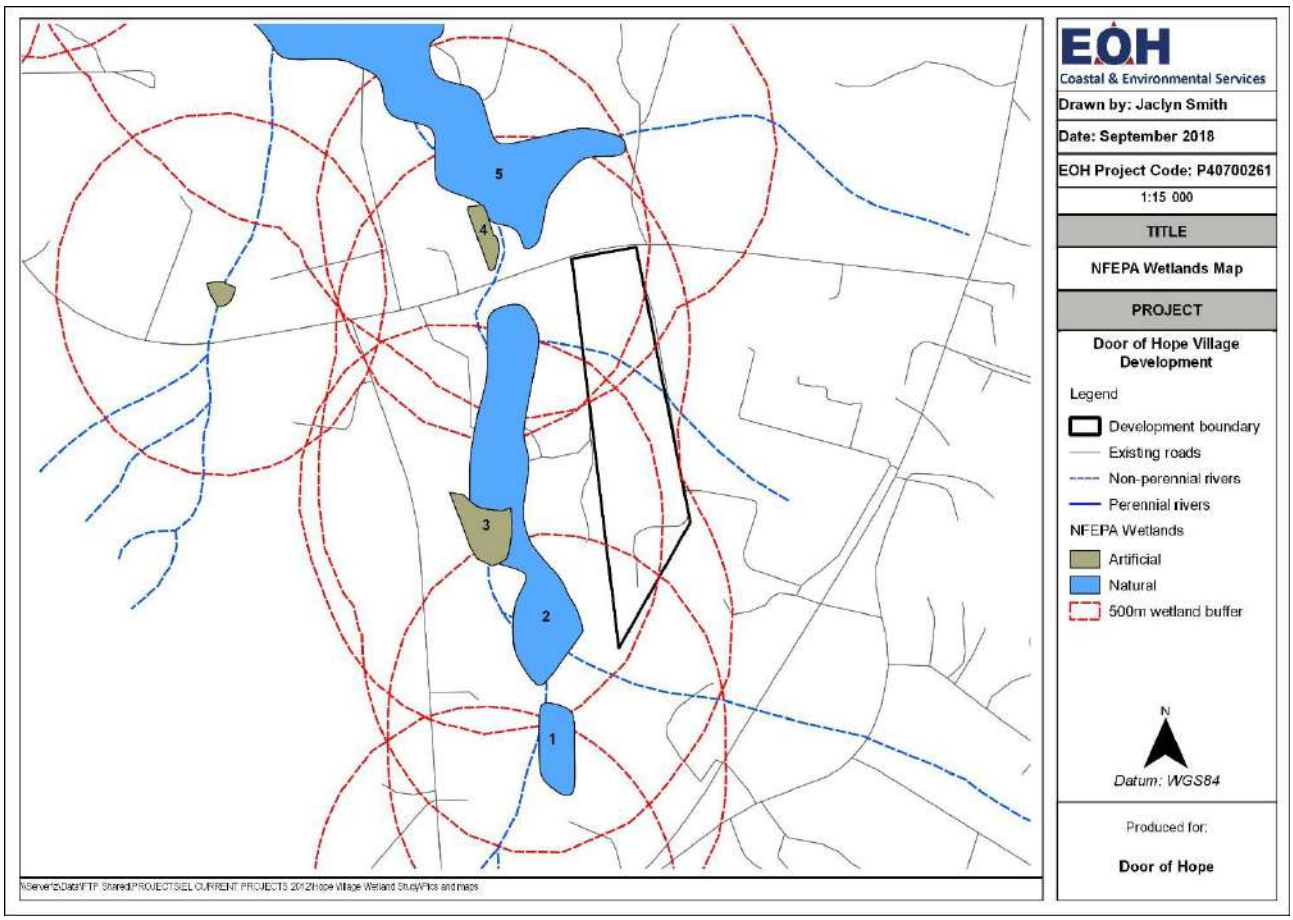

Figure 5.7: Wetlands surrounding the study area.

Table 5.2. Wetland classification for the wetlands located within 500m of the study area (Nel et al., 2011).

Wetlands	Level 3: Landscape Unit Landscape setting	Level 4: HGM Unit HGM Type	Wetland Type	Natural/ Artificial	Wetland condition (if available)	FEPA Status
Wetland 1	Slope	Seepage wetland	Central Bushveld Group 1 Seepage Wetland	Natural	C - Moderately modified	No
Wetland 2	Slope	Seepage Wetland	Central Bushveld Group 1 Seepage Wetland	Natural	C – Moderately Modified	No
Wetland 3	Slope	Seepage Wetland	Central Bushveld Group 1 Seepage Wetland	Artificial	Z3 – Heavily to critically modified	No
Wetland 4	Valley floor	Channelled valley-bottom wetland	Central Bushveld Group 1 Channelled valley-bottom wetland	Artificial	Z3 – Heavily to critically modified	No
Wetland 5	Valley floor	Channelled valley-	Central Bushveld Group 1 Channelled	Natural	C - Moderately modified	No

		bottom wetland	valley-bottom wetland			

5.1.6 Vegetation

According to Mucina and Rutherford (2006-2012) the vegetation in the study area is classified as the **Gauteng Shale Mountain Bushveld** of the Savanna Biome. The conservation status of this vegetation is classified as "**Vulnerable**". This vegetation type is characterised by a short, semi-open thicket dominated by a variety of woody species with an understorey dominated by a variety of grasses.

5.2 Site survey

A site survey was conducted on 27 and 28 August 2018. The purpose of the site visit was to gather data regarding the surrounding watercourses, ground truth the desktop study, delineating wetlands and assessing the state of the aquatic and wetland environment. This includes identifying any potential impacts that the Door of Hope Village Development may have on the aquatic and wetland environment and the significance of those impacts.

5.2.1 Wetland classification and delineation

There were three natural wetlands identified during the desktop study surrounding the study site and two artificial water storage dams. The site survey confirmed this. Only one of the wetlands, Wetland 2 was assessed in terms of PES, as requested by DWS. This wetland is adjacent to the study site and it is anticipated that this wetland is the mostly likely to be affected by any negative environmental impacts associated with the development. The other natural wetland, wetland 1 is upslope and wetland 5 is separated by a road and large artificial water storage dam.

Table 5.3 Wetland Classification according to Ollis et al. (2013).

Wetland	Level 2 Regional Setting	Level 3 Landscape Unit	Level 4 HGM Unit
	Ecoregion	Landscape setting	HGM Type
Wetland 2	Eastern Coastal Belt	Valley floor	Channelled valley-bottom wetland

The wetland has already been delineated by NFEPA however, a site visit and desktop investigation showed the delineation to be slightly inaccurate. The delineation has been slightly amended based on google earth imagery and the site investigation.

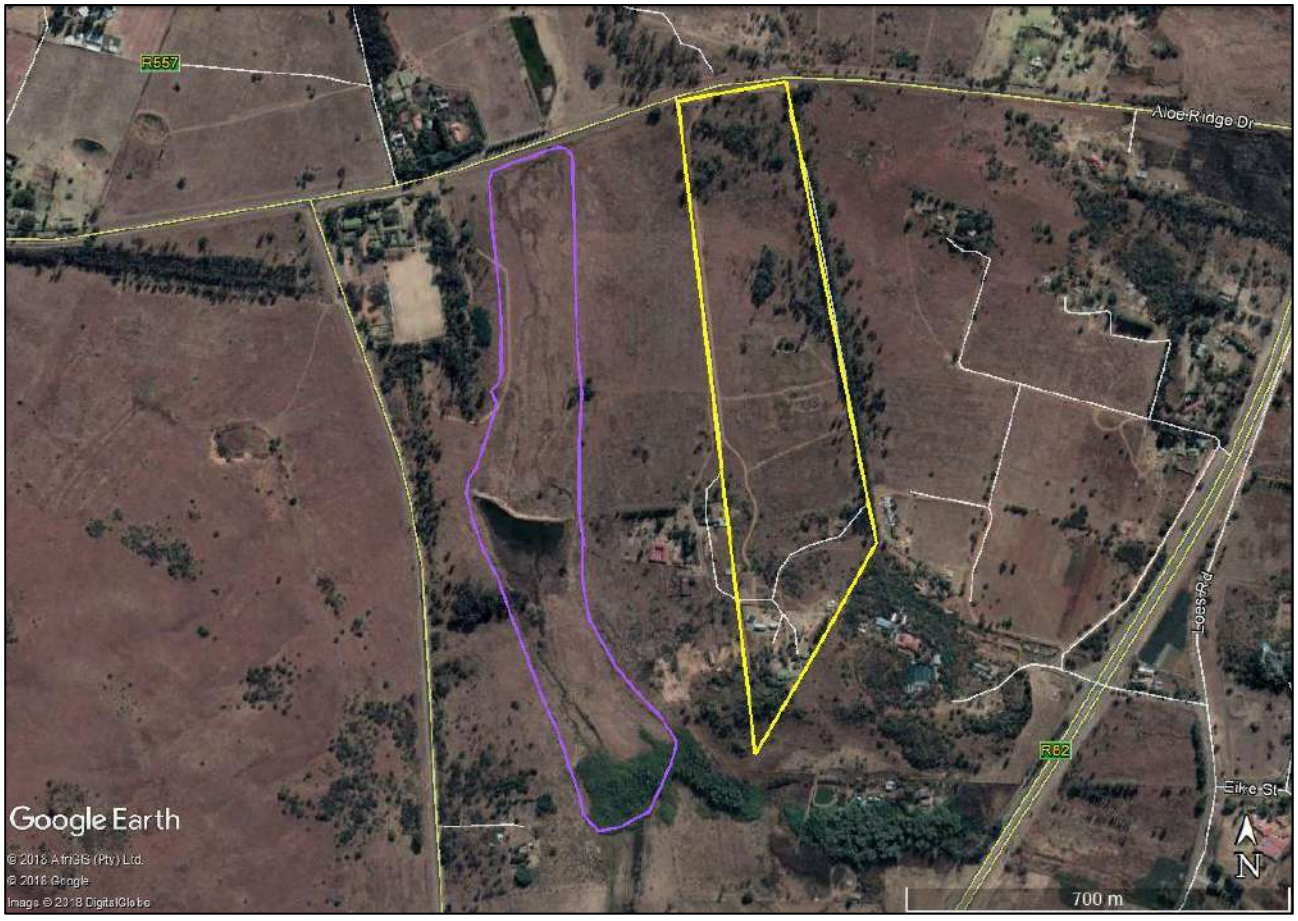

Figure 5.8 Delineation of Wetland 2.

5.2.2 Ecosystem services

Ecosystem services were assessed for Wetland 2. The overall scores (average of effectiveness and opportunity scores) for the goods and services provided by the wetland are illustrated below, including threats and opportunities (Table 5.7). The rating of the extent to which a benefit is being supplied for each ecosystem service is also listed. The overall scores are shown in a radar diagram in Figure 4.7. From the site visit it was evident that the wetlands are not currently providing many significant ecosystem services. All ecosystem services were rated as intermediate with cultural significance and education and research rated as low and moderately low respectively. No ecosystem services were rated as high.

These scores were based on factors such as:

- Extent of vegetation cover in the wetland;
- Lack of erosion;
- Lack of extensive soil disturbance within the wetland;
- Runoff intensity from the wetland's catchment;
- Presence of a dam within the wetland; and
- Location of the wetland within a small scale farming area.

Table 5.4 Ecosystem Services provided by the Wetland.

	Wetland 2	
Ecosystem service	**Overall score**	**Extent to which benefit is being supplied (as per Table 4.2)**
Flood attenuation	1.6	Intermediate
Streamflow regulation	1.3	Intermediate
Sediment trapping	1.4	Intermediate
Phosphate trapping	1.9	Intermediate
Nitrate removal	2.1	Intermediate
Toxicant removal	1.7	Intermediate
Erosion control	1.8	Intermediate
Carbon storage	2.0	Intermediate
Maintenance of biodiversity	2.0	Intermediate
Water supply for human use	1.4	Intermediate
Natural resources	1.8	Intermediate
Cultivated foods	1.4	Intermediate
Cultural significance	0.8	Low
Tourism and recreation	1.6	Intermediate
Education and research	1.0	Moderately low
TOTAL	23.7	
Average score	**1.6**	**Intermediate**
Threats	1.0	
Opportunities	0.0	

Threats to the ecosystem services provided by the wetlands are relatively low and relate to transformation of land within the wetlands catchment.

Opportunities to enhance the supply of ecosystems services by the wetlands relate to better control/ monitoring of land uses within the wetlands catchment.

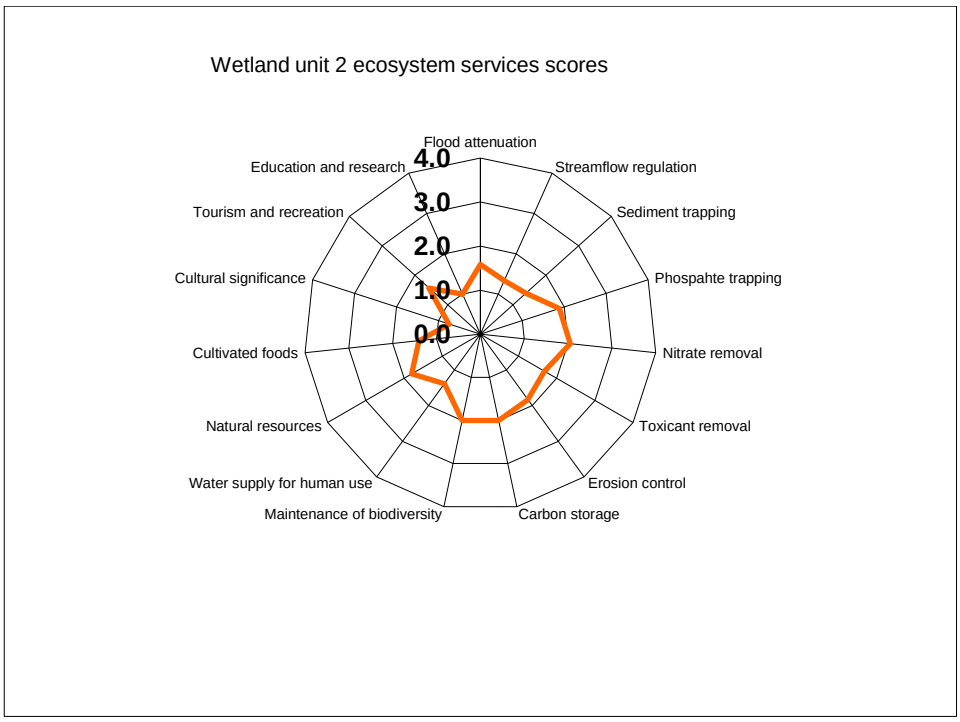

Figure 5.9 Radar diagram for Wetland 2

5.2.3 Present Ecological State

The wetland is in a modified condition. Current impacts on the wetland include the long lasting effects of the development of a dam within the wetland, surrounding cultivated lands, invasion by alien invasive plant species and a small vehicle track through the wetland.

Hydrology

The hydrological health was assessed as "E", ie. largely modified with a large change in ecosystem processes. It is expected that the hydrological health will remain stable for the next 5 years.

	Hydrology	
	Impact score	**Change score**
	Wetland 2	**Wetland 2**
Overall weighted impact score	**6.0**	**0.0**
Present state category	**E**	→

Geomorphology

The geomorphological health was assessed as "C", i.e. moderately modified. There is moderate change in geomorphology present within the wetland. It is expected that the hydrological health will remain stable over the next 5 years.

	Geomorphology	
	Impact score	**Change score**
	Wetland 2	**Wetland 2**
Overall weighted impact score	**2.8**	**0.0**
Present state category	**C**	→

Vegetation

The vegetation health was assessed as "C", i.e. moderately modified. Impacts on the vegetation relate to the presence of alien invasive plant species within the wetland and land uses within and surrounding the wetland which have somewhat altered the natural state of the wetland. It is expected that the vegetation condition will remain stable over the next 5 years, however, vegetation extent and composition is dependent on climatic conditions.

	Vegetation	
	Impact score	**Change score**
	Wetland 2	**Wetland 2**
Overall weighted impact score	**3.7**	**-1.0**
Present state category	**C**	↓

Overall PES

For the overall present ecological state, the following equation was used:

Health = ((Hydrology score) x3 + (Geomorphology score) x2 + (Vegetation score) x2)) ÷ 7.

This resulted in a score of 4.42 or a PES of D, reflecting the largely modified state of the wetland. This is mostly due to the impact on the hydrology of the wetland by construction of a dam within it.

	HYDROLOGY		**GEOMORPHOLOGY**		**VEGETATION**		**OVERALL PES**		**OVERALL TRAJECTORY OF CHANGE**	
WETLAND 2	**0**	**A**	**0**	**A**	**0.6**	**A**	**0.17**	**A**	**0**	→

5.2.4 Riparian Delineation

Figure 5.8 below indicates the delineated riparian area of the non-perennial river running through the site. The non-perennial river runs from the south east to the north west portion of the site and is relatively small and flat. This non-perennial river has been affected by the construction of a small dam wall. The flow path of the non-perennial river is affected by the small earth dam wall, which has a small spillway, this is where the non-perennial river continues through the site and into the adjacent property and ultimately into Wetland 2. The non-perennial river and small earth dam were noticeably dry during the site visit. Consultation with the current landowner confirmed that the non-perennial river does not flow.

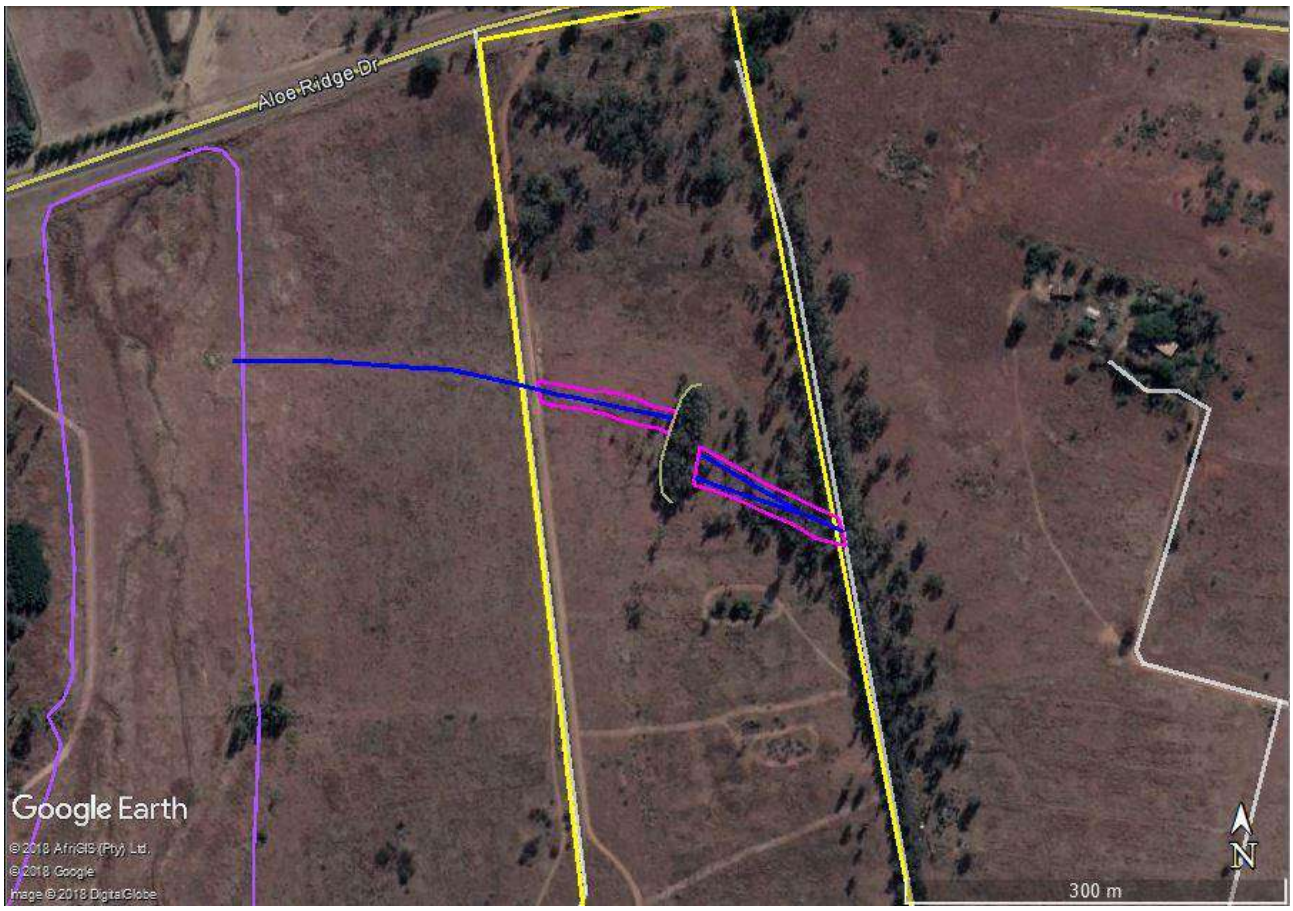

Figure 5.10 Riparian delineation of the non-perennial river (blue line – non-perennial river path; pink line – riparian delineation).

5.2.5 Riparian and wetland vegetation

According to Mucina and Rutherford the following species are likely to occur within the Gauteng Shale Mountain Bushveld with the study site

Acacia caffra, Acacia karroo, Cussonia spicata, Combretum Molle, Englerophytum magalismontanum Rhus leptodictya, Ehretia rigida, Maytenus Heterphylla, Euclea crispa, Zanthoxylum capense, Dombeya rotundifolia, Protea caffra, Celtis Africana, Ziziphus mucronata, Vangueria infausta, Canthium gilfillanii, Chrysantehmoides monilifera, Dichrostachys cinerea, Diospyros austro-africana, Dyospyros lycoids, Grewia occidentalis, Gymnosporia polyacantha, olea europea, Tephrosia capensis, Terphrosia longipes, Acalypha angustata, Asparagus suaveolens, Athrixia elata, Feliceia muricata, Indigofera comosa, Rhus magalismontana, Elephantorrhiza elephantine, Kalanchoe rotundifolia, Ancylobotrys capensis, Hyparrhenia dregeana, Cymbopogon caesius, Digitaria eriantha, Eragrostis curvula, Dicoma zeyheri, Helichrysum nudifolium, Helichrysum rugulosum, Hermannia lancifolia, Hibiscus pusillus, Selaginella dregei, enecio venosus, Vernonia natalensis, Vernonia oligocephala, Cheilanthes hirta, Pellaea calomelanos and Scadoxus puniceus.

There were a number of alien invasive plant species observed on site including:

- *Eucalyptus species;*
- *Salix babylonica* (Weeping willow); and
- *Campuloclinium macrocephalum* (pom pom weed)

Indigenous plant species observed on site include:

- *Asparagus laricinus;* and
- *Themeda triandra*

5.2.6 Observations

The following site observations were made with regards to existing threats/impacts on the non-perennial river running through the study site:

- Historical imagery shows that the non-perennial river has been artificially modified (straightened and channelled).
- The potential flow of the non-perennial river has been altered by small earth dam.
- The path of the non-perennial river appears to have separated into two separate flow paths before entering the small earth dam.
- There are numerous Eucalyptus trees growing within the small earth dam and surrounding area.
- The non-perennial river and surrounding study site were severely dry on the day of the site audit.
- Historical imagery also shows the non-perennial river to have been affected by occasional fires.

The following site observations were made with regards to existing threats/impacts on Wetland 2 which occurs adjacent to and east of the study site:

- The wetland has been modified by the placement of an earth dam in the centre of the wetland.
- There is a small vehicle track running through and adjacent to the wetland.
- Historical imagery show that surrounding areas have been transformed over the years with cultivated lands very close to and within the wetland in some areas.
- There is a culvert placed at the northern boundary of the wetland for the road, Aloe Ridge Drive which borders the wetland.
- Historical imagery shows the wetland to have been affected by occasional fires.

Below is a photo sequence of the riparian and wetland environment within and surrounding the study site:

South eastern upstream view of the non-perennial river running through the study site.
Co-ordinates: 26°22’46.15”S; 27°57’53.01”E

South eastern view of Eucalyptus trees growing within and surrounding the non-perennial river.
Co-ordinates: 26°22'47.35"S; 27°57'55.23"E

South eastern upstream view of the non-perennial river and small earth dam wall.
Co-ordinates: 26°22'46.72"S; 27°57'55.82"E

South eastern upstream view of small spillway type feature along the earth dam wall.
Co-ordinates: 26°22'46.71"S; 27°57'55.82"E

South eastern upstream view of non-perennial river showing the small and flat and relatively unnoticeable nature of the river.
Co-ordinates: 26°22'48.83"S; 27°57'59.00"E

North western view of the small earth dam wall.
Co-ordinates: 26°22'49.31"S; 27°57'57.95"E

Southern view of Wetland 2 taken from the culvert on Aloe Ridge Road.
Co-ordinates: 26°22'39.82"S; 27°57'42.53"E

North eastern view of the culvert at the bottom northern boundary of Wetland 2.
Co-ordinates: 26°22'40.11"S; 27°57'42.47"E

North eastern view of the artifical dam within Wetland 2.
Co-ordinates: 26°23'4.57"S; 27°57'34.34"E

North eastern view of *Salix babylonica* growing within wetland 2.
Co-ordinates: 26°23'8.80"S; 27°57'34.70"E

6 SITE SENSITIVITY

In terms of Appendix 6 of the 2014 NEMA EIA Regulations (2014) (as amended) a specialist report must contain-

(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 alternatives;
(g) An identification of any areas to be avoided, including buffers;
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

A sensitivity map (Figure 6.1 below) was developed based on desktop and site information gathered, and was classified into areas of high, moderate and low sensitivity.

High Sensitivity

- All natural delineated wetlands, delineated riparian zones of rivers and tributaries of the rivers affected by the activity.

All activities within high sensitivity areas must be closely monitored by a qualified ECO to ensure that all proposed mitigation measures are implemented to manage and minimize potential impacts on the watercourse.

Moderate Sensitivity

- All artificial wetlands;
- Areas within 50m of natural wetlands;
- Areas within 32m of artificial wetlands; and
- Areas within 32m of rivers of the delineated riparian zones.

Moderate sensitivity areas act as buffers for the high sensitivity areas. Activities that may have an indirect impact on high sensitivity areas are not to occur within these buffer areas. Such activities would include:

- Stockpiling of topsoil, subsoil, etc;
- Temporary ablution facilities;
- Site camp establishment;
- Temporary laydown areas for equipment/materials;
- Overnight parking of heavy machinery/vehicles;
- Concrete batching; and
- Storage of chemicals/hazardous substances.

Low Sensitivity

- 500 m buffer placed around wetlands (regulated by DWS).

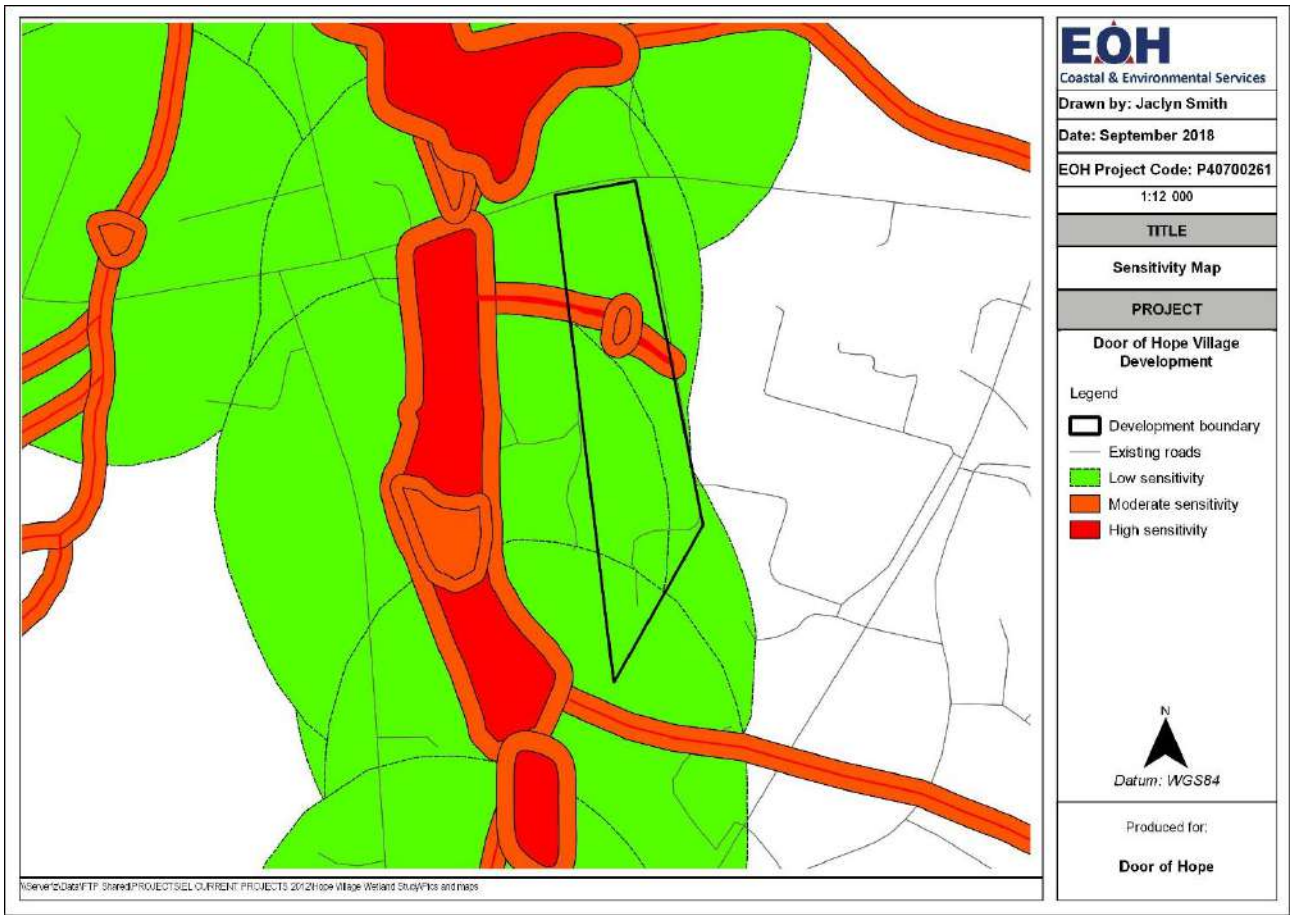

Figure 6.1 Sensitivity map of the study area.

7 MANNER IN WHICH THE ENVIRONMENT MAY BE AFFECTED

In terms of Appendix 6 of the 2014 NEMA EIA Regulations (2014) (as amended) a specialist report must contain-

(cB) A description of the existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;
(k) Any mitigation measures for inclusion in the EMPr;

Impacts that could be a direct or indirect result of the proposed activity were identified for the Planning and Design, Construction and Operation Phase. These included the consideration of direct, indirect and cumulative impacts that may occur, and also considers the no-go or existing impacts.

Table 7.1 below provides a mind map of all issues identified during the assessment of all phases of the proposed development.

Table 7.1 Mind Map of Issues identified during all phased of the proposed development.

THEMES	CATEGORIES/ISSUES	PLANNING AND DESIGN PHASE	CONSTRUCTION PHASE	OPERATION PHASE
Legislation environment	Legal and policy compliance	**X**	**X**	**X**
Wetland and aquatic environment	Scheduling of construction	**X**		
	Stormwater management	**X**	**X**	**X**
	Invasion of alien species	**X**	**X**	**X**
	Water quality		**X**	**X**
	Material stockpiling		**X**	
	Riparian vegetation and habitat		**X**	
	Maintenance			**X**

Impacts and issues that were identified during the Planning and Design, Construction and Operational Phases of the proposed development and are described in Table 7.2.

Table 7.2 Potential issues identified that could result from the proposed development.

THEME	APPLICABILITY TO EACH PHASE		
	PLANNING AND DESIGN	CONSTRUCTION	OPERATION
Legal and policy compliance	YES Non-compliance with the laws and policies of South Africa as they pertain to the aquatic environment.	YES Non-compliance with the laws and policies of South Africa as they pertain to the aquatic environment.	YES Non-compliance with the laws and policies of South Africa as they pertain to the aquatic environment.
Scheduling of construction	YES Inappropriate construction scheduling	N/A	N/A
Stormwater management	YES Inappropriate design of stormwater structures.	YES Inappropriate routing of stormwater runoff.	YES Inadequate/ineffective stormwater infrastructure.

THEME	APPLICABILITY TO EACH PHASE		
	PLANNING AND DESIGN	**CONSTRUCTION**	**OPERATION**
Invasion of alien species	YES Failure to plan for the removal and management of alien vegetation.	YES Failure to monitor alien vegetation during construction.	YES Failure to monitor effectiveness of rehabilitation and alien vegetation removal plan.
Water Quality	N/A	YES Accidental contamination of wet concrete. Accidental chemical or other spills in the vicinity of watercourses/ water bodies.	YES Accidental sewage spills or leaking from sewerage infrastructure that may impact ground and surface water.
Material stockpiling	N/A	YES Stockpiling of construction material within 50 m of a watercourse can lead to erosion and sedimentation and pollution of the watercourse.	N/A
Riparian vegetation and habitat	N/A	YES Indiscriminate removal of riparian vegetation resulting in erosion and sedimentation.	N/A
Maintenance	N/A	N/A	YES Inadequate maintenance of infrastructure can lead to sewage and water leaks.

Table 7.2 provides the impacts and rating scales according to the various phases of the proposed activity.

Table 7.3: Impacts and mitigation measures for the Planning and Design, Construction and Operation Phases.

PLANNING AND DESIGN PHASE									
ISSUE/RISK	**DESCRIPTION OF IMPACT**	**NATURE OF IMPACT**	**SPATIAL SCALE (EXTENT)**	**TEMPORAL SCALE (DURATION)**	**CERTAINTY SCALE (LIKELIHOOD)**	**SEVERITY/ BENEFICIAL SCALE**	**SIGNIFICANCE PRE-MITIGATION**	**MITIGATION MEASURES**	**SIGNIFICANCE POST-MITIGATION**
Legislative Environment									
Legal and policy compliance	During the planning and design phase non-compliance with the legal requirements and policies of South Africa as they pertain to the aquatic environment could lead to damage to the aquatic environment, unnecessary delays in construction activities, and potentially criminal cases, based on the severity of the non-compliance, being brought against the proponent and his/her contractors.	**DIRECT**	**Study area**	**Short term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• All legal matters pertaining to permitting must be completed prior to any construction activity. • In particular, all necessary Water Use Licences must be in order for any of the following activities: ➢ Construction activities within the 1:100 year floodline, (or within 100 m of a watercourse) and within 500 m of a wetland or where infrastructure will traverse rivers or drainage lines (if applicable). ➢ Abstraction permit should boreholes be used for water supply for the development.	**LOW NEGATIVE**
Wetland and aquatic environment									
Scheduling of construction	During the planning and design phase inappropriate construction scheduling that does not take into account the seasonal requirements of the aquatic environment, e.g. allowing for unimpeded flood events, could lead to short-term (and potentially long-term) impacts on the aquatic environment such as excessive sediment mobilization, etc.	**INDIRECT**	**Study area**	**Medium term**	**Possible**	**Moderately severe**	**MODERATE NEGATIVE**	• Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc. • When not possible, suitable stream diversion structures must be used to ensure the river is not negatively impacted by construction activity.	**LOW NEGATIVE**

Stormwater management	During the planning and design phase the inappropriate design of stormwater structures and associated infrastructure may result in increased levels of erosion, sedimentation and pollution of the watercourses.	**DIRECT**	**Study area**	**Medium-term**	**Possible**	**Moderately severe**	**MODERATE NEGATIVE**	• During the planning and design phase appropriate stormwater structures must be designed to minimise erosion and sedimentation of watercourses, eg. cut-off drains. • Pervious surfaces should be used for the parking lot, roads and footpaths where possible to promote infiltration and reduce concentrated runoff.	**LOW NEGATIVE**
Invasion of alien species	During the planning and design phase, failure to plan for the removal and management of alien vegetation could result in the invasion of alien vegetation in riparian and wetland areas during the construction and operation phase. This would have an adverse impact on the aquatic ecosystem.	**INDIRECT**	**Study area**	**Long-term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• During the planning and design phase a Rehabilitation and Alien Vegetation Management Plan must be designed to reduce the establishment and spread of undesirable alien plant species.	**LOW NEGATIVE**

CONSTRUCTION PHASE									
ISSUE/RISK	**IMPACT**	**NATURE OF IMPACT**	**SPATIAL SCALE (EXTENT)**	**TEMPORAL SCALE (DURATION)**	**CERTAINTY SCALE (LIKELIHOOD)**	**SEVERITY/ BENEFICIAL SCALE**	**SIGNIFICANCE PRE-MITIGATION**	**MITIGATION MEASURES**	**SIGNIFICANCE POST-MITIGATION**
Legislative Environment									
Legal and policy compliance	During the construction phase non-compliance with the legal requirements and policies of South Africa as they pertain to the aquatic environment could lead to damage to the aquatic environment, unnecessary delays in construction activities, and potentially criminal cases, based on the severity of the non-compliance, being brought against the proponent and his/her contractors.	**DIRECT**	**Study area**	**Short term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• All construction related conditions in the Environmental Authorisation must be adhered to. • All conditions in the Water Use Licence must be adhered to especially relating to water monitoring etc (if required). • All conditions in any other permits must be adhered to.	**LOW NEGATIVE**
Wetland and Aquatic Environment									
Stormwater Management	During the construction phase the inappropriate routing of stormwater runoff will lead to stream sedimentation, adversely affecting the aquatic environment.	**DIRECT**	**Study area**	**Long-term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• During the construction phase stormwater must be managed effectively to minimize the ingress of sediment-laden stormwater into the non-perennial river and/or into Wetland 2.	**LOW NEGATIVE**

Invasion of alien species	During the construction phase, the removal of existing vegetation creates 'open' habitats that will inevitably be colonised by pioneer plant species. While this is part of a natural process of regeneration, which would ultimately lead to the re-establishment of a secondary vegetation cover, it also favours the establishment of undesirable species in the area. These species colonise areas of disturbance and once established, they are typically very difficult to eradicate and can pose a threat to the ecosystem. Failure to monitor alien vegetation during construction could lead to infestations.	**INDIRECT**	**Study area**	**Long-term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• Vehicles and machinery must park and operate within suitably designated areas to prevent unnecessary disturbance of the larger environment. • Vehicle and machinery use should also be limited within the moderate and high sensitivity areas. • Implement an Alien Management Plan during the construction phase. • Eradicate alien plants from the impacted area as they appear; and • Monitor the project area for any new growth of invasive plants until completion of construction. • Short-term monitoring for a period of 12 months after construction has been completed should be conducted.	**LOW NEGATIVE**
Water quality	During the construction phase, accidental contamination of wet concrete (highly alkaline) in the watercourses could result in flash kills of macro-invertebrates and fish species in the vicinity (see appendix B).	**DIRECT INDIRECT CUMULATIVE**	**Study area**	**Short-term**	**Possible**	**Severe**	**HIGH NEGATIVE**	• During the construction phase no concrete mixing must take place within 50 m of any river bank, drainage line or wetland. • All concrete mixing must occur on impermeable surfaces. • A serviced fire extinguisher (to neutralise pH levels if a spill occurs) must be available on site in the event that wet concrete is accidentally spilled into a river. • The mitigation measures in Appendix B must be	**LOW NEGATIVE**

								used in conjunction with this report.	
	During the construction phase, accidental chemical spills or other spills (sewage, etc.) in the vicinity of the rivers and wetlands will result in water pollution, adversely affecting the aquatic ecosystem.	**DIRECT CUMULATIVE**	**Study area, downstream of watercourses**	**Short-term**	**Possible**	**Severe**	**HIGH NEGATIVE**	• During the construction phase no machinery should be parked overnight within the moderate and high sensitivity areas as indicated in Figure 6.1 in Section 6 of this report. • All stationary machinery must be equipped with a drip tray to retain any oil leaks. • Chemicals used for construction must be stored safely on bunded surfaces in the construction site camp and not within the moderate or high sensitivity areas as shown in Figure 6.1 in Section 6 of this report. • Emergency plans must be in place in case of spillages. • No ablution facilities should be located within moderate or high sensitivity areas as shown in Figure 6.1 of Section 6 of this report. • Chemical toilets must be regularly maintained/ serviced to prevent ground or surface water pollution.	**LOW NEGATIVE**

Material Stockpiling	During the construction phase, stockpiling of construction materials within 50 m of a watercourse could result in erosion and mobilisation of the materials into the nearby watercourse, resulting in sedimentation and a decrease in water quality and aquatic habitat.	**DIRECT INDIRECT CUMULATIVE**	**Study area, downstream of water courses**	**Medium-term**	**Possible**	**Moderately negative**	**MODERATE NEGATIVE**	• During the construction phase no construction material must be stored within the moderate or high sensitivity areas in Figure 6.1 of Section 6 of this report. • Stockpiles should not be placed within the moderate or high sensitivity areas in Figure 6.1 of Section 6 of this report. • Stockpiles must be monitored for erosion and mobilisation of materials towards watercourses. If this is noted by an ECO, suitable cut-off drains or berms must be placed between the stockpile area and the nearest watercourse. • Stockpiles should not exceed 1.5 m in height. • Stockpiles should be covered during periods of gale force winds.	**LOW NEGATIVE**
Riparian vegetation and habitat	During the construction phase inappropriate activities/ encroachment into the non-perennial river on site and other watercourses could affect the integrity of the watercourses and cause erosion of these areas.	**DIRECT INDIRECT**	**Study area**	**Medium-term**	**Possible**	**Moderately sever**	**MODERATE NEGATIVE**	• Vegetation clearing limited to construction footprint only. • A Rehabilitation and Alien Vegetation Management Plan must be developed and implemented. • Removal of the alien invasive vegetation should be prioritised. • Vehicles and machinery must park and operate within suitably designated areas to prevent unnecessary disturbance of the larger environment.	**LOW NEGATIVE**

OPERATION PHASE									
ISSUE/RISK	**IMPACT**	**NATURE OF IMPACT**	**SPATIAL SCALE (EXTENT)**	**TEMPORAL SCALE (DURATION)**	**CERTAINTY SCALE (LIKELIHOOD)**	**SEVERITY/ BENEFICIAL SCALE**	**SIGNIFICANCE PRE-MITIGATION**	**MITIGATION MEASURES**	**SIGNIFICANCE POST-MITIGATION**
Legislative Environment									
Legal and policy compliance	During the operation phase non-compliance with the legal requirements and policies of South Africa as they pertain to the aquatic environment could lead to damage to the aquatic environment and potentially criminal cases, based on the severity of the non-compliance, being brought against the proponent and his/her contractors.	**DIRECT**	**Study area**	**Short term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• All construction related conditions in the Environmental Authorisation must be adhered to. • All conditions in the Water Use Licence must be adhered to especially relating to water monitoring etc (if required). • All condition stipulated in any other additional permits must be adhered to.	**LOW NEGATIVE**
Wetland and Aquatic Environment									

Stormwater Management	During the operational phase stormwater infrastructure might not be adequate or effective and may result in soil erosion and sedimentation of watercourses.	**DIRECT**	**Study area**	**Long-term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• During the operational phase, stormwater management measures such as attenuation structures, channels, etc. must be properly maintained and monitored. • If the stormwater management measures put in place are deemed insufficient, a qualified engineer must be approached to assist with additional storm water attenuation mechanisms and remediation.	**LOW NEGATIVE**
Invasion of alien species	During the operational phase failure to implement an effective rehabilitation and alien vegetation removal plan post-construction could result in alien plant invasion within non-perennial river and Wetland 2.	**INDIRECT CUMULATIVE**	**Study area**	**Medium-term**	**Possible**	**Moderately severe**	**MODERATE NEGATIVE**	• An alien vegetation removal and rehabilitation plan must be implemented post-construction. • The effectiveness of this plan should be monitored on a biannually for the first year following construction or until such time as the ECO deems the rehabilitation sufficient. • Alien plants must be removed from aquatic environments through appropriate methods such as hand pulling, cutting etc. This must be done under the supervision of the ECO.	**LOW NEGATIVE**
Water quality	During the operational phase accidental spillages or leachate from the sewerage infrastructure could result in ground and surface water pollution.	**DIRECT INDIRECT CUMULATIVE**	**Study area**	**Long-term**	**Possible**	**Severe**	**HIGH NEGATIVE**	• During the operation phase the sewerage infrastructure must be properly maintained and must be monitored on a regular basis to ensure that the systems are functioning correctly.	**LOW NEGATIVE**

Maintenance	During the operational phase inadequate maintenance of sewerage and water infrastructure could lead to spillages or leaks which may also result in erosion of the surrounding area	**DIRECT CUMULATIVE**	**Study area**	**Long-term**	**Possible**	**Moderately severe**	**MODERATE NEGATIVE**	• During the operation phase all infrastructure must be maintained and monitored on a regular basis to check for leaks and any failures in the systems.	**LOW NEGATIVE**

Table 7.4: Impacts and mitigation measures for the No-Go alternative.

ISSUE	IMPACT	NATURE OF IMPACT	SPATIAL SCALE (EXTENT)	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Status quo – no housing development on the proposed study site	Should the project not proceed then the current land use will remain the same. In this instance, the likelihood of potential disturbance and contamination of surface and ground water is reduced and the PES of the adjacent wetland, Wetland 2 is likely to remain the stable over the next 5 years.	**INDIRECT CUMULATIVE**	**Study area**	**Long-term**	**Possible**	**SLIGHTLY BENEFICIAL**	**FEW BENEFITS**	N/A	**FEW BENEFITS**

8 ASSESSMENT OF CUMULATIVE IMPACTS

In terms of Environmental Impact Assessment, Cumulative Impact is defined as:

"means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities".

The major cumulative impact that the construction of the Door of Hope Village Development may bring about is the likely increase and attraction of similar developments in the area. The increase in similar developments around this area may result in a potential increase in more significant impacts on the surrounding aquatic environment. Potential impacts would include increased land clearing, resulting in increased sedimentation and erosion and increased water pollution from run off from hardened surfaces. In order to reduce this potential cumulative impact extra emphasis needs to be placed on ensuring that any contaminants associated with the construction and operational phases of the Door of Hope Village Development do not wash into the non-perennial river and adjacent wetland and adversely affect downstream aquatic ecosystems and water users.

9 IMPACT STATEMENT, CONCLUSION & RECOMMENDATIONS

In terms of Appendix 6 of 2014 NEMA EIA Regulations (2014) (as amended) a specialist report must contain-

(I) Any conditions for inclusion in the environmental authorisation;
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation;
(n) A reasoned opinion as to-
(i) whether the proposed activity, activities or portions thereof should be authorised; and
(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;

(q) Any other information requested by the competent authority.

9.1 Conclusions

Door of Hope Children's Mission are proposing to construct a village development on the remaining extent of portion 19 of the farm Harzenbergfontein 332 IQ, approximately 25,55 ha in extent in the Midvaal Local Municipality, Gauteng Province.

EOH CES was appointed by Door of Hope Children's Mission to complete an Aquatic and Wetland Impact Assessment. This report provides input into the Environmental Impact Assessment and Water Use Licencing Process.

The non-perennial river on site is considered to be of moderate ecological importance and the adjacent wetland is considered to be largely modified however, adverse impacts on site and to the non-perennial river could negatively impact the downstream river and wetland systems. The potential for these adverse impacts can be reduced by limiting the construction activities associated with the development to areas outside of the indicated MODERATE sensitivity area unless absolutely necessary and under the guidance of a qualified ECO.

The HIGH pre-mitigation impacts relate to water quality during the construction and operation phases. These HIGH pre-mitigation impacts can be mitigated to a LOW post-mitigation impact by application of the proposed mitigation measures.

Table 8.1: Assessment of pre- and post-mitigation impact significance.

	PRE-MITIGATION				POST-MITIGATION			
	LOW -	MOD -	HIGH -	VERY HIGH -	LOW -	MOD -	HIGH -	VERY HIGH -
Planning and Design	0	4	0	0	4	0	0	0
Construction	0	4	2	0	6	0	0	0
Operation	0	3	1	0	4	0	0	0
TOTAL	0	11	3	0	14	0	0	0

9.2 Water Use Licence

A Water Use Licence Application (WULA) is required for any construction activity within the extent of a watercourse (i.e. riparian and instream habitat or within 100 m of the watercourse) or the 1:100 year floodline; or within 500 m of a wetland in terms of the following triggers from the National Water Act (No. 36 of 1998):

- Sec 21 (c) - impeding or diverting the flow of water in a watercourse; and
- Sec 21 (i) - altering the bed, banks, course or characteristics of a watercourse.

It is recommended that a WULA is applied for all infrastructure affecting the riparian vegetation and within 500m of a wetland.

9.3 Recommendations for the proposed activity

All the mitigation measures provided below are to be implemented in the Planning and Design, Construction and Operation Phases of the proposed activity.

9.3.1 Planning and Design

- All legal matters pertaining to permitting must be completed prior to any construction activity.
- In particular, all necessary Water Use Licences must be in order for any of the following activities:
  - Construction activities within the 1:100 year floodline, (or within 100 m of a watercourse) and within 500 m of a wetland or where infrastructure will traverse rivers or drainage lines (if applicable).
  - Abstraction permit should boreholes be used for water supply for the development
- Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc.
- When not possible, suitable stream diversion structures must be used to ensure the river is not negatively impacted by construction activity.
- During the planning and design phase appropriate stormwater structures must be designed to minimise erosion and sedimentation of watercourses, eg. cut-off drains.
- Pervious surfaces should be used for the parking lot, roads and footpaths where possible to promote infiltration and reduce concentrated runoff.
- During the planning and design phase a Rehabilitation and Alien Vegetation Management Plan must be designed to reduce the establishment and spread of undesirable alien plant species.

9.3.2 Construction

- All construction related conditions in the Environmental Authorisation must be adhered to.
- All conditions in the Water Use Licence must be adhered to especially relating to water monitoring etc (if required).
- All conditions in any other permits must be adhered to.
- During the construction phase stormwater must be managed effectively to minimize the ingress of sediment-laden stormwater into the non-perennial river and/or into Wetland 2.
- Vehicles and machinery must park and operate within suitably designated areas to prevent unnecessary disturbance of the larger environment.
- Vehicle and machinery use should also be limited within the moderate and high sensitivity areas.
- Implement an Alien Management Plan during the construction phase.
- Eradicate alien plants from the impacted area as they appear; and
- Monitor the project area for any new growth of invasive plants until completion of construction.
- Short-term monitoring for a period of 12 months after construction has been completed should be conducted.
- During the construction phase no concrete mixing must take place within 50 m of any river bank, drainage line or wetland.
- All concrete mixing must occur on impermeable surfaces.

- A serviced fire extinguisher (to neutralise pH levels if a spill occurs) must be available on site in the event that wet concrete is accidentally spilled into a river.
- The mitigation measures in Appendix B must be used in conjunction with this report.
- During the construction phase no machinery should be parked overnight within the moderate and high sensitivity areas as indicated in Figure 6.1 in Section 6 of this report.
- All stationary machinery must be equipped with a drip tray to retain any oil leaks.
- Chemicals used for construction must be stored safely on bunded surfaces in the construction site camp and not within the moderate or high sensitivity areas as shown in Figure 6.1 in Section 6 of this report.
- Emergency plans must be in place in case of spillages.
- No ablution facilities should be located within moderate or high sensitivity areas as shown in Figure 6.1 of Section 6 of this report.
- Chemical toilets must be regularly maintained/ serviced to prevent ground or surface water pollution.
- During the construction phase no construction material must be stored within the moderate or high sensitivity areas in Figure 6.1 of Section 6 of this report.
- Stockpiles should not be placed within the moderate or high sensitivity areas in Figure 6.1 of Section 6 of this report.
- Stockpiles must be monitored for erosion and mobilisation of materials towards watercourses. If this is noted by an ECO, suitable cut-off drains or berms must be placed between the stockpile area and the nearest watercourse.
- Stockpiles should not exceed 1.5 m in height.
- Stockpiles should be covered during periods of gale force winds.
- Vegetation clearing limited to construction footprint only.
- A Rehabilitation and Alien Vegetation Management Plan must be developed and implemented.
- Removal of the alien invasive vegetation should be prioritised.
- Vehicles and machinery must park and operate within suitably designated areas to prevent unnecessary disturbance of the larger environment.

9.3.3 Operation

- All construction related conditions in the Environmental Authorisation must be adhered to.
- All conditions in the Water Use Licence must be adhered to especially relating to water monitoring etc (if required).
- All condition stipulated in any other additional permits must be adhered to.
- During the operational phase, stormwater management measures such as attenuation structures, channels, etc. must be properly maintained and monitored.
- If the stormwater management measures put in place are deemed insufficient, a qualified engineer must be approached to assist with additional storm water attenuation mechanisms and remediation.
- An alien vegetation removal and rehabilitation plan must be implemented post-construction.
- The effectiveness of this plan should be monitored on a biannually for the first year following construction or until such time as the ECO deems the rehabilitation sufficient.
- Alien plants must be removed from aquatic environments through appropriate methods such as hand pulling, cutting etc. This must be done under the supervision of the ECO.
- During the operation phase the sewerage infrastructure must be properly maintained and must be monitored on a regular basis to ensure that the systems are functioning correctly.
- During the operation phase all infrastructure must be maintained and monitored on a regular basis to check for leaks and any failures in the systems.

9.4 Suggested General Rehabilitation Measures

A Rehabilitation Plan has been recommended for inclusion into the Environmental Management Programme. This plan should include (at minimum) measures for control of erosion, revegetation and alien vegetation management.

9.4.1 Control of Erosion

- The time from commencement of rehabilitation activities to finalization thereof should be limited. Rehabilitation efforts should commence as soon as practical;
- Avoid over-wetting, saturation and unnecessary run-off during dust control activities and irrigation;
- Retain natural indigenous grass and shrubs and re-vegetate bare areas as soon as possible.
- Reprofile the banks of disturbed non-perennial river areas to a maximum gradient of 1:3 to ensure bank stability;
- Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles.
- Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion.

9.4.2 Alien Vegetation Management

- Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented;
- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish; and
- Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds.

9.5 Environmental statement and Opinion of the Specialist

The aquatic impacts of all aspects for the proposed development were assessed and considered to be acceptable, provided that the mitigation measures provided in this report are implemented. All impacts are rated as MODERATE to HIGH pre-mitigation, therefore implementation of recommended mitigation measures coupled with comprehensive rehabilitation and monitoring in terms of re-vegetation and restoration is an important element of the mitigation strategy. Implementing the recommended mitigations measures will reduce impacts to LOW.

It is recommended that the proposed Door of Hope Village Development is authorised provided the all mitigation measures in this report are implemented.

9.6 Fatal Flaws

It is the opinion of the specialist that NO FATAL FLAWS exist with the proposed development.

10 REFERENCES

Department of Water and Sanitation, (2014). A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa.

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Mucina, L. & Rutherford, M.C. (eds) 2006. *The vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria.

National Environmental Management Act (No 107 of 1998) as amended.

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National Spatial Biodiversity Assessment (2004).

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NFEPA Atlas, 2011 – 2014.

SANBI (2009). Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).

SANBI (bgis.sanbi.org).

Technical Report for the National Freshwater Ecosystem Priority Areas project.

The Constitution Act (108 of 1996).

APPENDIX A

Present Ecological State, Ecological Importance and Sensitivity data for the Klip River reach most likely to be affected by the development.

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
C22A-01315	Klip	65.26	1	y		SERIOUS MODIFICATION	E

MEAN EI CLASS	MEAN ES CLASS	DEFAULT ECOLOGICAL CATEGORY (EC)	RECOMMENDED ECOLOGICAL CATEGORY (REC)
MODERATE	MODERATE	C	#NUM!

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	LARGE	FISH SPP/SQ	9.00	INVERT TAXA/SQ	27.00	FISH PHYS-CHEM SENS DESCRIPTION	HIGH
RIP/WETLAND ZONE CONTINUITY MOD	LARGE	FISH: AVERAGE CONFIDENCE	4.78	INVERT AVERAGE CONFIDENCE	2.63	FISH NO-FLOW SENSITIVITY DESCRIPTION	HIGH
POTENTIAL INSTREAM HABITAT MOD ACT.	SERIOUS	FISH REPRESENTIVITY PER SECONDARY: CLASS	HIGH	INVERT REPRESENTIVITY PER SECONDARY, CLASS	MODERATE	INVERT PHYS-CHEM SENS DESCRIPTION	MODERATE
RIPARIAN-WETLAND ZONE MOD	SERIOUS	FISH REPRESENTIVITY PER SECONDARY: CLASS	HIGH	INVERT RARITY PER SECONDARY: CLASS	HIGH	INVERTS VELOCITY SENSITIVITY	VERY HIGH
POTENTIAL FLOW MOD ACT.	SERIOUS	FISH RARITY PER SECONDARY: CLASS	HIGH	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	HIGH	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	HIGH
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	SERIOUS	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	HIGH	HABITAT DIVERSITY CLASS	MODERATE	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	LOW

RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	LOW	**HABITAT SIZE (LENGTH) CLASS**	HIGH	**RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION**	**LOW**
RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING	HIGH	**INSTREAM MIGRATION LINK CLASS**	MODERATE		
		RIPARIAN-WETLAND ZONE MIGRATION LINK	MODERATE		
		RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS	MODERATE		
		INSTREAM HABITAT INTEGRITY CLASS	LOW		

APPENDIX B

Concrete Works – Information and Mitigation

Background

Concrete, cement, mortars, grouts and other Portland cement or lime-containing construction materials are basic or alkaline materials. They are highly toxic to fish and must only be used near water with extreme care.

What are acceptable pH ranges?

A pH level around 7 is typical for most watercourses, and this neutral pH is required for the survival of aquatic organisms. Should the pH rise or drop out of this range, fish and other aquatic organisms will become stressed and may die. Complete isolation of the work area is needed to ensure that pH value in the surrounding waterbody does not rise (become more alkaline) during works. The Ministry of Water, Land, and Air Protection's ***British Columbia Approved Water Quality Criteria for pH sets the range for acceptable pH*** change with respect to fresh water aquatic life between 6.5 and 9.0. However, any increase in pH noted in conjunction with concrete works should be monitored and emergency protection measures implemented in accordance with the best practices below.

Objectives

The objective of this set of best practices is to ensure no concrete materials or leachates enter any watercourses.

Operational or Construction-related Best Practices

To ensure your works meet the requirements of applicable legislation:

Concrete Works

- Use pre-cast concrete structures whenever possible.
- As concrete leachate is alkaline and highly toxic to fish and other aquatic life, ensure that all works involving the use of concrete, cement, mortars, and other Portland cement or lime containing construction materials (concrete) will **not** deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse.
- Concrete materials cast in place must remain inside formed structures.
- Keep a carbon dioxide (CO2) tank with regulator, hose and gas diffuser readily available during concrete work. Use it to release carbon dioxide gas into the affected area to neutralize pH levels should a spill occur. Train workers to use the tank.
- Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment.
- Report immediately any spills of sediments, debris, concrete fines, wash or contact water. Implement emergency mitigation and clean-up measures immediately.
- Completely isolate all concrete work from **any** water within or entering into **any** watercourse or stormwater system.
- Monitor the pH frequently in the watercourse immediately downstream of the isolated worksite until completion of the works. Emergency measures will be implemented if downstream pH has changed **more than 1.0 pH unit**, measured to an accuracy of +/- 0.2 pH units from the background level, or is recorded to be **below 6.0 or above 9.0 pH units**.
- Prevent any water that contacts uncured or partly cured concrete during activities like exposed aggregate wash-off, wet curing, or equipment washing from directly or indirectly entering any watercourse or stormwater system.

- Maintain complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 48 hours if ambient air temperature is above 0°C and for a minimum of 72 hours if ambient air temperature is below 0°C.
- Isolate and hold any water that contacts uncured or partly cured concrete until the pH is **between 6.5 and 8.0 pH units**, and the turbidity is **less than 25 nephelometric turbidity units (NTU)**, measured to an accuracy of +/- 2 NTU.

For further information regarding the safe use of concrete materials, refer to the following websites:

Cement and Concrete: Environmental Considerations
http://www.buildinggreen.com/features/cem/cementconc.html

Carbon Dioxide for Concrete Wash Water Treatment
http://www.praxair.com/Praxair.nsf/d63afe71c771b0d785256519006c5ea1/78b5b272ccfbcd88852565550069e32d?OpenDocument

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

The proposed development of a village estate for abandoned and orphaned children, De Deur, Gauteng.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	CES			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	135%.
Specialist name:	Jaclyn Smith			
Specialist Qualifications:	(BSc) Hons.			
Professional affiliation/registration:				
Physical address:	25 Tooma Street, Berea, East London, 5214			
Postal address:	P O Box 8145, Nahoon, East London,			
Postal code:	5200	Cell:	043-726 7809	
Telephone:	043-7267809	Fax:	086 410 7822	
E-mail:	ceselecoesnet.co.za			

2. DECLARATION BY THE SPECIALIST

I, Jaclyn Smith, declare that –

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

Coastal and Environmental Services (Pty) Ltd. t/a CES

Name of Company:

12th November 2019

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Jadyn Smith, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Coastal and Environmental Services (Pty) Ltd. t/a CES

Name of Company

12th November 2019

Date

Signature of the Commissioner of Oaths

12th November 2019

Date

LYNN SMIT
COMMISSIONER OF OATHS
REFERENCE NUMBER: 9/1/8/2 EAST LONDON
25 TECOMA STREET, BEREA
EAST LONDON, 5214

APPENDIX G2: ECOLOGICAL SPECIALIST STUDY

Ecological Assessment for Door of Hope Children's Mission Village Estate, Gauteng, South Africa.

Prepared by

Leigh-Ann de Wet

(M.Sc., Pri. Sci. Nat)

For

CES
ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

November 2018

Leigh-Ann de Wet
Biodiversity Assessments, Baseline surveys and Impact Assessments and Integrated Biodiversity Management Solutions.

leighann.dewet@gmail.com
083 352 1936

Appointment of Specialist

Leigh-Ann de Wet was commissioned by CES to undertake an Ecological Impact Assessment for the proposed Door of Hope Children's Mission Village Estate, Gauteng, South Africa. Terms of reference were to produce an Impact Assessment Report based on the results of a desktop assessment and associated site visit.

Expertise of the specialist

- M.Sc. in Botany from Rhodes University.
- Registered Professional Natural Scientist with the South African Council for Natural Scientific Professionals (Ecological Science: 400233/12).
- Ecological Consultant since 2009.
- Conducted, or have been involved in over 100 Ecological Impact Assessments, Baseline surveys, Biodiversity Action Plans and Offset Plans.
- Published four scientific papers, two popular articles and have three scientific papers in preparation.
- Presented 7 international conference presentations, and at two Botanical Society meetings.
- Lectured methods for specialist assessment for the Rhodes University short course on EIA.

Independence

Leigh-Ann de Wet has no connection with Door of Hope Children's Mission and is not a subsidiary of any kind of Door of Hope Children's Mission. The remuneration for services by CES in relation to this report and associated studies is unrelated to approval by decision-making authorities responsible for authorization of any Door of Hope Children's Mission activity.

Scope and Purpose of Report

The scope and purpose of the report is described in the section on Terms and Reference within this report.

Executive Summary

The Door of Hope Children's Mission has proposed the development of a village estate including schools, offices and housing along with other associated infrastructure. The development is aimed at the development of a community of families who will live together. This assessment provides a brief baseline of the proposed building site, as well as providing a summary of the vegetation and flora on site. Impacts are rated, and mitigation measures to reduce these impacts made.

The study area includes a ridge that comprises sections that form a Class 3 ridge, and some areas of the ridge that are transformed. The study area also falls within a CBA and ESA identified by the Gauteng C-Plan. The study area comprises Gauteng Shale Mountain Bushveld according to Mucina and Rutherford. No protected areas or National Protected Areas Expansion Strategy areas lie within 10kms of the site. Two Threatened Ecosystems occur within 5km of the site.

There are two main vegetation communities within the study area, these are grasslands (12.97ha), and the ridge (4.11ha). The area can be further divided into stands of alien trees, primarily *Eucalyptus grandis*, which extend in a line, possibly as a wind break, along the eastern edge of the property (5.4ha). Infrastructure, most of it pre-existing has also been built on the ride to the south of the site (1.52ha). The study area comprises both ridge open thicket as well as grassland. Overall, 66 species have been identified from the site. The site visit resulted in the recording of three Confirmed Species of Conservation Concern: *Gloriosa superba, Scadoxus puniceus* and *Aloe zebrina.* Other notable species include *Boophone disticha, Hypoxis hemerocallidea, Ledebouria marginata* and *Hypoxis multiceps*. The sensitivity of the grassland is low, with the sensitivity of the ridge moderate.

Impacts in general are medium negative and can be reduced to low negative with appropriate mitigations measures. Impacts associated with the loss of the ridge are a high negative and above the limits of acceptable change, indicating that the ridge areas be avoided.

Summary of impacts associated with the Hope Village Estate.

Impact	Without Mitigation	With mitigation
Issue 1: Loss of vegetation communities		
1: Loss of grassland	Moderate -	Moderate -
2: Loss of ridge open thicket*	High -	High -
Issue 2: Loss of Species of Conservation Concern and Biodiversity		
3: Loss of Species of Conservation Concern	Moderate -	Low -
4: Los of biodiversity in general	Moderate -	Low -
Issue 3: Ecosystem function and process		
5: Fragmentation	Moderate -	Low -
6: Invasion of alien species	Moderate -	Low -

*No impact will occur if the ridge is avoided, as per recommendation

Mitigation and management

- Keep the footprint of the construction as small as possible, the area of construction should be demarcated, and personnel not allowed to heavily use the surrounding natural vegetation.
- Avoid any construction or related activity occurring within the grasslands outside of the property as part of this development, including dumping, use of the grassland as a toilet, harvesting of plants etc...
- The ridge should not be further developed but rather managed as a conservation area or open space within the development.
- Any populations of SCC should be avoided wherever possible, where they cannot be avoided, every effort should be made to replant these individuals elsewhere in the landscaped gardens, or plant an equivalent or greater number of new individuals elsewhere in the gardens;
- A full site walk-through should be conducted in the summer prior to any construction activities to list all SCC and associated permits should be obtained for their removal or transplantation.
- Where possible at least one (comprising the ridge) corridors of natural vegetation should be incorporated into the design of the estate to allow for the retention of biodiversity within the site.
- Any existing and new alien species must be removed as soon as possible after emergence.
- An alien vegetation management plan must be applied to the site to maintain the site free of alien invasions throughout the construction and operational phase of the development.

Recommendations

It is the opinion of the specialist that the proposed development should go ahead, provided the following criteria are met:

1) The layout of the estate is adjusted to form natural corridors comprising, at the very least, the ridge areas but ideally including a grassland corridor as well;
2) Any and all corridors should be managed as conservation areas including alien vegetation control. They may be used as education areas;
3) The development and implementation of an alien invasive management plan for the site;
4) Permits must be obtained for each of the plant species that will be destroyed where required, this must be done by a qualified professional; and

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1 Introduction

The Door of Hope Children's Mission has proposed the development of a village estate including schools, offices and housing along with other associated infrastructure. The development is aimed at the development of a community of families who will live together.

This assessment provides a brief baseline of the proposed building site, as well as providing a summary of the vegetation and flora on site. Impacts are rated, and mitigation measures to reduce these impacts made.

1.1.1 Terms of Reference

The Terms of Reference (ToR) for the study are as follows:

- Identify and map vegetation communities within the site boundary and 200m surrounding the site;
- Identify all species encountered during the site visit and list these noting their presence within particular communities, as well as their habit (shrub, tree, geophyte etc…);
- Identify all alien plant species on site and map their location;
- Identify any Species of Conservation Concern (SCC) on site and map populations of these plants where possible;
- Determine and map the ecological sensitivity of each of the plant communities identified on site;
- Determine the status of the class 3 ridge areas located on site (transformed, degraded, pristine etc);
- Determine the activities permitted on the ridge based on field findings and the guidelines for class 3 ridges;
- Determine and rate the impacts of the proposed development to the vegetation and flora of the site;
- Recommend mitigation measures to reduce negative impacts associated with the proposed development;
- Make recommendations for the development based on the outcomes of the study.

1.1.2 Assumptions and limitations

- The field work was conducted over one day on the 21st of November 2018. The site assessment was conducted in summer (November to April) as per the guidelines for Gauteng.
- It should be noted that despite the timing of the study (in the wet season) the site (especially grassland areas) was particularly dry. This means that there is potential for geophytic, herbaceous and Graminaceaous plants to have been missed in this site visit but the information gathered is sufficient for the purpose of this assessment.
- Impacts have been rated based on the site layout as provided by CES at the time of writing this report.

2 The study area

2.1 Locality

The proposed site for this development is located in Aloe Ridge Drive, De Deur, Gauteng, South Africa (Figure 2-1). The site is the remaining extent of portion 19 of the farm Hartsenbergfontein 332. The development comprises a suite of buildings to house families as well as the orphanage and associated infrastructure including an office and administration building, a school, early childhood development and learning centres and residential houses. Currently the bulk of the existing residential areas are located to the south of the site, centred on rocky outcrops and the ridge area.

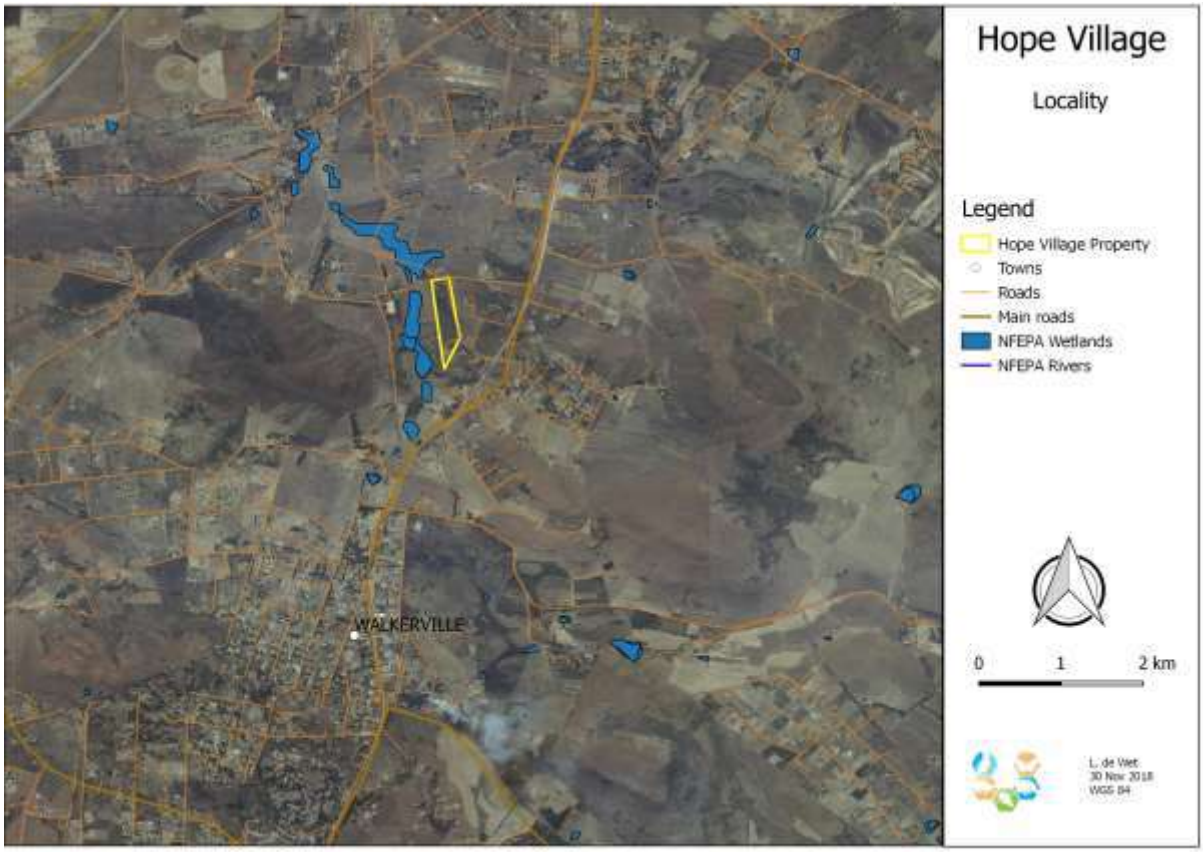

Figure 2-1: Locality map of the Door of Hope Village Estate site.

3 Methodology

The methodology for this assessment is based on analyses of available desktop information, a site visit and a resultant sensitivity and impact assessment. The methods of each of these study components are outlined below.

3.1 Desktop Assessment

Available desktop information was assessed to contextualize the site, and several databases and mapping tools were checked. These included the following:

- Google earth imagery was used to determine the current vegetation cover of the site;
- The National Vegetation Map developed by Mucina and Rutherford (2012 (Beta)) was consulted to determine the expected vegetation type;
- The Plants of South Africa (POSA) database was consulted for a list of plant species previously recorded from the general area including the site;
- The species lists for each of the vegetation types occurring in the study site provided by Mucina and Rutherford (2011) were used to augment the POSA species list;
- Conservation Planning Tools such as the List of Ecosystems that are Threatened and in Need of Protection, Wetlands datasets (NFEPA) and the Gauteng Conservation Plan (C-Plan) were mapped for the study site;
- A list of possible invasive species was extracted from the POSA list of plants recorded from the Pretoria National Botanical Gardens;
- A list of Possible Species of Conservation Concern was extracted from the POSA list of plants recorded from the Pretoria National Botanical Gardens though checking the list of recorded species against the following lists:
    - National Protected Tree List (Government Gazette Vol. 593, 21 November 2014, No. 38215);
    - Provincial Protected Species List (Traansvaal Nature Conservation Ordinance No. 12 of 1983);
    - National Protected Species List or TOPS (R 1187 of 2007); and
    - The National Red List for Plants (redlist.sanbi.org, as given by POSA).

3.2 Field Assessment

The site was surveyed based on Google Earth imagery and divided into areas of specific vegetation types as per stratified random sampling methodology. Each of these vegetation types were then surveyed in the field, with adaptive field techniques applied where in-field conditions required. For each of the different vegetation types, sample plots were done based on the field survey methodology described by Hawthorne for Rapid Botanical Sampling. Braun Blanquet was then used to determine the species list, dominant species in each vegetation type and the presence of Species of Conservation Concern and alien invasive species. These data were then used to describe the different plant communities on site. Figure 3-1 shows the sample plots for the study area.

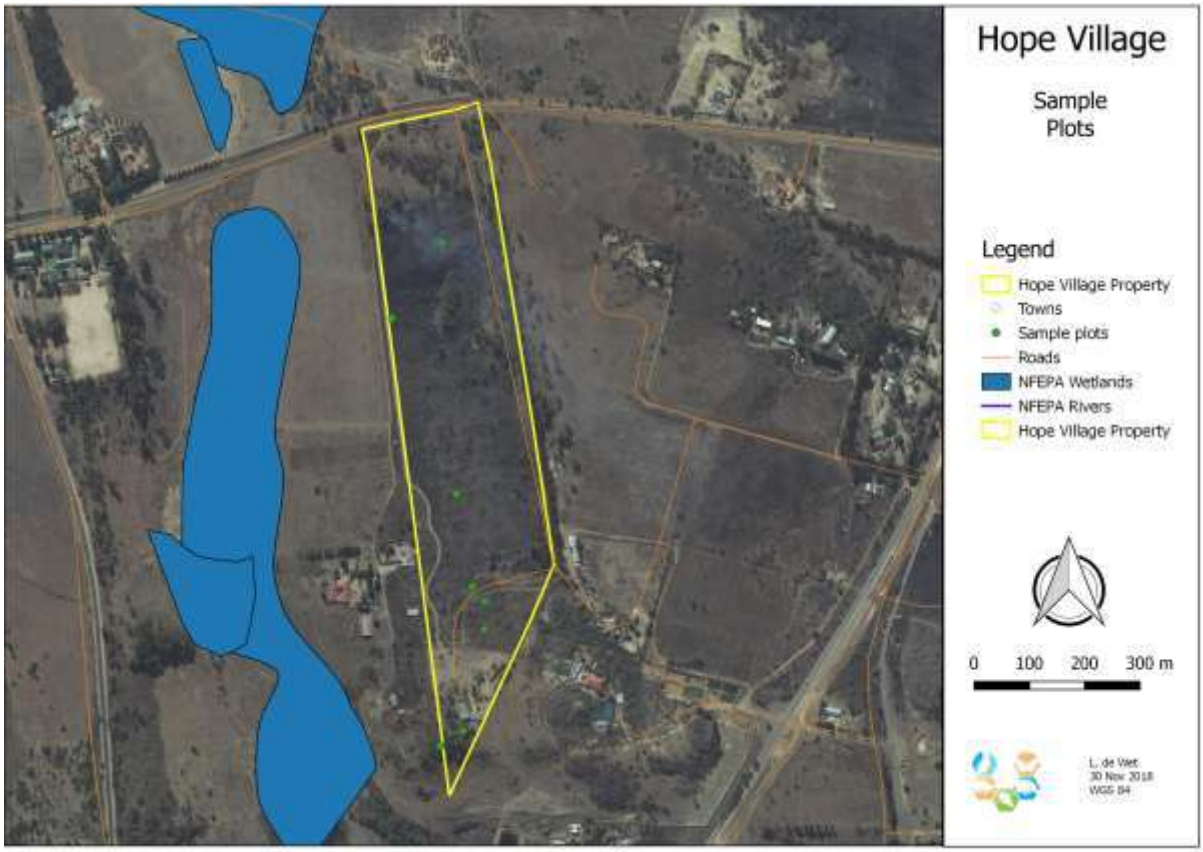

Figure 3-1: Sample plots at the Door of Hope Village Estate site.

3.3 Sensitivity Assessment

A list of sensitivity criteria was assessed, and the value of each of these criteria assigned a weighted score. The resultant matrix is then used to produce an overall sensitivity. This assessment determines the overall sensitivity of the site and aids in the making of recommendations with regards to proposed development within the site. Sensitivity criteria include the following:

- Species of Conservation Concern (Any red listed or protected species);
- Presence of sensitive habitats (such as wetlands, rocky outcrops);
- Presence of Critical Biodiversity Areas;
- Level of degradation of the site (erosion, grazing);
- Presence of indigenous vegetation;
- Proximity to watercourses;
- Proximity to wetlands;
- Proximity to National Parks;
- Proximity to other protected areas;
- Proximity to National Protected Areas Expansion Strategy (NPAES) Focus Areas;
- Proximity to Important Bird Areas (IBAs);
- Proximity to Ramsar sites;

- Proximity to World Heritage Sites; and
- Proximity to Threatened Ecosystems as gazetted.

3.4 Impact Assessment

The CES rating scale was used to rate the impacts for this assessment. The methodology is as follows.

Five factors need to be considered when assessing the significance of impacts, namely:

1. Relationship of the impact to **temporal** scales - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
2. Relationship of the impact to **spatial** scales - the spatial scale defines the physical extent of the impact.
3. The severity of the impact - the **severity/beneficial** scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party.

The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation' but includes concepts of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

4. The **likelihood** of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.
5. Each criterion is ranked to determine the overall **significance** of an activity (**Table 3-1**). The criterion is then considered in two categories, viz. effect of the activity and the likelihood of the impact. The total scores recorded for the effect and likelihood are then read off the matrix presented in **Table 3-2** and **Table 3-3**, to determine the overall significance of the impact. The overall significance is either negative or positive.

Table 3-1: Ranking of Evaluation Criteria

EFFECT	**Temporal Scale**		
	Short term	Less than 5 years	
	Medium term	Between 5-20 years	
	Long term	Between 20 and 40 years (a generation) and from a human perspective also permanent	
	Permanent	Over 40 years and resulting in a permanent and lasting change that will always be there	
	Spatial Scale		
	Localised	At localised scale and a few hectares in extent	
	Study Area	The proposed site and its immediate environs	
	Regional	District and Provincial level	
	National	Country	
	International	Internationally	
	Severity	**Severity**	**Benefit**
	Slight	Slight impacts on the affected system(s) or party(ies)	Slightly beneficial to the affected system(s) and party(ies)
	Moderate	Moderate impacts on the affected system(s) or party(ies)	Moderately beneficial to the affected system(s) and party(ies)
	Severe/ Beneficial	Severe impacts on the affected system(s) or party(ies)	A substantial benefit to the affected system(s) and party(ies)
	Very Severe/ Beneficial	Very severe change to the affected system(s) or party(ies)	A very substantial benefit to the affected system(s) and party(ies)
LIKELIHOOD	**Likelihood**		
	Unlikely	The likelihood of these impacts occurring is slight	
	May Occur	The likelihood of these impacts occurring is possible	
	Probable	The likelihood of these impacts occurring is probable	
	Definite	The likelihood is that this impact will definitely occur	

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

Table 3-2: Matrix used to determine the overall significance of the impact based on the likelihood and effect of the impact.

Likelihood		Effect													
		3	4	5	6	7	8	9	10	11	12	13	14	15	16
	1	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	2	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	3	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	4	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Table 3-3: Description of Environmental Significance Ratings and associated range of scores.

Significance Rate	Description	Score
Low	An acceptable impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in either positive or negative medium to short term effects on the social and/or natural environment.	LOW
Moderate	An important impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.	MEDIUM
High	A serious impact, if not mitigated, may prevent the implementation of the project (if it is a negative impact). These impacts would be considered by society as constituting a major and usually a long-term change to the (natural &/or social) environment and result in severe effects or beneficial effects.	HIGH
Very High	A very serious impact which, if negative, may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are not able to be mitigated and usually result in very severe effects, or very beneficial effects.	VERY HIGH

The environmental significance scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

Prioritising

The evaluation of the impacts, as described above is used to assess the significance of identified impacts and determine which impacts require mitigation measures.

Negative impacts that are ranked as being of "VERY HIGH" and "HIGH" significance will be investigated further to determine how the impact can be minimised or what alternative activities or mitigation measures can be implemented. These impacts may also assist decision makers i.e. numerous HIGH negative impacts may bring about a negative decision. For impacts identified as having a negative impact of "MODERATE" significance, it is standard practice to investigate alternate activities and/or mitigation measures. The most effective and practical mitigations measures will then be proposed. For impacts ranked as "LOW" significance, no investigations or alternatives will be considered. Possible management measures will be investigated to ensure that the impacts remain of low significance.

4 Conservation planning

There are several conservation planning tools that help with guiding proposed developments as well as assessing their ecological sensitivity, each of these was considered and assessed.

4.1 Gauteng Ridges

The study area includes, in the southern corner a ridge that comprises sections that form a Class 3 ridge, and some areas of the ridge that are transformed (Figure 4-1). According to Bredenkamp & Brown (1998 In: Pfab 2001): "The quartzite ridges of Gauteng, together with the Drakensberg Escarpment, should be regarded as one of the most important natural assets in the entire region of the northern provinces of South Africa. They are characterised by a unique plant species composition that is found nowhere else in South Africa or the world." In Gauteng, any topographic feature with a slope of 5^{O} or more is defined as a ridge. The Development Guidelines for Ridges indicates that ridges are important as biodiversity hotspots and refuges, as well as providing habitat for Species of Conservation Concern, wildlife corridors, and an important art of ecosystem processes (Pfab 2001, updated in 2006).

As ridges are important, the provincial government has adopted a strict no-go or low impact development policy (Pfab 2001, updated in 2006). The ridges in the province are divided into 4 classes with land use guidelines as per Table 4-1. Land use guidelines for the Hope Village site are those for Class 3 ridges. As the ridge is significantly impacted due to previous construction in conjunction with alien invasion, the guidelines for Class 4 ridges in this state indicate that the Class 4 guidelines should be applied.

Table 4-1: Categories and land use guidelines for ridges.

Ridge type	% of Gauteng Ridges	Policy
Class 1 (0 – 5% transformed)	47	• The consolidation of properties on Class 1 ridges is supported. • Further development activities and subdivisions will not be permitted on Class 1 ridges. • Only low impact activities with an ecological footprint of 5% or less will be permitted in the 200 metre buffer zone of the ridge.
Class 2 (5 – 35% transformed)	40	• The consolidation of properties on Class 2 ridges is supported. • The subdivision of property on Class 2 ridges will not be permitted. • Development activities and uses that have a high environmental impact on a Class 2 ridge will not be permitted. • Low impact development activities, such as tourism facilities, which comprise of an ecological footprint of 5% or less of the property may be permitted. (The ecological footprint includes all areas directly impacted on by a development activity,

Ridge type	% of Gauteng Ridges	Policy
		including all paved surfaces, landscaping, property access and service provision). • Low impact development activities on a ridge will not be supported where it is feasible to undertake the development on a portion of the property abutting the ridge.
Class 3 (35 – 65% transformed)	8	• The consolidation of properties on Class 3 ridges is supported. • The guidelines for Class 2 ridges will be applied to areas of the ridge that have not been significantly impacted on by human activity. • The guidelines for Class 4 ridges will be applied to areas of the ridge that have been significantly impacted on by human activity.
Class 4 (65 – 100% transformed)	5	• The consolidation of properties on Class 4 ridges is supported. • The subdivision of property on Class 4 ridges will not be permitted in areas of the ridge where the remaining contiguous extent of natural habitat is 4ha or more. • Further development activities will not be permitted in areas of the ridge where the remaining contiguous extent of natural habitat is 4ha or more.

4.2 Gauteng C-Plan

The most up to date and comparatively accurate conservation-planning tool is the Gauteng C-Plan. The main purposes of the C-Plan are:

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

CBAs are areas that need to be conserved in a natural or near natural state order to meet conservation targets, with ESA important for maintaining connectivity. There is an extensive network of these areas in the City of Johannesburg.

The study area falls within a CBA and ESA identified by the C-Pan (Figure 4-2). Compatible land uses for such a CBA include conservation and associated activities and land management recommendations are to obtain formal protection of these sites where possible and implement appropriate zoning to avoid net loss of intact habitat or identified land use. The site as a whole, regardless of being within a CBA is degraded, with little of conservation concern. A maintenance of corridors within the site will result in the retention of ESA properties. However, considering the degraded nature of the site, along with the level of alien invasion, the site is not considered to be of high conservation value.

4.3 Threatened Ecosystems

The list of threatened ecosystems covers terrestrial system only, with aquatic systems covered by NFEPA (See Section 3.4) (SANBI 2018). The ecosystems on the list comprise four categories, which are detailed in Table 4-2. The list of threatened ecosystems aims to reduce the rate of species and ecosystem extinction, reduce degradation of these systems as well as maintain the structure, function and composition of these systems. Threatened ecosystems represent 9.5% of the total area of South Africa (SANBI 2018).

Table 4-2: Categories of Threatened Ecosystems[1]

Category	Abbreviation	Description
Critically Endangered	CR	Ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation.
Endangered	EN	Ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems.
Vulnerable	VU	Ecosystems that have a high risk of ondergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems.
Protected	-	Ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable.

The study area has two Threatened Ecosystems within 10kms. These are the Critically Endangered Kliprivier Highveld Grassland and the Vulnerable Soweto Highveld Grassland. However, the Hope Village site does not fall into any threatened ecosystems (Figure 4-3).

4.4 Protected Areas

Formal protected areas are those that are included in the National Environmental Management: Protected Areas Act (Act 57 of 2003) and include nature reserves, national parks and protected environments. Protected areas provide protection against climate change and aid in ecological sustainability (Government of South Africa, 2008). Proximity to protected areas is important, as sites close to these areas may be ecologically sensitive, and buffers around protected areas should be maintained to preserve biodiversity and connectivity. The study area has no Protected Areas, or Protected Area Expansion Strategy Focus Areas within 10kms.

[1] National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN 1002).

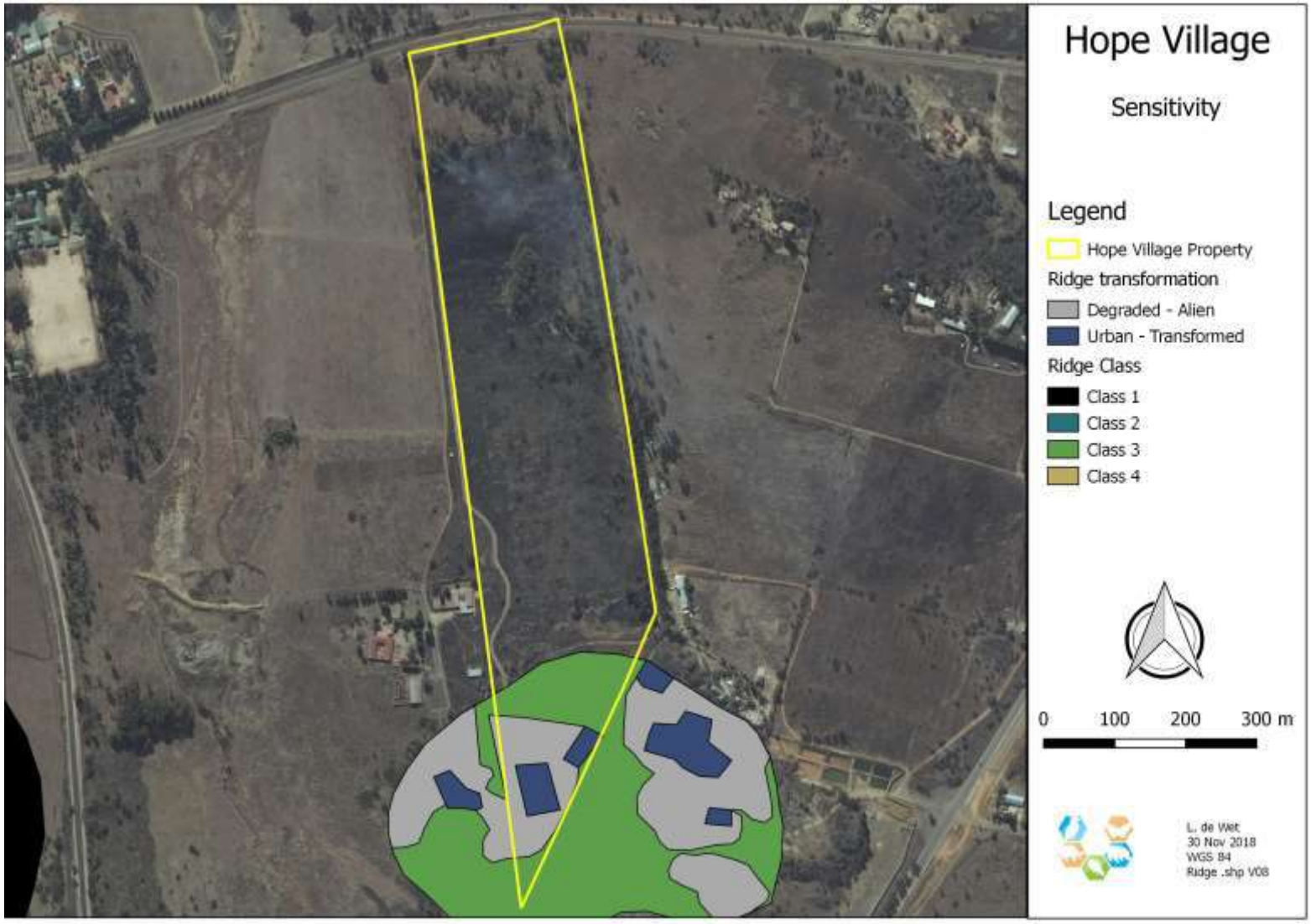

Figure 4-1: Ridges within the Hope Village Estate site.

Figure 4-2: Critical Biodiversity Areas within and near to the Hope Village Estate site.

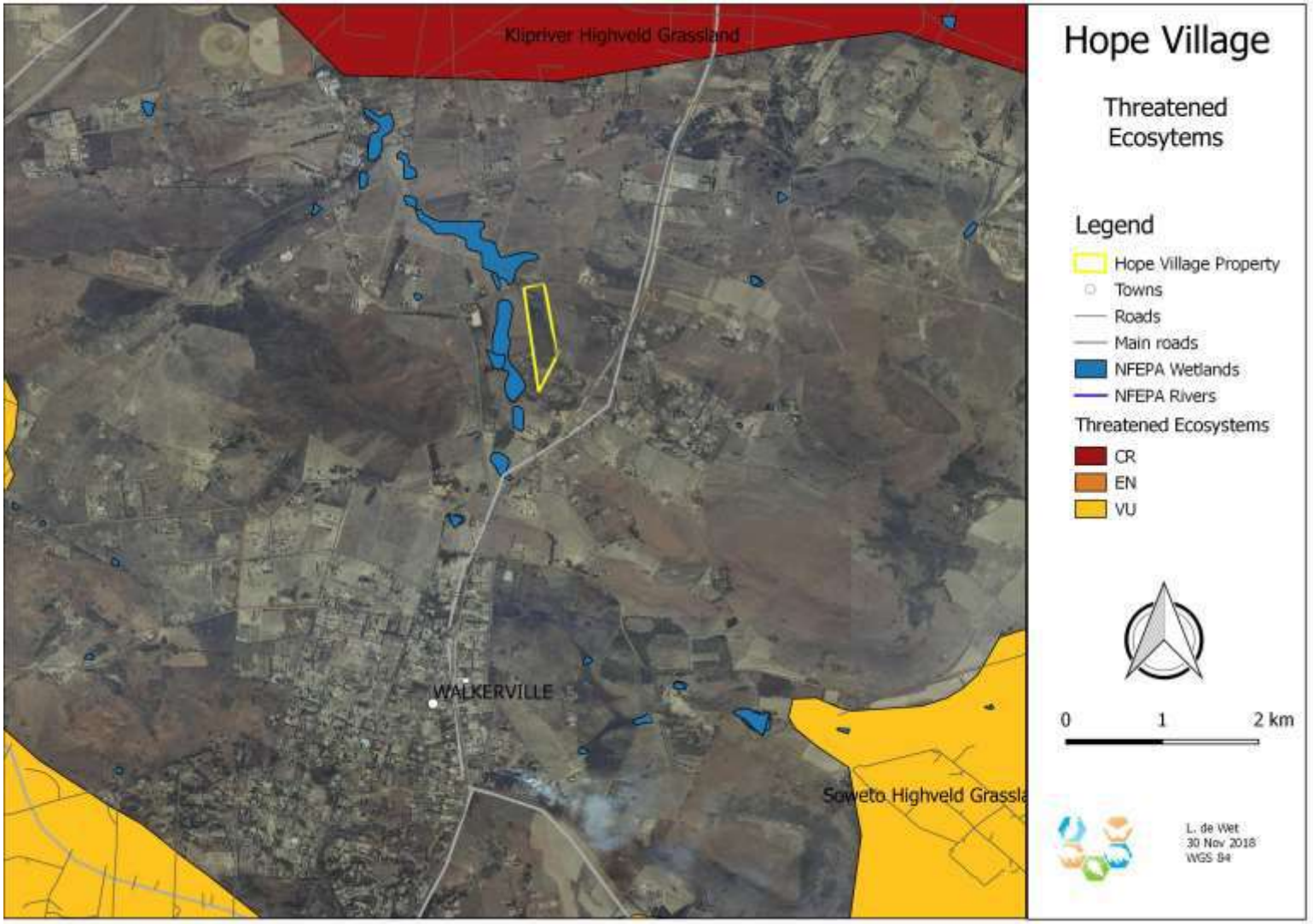

Figure 4-3: Threatened Ecosystems within and near to the Hope Village Estate site.

5 Biodiversity baseline

5.1 Vegetation

According to Mucina and Rutherford (2006), there is one vegetation type (Gauteng Shale Mountain Bushveld) within the Hope Village site (Figure 5-3).

5.1.1 Gauteng Shale Mountain Bushveld

This vegetation type occurs within the Gauteng province along ridges at an altitude of 1 300 to 1750metres (Mucina & Rutheroford 2011). It occurs on low, broken ridges with varying steepness and rocky outcrops with short vegetation ranging from 3 to 6m. It comprises an open thicket dominated by *Vachellia caffra, Searsia leptodictya, Searsia magalismontana, Cussonia spicata, Ehretia rigida, Maytenus heterophylla, Euclea crispa, Zanthoxylum capense, Dombeya rotundifolia, Protea caffra, Celtis africana, Ziziphus mucronata, Vangueria infausata, Canthium gilfillanii, Engelrophytum magalismontanum, Combretum molle, Acylobotrys capensis, Olea europaea* subsp. *africana* and *Grewia occidentalis*. The understory comprises mainly grass species. This vegetation type is vulnerable, with a conservation target of 24%, less than 1% of which is statutorily conserved (Mucina & Rutherford 2011).

5.1.2 Vegetation of the study area

The site visit indicated that there are two main vegetation communities within the study area, these are grasslands (12.97ha), and the ridge (4.11ha) (Figure 5-4). The area can be further divided into stands of alien trees, primarily *Eucalyptus grandis*, which extend in a line, possibly as a wind break, along the eastern edge of the property (5.4ha). Infrastructure, most of it pre-existing has also been built on the ridge to the south of the site (1.52ha). Much of the ridge area had recently been burnt.

5.1.2.1 Ridge

The ridge vegetation forms an open thicket, with a grassy understory with some herbaceous species and geophytes (Figure 5-1). It is about 5m tall at its tallest. The indigenous trees dominating this vegetation community type are *Vachellia caffra, Celtis africana* and *Dombeya rotundifolia* as relatively large trees and *Euclea crispa* and *Erhetia rigida* forming the shorter trees and shrubs stratum. The basal layer comprised grass species (either dry or burnt) with exposed rocky areas supporting *Boophone disticha, Kohautia amatymbica, Pentanisia angustifolia, Asparagus sp., Ipomoea bathycolops, Scadoxis punicens* and *Aloe zebrina*, among others.

This vegetation type is heavily invaded by a variety of invasive species including *Melia azedarach, Agave sisalana, Agave Americana, Pinus sp., Opuntia ficus-indica, Cercus jamacara*

and *Jacaranda mimosifolia*. The most dominant invasive is *Acacia mearnsii* which forms a dominant tree species on the northern part of the ridge.

Overall, the ridge is degraded, with some species of importance still remaining. Although it does have conservation value if the alien species are carefully managed and indigenous species left to thrive.

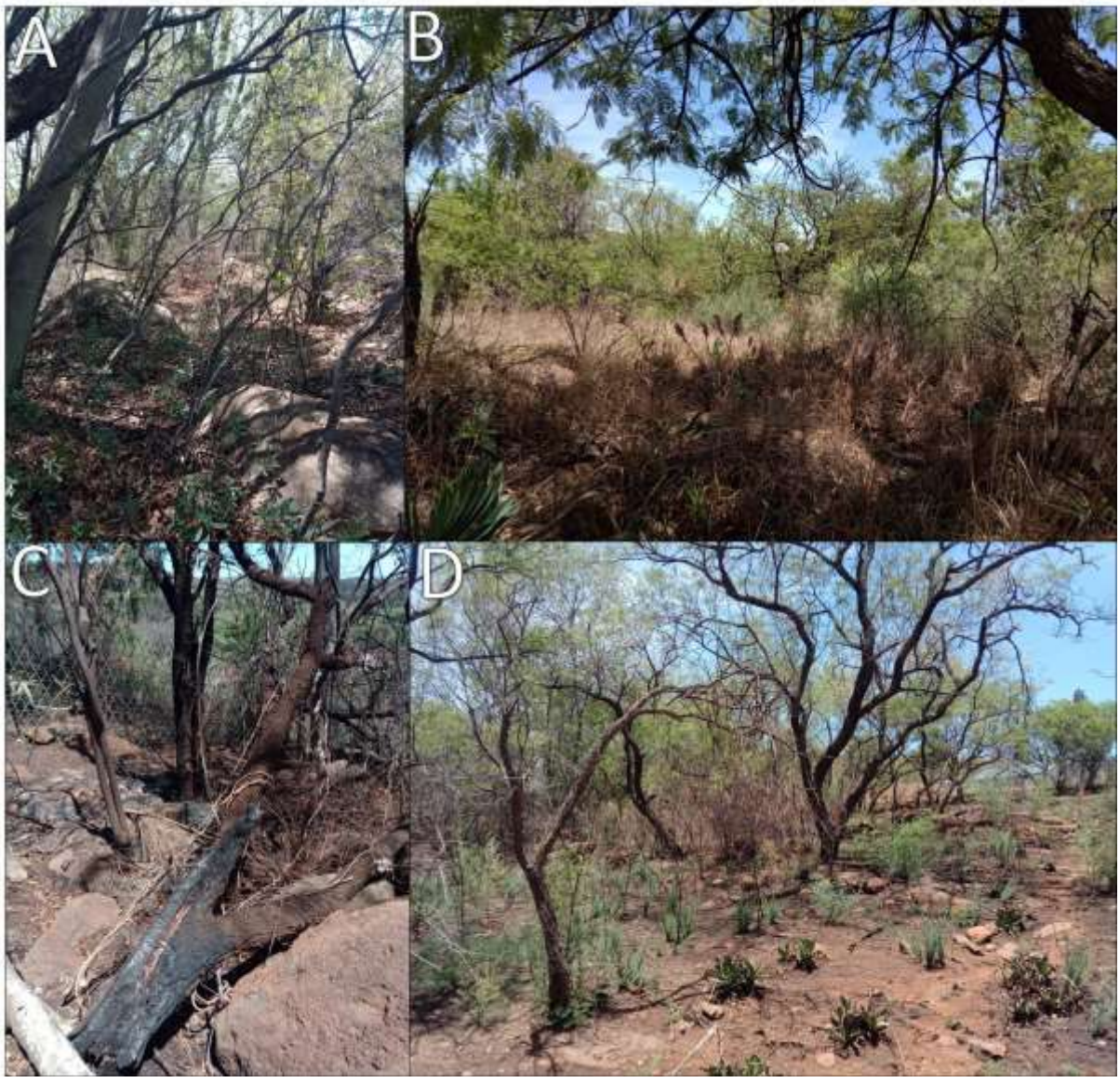

Figure 5-1: Ridge vegetation of the Hope Village Estate study site. A: Open thicket dominated by *Vachellia caffra* and *Celtis Africana*, B: Open thicket dominated by *Acacia mearnsii*, C: Degraded ridge vegetation with recent burning and heavy alien infestation. D: recently burned areas of the ridge with no grass layer.

5.1.2.2 Grassland

The grassland of the study area was dry at the time of the site visit, indicating a late wet season and corresponding late growth period and flowering time for the grasses. Some geophytic species and herbaceous species were present in the grassland (Figure 5-2). Dominant grass species include *Themeda triandra, Pentaschistis curvifolia* and various other dry grass species. Herbaceous species and geophytes recorded from this vegetation include the invasive *Verbena boniariensis* and *Verbena aristigera* along with the indigenous *Asaparagus* sp, *Ledebouria maryinata, Hypoxis hemerocallidea* and *Hilliariella oligocephala*.

The low number of species in the grassland indicates that it has a low conservation value however, it should be noted that additional species, including geophytes and herbaceous species may be recorded at a wetter time of year.

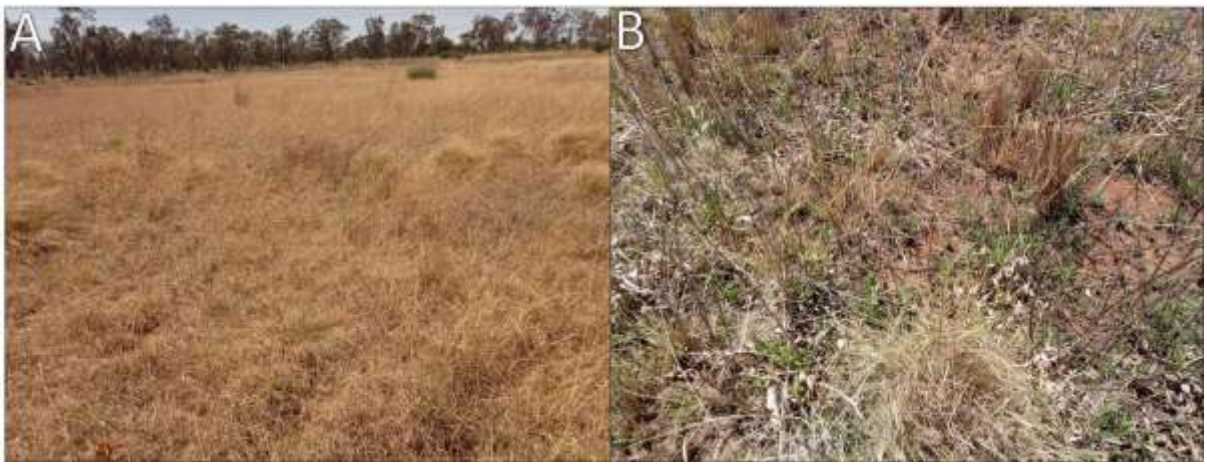

Figure 5-2: Grassland vegetation of the Hope Village Estate study site. A: dry grassland covering much of the site. B: grasses with scattered weedy herbs.

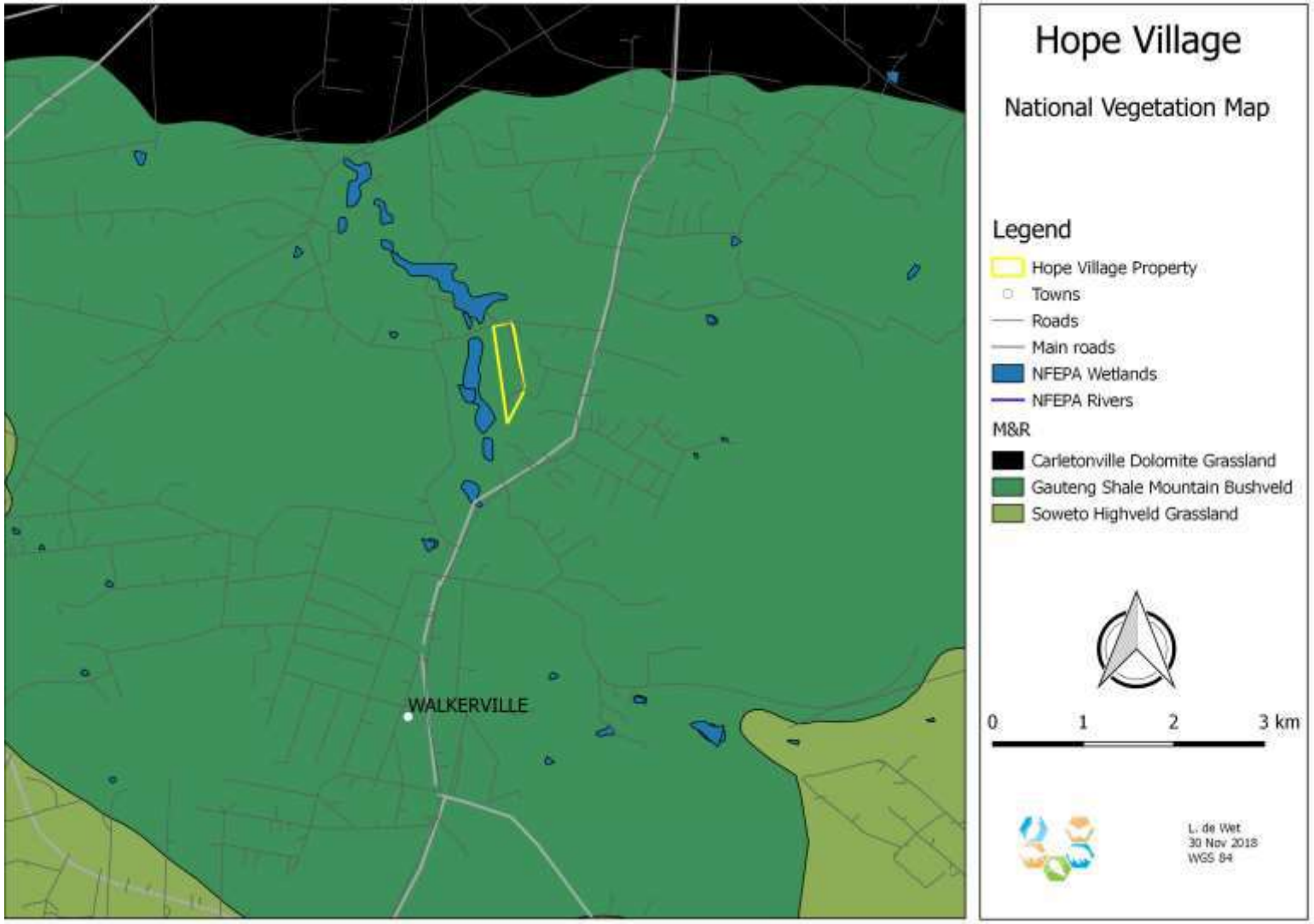

Figure 5-3: National Vegetation Map (Mucina & Rutherford, 2012) for the Hope Village Estate and surrounds.

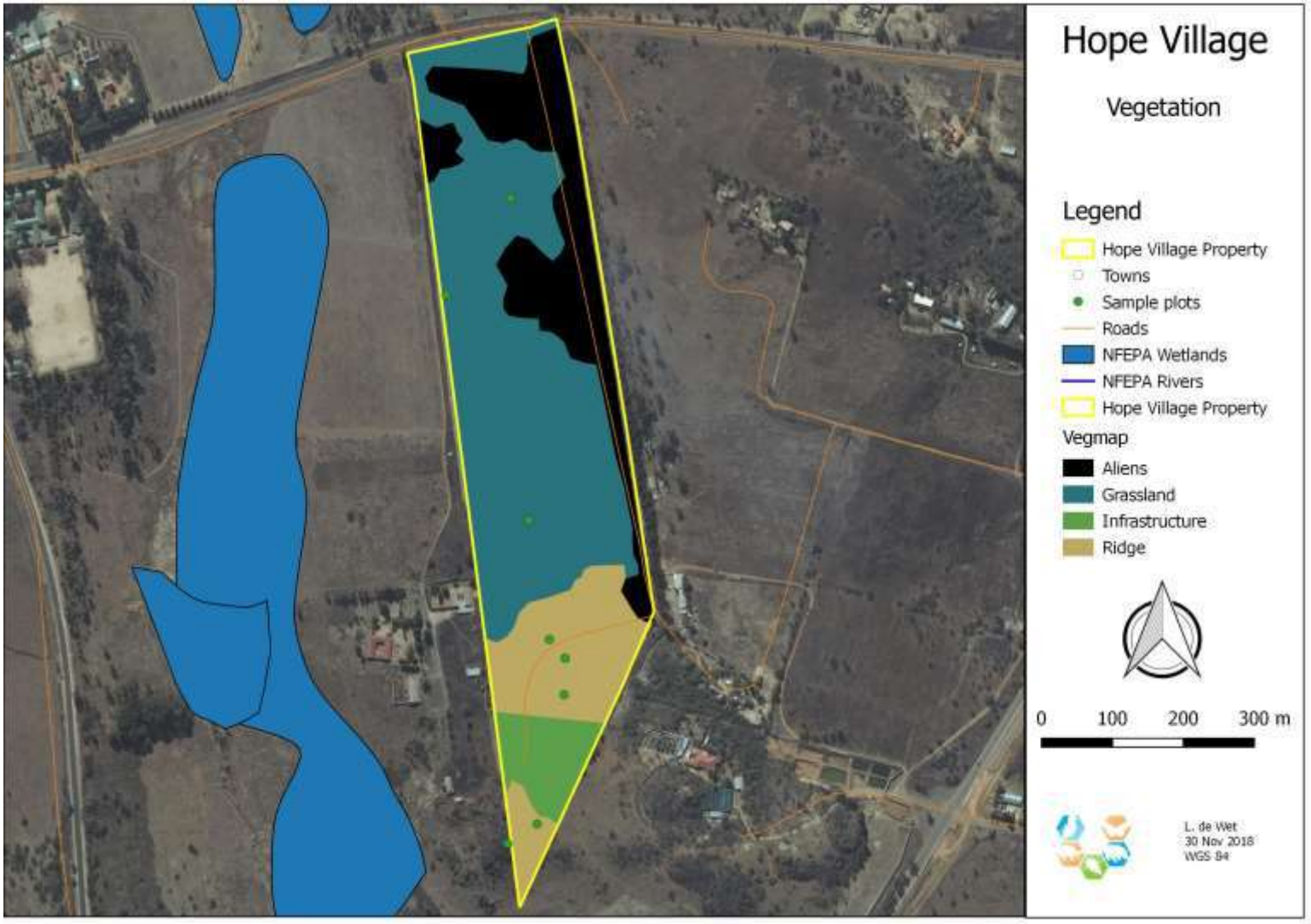

Figure 5-4: Site specific vegetation community map for the Hope Village Estate and surrounds.

5.2 Flora

Overall, the POSA species list includes 374 species (Appendix 2) that occur in the region of the Hope Village site. All of these species are not present in the relatively small area of the study site. The most common families in the study area include:

- Poaceae (Grass family) with 60 species;
- Asteraceae (Daisy family) with 51 species;
- Fabaceae (Pea family) with 42 species;
- Apocynaceae (Dogbane family) with 17 species; and
- Cyperaceae (Sedge family) with 15 species.

The study area comprises both ridge open thicket as well as grassland. Overall, 66 species have been identified from the site (a few species are currently being identified and are not included in this list) (Figure 5-5 and Figure 5-6), species recorded from the study site can be found in the full species list in Appendix 2. Common families recorded from the site include:

- Asteraceae (Daisy family) with 6 species;
- Poaceae (Grass family) with 5 species;
- Asparagaceae (Asparagus family) with 4 species;
- Malvaceae (Mallow family) with 3 species; and
- Solanaceae (Nightshade family) with 3 species.

Tree and shrub species are found exclusively in the rocky ridge areas aside from *Asparagus sp.* and *Vachellia caffra*. Common grass species to both the ridge and grassland areas include *Hyparrhenia* sp. and *Themeda triandra*. *Hermannia depressa* also tends to occur in both the ridge vegetation as well as the grassland in open, bare earth.

Figure 5-5: Herbaceous species recorded from the Hope Village Estate site. A: *Gnidia caffra*, B: *Gerbera viridifolia* C: *Hermannia depressa* and D: *Menodora africana*.

Figure 5-6: Tree and shrub species recorded from the Hope Village Estate site. A: *Celtis africana*, B: *Dombeya rotundifolia* C: *Vangueria parvifolia* and D: *Euclea crispa*.

5.2.1 Species of Special Concern

The expected species list includes 56 Possible Species of Conservation Concern (SCC) (Table 5-1). These species include those species that are listed as Endemic (by POSA), or on one or more of the following lists:

- National Protected Tree List (Government Gazette Vol. 593, 21 November 2014, No. 38215);
- Provincial Protected Species List (Traansvaal Nature Conservation Ordinance No. 12 of 1983);
- National Protected Species List or TOPS (R 1187 of 2007); and
- The National Red List for Plants (redlist.sanbi.org, as given by POSA).

Orange and Red listed species occurring in the region was obtained from CGDARD. According to this list, no Orange or Red listed species have been found on the property. One species: *Lithops lesliei* subsp. *lesliei* has been recorded within 5km of the study site. An additional 5 species have been recorded from within the QDS into which the study area falls. These are:

- *Cineraria longipes*
- *Dioscorea sylvatica*
- *Habenaria mossii*
- *Khadia beswickii*
- *Lepidium mossii.*

None of these species were found on site. However, the habitat is present for these species (grassland and rocky outcrops). A walkthrough prior to construction during the wet season will allow for the identification of any of these listed species. Management includes protected population of these species.

The site visit resulted in the recording of three Confirmed Species of Conservation Concern (Table 5-1), the Schedule 11 listed *Gloriosa superba, Scadoxus puniceus* and *Aloe zebrina.* Other notable species include *Boophone disticha, Hypoxis hemerocallidea, Ledebouria marginata* and *Hypoxis multiceps* (Figure 5-7). It is possible that additional SCC may occur on site and that these would be better seen in a wetter summer season (usually geophytes or other summer flowering groups). It is recommended that a full walk-through of the site be conducted prior to construction to ensure that all SCC have been recorded, and to apply for the required permits for their removal.

Of the possible and confirmed SCC:

- None are listed on the list of nationally Protected Trees;
- None are listed on the National TOPs list;
- 36 species that could possibly occur on site are recorded as endemic by POSA;
- 22 species that could possibly occur on site are listed on the provincial conservation ordinance under Schedule 11, 3 of these species were confirmed during the site visit;

- 4 species that could possibly occur on site are listed as Near Threatened according to the national Red Data list (POSA);
- 3 species that could possibly occur on site are listed as Data Deficient according to the national Red Data list (POSA);
- One species (*Cineraria longipes*) that could possibly occur on site is listed as Vulnerable according to the national Red Data list (POSA); and
- One species (*Pauridia canaliculata*) that could possibly occur on site is listed as Endangered according to the national Red Data list (POSA).

Figure 5-7: SCC occurring on the Hope Village Estate site. A: *Gloriosa superba* B: *Scadoxis puniceus* C: *Aloe zebrina* D: *Boophone disticha* E: *Hypoxis hemerocallidea* F: *Ledebouria marginata* and G: *Hypoxis multiceps*.

Table 5-1: Possible and Confirmed Species of Special Concern that may occur in the general area in and around the Hope Village Estate Site.

Family	Species	POSA	Recorded	Ecology	IUCN	Gauteng	TOPS	Protected Trees
Acanthaceae	*Blepharis stainbankiae*	x		Endemic				
Agapanthaceae	*Agapanthus campanulatus*	x			LC	Sch11		
	Khadia acutipetala	x		Endemic	LC			
Aizoaceae	*Lithops lesliei*	x			NT	Sch11		
	Crinum bulbispermum	x			LC	Sch11		
	Crinum graminicola	x			LC	Sch11		
	Haemanthus humilis	x			LC	Sch11		
Amaryllidaceae	*Scadoxus puniceus*		x			Sch11		
Apiaceae	*Alepidea peduncularis*	x			DD			
	Asclepias fallax	x		Endemic	LC			
	Schizoglossum periglossoides	x		Endemic	LC			
Apocynaceae	*Stenostelma umbelluliferum*	x		Endemic	NT			
	Aloe jeppeae	x			LC	Sch11		
	Aloe verecunda	x		Endemic	LC	Sch11		
	Aloe zebrina		x			Sch11		
	Kniphofia ensifolia	x			LC	Sch11		
Asphodelaceae	*Trachyandra erythrorrhiza*	x		Endemic	LC			
	Afroaster peglerae	x		Endemic	LC			
	Berkheya seminivea	x		Endemic	LC			
	Cineraria longipes	x		Endemic	VU			
	Cotula microglossa	x		Endemic	LC			
	Cotula nigellifolia	x		Endemic	LC			
	Nidorella anomala	x		Endemic	LC			
Asteraceae	*Pseudopegolettia tenella*	x		Endemic				
Brassicaceae	*Lepidium mossii*	x		Endemic	DD			

Family	Species	POSA	Recorded	Ecology	IUCN	Gauteng	TOPS	Protected Trees
Cleomaceae	*Cleome conrathii*	x			NT			
Colchicaceae	*Gloriosa superba*		x			Sch11		
Crassulaceae	*Crassula arborescens*	x		Endemic				
	Crassula setulosa	x		Endemic	NE			
Euphorbiaceae	*Spirostachys africana*	x			LC	Sch11		
Fabaceae	*Lessertia mossii*	x		Endemic	DD			
	Melolobium wilmsii	x		Endemic	LC			
	Pearsonia cajanifolia	x		Endemic	LC			
	Rhynchosia pedunculata	x		Endemic				
Geraniaceae	*Geranium multisectum*	x		Endemic	LC			
Hyacinthaceae	*Eucomis sp.*	x				Sch11		
Hypoxidaceae	*Pauridia canaliculata*	x			EN			
Iridaceae	*Gladiolus crassifolius*	x			LC	Sch11		
	Gladiolus papilio	x			LC	Sch11		
	Gladiolus permeabilis	x			LC	Sch11		
	Gladiolus sericeovillosus	x		Endemic	LC	Sch11		
	Gladiolus sericeovillosus	x			LC	Sch11		
Lobeliaceae	*Cyphia assimilis*	x		Endemic	LC			
Malvaceae	*Hermannia cordata*	x		Endemic	LC			
	Hermannia lancifolia	x		Endemic	LC			
Orchidaceae	*Eulophia hians*	x			LC	Sch11		
	Habenaria bicolor	x			NT	Sch11		
	Habenaria epipactidea	x			LC	Sch11		
Orobanchaceae	*Harveya huttonii*	x		Endemic	LC			
Poaceae	*Sporobolus pectinatus*	x		Endemic	LC			
Polygalaceae	*Polygala illepida*	x		Endemic	LC			
Proteaceae	*Leucospermum cuneiforme*	x		Endemic	LC	Sch11		

Family	Species	POSA	Recorded	Ecology	IUCN	Gauteng	TOPS	Protected Trees
Rubiaceae	*Galium spurium-aparine*	x		Endemic	NE			
Santalaceae	*Thesium deceptum*	x		Endemic	LC			
	Thesium exile	x		Endemic	LC			
	Thesium transvaalense	x		Endemic	LC			
Scrophulariaceae	*Selago capitellata*	x		Endemic	LC			
Thymelaeaceae	*Passerina falcifolia*	x		Endemic	LC			

5.2.2 Alien invasive species

Not all species recorded from the study area and surrounds are indigenous, some of these are not indigenous but have become naturalised. Other species are invasive in nature and legislated by CARA or NEM:BA (Table 5-2 and Table 5-3).

Table 5-2: Conservation of Agricultural Resources Act (CARA) legislation

Category	Restriction
1	Invader plants must be removed and destroyed immediately. No trade in these plants.
2	Invader plants may be grown under controlled conditions in permitted zones. No trade on these plants.
3	Invader plants may no longer be propagated or sold. Existing plants do not need to be removed.

Table 5-3: National Environmental Management: Biodiversity Act (NEM:BA) invasive species legislation.

Restriction	Category 1b	Category 2	Category 3
b. Having in possession or exercising physical control over any specimen of a listed invasive species.	Exempted	Permit required	Exempted
f. Spreading or allowing the spread of any specimen of a listed invasive species.	Prohibited	Permit required	Prohibited

Twenty-one (21) alien invasive species are expected to be found in and around the Hope Village site. of these, 16 are listed under CARA, and 19 under NEM:BA (Figure 5-8: Some of the alien invasive plant species recorded from the Hope Village site. A: *Acacia mearnsii*, B: *Melia azedararch*, C: *Opuntia ficus-indica* and D: *Cerceus jamacara*.

Table 5-4, Figure 5-8). All of the species these non-indigenous species recorded from the Hope Village site are invasive and must be controlled.

Figure 5-8: Some of the alien invasive plant species recorded from the Hope Village site. A: *Acacia mearnsii*, B: *Melia azedararch*, C: *Opuntia ficus-indica* and D: *Cerceus jamacara*.

Table 5-4: Alien invasive species both expected (according to POSA) and recorded from the Hope Village site.

Species	Common name	Expected	Present	CARA	NEMA
Acacia dealbata	Silver wattle	x		2	2
Acacia mearnsii	Black wattle		x	2	2
Achyranthes aspera	Burweed	x		1	
Agave sisalana	Sisal		x	2	2
Alisma plantago-aquatica	Mud plantain	x			1b
Cereus jamacaru	Queen of the night		x	1	1b
Cuscuta campestris	Common dodder	x		1	1b
Datura stramonium	Common thorn apple	x		1	1b
Eucalyptus grandis	Saligna gum		x	2	1b
Jacaranda mimosifolia	Jacaranda		x	3	1b
Melia azedarach	Seringa		x	3	1b
Nasturtium officinale	Watercress	x			2
Opuntia ficus-indica	Prickly-pear		x	1	1b
Phytolacca dioica	Belhambra		x	3	3
Phytolacca octandra	Forest inkberry	x			1b
Pinus sp.	Pine		x	2	
Ricinus communis	Castor-oil plant	x		2	2
Solanum mauritianum	Bugweed		x	1	1b
Solanum sisymbriifolium	Wild tomato	x	x	2	1b
Solanum sp.			x		1b
Verbena bonariensis	Purple top		x		1b

6 Sensitivity Assessment

Sensitivity was based on a set of criteria, scored based on various measures and then calculated within a matrix, an overall sensitivity is then assigned based on the total score. The sensitivity assessment was done on each of the vegetation communities of the site. As the monotypic alien stands occur within the grassland community, these were included in that community to fully assess the sensitivity, and the infrastructure area was included in the ridge vegetation community. The results of the sensitivity calculation can be seen in Table 6-1 and Table 6-2. The results are shown in Figure 6-1.

The area of the ridge within the Hope Village site is 5.63ha including the infrastructure currently on it. Of this, the infrastructure takes up 27% of the Hope Village site area of the ridge, with the ridge forming 73% of the area. If the whole ridge is taken into account (as mapped in Figure 4-1), this means that over 4ha of contiguous ridge habitat including areas of the ridge outside the Hope Village Site is present. However, the definition of "natural" is problematic as much of this vegetation is invaded, primarily by *Acacia mearnsii* but also by various others including *Phytolacca dioica, Jacaranda mimosifolia* and *Cereus jamacrara*. These invasive species constitute at least 40% of the canopy cover of the vegetation. However, considering the dryness of the wet season during the site visit and the presence of habitat for a variety of SCC, as well as applying the precautionary principle: this would indicate that the ridge comprises over 4ha of contiguous natural vegetation (including those areas of the ridge outside of the Hope Village site).

As per the guidelines, with a Class three ridge significantly impacted by anthropogenic activities, then Class 4 guidelines must be followed. Thus; the subdivision of the property will not be permitted, and further development activities will not be permitted in areas of the ridge where the remaining contiguous extent of natural habitat is 4ha or more. Within the Hope Village site, the areas of the ridge that are natural do not reach a contiguous 4ha. However, when taken in conjunction with the rest of the ridge as a habitat, the area of natural habitat would constitute 4ha or more.

Table 6-1: Sensitivity score for the grassland (including the alien vegetation) of the Hope Village site

Criteria	Rating	Score	Weighted score
Species of Conservation Concern	0 to 5	2	2
Sensitive Habitats	0-20	1	1
Critical Biodiversity Areas	CBA	5	5
Level of Degradation	11	4	4
Indigenous Vegetation	61-80%	4	4
Proximity to watercourses	>100m	1	0.7
Proximity to wetlands	>100m	1	0.7
Proximity to National Parks	>10kms	1	0.4
Proximity to other Protected Areas	>10kms	1	0.4
Proximity to NPAES Focus Areas	>10kms	1	0.7

Criteria	Rating	Score	Weighted score
Proximity to IBAs	>10kms	1	0.4
Proximity to Ramsar sites	>10kms	1	0.4
Proximity to World Heritage Sites	>10kms	1	0.4
Proximity to Threatened Ecosystems	2.5-5kms	3	2.1
		TOTAL SCORE	22.2
		as a /49 percentage	45.31
		Sensitivity rating	Low

Table 6-2: Sensitivity score for the ridge (including the infrastructure) of the Hope Village site

Criteria	Rating	Score	Weighted score
Species of Conservation Concern	0 to 5	2	2
Sensitive Habitats	61-80	4	4
Critical Biodiversity Areas	CBA	5	5
Level of Degradation	11	4	4
Indigenous Vegetation	41-60%	3	3
Proximity to watercourses	>100m	1	0.7
Proximity to wetlands	>100m	1	0.7
Proximity to National Parks	>10kms	1	0.4
Proximity to other Protected Areas	>10kms	1	0.4
Proximity to NPAES Focus Areas	>10kms	1	0.7
Proximity to IBAs	>10kms	1	0.4
Proximity to Ramsar sites	>10kms	1	0.4
Proximity to World Heritage Sites	>10kms	1	0.4
Proximity to Threatened Ecosystems	2.5-5kms	3	2.1
		TOTAL SCORE	24.2
		as a /49 percentage	49.39
		Sensitivity rating	Moderate

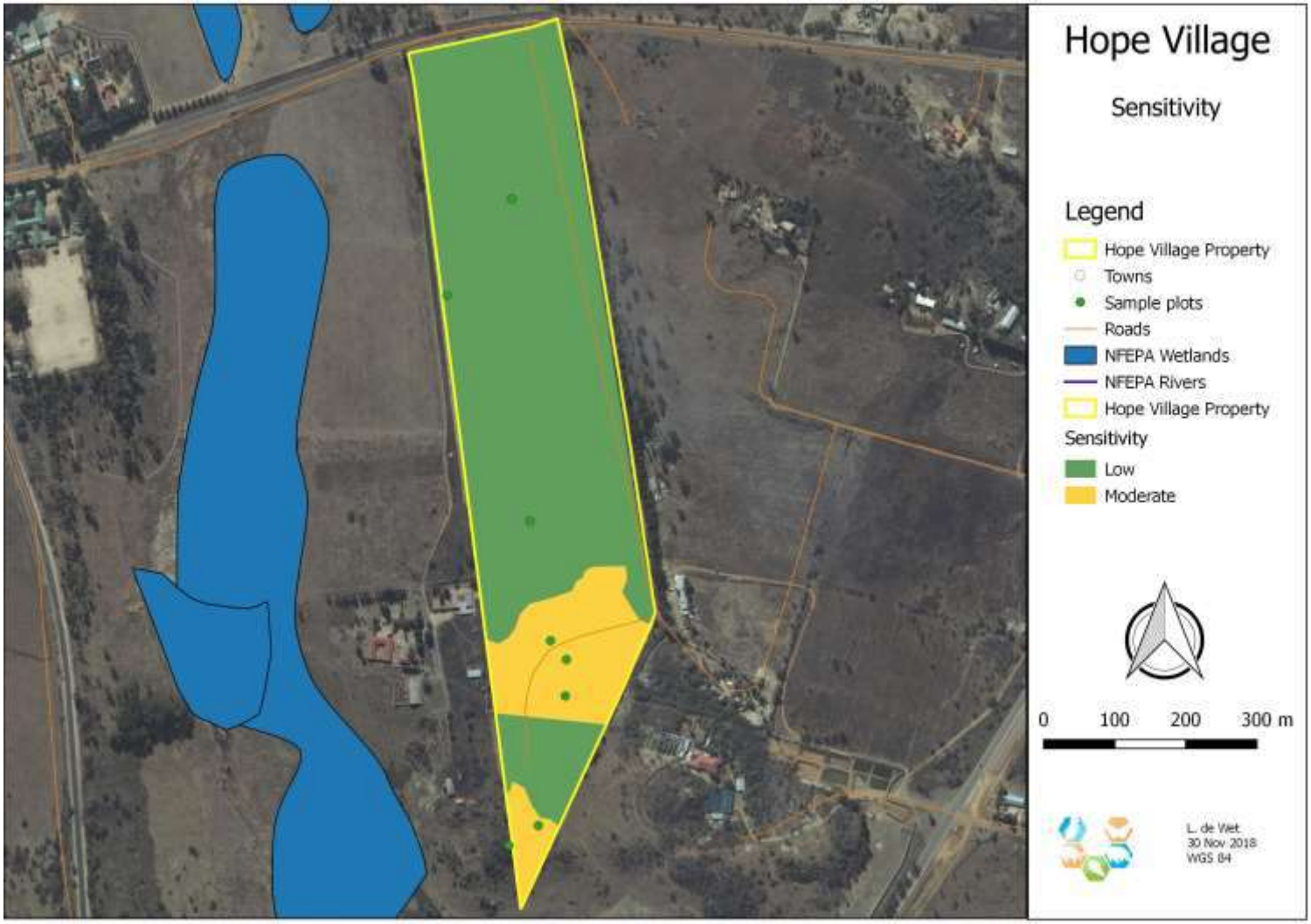

Figure 6-1: Sensitivity map for the Hope Village Estate and surrounds.

7 Impact Assessment

The impacts for the proposed development have been rated according to the methodology in Section 3.4. There are three issues and six impacts overall, and mitigation measures are recommended for each of the impacts.

7.1 Issue 1: Loss of vegetation communities

7.1.1 Impact 1: Loss of grassland

Cause and comment: The building of the Hope Village estate will result in the complete loss of the grassland as the plans allow for landscaping, but not the retention of the natural vegetation. This will result in the loss of 18.37ha of vegetation, 24% of which is predominantly alien species (*Eucalyptus grandis*), with 12.97ha of natural grassland lost due to the proposed development. This grassland is sandwiched between a wetland on the western side of the property, (with associated slightly different moist grassland) and a rocky outcrop comprising much of the slope of the adjacent property on the east of the site. As a result, this grassland is a relatively isolated patch of Soweto Highveld Grassland. However, the degraded nature of the grassland and its low species numbers, along with other factors, indicate that it has a low sensitivity.

Significance statement: The impact will be permanent, restricted to the study area and definite, with a moderate severity resulting in a moderate negative overall significance. As the full extent of the grassland within the site will be lost (12.97ha), the impact would remain moderate negative, even with mitigation measures. However, Considering the degraded low sensitivity of this grassland, coupled with the overall area of 12.97ha, this impact is considered to be within the limits of acceptable change.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Impact 4: Fragmentation of vegetation and edge effects					
Without Mitigation	Permanent	Study Area	Moderate	Definite	MODERATE-
With Mitigation	Permanent	Study Area	Moderate	Definite	MODERATE-

Mitigation and Management:

- Keep the footprint of the construction as small as possible, the area of construction should be demarcated, and personnel not allowed to heavily use the surrounding natural vegetation. Avoid any construction or related activity occurring within the grasslands outside of the property.

7.1.2 Impact 2: Loss of ridge open thicket

Cause and comment: The building of Hope Village Estate based on the current plan will result in the loss of the full area of the ridge within the Hope Village site. This includes the 4.11ha of ridge within the site. Considering the sensitivity of the ridge associated with the presence of sensitive habitats (rocky outcrops) and the ridge guidelines that allow for no development on such ridges (see section 6 above), it is recommended that the development of the area of ridge on the Hope Village site is avoided altogether. These areas should be managed for conservation (and could form part of conservation training for the facility), including the control and monitoring of alien invasive species.

Significance statement: The impact will be permanent, regional (based on the distribution of ridges) and definite, with a severe severity resulting in a high negative overall significance. As the full extent of the ridge within the site will be lost, the impact will remain a high negative. Considering the degraded nature of the ridge, the presence of 40% cover of alien species, and using the precautionary principle, the presence of the ridge as a CBA, and the ridge guidelines that indicate that no development should occur in the ridges, this impact is considered to be outside the limits of acceptable change. As such, development of the ridge should be avoided, and as a result the impact will be negligible.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Impact 4: Fragmentation of vegetation and edge effects					
Without Mitigation	Permanent	Regional	Severe	Definite	HIGH-
With Mitigation	Permanent	Regional	Severe	Definite	HIGH-
Avoid Development of Ridge (recommended)	No Impact				

Mitigation and Management:

- Keep the footprint of the construction as small as possible, the area of construction should be demarcated, and personnel not allowed to heavily use the surrounding natural vegetation. Avoid any construction or related activity occurring within the grasslands outside of the property.
- The ridge should be demarcated as a no-go area and managed as a conservation area or open space within the development.

7.2 Issue 2: Loss of Species of Conservation Concern and Biodiversity

7.2.1 Impact 3: Loss of Species of Conservation Concern

Cause and comment: The building of the Hope Village Estate will result in the loss of SCC. Three SCC were recorded within the site during this site visit, with the likelihood of additional species being recorded after higher rainfall events during the growing season. These species will be lost during the construction of the development.

Significance statement: The impact will be permanent, restricted to a localised area and definite, with a moderate severity resulting in a moderate negative overall significance. Mitigation measures can reduce this impact to a low negative overall significance.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Impact 4: Fragmentation of vegetation and edge effects					
Without Mitigation	Permanent	Regional	Moderate	Definite	MODERATE-
With Mitigation	Permanent	Localised	Slight	May occur	LOW-

Mitigation and Management:

- Keep the footprint of the construction as small as possible, the area of construction should be demarcated, and personnel not allowed to heavily use the surrounding natural vegetation.
- Any populations of SCC should be avoided wherever possible, where they cannot be avoided, every effort should be made to replant these individuals elsewhere in the landscaped gardens, or plant an equivalent or greater number of new individuals elsewhere in the gardens;
- A full site walk-through should be conducted in the summer prior to any construction activities to list all SCC and associated permits should be obtained for their removal or transplantation.

Impact 4: Loss of biodiversity in general

Cause and comment: As the construction of the Hope Village Estate will result in the loss of the natural vegetation of the site, this will in turn result in the loss of the species occurring within the site.

Significance statement: The impact will be permanent, restricted to the study area and definite, with a moderate severity resulting in a moderate negative overall significance. Mitigation will result in the reduction of the impact to a low negative, which is within the limits of acceptable change.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Impact 4: Fragmentation of vegetation and edge effects					
Without Mitigation	Permanent	Study Area	Moderate	Definite	MODERATE-
With Mitigation	Permanent	Localised	Slight	May occur	LOW-

Mitigation and Management:

- Keep the footprint of the construction as small as possible, the area of construction should be demarcated, and personnel not allowed to use the surrounding natural vegetation as a toilet, for dumping or as picnic sites.
- Where possible at least one (comprising the ridge) corridor of natural vegetation should be incorporated into the design of the estate to allow for the retention of biodiversity within the site.
- Any populations of SCC should be avoided wherever possible, where they cannot be avoided, every effort should be made to replant these individuals elsewhere in the gardens or plant an equivalent or greater number of new individuals elsewhere in the gardens.
- A full site walk-through should be conducted in the summer prior to any construction activities to list all SCC and associated permits should be obtained for their removal or transplantation.

7.3 Issue 3: Ecosystem function and Process

7.3.1 Impact 5: Fragmentation

Cause and comment: This site is prone to fragmentation due to its location between a wetland (and associated moist grassland) to the west and a rocky outcrop to the east. The site forms a small patch of grassland between different ecosystems. As such, the loss of the grassland will result in fragmentation of this already partially fragmented system. In addition, any loss of the ridge would further fragment this ecosystem. Fragmentation can result in the loss of biodiversity due to loss of dispersal, pollination and gene issues, among other considerations. It should be avoided where possible.

Significance statement: The impact will be permanent, restricted to a regional area and definite, with a moderate severity resulting in a moderate negative overall significance. Mitigation measures can reduce this impact to a low negative overall significance, an impact within the limits of acceptable change.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Impact 4: Fragmentation of vegetation and edge effects					
Without Mitigation	Permanent	Regional	Moderate	Definite	MODERATE-
With Mitigation	Permanent	Localised	Slight	Unlikely	LOW-

Mitigation and Management:

- Refer to mitigation measures listed under impact 3 above.

7.3.2 Impact 6: Invasion of alien species

Cause and comment: The building of the Hope Village Estate will result in the influx of seeds and disturbance of existing seedbanks of alien invasive species. Considering the number of alien species already recorded from the site, this impact will occur and must be managed.

Significance statement: The impact will be permanent, restricted to a regional area and definite, with a moderate severity resulting in a moderate negative overall significance. Mitigation measures can reduce this impact to a low negative overall significance and if an invasive alien management plan is applied this can even become a beneficial impact of low significance.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Impact 4: Fragmentation of vegetation and edge effects					
Without Mitigation	Permanent	Regional	Moderate	Definite	MODERATE-
With Mitigation	Permanent	Localised	Slight	Unlikely	LOW-

Mitigation and Management:

- Keep the footprint of the construction as small as possible, the area of construction should be demarcated, and personnel not allowed to heavily use the surrounding natural vegetation.
- Any existing and new alien species must be removed as soon as possible after emergence.
- An alien vegetation management plan must be applied to the site to maintain the site free of alien invasions throughout the construction and operational phase of the development.

8 Conclusions and Recommendations

The site comprises degraded grassland and ridge open thicket vegetation and is largely invaded by alien species. The site is situated largely within a CBA with some ESA areas, but the sensitivity of the existing vegetation is not particularly high. It is likely that additional SCC will be recorded from the site during a wetter time period. It is recommended that an additional site visit (in the form of a walkthrough prior to construction) be undertaken in summer to identify any SCC that may have been missed so that the relevant permits for their removal can be applied for. It is also recommended that the ridge land use guidelines are applied in this case and that areas of the ridge are set aside as conservation corridors within the site to ensure connectivity and conservation of a sensitive habitat.

Impacts in general are medium negative and can be reduced to low negative with appropriate mitigations measures (Table 8.1). Impacts associated with the loss of the ridge are a high negative and above the limits of acceptable change, indicating that the ridge areas be avoided.

Table 8.1: Summary of impacts associated with the Hope Village Estate.

Impact	Without Mitigation	With mitigation
Issue 1: Loss of vegetation communities		
1: Loss of grassland	Moderate -	Moderate -
2: Loss of ridge open thicket*	High -	High -
Issue 2: Loss of Species of Conservation Concern and Biodiversity		
3: Loss of Species of Conservation Concern	Moderate -	Low -
4: Los of biodiversity in general	Moderate -	Low -
Issue 3: Ecosystem function and process		
5: Fragmentation	Moderate -	Low -
6: Invasion of alien species	Moderate -	Low -

*No impact will occur if the ridge is avoided, as per recommendation

8.1 Mitigation and management

- Keep the footprint of the construction as small as possible, the area of construction should be demarcated, and personnel not allowed to heavily use the surrounding natural vegetation.
- Avoid any construction or related activity occurring within the grasslands outside of the property as part of this development, including dumping, use of the grassland as a toilet, harvesting of plants etc...
- The ridge should not be further developed but rather managed as a conservation area or open space within the development.
- Any populations of SCC should be avoided wherever possible, where they cannot be avoided, every effort should be made to replant these individuals elsewhere in the landscaped gardens, or plant an equivalent or greater number of new individuals elsewhere in the gardens;

- A full site walk-through should be conducted in the summer prior to any construction activities to list all SCC and associated permits should be obtained for their removal or transplantation.
- Where possible at least one (comprising the ridge) corridors of natural vegetation should be incorporated into the design of the estate to allow for the retention of biodiversity within the site.
- Any existing and new alien species must be removed as soon as possible after emergence.
- An alien vegetation management plan must be applied to the site to maintain the site free of alien invasions throughout the construction and operational phase of the development.

8.2 Recommendations

It is the opinion of the specialist that the proposed development should go ahead, provided the following criteria are met:

5) The layout of the estate is adjusted to form natural corridors comprising, at the very least, the ridge areas but ideally including a grassland corridor as well;
6) Any and all corridors should be managed as conservation areas including alien vegetation control. They may be used as education areas;
7) The development and implementation of an alien invasive management plan for the site;
8) Permits must be obtained for each of the plant species that will be destroyed where required, this must be done by a qualified professional; and

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10 APPENDIX 1: Specialist CV

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Kloof
Durban

Leigh-Ann de Wet
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Biodiversity Specialist

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Profile

A biodiversity specialist with a history in botanical research, biodiversity assessments and associated planning in developing countries. Possesses experience in classification of ecosystems and development of management and monitoring plans for a variety of ecosystems from the spiny thicket of Madagascar to the Rainforests of West and Central Africa. Experience also includes Biodiversity Assessments (comprising classification and mapping of ecosystems and habitats) of ecosystems and vegetation types throughout Southern Africa including grasslands, forests, thicket, bushveld and fynbos with associated conservation and management recommendations.

Key Expertise

Ecological research methodology development	Report and paper writing
Ecological research	Synthesis of specialist work into integrated assessments
Habitat and vegetation mapping	Ecological statistics
Habitat and vegetation classification	Environmental Management and Monitoring

Education

2005 - 2007	**MSc** in Botany – Rhodes University
2005	**BSc Honours** in Botany (with Distinction) – Rhodes University
2001 - 2004	**BSc** (Botany and Entomology) – Rhodes University

Courses

2013	Wetland Management: Introduction to Law – University of the Free State
2013	Wetland Management: Introduction and Delineation Short Course – University of the Free State
2011	Land Degradation Short Course – Rhodes University
2009	EIA Short Course – Rhodes University and Coastal and Environmental Services

Membership

2012 – Present	Professional Natural Scientist with SACNASP: Ecological Science (No. 400233/12)
2012 – Present	High Conservation Value Assessor (plants) with the Round Table of Sustainable Biofuels.
2013 – Present	South African Association of Botanists

2013 – Present	Botanical Society of South Africa
2013 – Present	Wildlife and Environment Society of South Africa
2013	Grasslands Society of Southern Africa

Professional experience

2014 - Current Owner of LD Biodiversity Consulting – Biodiversity Specialist

Started own company (Sole Proprietor) to focus on Ecological Assessments including baseline assessments (habitat and ecosystem classification) as well as Management and Monitoring for large projects. Responsibilities include:

- Ecological Surveys including Baseline Assessments, Biodiversity Management and Monitoring Plans and Spatial Planning for biodiversity goals to meet international standards
- Offset design
- Strategic Environmental Planning
- Mapping (QGIS)
- Research
- Financial Management

2012 - 2014 Digby Wells Environmental – Unity Manager: Biophysical

Management of the Biophysical Department, specifically Flora and Fauna although included the overseeing and review of both Freshwater Ecology and Wetlands as well. Responsibilities includeed:

- Conducting and management of Ecological Baseline and Impact Assessments to meet international standards
- Biodiversity Management and Monitoring Plans
- Management of a team of between four and seven colleugues and specialists

2009 – 2012 Coastal and Environmental Services – Senior Environmental Consultant and Ecological Specialist

Ecological specialist responsible for conducting ecological assessments including baseline and impact assessments for Fauna and Flora. Later in this time for overseeing junior ecologists and training. Key responsibilities included:

- Conducting Ecological Baseline and Impact Assessments to international standards
- Strategic environmental planning
- Managing teams of specialists
- Mapping (Arc)
- Research

2007 - 2009 Rhodes University (South Africa) and Sheffield University (England) – NERC Research Assistant

Design and conducting of a large common or garden experiement looking at the effects of global climate change on grassland compoisition. Key responsibilities included:

- Experimental design
- Experiment implementation

- Data analyses

Awards

2005	Best Young Botanist second prize for a presentation entitled: "Population biology and effects of harvesting on *Pelargonoium reniforme* (Geraniaceae) in Grahamstown and surrounding areas" at the SAAB conference. Dean's list, Academic Colours, Masters Scholarship.
2004	Putterill Prize for conservation in the Eastern Cape, Dean's list, Academic Half Colours, Honours Scholarship.
2001 - 2003	Dean's List

Publications

de Wet, L., Downsborough, L., Reimers, B., and Weah, C. (in prep). Traditional ecological knowledge and social survey as a proxy for large mammal scientific survey in Liberia.

de Wet, L., Downsborough, L., Reimers, B., and Weah, C (in prep). Traditional ecological knowledge and presence of large mammals in Liberia: a case study.

de Wet, L., and Downsborough, L. (in prep). A case for using traditional knowledge for community managed multiple use conservation areas in Liberia.

Taylor, S, Ripley, B, Martin, T, **de Wet, L,** Woodward, I and Osborne, C (2014.) Physiological advantages of C4 grasses in the field: a comparative experiment demonstrating the importance of drought. Global Change Biology – in Press.

Ripley BS, **de Wet, L** and Hill MP (2008). Herbivory-induced reduction in photosynthetic productivity of water hyacinth, *Eichhornia crassipes* (Martius) Solms-Laubach (Pontederiaceae), is not directly related to reduction in photosynthetic leaf area. African Entomology 16(1): 140-142.

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de Wet L (2005). Is *Pelargonium reniforme* in danger? The effects of harvesting on *Pelargonium reniforme*. Veld & Flora. December: 182-184.

Presentations

2013 **LR de Wet** – Biodiversity Actions Plans for existing mines: Making them Work for Grassland Conservation - Grassland Society of Southern Africa Congress, Limpopo

2011 **LR de Wet** - Finding Ecological Benefits of Windfarms – Thicket Forum, Grahamstown

2010 Lubke, RA, N Davenport, **LR de Wet** and C Fordham – The ecology and distribution of endorheic pans in the subtropical thicket vegetation near Port Elizabeth, Eastern Cape, South Africa – International Association for Vegetation Science, 53rd Annual Symposium, Ensenada, Mexico.

2006 **LR de Wet,** Barker, N and Peter, C – Pollinator-mediated selection in *Pelargonium reniforme* as described by Inter Simple Sequence Repeat markers. – South African Association of Botanists (SAAB) conference.

2006 **LR de Wet**, Barker, N and Peter, C– Pollinator-mediated selection of *Pelargonium reniforme* and two floral morphs described by inter simple sequence repeat markers – Southern African Society for Systematic Biology (SASSB) conference.

2005 **LR de Wet** and Vetter, S – Population biology and effects of harvesting on *Pelargonium reniforme* (Geraniaceae) in Grahamstown and surrounding areas, Eastern Cape, South Africa – South African Association of Botanists (SAAB) conference.

2005 **LR de Wet** and Vetter, S – Harvesting of *Pelargonium reniforme* in Grahamstown; what are the implications for populations of the plant? – Thicket Forum

2005 **LR de Wet** – Harvesting of *Pelargonium reniforme* in Grahamstown; what are the implications for populations of the plant? – Annual general meeting. Botanical Society of South Africa, Albany Branch.

2004 **LR de Wet** – Population biology of *Pelargonium reniforme* – Annual general meeting. Botanical Society of South Africa, Albany Branch.

11 APPENDIX 2 – Expected Plant Species

Family	Species	Recorded	POSA
Acanthaceae	*Barleria macrostegia*		x
	Barleria obtusa		x
	Blepharis stainbankiae		x
	Crabbea acaulis		x
Agapanthaceae	*Agapanthus campanulatus*		x
Agavaceae	*Chlorophytum bowkeri*		x
	Chlorophytum fasciculatum		x
Aizoaceae	*Delosperma sp.*		x
	Hereroa sp.		x
	Khadia acutipetala		x
	Lithops lesliei		x
	Mossia intervallaris		x
Alismataceae	*Alisma plantago-aquatica*		x
Alliaceae	*Tulbaghia leucantha*		x
Amaranthaceae	*Achyranthes aspera*		x
	Amaranthus muricatus		x
	Chenopodium album		x
	Chenopodium schraderianum		x
	Chenopodium sp.		x
	Chenopodium stellulatum		x
Amaryllidaceae	*Boophone disticha*	x	
	Crinum bulbispermum		x
	Crinum graminicola		x
	Haemanthus humilis		x
	Scadoxis punicens	x	
Anacardiaceae	*Searsia discolor*		x
	Searsia lancea	x	
	Searsia leptodictya		x
	Searsia magalismontana		x
	Searsia rigida	x	x
Apiaceae	*Afrosciadium magalismontanum*		x
	Alepidea peduncularis		x
	Bupleurum mundii		x
	Heteromorpha arborescens		x
Apocynaceae	*Ancylobotrys capensis*		x
	Asclepias adscendens		x
	Asclepias aurea		x
	Asclepias eminens		x
	Asclepias fallax		x

Family	Species	Recorded	POSA
	Asclepias fulva		x
	Asclepias gibba		x
	Aspidoglossum biflorum		x
	Aspidoglossum lamellatum		x
	Cordylogyne globosa		x
	Gomphocarpus sp.	x	
	Pachycarpus schinzianus		x
	Parapodium costatum		x
	Pentarrhinum insipidum	x	
	Raphionacme hirsuta		x
	Raphionacme velutina		x
	Schizoglossum periglossoides		x
	Stenostelma umbelluliferum		x
	Xysmalobium undulatum		x
Aquifoliaceae	*Ilex mitis*		x
Asparagaceae	*Agave americana*	x	
	Agave sisalana	x	
	Asparagus cooperi	x	x
	Asparagus laricinus	x	x
	Asparagus setaceus		x
	Asparagus suaveolens		x
Asphodelaceae	*Aloe jeppeae*		x
	Aloe marlothii		x
	Aloe sp.		x
	Aloe verecunda		x
	Aloe zebrina	x	
	Bulbine narcissifolia		x
	Kniphofia ensifolia		x
	Trachyandra erythrorrhiza		x
	Trachyandra laxa		x
	Trachyandra saltii		x
Asteraceae	*Afroaster peglerae*		x
	Afroaster serrulatus		x
	Athrixia angustissima		x
	Athrixia elata		x
	Athrixia phylicoides		x
	Barkheya zeyheri	x	
	Berkheya seminivea		x
	Berkheya zeyheri		x
	Brachylaena sp.		x
	Cineraria aspera		x
	Cineraria longipes		x
	Cineraria lyratiformis		x

Family	Species	Recorded	POSA
	Conyza podocephala		x
	Cotula coronopifolia		x
	Cotula microglossa		x
	Cotula nigellifolia		x
	Crepis hypochaeridea		x
	Denekia capensis		x
	Dimorphotheca spectabilis		x
	Felicia filifolia	x	x
	Garuleum woodii		x
	Gazania sp.	x	
	Gerbera viridifolia	x	
	Haplocarpha scaposa	x	
	Helichrysum aureum		x
	Helichrysum caespititium		x
	Helichrysum cephaloideum		x
	Helichrysum chionosphaerum		x
	Helichrysum harveyanum		x
	Helichrysum kraussii		x
	Helichrysum lepidissimum		x
	Helichrysum mundtii		x
	Helichrysum nudifolium		x
	Helichrysum rugulosum		x
	Helichrysum setosum		x
	Hilliaraella oligocephala	x	
	Hilliardiella aristata		x
	Hilliardiella elaeagnoides		x
	Hilliardiella hirsuta		x
	Hilliardiella sutherlandii		x
	Lopholaena coriifolia		x
	Nidorella anomala		x
	Osteospermum scariosum		x
	Phymaspermum athanasioides		x
	Pseudopegolettia tenella		x
	Schistostephium crataegifolium		x
	Schkuhria pinnata		x
	Senecio asperulus		x
	Senecio coronatus		x
	Senecio harveianus		x
	Senecio hieracioides		x
	Senecio lydenburgensis		x
	Senecio sp.		x
	Tagetes minuta		x
	Tarchonanthus camphoratus		x

Family	Species	Recorded	POSA
	Ursinia nana		x
Bignoniaceae	*Jacaranda mimosifolia*	x	
	Tecomaria capensis	x	
Boraginaceae	*Cynoglossum hispidum*		x
	Erhetia ridiga	x	
Brassicaceae	*Lepidium mossii*		x
	Nasturtium officinale		x
	Rorippa nudiuscula		x
Cactaceae	*Cereus jamacara*	x	
	Opuntia ficus-indica	x	
Cannabaceae	*Celtis africana*	x	
Caryophyllaceae	*Dianthus mooiensis*		x
	Pollichia campestris		x
Celastraceae	*Gymnosporia polyacantha*	x	
	Maytenus c.f. tenuispina	x	
	Pterocelastrus echinatus		x
Cleomaceae	*Cleome conrathii*		x
	Cleome maculata		x
	Cleome monophylla		x
Colchicaceae	*Gloriosa superba*	x	
Combretaceae	*Combretum erythrophyllum*		x
Commelinaceae	*Cyanotis speciosa*		x
Convolvulaceae	*Cuscuta campestris*		x
	Falkia oblonga		x
	Ipomoea bathycolpor	x	
	Ipomoea crassipes		x
	Ipomoea oblongata		x
Crassulaceae	*Cotyledon orbiculata*	x	
	Crassula alba		x
	Crassula arborescens		x
	Crassula capitella		x
	Crassula setulosa		x
Cucurbitaceae	*Coccinia adoensis*		x
	Cucumis hirsutus		x
	Cucumis zeyheri		x
	Kedrostis africana		x
Cyperaceae	*Abildgaardia ovata*		x
	Bulbostylis burchellii		x
	Cyperus congestus		x
	Cyperus denudatus		x
	Cyperus longus		x
	Cyperus obtusiflorus	x	x
	Fimbristylis complanata		x

Family	Species	Recorded	POSA
	Fuirena coerulescens		x
	Fuirena pubescens		x
	Isolepis cernua		x
	Isolepis costata		x
	Isolepis fluitans		x
	Kyllinga pulchella		x
	Schoenoplectus muriculatus		x
	Scirpoides burkei		x
Droseraceae	*Drosera burkeana*		x
Ebenaceae	*Diospyros austro-africana*		x
	Diospyros lycioides		x
	Euclea crispa	x	x
Ericaceae	*Erica drakensbergensis*		x
	Erica woodii		x
Euphorbiaceae	*Acalypha angustata*		x
	Ricinus communis		x
	Spirostachys africana		x
Fabaceae	*Abrus laevigatus*		x
	Acacia caffra	x	
	Acacia dealbata		x
	Acacia mearnsii	x	
	Argyrolobium rupestre		x
	Argyrolobium tuberosum		x
	Crotalaria distans		x
	Dichilus lebeckioides		x
	Dichilus strictus		x
	Elephantorrhiza elephantina		x
	Eriosema burkei		x
	Erythrina zeyheri		x
	Indigastrum burkeanum		x
	Indigastrum fastigiatum		x
	Indigofera dimidiata		x
	Indigofera hedyantha		x
	Indigofera hilaris		x
	Indigofera obscura		x
	Indigofera oxytropis		x
	Indigofera zeyheri		x
	Lablab purpureus		x
	Leobordea foliosa		x
	Lessertia mossii		x
	Lotononis macrosepala		x
	Macrotyloma axillare		x
	Melolobium wilmsii		x

Family	Species	Recorded	POSA
	Mundulea sericea		x
	Pearsonia cajanifolia		x
	Rhynchosia adenodes		x
	Rhynchosia nervosa		x
	Rhynchosia pedunculata		x
	Rhynchosia reptabunda		x
	Rhynchosia sordida		x
	Rhynchosia totta		x
	Senegalia caffra		x
	Senegalia hereroensis		x
	Tephrosia longipes		x
	Tephrosia semiglabra		x
	Trifolium africanum		x
	Vicia sativa		x
	Vigna vexillata		x
	Zornia linearis		x
Geraniaceae	*Geranium multisectum*		x
	Monsonia angustifolia		x
	Pelargonium sidoides		x
Gunneraceae	*Gunnera perpensa*		x
Hyacinthaceae	*Drimia angustifolia*		x
	Eucomis sp.		x
	Ledebouria cooperi		x
	Ledebouria inquinata		x
	Ledebouria marginata	x	
Hypericaceae	*Hypericum aethiopicum*		x
Hypoxidaceae	*Hypoxis acuminata*		x
	Hypoxis hemerocallidea	x	
	Hypoxis multiceps	x	x
	Pauridia canaliculata		x
Iridaceae	*Babiana bainesii*		x
	Gladiolus crassifolius		x
	Gladiolus papilio		x
	Gladiolus permeabilis		x
	Gladiolus sericeovillosus		x
	Gladiolus sericeovillosus		x
	Moraea pallida		x
	Moraea simulans		x
	Tritonia nelsonii		x
Juncaceae	*Juncus exsertus*		x
	Juncus oxycarpus		x
Lamiaceae	*Ajuga ophrydis*		x
	Leonotis schinzii	x	x

Family	Species	Recorded	POSA
	Mentha aquatica		x
	Ocimum obovatum	x	
	Salvia runcinata		x
	Syncolostemon pretoriae		x
	Teucrium trifidum		x
Lobeliaceae	*Cyphia assimilis*		x
	Lobelia erinus		x
	Lobelia flaccida		x
	Monopsis decipiens		x
Lythraceae	*Nesaea sagittifolia*		x
	Nesaea schinzii		x
Malvaceae	*Dombeya rotundifolia*	x	
	Hermannia coccocarpa		x
	Hermannia cordata		x
	Hermannia depressa	x	x
	Hermannia geniculata		x
	Hermannia grandistipula		x
	Hermannia lancifolia		x
	Hermannia sp.		x
	Hibiscus microcarpus	x	
	Melhania prostrata		x
	Sida chrysantha		x
	Sida rhombifolia		x
Meliaceae	*Melia azedarach*	x	
Menispermaceae	*Antizoma angustifolia*		x
Molluginaceae	*Psammotropha myriantha*		x
Moraceae	*Ficus sp.*	x	
Myrsinaceae	*Myrsine africana*		x
Oleaceae	*Menodora africana*	x	
Onagraceae	*Oenothera tetraptera*		x
Orchidaceae	*Eulophia hians*		x
	Habenaria bicolor		x
	Habenaria epipactidea		x
	Satyrium hallackii		x
Orobanchaceae	*Harveya huttonii*		x
	Harveya speciosa		x
	Striga bilabiata		x
Phytolaccaceae	*Phytolacca dioica*	x	
	Phytolacca octandra		x
Pinaceae	*Pinus sp.*	x	
Plantaginaceae	*Plantago lanceolata*		x
	Veronica anagallis-aquatica		x
Poaceae	*Agrostis eriantha*		x

Family	Species	Recorded	POSA
	Alloteropsis semialata		x
	Andropogon appendiculatus		x
	Andropogon schirensis		x
	Aristida bipartita		x
	Aristida canescens		x
	Aristida diffusa		x
	Aristida sp.		x
	Arundinella nepalensis		x
	Brachiaria serrata		x
	Chloris virgata	x	x
	Cymbopogon caesius		x
	Cynodon transvaalensis		x
	Digitaria diagonalis		x
	Digitaria monodactyla		x
	Digitaria ternata		x
	Digitaria tricholaenoides		x
	Diheteropogon amplectens		x
	Echinochloa jubata		x
	Elionurus muticus		x
	Eragrostis capensis		x
	Eragrostis curvula		x
	Eragrostis nindensis		x
	Eragrostis sclerantha		x
	Eragrostis sp.		x
	Eragrostis stapfii		x
	Eragrostis tef		x
	Eustachys paspaloides		x
	Harpochloa falx		x
	Helictotrichon sp.		x
	Heteropogon contortus		x
	Hyparrhenia dregeana		x
	Hyparrhenia hirta		x
	Imperata cylindrica		x
	Koeleria capensis		x
	Leersia hexandra		x
	Leptochloa fusca		x
	Lolium multiflorum		x
	Lolium perenne		x
	Miscanthus junceus		x
	Panicum coloratum		x
	Panicum maximum		x
	Panicum repens		x
	Panicum schinzii		x

Family	Species	Recorded	POSA
	Panicum sp.	x	
	Paspalum dilatatum		x
	Paspalum distichum		x
	Pennisetum sphacelatum		x
	Phragmites australis		x
	Poa annua		x
	Setaria nigrirostris		x
	Setaria sp.	x	
	Setaria sphacelata		x
	Sporobolus natalensis		x
	Sporobolus pectinatus		x
	Sporobolus sp.		x
	Themeda triandra	x	
	Trachypogon spicatus		x
	Trichoneura grandiglumis		x
	Tristachya leucothrix	x	x
	Urelytrum agropyroides		x
	Urochloa panicoides		x
Polygalaceae	*Muraltia empetroides*		x
	Polygala houtboshiana		x
	Polygala illepida		x
Polygonaceae	*Persicaria decipiens*		x
	Persicaria madagascariensis		x
	Rumex conglomeratus		x
Polypodiaceae	*Pleopeltis macrocarpa*		x
Potamogetonaceae	*Potamogeton pectinatus*		x
Proteaceae	*Leucospermum cuneiforme*		x
	Protea caffra		x
Pteridaceae	*Adiantum raddianum*		x
	Cheilanthes quadripinnata		x
Ranunculaceae	*Ranunculus dregei*		x
	Ranunculus multifidus		x
Rhamnaceae	*Ziziphus zeyheriana*	x	x
Rosaceae	*Cliffortia nitidula*		x
	Erobotrya japonica	x	
	Rubus rigidus		x
Rubiaceae	*Afrocanthium gilfillanii*		x
	Anthospermum hispidulum		x
	Galium capense		x
	Galium spurium-aparine		x
	Kohautia amatymbica	x	
	Pentanisia angustifolia	x	x
	Vangueria infausta		x

Family	Species	Recorded	POSA
Santalaceae	*Osyris lanceolata*	x	x
	Thesium costatum		x
	Thesium deceptum		x
	Thesium exile		x
	Thesium rasum		x
	Thesium sp.		x
	Thesium transvaalense		x
	Thesium utile		x
	Thesium zeyheri		x
Sapindaceae	*Pappea capensis*		x
Sapotaceae	*Mimusops zeyheri*		x
Scrophulariaceae	*Buddleja saligna*		x
	Diclis rotundifolia		x
	Jamesbrittenia burkeana		x
	Selago capitellata		x
Solanaceae	*Datura stramonium*		x
	Physalis angulata		x
	Solanum campylacanthum		x
	Solanum humile		x
	Solanum mauritianum	x	
	Solanum retroflexum		x
	Solanum sisymbriifolium	x	x
	Solanum sp.	x	
	Withania somnifera		x
Thymelaeaceae	*Gnidia caffra*	x	
	Lasiosiphon caffer		x
	Lasiosiphon capitatus		x
	Lasiosiphon kraussianus		x
	Passerina falcifolia		x
Verbenaceae	*Lippia wilmsii*		x
	Verbena aristigera	x	
	Verbena boniariensis	x	
Vitaceae	*Rhoicissus tridentata*	x	x

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

The proposed development of a village estate for abandoned and orphaned children, De Deur, Gauteng.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Leigh-Ann de Wet			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	3 (Communic)	Percentage Procurement recognition	N/A
Specialist name:	LEIGH-ANN DE WET			
Specialist Qualifications:	MSc (BOTANY RHODES)		Pri. Sci. Nat. (ECOLOGY)	
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E-mail:	leighann.dewet@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, LEIGH-ANN DE WET, declare that –

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

LEIGH-ANN DE WET

Name of Company:

17 NOVEMBER 2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, LEIGH-ANN DE WET, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

LEIGH-ANN DE WET
Name of Company

17 NOVEMBER 2019
Date

Signature of the Commissioner of Oaths

17/11/2019
Date

I certify that the DEPONENT has acknowledged that he/she knows and understands the contents of this affidavit that he/she does not have any objection to taking the oath, and that he/she considers it to be binding on his/her conscience, and which was sworn to and signed before me S. DE WET on this the 17 day of NOVEMBER 20 19 and that the administering oath complied with the regulations contained in Government Gazette No. R1258 of 21 July 1972, as amended

(SAICA NO. 0711597 3)

SUSAN CLAIRE DE WET CA (SA)
1 Montgomery Drive, Mount Edgecombe

APPENDIX G3: ARCHAEOLOGICAL IMPACT ASSESSMENT

An EOH Company

PROPOSED DOOR OF HOPE VILLAGE PROJECT, SEDIBENG DISTRICT MUNICIPALITY, GAUTENG PROVINCE

Archaeological Impact Assessment

Prepared for: **CES**

Prepared by: **Exigo Sustainability**

ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) ON A PORTION OF THE FARM HARTSENBERGFONTEIN 332I FOR THE PROPOSED DOOR OF HOPE VILLAGE PROJECT, SEDIBENG DISTRICT MUNICIPALITY, GAUTENG PROVINCE

Compiled for:
EOH Coastal & Environmental Services

Compiled by:

Neels Kruger

DOCUMENT DISTRIBUTION LIST

Name	Institution
Michael Johnson	EOH Coastal & Environmental Services

DOCUMENT HISTORY

Date	Version	Status
29 November 2018	1.0	Draft
10 December 2018	2.0	Final Draft
26 July 2019	3.0	Final

DECLARATION

I, Nelius Le Roux Kruger, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed Door of Hope Village Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, including the relevant Heritage Legislation (National Heritage Resources Act no. 25 of 1999, Human Tissue Act 65 of 1983 as amended, Removal of Graves and Dead Bodies Ordinance no. 7 of 1925, Excavations Ordinance no. 12 of 1980), the Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment (SAHRA and the CRM section of ASAPA), regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this declaration are true and correct.

_____

Signature of specialist
Company: Exigo Sustainability
Date: 26 July 2019

EXECUTIVE SUMMARY

This report details the results of an Archaeological Impact Assessment (AIA) study subject to an Environmental Basic Assessment (BA) process for the establishment of the proposed Door of Hope Village situated on a portion of the farm Hartsenbergfontein 332IQ north of Walkerville area of the Gauteng Province. The project entails the establishment of the new Door of Hope Village centre over a surface portion of approximately 24ha. The report includes background information on the area's archaeology, its representation in Southern Africa, and the history of the larger area under investigation, survey methodology and results as well as heritage legislation and conservation policies. A copy of the report will be supplied to the Gauteng Provincial Heritage Resources Authority (Gauteng-PHRA) and recommendations contained in this document will be reviewed.

Project Title	Door of Hope Village Project
Project Location	S26.38182° E27.96623°
1:50 000 Map Sheet	2627BD
Farm Portion / Parcel	Hartsenbergfontein 332IQ
Magisterial District / Municipal Area	Sedibeng District Municipality
Province	Gauteng Province

A number of archaeological and historical studies have been conducted in this section of the Gauteng most of which infer a varied and rich heritage landscape. The literature shows traces of Iron Age farmer presence and a rich Colonial frontier denoting European farmer expansion. The landscape that encompasses the Door of Hope Village footprints seems to have been inhabited continuously for centuries in prehistoric and historical times, the remnants of which are visible in transformed agriculture and rural settlement areas. The following general recommendations are made based on general observations in the proposed Door of Hope Village area pertaining to a number of identified occurrences of heritage potential:

- A number of monoliths used as fencing posts occur on the property along disused agricultural fields. The utilization of these natural features during historical and recent times for agricultural purposes is a common occurrence across farming areas in South Africa and the monoliths do not carry implicit historical significance. No action in terms of heritage mitigation is required for these features.
- The remains of a Historical Period "kraal" (**Site Exigo-DOH-HP01**) occurring along the northern periphery of the project is rated as low heritage significance as no material culture or man-made structures occur at the poorly preserved site. The "kraal" occurs within the project area and it is recommended that the area be monitored by an informed ECO in order to avoid the destruction of previously undetected heritage remains.
- An informal burial site containing at least 3 graves (**Site Exigo-DOH-BP01)** occurs within the project development area. The site is of high significance and a 50m conservation buffer is required for the burial site as a primary measure. It is recommended that infrastructure components proposed for the project avoid encroaching on the required 50m conservation buffer. In addition it is recommended that the burial site be fenced off with wire, chicken wire or palisade fencing of a minimum height of 1.8m placed no closer than 2m from the burials. An access gate should be erected and access control should be applied to the site. A heritage Site Management Plan (SMP) should be compiled for the burials to stipulate conservation measures, responsible persons and chance find procedures for further heritage

mitigation. The developer should carefully liaise with the heritage specialist, SAHRA as well as local communities and possible affected parties with regards to the management and monitoring of any human grave or cemetery in order to detect and manage negative impact on the sites. **Should impact on the burial site prove inevitable, full grave relocations are recommended for these burial grounds. This measure should be undertaken by a qualified archaeologist, and in accordance with relevant legislation, permitting, statutory permissions and subject to any local and regional provisions and laws and by-laws pertaining to human remains. A full social consultation process with the Kamffer family and other affected parties should occur in conjunction with the mitigation of cemeteries and burials (see Addendum B).**

- Considering the localised nature of heritage remains, the general monitoring of the development progress by an ECO is recommended during planning and construction phases of the project.. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately
- It is essential that cognisance be taken of the larger archaeological landscape of the area in order to avoid the destruction of previously undetected heritage sites. It should be stated that the possibility of undetected archaeological remains occurring elsewhere in the project area should not be excluded. Burials and historically significant structures dating to the Colonial Period occur on farms in the area and these resources should be avoided during all phases of construction and development, including the operational phases of the development

Door of Hope Village Project Heritage Sites Locations

Site Code	Coordinate S E	Short Description	Mitigation Action
EXIGO-DOH-BP01	S26.37828° E27.96456°	Burial Site	Site monitoring, avoidance, 100m conservation buffer, site management. Grave relocation subject to authorisations and permitting if impacted on.
EXIGO-DOH-HP01	S26.37687° E27.96554°	Historical Period Site	Site monitoring.

This report details the methodology, limitations and recommendations relevant to these heritage areas, as well as areas of proposed development. It should be noted that recommendations and possible mitigation measures are valid for the duration of the development process, and mitigation measures might have to be implemented on additional features of heritage importance not detected during this Phase 1 assessment (e.g. uncovered during the construction process).

NOTATIONS AND TERMS/TERMINOLOGY

Absolute dating: Absolute dating provides specific dates or range of dates expressed in years.

Archaeological record: The archaeological record minimally includes all the material remains documented by archaeologists. More comprehensive definitions also include the record of culture history and everything written about the past by archaeologists.

Artefact: Entities whose characteristics result or partially result from human activity. The shape and other characteristics of the artefact are not altered by removal of the surroundings in which they are discovered. In the Southern African context examples of artefacts include potsherds, iron objects, stone tools, beads and hut remains.

Assemblage: A group of artefacts recurring together at a particular time and place, and representing the sum of human activities.

Context: An artefact's context usually consists of its immediate *matrix*, its *provenience* and its *association* with other artefacts. When found in *primary context*, the original artefact or structure was undisturbed by natural or human factors until excavation and if in *secondary context,* disturbance or displacement by later ecological action or human activities occurred.

Cultural Heritage Resource: The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

Cultural landscape: A cultural landscape refers to a distinctive geographic area with cultural significance.

Cultural Resource Management (CRM): A system of measures for safeguarding the archaeological heritage of a given area, generally applied within the framework of legislation designed to safeguard the past.

Feature: Non-portable artefacts, in other words artefacts that cannot be removed from their surroundings without destroying or altering their original form. Hearths, roads, and storage pits are examples of archaeological features

Lithic: Stone tools or waste from stone tool manufacturing found on archaeological sites.

Matrix: The material in which an artefact is situated (sediments such as sand, ashy soil, mud, water, etcetera). The matrix may be of natural origin or human-made.

Midden: Refuse that accumulates in a concentrated heap.

Microlith: A small stone tool, typically knapped of flint or chert, usually about three centimetres long or less.

Monolith: A geological feature such as a large rock, consisting of a single massive stone or rock, or a single piece of rock placed as, or within, a monument or site.

Phase 1 CRM Assessment: An Impact Assessment which identifies archaeological and heritage sites, assesses their significance and comments on the impact of a given development on the sites. Recommendations for site mitigation or conservation are also made during this phase.

Phase 2 CRM Study: In-depth studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required. Mitigation / Rescue involves planning the protection of significant sites or sampling through excavation or collection (in terms of a permit) at sites that may be lost as a result of a given development.

Phase 3 CRM Measure: A Heritage Site Management Plan (for heritage conservation), is required in rare cases where the site is so important that development will not be allowed and sometimes developers are encouraged to enhance the value of the sites retained on their properties with appropriate interpretive material or displays.

Provenience: Provenience is the three-dimensional (horizontal and vertical) position in which artefacts are found. Fundamental to ascertaining the provenience of an artefact is *association,* the co-occurrence of an artefact with other archaeological remains; and *superposition,* the principle whereby artefacts in lower levels of a matrix were deposited before the artefacts found in the layers above them, and are therefore older.

Random Sampling: A probabilistic sampling strategy whereby randomly selected sample blocks in an area are surveyed. These are fixed by drawing coordinates of the sample blocks from a table of random numbers.

Site (Archaeological): A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity. These include surface sites, caves and rock shelters, larger open-air sites, sealed sites (deposits) and river deposits. Common functions of archaeological sites include living or habitation sites, kill sites, ceremonial sites, burial sites, trading, quarry, and art sites,

Stratigraphy: This principle examines and describes the observable layers of sediments and the arrangement of strata in deposits

Systematic Sampling: A probabilistic sampling strategy whereby a grid of sample blocks is set up over the survey area and each of these blocks is equally spaced and searched.

LIST OF ABBREVIATIONS

Abbreviation	Description
ASAPA	Association for South African Professional Archaeologists
AIA	Archaeological Impact Assessment
BP	Before Present
BCE	Before Common Era
BGG	Burial Grounds and Graves
CRM	Culture Resources Management
ECO	Enviromental Control Officer
EIA	Early Iron Age (also Early Farmer Period)
EIA	Environmental Impact Assessment
EFP	Early Farmer Period (also Early Iron Age)
ESA	Earlier Stone Age
GIS	Geographic Information Systems
HIA	Heritage Impact Assessment
ICOMOS	International Council on Monuments and Sites
K2/Map	K2/Mapungubwe Period
LFP	Later Farmer Period (also Later Iron Age)
LIA	Later Iron Age (also Later Farmer Period)
LSA	Later Stone Age
MIA	Middle Iron Age (also Early later Farmer Period)
MSA	Middle Stone Age
NHRA	National Heritage Resources Act No.25 of 1999, Section 35
PFS	Pre-Feasibility Study
PHRA	Provincial Heritage Resources Authority
SAHRA	South African Heritage Resources Association
YCE	Years before Common Era (Present)

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1 BACKGROUND

1.1 Scope and Motivation

Exigo Sustainability was commissioned by CES for an Archaeological Impact Assessment (AIA) study subject to an Environmental Basic Assessment (BA) process for the Door of Hope Village in the Sedibeng District Municipality, Gauteng Province. The rationale of this AIA is to determine the presence of heritage resources such as archaeological and historical sites and features, graves and places of religious and cultural significance in previously unstudied areas; to consider the impact of the proposed project on such heritage resources, and to submit appropriate recommendations with regard to the cultural resources management measures that may be required at affected sites / features.

1.2 Project Direction

Exigo Sustainability's expertise ensures that all projects be conducted to the highest international ethical and professional standards. As archaeological specialist for Exigo Sustainability, Mr Nelius Kruger acted as field director for the project; responsible for the assimilation of all information, the compilation of the final consolidated AIA report and recommendations in terms of heritage resources on the demarcated project areas. Mr Kruger is an accredited archaeologist and Culture Resources Management (CRM) practitioner with the Association of South African Professional Archaeologists (ASAPA), a member of the Society for Africanist Archaeologists (SAFA) and the Pan African Archaeological Association (PAA) as well as a Master's Degree candidate in archaeology at the University of Pretoria.

1.3 Project Brief

Door of Hope is proposing the establishment of a new village near Walkerville within the Sedibeng District Municipality of the Gauteng Province. In particular, the project which will cover a surface portion of approximately 24ha on the farm Hartsenbergfontein 332IQ, will consist of the following:

- Residential House
- Office Block
- School Buildings
- Dining Hall
- Sports Fields / Courts
- Vegetable Gardens
- Baby House
- Medical Facility
- Early Childhood Development Centre
- Play Areas
- Main Roads
- Paved walkways/ bike paths

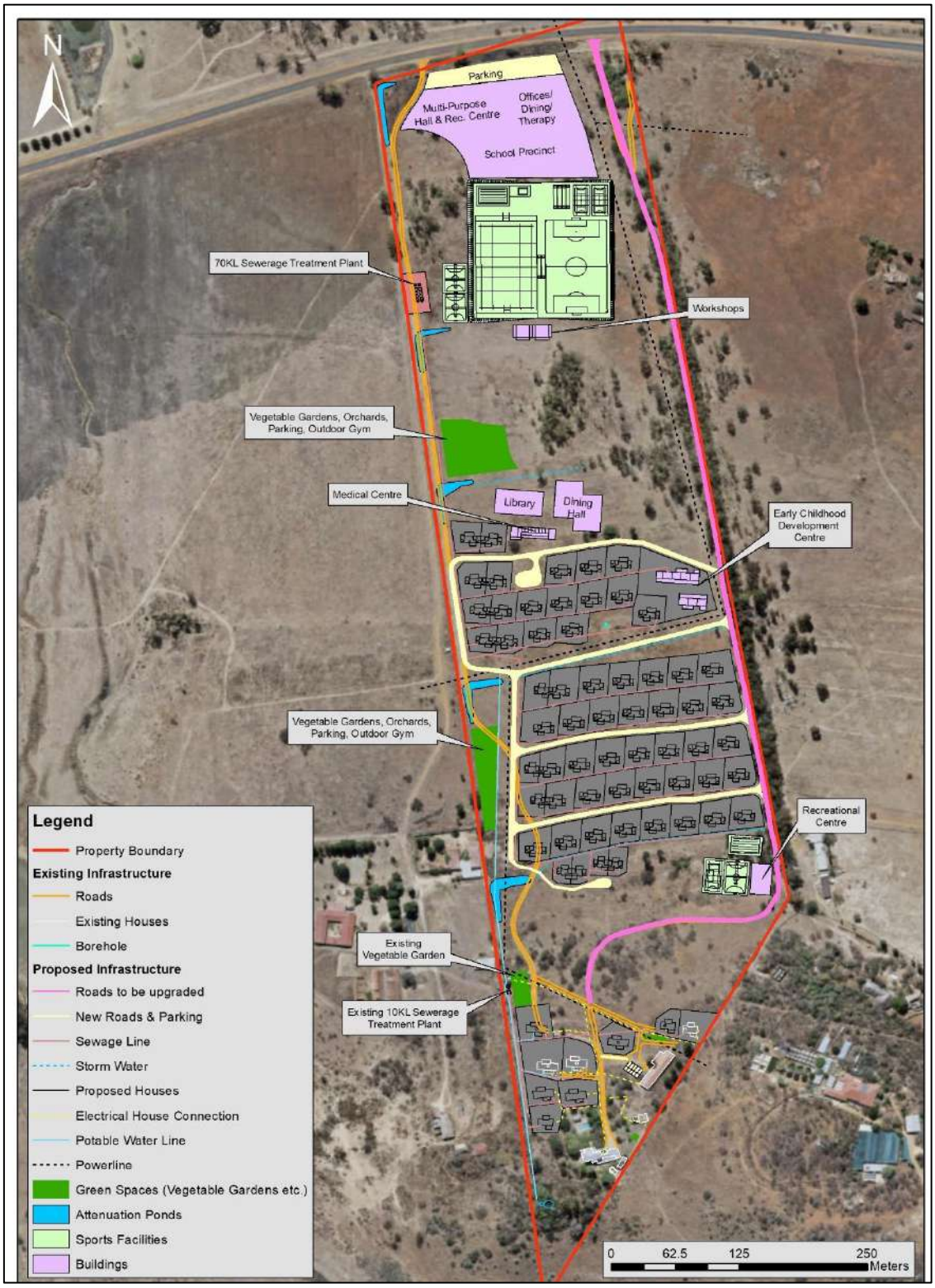

Figure 1-1: Project map indicating infrastructure components proposed for the Door of Hope Village.

1.4 Terms of Reference

Heritage specialist input into the Environmental Impact Assessment (EIA) process is essential to ensure that, through the management of change, developments still conserve our heritage resources. Heritage specialist input in EIA processes can play a positive role in the development process by enriching an understanding of the past and its contribution to the present. It is also a legal requirement for certain development categories which may have an impact on heritage resources (Refer to Section 2.5.2).

Thus, EIAs should always include an assessment of heritage resources. The heritage component of the EIA is provided for in the **National Environmental Management Act, (Act 107 of 1998)** and endorsed by section 38 of the **National Heritage Resources Act (NHRA - Act 25 of 1999)**. In addition, the NHRA protects all structures and features older than 60 years, archaeological sites and material and graves as well as burial sites. The objective of this legislation is to ensure that developers implement measures to limit the potentially negative effects that the development could have on heritage resources. Based hereon, this project functioned according to the following **terms of reference for** heritage specialist input**:**

- *Provide a detailed description of all archaeological artefacts, structures (including graves) and settlements which may be affected, if any.*
- *Assess the nature and degree of significance of such resources within the area.*
- *Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance;*
- *Assess and rate any possible impact on the archaeological and historical remains within the area emanating from the proposed development activities.*
- *Propose possible heritage management measures provided that such action is necessitated by the development.*
- *Liaise and consult with the South African Heritage Resources Agency (SAHRA)*

1.5 CRM: Legislation, Conservation and Heritage Management

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

1.5.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and its provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

a. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act No 25 of 1999 (section 35) the following features are protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years

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

In addition, the national estate includes the following:

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

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."

b. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves and burial grounds are commonly divided into the following subsets:

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

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant local authorities.

c. National Heritage Resources Act No 25 of 1999, section 35

This act (Act 107 of 1998) states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made. Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

1.5.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs

and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

A detailed guideline of statutory terms and requirements is supplied in Addendum 1.

2 REGIONAL CONTEXT

2.1 Area Location

The project area for the Door of Hope Village is located on a portion of the farm Hartsenbergfontein 332IQ north-east of Walkerville within the Sedibeng District Municipality of the Gauteng Province. The Johannesburg CBD is situated more or less 25km to the north and Vereeniging occurs 30km south of the project area. The project footprint appears on 1:50 000 map sheets **2627BD** (see Figure 2-1), more or less at the following geographical point:

- **S26.38182° E27.96623°**

2.2 Area Description: Receiving Environment

The development site lies within the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The original vegetation is classified as Moist Cool Highveld Grassland. The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. The general landscape is characterised by undulating, Highveld grassland that is drained by the Klein-Rietspruit. The Vaal River flows approximately 35km south of the study area. The Walkerville area is situated approximately 1 500m above sea level. It has an annual summer rainfall of 650 mm per annum. The geology is made up of volcanic rock to the west and shale in the east.

2.3 Site Description

The landscape on the farm Hartsenbergfontein 332IQ is generally an open flat piece of land delineated by farm boundaries. The survey area is approximately 24 hectares in extent. The current land-use of the proposed development site is accommodation and recreation for the Door of Hope centre along the southern edge of the property where a number of buildings and refuse dumps occur along a rocky outcrop. Here, a large residential house with associated features such a water fountain and concrete hedge seems to date to the 1960's. Large portions of the project area have been converted to agricultural fields in past decades and a large embankment dam occurs in a central portion. Neighbouring farms are being used for livestock grazing, farming and tourism.

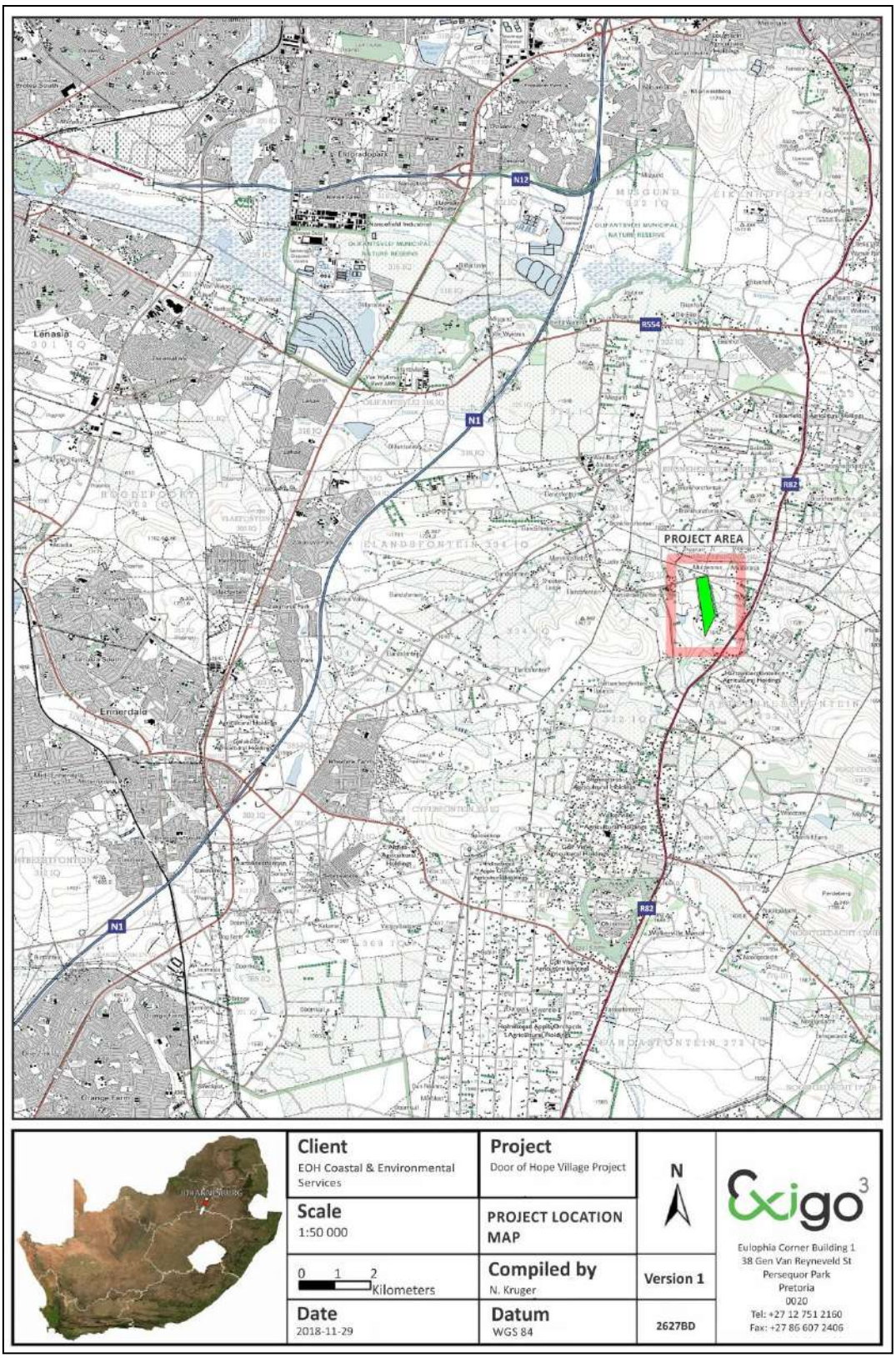

Figure 2-1: 1:50 00 Map representation of the location of the proposed Door of Hope Village (sheet 2627BD).

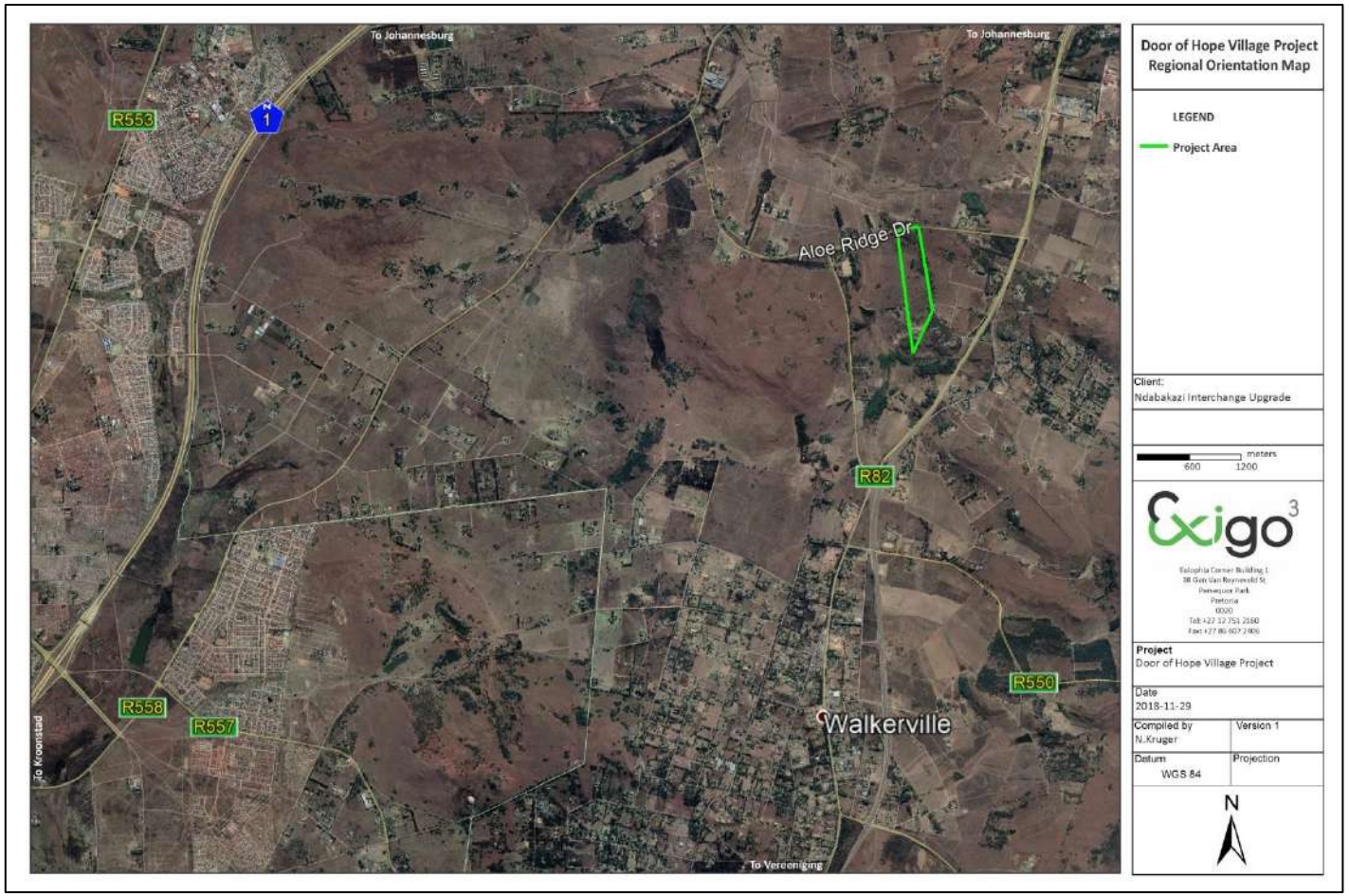

Figure 2-2: Aerial map providing a regional setting for the Door of Hope Village project locality.

3 METHOD OF ENQUIRY

3.1 Sources of Information

Data from detailed desktop, aerial and field studies were employed in order to sample surface areas systematically and to ensure a high probability of heritage sites recording.

3.1.1 Desktop Study

A desktop study was prepared in order to contextualize the proposed project within a larger historical milieu. As such, the study functioned to provide a historical context for the proposed project and archival sources, aerial photographs, historical maps and local histories were used to create a baseline of the landscape's heritage. This desktop study also relied on commercially driven Heritage Assessments as well as academic papers and research articles that have been conducted in the region around the project area.

3.1.2 Aerial Representations and Survey

Aerial photography is employed to locate and study archaeological sites, particularly where larger scale area surveys are performed. This method was applied to assist the foot site survey where depressions, variation in vegetation, soil marks and landmarks were examined. Specific attention was given to shadow sites (shadows of walls or earthworks which are visible early or late in the day), crop mark sites (crop mark sites are visible because disturbances beneath crops cause variations in their height, vigour and type) and soil marks (e.g. differently coloured or textured soil (soil marks) might indicate ploughed-out burial mounds). Attention was also given to moisture differences, as prolonged dampening of soil as a result of precipitation frequently occurs over walls or embankments. By superimposing high frequency aerial photographs with images generated with Google Earth, potential sensitive areas were subsequently identified, geo-referenced and transferred to a handheld GPS device. These areas served as referenced points from where further vehicular and pedestrian surveys were carried out. The aerial survey suggested a landscape that has been transformed over the last century by human activity relating to agriculture and settlement (see Figure 3-1).

3.1.3 Mapping of sites

Historical and current maps of the project area were examined (see Figure 3-2). By merging data obtained from the desktop study and the aerial survey, sites and areas of possible heritage potential were plotted on these maps of the larger Walkerville area using GIS software. These maps were then superimposed on high definition aerial representations in order to graphically demonstrate the geographical locations and distribution of potentially sensitive landscapes. Historical maps of the project area indicate the presence of man-made features such a farmstead, a dam and later buildings on the property (see Figure 3-2).

3.1.4 Field Survey

Archaeological survey implies the systematic procedure of the identification of archaeological sites. An archaeological survey of the Door of Hope project area subject to this study were conducted on 22 November 2018. The survey process encompassed field surveys in accordance with standard archaeological practice by which heritage resources are observed and documented. In order to sample surface areas systematically and to ensure a high probability of site recording, the entire project area was carefully inspected on foot by means of a transect survey. GPS reference points identified during the aerial and mapping surveys were also visited and random spot checks were made (see detail in previous section). Using a Garmin E-trex Montana GPS, the site was geo-referenced and photographed with a Samsung Digital camera. Real time aerial mapping and positioning by means of a hand-held tablet-based Google Earth application was also employed on site to investigate possible disturbed areas during the survey.

Figure 3-1: Historical aerial images dating to 1938 (left) and 1955 (right) indicating the development area within the historical landscape. Note the presence and absence of a farmstead along the northern border as well as a dwelling on the southern property border on the later image (white arrows). Agricultural fields are indicated by the green arrow.

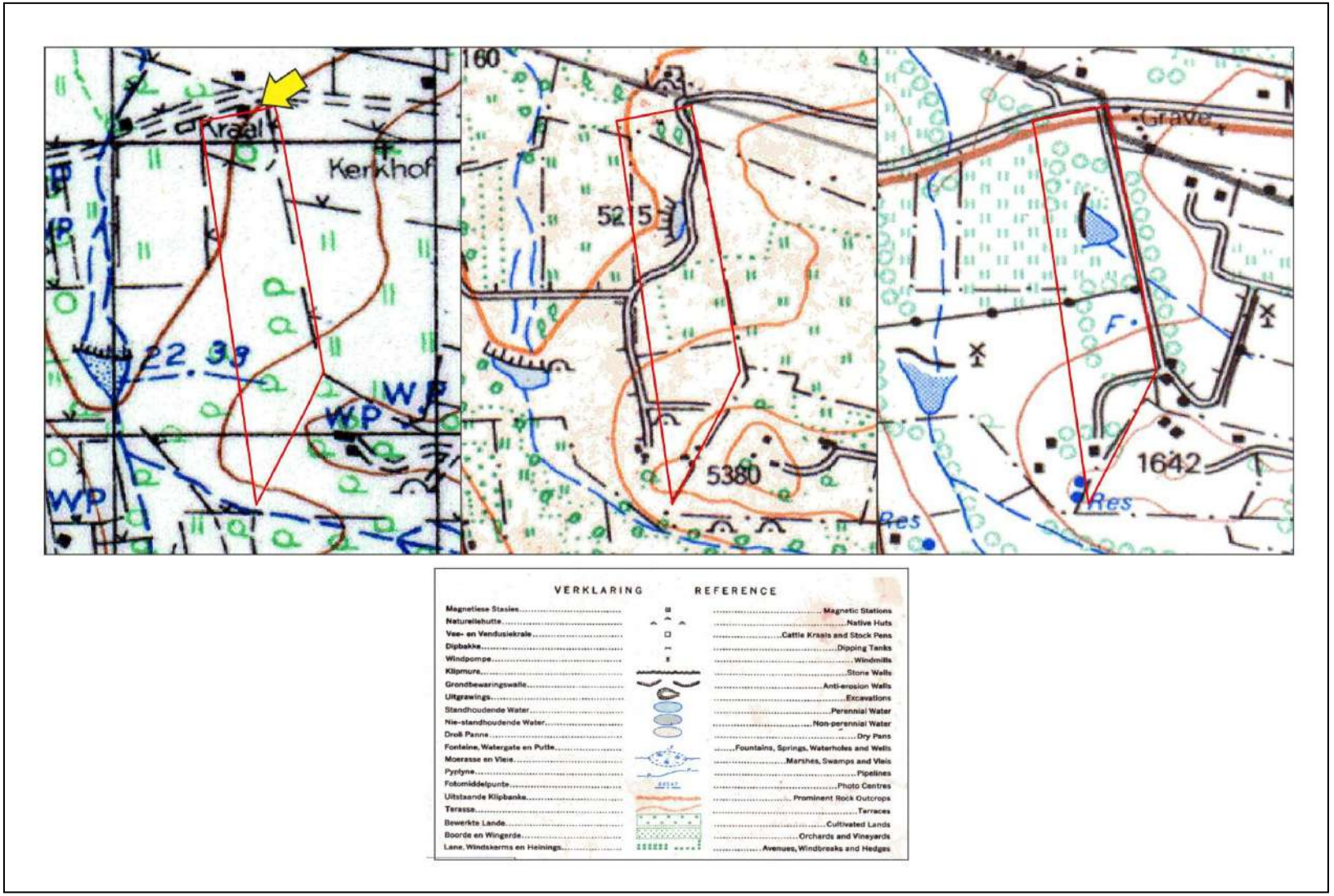

Figure 3-2: Historical topographic maps dating to 1944 (left), 1956 (middle) and 1976 (right) indicating the development area within the historical landscape. Note the presence of a "'kraal" (1944 - yellow arrow) and dwellings and structures on later maps.

3.1.5 General Public Liaison

Correspondence with the developer at the property provided information on the possible locations of heritage resources and brief commentaries on the recent history of the farm. He indicated that, besides for the informal cemetery, according to his knowledge no heritage resources were present within the area demarcated for development of new infrastructure, subject to this AIA Study.

3.2 Limitations

3.2.1 Access

The project area subject to this survey is accessed directly from Aloe Ridge Drive connecting to the R82 road. Access control is applied to the survey areas but no restrictions were encountered during the site visits in terms of access as the author was accompanied by the developer.

3.2.2 Visibility

The surrounding vegetation in the project area is mostly comprised out of mixed grassland, trees and scrubs and riparian vegetation along the dam. The general visibility at the time of the AIA survey (November 2018) ranged from low in densely vegetated areas to high in transformed regions (see Figures 3-3 to 3-18). In single cases during the survey sub-surface inspection was possible. Where applied, this revealed no archaeological deposits.

Figure 3-3: View of general surroundings in the project area.

Figure 3-4: View of the large embankment dam in the project area.

Figure 3-5: A modern structure present on the property.

Figure 3-6: The remains of a modern brick structure present on the property.

Figure 3-7: View of dense vegetation along the northern periphery of the site.

Figure 3-8: View of dense vegetation and pioneering species along the eastern border the site.

Figure 3-9: Partially destroyed braai structures in the project area.

Figure 3-10: View of old agricultural fields in the project area.

Figure 3-11: View of old agricultural fields in the project area.

Figure 3-12: View of old agricultural fields in the project area, looking north.

Figure 3-13: Large refuse dumps occurring in the project area along a rocky outcrop.

Figure 3-14: View of a large residence in a southern section of the project area.

Figure 3-15: The partially collapsed remains of a water fountain (left) and a concrete hedge at the modern residence.

Figure 3-16: View of new buildings for the Door of Hope centre in a southern section of the project area.

Figure 3-17: View of the current Door of Hope centre in a southern section of the project area.

3.2.3 Limitations and Constraints Summary

The foot and vehicular site survey for the Door of Hope Village primarily focused around areas of potential heritage sensitivity as well as areas of high human settlement catchment probability (for example, in association with vegetation changes or around soil disturbances).

- **Visibility** proved to be a minor constraint where denser surface cover obscured surface occurrences.

Even though it might be assumed that survey findings are representative of the heritage landscape of the project area for the Door of Hope Village, it should be stated that the possibility exists that individual sites could be missed due to the localised nature of some heritage remains as well as the possible presence of sub-surface archaeology. Therefore, maintaining due cognisance of the integrity and accuracy of the archaeological survey, it should be stated that the heritage resources identified during the study do not necessarily represent all the heritage resources present in the project area. The subterranean nature of some archaeological sites, dense vegetation cover and visibility constraints sometimes distort heritage

representations and any additional heritage resources located during consequent development phases must be reported to the Heritage Resources Authority or an archaeological specialist.

3.3 Impact Assessment

For consistency among specialists, impact assessment ratings by Exigo Specialists are generally done using the Plomp[1] impact assessment matrix scale supplied by Exigo. According to this matrix scale, each heritage receptor in the project area is given an impact assessment. An assessment of potential heritage impacts for the proposed project is included in this report (see Section 6).

4 ARCHAEO-HISTORICAL CONTEXT

4.1 The archaeology of Southern Africa

Archaeology in Southern Africa is typically divided into two main fields of study, the **Stone Age** and the **Iron Age** or **Farmer Period**. The following table provides a concise outline of the chronological sequence of periods, events, cultural groups and material expressions in Southern African pre-history and history.

Table 1 Chronological Periods across Southern Africa

Period	Epoch	Associated cultural groups	Typical Material Expressions
Early Stone Age 2.5m – 250 000 YCE	Pleistocene	Early Hominins: *Australopithecines* *Homo habilis* *Homo erectus*	Typically large stone tools such as hand axes, choppers and cleavers.
Middle Stone Age 250 000 – 25 000 YCE	Pleistocene	First *Homo sapiens* species	Typically smaller stone tools such as scrapers, blades and points.
Late Stone Age 20 000 BC – present	Pleistocene / Holocene	*Homo sapiens sapiens* including San people	Typically small to minute stone tools such as arrow heads, points and bladelets.
Early Iron Age / Early Farmer Period 300 – 900 AD	Holocene	First Bantu-speaking groups	Typically distinct ceramics, bead ware, iron objects, grinding stones.
Middle Iron Age (Mapungubwe / K2) / early Later Farmer Period 900 – 1350 AD	Holocene	Bantu-speaking groups, ancestors of present-day groups	Typically distinct ceramics, bead ware and iron / gold / copper objects, trade goods and grinding stones.
Late Iron Age / Later Farmer Period 1400 AD -1850 AD	Holocene	Various Bantu-speaking groups including Venda, Thonga, Sotho-Tswana and Zulu	Distinct ceramics, grinding stones, iron objects, trade objects, remains of iron smelting activities including iron smelting furnace, iron slag and residue as well as iron ore.
Historical / Colonial Period ±1850 AD – present	Holocene	Various Bantu-speaking groups as well as European farmers, settlers and explorers	Remains of historical structures e.g. homesteads, missionary schools etc. as well as, glass, porcelain, metal and ceramics.

4.2 The Gauteng and Landscape: Specific Themes.

The archaeological history of the Gauteng Province dates back to about 2 million years and possibly older.

[1] Plomp, H.,2004

Several archaeological sites have been recorded in the landscape around Barkly East. A number of Archaeological Impact Assessments (e.g. Coetzee 2003, Roodt 2008, Van Schalkwyk 2010 and Pistorius 2007) have been conducted in the Walkerville area. Generally, sites documenting Earlier, Middle and Later Stone Age habitation occur across the Highveld, mostly in open air locales or in sediments alongside rivers or pans. Sites dating to the Iron Age occur on the Highveld where environmental factors and population density delegated that the spread of Iron Age farming. Moving into recent times, the archaeological record reflects the development of a rich colonial frontier, characterised by, amongst others, a complex industrial archaeological landscape such as mining developments and war events, which herald the modern era in South African history.

4.2.1 The Stone Ages

The Earlier Stone Age, from between 1.5 million and 250 000 years ago, refers to the earliest that *Homo sapiens sapiens'* predecessors began making stone tools. The earliest stone tool industry was referred to as the Olduwan Industry, originating from stone artefacts recorded at Olduvai Gorge, Tanzania. The Acheulian Industry, the predominant Southern African Early Stone Age Industry, which replaced the Olduwan Industry approximately 1.5 million years ago, is attested to in diverse environments and over wide geographical areas. The hallmark of the Acheulian Industry is its large cutting tools (LCTs or bifaces), primarily handaxes and cleavers. The most well-known Early Stone Age site in Southern Africa is Amanzi Springs, situated about 10km north-east of Uitenhage, near Port Elizabeth (Deacon 1970). In a series of spring deposits a large number of stone tools were found in situ to a depth of 3-4m. Wood and seed material preserved remarkably very well within the spring deposits, and possibly date to between 800 000 to 250 000 years old. Large stone ESA tools are often found associated with the gravels in the area, and were later replaced by smaller stone tools called the Middle Stone Age (MSA) flake and blades industries.

The Middle Stone Age (MSA) spans a period from 250 000-30 000 years ago and focuses on the emergence of modern humans through the change in technology, behaviour, physical appearance, art and symbolism. The large handaxes and cleavers were replaced by smaller stone artefacts called the MSA flake and blade industries. Surface scatters of these flake and blade industries occur widespread across Southern Africa. The majority of MSA sites occur on flood plains and sometimes in caves and rock shelters. Sites usually consist of large concentrations of knapped stone flakes such as scrapers, points and blades and associated manufacturing debris.

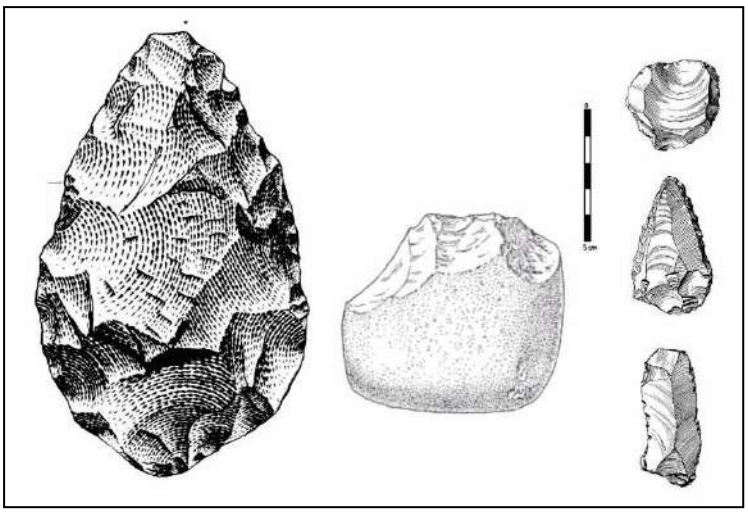

Figure 4-1: Typical ESA handaxe (left) and cleaver (center). To the right is a MSA scraper (right, top), point (right, middle) and blade (right, bottom).

The Later Stone Age (LSA) spans the period from about 20 000 years ago until the colonial era, although some communities continue making stone tools today. The period between 30 000 and 20 000 years ago is referred to as the transition from the MSA to LSA; although there is a lack of crucial sites and evidence that represent this change. The LSA is marked by a series of technological innovations, new tools and artefacts, the development of economic, political and social systems, and core symbolic beliefs and rituals. The stone toolkits changed over time according to time-specific needs and raw material availability, from smaller microlithic Robberg, Wilton Industries and in between, the larger Albany/Oakhurst and the Kabeljous Industries. Bored stones used as part of digging sticks, grooved stones for sharpening and grinding and stone tools fixed to handles with mastic also become more common. Fishing equipment such as hooks, gorges and sinkers also appear within archaeological excavations. Most importantly bows and arrows revolutionized the hunting economy. It was only within the last 2000 years that earthenware pottery was introduced. Before then tortoiseshell bowls were used for cooking and ostrich eggshell (OES) flasks were used for storing water. Sites dating to the LSA are better preserved in rock shelters, although open sites with scatters of mainly stone tools can occur. Well-protected deposits in shelters allow for stable conditions that result in the preservation of organic materials such as wood, bone, hearths, ostrich eggshell beads and even bedding material.

The earliest ancestors of modern man may therefore have roamed the Vaal valley at the same time that their contemporaries occupied some of the dolomite caves near Krugersdorp. Middle Stone Age sites dating from as early as two hundred thousand years ago have been found all over South Africa. Middle Stone Age hunter-gatherer bands also lived and hunted in the Orange and Vaal River valleys. These people, who probably looked like modern humans, occupied campsites near water but also used caves as dwellings. They manufactured a wide range of stone tools, including blades and point s that may have had long wooden sticks as hafts and were used as spears. The Late Stone Age commenced twenty thousand years ago or somewhat earlier. The various types of Stone Age industries scattered across the country are associated with the historical San and Khoi-Khoi people. The San were renowned as formidable hunter-gatherers, while the Khoi-Khoi herded cattle and small stock during the last two thousand years. Late Stone Age people manufactured tools that were small but highly effective, such as arrow heads and knives. The Late Iron Age people were also known for their rock art skills. At least one rock engraving site exists near Vereeniging, at Redan.

4.2.2 The Iron Age Farmer Period

The beginnings of the Iron Age (Farmer Period) in southern Africa are associated with the arrival of a new Bantu speaking population group at around the third century AD. These newcomers introduced a new way of life into areas that were occupied by Later Stone Age hunter-gatherers and Khoekhoe herders. Distinctive features of the Iron Age are a settled village life, food production (agriculture and animal husbandry), metallurgy (the mining, smelting and working of iron, copper and gold) and the manufacture of pottery. Iron Age farming communities generally preferred to occupy river valleys within the eastern half of southern Africa owing to the summer-rainfall climate that was conducive for growing millet and sorghum. Even though much research has been conducted on the Iron Age (IA) across southern Africa, only a small portion has focused on the Gauteng. Complex stone wall clusters are scattered across the landscapes of the Southern Highveld and the Free State. These stone structures, commonly associated with Bantu speaking farming communities, are the remnants of a complex 500 year old sequence of stone wall building in central interior of South Africa. Tim Maggs, noted archaeologist of the later Farmer Period in southern Africa, named the first phase in this sequence “Type N” walling, dating to the 15th to 17th centuries AD (Maggs 1976). This phase, which mostly developed in the Free State, was characterised by central cattle kraals linked by outer walls, while the whole settlement was surrounded by a perimeter wall which also incorporated small stock enclosures. After the 17th century, the “Type N” style of building spread across the Vaal River in consecutive phases where it later became known as “Klipriviersberg” type walling (Taylor 1979a). These settlements

typically displayed outer scalloped walls that demarcated back courtyards, a large number of small stock kraals and straight walls which separated household units in the domestic zone. Beehive huts would have housed communities on these sites. The Klipriviersberg walling type dates to the 18th and 19th centuries and are associated with the Fokeng cluster of the Sotho-Tswana speaker group. These people used iron implements and there is a site of one of their kraals just to the east of the boundary between Hartzenbergfontein and Roodepoort. In addition, settlement remains occur in Grade Road, Walker's Fruit Farms; at the base of Perdeberg; and at plot 143 Homestead Apple Orchards as well as at Walkerville Manor.

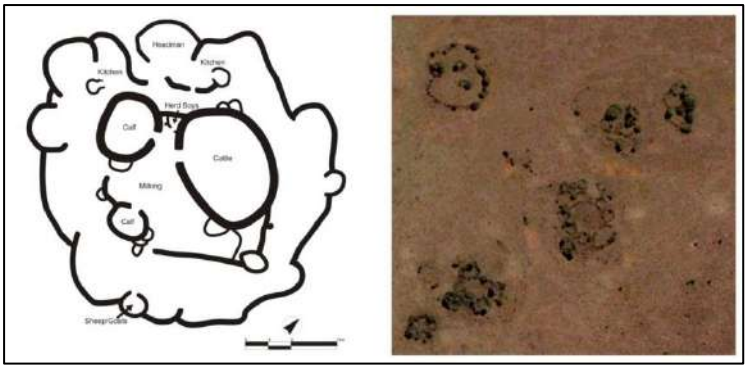

Figure 4-2: Characteristic Klipriviersberg-type stone walled settlements east of Vereeniging on the Highveld (after Huffman [2007

Figure 4-3: Iron Age stone walling on a small hill near Walkerville.

4.2.3 Historical and Colonial Times and Recent History

The first white person to settle in the Walkerville area was an unknown Voortrekker in about 1838. The remains of a hut built with the front axle of his wagon is near Dairy Cottage on Woodacres Dairy Farm. This Voortrekker sold the Hartzenbergfontein property to Hendrik Balthazar Greyling in about 1859 and the whole property, in extent over 3,422morgen was transferred to Greyling on the 11th December 1861. This deed of transfer has been lost but is referred to in numerous other deeds. Hendrik Greyling died in 1879 and his wife Anna Margaretha nee Scheepers split the farm into undivided portions amongst the nine children and herself. The children and their husbands purchased the undivided tenth shares for 15 pounds a share. Each share was equivalent to over 342 morgen. Each tenth share forms the basis of the present subdivision of Hartzenbergfontein, Walkerville and its surrounds being on two tenths of the original area. A further two sections are still owned by the descendants of the family, namely the two large Kamffer farms, one in

Hartzenbergfontein and one in Drumblade. The Kamffer family plays a prominent role in the histery of Walkerville and the farm Hartzenbergfontein. One of the Greyling daughters, Aletta Maria Gertiena, married Christoffel Johannis Kamffer and they settled on their portion of the farm, just South East of Aloe Ridge School. They had two sons, Hendrik and Willem Kamffer. In the latter part of the 19th century the district was composed of enormous farms. In the way that such matters were executed in those times, a farm's extent was measured by the distance a horse could walk in one day. This was about 3000 morgan, or 6 300 acres. There were no boundary fences and the law forbade any subdivision, except where portions were left to family members. Probably due to the lack of entertainment as much as any other reason, families were extremely large, and this often led to problems when the head of the family passed away. After the death of President Paul Kruger early in the last century, this statute fell away -sort of. As the population began to increase, people realised that land was a very valuable commodity, and thus began the division of these huge farms into the 5, 10 and 20 acre plots that most of us live on today. However, the law pronounced that only 50% of any one farm could be subdivided - the other half becoming a commonage on which the people who had bought the land parcels could graze their livestock.

Figure 4-4: View of the old Walkerville Post Office.

Figure 4-5: The ruined remains of the Kamffer farmstead building on the farm Hartsenbergfontein.

Figure 4-6: Hendrik Kamffer photographed in 1916.

Figure 4-7: The Kamffer family during the first part of the 20th century

5 RESULTS: ARCHAEOLOGICAL SURVEY

In terms of heritage resources, the landscape around the project area is primarily well known for the occurrence of Iron Age Farmer and Historical Period sites. The landscape around the proposed Door of Hope Village project remains pristine in places with the regular occurrence of transformed zones as a result of agriculture. Single occurrences of heritage potential were nonetheless identified in the project area and these were coded "**Exigo-DOH-HP"** (Exigo Door of Hope Village Historical Period) and "**Exigo-DOH-BP"** (Exigo Door of Hope Village Burial Place).

5.1 The Stone Age

Stone Age remains associated with caves, outcrops/hills and river courses are known to exist in the larger Gauteng landscape. However, no stone tools or associated material culture or evidence of any factory or workshop site were found in the project areas.

5.2 The Iron Age Farmer Period

A frontier zone between the east and the west, the Gauteng around the project area is rich in precolonial Iron Age Farmer Period remnants. However, the site inspection identified no Iron Age farmer sites.

5.3 Colonial / Historical Period Sites

European and local farming communities settled in the former Trans-Vaal region during the Colonial Period in the last centuries. The project area remained rural for the largest part of the previous century but aerial imagery dating to the first part of the 20th century indicate the occurrence of a Historical Period structure, possibly a small farmstead, along the northern periphery of the site. Literature notes that Christoffel Johannis Kamffer settled south east of Aloe Ridge School in this area but it is unclear if this structure is their farmstead (see Section 4.2.3). This structure disappeared from later imagery (see Figure 5-1) and no remnants of this feature were found during the site visit. In addition, a number of monoliths used as fencing posts occur on the property along disused agricultural fields. The utilization of these natural features during historical and recent times for agricultural purposes is a common occurrence across farming areas in South Africa and the monoliths does not carry implicit historical significance.

Figure 5-1: Historical aerial photo dating to 1938 (left) and 1955 (right) indicating the presence, and absence of a Historical Period structure in the project area.

Figure 5-2: Stone monolith fence posts along agriculture areas in the project area.

Figure 5-3: An example of stone fence posts in farming areas in the Eastern Cape of South Africa

- **Site Exigo-DOH-HP01: Historical / Colonial Period Building**
  S26.37687° E27.96554°

A number of upright stones and monoliths were noted along the northern periphery of the project area. Here, prickly pears (an alien plant species commonly associated with human habitation areas) grow in association with ashy soil around the stones. No material culture or man-made structures were noted at the site. An analysis of historical topographical maps and aerial photographs indicate the presence of a "kraal" by at least 1944 and it might be assumed that the "kraal" was related the possible farmstead visible on early aerial photos (see reference above). The occurrence is not indicated on later maps and it seems as though the feature disappeared with the assumed farmstead during the mid-1900s. As the site is generally devoid of material culture or man-made structures it carries limited heritage significance.

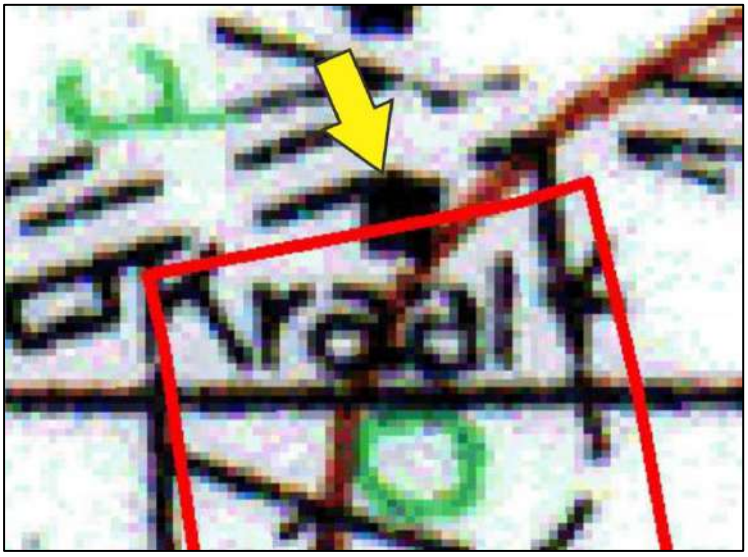

Figure 5-4: A "kraal" indicated on a 1944 topographic map at Site Exigo-DOH-HP01.

Figure 5-5: View of a stone structures and a prickly pear (left – background) at Site Exigo-DOH-HP01.

5.4 Graves / Human Burial Sites

A single burial site was documented in the project area. The burial place holds at least 3 graves, some of which are unmarked.

- **Site Exigo-DOH-BP01: Burial Site**
  S26.37828° E27.96456°

An informal cemetery containing at least 3 graves occurs along the north western border of the project area under a stand of Eucalyptus trees. One of the burials is indicated by slate rock headstone baring the following inscription:

Hier rus ons dierbare seuntjie
Willem Jacobus Kamffer
…(?) AUG 1913
OVERL 21 AUG 1914
HY RUS IN JEZUZ ARMS

It is highly likely that the grave belongs to an infant relative of one of the Kamffer family members who settled on the property and the surrounding farms, possibly within the context of the farmstead visible on early aerial imagery. However, it seems peculiar that the child was not buried with other Kamffer family members in the family cemetery on the neighbouring property near the ruins of the Kamffer homestead. In addition, two additional unmarked graves occur at the site. These burials are indicated by stone cairns and it's relation to the Kamffer grave is unclear. The burial site is of high heritage significance, it is situated within the development footprint of the project and a conservation buffer should be observed. Alternatively, the burials should be relocated according to the applicable social and statutory requirements, should impact prove inevitable.

Figure 5-6: View of the marked infant grave at Site Exigo-DOH-BP01.

Figure 5-7: View of an unmarked grave next to the infant grave at Site Exigo-DOH-BP01 (yellow arrow).

Figure 5-8: View of an unmarked grave near to the infant grave at Site Exigo-DOH-BP01 (yellow arrow).

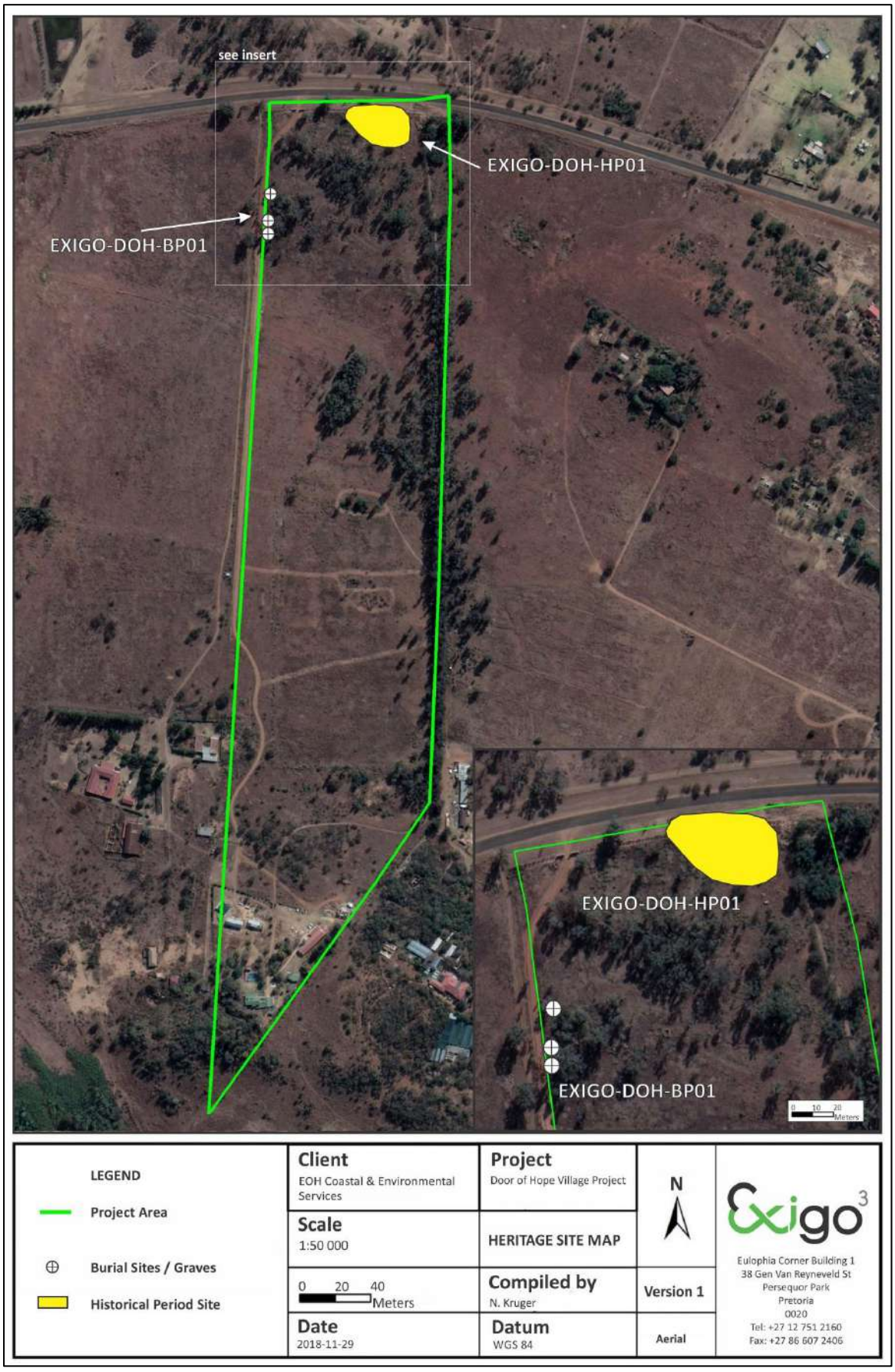

Figure 5-9: Aerial map indicating the locations of occurrences of heritage potential in the project area, discussed in the text.

6 RESULTS: STATEMENT OF SIGNIFICANCE AND IMPACT RATING

6.1 Potential Impacts and Significance Ratings[2]

The following section provides a background to the identification and assessment of possible impacts and alternatives, as well as a range of risk situations and scenarios commonly associated with heritage resources management. A guideline for the rating of impacts and recommendation of management actions for areas of heritage potential within the project area is supplied in Section 10.2 of the Addendum.

6.1.1 General assessment of impacts on resources

Generally, the value and significance of archaeological and other heritage sites might be impacted on by any activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). Thus, the destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. However, in the long run, the proximity of operations in any given area could result in secondary indirect impacts. The EIA process therefore specifies impact assessment criteria which can be utilised from the perspective of a heritage specialist study which elucidates the overall extent of impacts.

6.1.2 Direct impact rating

Direct or primary effects on heritage resources occur at the same time and in the same space as the activity, e.g. loss of historical fabric through demolition work. **Indirect effects or secondary effects** on heritage resources occur later in time or at a different place from the causal activity, or as a result of a complex pathway, e.g. restriction of access to a heritage resource resulting in the gradual erosion of its significance, which is dependent on ritual patterns of access (refer to Section 10.3 in the Addendum for an outline of the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected). The significances of the impacts were determined through a synthesis of the criteria below:

Probability: This describes the likelihood of the impact actually occurring.	
Improbable:	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable:	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly Probable	It is most likely that the impact will occur at some stage of the development.
Definite:	The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.
Duration: The lifetime of the impact	
Short term:	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
Medium term:	The impact will last up to the end of the phases, where after it will be negated.
Long term:	The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
Permanent:	Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.
Scale: The physical and spatial size of the impact	

[2] Based on: Winter, S. & Baumann, N. 2005. *Guideline for involving heritage specialists in EIA processes: Edition 1.*

Local:	The impacted area extends only as far as the activity, e.g. footprint
Site:	The impact could affect the whole, or a measurable portion of the above mentioned properties.
Regional:	The impact could affect the area including the neighbouring residential areas.
Magnitude/ Severity: Does the impact destroy the environment, or alter its function.	
Low:	The impact alters the affected environment in such a way that natural processes are not affected.
Medium:	The affected environment is altered, but functions and processes continue in a modified way.
High:	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.	
Negligible:	The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
Low:	The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
Moderate:	The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
High:	The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights were assigned to each attribute:

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2
	Medium	6
	High	8
Significance	**Sum (Duration, Scale, Magnitude) x Probability**	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity is rated without mitigation measures and with mitigation measures for both construction and operational phases of the development.

The following table summarizes impacts to the heritage receptors within and in close proximity of the project area:

Nr	Activity	Impact	Without or With Mitigation	Nature (Negative or Positive Impact)	Probability		Duration		Scale		Magnitude/ Severity		Significance		Mitigtion Measures
					Magnitude	Score	Magnitude	Score	Magnitude	Score	Magnitude	Score	Score	Magnitude	
Planning Phase															
	Site Exigo-DOH-HP01	Potential damage to Historical Period feature	**WOM**	**Negative**	Probable	2	Short term	1	Site	2	Low	2	14	Negligible	
1			**WM**	**Positive**	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	Frequent site monitoring by ECO.
	Site Exigo-DOH-BP01	Potential damage to burial sites	**WOM**	**Negative**	Probable	2	Short term	1	Site	2	High	8	22	Low	
2			**WM**	**Positive**	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	Frequent site monitoring by heritage specialist / ECO, heritage site management plan.
Construction Phase															
	Site Exigo-DOH-HP01	Potential damage to Historical Period feature	**WOM**	**Negative**	Probable	2	Long term	4	Site	2	Low	2	20	Negligible	
3			**WM**	**Positive**	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	Frequent site monitoring by ECO.
	Site Exigo-DOH-BP01	Potential damage to burial sites	**WOM**	**Negative**	Definite	5	Long term	4	Site	2	High	8	70	High	Site monitoring, avoidance, 100m conservation buffer, site management.
4			**WM**	**Positive**	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	Grave relocation subject to authorisations and permitting if impacted on.
Operational Phase															
	Site Exigo-DOH-HP01	Potential damage to Historical Period feature	**WOM**	**Negative**	Improbable	1	Permanent	5	Local	1	Low	2	8	Negligible	No further action required.
5			**WM**	**Positive**	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	
	Site Exigo-DOH-BP01	Potential damage to burial sites	**WOM**	**Negative**	Definite	5	Permanent	5	Site	2	High	8	75	High	Avoidance, 100m conservation buffer and implementation of site management plan.
6			**WM**	**Positive**	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	Grave relocation subject to authorisations and permitting if impacted on.

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6.2 Evaluation Impacts

Previous studies conducted in the larger Gauteng landscape around the project area suggest a rich and diverse archaeological landscape. The Door of Hope Village landscape has been inhabited continuously in prehistoric and historical times where large portions of land have been transformed for agriculture. Cognisance should be taken of archaeological material that might be present in surface and sub-surface deposits.

6.2.1 Archaeology

The study did not identify any archaeological receptors which will be directly impacted by the proposed project and no impact on archaeological sites or features is anticipated.

6.2.2 Built Environment

A number of Historical Period buildings relating to rural settlement occur in the general landscape and more recently constructed buildings occur in the project footprint. However, no impact on the built environment is anticipated.

6.2.3 Cultural Landscape

The larger area comprises a rich cultural horizon and the natural landscape surrounding the proposed project encompasses open grasslands, typical of the southern Highveld and rural Gauteng. The cultural landscape holds Iron Age remains, Colonial Period farmsteads and Historical towns. The proposed project is unlikely to result in a significant impact on the cultural landscape of this area.

6.2.4 Graves / Human Burials Sites

A burial site containing 3 graves was located in the project development footprint. These receptors are of high significance for their social and cultural value. The potential impact on the resources is anticipated to be high but this impact rating can be limited to an indelible impact by the implementation of mitigation measures (avoidance, site management, site monitoring / grave relocation) for the sites, if / when required.

In the rural areas of the Gauteng, graves and cemeteries sometimes occur within settlements or around homesteads but they are also randomly scattered around archaeological and historical settlements. The probability of additional and informal human burials encountered during development should thus not be excluded. In addition, human remains and burials are commonly found close to archaeological sites; they may be found in "lost" graveyards, or occur sporadically anywhere as a result of prehistoric activity, victims of conflict or crime. It is often difficult to detect the presence of archaeological human remains on the landscape as these burials, in most cases, are not marked at the surface. Human remains are usually observed when they are exposed through erosion. In some instances packed stones or rocks may indicate the presence of informal pre-colonial burials. If any human bones are found during the course of construction work then they should be reported to an archaeologist and work in the immediate vicinity should cease until the appropriate actions have been carried out by the archaeologist. Where human remains are part of a burial they would need to be exhumed under a permit from SAHRA (for pre-colonial burials as well as burials later than about AD 1500). Should any unmarked human burials/remains be found during the course of construction, work in the immediate vicinity should cease and the find must immediately be reported to the archaeologist, or the South African Heritage Resources Agency (SAHRA). Under no circumstances may burials be disturbed or removed until such time as necessary statutory procedures required for grave relocation have been met.

Heritage resources occur within the Door of Hope Village project zones and potential direct impacts on these heritage receptors are foreseen. However, these impacts can be mitigated and in the opinion of the author of this AIA study the proposed Door of Hope Village project may proceed from a culture resources management perspective on the condition that mitigation measures are implemented where applicable, and provided that no subsurface heritage remains are encountered during construction.

6.3 Management actions

Recommendations for relevant heritage resources management actions are vital to the conservation of heritage resources. A general guideline for recommended management actions is included in Section 10.4 of the Addendum. The following management measures should be considered during implementation of the proposed Door of Hope Village.

OBJECTIVE: prevent unnecessary disturbance and/or destruction of previously undetected heritage receptors.

- *For the Historical Period remains if a "kraal" of low significance (***Site Exigo-DOH-HP01)** *within the project area the following are required in terms of heritage management and mitigation:*

PROJECT COMPONENT/S	All phases of construction and operation.		
POTENTIAL IMPACT	Damage/destruction of sites.		
ACTIVITY RISK/SOURCE	Digging foundations and trenches into sensitive deposits that are not visible at the surface.		
MITIGATION: TARGET/OBJECTIVE	To conserve the historical fabric of the sites and to locate undetected heritage remains as soon as possible after disturbance so as to maximize the chances of successful rescue/mitigation work.		
MITIGATION: ACTION/CONTROL		**RESPONSIBILITY**	**TIMEFRAME**
Fixed Mitigation Procedure (**required**)			
Site Monitoring: Regular examination of trenches and excavations.		ECO, HERITAGE ASSESSMENT PRACTITIONER	Monitor as frequently as practically possible.
PERFORMANCE INDICATOR	Archaeological sites are discovered and mitigated with the minimum amount of unnecessary disturbance.		
MONITORING	Successful location of sites by person/s monitoring.		

- *For the highly significant burial site (**Site Exigo-DOH-BP01)** occurring within the project area the following are required in terms of heritage management and mitigation:*

PROJECT COMPONENT/S	All phases of construction and operation.		
POTENTIAL IMPACT	Damage/disturbance to subsurface burials and surface burial features.		
ACTIVITY RISK/SOURCE	Digging foundations and trenches into sensitive deposits that are not visible at the surface.		
MITIGATION: TARGET/OBJECTIVE	To locate human burials as soon as possible after disturbance so as to maximize the chances of successful rescue/mitigation work.		
MITIGATION: ACTION/CONTROL		**RESPONSIBILITY**	**TIMEFRAME**
Preferred Mitigation Procedure			

Avoidance: Implement a heritage conservation buffer of at least 50m around the grave / cemeteries, if necessary redesign the project infrastructure to avoid the heritage resource and the proposed conservation buffer. Fence all burial places and apply access control. Implement a site management plan detailing strict site management conservation measures.	DEVELOPER QUALIFIED HERITAGE SPECIALIST	Prior to and during the commencement of construction and earth-moving as well as during operation phase.
Alterative Mitigation Procedure (**if preferred mitigation procedure is not feasible**)		
Grave Relocation: Relocation of burials and documentation of site, full social consultation with affected parties, possible conservation management and protection measures. Subject to authorisations and relevant permitting from heritage authorities and affected parties.	QUALIFIED HERITAGE SPECIALIST	Prior to the commencement of construction and earth-moving.
Fixed Mitigation Procedure (**required**)		
Site Monitoring: Regular examination of trenches and excavations in this area in order to avoid the destruction of previously undetected burials or heritage remains.	ECO	Monitor prior to and during the commencement of construction and earth-moving...
PERFORMANCE INDICATOR	Archaeological sites are discovered and mitigated with the minimum amount of unnecessary disturbance.	
MONITORING	Successful location of sites by person/s monitoring.	

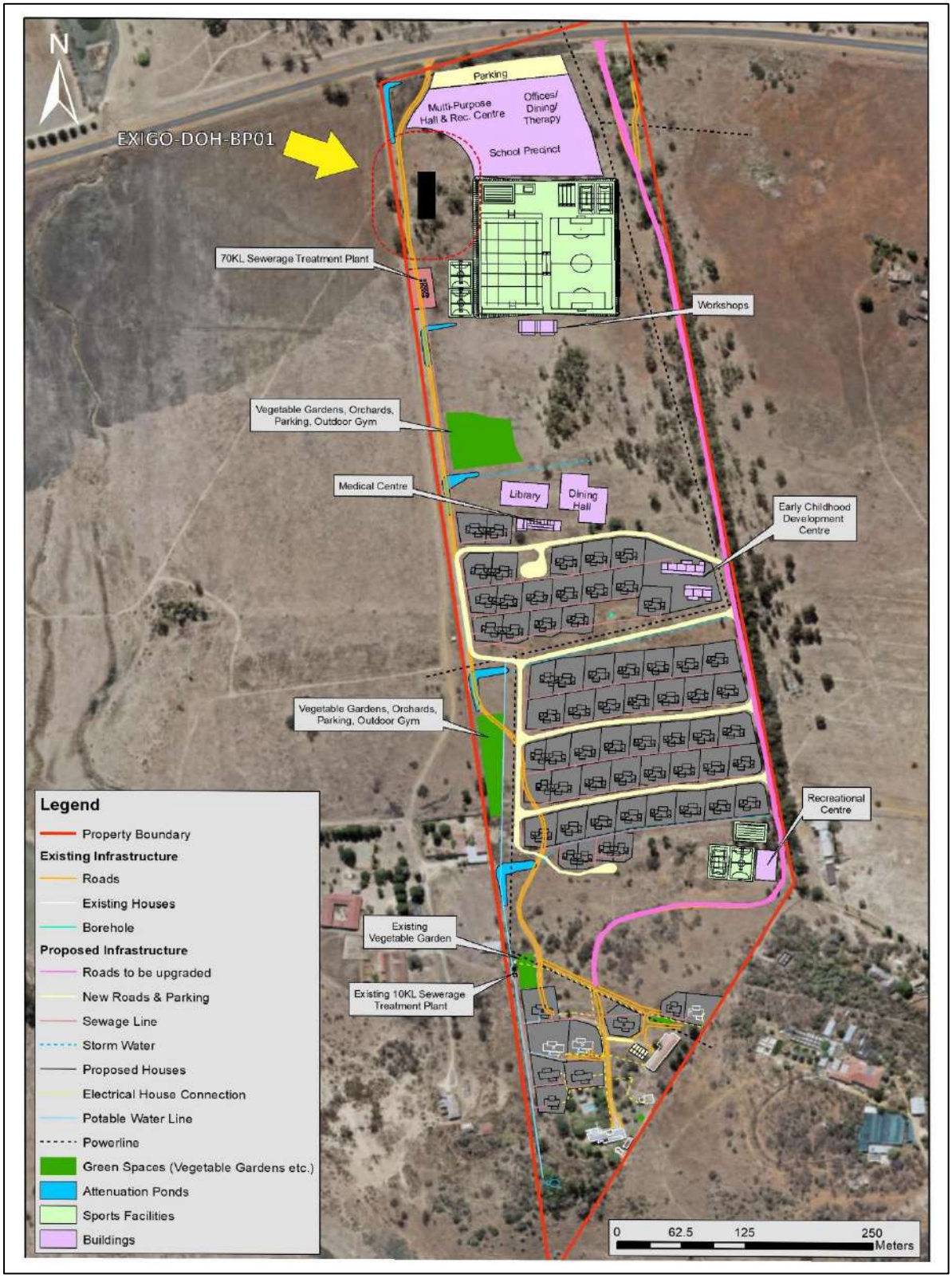

Figure 6-1: Aerial map indicating the extent of required 50m heritage conservation buffer (red dashed line) in relation to Door of Hope Village infrastructure components, discussed in the text.

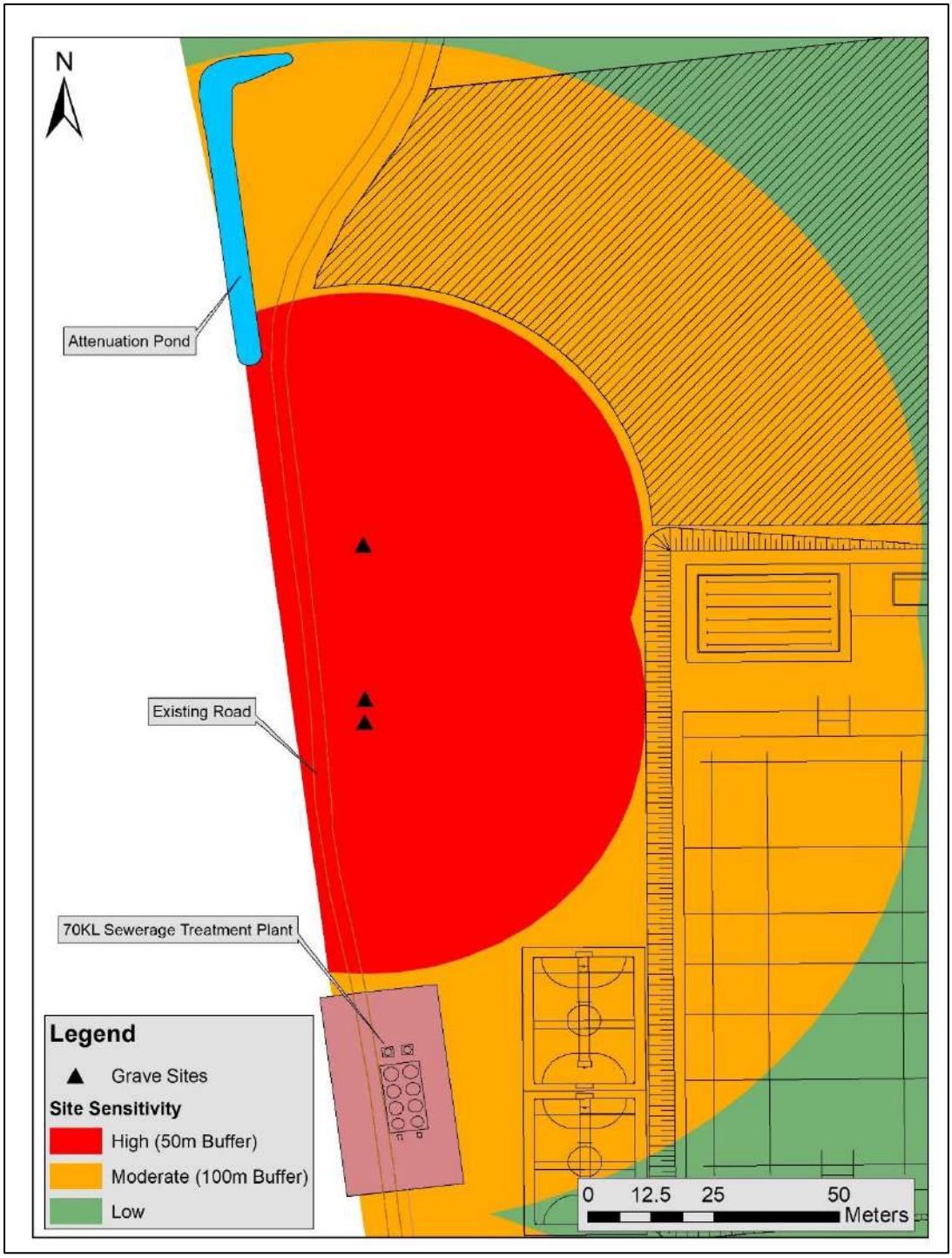

Figure 6-2: Detailed plan of infrastructure components around required heritage conservation buffer (50m), discussed in the text.

7 RECOMMENDATIONS

In terms of heritage resources, the landscape around the project area is primarily well known for the occurrence of Iron Age farmer presence and a Colonial frontier denoting farmer expansion. The landscape that encompasses the Door of Hope Village footprints seems to have been inhabited continuously for centuries in prehistoric and historical times, the remnants of which are visible in transformed agriculture and rural settlement areas. The following general recommendations are made based on general observations in the proposed Door of Hope Village area pertaining to a number of identified occurrences of heritage potential:

- A number of monoliths used as fencing posts occur on the property along disused agricultural fields. The utilization of these natural features during historical and recent times for agricultural purposes is a common occurrence across farming areas in South Africa and the monoliths does not carry implicit historical significance. No action in terms of heritage mitigation is required for these features.
- The remains of a Historical Period "kraal" (**Site Exigo-DOH-HP01**) occurring along the northern periphery of the project is rated as low heritage significance as no material culture or man-made structures occur at the poorly preserved site. The "kraal" occurs within the project area and it is recommended that the area be monitored by an informed ECO in order to avoid the destruction of previously undetected heritage remains.
- An informal burial site containing at least 3 graves (**Site Exigo-DOH-BP01)** occurs within the project development area. The site is of high significance and a 50m conservation buffer is required for the burial site as a primary measure. It is recommended that infrastructure components proposed for the project avoid encroaching on the required 50m conservation buffer. In addition it is recommended that the burial site be fenced off with wire, chicken wire or palisade fencing of a minimum height of 1.8m placed no closer than 2m from the burials. An access gate should be erected and access control should be applied to the site. A heritage Site Management Plan (SMP) should be compiled for the burials to stipulate conservation measures, responsible persons and chance find procedures for further heritage mitigation. The developer should carefully liaise with the heritage specialist, SAHRA as well as local communities and possible affected parties with regards to the management and monitoring of any human grave or cemetery in order to detect and manage negative impact on the sites. **Should impact on the burial site prove inevitable, full grave relocations are recommended for these burial grounds. This measure should be undertaken by a qualified archaeologist, and in accordance with relevant legislation, permitting, statutory permissions and subject to any local and regional provisions and laws and by-laws pertaining to human remains. A full social consultation process with the Kamffer family and other affected parties should occur in conjunction with the mitigation of cemeteries and burials (see Addendum B).**
- Considering the localised nature of heritage remains, the general monitoring of the development progress by an ECO is recommended during planning and construction phases of the project. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately
- It is essential that cognisance be taken of the larger archaeological landscape of the area in order to avoid the destruction of previously undetected heritage sites. It should be stated that the possibility of undetected archaeological remains occurring elsewhere in the project area should not be excluded. Burials and historically significant structures dating to the Colonial Period occur on

farms in the area and these resources should be avoided during all phases of construction and development, including the operational phases of the development.

In addition to these site-specific recommendations, careful cognizance should be taken of the following:

- As Palaeontological remains occur where bedrock has been exposed, all geological features should be regarded as sensitive.
- Water sources such as drainage lines, fountains and pans would often have attracted human activity in the past. As Stone Age material the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits.

8 GENERAL COMMENTS AND CONDITIONS

This AIA report serves to confirm the extent and significance of the heritage landscape of the proposed Door of Hope Village area. The larger heritage horizon encompasses rich and diverse archaeological landscapes and cognisance should be taken of heritage resources and archaeological material that might be present in surface and sub-surface deposits. If, during construction, any possible archaeological material culture discoveries are made, the operations must be stopped and a qualified archaeologist be contacted for an assessment of the find. Such material culture might include:

- Formal Earlier Stone Age stone tools.
- Formal MSA stone tools.
- Formal LSA stone tools.
- Potsherds
- Iron objects.
- Beads made from ostrich eggshell and glass.
- Ash middens and cattle dung deposits and accumulations.
- Faunal remains.
- Human remains/graves.
- Stone walling or any sub-surface structures.
- Historical glass, tin or ceramics.
- Fossils.

If such sites were to be encountered or impacted by any proposed developments, recommendations contained in this report, as well as endorsement of mitigation measures as set out by Gauteng-PHRA, SAHRA, the National Resources Act and the CRM section of ASAPA will be required.

It must be emphasised that the conclusions and recommendations expressed in this archaeological heritage sensitivity investigation are based on the visibility of archaeological sites/features and may not therefore, represent the area's complete archaeological legacy. Many sites/features may be covered by soil and vegetation and might only be located during sub-surface investigations. If subsurface archaeological deposits, artefacts or skeletal material were to be recovered in the area during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately **(*cf*. NHRA (Act No. 25 of 1999)**, Section 36 (6)). It must also be clear that Archaeological Specialist Reports will be assessed by the relevant heritage resources authority (SAHRA).

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10 ADDENDUM 1: HERITAGE LEGISLATION BACKGROUND

10.1 CRM: Legislation, Conservation and Heritage Management

The broad generic term Cultural Heritage Resources refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

10.1.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and their provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

d. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act of 1999 a historical site is any identifiable building or part thereof, marker, milestone, gravestone, landmark or tell older than 60 years. This clause is commonly known as the "60-years clause". Buildings are amongst the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Iron Age settlements. "Tell" refers to the evidence of human existence which is no longer above ground level, such as building foundations and buried remains of settlements (including artefacts).

The Act identifies heritage objects as:

- objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects, meteorites and rare geological specimens
- visual art objects
- military objects
- numismatic objects
- objects of cultural and historical significance
- objects to which oral traditions are attached and which are associated with living heritage
- objects of scientific or technological interest
- any other prescribed category

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(d) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(e) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(f) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(g) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(h) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(i) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(j) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."

e. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and the Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities.

10.1.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

The National Heritage Resources Act (Act No. 25 of 1999, section 38) provides guidelines for Cultural Resources Management and prospective developments:

***"38.** (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a*

development categorised as:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site:

(i) exceeding 5 000 m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."

And:

"The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(k) The identification and mapping of all heritage resources in the area affected;

(l) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(m) an assessment of the impact of the development on such heritage resources;

(n) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(o) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(p) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(q) plans for mitigation of any adverse effects during and after the completion of the proposed development (38. [3] 1999:64)."

Consequently, section 35 of the Act requires Heritage Impact Assessments (HIAs) or Archaeological Impact Assessments (AIAs) to be done for such developments in order for all heritage resources, that is, all places or objects of aesthetics, architectural, historic, scientific, social, spiritual, linguistic or technological value or significance to be protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures older than 60

years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects.Heritage resources management and conservation.

10.2 Assessing the Significance of Heritage Resources

Archaeological sites, as previously defined in the National Heritage Resources Act (Act 25 of 1999) are places in the landscape where people have lived in the past – generally more than 60 years ago – and have left traces of their presence behind. In South Africa, archaeological sites include hominid fossil sites, places where people of the Earlier, Middle and Later Stone Age lived in open sites, river gravels, rock shelters and caves, Iron Age sites, graves, and a variety of historical sites and structures in rural areas, towns and cities. Palaeontological sites are those with fossil remains of plants and animals where people were not involved in the accumulation of the deposits. The basic principle of cultural heritage conservation is that archaeological and other heritage sites are valuable, scarce and *non-renewable.* Many such sites are unfortunately lost on a daily basis through development for housing, roads and infrastructure and once archaeological sites are damaged, they cannot be re-created as site integrity and authenticity is permanently lost. Archaeological sites have the potential to contribute to our understanding of the history of the region and of our country and continent. By preserving links with our past, we may not be able to revive lost cultural traditions, but it enables us to appreciate the role they have played in the history of our country.

- Categories of significance

Rating the significance of archaeological sites, and consequently grading the potential impact on the resources is linked to the significance of the site itself. The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences. The guidelines as provided by the NHRA (Act No. 25 of 1999) in Section 3, with special reference to subsection 3 are used when determining the cultural significance or other special value of archaeological or historical sites. In addition, ICOMOS (the Australian Committee of the International Council on Monuments and Sites) highlights four cultural attributes, which are valuable to any given culture:

- *Aesthetic value:*

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria include consideration of the form, scale, colour, texture and material of the fabric, the general atmosphere associated with the place and its uses and also the aesthetic values commonly assessed in the analysis of landscapes and townscape.

- *Historic value:*

Historic value encompasses the history of aesthetics, science and society and therefore to a large extent underlies all of the attributes discussed here. Usually a place has historical value because of some kind of influence by an event, person, phase or activity.

- *Scientific value:*

The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality and on the degree to which the place may contribute further substantial information.

- *Social value:*

Social value includes the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a certain group.

It is important for heritage specialist input in the EIA process to take into account the heritage management structure set up by the NHR Act. It makes provision for a 3-tier system of management including the South Africa Heritage Resources Agency (SAHRA) at a national level, Provincial Heritage Resources Authorities (PHRAs) at a provincial and the local authority. The Act makes provision for two types or forms of protection of heritage resources; i.e. formally protected and generally protected sites:

Formally protected sites:

- Grade 1 or national heritage sites, which are managed by SAHRA
- Grade 2 or provincial heritage sites, which are managed by the provincial HRA (MP-PHRA).
- Grade 3 or local heritage sites.

Generally protected sites:

- Human burials older than 60 years.
- Archaeological and palaeontological sites.
- Shipwrecks and associated remains older than 60 years.
- Structures older than 60 years.

With reference to the evaluation of sites, the certainty of prediction is definite, unless stated otherwise and if the significance of the site is rated high, the significance of the impact will also result in a high rating. The same rule applies if the significance rating of the site is low. The significance of archaeological sites is generally
ranked into the following categories.

Significance	Rating Action
No significance: sites that do not require mitigation.	None
Low significance: sites, which may require mitigation.	2a. Recording and documentation (Phase 1) of site; no further action required 2b. Controlled sampling (shovel test pits, augering), mapping and documentation (Phase 2 investigation); permit required for sampling and destruction
Medium significance: sites, which require mitigation.	3. Excavation of representative sample, C14 dating, mapping and documentation (Phase 2 investigation); permit required for sampling and destruction [including 2a & 2b]
High significance: sites, where disturbance should be avoided.	4a. Nomination for listing on Heritage Register (National, Provincial or Local) (Phase 2 & 3 investigation); site management plan; permit required if utilised for education or tourism
High significance: Graves and burial places	4b. Locate demonstrable descendants through social consulting; obtain permits from applicable legislation, ordinances and regional by-laws; exhumation and reinterment [including 2a, 2b & 3]

Furthermore, the significance of archaeological sites was based on six main criteria:

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter),
- Social value,
- Uniqueness, and
  Potential to answer current and future research questions.

11 ADDENDUM 2: CONVENTIONS USED TO ASSESS THE SIGNIFICANCE OF HERITAGE

11.1 Site Significance Matrix

According to the NHRA, Section 2(vi) the **significance** of heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these. The following matrix is used for assessing the significance of each identified site/feature.

2. SITE EVALUATION			
2.1 Heritage Value (NHRA, section 2 [3])	High	Medium	Low
It has importance to the community or pattern of South Africa's history or pre-colonial history.			
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.			
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.			
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.			
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.			
It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.			
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			
It has significance relating to the history of slavery in South Africa.			
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.			
2.2 Field Register Rating			
National/Grade 1 [should be registered, retained]			
Provincial/Grade 2 [should be registered, retained]			
Local/Grade 3A [should be registered, mitigation not advised]			
Local/Grade 3B [High significance; mitigation, partly retained]			
Generally Protected A [High/Medium significance, mitigation]			
Generally protected B [Medium significance, to be recorded]			
Generally Protected C [Low significance, no further action]			
2.3 Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Local			
Specific community			

11.2 Impact Assessment Criteria

The following table provides a guideline for the rating of impacts and recommendation of management actions for sites of heritage potential.

Significance of the heritage resource

This is a statement of the nature and degree of significance of the heritage resource being affected by the activity. From a heritage management perspective it is useful to distinguish between whether the significance is embedded in the physical fabric or in associations with events or persons or in the experience of a place; i.e. its visual and non-visual qualities. This statement is a primary informant to the nature and degree of significance of an impact and thus needs to be thoroughly considered. Consideration needs to be given to the significance of a heritage resource at different scales (i.e. sitespecific, local, regional, national or international) and the relationship between the heritage resource, its setting and its associations.

Nature of the impact

This is an assessment of the nature of the impact of the activity on a heritage resource, with some indication of its positive and/or negative effect/s. It is strongly informed by the statement of resource significance. In other words, the nature of the impact may be historical, aesthetic, social, scientific, linguistic or architectural, intrinsic, associational or contextual (visual or non-visual). In many cases, the nature of the impact will include more than one value.

Extent

Here it should be indicated whether the impact will be experienced:

- On a site scale, i.e. extend only as far as the activity;
- Within the immediate context of a heritage resource;
- On a local scale, e.g. town or suburb
- On a metropolitan or regional scale; or
- On a national/international scale.

Duration

Here it should be indicated whether the lifespan of the impact will be:

- Short term, (needs to be defined in context)
- Medium term, (needs to be defined in context)
- Long term where the impact will persist indefinitely, possibly beyond the operational life of the activity, either because of natural processes or by human intervention; or
- Permanent where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Of relevance to the duration of an impact are the following considerations:

- Reversibility of the impact; and
- Renewability of the heritage resource.

Intensity

Here it should be established whether the impact should be indicated as:

- Low, where the impact affects the resource in such a way that its heritage value is not affected;
- Medium, where the affected resource is altered but its heritage value continues to exist albeit in a modified way; and
- High, where heritage value is altered to the extent that it will temporarily or permanently be damaged or destroyed.

Probability

This should describe the likelihood of the impact actually occurring indicated as:

- Improbable, where the possibility of the impact to materialize is very low either because of design or historic experience;
- Probable, where there is a distinct possibility that the impact will occur;
- Highly probable, where it is most likely that the impact will occur; or
- Definite, where the impact will definitely occur regardless of any mitigation measures

Confidence

This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Impact Significance

The significance of impacts can be determined through a synthesis of the aspects produced in terms of the nature and degree of heritage significance and the nature, duration, intensity, extent, probability and confidence of impacts and can be described as:

- Low; where it would have a negligible effect on heritage and on the decision
- Medium, where it would have a moderate effect on heritage and should influence the decision.
- High, where it would have, or there would be a high risk of, a big effect on heritage. Impacts of high significance should have a major influence on the decision;
- Very high, where it would have, or there would be high risk of, an irreversible and possibly irreplaceable negative impact on heritage. Impacts of very high significance should be a central factor in decision-making.

11.3 Direct Impact Assessment Criteria

The following table provides an outline of the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected

	TYPE OF DEVELOPMENT			
HERITAGE CONTEXT	**CATEGORY A**	**CATEGORY B**	**CATEGORY C**	**CATEGORY D**
CONTEXT 1 High heritage Value	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected	Very high heritage impact expected
CONTEXT 2 Medium to high heritage value	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected
CONTEXT 3 Medium to low heritage value	Little or no heritage impact expected	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected
CONTEXT 4 Low to no heritage value	Little or no heritage impact expected	Little or no heritage impact expected	Minimal heritage value expected	Moderate heritage impact expected

NOTE: A DEFAULT "LITTLE OR NO HERITAGE IMPACT EXPECTED" VALUE APPLIES WHERE A HERITAGE RESOURCE OCCURS OUTSIDE THE IMPACT ZONE OF THE DEVELOPMENT.

HERITAGE CONTEXTS	CATEGORIES OF DEVELOPMENT
Context 1: Of high intrinsic, associational and contextual heritage value within a national, provincial and local context, i.e. formally declared or potential Grade 1, 2 or 3A heritage resources **Context 2:** Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources. **Context 3:** Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources	**Category A: Minimal intensity development** - No rezoning involved; within existing use rights. - No subdivision involved. - Upgrading of existing infrastructure within existing envelopes - Minor internal changes to existing structures - New building footprints limited to less than 1000m2. **Category B: Low-key intensity development** - Spot rezoning with no change to overall zoning of a site. - Linear development less than 100m - Building footprints between 1000m2-2000m2

Context 4: Of little or no intrinsic, associational or contextual heritage value due to disturbed, degraded conditions or extent of irreversible damage.	- Minor changes to external envelop of existing structures (less than 25%) - Minor changes in relation to bulk and height of immediately adjacent structures (less than 25%). **Category C: Moderate intensity development** - Rezoning of a site between 5000m2-10 000m2. - Linear development between 100m and 300m. - Building footprints between 2000m2 and 5000m2 - Substantial changes to external envelop of existing structures (more than 50%) - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 50%) **Category D: High intensity development** - Rezoning of a site in excess of 10 000m2 - Linear development in excess of 300m. - Any development changing the character of a site exceeding 5000m2 or involving the subdivision of a site into three or more erven. - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 100%)

11.4 Management and Mitigation Actions

The following table provides a guideline of relevant heritage resources management actions is vital to the conservation of heritage resources.

No further action / Monitoring

Where no heritage resources have been documented, heritage resources occur well outside the impact zone of any development or the primary context of the surroundings at a development footprint has been largely destroyed or altered, no further immediate action is required. Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage\ remains are destroyed.

Avoidance

This is appropriate where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. Mitigation is not acceptable or not possible. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources.

Mitigation

This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated to a degree of medium to low significance, e.g. the high to medium impact of a development on an archaeological site could be mitigated through sampling/excavation of the remains. Not all negative impacts can be mitigated.

Compensation

Compensation is generally not an appropriate heritage management action. The main function of management actions should be to conserve the resource for the benefit of future generations. Once lost it cannot be renewed. The circumstances around the potential public or heritage benefits would need to be exceptional to warrant this type of action, especially in the case of where the impact was high.

Rehabilitation

Rehabilitation is considered in heritage management terms as a intervention typically involving the adding of a new heritage layer to enable a new sustainable use. It is not appropriate when the process necessitates the removal of previous historical layers, i.e. restoration of a building or place to the previous state/period. It is an appropriate heritage management action in the following cases:

- The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.
- Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric.
- Where the rehabilitation process will not result in a negative impact on the intrinsic value of the resource.

Enhancement

Enhancement is appropriate where the overall heritage significance and its public appreciation value are improved. It does not imply creation of a condition that might never have occurred during the evolution of a place, e.g. the tendency to sanitize the past. This

management action might result from the removal of previous layers where these layers are culturally of low significance and detract from the significance of the resource. It would be appropriate in a range of heritage contexts and applicable to a range of resources. In the case of formally protected or significant resources, appropriate enhancement action should be encouraged. Care should, however, be taken to ensure that the process does not have a negative impact on the character and context of the resource. It would thus have to be carefully monitored

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

THE PROPOSED DEVELOPMENT OF A VILLAGE ESTATE FOR ABANDONED AND ORPHANED CHILDREN, DE DEUR, GAUTENG.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	**Exigo Sustainability**			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	135%
Specialist name:	Neels Kruger			
Specialist Qualifications:	BA (Archaeology), BA Hons (Archaeology, Anthropology)			
Professional affiliation/registration:	Association of Southern African Professional Archaeologists (ASAPA): Registered Archaeologist & Culture Resources Management Practitioner			
Physical address:	70 Regency Dr, Route 21 Business Park, Centurion, 0178			
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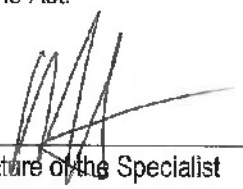
Postal code:	0102	Cell:	082 967 2131	
Telephone:	012 751 2160	Fax:		
E-mail:	neels@exigo3.com			

2. DECLARATION BY THE SPECIALIST

I, Neels Kruger, declare that –

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

Exigo Sustainability (Pty) Ltd

Name of Company:

2019-11-07

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Neels Kruger**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Exigo Sustainability (Pty) Ltd

Name of Company

2019-11-07

Date

Signature of the Commissioner of Oaths

2019-11-07

Date

Certified a true copy of the original:

Date 2019-11-07

Ex Officio COMMISSIONER OF OATHS (RSA)
ANTOINETTE M. MALULEKE
(Office Manager - RO-20/02/2019)
Ground Floor 72 Regency Drive
Route 21 Corporate Park, Irene X31, Centurion 0062

APPENDIX G4: PALAEONTOLOGICAL DESKTOP STUDY

Development at the Door of Hope on a portion of the Farm Hartsenbergfontein 3321Q in the Sedibeng District Municipality, Gauteng

DESKTOP STUDY
PALAEONTOLOGY

Compiled by Dr JF Durand (Sci. Nat.)

For:

Exigo Sustainability (Pty) Ltd.
The Village Office Park
309 Glenwood Road
Faerie Glen
Pretoria
0043

11 November 2018

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1. Executive Summary

The rock formations that underlie the study site are over 2 billion years old. Stromatolites have been reported from the Timeball Hill Formation elsewhere but the likelihood that fossils are preserved in the study site are slim due to the thermal metamorphosis this formation would have experienced during the intrusion of the syenite dyke that runs through the study site. Excavations during development should be monitored by the ECO and in the unlikely event of stromatolites being discovered in the study site, the ECO should follow the Chance Find Procedure (p.12).

2. Introduction

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in *i.a.* the origin of life, dinosaurs and humans. Fossils are also used to identify rock strata and determine the geological context of the geological formations and the chronostratigraphy of Southern Africa.

Some of the oldest evidence of life on Earth came from the rocks at Barberton which contain fossilized bacteria. Stromatolites in the dolomitic regions in South Africa were formed by shallow marine mats of cyanobacteria. The cyanobacteria, which were some of the first photosynthesising organisms, provided most of the oxygen in our atmosphere.

The first evidence of tectonic plate movement was discovered after studying the distribution of Karoo-age fossils in South Africa and other continents and subcontinents such as India, Antarctica, South America and Australia. Fossils are also used to study evolutionary relationships, sedimentary processes and palaeoenvironments.

South Africa is probably best known palaeontologically for having more than half of all the hominin specimens in the world, the greatest variety of hominins in a country and the longest record of continuous hominin occupation in the world.

The Heritage Act of South Africa stipulates that fossils and fossil sites may not be altered or destroyed. The purpose of this document is to detail the probability of finding fossils in the study area which may be impacted by the proposed development.

3. Terms of reference for the report

According to the South African Heritage Resources Act (Act 25 of 1999) (Republic of South Africa, 1999), certain clauses are relevant to palaeontological aspects for a terrain suitability assessment.

- **Subsection 35(4)** No person may, without a permit issued by the responsible heritage resources authority-
- (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
- (c) trade in, sell for private gain, export or attempt to export from the republic any category of archaeological or palaeontological material or object, or any meteorite; or
- (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist with the detection or recovery of metals or archaeological material or objects, or use such equipment for the recovery of meteorites.
- **Subsection 35(5)** When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedures in terms of section 38 has been followed, it may-
- (a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
- (b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
- (c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
- (d) recover the costs of such investigation form the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

South Africa’s unique and non-renewable palaeontological heritage is protected in terms of the NHRA. According to this act, heritage resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

As areas are developed and landscapes are modified, heritage resources, including palaeontological resources, are threatened. As such, both the environmental and heritage legislation require that development activities must be preceded by an assessment of the impact undertaken by qualified professionals. Palaeontological Impact Assessments (PIAs) are specialist reports that form part of the wider heritage component of:

- Heritage Impact Assessments (HIAs) called for in terms of Section 38 of the National Heritage Resources Act, Act No. 25, 1999 by a heritage resources authority.
- Environmental Impact Assessment process as required in terms of other legislation listed in s. 38(8) of NHRA;
- Environmental Management Plans (EMPs) required by the Department of Mineral Resources.

HIAs are intended to ensure that all heritage resources are protected, and where it is not possible to preserve them in situ, appropriate mitigation measures are applied. An HIA is a comprehensive study that comprises a palaeontological, archaeological, built environment, living heritage, etc specialist studies. Palaeontologists must acknowledge this and ensure that they collaborate with other heritage practitioners. Where palaeontologists are engaged for the entire HIA, they must refer heritage components for which they do not have expertise on to appropriate specialists. Where they are engaged specifically for the palaeontology, they must draw the attention of environmental consultants and developers to the need for assessment of other aspects of heritage. In this sense, Palaeontological Impact Assessments that are part of Heritage Impact Assessments are similar to specialist reports that form part of the EIA reports.
The standards and procedures discussed here are therefore meant to guide the conduct of PIAs and specialists undertaking such studies must adhere to them.
The process of assessment for the palaeontological (PIA) specialist components of heritage impact assessments, involves:

Scoping stage in line with regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involves an **initial assessment** where the specialist evaluates the scope of the project (based, for example, on NID/BIDs) and advises on the form and extent of the assessment process. At this stage the palaeontologist may also decide to compile a **Letter of Recommendation for Exemption from further Palaeontological Studies**. This letter will state that there is little or no likelihood that any significant fossil resources will be impacted by the development. This letter should present a reasoned case for exemption, supported by consultation of the relevant geological maps and key literature.

A **Palaeontological Desktop Study** – the palaeontologist will investigate available resources (geological maps, scientific literature, previous impact assessment reports, institutional fossil collections, satellite images or aerial photos, etc) to inform

an assessment of fossil heritage and/or exposure of potentially fossiliferous rocks within the study area. A Desktop studies will conclude whether a further field assessment is warranted or not. Where further studies are required, the desktop study would normally be an integral part of a field assessment of relevant palaeontological resources.

A **Phase 1 Palaeontological Impact Assessment** is generally warranted where rock units of high palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large-scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed project area is unknown. In the recommendations of Phase 1, the specialist will inform whether further monitoring and mitigation are necessary. The Phase 1 should identify the rock units and significant fossil heritage resources present, or by inference likely to be present, within the study area, assess the palaeontological significance of these rock units, fossil sites or other fossil heritage, comment on the impact of the development on palaeontological heritage resources and make recommendations for their mitigation or conservation, or for any further specialist studies that are required in order to adequately assess the nature, distribution and conservation value of palaeontological resources within the study area.

A **Phase 2 Palaeontological Mitigation** involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or the recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before Phase 2 may be implemented.

A **'Phase 3' Palaeontological Site Conservation and Management Plan** may be required in cases where the site is so important that development will not be allowed, or where development is to co-exist with the resource. Developers may be required to enhance the value of the sites retained on their properties with appropriate interpretive material or displays as a way of promoting access of such resources to the public.

The assessment reports will be assessed by the relevant heritage resources authority, and depending on which piece of legislation triggered the study, a response will be given in the form of a Review Comment or Record of Decision (ROD). In the case of PIAs that are part of EIAs or EMPs, the heritage resources authority will issue a comment or a record of decision that may be forwarded to the consultant or developer, relevant government department or heritage practitioner and where feasible to all three.

4. Details of study site and the type of assessment:

Figure 1: Google Earth photo of the study site

The study site is situated in a peri-urban area amongst smallholdings on a portion of the Farm Hartsenbergfontein 3321Q in the Sedibeng District Municipality, Gauteng. The study site lies immediately north of Wakerville between Ennerdale and Eikenhof and approximately 12 km south of Johannesburg.

The relevant literature and geological maps for the study site in which the development is proposed to take place, have been studied for a Desktop Report.

5. Geological setting of the study site

The study site is indicated by the white polygon.

Figure 2: Geology of the study site and surroundings. Adapted from the 2626 WEST RAND 1: 250 000 Geology Map (Council for Geoscience, 1996)

GEOLOGICAL LEGEND

	Lithology	Stratigraphy		Age
	Syenite dyke			Mokolian
Vh	Andesite, agglomerate, tuff	Hekpoort Formation	Pretoria Group of the Transvaal Supergroup	Vaalian
Vt	Ferruginous shale, hornfels, ferruginous quartzite	Timeball Hill Formation		

The study site is underlain by the Hekpoort Formation that overlies the Timeball Hill Formations of the Pretoria Group of the Transvaal Supergroup.

6. Palaeontological potential of the study site

The study site is indicated by the black polygon

Colour	Palaeontological Significance	Action
ORANGE	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely.
GREEN	MODERATE	Desktop study is required.
GREY	INSIGNIFICANT	No study required.

Figure 3: Palaeosensitivity map of the study site and surroundings (SAHRA, 2018)

The 2224 Ma Hekpoort Formation consists of basaltic andesite, agglomerate, tuff that were formed during a period of subaerial volcanism. Intervals between volcanic episodes are marked by small lacustrine shale deposits (Eriksson *et al*., 2009). This formation has a Low Palaeosensitivity and no fossils have been recorded from this formation (Groenewald, 2014).

The Timeball Hill Formation consists of shale, siltstone, diamictite, conglomerate, quartzite and minor lavas. These sediments were deposited in lacustrine and fluvio-deltaic environments (Eriksson et al., 2009). Stromatolites occur in this formation (Groenewald, 2014).

The syenite dyke that runs through the study site is palaeontologically insignificant.

References:

Eriksson, P.G.; Altermann, W. & Hatzer, F.J., (2009). The Transvaal Supergroup and its precursors. In: Johnson, M.R.; Anhauysser, C.R. & Thomas, R.J. (Eds.) The Geology of South Africa. Johannesburg: Geological Society of South Africa. Pp. 237-260.

Geological Survey (1986) 2528 PRETORIA 1: 250 000 Geology Map.

Groenewald, G. (2014). Palaeontological heritage of Gauteng. SAHRA Palaeotechnical Report.

7. Conclusion and recommendations:

Stromatolites have been reported from the Timeball Hill Formation elsewhere but the likelihood that fossils are preserved in the study site are slim due to the thermal metamorphosis this formation would have experienced during the intrusion of the syenite dyke.

In the unlikely event of stromatolites being discovered in the Timeball Hill Formation, the ECO should follow the Chance Find Procedure. Although disturbed fossils should be collected and stored safely until it can be inspected by a palaeontologist, no attempt should be made to remove such accidentally discovered fossils from the rock by an unqualified person.

PROCEDURE FOR CHANCE PALAEONTOLOGICAL FINDS

Extracted and adapted from the National Heritage Resources Act, 1999 Regulations Reg No. 6820, GN: 548.

The following procedure must be considered in the event that previously unknown fossils or fossil sites are exposed or found during the life of the project:

1. Surface excavations should continuously be monitored by the ECO and any fossil material be unearthed the excavation must be halted.

2. If fossiliferous material has been disturbed during the excavation process it should be put aside to prevent it from being destroyed.

3. The ECO then has to take a GPS reading of the site and take digital pictures of the fossil material and the site from which it came.

4. The ECO then should contact a palaeontologist and supply the palaeontologist with the information (locality and pictures) so that the palaeontologist can assess the importance of the find and make recommendations.

5. If the palaeontologist is convinced that this is a major find an inspection of the site must be scheduled as soon as possible in order to minimise delays to the development.

From the photographs and/or the site visit the palaeontologist will make one of the following recommendations:

a. The material is of no value so development can proceed, or:

b. Fossil material is of some interest and a representative sample should be collected and put aside for further study and to be incorporated into a recognised

fossil repository after a permit was obtained from SAHRA for the removal of the fossils, after which the development may proceed, or:

c. The fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and take them to a recognised fossil repository, after which the development may proceed.

7. If any fossils are found then a schedule of monitoring will be set up between the developer and palaeontologist in case of further discoveries.

8. Declaration of Independence:

I, Jacobus Francois Durand declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Palaeontological specialist:
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