January 2021

VEGETATION ECOLOGICAL AND WETLAND ASSESSMENT:

Proposed Putfontein Cemetery

A report commissioned by

TSHANDUKO ENVIRONMENTAL ENGINEERING (PTY) LTD

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Factors limiting the quality of this study

A once off survey was conducted while the study was done on 10 January 2021. Thus, only those flowering plants that flowered at the time of the visit could be identified with high levels of confidence. Some of the more rare and cryptic species may have been overlooked due to their inconspicuous growth forms. Many of the rare and endangered succulent species can only be distinguished (in the veld) from their very similar relatives on the basis of their reproductive parts. These plants flower during different times of the year. Multiple visits to any site during the different seasons of the year could therefore increase the chances to record a larger portion of the total species complex associated with the area. Due to security reasons some sections could not be visited on foot. The survey of the study site is however considered as successful with a correct identification of the different vegetation units.

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Approach

Conclusions reached, and recommendations made are based not only on occurrence of individual species, but more appropriately on habitats and ecosystem processes. Planning must therefore allow for the maintenance of species, habitats and ecosystem processes, even if Red Data or endemic plant or animal species are absent.

Prof LR Brown *Pri.SciNat*; MGSSA
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INTRODUCTION

The natural resources of southern Africa, with its highly complex and diversified society, are continually under threat from development especially in areas richly endowed with natural resources. Uncontrolled and ill-planned development is one of the biggest threats to the naturally evolved life forms on earth. Past development in many parts of the world has led to the destruction of various plant and animal species and their habitats. Urbanisation causes land transformation and fragmentation and resultant loss of biodiversity. The achievement of balanced development satisfying the human needs and simultaneously conserving the natural resources/habitats is one of the biggest challenges faced by decision-makers. In practice, a foundation for sustainability entails natural resources, for example to link the vegetation of a site directly or indirectly to its closest natural surroundings, to establish green corridors and to create functional landscapes that maintain biodiversity (Pickett & Cadenasso, 2008).

Cities are constantly changing and increasing in size due to human population increase and an influx of people from rural areas into cities. Currently the design of new developments in cities focuses on human needs mainly without taking the environment into account. In many areas urban development has led to a total destruction of ecosystems while also affecting the climate at a local scale. Humans have been influencing the environment for thousands of years and in many cases have shown no consideration for the environment. As a result humans have been responsible for the extinction of many species through their various activities (e.g. agriculture, mining, ill-planned urban development, deforestation, soil erosion etc.) which has not only affected the local ecosystems negative, but also had negative effects on a regional landscape scale.

In order to prevent the destruction of any ecosystem, it is important that systematic planning and co-ordination of human activities and development should receive priority. This planning should include studies of the natural environment (soil, water, vegetation, animals and cultural / historical aspects). The planning and design of urban areas must therefore be done in such a way as to ensure that important ecosystem functions and services of the environment is maintained. Biodiversity must be protected to ensure the continued existence of plant and animal life in an area. It is therefore important that urban developers, landscapers and environmentalists together design development within urban areas. Before any development can take place it is important that all aspects of the environment is first

assessed to identify areas of concern and inform the planning of the proposed development.

Wetlands and riparian zones are ecosystems (with specific plant and animal communities) that are associated with bodies of water or are dependent on permanent, seasonal or ephemeral surface/subsurface water. The vegetation of these areas is normally lusher than that of the surrounding terrestrial vegetation. These areas play an important role in channelling water, retention of water and release of water to adjacent ecosystems. These areas also support a unique floral and faunal component.

Plant communities are regarded as fundamental units of an ecosystem and therefore form the base for environmental planning and the compilation of environmental management plans. Plant species assemblages reflect habitat and ecosystem health and rarity and are therefore imperative for an Environmental Impact Assessment.

AIMS OF THE STUDY

This report aims to present ecological report on the flora as well as a watercourse assessment of the proposed Putfontein Cemetery (hereafter referred to as the study area).

The objectives of this study were to:

- Identify, describe and delineate the different vegetation units present on the study site.
- Identify species of conservation importance that could possibly occur on the proposed site.
- To assess the wetland present on the site
- To provide a sensitivity map of the study area (where applicable).

STUDY AREA

Location

The study area falls within the **Grassland Biome** and classified as belonging to the endangered Eastern Highveld Grassland vegetation type (Gm 12) (Mucina & Rutherford 2006).

The site is located in the town of Springs and borders onto Springs Road in the south-west , Combrink Street in the north, Concorde Crescent in the south-east, and open vacant land in the north-east (Figure 1).

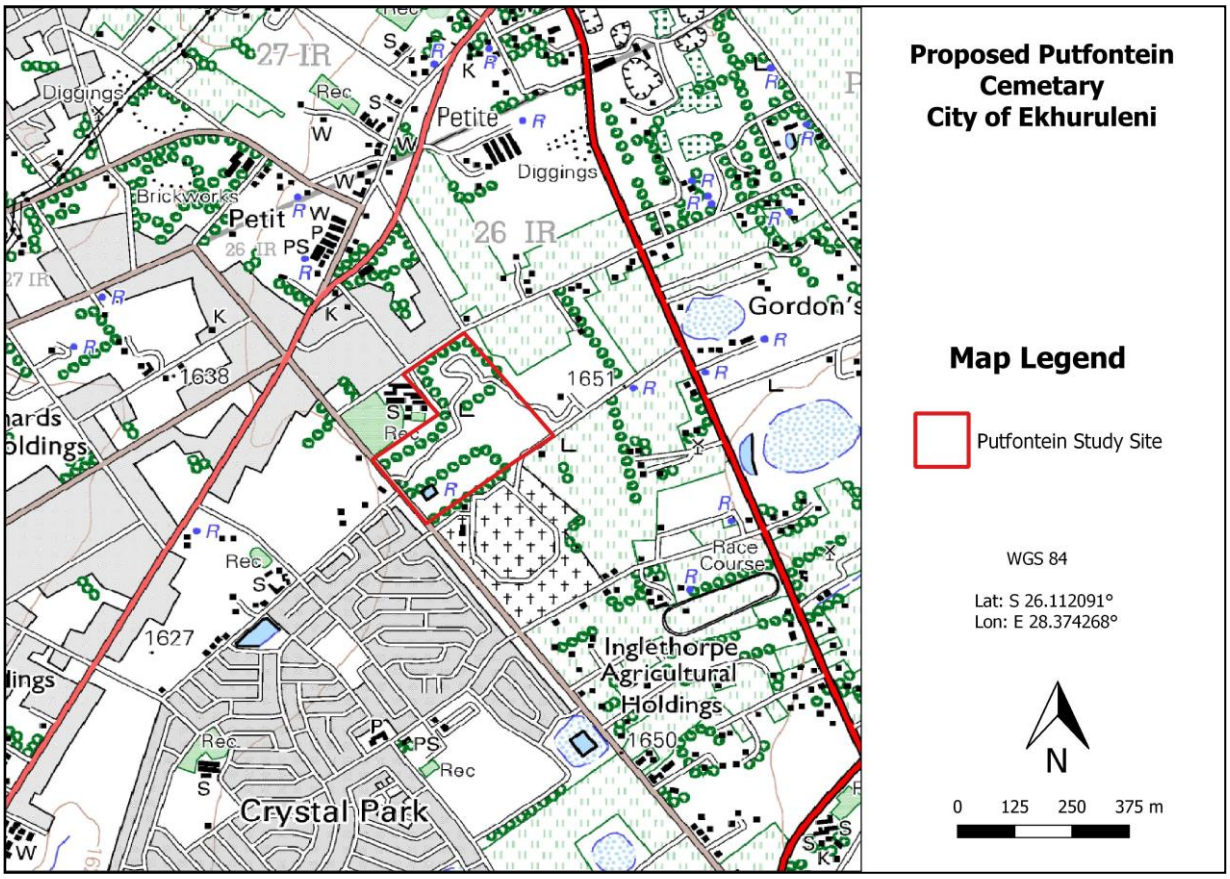


Figure 1. Locality the study area (Red lines)

Existing impacts on the site

- The area is overgrown with alien invasive species.
- No fencing exists.
- Various footpaths are present that are used by pedestrians as a throughway.
- Rubble and litter are present in various locations.

METHODS

VEGETATION

The Braun-Blanquet survey principles to survey and describe plant communities as ecological units were used for this study. This vegetation survey method has been used as the basis of a national vegetation survey of South Africa (Mucina et al. 2000) and are considered to be an efficient method of classifying and describing vegetation (Brown *et al.* 2013). The study is based on the floristic composition of the different vegetation units. An overview of the vegetation was first obtained from relevant literature. The vegetation was stratified into relative homogeneous units using Google Earth images and topographic maps. All these units were verified on foot and vegetation sample plots placed in each. The different vegetation units (ecosystems) are not only described in terms of their plant species composition, but also evaluated in terms of the potential habitat for sensitive/red data plant species. Ecological sensitivity and conservation value of the plant communities were assessed and categorised according to habitat and plant species assemblages (even though red data species or suitable habitat for such species could be absent an area could still have pristine habitat comprising a high diversity of climax species giving it a high conservation value).

Data recorded included:

Data pertaining to the vegetation physiognomy and floristic composition (species richness and canopy cover of each species) was gathered. A list of all plant species present, including trees, shrubs, grasses, forbs, geophytes and succulents were compiled. All identifiable plant species were listed. Notes were additionally made of any other features that might have an ecological influence.

Red data species

An investigation was also carried out on rare and protected plants that might possibly occur in the region. For this investigation the National Red List of Threatened Plants of South Africa, Lesotho & Swaziland, compiled by the Threatened Species Programme, South African National Biodiversity Institute (SANBI) was used. GDARD supplied a list of red data plant species that have been noted within the QDG. The old Plants of South Africa (POSA) site as well as the New Plants of South Africa (new POSA) (SANBI 2016) was also used. Internet sources were also consulted on the distribution of these species in the area.

Other information used included:

- The IUCN conservation status categories on which the Threatened Species Programme, Red List of South African Plants (2013) is based, was also obtained.

The presence of rare and protected species or suitable habitat was recorded during the field visit.

QDG data as well as other red data lists are used as guidelines to assist when conducting the field work. Unless a specific species was recorded previously on the specific site under investigation, the QDG lists cannot be used as meaning that the species listed do occur on the site. These lists are not comprehensive and continually change as people find and record new habitats and red data species. It could therefore mean that a red data species found in an adjacent QDG or one even further away, could potentially occur in another QDG. However, since no study has been done in that grid it will result in it not being listed for that QDG. The fact that it is not listed does however, not mean that the species or suitable habitat is not present. It is therefore imperative that a **physical site visit is conducted** to determine firstly, the presence of the listed red data species or suitable habitat on the site, and secondly, and most importantly the suitability of the site for the presence other red data species also.

Data processing

A classification of vegetation data was done to identify, describe and map vegetation types. The descriptions of the vegetation units include the tree, shrub and herbaceous layers. The conservation priority of each vegetation unit was assessed by evaluating the plant species composition in terms of the present knowledge of the vegetation of the Grassland and Savanna biomes of South Africa. The following four conservation priority categories were used for each vegetation unit:

High:	Area with natural vegetation with a high species richness and habitat diversity; presence of viable populations of red data plant species OR suitable habitat for such species; presence of unique habitats; less than 5% pioneer/alien plant species present. These areas are ecologically valuable and important for ecosystem functioning. This land should be conserved and managed and is not suitable for development purposes.
Medium-high:	Natural area with a relatively high species richness and diversity; not a threatened or unique ecosystem; moderate habitat diversity; between 5-10% pioneer/alien plant species present; that would need low financial input and management to improve its current condition; and where low-density development could be considered with limited impact on the vegetation / ecosystem. It is recommended that larger sections of the vegetation are maintained**.**

Medium: An area with a relatively natural species composition; not a threatened or unique ecosystem; moderate species diversity; between 11-20% pioneer/alien plant species present; that would need moderate to major financial input to rehabilitate to an improved condition; and where medium density development could be considered with limited impact on the vegetation / ecosystem. Where possible certain sections of the vegetation could be maintained**.**

Low-medium: Area with relatively natural vegetation, though a common vegetation type; moderate to low species and habitat diversity; previously or currently degraded or in secondary successional phase; between 20-40% pioneer and/or alien plant species; low ecosystem functioning; low rehabilitation potential.

Low: A totally degraded and transformed area with a low habitat diversity and ecosystem functioning; no viable populations of natural plants; >40% pioneer and/or alien plant species present; very low habitat uniqueness; whose recovery potential is extremely low; and on which development could be supported with little to no impact on the natural vegetation / ecosystem.

Impact analysis

An **impact analysis** was done for the vegetation units identified. This was achieved by evaluating the different vegetation units against a set of habitat criteria. For impact assessment the **potential impacts** on the vegetation was assessed by using the NEMA 2014 guidelines and criteria. To further quantify the severity of each impact, values were assigned to criteria ratings (Table 1).

Table 1: Criteria, criteria ratings and values (in brackets) used in this study to assess possible impacts on vegetation during the proposed development

Criteria	Rating (value)
Extent of impact	Site (1), Region (2), National (3), International (4)
Duration of impact	Short term (1), Medium term (3), Long term (4), Permanent (5)
Magnitude of impact	Low (2), Moderate (6), High (8)
Probability of impact	Improbable (1), Probable (2), Highly probable (4), Definite (5)

WETLANDS

The term “wetland” is a generic term for all the different kinds of habitats where the land is wet for some period of time each year, but not necessarily permanently wet. Wetlands are defined in the National Water Act (36 of 1998) 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”. Wetlands are found where the landform (topography) or geology slows down or obstructs the movement of water through the catchment, or where the groundwater surfaces causing the soil layers in the area to be temporarily, seasonally or permanently wet. This provides an

environment where particular plants (hydrophytes) that are adapted to wet conditions tend to grow in abundance. The plants in turn affect the soil and hydrology by further slowing down the movement of water (e.g. reed beds) or by producing organic matter that may accumulate in the soil.

Wetlands are important because of the functions and values that they provide which benefit mankind. These benefits can be either direct or indirect benefits. Until very recently the benefits of wetlands to society were often not recognized, and many wetlands have been destroyed, or poorly managed. Wetland benefits refer to: "*those functions, products, attributes and services provided by the ecosystem that have values to humans in terms of worth, merit, quality or importance. These benefits may derive from outputs that can be consumed directly; indirect uses which arise from the functions or attributes occurring within the ecosystem; or possible future direct outputs or indirect uses*" (Howe et al., 1991 in Kotze et al., 2005).

The functioning of a wetland is also affected by other factors, many of which result from the activities of people. These include "off-site" factors which take place in the surrounding catchment (e.g. a change in land cover from natural grassland to a gum tree plantation which would decrease the amount of water reaching the wetland) and "on-site" factors which take place at the wetland (e.g. fire, draining, damming, etc.).

FIELD SURVEYS

Prior to the site visit, a desktop study was conducted of the study area using 1:50 000 topographical maps, aerial images obtained from Google Earth and the SANBI BGIS Map Viewer (accessed January 2021) to determine the presence of a wetland on the site.

A Dutch soil auger was used to extract the cores to a depth of 50cm. All soil samples were evaluated in hand for soil composition, colour, number, size and chroma of mottles as well as wetness, after which they were discarded. The location of each soil core was marked using a hand-held Garmin Colorado 300 GPS. Field verification was limited to the presence of hydric soils on the site as well as presence of hygrophytic and hydrophilic vegetation.

Wetland assessment

Wetland health / Wetland Index of Habitat Integrity (IHI)

WET-Health and Wetland IHI assists in assessing the health of wetlands using indicators based on geomorphology, hydrology, water quality and vegetation. For the purposes of

rehabilitation planning and assessment, WET-Health helps users understand the condition of the wetland in order to determine whether it is beyond repair, whether it requires rehabilitation intervention, or whether, despite damage, it is perhaps healthy enough not to require intervention. It also helps diagnose the cause of wetland degradation so that rehabilitation workers can design appropriate interventions that treat both the symptoms and causes of degradation.

The Wetland IHI is a tool that was developed to be able to assess and monitor floodplain and valley-bottom wetlands and provides a score on the Present Ecological State of of the wetland habitat. A Wetland IHI assessment was conducted as per the procedures in DWAF (2007).

The tool evaluates the intactness of the wetland and is determined by a score known as the Present Ecological Score (PES). The Present Ecological State (PES) refers to the current state or condition of a watercourse in terms of all its characteristics and reflects the change to the watercourse from its reference condition. The health assessments for the hydrology, geomorphology and vegetation components were then represented by the Present Ecological State (PES) categories. The PES categories are divided into six (A-F) units based on a gradient from “unmodified/natural” (Category A) to “severe/complete deviation from natural” (Category F) as depicted in Table 2.

Table 2. Present Ecological State categories used to define health of water courses (adapted from Kleynhans, 1999).

Description	PES Score (%)	PES Category
Unmodified, natural.	**90-100**	**A**
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	**80-90**	**B**
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	**60-80**	**C**
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	**40-60**	**D**
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	**20-40**	**E**
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	**0-20**	**F**

A summary of the change class, description and symbols used to evaluate wetland health are summarised in Table 3 below.

Table 3. Trajectory descriptions and symbols used to evaluate future direction of change to wetland health (Macfarlane et al, 2007).

Change Category	Description	Symbol
Improve	Condition is likely to improve over the over the next 5 years	(↑)
Remain stable	Condition is likely to remain stable over the next 5 years	(→)
Slowly deteriorate	Condition is likely to deteriorate slightly over the next 5 years	(↓)
Rapidly deteriorate	Substantial deterioration of condition is expected over the next 5 years	(↓↓)

Ecological Importance and Sensitivity

The **Ecological Importance and Sensitivity** (EIS) of a watercourse is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales, and both abiotic and biotic components of the system are taken into consideration. Sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The ecological importance and sensitivity categories are indicated in Table 4.

Table 4. Ecological Importance & Sensitivity Categories of Wetlands (DWAF, 1999)

EIS CATEGORIES	DESCRIPTION	RATING
LOW/MARGINAL	Not ecologically important and sensitive at any scale. The biodiversity of wetland is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers	>0 and <1
MODERATE	Ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers	>1 and <2
HIGH	Ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers	>2 and <3
VERY HIGH	Ecologically important and sensitive on a national (or even international) level. Biodiversity usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water in rivers	>3 and <4

Wetland ecoservices

WET-EcoServices (Kotze *et al.* 2004) was used to assess the goods and services that the floodplain/stream provides. This tool provides guidelines for scoring the importance of different ecosystem services delivered by a wetland. The different services are then assessed based on existing knowledge and/or field assessment data. Each of fifteen different categories are assessed based on various characteristics (e.g. size of the wetland, pattern of flow through the wetland, social value and uses, etc.) that are relevant to the particular benefit.

RESULTS OF THE VEGETATION SURVEY

Vegetation units

A total of two (2) different vegetation units were identified on the property and are discussed below (Figure 2):

1. Wetland areas
2. *Eucalyptus* woodland

1. Wetland areas

Status	Semi-natural		
Vegetation structure:	Grassland / Forbland		
Topography:	Depression	**Soil**	Clay
Rock cover:	< 1%		
Need for rehabilitation	Medium		
Conservation Priority	**High**		

Two wetland areas are present within the study area, one located in the southern and one in the north-eastern section of the study site.

Southern wetland

This wetland area is dominated by the forb *Typha capensis* and the grasses *Phragmites australis, Agrostis lachnantha* and *Leersia hexandra.* Various stormwater drainage channels on the current cemetery to the east of the study site channels water into this system. A small open water section is also present.

North-eastern wetland

This wetland area is located in the northeastern section of the study area. The vegetation is characterised by the prominence of the grasses *Leersia hexandra, Setaria sphacelata* and the alien invader tree *Eucalyptus camaldulensis.* And old berm is present in the western boundary of this wetland.

Vegetation cover

Trees: 20-50%; Shrubs: 10%; Grasses: 60-70%; Forbs: 5-15%

Red data species

No red data species were found to be present within this unit though marginal habitat exists for selected species (see Annexure 1).

Alien plant species

Acacia mearnsii, Campuloclinium macrocephalum, Cirsium vulgare, Eucalyptus camaldulensis, Verbena bonariensis, Verbena brasiliensis.

The following is a list of plant species identified in unit 1a during the survey (=alien invasive species; =medicinal value; =Protected species; =Garden hybrid) (W=woody; G=grass; F=forb):

Cat	Species	Class
	Acacia mearnsii De Wild.	W
	Agrostis lachnantha Nees	G
	Aristida scabrivalvis Hack.	G
	Campuloclinium macrocephalum (Less.) DC.	F
	Chamaecrista mimosoides (L.) Greene	F
	Chenopodium album L.	F
	Cirsium vulgare (Savi) Ten.	F
	Cynanchum obtusifolium L.f.	F
	Cynodon dactylon (L.) Pers.	G
	Cyperus obtusiflorus Vahl	F
	Eragrostis curvula (Schrad.) Nees	G
	Eragrostis plana Nees	G
	Eucalyptus camaldulensis Dehnh.	W
	Hyparrhenia tamba (Steud.) Stapf	G
	Imperata cylindrica (L.) Raeusch.	G
	Juncus species	F
	Leersia hexandra Sw.	G
	Mariscus congestus (Vahl) C.B.Clarke	F
	Medicago sativa L.	F
	Melilotus alba Desr.	F
	Monopsis decipiens (Sond.) Thulin	F
	Nidorella anomala Steetz	F
	Paspalum dilatatum Poir.	G
	Paspalum urvillei Steud.	G
	Phragmites australis (Cav.) Steud.	G
	Plantago lanceolata L.	F
	Schoenoplectus species	F
	Senecio species	F
	Setaria sphacelata (Schumach.) Moss	G
	Trifolium repens L.	F
	Triraphis schinzii Hack.	G
	Typha capensis (Rohrb.) N.E.Br.	F
	Verbena bonariensis L.	F
	Verbena brasiliensis Vell.	F
	Yucca gloriosa L.	W

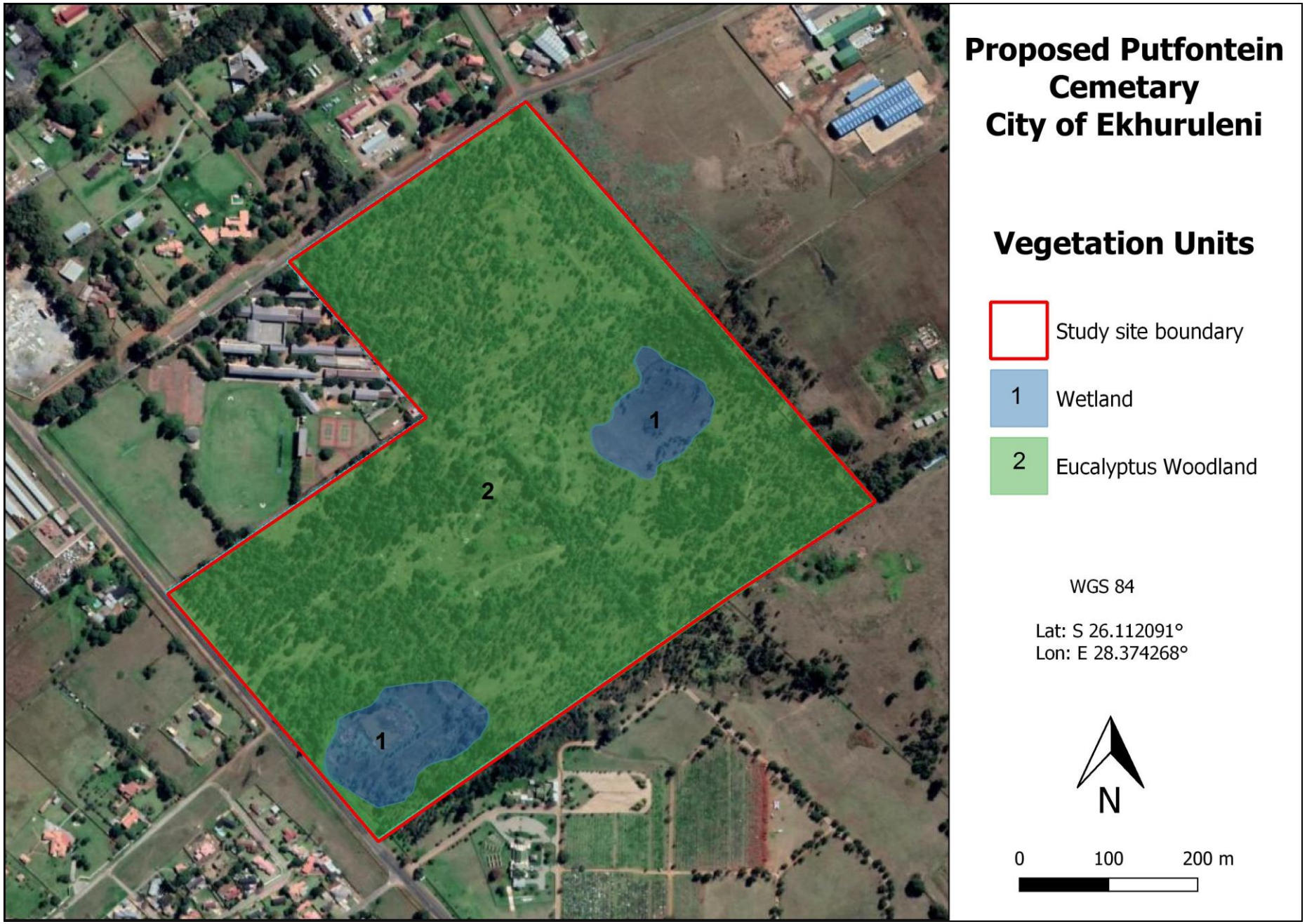


Figure 2. Vegetation units of the study area. (Image obtained from Google Earth 2021).

2. *Eucalyptus* Woodland

Status	Transformed		
Vegetation structure:	Tall dense woodland		
Topography:	Level areas with slight north-eastern slope (1^0)	**Soil**	Loam to clayey
Rock cover:	1%		
Need for rehabilitation	High		
Conservation Priority	**Low**		

This unit comprises the largest section of the study area and is found on loamy soil with very few rocks present.

The vegetation is dominated by the declared alien invader trees *Eucalyptus camaldulensis* and *Melia azedarach.* Prominent species include various alien invasive species as well as pioneer weedy species such as the declared invader shrub *Robinia pseudoacacia*, declared invader weeds *Ipomoea purpurea, Mirabilis jalapa, Datura stramonium,* pioneer forbs *Tagetes minuta, Bidens pilosa, Lepidium bonariense, Trifolium repens,* the grasses *Cynodon dactylon, Melinis repens* and the alien invasive grass *Pennisetum clandestinum.*

Vegetation cover

Trees: 75%; Shrubs: 15%; Grasses: 25-40%; Forbs: 25%

Red data species

No red data species were found within this unit and it is highly unlikely that such species would be present due to the area being transformed.

Alien plant species

Acacia melanoxylon, Acacia mearnsii, Agave americana, Araujia sericifera, Datura stramonium, Eucalyptus camaldulensis, Melia azedarach, Mirabilis jalapa, Opuntia ficus-indica, Pinus pinaster, Robinia pseudoacacia, Ipomoea purpurea, Pennisetum clandestinum, Solanum mauritianum, Tipuana tipu.

The following is a list of plant species identified in unit 1a during the survey (=alien invasive species; =medicinal value; =Protected species; =Garden hybrid) (W=woody; G=grass; F=forb):

Cat	Species	Class
	Acacia melanoxylon R.Br.	W
	Acacia mearnsii	W
	Agave americana L.	F
	Amaranthus hybridus L.	F
	Araujia sericifera Brot.	F
	Bidens pilosa L.	F
	Chenopodium album	F
	Commelina erecta L.	F
	Conyza bonariensis (L.) Cronquist	F
	Conyza podocephala DC.	F
	Cynodon dactylon (L.) Pers.	G
	Dalea species	F
	Datura stramonium L.	F
	Eragrostis curvula (Schrad.) Nees	G
	Eucalyptus camaldulensis Dehnh.	W
	Hypoxis iridifolia Baker	F
	Ipomoea purpurea (L.) Roth	F
	Lepidium bonariense L.	F
	Mariscus congestus (Vahl) C.B.Clarke	F
	Melia azedarach L.	W
	Melinis repens (Willd.) Zizka	G
	Mirabilis jalapa L.	F
	Opuntia ficus-indica (L.) Mill.	F

	Panicum maximum Jacq.	G
	Paspalum dilatatum Poir.	G
	Pennisetum clandestinum Chiov.	F
	Pinus pinaster Aiton	W
	Plantago lanceolata L.	F
	Robinia pseudo-acacia L.	W
	Schkuhria pinnata (Lam.) Cabrera	F
	Solanum mauritianum Scop.	W
	Tagetes minuta L.	F
	Tipuana tipu (Benth.) Kuntze	W
	Trifolium repens L.	F
	Urochloa panicoides P.Beauv.	G
	Verbena tenuisecta Briq.	F
	Vernonia poskeana Vatke & Hildebr.	F

Wetland assessment

Two wetland areas were found to be present on the site. Only one is indicated on SANBI BGIS.

Present Ecological Status (PES)

The results from the PES analysis for the wetland areas indicate them to be largely modified (PES class D/E – 38.8%, Table 5). A vast change in ecosystem processes and loss of natural habitats has taken place but there is still some remaining natural habitat with some natural ecosystem processes taking place. The score of the wetland areas can be ascribed to the various anthropogenic influences (drainage channels, past ploughing, dumping of litter & rubble) and the effect of the surrounding alien invasive plant species that are encroaching into these areas.

Due to surrounding developments and roads the hydrology has been impacted with a loss in normal hydrological processes. The surface roughness around the wetland is still high with good vegetation cover. All the anthropogenic influences as well as the alien plant invasions in and around the wetland has changed the landscape and topography. This has resulted in the natural vegetation becoming degraded to such an extent that secondary successional and pioneer plant species have become prominent/dominant in some areas.

The area does however still have a good vegetation cover and moderate species composition.

Table 5. Present Ecological State (PES) of the southern wetland on the study site

OVERALL PRESENT ECOLOGICAL STATE (PES) SCORE					
	Ranking	Weighting	Score	*Confidence*	PES Category
DRIVING PROCESSES:		**100**	**3.4**	***Rating***	
Hydrology	1	100	3.9	*1.7*	**E/F**
Geomorphology	2	80	2.7	*2.9*	**D**
Water Quality	3	30	3.7	*1.0*	**E**
WETLAND LANDUSE ACTIVITIES:		**80**	**2.6**	***2.7***	
Vegetation Alteration Score	1	100	2.6	*2.7*	**D**
OVERALL SCORE:			**3.1**	***Confidence Rating***	
	PES %		**38.8**		
	PES Category		**D/E**	***1.2***	

Ecological Importance and Sensitivity (EIS)

The EIS and functions for the wetland was calculated using DWA guidelines and a model, as developed by M. Rountree, but not yet published. Information was used form the SIBIS and VEGMAP products. A mean score between 0 and 4 is obtained, with 0 as the lowest and 4 as the highest score (0-1 = Low to very low; >1-2 = Moderate; >2-3 = Medium-high: >3-4 = High to very high). The scores for the different wetlands are indicated in tables 6 & 7 below:

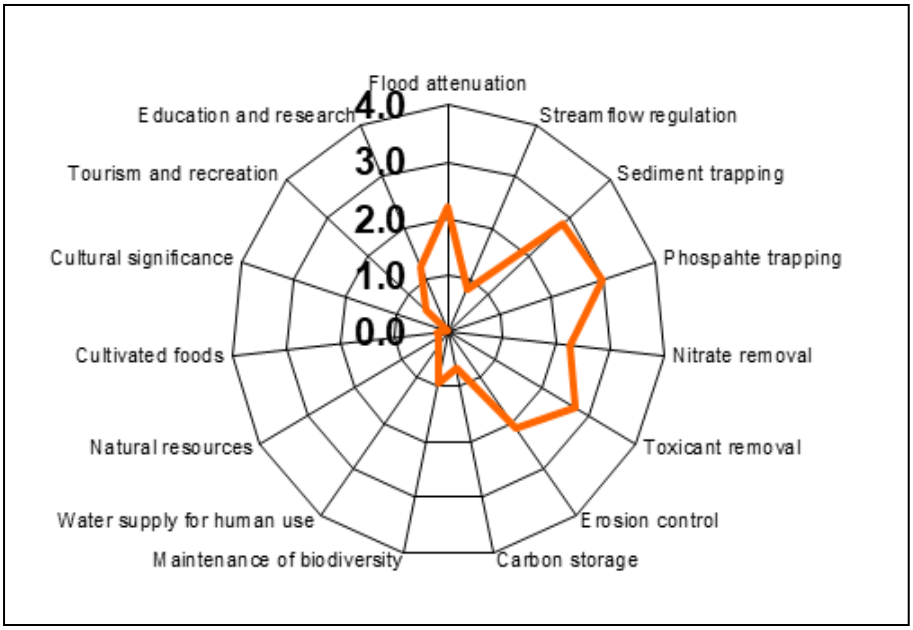
The wetland areas obtained a score of 1.14 (Table 6) indicating the area to have a **low-moderate ecological sensitivity**. This is also ascribed to anthropogenic influences, alien invader plants, and the area being surrounded by the various developments.

Table 6. EIS calculation of the southern wetland on the study site

ECOLOGICAL IMPORTANCE AND SENSITIVITY	Score (0-4)	*Confidence (1-5)*
Biodiversity support	1.33	*4*
Landscape scale	1.25	*5.00*
Sensitivity of the wetland	0.83	*3.67*
ECOLOGICAL IMPORTANCE & SENSITIVITY	**1.14**	***4.22***

Wetland ecoservices

The ecosystem services provided by wetland areas are regarded as **low-moderate**. The wetlands play a role in phosphate, nitrate and toxicant removal and in sediment trapping. These areas have a low stream flow and flood attenuation functions while it plays no role in the maintenance of biodiversity. These can all be described to the various factors as mentioned previously in this report.



maintenance, whilst also being a source of water for the informal settlement along its edges. (see diagram right).

DISCUSSION

Vegetation type

The vegetation of the study is a classified as belonging to the endangered Eastern Highveld Grassland vegetation type (Gm 12) (Mucina & Rutherford 2006). This Grassland occurs mostly in the Gauteng and Mpumalanga Provinces of South Africa at altitudes between 1520-1780 m. The terrain is mostly undulating plains with low hills and depressions. The grass layer is short and dense that is dominated by the grasses *Themeda triandra, Eragrostis curvula, Digitaria eriantha* and *Tristachya leucothrix.* Other species present include the grasses *Monocymbium ceresiiforme, Setaria sphacelata, Eragrostis plana, Trachypogon spicatus, Sporobolus africanus, Microchloa caffra* and the forbs *Pelargonium luridum, Haplocarpa scaposa, Justicia anagalloides, Berkheya setifera* and *Dicoma anomala.* Only a small fraction of the target of 24% is formally conserved while it is estimated that close to 44% has already been transformed due to cultivation, mining, urbanisation and dams.

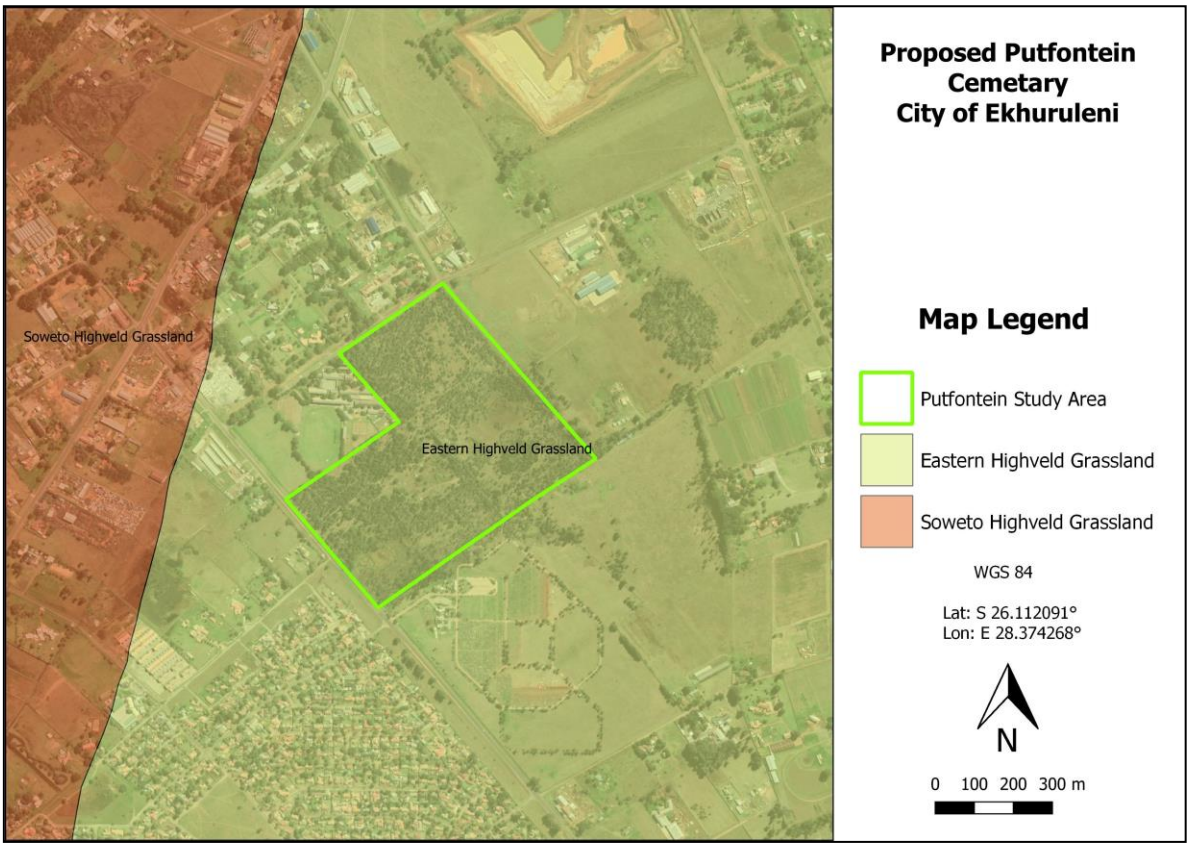


Figure 3. Vegetation type of study area (Mucina & Rutherford 2006)

The vegetation of the study area shows no resemblance to this vegetation type and is regarded as being transformed.

Gauteng ecosystem classification

The study area is classified as belonging to the Blesbokspruit Highveld Grassland (GP 1) ecosystem. This system is regarded as a Critically Rare ecosystem that originally comprised an area of 94 000 ha of which only 1% is protected. There is 26 threatened or endemic plant and animal species that were previously recorded within this ecosystem. Key biodiversity species include Red or Orange listed plants *Delosperma leendertziae* and *Khadia beswickii*.

According to GDARD C-Plan 3.3 the study area is regarded as being and Ecological Support Area (Figure 4). The entire area is however dominated and overgrown with alien invasive and pioneer weedy species.

Figure 4. Classification of the study site according to GDARD C-Plan 3.3. (Light green areas = ESA) (image obtained bgisviewer.sanbi.org).

Vegetation units

Vegetation unit 1 (wetland areas) consists of two small wetlands located in the southern and north-eastern sections of the study site. The wetlands are classified as belonging to the Mesic Highveld Grassland Group and are classified as artificial by NFEPA (Table 7).

Table 7. NFEPA classification of wetland area.

Wetland type	Description	Condition	NFEPA rank	FEPA status
Mesic Highveld Grassland Group	*Artificial*	Z3	6	No status
# wetland units: 1				

This HGM unit is indicated on the historical 1:50 000 maps as a reservoir or water abstraction source an not indicated as a wetland. It could potentially be a permanent sink for storm water or water runoff from the existing cemetery roads and hard infrastructure. The neglect of the area could have resulted in sediment build-up due to situation and aggregates from hard surfaces and caused hydrophytes to establish.

These areas have nonetheless developed into wetlands with wetland soil, vegetation and topography albeit having a low-moderate PES, EIS and Ecosystem Services. Wetlands are considered to be important ecosystems due to their water retention and water channeling functions as well as biodiversity support. From and plant ecological point of the view these areas have a medium conservation value, but due to there water reterntion function they are regarded as having a **high conservation value.**

Vegetation unit 2 (*Eucalyptus* woodland) comprises the largest section of the study area. The area is completely overgrown by declared alien invasive trees, shrubs and weeds. As a result the natural vegetation has been displaced with little to no natural habitat remaining. Rubble and litter are strewn throughout the entire area various pioneer weedy grasses and forbs. Various

footpaths are present with vagrants living in the area. The area is utilised by vagrants to harvest wood. Various people were observed cutting down trees in this unit during the field survey. The alien invasive plants pose a threat to the environment and negatively affects ecosystem processes. From a plant ecological and ecosystem functioning point of view this area is considered to have a **low (none) conservation value.**

Alien plant species

The study site is characterised by a large number of declared alien invasive species that are present in especially vegetation unit 2 and are listed below:

			Vegetation units	
Species	**CARA**	**NEMBA**	**1**	**2**
Acacia mearnsii De Wild.	2	2	●	
Agave americana	2	Not listed		●
Araujia sericifera	1	1b		●
Campuloclinium macrocephalum (Less.) DC.	1	1	●	
Cirsium vulgare (Savi) Ten.	1	1b	●	
Datura stramonium L.	1	1b		●
Eucalyptus camaldulensis Dehnh.	1	2	●	
Ipomoea purpurea	1	3		●
Melia azedarach L.	1b	3		●
Mirabilis jalapa L.	1b	1		●
Opuntia ficus-indica	1b	1		●
Pennisetum clandestinum Chiov.	1b	not listed		●
Pinus pinaster Schltdl. & Cham.	1b	2		●
Robinia pseudo-acacia L.	1b	2		●
Solanum sisymbriifolium Lam.	1b	1	●	
Tipuana tipu (Benth.) Kuntze	3	3		●
Verbena bonariensis L.		1b	●	
Verbena brasiliensis Vell.		1b	●	

Medicinal plants

Only two medicinal plant species were found during the survey on the study area as listed in the table below. None of these species are threatened while one species, *Datura stramonium,* is a declared alien invasive weed.

Plant name	Plant part used	Medicinal use	Vegetation unit
Datura stramonium	Leaves & green fruit	Asthma, rheumatism, abscesses, bronchitis, tonsillitis	2
Typha capensis	Fleshy rhizomes	Diarrhea, dysentery, male potency enhancer, blood circulation improvement	1

Red data species

The presence of a subpopulation of a species of conservation concern on a proposed development site is used as an indicator amongst other, of the sensitivity of the vegetation

ecosystem. If such a species is found to be present the competent authority may refuse authorisation for the proposed activity or require mitigation measures to be implemented. Lists of red data species are normally acquired via various resources and if no specific recording was made/confirmed on the site, lists obtained from Quarter Degree Grids (QDSG) are used as a broad guideline. At this broad scale the list will include species that may not be found on the proposed site since no suitable habitat exists. These lists therefore provide broad guidelines only but are useful tools to assess the habitat suitability of the site for these species.

According to GDARD a total of 9 red data plant species were recorded in the QDG within which the study area is located. The **confidential list** of GDARD is included as Annexure 1.

No such species or suitable habitat was found to be present in vegetation unit 2 while marginal habitat exists for five species in vegetation unit 1.

Connectivity

The study area is surrounded by various developments in the north, south and west while it has some but limited connectivity to moderately degraded open land in the east.

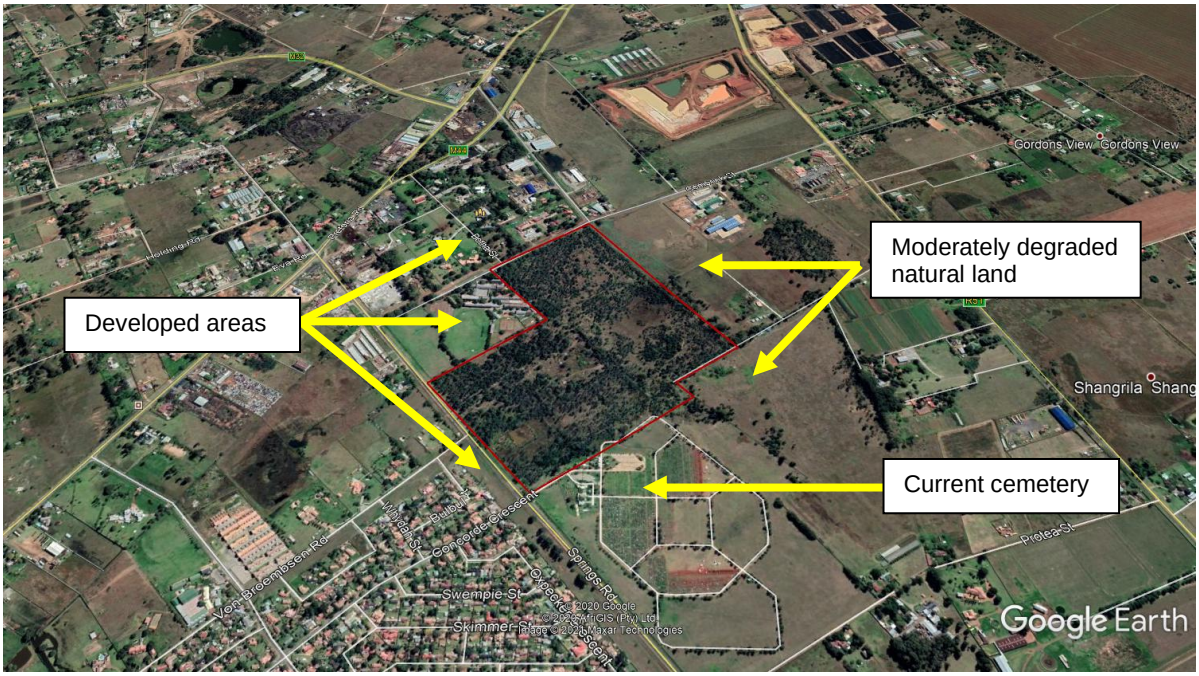


Figure 5. Connectivity of study area.

POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT ON THE ASSOCIATED FLORA

The following assessment of impacts was done and was guided by the requirements of the NEMA EIA Regulations (2014) and is presented in Table 8 below.

Habitat loss

Habitat loss imply loss of plant and animal species which ultimately results in loss of biodiversity. Due to the transformed condition of the study site, there is no natural vegetation left and the proposed development should have no negative effect on the natural environment from a vegetation perspective. The wetland areas, although degraded does provide habitat for various aquatic animals and insects with some natural vegetation remaining. All rubble and litter should be removed from the site.

Mitigation and recommendations

No development should be allowed within the wetland areas. The wetland areas should be fenced off prior to development and no person allowed within these areas unless for the purposes of alien plant control and removal.

Alien vegetation

Alien species poses a huge threat to the natural environment due to their competitive nature that leads to the displacement of natural indigenous species (plants and animals), and also due to their excessive use of soil water.

Alien and invasive plant species are grouped according to the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) into three categories:

- Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.
- Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
- Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

Table 8. Impact assessment of proposed development on the vegetation

Activity	Potential impact	Environmental significance									Reversibility	Cumulative impact	Irreplaceble loss	Mitigation measures
		Nature	Extent	Duration	Magnitude	Probability	Rating before mitigation		Rating after mitigation					
Environmental Component: Vegetation, Fauna														
Clearing of vegetation for construction	Loss of plant species	–	1	3	2	4	24	**Low**	4	**Negligible**	Irreversible	Low	Low	See potential impacts and recommended mitigation measures in report
	Loss of rare/medicinal species	–	1	3	2	2	12	**Negligible**	4	**Negligible**	Irreversible	Low	Low	
	Loss of animal species	–	2	3	2	4	28	**Low**	4	**Negligible**	Irreversible	Low	Low	
	Loss of biodiversity	–	1	3	2	4	24	**Low**	4	**Negligible**	Irreversible	Low	Low	
	Increased soil erosion	–	2	3	2	2	14	**Negligible**	4	**Negligible**	Reversible	Low	Low	
	Alien plant invasion	+	3	3	6	4	48	**Low**	4	**Negligible**	Reversible	Low	Low	

The following categories have been listed by the National Environmental Management: Biodiversity Act (10/2004) (NEMBA):

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

Mitigation and recommendations

All alien vegetation should be eradicated within the study site and invasive species as listed in this report should be given the highest priority. The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier's specifications. Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983) and National Environmental Management: Biodiversity Act (10/2004) (NEMBA). These acts define weeds as alien plants, with no known useful economic purpose that should be eradicated. Where herbicides are used to clear vegetation, selective and biodegradable herbicides registered for the specific species should be applied to individual plants only. General spraying and the use of non-selective herbicides (e.g. Roundup, Mamba etc.) should be prohibited at all times.

Waste Management

Adequate waste management measures must be implemented preventing possible illegal dumping and littering of adjacent sensitive areas.

- The excavation and use of rubbish pits are forbidden.
- Burning of waste is forbidden.
- A fenced area must be allocated for waste sorting and disposal.
- Individual skips for different types of waste (e.g. 'household' type refuse, building rubble, etc.) should be provided.

Storm water Management and pollution of water system

All storm water generated by the development must be appropriately managed.

- The storm water drainage network system must be kept separate from the wastewater (water containing waste) system.
- The storm water system must be designed such that no large amount of water is released into the wetland/stream system at one point only.
- The release of water into the wetland/stream system must be designed such that the force of the water is reduced to prevent unnecessary erosion.

Prior to construction commencement

- It is vitally important that storm water management is properly managed on site both during and after construction.
- The Storm water Management Plan must be approved prior to construction commencing.

Environmental Control Officer (ECO)

A suitably qualified ECO should be appointed to monitor all activities and to report any actions that could or potentially could have a negative effect on the environment. The ECO should also keep records of all actions related to the environmental management plan that should be available on site for inspection. It is also recommended that photographic records are kept before, during and after construction of the various activities.

CONCLUSION & RECOMMENDATIONS

The study area is mostly surrounded by residential areas, a school, and a cemetery in the west, north and south respectively. The study area borders onto moderately to severely degraded areas in the east. The site is mostly open and easily accessible to people who use it as a throughway with various footpaths traversing the site. Rubble and dumping has (and is) taking place on the site while vagrants live in sections in-between the trees where people also harvest the wood for cooking and other purposes.

On a country-wide scale the study area falls within the endangered Eastern Highveld Grassland vegetation type (Gm 12) and on a provincial scale within the Critically Rare Blesbokspruit Highveld Grassland (GP 1). According to GDARD C-Plan 3.3 the area is regarded as being and Ecological Support Area. The vegetation of the *Eucalyptus camaldulensis* woodland (vegetation unit 2) is however, dominated by the declared alien invader tree *Eucalyptus camaldulensis* together with a large number of other highly invasive alien plant species. The alien plant species has displaced most of the natural vegetation with only a few secondary successional and pioneer species remaining. Dumping of rubble and litter further contributes to the degradation of the vegetation with some garden hybrid species establishing in the area. The vegetation therefore shows no resemblance to natural vegetation and vegetation types that originally occurred in the area. Thus, from a plant ecological and ecosystem functioning point of view this vegetation unit has a **low conservation value and ecosystem sensitivity** (Figure 6)**.**

Two wetland areas (vegetation unit 1) were identified on the study site. The vegetation of the wetlands consists of a mixture of natural and alien invasive vegetation. The wetland areas are mostly artificial and resulted from human actions. The section in the south is classified as a reservoir on 1:50 000 topographic maps while berms were erected many years ago around the north-eastern section that all caused water to collect in these areas. They have however developed permanently wet/moist conditions and function as wetlands. The vegetation, although degraded and threatened by alien plant invasion, is typical of wetlands with wetland soil conditions. From a plant ecological point of view the vegetation has a medium-low conservation value, however the wetland ecosystem in total (ecosystem functioning role) is regarded as having a **high ecosystem sensitivity and conservation value** (Figure 6)**.**

Only two medicinal plants were found to be present on the study site. None are regarded as threatened while one is a declared weed.

No red data species or suitable habitat were found to be present in vegetation unit 2 (*Eucalyptus camaldulensis* woodland) while marginal habitat was found to be present for five species in the wetland areas (vegetation unit 2).

The largest part of the study area comprises alien invasive plants while various anthropogenic influences are present. The alien plants pose a risk to the surrounding areas and should be eradicated as a high priority. No development should be allowed in the wetland areas, but the alien plants present should be removed from these systems. If the recommended mitigation measures are followed it is not thought that the development of the site should have any negative effect on the environment.

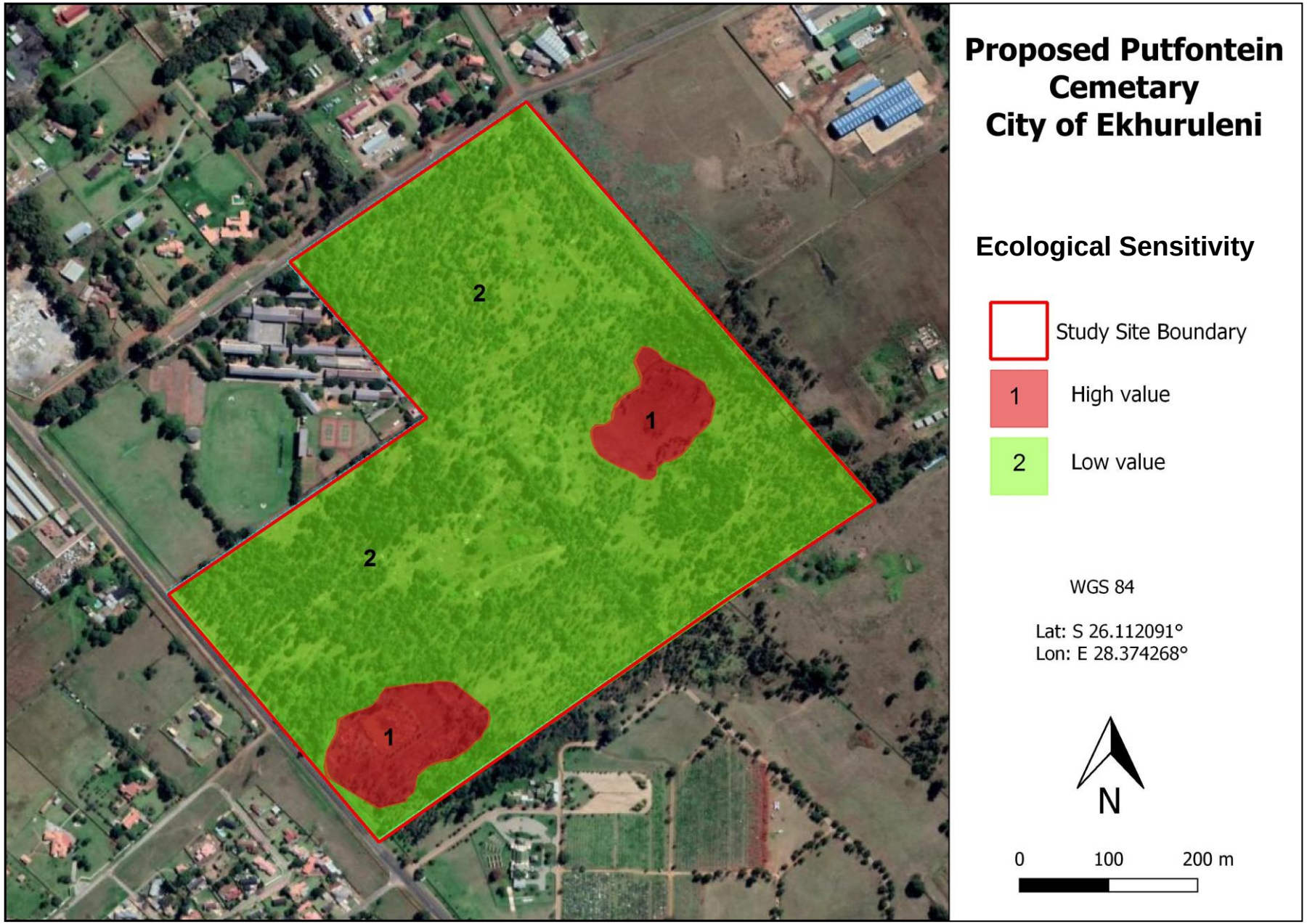


Figure 6. Conservation/Sensitivity map for the vegetation units

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Annexure 1

Red data species recorded in the QDG

CONFIDENTIAL

The data in the table below is confidential and may not be made available in any document available for public perusal. This annexure must be removed from any document that is published or made available to public or any third party. Gauteng Nature Conservation retains the copyright of all Red List information as well as the right to recall this data in the event of any contravention of the conditions stipulated above.

SPECIES	PRIORITY GROUPING	CONSERVATION STATUS ([1]global status; [2]national status)	OBSERVED	COMMENTS
Adromischus umbraticola subsp. *umbraticola*	A2	Near Threatened[1]	✘	No suitable habitat
Argyrolobium campicola	A3	Near Threatened[1]	✘	Habitat transformed
Boophane disticha	N/A	Declining[2]	✘	No suitable habitat
Bowiea volubilis subsp. *volubilis*	B	Vulnerable[2]	✘	No suitable habitat
Crinum bulbispermum	N/A	Declining[2]	✘	Not found, marginal habitat unit 1
Crinum macowanii	N/A	Declining[2]	✘	Not found, marginal habitat unit 1
Eucomis autumnalis	N/A	Declining[2]	✘	Not found, marginal habitat unit 1
Eulophia coddii	A2	Vulnerable[1]	✘	No suitable habitat
Gladiolus robertsoniae	A3	Near Threatened[1]	✘	Habitat transformed
Gunnera perpensa	N/A	Declining[2]	✘	Not found, marginal habitat unit 1
Habenaria bicolor	B	Near Threatened[2]	✘	No suitable habitat
Hypoxis hemerocallidea	N/A	Declining[2]	✘	Not found
Ilex mitis var. *mitis*	N/A	Declining[2]	✘	No suitable habitat
Khadia beswickii	A1	Vulnerable[1]	✘	No suitable habitat
Kniphofia typhoides	A3	Near Threatened[1]	✘	Not found, marginal habitat unit 1
Lithops lesliei subsp. lesliei	A3	Near Threatened[2]	✘	No suitable habitat