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DRAFT

WETLAND DELINEATION AND FUNCTIONALITY ASSESSMENT

for the

proposed Central Industrial Area development, Richards Bay, Kwa-Zulu Natal.

Compiled for

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Project Responsibilities

ASPECT INVESTIGATED	SPECIALIST	QUALIFICATIONS	EXPERIENCE
Wetland functionality assessment and report writing	Jacolette Adam	M.Sc.	17 years of professional experience in the environmental sector, and has been a certified Professional Natural Scientist since 2002 (400088/02). She is also a Fellow member of the Water Institute of South Africa (WISA), Environmental Law Association (ELA) of SA, the International Association for Impact Assessment South Africa (IAIASA) and has successfully completed numerous environmental assessments throughout South Africa for a wide range of clients.
Wetland functionality assessment and report writing	Charleen Smuts	M.Sc.	Charleen is a Candidate of Professional Natural Scientist, member of the South African Affiliate of the International Association for Impact Assessment (IAIASA), the South Africa Wetland Society (SAWS) and the Botanical Society of South Africa (BOTSOC). She has 4 years of experience and has conducted numerous ecological and wetland delineation and functionality assessments. Furthermore, Charleen has been involved in a wide range of environmental authorisation projects.
GIS mapping	Madeleine Knoetze	B.Sc.	Madeleine has 2 years of experience in the field of environmental management. She is a member of the International Association for Impact Assessments South Africa (IAIAsa). She has assisted in the completion of a numerous environmental assessments, as well as ecological and wetland assessments. She is skillful in the field of Geographic Information Systems (GIS) leading to involvement in large and small scale mapping projects in KwaZulu-Natal and Gauteng.

ABBREVIATIONS AND ACRONYMS

CA	Competent Authority
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CREW	Custodians of Rare and Endangered Wildflowers
DAFF	Department of Agriculture, Forestry and Fisheries
DEDTEA	Department of Economic Development, Tourism and Environmental Affairs
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EGSA	Ecosystem Goods and Service Areas
EIS	Ecological Importance and Sensitivity
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
ESA	Ecological Support Areas
ESMP	uMhlathuze Environmental Services Management Plan
GA	General Authorisation (GN 509)
IUCN	International Union for Conservation of Nature and Natural Resource
KZN	KwaZulu-Natal
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NFA	National Forests Act (Act 84 of 1998)
NFEPA	National Freshwater Ecosystems Priority Areas
NWA	National Water Act (Act 36 of 1998)
NWCS	National Wetland Classification System
PES	Present Ecological State
PNCO	Provincial Nature Conservation Ordinance
PRECIS	National Herbarium Pretoria (PRE) Computerised Information System
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SEA	EKZNW Strategic Environmental Assessment
SIBIS	Integrated Biodiversity Information System
STM	Stormwater Management Plan
TOPS	NEMBA Threatened or Protected Species
VEGMAP	Vegetation Map of Southern Africa
WMA	Water Management Area
WULA	Water Use License Application
ZCBF	Zululand Chamber of Business Foundation

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EXECUTIVE SUMMARY

Exigent Engineering was appointed by uMhlathuze Local Municipality to conduct an Environmental Authorisation Amendment process following the successful bid on a tender released on 28 October 2016. Exigent's proposal included an updated Wetland Delineation and Functionality Assessment for the proposed Central Industrial Area (CIA) development site located on the Remainder of Reserve 6 No. 15825-GV Richards Bay, in the King Cetshwayo District Municipality, KwaZulu-Natal (KZN) (Figure 2-1). The proposed development will include general industry, service industry, limited commercial, a public car cark and public open space. The land occupies an area of approximately 177 hectares.

The study area forms part of one of the major conservation corridors of Richards Bay, linking to Thulazihleka Pan and Ngodweni Canal, leading to the Port of Richards Bay. It is surrounded by industrial, urban and residential development. These formalised structures have impacted on the periphery of the study area mainly through dumping and introduction of alien and invasive species. A few single informal dwellings were located within the area. The majority of the site however is in a highly functional ecological state, comprising of large permanently inundated wetland habitats. This study area is the link between various large and important water bodies in the area, and it is critical to ensure functioning of this ecosystem. The wetlands have been identified and classified per the Department of Water and Sanitation (DWS) and the South African National Biodiversity Institute (SANBI) requirements.

A 50m buffer zone has been proposed around the permanent wetlands – upholding protection of peatlands and permanent wetlands as a proposed compromise between the CIA development and conservation of some of the sensitive areas on the study site. Most of the seasonal wetlands delineated fall within the proposed buffer and are therefore included in the protection. As per the previous approved development layout, these sensitive areas will form a conservation corridor linking the large network of natural drainage systems of the immediate area to the Port of Richards Bay. This conservation corridor is considered sensitive and no development must take place in these areas. It is acknowledged that construction activities will however take place within seasonal and temporary zones of this wetland system, therefore wetlands specific management measures must be strictly implemented and adhered to. These include:

- The no-go boundaries must be demarcated by an independent qualified wetland specialist prior to commencement of construction.
- Removal of alien species within the construction area must be an ongoing activity throughout the construction phase;
- An overarching Alien and Invasive plant species Management Programme must be developed for the operational phase. This plan must be approved by the Competent Authority (CA) prior to commencement of operation.
- No placement of soil inside the demarcated permanent wetland or buffer area;
- Engineering designs should cater for current wetland conditions to ensure limited impact on the functioning of the wetland;
- Prevent excavated material from entering water resources and other sensitive areas;
- All spills should be immediately cleaned up and treated accordingly;
- No dumping of construction waste material must be allowed;
- Incorporate adequate erosion management measures to limit erosion and associated sedimentation of the water resource;

- Management measures may include berms, silt fences, hessian curtains and stormwater diversion away from areas susceptible to erosion. Care should however be taken to avoid additional disturbance during the implementation of these measures;
- A Stormwater Management Plan (SMP) must be designed for the study area in its entirety. This must include filtered low-flow dispersion discharge techniques into the demarcated wetland area to ensure that surface water flows can still provide feed to the protected wetland areas. This SMP must be approved by the CA and be included as a condition of the Amendment Authorisation.
- Water quality monitoring programme must be developed prior to commencement of construction and must be approved by the Department of Water and Sanitation (DWS). A baseline water quality assessment must take place prior to commencement of construction. Thereafter water quality monitoring must take place monthly throughout the construction phase and yearly throughout the operational phase of the development.

No Red Data species were observed within the boundaries of the study area. However, two protected species, the Swamp fig (*Ficus trichopoda*) and Powder-puff tree (*Barringtonia racemosa*) were observed in the remnant swamp forest present in the south-eastern section of the study area, as well as the artificial drainage line along the eastern border of the study area. A Marula tree (*Sclerocarya birrea* subsp. *caffra*) was located in the southern section of the study area. It is likely that other Marula individuals were overlooked during the site visit and therefore it is recommended that a search be launched for this protected species, prior to the commencement of construction. A permit from the Department of Agriculture, Forestry and Fisheries (DAFF) will be required for the removal of any of these three protected species.

1. INTRODUCTION

Exigent Engineering was appointed by uMhlathuze Local Municipality to conduct an Environmental Authorisation Amendment process. The scope of work included an updated Wetland Delineation and Functionality Assessment for the proposed Central Industrial Area (CIA) development site, within the uMhlathuze Local Municipality, in the King Cetshwayo District Municipality, KwaZulu-Natal (KZN) (Figure 2-1).

The City of uMhlathuze has indicated that the establishment of the CIA has been earmarked for land uses that include light industry; service industry; commercial; public open spaces, and associated infrastructure development. The proposed development thereof was subject to a full EIA from 2009 until 2012. The application was approved in terms of Government Notice R386 and R387 of the 2006 EIA Regulations, with Environmental authorization (EA) obtained by the municipality on 28 March 2012. The authorisation stipulated a validity period of five years from date of issue, therefore a Part 1 Amendment Application was lodged to the KZN Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) which was approved on 23 March 2017, extending the validity of the Authorisation for 12 months to 29 March 2018.

One of the most significant conditions under which the EA was issued, was the development layout which observed a 100m buffer around temporary and seasonal wetlands. The feasibility of the development would increase dramatically if the approved layout is amended by utilising areas within the 100m buffer zone.

It was noted that one of the limitations of the wetland specialist study conducted by CES 2010 was security risks. These security risks limited the sampling to safer, more accessible regions of the area. Exigent therefore undertook this wetland assessment to ensure that all areas within the study site were sampled and assessed to afford an improved representation of the wetlands of the study area. The results will then inform the amendment process in terms of the possibility to develop within the previously approved no-go 100m buffer zone.

This report therefore informs a Part 2 Amendment Application process to be submitted to DEDTEA for the proposed amendment of the CIA development layout.

2. SCOPE OF WORK

The Scope of Work includes a wetland specialist study. All wetlands were assessed within the project study area Figure 2-2. The total study area is approximately 177 hectares in extent.

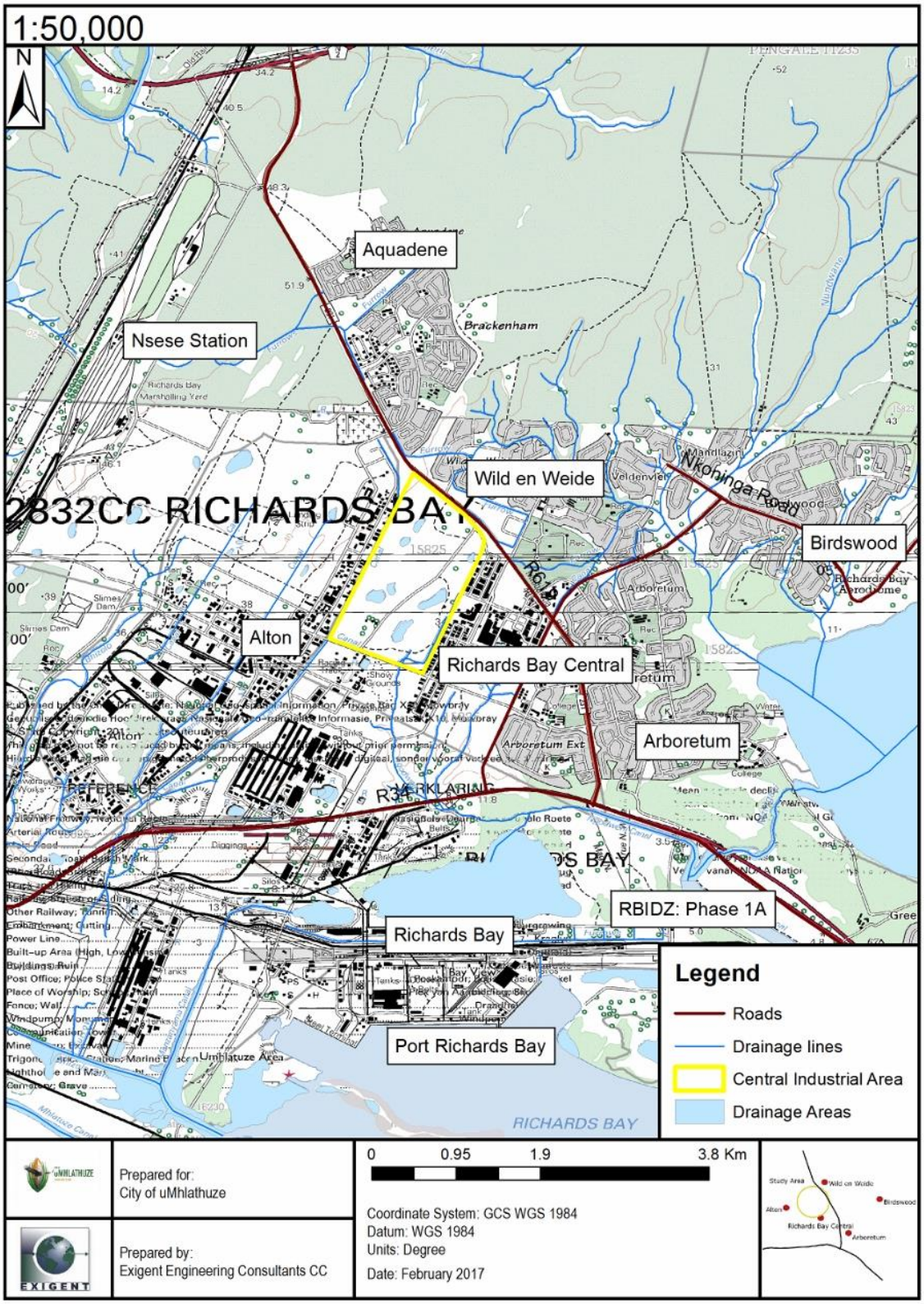

Figure 2-1. Map indicating the proposed Central Industrial Area locality.

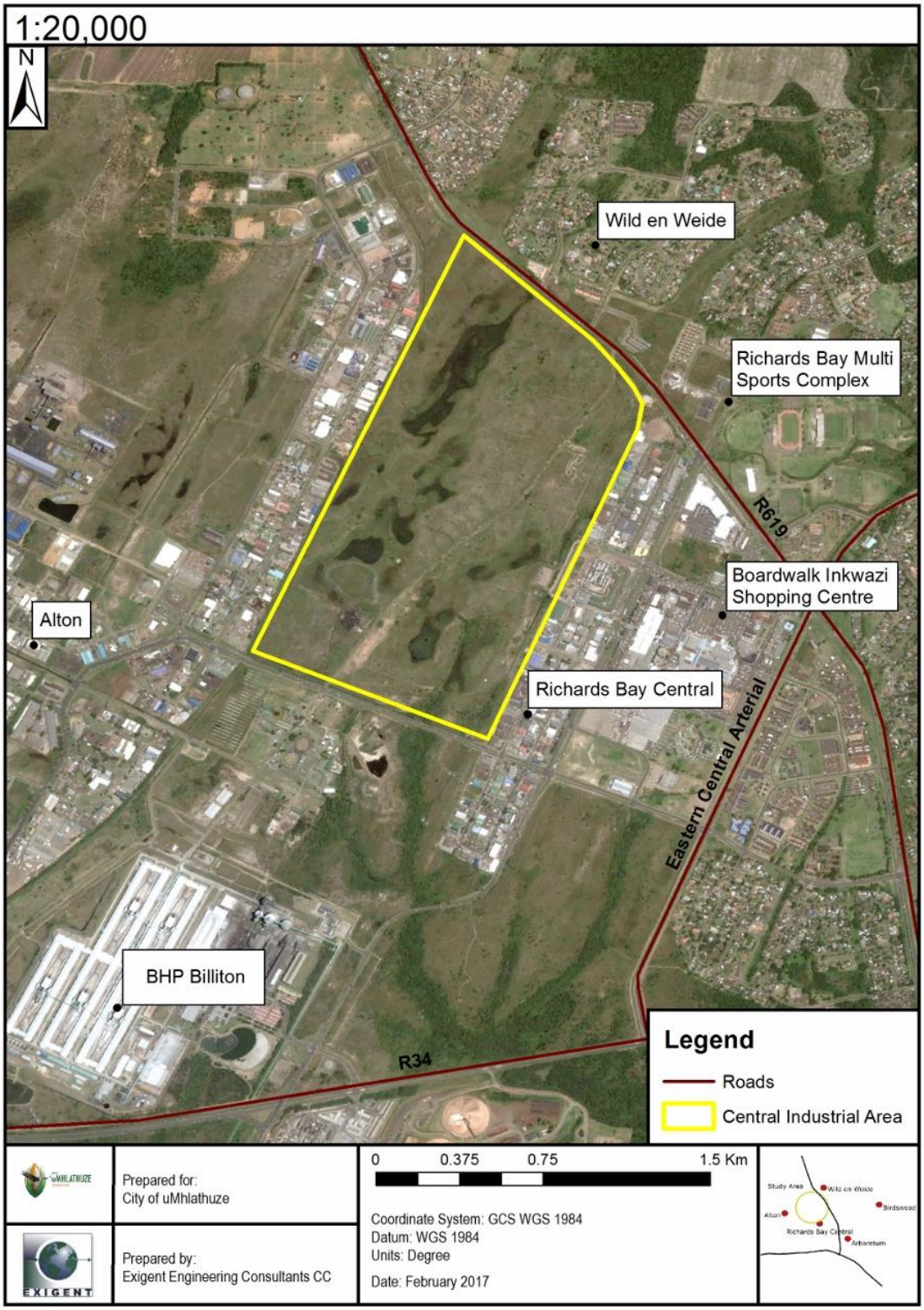

Figure 2-2: Map indicating the extent of the study area.

2.1. Wetland assessment

Following a separate desktop assessment of wetlands within the region and the classification of these wetlands, the findings were validated in the field in terms of wetland significance. These wetlands were then included in the assessment.

Specifically, the wetland delineation and assessment addresses the following primary elements:

1. The delineation of wetland habitats within the proposed development area.
2. Determination of all wetland boundaries.
3. Determination of ecological buffers as stipulated by National Department of Water and Sanitation (DWS) and Ezemvelo KwaZulu-Natal Wildlife (EKZNW).
4. The compilation of a geographically referenced inventory of the wetlands that will be lost or impacted on by construction activities.
5. Specifically focusing on functional assessment using the WET-Health Level Rapid Assessment to establish the Present Ecological State (PES).
6. Determine the Ecological Importance and Sensitivity (EIS) (WET-EIS tool).
7. Assessment of the importance of the wetland in providing ecosystem goods and services according to the WET-Eco-services assessment tool; outlining important characteristics and components thereof, which may influence the proposed development during construction and operation.
8. Recommend suitable mitigation measures to minimise predicted impacts associated.
9. The identification of permit requirements as related to the infilling or destruction of wetlands.
10. A discussion of any other sensitivities and important issues from the specialist perspective that are not identified in terms of reference.

3. RELEVANT LEGISLATION

3.1. Biodiversity legislation

3.1.1. Constitution of the Republic of South Africa Act

The Constitution of the Republic of South Africa Act (Act No. 108 of 1996) places a duty on the State and citizens to protect the environment. Section 24 provides that:

"*Everyone has the right –*
(b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that
i) prevent pollution and ecological degradation.
ii) promote conservation.
iii) secure ecologically sustainable development and use of natural resources while promoting
iv) justifiable economic and social development".

3.1.2. National Environmental Management Act

The principles underpinning environmental management contained in the National Environmental Management Act (Act 107 of 1998) (NEMA) must be considered by any organ of state in the exercise of any power that may impact on the environment. Section 2 (4a) states that sustainable development requires the consideration of all relevant factors including the following:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimized and remedied.
- That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimized and remedied.
- That the development, use and exploitation of renewable resources and the ecosystems of which they are a part do not exceed the level beyond which their integrity is jeopardized.
- That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimized and remedied.

3.1.3. National Forests Act

Government Gazette No 26731 of August 2004, and any later revisions as released, provide a list of tree species protected under the National Forests Act (NFA) (Act 84 of 1998). In terms of the NFA, indigenous trees within a natural forest or protected tree species may not be cut, disturbed, damaged or destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold except under licence granted by the Department of Agriculture, Forestry and Fisheries (DAFF), or a delegated authority. Applications for such activities should be made to the responsible official in each province.

3.1.4. National Environmental Management: Biodiversity Act

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) addresses, amongst others:

- Biodiversity planning and monitoring.
- Protection of threatened or protected ecosystems.
- Protection of threatened or protected species.
- The control of alien species, invasive species and genetically modified organisms.

Species that are classified as threatened and/or protected are listed in Government Gazette 151 of February 2007 and the regulations are included in Government Gazette 152 of February 2007, with the most recent amendment in Government Notice 576 of July 2011.

Threatened ecosystems in need of protection are listed Government Notice 1002 of December 2011.

The NEMBA: Alien and Invasive Species Lists, 2016 (No 864) was published on 29 July 2016 in GN 40166.

3.1.5. KZN Nature Conservation Ordinance

The KZN Nature Conservation Ordinance (No. 15 of 1974) relates to nature conservation and concerns in the province. The ordinance lists the protected and specially protected plants in the province and prohibits the picking, sale, export or removal of protected plants.

The ordinance also lists invader weeds, which must be controlled on study area and may not be sold or donated.

Schedule 12 is a list of protected indigenous species which requires a permit prior to being exported from or imported into the Province.

3.2. Wetland legislation

Locally, the South African Constitution, various Acts and two international treaties allow for the protection of wetlands and rivers. These systems are protected from destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa.
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998.
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000).
- NEMA inclusive of all amendments, as well as the NEMBA.
- National Water Act (Act 36 of 1998).
- Conservation of Agricultural Resources Act (Act 43 of 1983).
- Minerals and Petroleum Resources Development Act (Act 28 of 2002).
- KZN Nature Conservation Ordinance (No. 19 of 1974).
- NFA (Act 84 of 1998).
- Section 21 of the National Water Act (Act 36 of 1998).
- Government Notice 506 of the National Water Act (Act 36 of 1998).
- Regulation 983, 984 and 985 of the NEMA.

The NEMA Regulations (2014) require approval for various activities related to watercourses and wetlands.

The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983) also applies to this project. CARA has categorised a large number of invasive plants together with associated obligations of the land owner.

The NWA clearly defines a water-course and resource quality characteristics. According to section 21 (c) and (i) water uses almost any activity in any catchment has the potential to change the resource quality characteristics (flow regime, water quality, habitat and biota) and would require some form of authorization in terms of these water uses. Government Notice 509 serves as a notice of the promulgation of the availability of a General Authorisation of Section 21 (c) or (i) water uses in terms of the NWA. The Notice replaces the need for a Water Use Licence Application in terms of the NWA should the water user be within the limits of the Notice. The Notice lists a series of mitigation requirements for developments as well as other items which have to be taken into consideration by the water user. Along with these requirements a risk matrix is required to be undertaken, which proves to the DWS that the proposed development will have a low impact on the receiving environment.

A license is required to carry out any activity involving modifications to watercourses or wetlands. As the proposed CIA development falls within a large wetland system, a Water Use License Application

(WULA) for Section 21 water uses will be required for the wetlands impacted onsite, as well as the wetlands located within the 500m DWS regulatory area.

3.3. Provincial legislation and policy for buffers

Currently, there are no accepted wetland buffer distances provided by the provincial authorities. A standard 30m buffer has been applied to wetlands in the province, disregarding site specific conditions. The EKZNW Biodiversity Impact Assessment Guideline (2013) have however compiled criteria for determining the width of wetland buffers based on the biophysical factors and the interactions between them. Other policies that are relevant include:

- Provincial Nature Conservation Ordinance (PNCO) – Protected Flora;
- KZN Biodiversity Conservation Plan; and
- KZN Vegetation Map (2011).

The recommended buffers for the wetlands identified in the study area will however be based on site specific conditions in combination with specialist experience.

4. ASSUMPTIONS AND LIMITATIONS

- The GPS Oregon 600 which was used for wetland delineations is at best accurate to within five meters.
- This study focussed only on the delineation of wetlands and wetland boundaries within the study area. Delineation of wetlands and wetland boundaries in the DWS regulatory area were not undertaken.

5. DESCRIPTION OF RECEIVING ENVIRONMENT

5.1. Locality

The study area is located on the Remainder of Reserve 6 No. 15825-GV, Richards Bay, in the uMhlathuze Local Municipality within the King Cetshwayo District Municipality, KwaZulu-Natal. The study area lies within quarter degree grid cells 2832CC and 2832CA with the geographical coordinates of the centre of the site at 28°44'47.67"S and 32°02'29.91"E. The R619 (North Central Arterial to Mtubatuba) bounds the study area to the north and Guldengracht bounds the study area to the south. The extent of the study area is approximately 177 hectares (Figure 2-2).

5.2. Land use and surrounding infrastructure

The Central Arterial road reserve runs parallel to Ceramic Curve in the established industrial area of Alton North. This road reserve was included in the assessment of the area. The CBD of Richards Bay borders the study area to the east while the Zululand Chamber of Business Foundation (ZCBF) is located to the south of the study area. An overhead powerline traverses the northern and eastern boundaries of the site. A small electricity substation is located within the eastern boundary while an illegal sand blasting business is operating in the southern section. Drennan, Maud & Partners (2008) also reports that a number of buried cables and pipelines also cross the site.

An old north-south tar road bisects the study area. This allows access to the study area and has resulted in several areas being polluted.A number of footpaths were observed, some leading to informal shelters that are scattered throughout the site. A motorcycle / four-wheeler track, with various tyres and concrete pipes as obstacles, were located in the northern section of the study area (Figure 5-1).

a)

b)

c)

d)

e)

f)

Figure 5-1. Study area land uses where a) depicts the overhead powerlines; b) the electricity substation, c) shows the sandblasting business with the existing tar road in the foreground; d) depicts dumped rubbish; e) shows an informal shelter while f) depicts the motorcycle / four-wheeler obstacle track.

5.3. Biophysical description

5.3.1. Climate

The climate of the study area can be described as summer rainfall towards the interior of the Maputaland Coastal Belt but comprise generally of a weak rainfall seasonality, especially closer to the coast. The study area experiences relatively high precipitation reaching mean annual precipitation

values of approximately 1200 mm in coastal localities, decreasing to the interior. High humidity and temperature is experienced during summer months with the mean maximum being 35.3 °C and a mean winter temperature of 5.5 °C. No incidence of frost is recorded within the region (Mucina & Rutherford, 2006).

The Richards Bay area sees most of its rainfall events occurring in the summer months with the maximum precipitation occurring in February, with an average of 137 mm. The average temperatures vary between an average maximum temperature of 29 °C in the summer months and that of 23 °C during the winter months (Climate-Data.org, 13/02/17).

5.3.2. Geology, topography and soil

The study area is located on the Maputaland Coastal Belt which is generally a relatively flat landscape. It comprises of 18 000 years old quaternary sediments of marine origin mainly with yellowish and argillaceous redistributed sands of the Berea and Muzi Formations (Maputaland Group). The soils are nutritiously very poor and well leached, except in the interdune depressions were organic-rich soils are often present (Mucina & Rutherford, 2006). The main land types “Ha” and “Hb” present on site may include the Constantia, Shepstone and Vilafontes soil forms while the less distributed “Db” land type on site is associated with a wide variety of geological units such as the basement granites, Natal Group sandstones, Dwyka tillites, Ecca shales and sandstones, mudstones, shale and/or sandstones of the Escourt, Emakwezini, Nyoka, Ntabene and Clarens Formations, siltsrone/sandstone of the Zululand Group and some Cenozoic deposits. The “Db” broad soil pattern are generally situated in low gradient slopes and are therefore prone to inundation/flooding. “Db” landtype unit is characterised by duplex soils with non–red B horizons (Council for Geoscience, 2012).

The site is underlain by the KwaMbonambi Formation, which is light grey-brown and pale yellow. The clay content of the soil increases downward into the soil profile, probably originating from the Port Durnford sandy clays (Drennan, Maud and Partners, 2008). The KwaMbonambi Formation, as well as the Port Durnford Formation, forms part of the Maputaland Group. The older Port Durnford Formation consists of mainly carbonaceous mudstone and claystones. The KwaMbonambi Formation consists of a variety of grey, orange and red sands. Peat occurs on the seaward, wetter margins of this formation (Roberts *et al*., 2006). According to Grundling & Grobler (2005), peat accumulates mostly along the eastern and southern coastline and the eastern parts of the central plateau in wetter areas of the country. They are very rare and unique wetland types of Southern Africa that provide an important ecosystem habitat due to the diversity that they support, their size, distribution and threats (Grundling & Grobler, 2005).

During the site visit, it was confirmed that the permanently and, upon occasional, seasonally wet areas within the site contained peat soils. Peat is a highly organic soil which is of high conservative importance. The peat exhibits a black colour which varies in humification scale across the site.

5.3.3. Hydrology

The study area falls within the Usuthu-Mhlatuze Water Management Area (WMA). It consists of a number of catchments, namely the Mhlatuze, Mfolozi, Mkuze/Hluhluwe, Phongola, Usuthu and Lake Sibaya catchments which all form part of the Usuthu Basin. Within the Umhlatuze Drainage Region the

major water resources in the Umhlathuze Catchment are Mhlatuze and Nseleni Rivers, the Goedertroudam and several irrigation dams and impoundments, several lakes and pans (Qhubu Lake, Mzingazi Lake, Nhlabane Lake & Nsezi Lake), riparian areas along most of the riverine habitat, hillslope seepages, valley bottom wetland systems; and Mhlatuze River Floodplain & Estuary. The most important wetland systems within the Umhlathuze Catchment are Mzingazi, Qhubu and Nhlabane Lake (as it supplies water to Richards Bay and surroundings), Mhlatuze Floodplain, Mhlatuze Estuary and associated valley bottom wetland feeding into it, and Mountainous seeps in the upper reaches of Mhlatuze River (NFEPA) (DWA, 2014).

The study area is located in the quaternary catchments W12F and W12J (Figure 5-2). The proposed development is located within the Indian Ocean Coastal Belt Group 1 Wetland vegetation type (NFEPA, 2012). This wetland vegetation type is classified as Least Threatened. All Swamp Forest wetland habitat within the Usutu to Mhlathuze WMA however, is categorised as highest priority and are important to conserve (DWA, 2014). Dominant land uses in this catchment include cultivation, forestation, communal lands, urbanisation and developments, infrastructure, nature reserves and dams and impoundments (DWA, 2014).

The hydrology of the area surrounding the proposed CIA development site has been projected in Figure 5-2 In this image, it can be seen that a large tributary of the Ngondweni channel originates within the site boundary. Various artificial drainage lines run parallel to study area boundary, draining the water from both the site, as well as surrounding properties. There are also numerous open water bodies within the proposed site boundary which are expected to drain into the larger Ngondweni channel and into the Port of Richards Bay.

5.3.4. General description of the vegetation of the area

The study area is located within the Indian Ocean Coastal Belt Biome, located within the Maputaland Coastal Belt vegetation type (Mucina & Rutherford, 2006). The EKZNW Vegetation Map (2011) characterise this area as Maputaland Wooded Grassland and further identifies Swamp Forest: *Ficus trichopoda* swamp forest and Alluvial wetlands: Sub-tropical alluvial vegetation, Freshwater wetlands: Subtropical Freshwater Wetlands including Short grass/Sedge wetlands and Coastal Lakes and Pans in the study area (Figure 5-3). The wetland vegetation type is imbedded within all mainland biomes of South Africa.

According to the National Biodiversity Assessment the whole study area lies within a critically endangered area (SANBI 2011). EKZNW (2011) classifies the Maputaland Wooded Grassland vegetation type as Endangered with a small percentage being conserved in Nature Reserves such as the iSimangaliso Wetland Park, Sileza, Enseleni and Amathikulu. The Freshwater wetlands: Subtropical Freshwater Wetlands are classified as Vulnerable while the Freshwater wetlands: Subtropical Freshwater Wetlands: Coastal Lakes and Pans and Short grass/Sedge wetlands and Alluvial wetlands: Sub-tropical alluvial vegetation are classified as least concern (Figure 5-4; EKZNW, 2011).

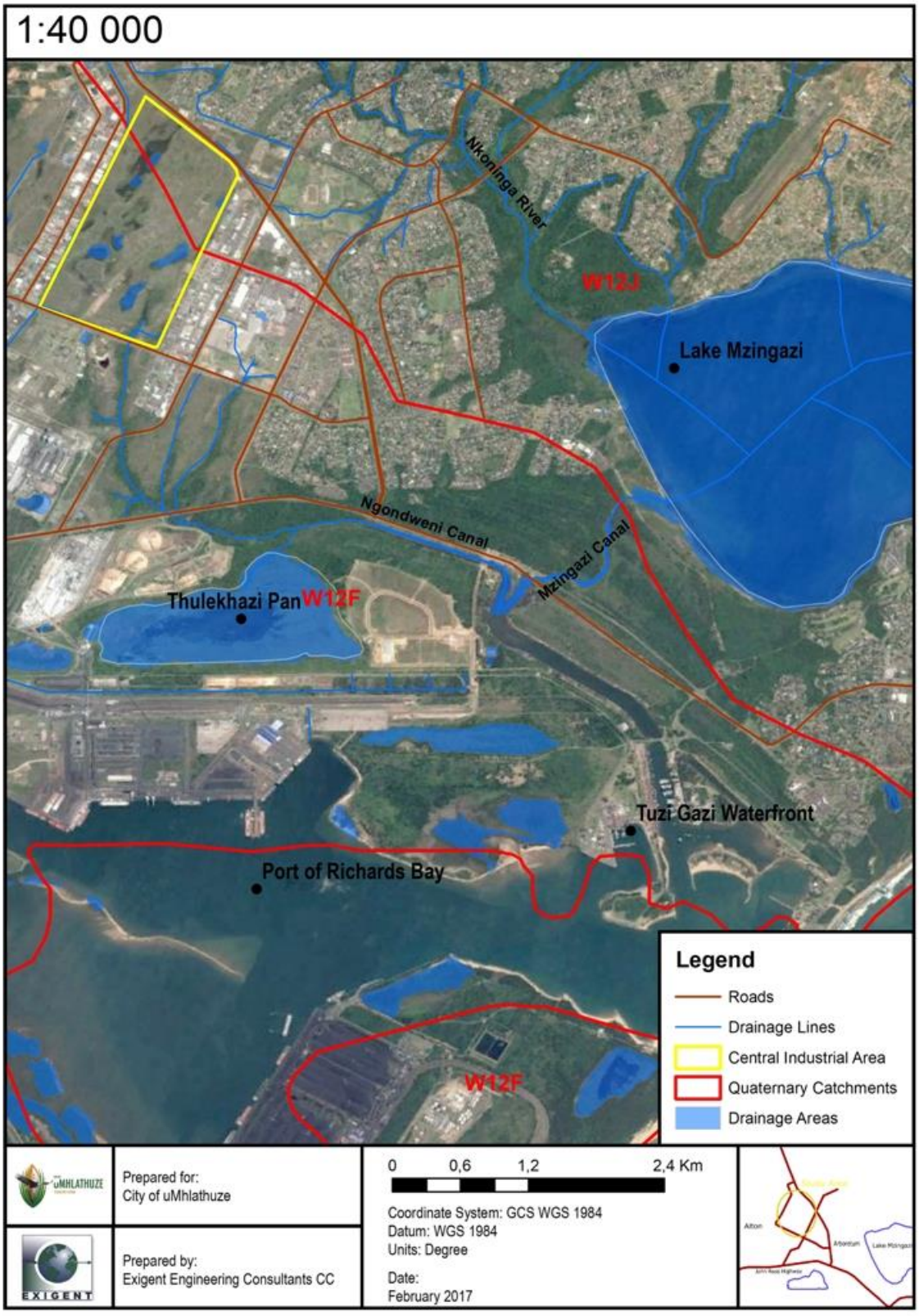

Figure 5-2. Hydrology of the study area.

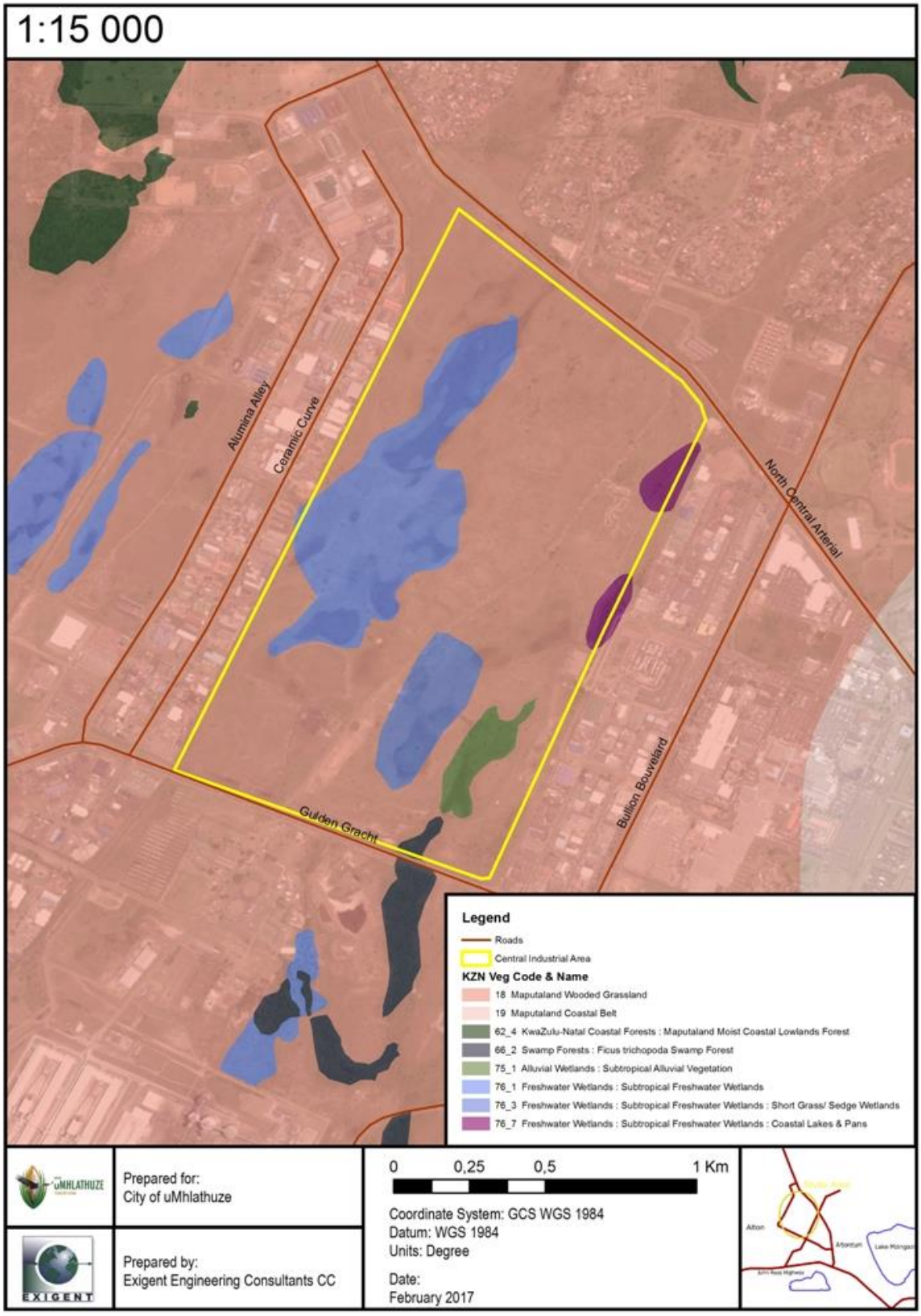

Figure 5-3. Vegetation map of the proposed Central Industrial Area (EKZNW, 2011).

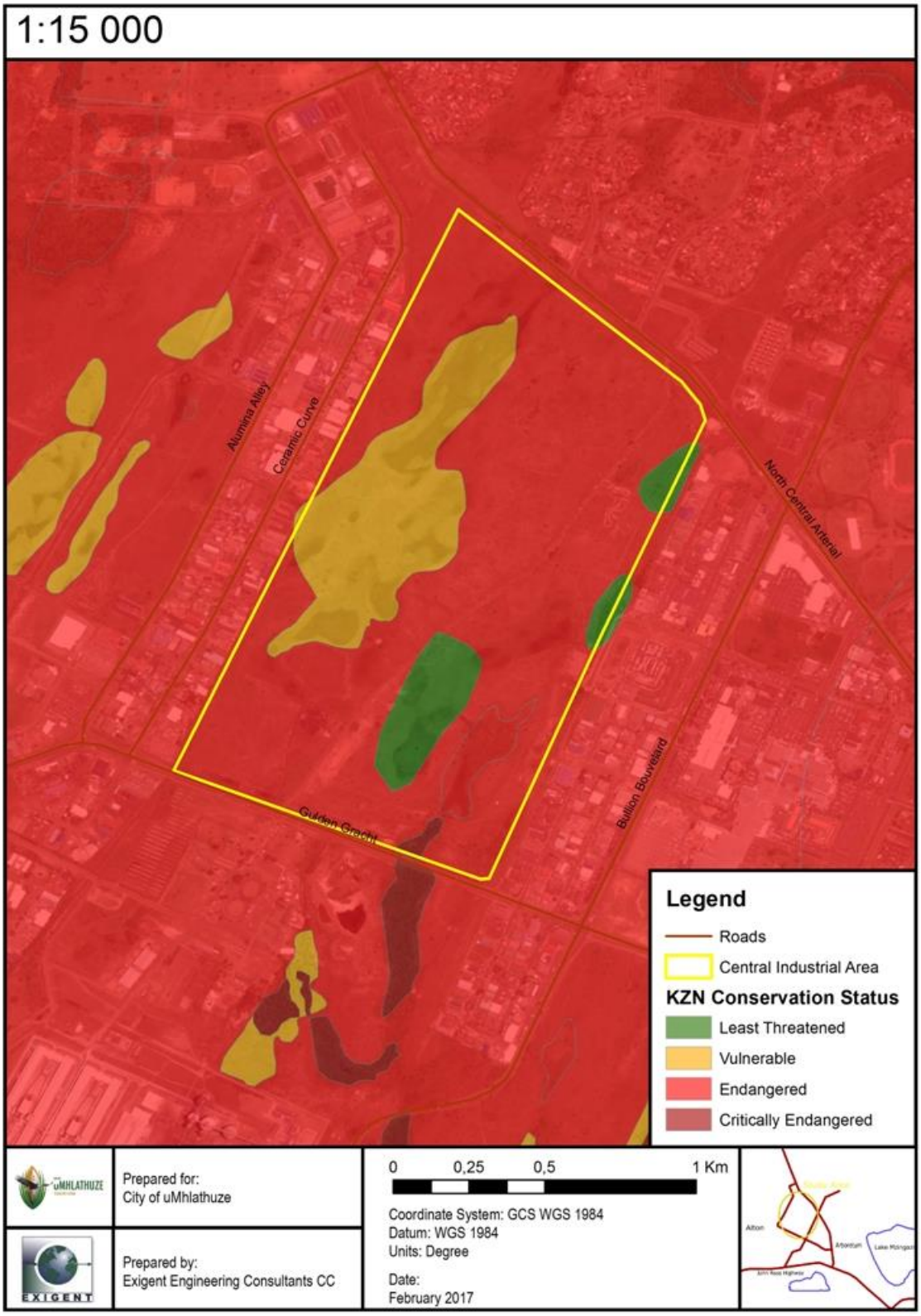

Figure 5-4. KZN Conservation Status of the study area (EKZNW, 2011).

In its undisturbed state, the Maputaland Wooded Grassland vegetation type comprises of coastal sandy grasslands rich in geoxylic suffrutices, dwarf shrubs, small trees and a rich herbaceous flora (Mucina & Rutherford, 2006). This vegetation types was not represented in the study area however several species typical of this stratum coincides with the species identified in the typical hygrophilous grassland vegetation observed during the field assessment. Table 5-1 lists the species representative from the Maputaland Wooded Grassland.

Table 5-1. Dominant species representative from different stratums of the Maputaland Wooded Grassland vegetation type (Mucina & Rutherford, 2006).

Grasses	Shrubs/Herbs	Trees/Geoxylic suffrutices
	Shrubs	**Tees**
Diheteropogon amplectens	*Agathisanthemum bojeri*	*Achridocarpus natalitius* var. *linearifolius*
Themeda triandra	*Helichrysum krausii*	*Dichrostachys cinerea* subsp. *nyassana*
Urelytrum agropyroides	*Crotolaria monteiroi* var. *monteiroi*	*Diospyros lycoides* subsp. *sericea*
Aristida stipitata subsp. *graciliflora*	**Herbs**	*Hyphaene coriacea*
Bewsia biflora	*Cyrtanthus galpinii*	*Terminalia sericea*
Cyperus obtusiflorus	*Chamaecrista plumosa*	**Geoxylic suffrutices**
Cyperus tenax		*Parinari curatellifolia*
Digitaria natalensis		*Salacia krausii*
Eustachya paspaloides		*Ancylobotrys petersiana*
Setaria sphacelata		*Diospyros galpinii*
Sporobolus fimbriatus		*Eugenia capensis*
Sporobolus subulatus		*Syzygium cordatum*

Swamp forests in its undisturbed state are characteristically 12-15 metres tall and mainly consist of two strata: canopy and shrub layers. The understorey is poorly developed and some ferns and orchids are of importance and occur frequently (Mucina & Rutherford, 2006). A remnant swamp forest was present in the south-eastern section of the study area. Typical Swamp Forests species are listed in Table 5-2.

Table 5-2. Dominant species representative from different stratums of the Swamp Forest vegetation type (Mucina & Rutherford, 2006).

Grasses	Shrubs	Trees
Scleria angusta	*Burchellia bubalina*	*Barringtonia racemosa*
	Psychotria capensis	*Ficus trichopoda*
	Tarenna pavettoides	*Macaranga capensis*
	Hibiscus tiliaceus	*Rauvolfia caffra*
	Herbs	*Schefflera umbellifera*
	Eulophia horsfallii	*Shirakiopsis elliptica*
	Microsorum punctatum	*Syzygium cordatum*
	Nephrolepis biserrata	*Ficus lutea*
		Allophylus dregeanus
		Bridelia micrantha
		Cassipourea gummiflua
		Morella serrata
		Phoenix reclinata
		Sapium integerrimum

EKZNW delineated a Subtropical Alluvial Wetland system that is located to the north of the remant swamp forest of the study area (Figure 5-3). The features that are keen to these vegetation units are relatively flat alluvial riverine terraces that support macrophytic vegetation, marginal reed belts and flooded grasslands, ephemeral herblands and riverine thickets (Mucina & Rutherford, 2006).

Table 5-3 lists the species representative from the Subtropical Alluvial Wetlands for the proposed Central Industrial Area.

Table 5-3. Dominant species representative from the Subtropical Alluvial Wetlands (Mucina & Rutherford, 2006).

Riparian thickets		
Small Trees:	Tall shrubs:	Herbs:
Acacia natalica	*Salvadora angustifolia*	*Commelina benghalensis*
Acacia robusta	*Commiphora glandulosa*	*Abutilon austro-africanum*
Boscia foetida subsp. *rehmanniana*	*Commiphora pyracanthoides*	*Acalypha indica*
Combretum erythrophyllum	*Euclea divinorum*	*Achyranthes aspera*
Phoenix reclinata	*Grewia bicolor*	*Boerhavia erecta*
Salix mucronata subsp. *woodii*	*Gymnosporia senegalensis*	*Commicarpus fallacissimus*
Ziziphus micronata	Low shrubs:	*Cucumis zeyheri*
Acacia luderitzii	*Justica flava*	*Heliotropium ovalifolium*
Acacia newbrownii	*Ocimum canum*	*Lobelia angolensis*
Acacia nigrescens	Graminoids:	*Oxygonum sinuatum*
Acacia tortilis	*Eragrostis trichophora*	*Pupalia lappacea*
Acacia xanthoploea	*Panicum maximum*	*Ruellia patula*
Colophospermum mopane	*Setaria incrassate*	Geophytic Herb:
Combretum hereroense	*Sporobolus ioclados*	*Crinum moorei*
Philenoptera violacea	*Chloris virgate*	Succulent Herb:
Pseudoscolopia polycantha	*Dactyloctenium aegyptium*	*Portulaca quadrifida*
	Enneapogon cenchroides	
	Urochloa mosambicensis	
Reed beds: Megagraminoids		
Phragmites austrtalis	*Phragmites mauritianus*	*Prionium serratum*
Flooded grasslands & herblands		
Megagraminoid:	Graminoids:	
Cyperus immensus	*Cynodon dactylon*	*Cyperus fastigiatus*
Herbs:	*Cyperus articulates*	*Cyperus sexangularis*
Alternanthera sessilis	*Echinochloa pyramidalis*	*Dactyloctenium aegyptium*
Amaranthus praetermissus	*Urochloa mosambicensis*	*Hemarthria altissima*
Grammatotheca bergiana	*Bolboschoenus glaucus*	*Ischaemum afrum*
Marsilea ephippiocarpa	*Chloris mossambicensis*	*Phaspalum obtusifolium*
Scutellaria racemosa	*Chloris virgata*	*Setaria sphacelata*
Geophytic Herb:	*Cyperus corymbosus*	*Sporobolus consimilis*
Trachyandra saltii	*Cyperus difformis*	*Sporobolus fimbriatus*
Aquatic Herbs:	*Cyperus distans*	
Ceratophyllum muricatum		
Ottelia exserta		

Subtropical freshwater wetlands characteristically support low beds dominated by reeds, sedges and rushes and comprise of waterlogged meadows dominated by grasses. It is found typically along edges of seasonal pools in Aeolian depressions as well as fringing alluvial backwater pans or artificial dams. Typical Freshwater wetland species are listed in Table 5-4 for the proposed CIA development.

Several wetlands were identified within the study area. These identified wetland areas have been assessed in detail as part of this scope of work and are discussed further in Section 7.2.

Table 5-4. Dominant species representative from the Freshwater Wetlands: Subtropical Freshwater Wetlands (Mucina & Rutherford, 2006).

Grasses	Herbs	Small Trees
Marshes		
Chloris virgate	*Pentodon pentandrus*	*Hyphaene coriacea*
Cyanodon dactylon	*Persicaria senegalensis*	*Phoenix reclinata*
Cyperus articulates	*Burmannia madagascariensis*	
Dactyloctenium aegyptium	*Centella coriacea*	
Diplachne fusca	*Commelina diffusa*	
Echinochloa pyramidalis	*Convolvulus mauritanicus*	
Fimbristylisobtusifolia	*Desmodium dregeanum*	
Hemarthria altissima	*Eclipta prostrata*	
Imperata cylindrical	*Epaltes gariepina*	
Ischaemum arcuatum	*Eriocaulo abyssinicum*	
Leersia hexandra	*Ethulia conyzoides*	
Pycreus mundii	*Glinus lotoides*	
Sporobolus nitens	*Hydrocotyle ranuculoides*	
Sporobolus smutsii	*Ludwigia adscendens* subsp. *diffusa*	
Urochloa stolonifera	*Ludwigia leptocarpa*	
Bolboschoenus glaucus	*Ludwigia octovalvis*	
Courtoisia cyperoides	*Ludwigia palustris*	
Cyperus alopecuroides	*Neptunia oleracea*	
Cyperus pectinatus	*Persicaria attenuate* subsp. *africana*	
Digitaria natalensis	*Persicaria hystricula*	
Echinochloa stragnina	*Rorippa madagascariensis*	
Eragrostis lappula	*Sium repandum*	
Eriochloa meyeriana	*Vahlia capensis*	
Fimbristylis bisumbellata	*Eulophia angolensis*	
Fuirena ecklonii	*Zeuxine africana*	
Oxycarym cubense	*Salicornia pachystachya*	
Phasphalidum obtusifolium	*Buchnera longespicata*	
Phaspalum commersonii	*Bergia salaria*	
Pycreus pelophilus	*Lagarosiphon crispus*	
Pycreus polystachyos		
Scleria poiformis		
Sporobolus consimilis		
Eragrostis chapelieri		
Lakes and ponds		
Grasses	**Herbs**	**Small Trees**
Eleocharis dulcis	*Azolla pinata* subsp. *africana*	
	Ceratophyllum demersum	
	Lemna minor	
	Nymphaea nouchali var. *caerulea*	
	Pistia stratoides	
	Wolffia arrniza	

Grasses	Herbs	Small Trees
	Aponogeton desertorum	
	Aponogeton natalnsis	
	Aponogeton rehmannii	
	Ceratophyllum muricatum	
	Marsilea macrocarpa	
	Najas marina subsp. *delilei*	
	Najas pectinate	
	Nymphoides indica subsp. *occidentalis*	
	Nymphoides rautanenii	
	Ottelia exserta	
	Potamogeton crispus	
	Potamogeton pectinatus	
	Potamogeton schweinfurthii	
	Spirodela polyrhiza	
	Spirodela punctate	
	Trapa natans var. *bispinosa*	
	Utricularia gibba subsp. *exolta*	
	Utricularia inflexa	
	Utricularia subulata	
	Crinum paludosum	
Reed and Sedge beds		
Grasses	**Herbs**	**Small Trees**
Cladium mariscus subsp. *jamaicense*		
Cyperus papyrus		
Phragmites australis		
Phragmites mauritianus		
Schoenoplectus corymbosus		
Schoenoplectus differmis		
Typha capensis		
Cyperus fastigiatus		
Cyperus differmis		
Cyperus digitatus		
Cyperus latifolius		
Cyperus sexangularis		
Fuirena ciliaris		

Table 5-5. A summary of the key vegetation types of the proposed CIA development (Mucina and Rutherford, 2006 and EKZNW, 2011).

Vegetation type	Status (NSBA)*	Description
Swamp Forest: *Ficus trichopoda* swamp forest	Critically Endangered	Approximately 66 % is currently conserved in the iSimangaliso Wetland Park, Maphelana, Dududuku and Raphia palms and Umlazai Nature Reserves. An unknown percentage has already been transformed by plantations and illegal clearing for making fruit and vegetable gardens. *Chromolaena odorata*, *Lantana camara* and *Pereskia* species are typical alien invaders of this vegetation type.
Maputaland Wooded Grassland	Endangered	Approximately 17% is being conserved in the Nature Reserves such as the iSimangaliso Wetland Park. Approximately 46% of this vegetation type has already been transformed by plantations and partly for cultivated land. 90% of the southernmost portion of this vegetation type is transformed by timber pulp plantations, cane fields and informal settlements. Alien plant infestations include scattered populations of *Chromolaena odorata* and *Lantana camara.*

Freshwater wetlands: Sub-tropical freshwater wetlands	Vulnerable	Approximately 40-50% is conserved in Nature Reserves such as iSimangaliso Wetland Park, Kruger National Park, Nduma Game Reserve, Thembe Elephant Park, as well as in Nhlabane, Nylsvley, Nkombo, Sileza and Richards Bay Nature Reserves. A further 10% is protected in private game reserves in Limpopo, Mpumulanga and KwaZulu-Natal Provinces. Only 4% is transformed by cultivation, urban sprawl and local grazing. Disturbance of this vegetation type leads to alien invasive species infestation such as *Chromolaena discolor*, *Lantana camara, Melia azedarach* and aquatic weeds such as *Eichhornia crassipes, Pistia stratiotes* and *Salvinia molesta*.
Alluvial wetlands: Subtropical Alluvial Vegetation	Least concern	Large areas are conserved in Kruger and Mapungubwe National Parks, Vemre and D'nyala Nature Reserves, Ndumo Game Reserve and iSimangaliso Wetland Park, as well as in a number of private reserves fringing the western borders of Kruger National Park and the Limpopo river. Much of the area has been transformed for cultivation, urban development and road building. Common alien woody species include *Melia azedarach* and *Chromolaena odorata*.
Freshwater wetlands: Sub-tropical freshwater wetlands: Coastal Lakes and Pans and Short grass/Sedge wetlands		

*National Spatial Biodiversity Assessment

6. METHODOLOGY

6.1. Desktop evaluation

Prior to conducting the site visit, an initial Level 1 (desktop) survey was done using Google Earth's map timeline function to detect changes in visible vegetation gradients. Maps are available from 2004-2016. Possible wetlands and other sensitive features were identified and GPS coordinates were noted to assist with the study area visit.

6.2. Literature and database survey

A literature survey was conducted to assist with the study. The full reference to resources used is listed in Section 16.

Relevant resources included:

- uMhlathuze Environmental Services Management Plan (ESMP).
- Vegetation Map of Southern Africa (VEGMAP).
- National Spatial Biodiversity Assessment.
- Red Data Plant Lists.
- Floral field guides and books.

6.2.1. Local databases

The aim of the uMhlathuze Environmental Services Management Plan (ESMP) is to provide the municipality with a clear understanding of activities that need to be undertaken to protect and enhance the supply of environmental services in the area. The following levels has been assigned to areas within the local municipal boundaries (uMhlathuze IDP review, 2009/2010):

- **Level 1** is the **Conservation Zone** and represents areas of high biodiversity/environmental significance that need or warrant legal protection. In this zone are included unique areas, natural habitats such as wetlands, natural forests and areas within the 1:100m floodline.
- **Level 2** is the **Open Space Linkage Zone** and includes natural buffers for level 1 areas as well as those areas linking level 1 areas.

- **Level 3** represents the **Development Zone** and includes those areas not included in levels 1 and 2. Care should still be taken that development does not negatively impact on level 1 and 2 areas. In other words, development or transformation.
- **Level 4** is the **Nature Reserves**

The development of the CIA will impede into ESMP Level 1: Conservation Zone and Level 2: Open Space Linkage Zone along the EA approved conservation corridor as well as a small portion in the north-eastern section of the study area (Figure 6-1). These areas were identified as wetlands during the site visit.

6.2.2. Provincial databases

The EKZNW Strategic Environmental Assessment (SEA) Database (2000) was used to model the distribution of a selection of 255 red data and endemic species. The species listed in Section 4 are those SEA species that have the potential to occur in the area.

The EKZNW Conservation Plan (C-Plan) was used in a GIS assessment of the study area. This database includes the layers of the following databases:

- National Land Cover 2000 (ver.1.2) edited for errors known to occur in provincial protected areas (January 2004).
- Provincial and national protected areas of the province (EKZNW).
- National Vegetation Map (December 2003) (refer to the National Botanical Institute).
- Forests of KZN (December 2003) (EKZNW).
- Wetlands of KZN (January 2004) (EKZNW).
- Biophysical data from Schulze, R.E. (1997).
- South African Atlas of Agrohydrology and Climatology.
- Water Research Commission, Pretoria.
- Species distributions from EKZNW's Biodiversity database and supplemented by species specialist group records and inputs.

The first use of the conservation planning analysis in C-Plan is an **irreplaceability map** of the planning area. This map is divided into 2 x 2 km grid cells called 'planning units'. Each cell has associated with it an 'Irreplaceability Value' which is one reflection of the cell's importance with respect to the conservation of biodiversity. Irreplaceability reflects the planning units ability to meet set 'targets' for selected biodiversity 'features' (EKZNW, 2004, Incomplete Draft). Where a planning unit has an irreplaceability value of 0, all biodiversity features recorded here are conserved to the target amount within reserves in South Africa, and there is unlikely to be a biodiversity concern with the development within the study area. An irreplaceability value of 1 would imply there are various issues of biodiversity concern within the study area, which requires conservation and, therefore, development of the study area is not recommended.

Minset is a feature that is utilized within the C-Plan. This tool uses a minimum amount of study areas in order to optimize the achievement of conservation targets by placing numerous constraints on the users. It presents the most efficient solution to achieving conservation targets and other land use constraints (EKZNW, 2011).

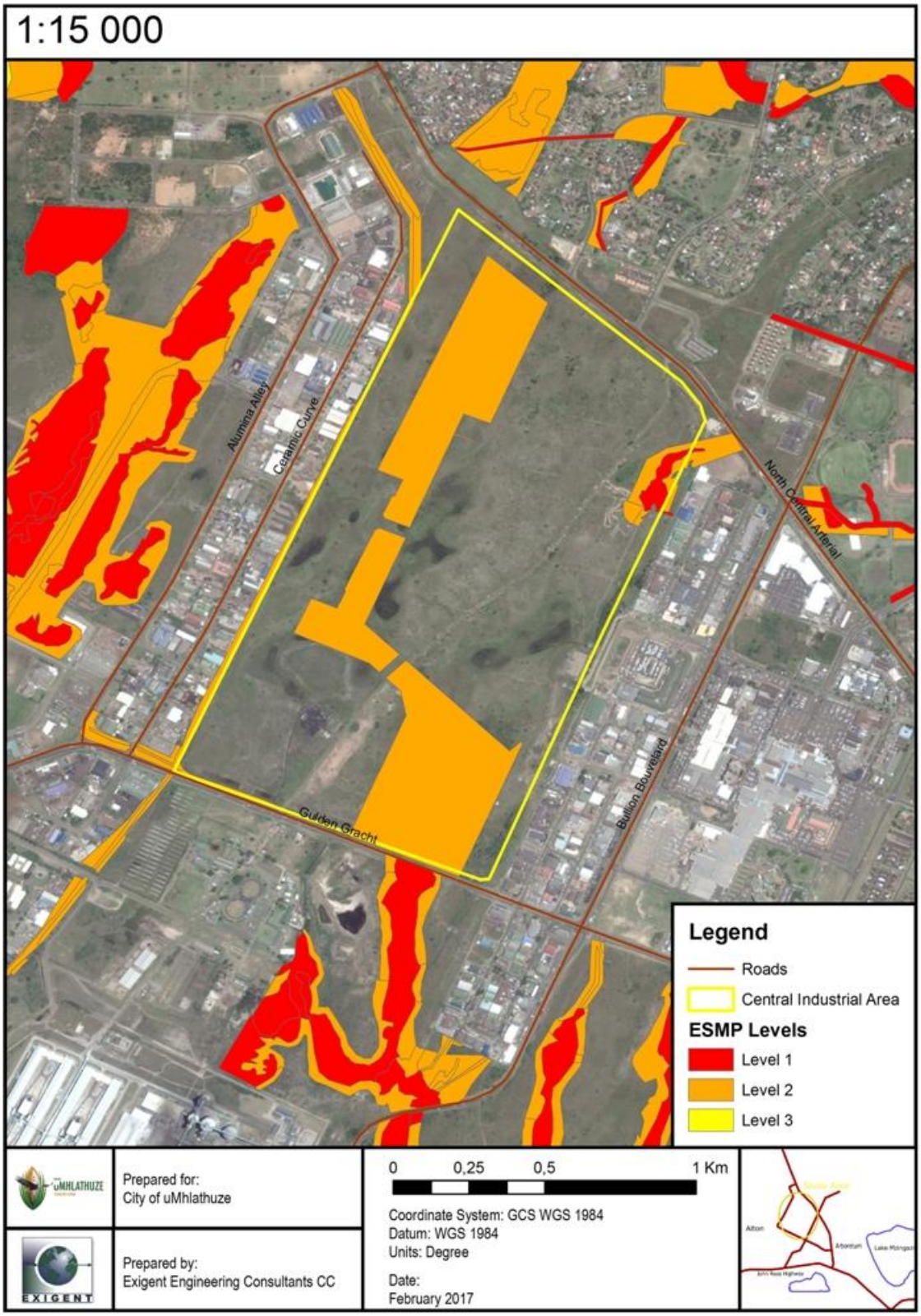

Figure 6-1. Proposed CIA developement on the ESMP of uMhlathuze Municipality. It should be noted that the ESMP levels within the study area is depicted by the current approved layout.

The EKZNW Minset data classifies the major conservation areas into 4 main categories:

- Critical Biodiversity Area (CBA) Mandatory: These are areas that have no other options than to meet their required biodiversity targets for both the biodiversity patterns and the ecological process features. This category is subdivided into two sets, depending on the irreplaceability of the area.
    - CBA 1 Mandatory areas have an irreplaceability score that is equal to 1, meaning that the area is highly irreplaceable.
    - CBA 2 Mandatory areas have an irreplaceability score that lies between 0.8 and is smaller than 1.
- CBA Optimal: These areas are ideal areas to meet their biodiversity conservation targets whilst aiming to avoid high cost areas. This classification is allocated to areas with an irreplaceability score that lies between 0 and 0.8. This category as well as the CBA Mandatory Areas are determined by the National Threatened Ecosystems, the National and KZN Protected Area Expansion Strategy, the KZN threatened Ecosystems, Forests and macro-ecological corridors that are in areas that are under great environmental pressures.
- Ecological Support Areas (ESA): Areas that are not essential for meeting biodiversity targets directly. However, they do play an important role in supporting and sustaining the ecological functioning of the CBAs. These areas are determined by the macro-ecological corridors.
- Ecosystem Goods and Service Areas (EGSA): These are areas that are classified as natural/near natural vegetation which has the capability of delivering important ecosystem goods and services to the KZN province and the inhabitants of the land. Based on the EKZNW Minset data, it was found that the study area is indicated as a Biodiversity Area (Figure 6-2) and has numerous conservation areas, varying in conservation status.

KZN Vegetation Type Map (2011)

The KZN Vegetation Type Map (KZN VT) has undergone several changes since the publication of the Mucina and Rutherford (2006) national Vegmap. Ezemvelo KZN Wildlife has, in collaboration with various government departments, NGOs, Working Groups and Forums e.g. KZN Wetland Forum, IAIA (members of the International Association for Impact Assessment), municipalities and parastatals, refined the KZN VT to develop an accurate representation of the pre-transformation extent of the vegetation types present. As a result of the finer scale mapping and classification, the KZN VT map has in some cases identified new vegetation types and or subtypes within the vegetation types identified at national level. These changes have been peer reviewed and adopted by the National Vegetation Committee, and will be incorporated into the revised SA Vegmap. An example thereof in this study area, is the Swamp Forest, as identified by KZN Vegetation Map (Figure 5-3).

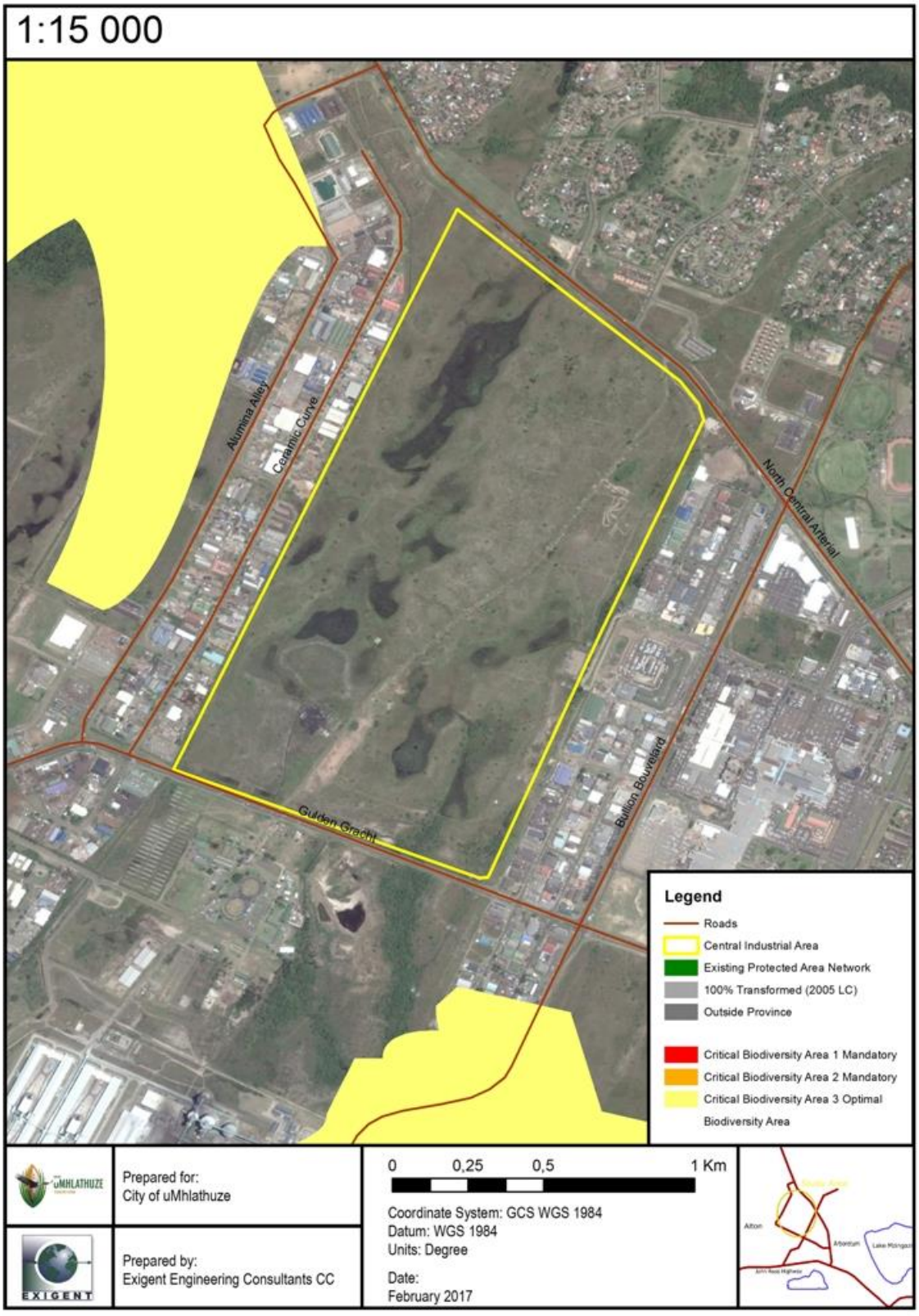

Figure 6-2. Biodiversity Priority Areas (EKZNW Minset 2011).

6.2.3. National databases

The Integrated Biodiversity Information System (SIBIS) database from the South African National Biodiversity Institute (SANBI) contains information from a number of SANBI databases, namely:

- Acocks (plant species observations).
- Custodians of Rare and Endangered Wildflowers (CREW) (threatened plant species localities).
- DNA laboratories (plant and reptile DNA accessions).
- Garden Accessions (plant collection records).
- MSB (plant seed collection records).
- National Herbarium Pretoria (PRE) Computerised Information System (PRECIS) (taxonomy and herbarium specimens).
- Species Status (NEMBA-listed species).
- TSP (threatened plant species).
- National Freshwater Ecosystems Priority Areas (NFEPA) – (Nel et al., 2011). This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.
- National Spatial Biodiversity Assessment.

The SIBIS database provides information of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List status, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix listing or NEMBA Threatened or Protected Species (TOPS) status of the study area, on an interactive map. The NFEPA database includes various water and water related layers, including wetland delineation and vegetation data, catchment data, area of high groundwater recharge and water management areas. Per the NFEPA database, the study area is in the Indian Ocean Coastal Belt Group 1 with slope, bench and valley floor wetlands within the study area. Figure 6-3 depicts the NFEPA map for the study area. During the site visit however, the wetlands were classified as channelled valley bottom wetlands and unchannelled valley bottom wetlands. This will be described in Section 7 of this report.

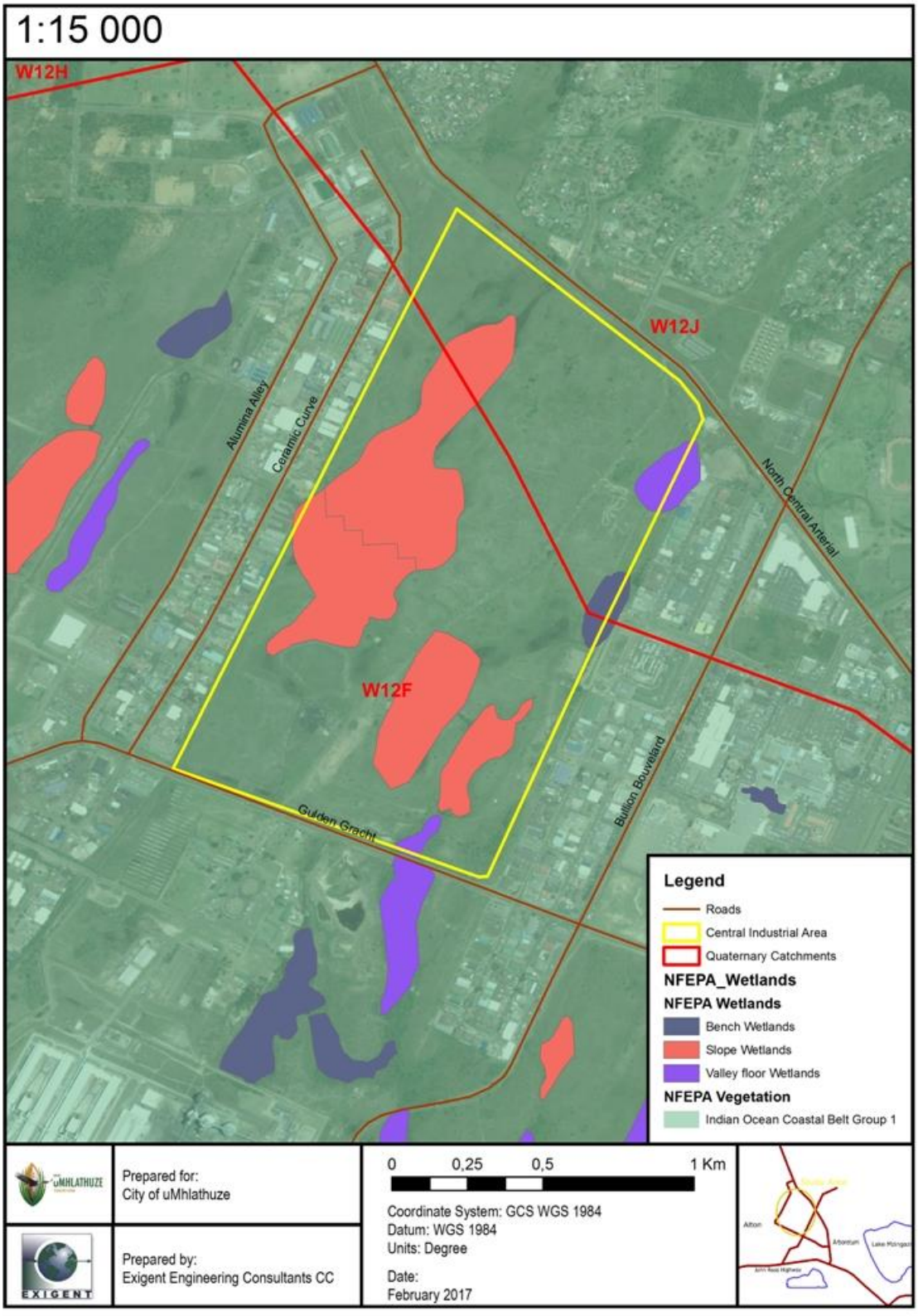

Figure 6-3. NFEPA map of the proposed CIA development.

6.3. Vegetation assessment

The wetland areas were stratified into relatively homogeneous habitat units based on the morphology of the terrain. This was done with the help of 1:50 000 topographical maps and Google earth aerial photos of the study area and the actual field survey was conducted from 6 December 2016 to 9 December 2016. A species list was compiled for the wetland areas during the study area visit to ensure that representative species were captured.

6.3.1. Red data species/CITES assessment

The available habitat on the study area was compared to the habitat requirements of all Red Data fauna and flora species potentially occurring in the area. Based on this assessment, Red Data species with a probability of occurring on the study area were identified.

6.3.2. Protected tree species under the National Forest Act 1998

On 7 September 2014, Regulation 716 was gazetted under the NFA which stated that in terms of Section 15(1), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.

Schedule A of the Regulations list the various species which requires a license. The species occurring within the development footprint which require a license have been described in Section 9.

6.4. Wetland assessment

In term of Section 1 of the NWA (Act No. 36 of 1998), wetlands are defined as following: "(1) *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*." Riparian zones, which is also a watercourse, is defined as: "*the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas*".

Any area where water collects for long enough and often enough to influence the flora, fauna and soil, can be classified as a wetland. The main distinguishing features of wetlands are the presence of water at or near the surface, hydromorphic soil and vegetation adapted to saturated soils. These features can be used to determine if a wetland occurs on the study area or not (DWAF 2003).

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with drainage lines.

6.4.1. Wetland delineation

The wetlands were delineated based on the principles in the DWS guideline document "*A practical field procedure for identification and delineation of wetlands and riparian areas, Edition 1 (September 2005),* in conjunction with the updated draft delineation guideline "*Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas"*. The criteria set out in the guidelines for assessment of presence of a wetland are as follows:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation; such as grey horizons, mottling streaks, hard pans, organic matter depositions, iron and manganese concretion resulting from prolonged saturation;
- The presence, at least occasionally, of water loving plants (hydrophytes); and
- 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.

Due to the variable nature of South Africa's climate the direct presence of water is often an unreliable indicator of wetland conditions. Prolonged saturation of soil has a characteristic effect on soil morphology, affecting soil matrix chroma and mottling in particular.

The wetlands were delineated by making use of the following wetland indicators (DWAF, 2005):

- **Terrain unit indicator** helps identifying those parts of the landscape where wetlands are most likely to occur. Wetlands occupy characteristic positions in the landscape and can occur on the following terrain units: crest, midslope, footslope and valley bottom (Figure 6-4).
- **The Soil Form indicator** identifies the soil forms, as defined by the Soil Classification Working group (1991), which are associated with prolonged and frequent saturation.
- **Soil wetness indicator** identifies the morphological signatures developed in the soil profile as a result of prolonged and frequent saturation. Notes were taken on soil chroma to a depth of 50 cm and this was related to hydrological conditions in terms of the criteria for distinguishing different soil saturation zones within a wetland (Kotze *et al*., 1994).

The vegetation indicator identifies hydrophytic vegetation associated with frequently saturated soils (

Table 6-1).

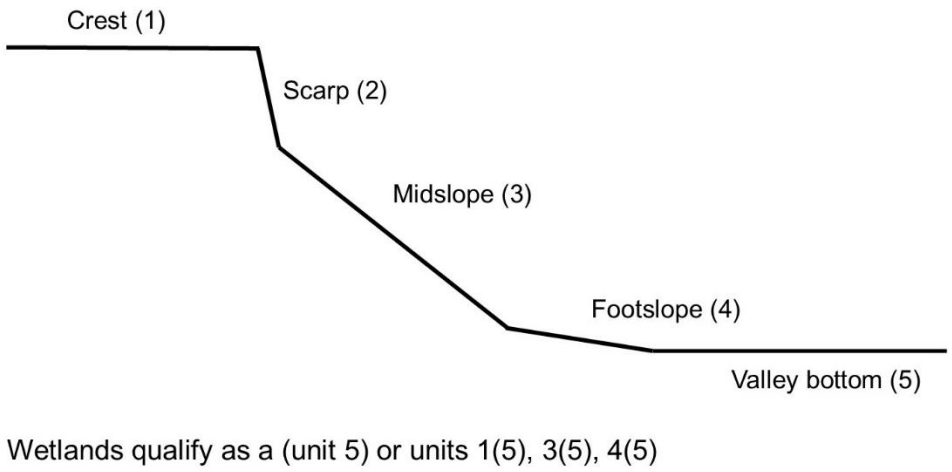

Figure 6-4. Terrain units.

Table 6-1. Criteria for distinguishing different soil saturation zones and hydric vegetation within a wetland (from Kotze *et al*., 1994).

SOIL	DEGREE OF WETNESS		
	Temporary	Seasonal	Permanent / Semi-permanent
Soil depth 0-20cm	Matrix brown to greyish brown (chroma 0-3, usually 1 or 2). Few/no mottles. Non-sulphuric.	Matrix brownish grey to grey (chroma 0-2). Many mottles. Sometimes sulphuric.	Matrix grey (chroma 0-1). Few/no mottles. Often sulphuric.
Soil depth 20-40cm	Matrix greyish brown (chroma 0-2, usually 1). Few/many mottles.	Matrix brownish grey to grey (chroma 0-1). Many mottles.	Matrix grey (chroma 0-1). No/few mottles.
VEGETATION			
If herbaceous:	Predominantly grass species; mixture of species, which occur extensively in non-wetland areas, and hydrophytic plant species, which are restricted largely to wetland areas.	Hydrophytic sedge and grass species which are restricted to wetland areas, usually <1m tall.	Dominated by: (1) emergent plants, including reeds (*Phragmites* sp.), sedges and bulrushes (*Typha* sp.), usually >1m tall (marsh); or (2) floating or submerged aquatic plants.

Using the desktop delineation GPS points, sampling took place, firstly, to verify if the desktop GPS points did in fact represent a wetland area and, secondly, using soil sampling and visual observation of plant species and moving away from the already proven wetland, further soil samples were taken until no wetland indicators were found.

6.4.2. Wetland classification system

Since the late 1960s, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et. al.*, 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects.

SANBI in collaboration with several specialists and stakeholders developed the newly revised and now accepted National Wetland Classification System (NWCS 2010). This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, including structural features at the finer or lower levels of classification (SANBI 2009). The latest SANBI Classification System for Wetlands and other Aquatic Ecosystems in South Africa USER MANUAL: Inland Systems was used in this report to define and describe the wetlands located within the study area (Ollis *et al*, 2013).

Wetlands develop in response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determine the form and function of the respective wetlands. Water is, thus, the common driving force in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in wetland classification as the HGM approach has been adopted throughout the water resources management realm with regards to the determination of the PES and EIS and WET-Health assessments for aquatic environments. These systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the DWS.

6.4.3. Wetland condition (WET-Health)

PES and Ecological importance

Kotze *et al*. (2008) has highlighted the importance of estimating the functioning importance or ecosystem services of a wetland. These functions are impacted by the connectivity of the wetland to other ecosystems as well as the size thereof. In this study, several other sources of information were also considered, which included the NFEPA project completed by the CSIR (CSIR, 2011), and regional and national biodiversity assessments, the latest being the National Biodiversity Assessment released by SANBI (Driver *et al*., 2012).

Wetland Condition is defined as a measure of the deviation of wetland structure and function from its natural reference condition (Macfarlane *et al.*, 2007). In the current assessment, the hydrological, geo-morphological and vegetation integrity were assessed for the wetland units associated with the study area, to provide a PES score (Macfarlane *et al.*, 2007).

Table 6-2 and Table 6-3 below display the criteria for the assessment of the habitat integrity of the wetlands on site.

Table 6-2. Health categories used by WET-Health for describing the integrity of wetlands (Kleinhans *et al*., 1999; Macfarlane *et al*., 2007).

Description	PES Score	PES Rating	Management
Unmodified, natural	> 4	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 discernible and a small loss of natural habitats and biota may have taken place, but the ecosystem functions are essentially unchanged	>3 and <=4	B	Some human-related disturbance, but mostly of low impact
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact and the basic ecosystem functions are still predominantly unchanged	>2 and <=3	C	Multiple disturbances associated with need for socio-economic development, e.g. impoundment
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred	<=2	D	habitat modification and water quality degradation
The change in ecosystem processes and loss of natural habitat and biota is serious. The loss of natural habitat, biota and basic ecosystem functions is extensive	>0 and <2	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. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible	0	F	

Table 6-3. Habitat assessment criteria for the wetlands on site (Source: Kotze *et al*., 2005).

Criteria and attributes	Relevance
Hydrologic	
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes and velocity, which affect inundation of wetland habitats resulting in vegetation changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water quality	
Water quality modification	From point or diffuse sources. Measured directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment load modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Hydrolic/Geomorphic	
Canalisation	Results in desiccation or changes to inundation patterns of wetlands and thus changes in habitats. River diversions or drainage.
Topographic alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities that reduce or change wetland habitat directly in inundation patterns.
Biotic	
Terrestrial encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous vegetation removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive plant encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of biota	Overgrazing, over fishing, etc.

Ecological importance and sensitivity

Ecological importance is an expression of a wetland's importance to the maintenance of ecological diversity and functioning on local and wider spatial scales. Ecological sensitivity refers to the system's ability to tolerate disturbance and its capacity to recover from disturbance once it has occurred (DWAF, 1999). This classification of water resources allows for an appropriate management class to be allocated to the water resource and includes the following:

- Ecological Importance in terms of ecosystems and biodiversity;
- Ecological functions; and
- Basic human needs.

Habitat and biotic factors are rated according to a four-point scale (Table 6-4). The median of the resultant score is calculated to derive the EIS category (Table 6-5).

Table 6-4. Four-point scale to assess biotic and habitat determinants that indicate importance or sensitivity.

Rating	Explanation
None, Rating = 0	Rarely sensitive to changes in biodiversity, landscape scale or wetland sensitivity
Low, Rating =1	One or a few elements sensitive to changes in biodiversity, landscape scale or wetland sensitivity
Moderate, Rating =2	Some elements sensitive to changes in biodiversity, landscape scale or wetland sensitivity
High, Rating =3	Many elements sensitive to changes in biodiversity, landscape scale or wetland sensitivity
Very high, Rating =4	Very many elements sensitive to in biodiversity, landscape scale or wetland sensitivity

Table 6-5. Environmental Importance and Sensitivity rating scale used for calculation of EIS scores (DWAF, 1999).

Ecological Importance and Sensitivity Categories	Rating	Recommended Ecological Management Class
Very High Wetlands that are considered ecologically important and sensitive on a national level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water in major rivers	>3 and <=4	A
High Wetlands that are ecologically important and sensitive on a provincial level. 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	B
Moderate Wetlands that are ecologically important and sensitive on a 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	C
Low/Marginal Wetlands that is not ecologically important and sensitive at any scale. The biodiversity of these wetlands 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	D

WET-EcoServices

The overall goal of WET-EcoServices is to assist decision makers, government officials, planners, consultants and educators in undertaking quick assessments of the ecosystem services that wetlands provide. Ecosystem services of wetlands include regulating services such as flood control, supporting services such as nutrient recycling, provisioning services such as food and water, and cultural services such as education and recreation. Ecosystem services for each HGM unit is assessed separately (Kotze *et al.*, 2005). Table 6-6 below lists and describes the ecosystem services of wetlands that are assessed when using the WET-EcoServices tool.

Table 6-6. Ecosystem services included and assessed by WET-EcoServices (Kotze *et al*., 2005)

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 sediments 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**			Through the provision of habitat and maintenance of the 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 of 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		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

6.5. Limitations

In order to obtain a comprehensive understanding of the dynamics of the vegetation on the study area, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and replication. However, due to time constraints, such long-term studies are not always feasible and most conclusions will be based on the one week field surveys in December 2016.

7. RESULTS

All areas with wetland habitat were identified within the scope of this study. Wetlands were identified using the hydrological, vegetation and soil characteristics.

7.1. Classification of study area wetlands to HGM Level 4

A classification system developed for the National Wetlands Inventory is based on the principles of the hydro-geomorphic (HGM) approach to wetland classification (Ewart-Smith *et al.,* 2006). This classification system was further developed and refined and a new classification system, the

"*Classification System for Wetlands and other Aquatic Ecosystem in South Africa*" was published (Ollis *et al*., 2013). The current wetland study follows this new classification system, by classifying wetlands in terms of a functional unit in line with a Level 4 category recognised in the classification system (Ollis *et al.*, 2013).

Level 1:
Inland system

Level 2: Regional Setting
DWS Ecoregion
According to the DWA Level 1 Ecoregions, the area falls under the Natal Coastal Plain (Kleinhans *et al*., 2005).

Bioregions
According to NFEPA WetVeg Group the study area falls within the Indian Ocean Coastal Belt Group 1. According to the most recent vegetation map of South Africa, the vegetation on the study area falls in the Maputaland Coastal Belt (Mucina & Rutherford, 2006).

Level 3: Landscape setting
a. Valley Floor
The base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate. (Ollis *et al*., 2013).

Level 4: Hydrogeomorphic Unit (HGM unit)

Two HGM wetland units were recorded in the study area namely:

a. River
Rivers are linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit (Ollis *et al*., 2013).

b. Valley-bottom wetlands
Valley bottom wetlands are areas that are mostly a flat wetland area located along a valley floor, often connected to an upstream or adjoining river channel (Ollis *et al*., 2013).

Valley-bottom wetlands are either channelled or unchannelled. Both channelled and unchannelled valley bottom wetlands are present within the study area.

Channelled valley bottom wetlands: valley bottom wetland with a river channel running through it.
Unchannelled valley bottom wetland: a valley-bottom wetland without a river channel running through it.

7.2. Study area wetland description

The majority of the study area lies within a valley bottom system and exhibit wetland characteristics. Wetland soil sampling took place by means of a hand auger along thirteen (13) transects which included 114 sampling points (Figure 7-1). All three wetness zones were encountered and are depicted in Figure 7-2. It should be noted however that the wetlands within the study area are not individual units but forms part of a large wetland system. For the purpose of this report, the wetlands were grouped based on similar vegetation communities (Figure 7-3).

1. Grassy / sedge freshwater wetlands
2. Wetlands associated with the remnant coastal forest
3. Reed / bulrush wetlands in drainage channel

7.2.1. Grassy / sedge freshwater wetlands

This wetland system is the largest vegetation community within the study area. It is classified as an unchannelled valley bottom wetland and is approximate 92,6 hectares in extent. All three wetness zones were present during the site visit with the permanent zone inundated, water deeper than one meter at several positions in the system. Due to the presence of the different wetness zones, the vegetation is diverse, ranging from obligate water plant species such as *Nymphaea nouchali* and *Nymphoides thunbergiana* to facultative and opportunistic wetland plants such as *Kyllinga alba, Cynodon dactylon* and *Eragrostis racemosa*. Other plant species included *Ascolepis capensis, Bulbostylis hispidula, Centella asiatica, Cyperus articulatus, Cyperus congestus, Cyperus fastigiatus, Cyprus longus* var. *tenuiflorus, Cyperus natalensis, Eleocharis acutangula, Isolepis cernua, Juncus lomatophyllus, Imperata cylindrical, Ischaemum fasciculatum* and *Typha capensis*.

During sampling in this wetland vegetation community, a peat substrate was found. The peat was found to vary in depth. At the majority of these sampling points, the top 10 cm of the peat is undecomposed (H4 on the Von Post humification scale), and plant matter is still distinguishable. Below 10 cm the peat becomes more humified to a H7 - H8 on the Von Post Humification Scale. The Von Post Humification scale ranges from H1 (completely undecomposed peat which releases clear water when squeezed and plant remains easily identifiable) to H10 (completely decomposed peat with no discernible plant structure, and when squeezed, all the peat escapes between the fingers). At most samples, the soil became sandy at approximately 30cm with numerous or a few redoximorphic features (mottles) in the grey matrix, depending on the wetness zone; and are typically orange in colour; they were found to be small to large; and faint or bright.

Limited impacts were observed in this wetland vegetation community. Footpaths traversing the study area were mainly located in the temporary wetness zones and alien and invasive species were restricted to the areas where the existing tar road bisects this community. Alien and weed species observed included *Bidens bipinnata, Bidens pilosa, Chromolaena odorata, Ipomoea purpurea, Lantana camara*, *Ricinus communis* and *Tagetes minuta*.

Figure 7-1. Sampling points during wetland delineation.

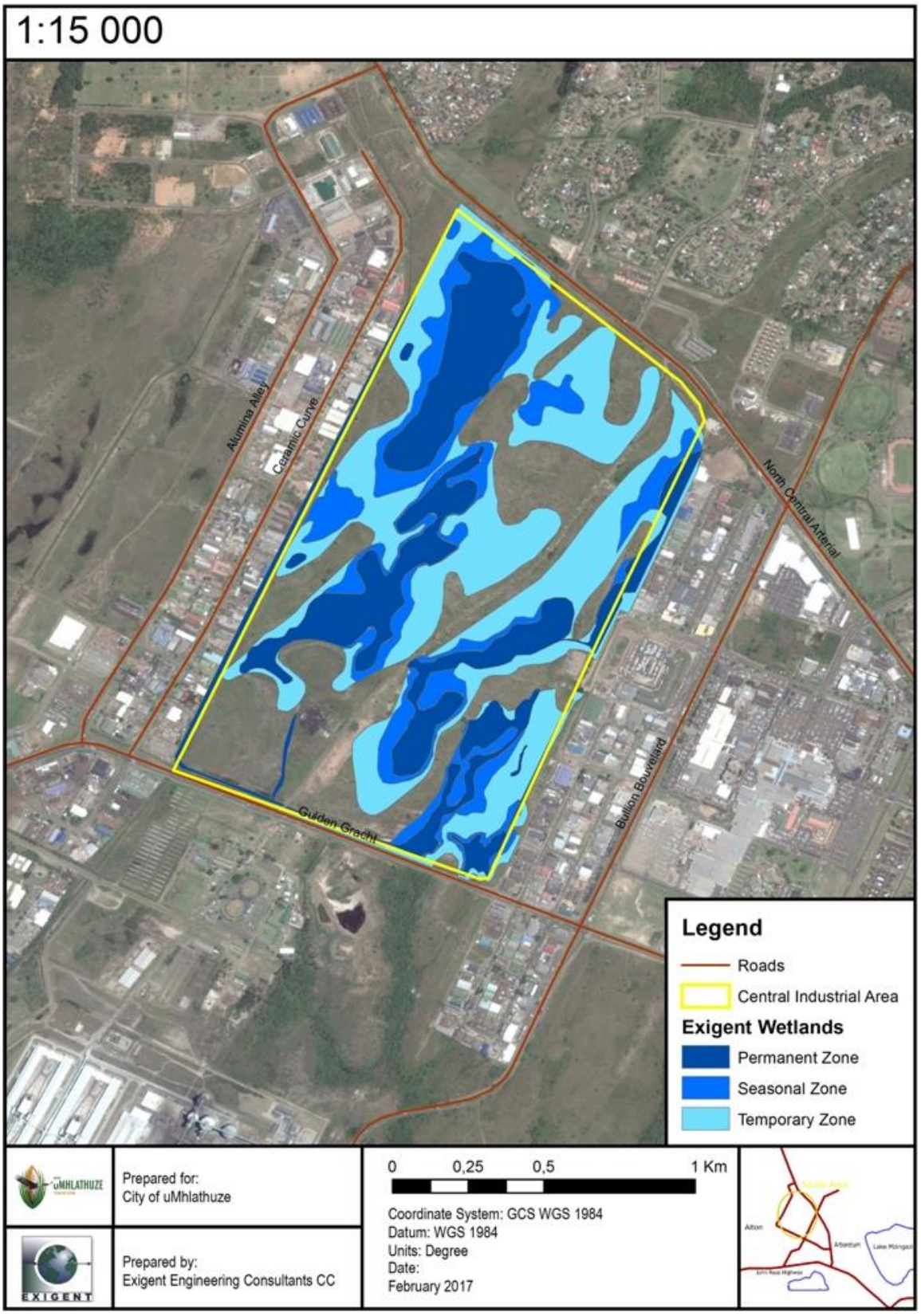

Figure 7-2. Wetness zones and vegetation communities identified within the study area.

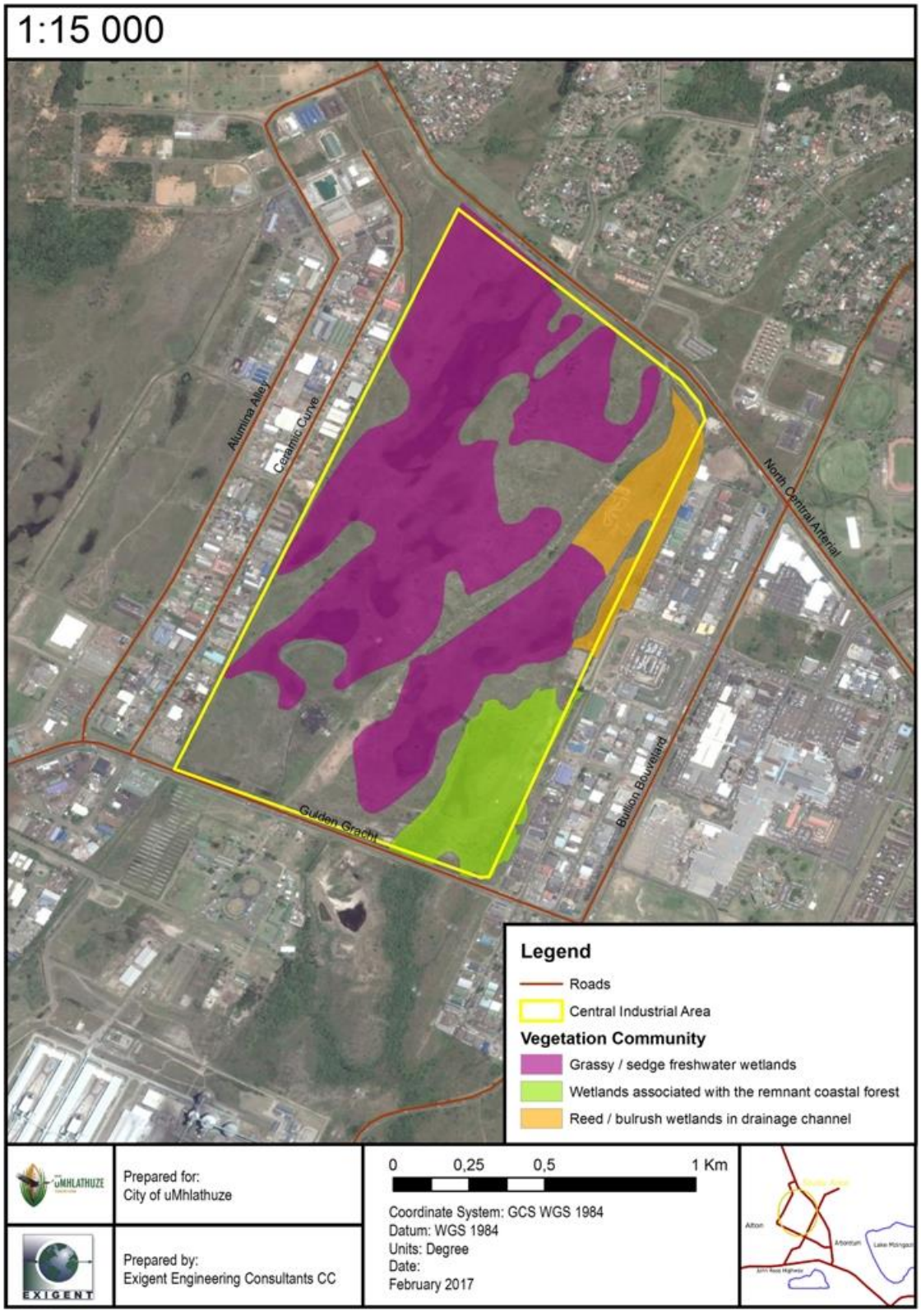

Figure 7-3. Wetland vegetation communities within the study area.

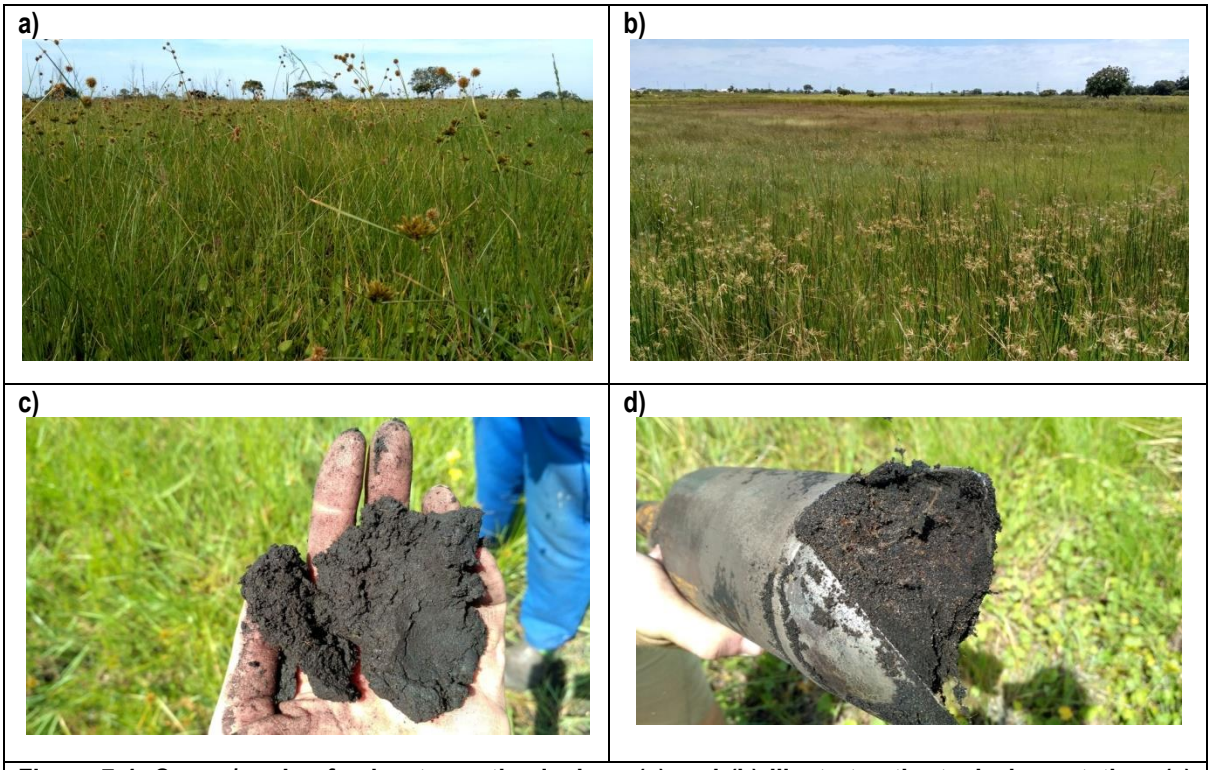

Figure 7-4. Grass / sedge freshwater wetland where (a) and (b) illustrates the typical vegetation; (c) depicts peat from one soil sample and (d) orange mottling in the grey sandy soil.

Wetland condition and Services:

The ecosystem services provided by this wetland vegetation community is key, specifically as it is in such a good condition. These include regulating services such as flood attenuation, supporting services such as phosphate, nitrate and toxicant removal. Other services include sediment trapping, carbon storage, erosion control and biodiversity maintenance.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
1	0	100	1,5	-1	2,5	-1	1,4	-1
PES Category (See Table 5.29)			B	↓	C	↓	B	↓
Wetland Impact Score			1,76					
Wetland PES			B					

	Score	Confidence	Class
ECOLOGICAL IMPORTANCE & SENSITIVITY	2,6	2,5	B

7.2.2 Wetlands associated with the remnant coastal forest

This channelled valley bottom wetland is associated with the concentrated surface flow from a tributary leading to the Ngondweni channel. It is approximately 16,1 hectares in extent and exhibits typical species of a coastal forest. Anthropogenic influences however have reduced the species density, opening the canopy. The riparian zone is vegetated with protected species such as *Ficus trichopoda* (Swamp fig) and *Barringtonia racemosa* (Powder puff tree). Other species included *Brachylaena discolour*, *Strelitzia nicolai*, *Syzygium cordatum*, *Phoenix reclinata*, *Bridelia micrantha, Macaranga capensis*, *Tarenna pavettoides, Grewia occidentalis, Pteridium aquilinum* and *Nephrolepis biserrata*. Pockets of permanently wet areas comprise of species such as *Cyperus fastigiatus, Phragmites australis and Typha capensis.* On the edge of the coastal forest, where wetland conditions persist, *Imperata cylindrica* species is dominant. A peat substrate was also found in this wetland vegetation community. The peat was found to a depth of 30cm and humified classified as a H7 on the Von Post Humification Scale. The peat is underlain by a light sandy soil horizon. A few redoximorphic features (mottles) are encountered in a light sandy matrix, mostly from 10 cm downwards; and are typically orange in colour; they were found to be small to large; and faint or bright (Figure 7-5).

Due to the protective coverage of the trees and the isolation of the patch, homeless utilise it. During the site visit, people were bathing and washing their clothes in the inundated areas. Other impacts include an artificial channel that runs parallel on the eastern border of the study area, adjacent to the edge of this vegetation community. Several alien invasive species have established here. They include but are not limited to *Chromolaena odorata, Lantana camara*, *Pennisetum clandestinum* and *Ricinus communis.*

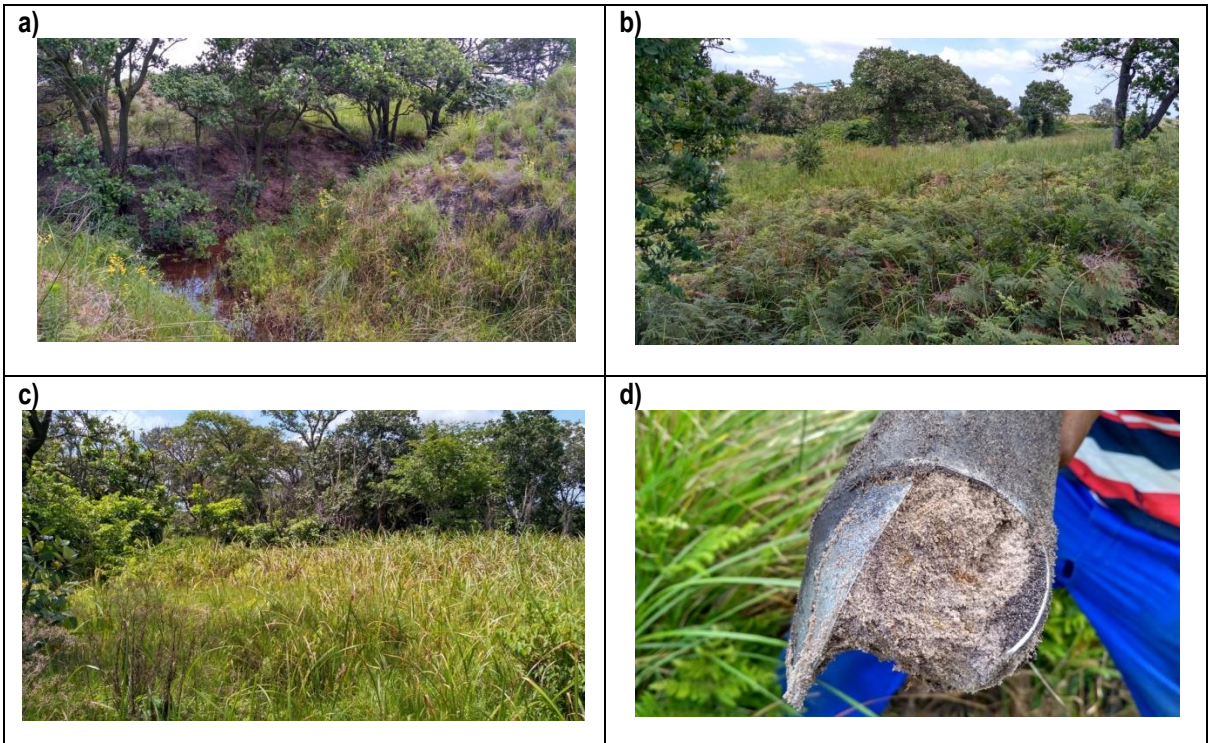

Figure 7-5. Wetlands associated with a remnant coastal forest where (a) depicts the active river channel; (b) and (c) depicts the typical vegetation community; and (d) the light sandy soil with orange mottling.

Wetland condition and Services:
Services provided by this wetland include flood attenuation, phosphate, nitrate and toxicant trapping as well as erosion control. It maintains biodiversity and provides natural resources to the homeless community.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
1	4	100	3,5	-1	3,5	-2	2,0	-2
PES Category (See Table 5.29)			C	↓	C	↓↓	C	↓↓
Wetland Impact Score			3,08					
Wetland PES			C					

	Score	Confidence	Class
ECOLOGICAL IMPORTANCE & SENSITIVITY	2	3,4	C

7.2.3. Reed / Bulrush wetlands in drainage channel

Artificially channelled wetlands are located along the eastern, southern and western boundaries of the study area. These channels are permanently inundated. The eastern channel is particularly wide along the northern portion and is dominated by the plant species *Imperata cylindrica*. Here a berm allows access for pedestrians and vehicles into the study area. Other species typically found in the permanent zones were Nymphaea lotus, *Phragmites australis and Typha capensis*. Natural seasonal and temporary zones are located to the west of this eastern drainage channel. It is approximately 11,3 in extent. Comparable to the other wetland soils of the study area, the soil exhibits a highly organic sandy topsoil, underlain by a light sandy soil horizon. A few mottles are encountered in the grey matrix, mostly from 10 cm downwards; and are typically orange in colour; they were found to be small to large; and faint or bright (Figure 7-6).

Due to the proximity of these wetlands to the commercial and industrial areas of Richards Bay, impacts are much more evident than the rest of the study area. Signs of diesel/oil spillages were observed in and adjacent to eastern channel. These wetlands are furthermore polluted with rubbish dumped in and alongside the wetlands. Several footpaths traverse the areas and have resulted in the spread and infestation of numerous invasive alien and weed species. These include but are not limited to *Chromolaena odorata, Conyza albida, Datura stramonium, Hibiscus trionum, Ipomoea purpurea, Lantana camara, Melia azadarach, Psidium guajava, Pteridium aquilinum, Ricinus communis, Rumex crispes* and *Solanum mauritianum.*

a)

b)

c)

d)

Figure 7-6. Reed / bulrush wetlands where (a); (b) and (c) indicates the wetland vegetation; and (d) a soil sample with faint orange mottling in a grey sandy matrix.

Wetland condition and Services:

EcoServices include regulating services such as flood attenuation, supporting services such as phosphate, nitrate and toxicant removal. Other services include sediment trapping and erosion control.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
1	4	100	4,0	-1	6,3	-1	6,4	-2
PES Category (See Table 5.29)			D	↓	E	↓	E	↓↓
Wetland Impact Score			5,33					
Wetland PES			D					

	Score	Confidence	Class
ECOLOGICAL IMPORTANCE & SENSITIVITY	1,0	3,2	C

8. INVASIVE PLANT SPECIES

Any plant that occurs in an area where it is not indigenous is referred to as an alien (exotic, foreign, introduced, non-native and non-indigenous) plant. If these plants are able to maintain populations without human help they can be referred to as naturalised plants. If such naturalised plants are also able to spread over considerable distances into new, undisturbed, natural areas and replace the indigenous vegetation, they are regarded as alien invasive plants, or invaders (Klein 2002).

Alien invasive plants are similar to pioneer plants in that they rapidly colonise disturbed areas, but differ from pioneer plants in having the additional ability to encroach upon undisturbed, pristine areas. They usually grow vigorously and disperse rapidly, and instead of being outcompeted by better-adapted plants, the invasive plants actively displace the indigenous vegetation and often transform the plant community (Klein 2002).

Alien plant invasions can cause:

- A decline in biological diversity;
- Local extinction of indigenous species;
- Decrease in productivity of agriculture and rangeland;
- Increased agricultural input costs;
- Reduced streamflow in rivers;
- Choking of watercourses;
- A decline in animal species; and
- Respiration by submerged weeds can cause oxygen deficiencies in water.

The control of invasive plant species is addressed under the Conservation of Agricultural Resources Act (CARA), Act 43 of 1983 Regulations 15 and 16 and the National Environmental Management: Biodiversity Act (NEMBA), Act 10 of 2004. CARA classifies invasive species under three categories while NEMBA identifies four categories according to the invasiveness and threat to the environment.

Table 8-1. Invasive plant species categories (Landcare South Africa, no date; NEMBA, 2004).

CARA categories		NEMBA categories	
1	Invaders are species that will no longer be allowed to occur on any property in South Africa because their harmful properties outweigh their useful qualities.	1a	These invader species must be controlled. The landowner must take immediate to control and maintain the control of the listed invasive species and allow an authorised official from the Department onto the land to monitor, assist or implement the control of the listed invasive species.
2	Plants are species proven to have a potential of becoming invasive, but with commercial value. Provision is made in CARA in Regulations 15 and 16 for the species to occur in certain demarcated areas, but the species have to be removed from all areas outside the demarcated areas. Category 2 plants may never occur within 30 m of the 1:50 year floodline of any wetlands or watercourses.	1b	The plant invasive species must be contained. The landowner must control the listed invasive species in accordance with the Invasive Species Management Programme if it has been developed in terms of Regulation 7. The landowner must allow an authorised official from the Department onto the land to monitor, assist or implement the containment of the listed invasive species or compliance with the Invasive Species Management Programme contemplated in Regulation 7.

CARA categories		NEMBA categories	
3	Invaders are plants that are proven to have the potential of becoming invasive. These plants are, however, popular garden plants (ornamentals or shade trees) and it will take a long time to replace these species. Category 3 plants are not allowed to occur anywhere, unless the plants were already in existence when the regulations came into effect. None of the plants may occur within 30 m of the 1:50 year flood zone of any wetlands or water courses.	2	These species require a permit to carry out a restricted activity within an area specified in the Notice, within National Parks, Provincial Reserves, mountain catchment areas or Forestry Reserves specified in the Protected Areas Act, or in the Permit. Landowners must ensure that the specimens do not spread outside the land or area specified in the permit. Any species listed as Category 2 Invasive Species outside the specified area must be considered as Category 1B Listed Invasive Species and must managed accordingly.
		3	These invasive species are subject to exemptions and prohibitions. However, any plant invasive listed in Category 3 that occurs in riparian areas, must be considered as Category 1b Listed Invasive Species and must be managed accordingly.

Table 8-2 contains a list of invasive species, as listed in the National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Lists, 2016 (No 864), observed during the site visit. Not all species are classified as per CARA and NEMBA, although they may be recognised as problem plants within South Africa (Bromilow, 2001).

Table 8-2. List of alien and invasive and weed species observed in the study area.

Species name	Type	CARA Category	NEMBA Category
Chromolaena odorata	Alien and invasive	1	1b
Solanum mauritianum	Alien and invasive	1	1b
Psidium guajava	Alien and invasive	1	2
Pennisetum clandestinum	Alien and invasive	1	1b
Lantana camara	Alien and invasive	1	1b
Datura stramonium	Alien and invasive	1	1b
Ipomoea purpurea	Alien and invasive	1	1b
Ricinus communis	Alien and invasive	2	2
Melia azadarach	Alien and invasive	3	1b
Conyza albida	Weed	Not categorised	
Pteridium aquilinum	Weed	Not categorised	
Tagetes minuta	Weed	Not categorised	
Rumex crispes	Weed	Not categorised	
Hibiscus trionum	Weed	Not categorised	

Failure of the owner to remove CARA Category 1 and 2 invaders and NEMBA Category 1b from his/her property may result in prosecution under CARA or NEMBA legislation.

9. PROTECTED PLANT SPECIES

Various plant species and/or plant communities are protected by legislation, namely:

1. KZN Nature Conservation Act (Act 9 of 1997);
2. National Forest Act (Act 84 of 1998);
3. NEMBA (Act 10 of 2004); and
4. CITES.

The distribution ranges of all species were assessed and a list compiled of species with a distribution range within the study area. During the site visit, the distribution of these species was noted for permit application purposes.

9.2. KZN Nature Conservation Act

In terms of Chapter 8 of the KZN Nature Conservation Act (1997), affected indigenous plant species are divided into "specially protected" and "protected" categories, each with specific protection criteria. "Specially protected" plants are those species that are deemed to be under most threat of extinction and therefore require the greatest possible legal protection. Protected plants are those plants that are not currently considered to be as threatened as specially protected species, but need legal protection to protect them from being over-exploited. If a person wishes to gather, export, import, introduce, sell, relocate or translocate a specially protected or a protected species, a permit should be obtained from EKZNW before doing so.

Table 9-1 lists the KZN Nature Conservation Act species with a distribution range in the study area. A permit will be required prior to removal of any of these specimens. None of these species were observed during the field survey, however should they be observed during construction, they should not be removed without a permit from EKZNW.

Table 9-1. KZN Nature Conservation Act (1997) protected and specially protected species.

SPECIES NAME	COMMON NAME
Specially protected trees	
Warburgia salutaris	Pepper-bark tree
Protected species	
Bersama lucens	Glossy white ash
Brionadia salicina	Matumi
Cassipourea gerrardii	Common onionwood
Cassipourea mossambicus	Sand onionwood
Encephalartos lebomboensis	Lebombo cycad
Gladiolus dalenii	Natal lily
Haworthia limifolia	Harworthias
Huernia hystrix	Porcupine huernia
Huernia zybrina	Zebra huernia
Newtonia hildebrandtii	Lebombo wattle
Eulophia clitellifera	Orchidaceae
Eulophia speciosa	Orchidaceae
Eulophia streptopetala	Twisted-petal eulophia
Eulophia welwitschii	Orchidaceae
Eulophia petersii	Orchidaceae
Eulophia leachii	Orchidaceae
Podocarpus falcatus	Common yellowwood
Prunus africana	Red stinkwood
Albuca setosa	Small white albuca
Cryptocarya woodii	Cape quince
Stapelia gigantean	Giant stapelia
Sideroxylon inerme	White milkwood

9.3. National Forest Act (1998)

Based on an assessment of the list of protected tree species, as identified in Regulations 716 of the NFA, there are 17 species with a distribution range in the study area (Table 9-2). A permit will be required prior to removal of any of these specimens. Three of these species, the Swamp fig (*Ficus trichopoda*), Powder-puff tree (*Barringtonia racemosa*) and Marula (*Sclerocarya birrea*) was confirmed during the site visit. *Ficus trichopoda* and *Barringtonia racemosa* was observed in the artificial drainage channels and the remnant coastal forest while *Sclerocarya birrea* was located within the hygrophilous

grassland outside of the grassy / sedge freshwater wetland. Based on the proposed amended layout and the EA approved layout, a permit from DAFF will be required prior to removal of these species.

Table 9-2. DAFF Protected tree species. Bold indicates species observed within the study area.

Species name	Common name
Ficus trichopoda	**Swamp fig**
Mimusops caffra	Coastal red milk wood
Sideroxylon inerme	White milk wood
Boscia albitrunca	Shepard's tree
Cleistanthus schlechteri	False tamboti
Ocotea bullata	Stink wood
Barringtonia racemosa	**Powder-puff tree**
Pittosporum viridiflorum	Cheese wood
Podocarpus falcatus	Outeniqua yellow wood
Podocarpus latifolius	Red yellow wood
Bruguieria gymnorrhiza	Black mangrove
Rhizophora mucronata	Red mangrove
Ceriop tagal	Kirkiri
Catha edulis	Bushman's tea
Cassipourea swaziensis	Swazi onion wood
Balanites maughamii	Green thorn
Sclerocarya birrea	**Marula**

9.4. Red data listed species

South Africa is a signatory to the United Nations Convention on Biological Diversity (1992) and, as such, needs to conserve biological diversity, promote the sustainable use of biological diversity, and ensure the fair and equitable sharing of benefits arising out of the utilisation of genetic resources. Principle 4(a) of the NEMA states that disturbance to ecosystems and loss of biodiversity should be avoided, minimised and remedied.

To promote the conservation of biodiversity, species of concern have been identified by the World Conservation Organisation (IUCN) Red Data lists which they feel require protection. The IUCN has three threatened categories, namely Critically Endangered, Endangered and Vulnerable. Species that have been evaluated according to the IUCN criteria and do not fall into one of the threatened categories can be classified as Least Concern, Near Threatened or Data Deficient (Minter *et al.,* 2004; Hilton-Taylor, 1996):

- **Extinct:** The species are presumed extinct when extensive surveys have failed to record an individual. Surveys should be in known and expected habitat, at appropriate times and throughout its historic range.
- **Extinct in the Wild:** Exhaustive surveys in known and expected habitat, at appropriate times and throughout its historic range have failed to record an individual. Populations occur well outside the past range, in cultivation or in captivity.
- **Critically Endangered:** Species facing an extremely high risk of extinction in the wild.
- **Endangered:** These taxa are in danger of extinction and are unlikely to survive if the current situation continues.
- **Vulnerable:** Vulnerable species are facing a high risk of extinction in the wild. Vulnerable species are taxa that are likely to move into the Endangered category in the near future if the factors causing the decline continue to be present.

- **Near Threatened:** Species are classified as Near Threatened when they do not meet the criteria for the threatened categories, but are close to classifying as Threatened or will likely classify as Threatened in the near future.
- **Data Deficient:** A species is classified as a Data Deficient when there is a lack of appropriate data on the distribution and/or population status of the species. The species may be well studied, and the biology known, but data on the abundance and/or distribution are not available. The category indicates that more data are required and that there is a possibility that the species may be classified into one of the threat categories in the future.
- **Least Concern:** Species that are widespread and abundant are normally included in this category.

From the RDL/SEA species assessment, it was indicated that species listed for the quarter degree squares (QDS) 2832CC and 2832CA are listed in Table 9-3 below. Species with high probability of occurring on site has been highlighted in bold text. None of these species were found within the study area during the survey, however should they be impacted by construction activities, a permit is required prior to removal thereof.

Table 9-3. Results of the Red Data Listed/SEA assessment.

Species name	Current IUCN listing	Flowering season	Probability of occurrence	Motivation
Eulophia speciosa	**Declining**	**October and January**	**High**	**The plants normally grow in savanna grassland, bushland and wooded grassland, and have also been recorded from marshy coastal grassland and montane grassland. They are found from near sea level (often exposed to salt spray) to 1 700 m in southern Africa. In South Africa the plants usually grow in colonies of up to 50 plants in sandy soils or in clay (http://www.plantzafrica.com).**
Aloe cooperi	**Declining**	**December to March. However, *A. cooperi* subsp. *pulchra* flowers April to May**	**High**	**Grows in grasslands in dry, rocky areas or wet, marshy habitats in altitude from sea level to 1 800 m (Van Wyk & Smith, 2003). Possible habitat on site.**
Aloe linearifolia	**Near threatened**	**February to March**	**High**	**Occurs in grasslands at altitudes 100 m to 2000 m (Van Wyk & Smith, 2003). Possible habitat on site.**
Cineraria atriplicifolia	**Vulnerable**	**March to July**	**High**	**Grassland, open dry thornveld, or sometimes at the edges of thicket or forest or below steep cliffs in river valleys, 30-800 m (Von Staden, 2008). Habitat available within the study area.**

Species name	Current IUCN listing	Flowering season	Probability of occurrence	Motivation
Kniphofia leucocephala	**Critically endangered**	**September to December, but occasional flowers appear throughout the year.**	**High**	**Known only from vleis or wetlands in low-lying coastal grassland in the Richards Bay area of KwaZulu-Natal (www.plantzafrica.com). Possible habitat on site.**
Kniphofia littoralis	**Near threatened**	**August to October**	**High**	**Coastal grassland. Moist depressions, not usually in permanently waterlogged soils, 5-200m (Scott-Shaw & Victor, 2005). Possible habitat on site.**
Raphionacme lucens	**Near threatened**	**July to January**	**High**	**In Coastal Grassland Zululand (Pooley 1998). Possible habitat on site.**
Restio zuluensis	**Vulnerable**		**High**	**Grows on the margins of wetlands in short coastal grassland (Von Staden & Scott-Shaw, 2007). Short coastal grassland wetlands present within the study area.**
Elaeodendron croceum	Declining	August to April	Medium to high	Occurs on the margins of coastal and other moist inland forests (http://www.plantzafrica.com). Possible habitat within the study area.
Asclepias gordon-grayae	Endangered	September to April	Medium to high	Tall, unburnt coastal grassland, in black peat soils in marshy areas, 10-100 m (Nicolas et al., 2007). Coastal grassland with wetland habitat present within the study area.
Cyperus sensilis	Near threatened		Medium to high	Coastal grasslands and dunes. Associated with seasonal pans, forms a conspicuous zone around the water edge. Altitude 5-50 m. Perennial Herb. Species is potentially tolerant of wetland degradation (Agenbag, 2010). Possible habitat on site in the form of wetlands.
Freesia laxa subsp. *azurea*	Vulnerable	Mid-spring to mid-summer	Medium to high	Grassy dunes or light shade along margins of coastal forests (Von Staden, 2012). Possible habitat on site.
Adenia gummifera var. *gummifera*	Declining	October to April	Medium	Forested ravines, forest patches and forest margins, forest scrub, miombo woodland, savanna, dune forest, on stony slopes, termitaria and littoral bush, 0-1800 m (Williams *et al*., 2008). Possible habitat on site.

Species name	Current IUCN listing	Flowering season	Probability of occurrence	Motivation
Thesium polygaloides	Vulnerable	September to April	Low	Indian Ocean Coastal Belt Swamps (Burgoyne & Daniels, 2009). Remnant Coastal forest and swamp present within the study area.
Bonatea lamprophylla	Vulnerable	September to November	Low	Deeply shaded areas in coastal dune forest (Victor et al., 2006). No habitat present on site.
Disperis johnstonii	Near threatened	February to March	Low	Brachystegia woodland, forest patches, usually in shelter of rocks, 1050-1350 m (Kurzweil & Victor, 2009). No available habitat within the study area.
Sisyranthus franksiae	Threatened			Terrestrial (SANBI, 2014). Limited information available,
Nidorella tongensis	Threatened			No information available

10. ECOLOGICAL SENSITIVITY ASSESSMENT

The habitats within the study area were assessed based on their conservation status, species diversity, Red List species status and extent of transformation/degradation.

The conservation importance categories are:

- **High**: This category contains areas classified as natural wetlands (riverine, drainage lines, etc), rocky outcrops, indigenous bush clumps and pristine grassland areas. These communities have a limited alien species invasion and Red List species occur. These areas must be conserved and not impacted.
- **Medium**: These are communities that are moderately transformed/disturbed with both alien invasive species and a large proportion of indigenous species. These are areas that require mitigation measures should activities occur within these areas.
- **Low:** These areas consist of alien plantations, agricultural areas and previously disturbed areas that have a large percentage of alien species invasion. The possibility of Red Data species occurring within these areas is highly unlikely. These areas have little conservation value.

The objective of the sensitivity assessment is to indicate the location and extent of all sensitive areas on the study area that must be protected from transforming land uses. Sensitive areas must be avoided, or impacts mitigated where possible. The sensitive areas within the study area are depicted in Figure 10-1.

All wetland areas should be considered as sensitive. The grassy / sedge wetlands on site are of particular importance due to the confirmation of peat. The majority of study area lies within a valley floor and functions as a single wetland system linking to Thulazihleka Pan and Ngodweni Canal and leading to the Port of Richards Bay. Therefore mitigation measures, as described in Section 11.2 must strictly be adhered to.

Further details on the motivation for the sensitivity assessment classification are provided in Table 10-1.

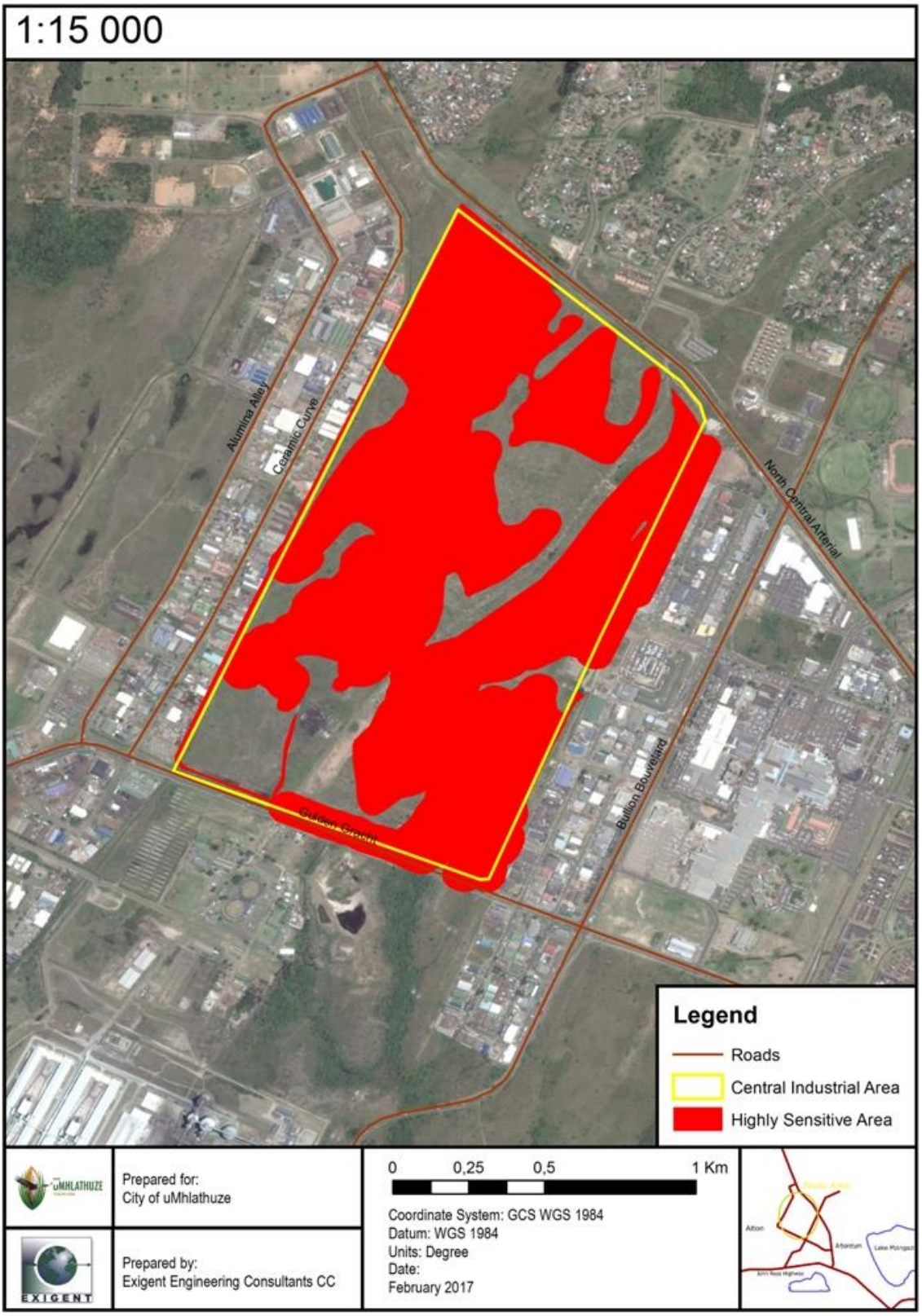

Figure 10-1. Wetland sensitivity within the study area.

Table 10-1. Motivation of extent of High Sensitivity Areas.

Vegetation types:	Grassy / sedge freshwater wetlands Wetlands associated with the remnant coastal forest Reed / bulrush wetlands in drainage channel
Vegetation:	Diverse range of species that include but not limited to *Nymphaea nouchali, Nymphoides thunbergiana, Kyllinga alba, Cynodon dactylon, Eragrostis racemosa*, *Ascolepis capensis, Bulbostylis hispidula, Centella asiatica, Cyperus articulatus, Cyperus congestus, Cyperus fastigiatus, Cyprus longus* var. *tenuiflorus, Cyperus natalensis, Eleocharis acutangula, Isolepis cernua, Juncus lomatophyllus, Imperata cylindrical, Ischaemum fasciculatum, Typha capensis*, *Brachylaena discolour*, *Strelitzia nicolai*, *Syzygium cordatum*, *Phoenix reclinata*, *Bridelia micrantha, Macaranga capensis*, *Tarenna pavettoides, Grewia occidentalis, Pteridium aquilinum, Nephrolepis biserrata*, *Cyperus fastigiatus* and *Phragmites australis*. Invasion by alien species is restricted to areas adjacent to the exsiting tar road and the drainage channel located along the east of the study area. They include species such as *Chromolaena odorata*, *Solanum mauritianum*, *Psidium guajava*, *Lantana camara*, *Ricinus communis*, *Melia azedarach* has occurred, especially surrounding the swamp forests.
Connectivity:	The majority of study area lies within a valley floor and comprise of one wetland system linking to Thulazihleka Pan and Ngodweni Canal, leading to the Port of Richards Bay. This is one of the major ecological corridors in Richards Bay. A buffer has been set and is described in Section 11 below.
Red List Plants:	No Red Data plant species were observed. Three protected species, *Ficus trichopoda*, *Barringtonia racemosa* and *Sclerocarya birrea* were confirmed.
Wetlands:	Yes
Rivers:	Yes

Figure 10-2 depicts the proposed new layout in a solid black line. This layout was the results of negotiations between the applicant's preferred ecological corridor (dotted green line in Figure 10-2) and the sensitive wetland areas. A 50m buffer zone is proposed around the permanent wetlands, upholding protection of peatlands and permanent wetlands. Most of the delineated seasonal wetlands fall within the proposed buffer and are therefore included in the protection buffer (Figure 10-3).

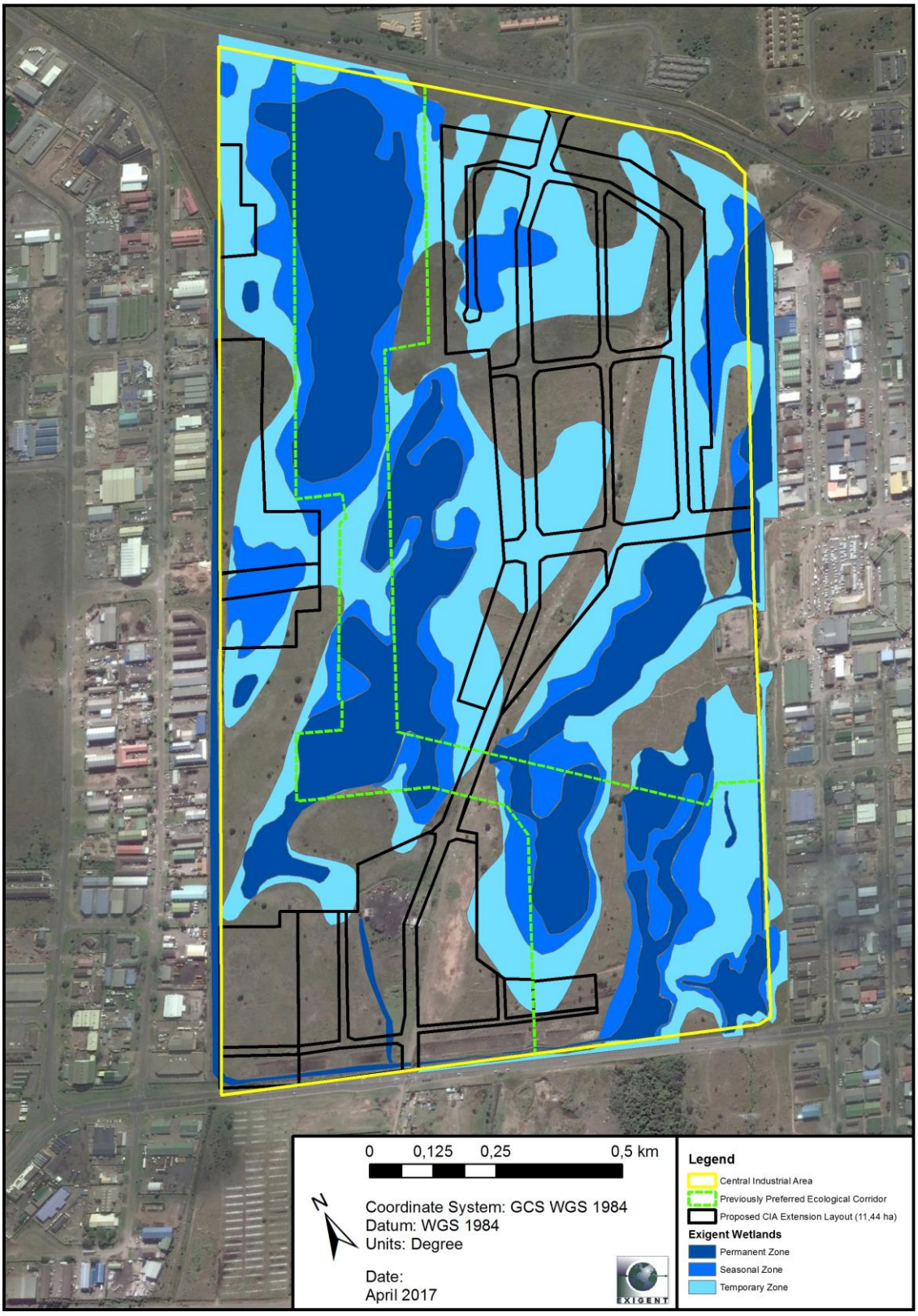

Figure 10-2. Proposed amendment layout for the CIA development.

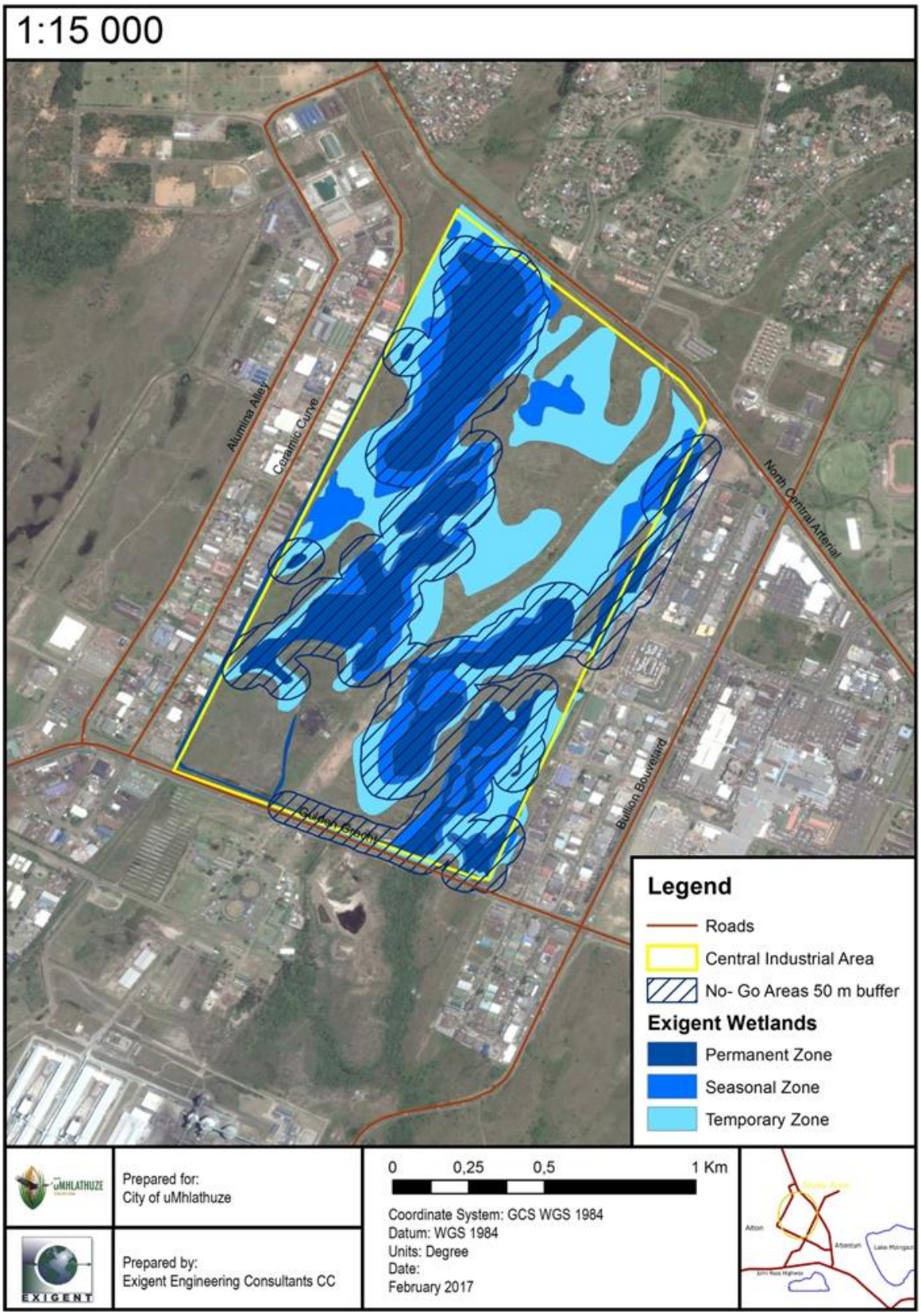

Figure 10-3. The recommended 50m buffer zone around the permanent wetlands in the study area.

11. IMPACT ASSESSMENT

The methodology to assess the impacts of the proposed amended CIA development layout is described in Table 11-1 below.

Table 11-1. Criteria by which impacts were assessed.

ASPECT	IMPACT RATING
Status of the impact: A statement of whether the impact is positive (a benefit), negative (a cost), or neutral.	
Direct impacts	Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
Indirect impacts	Impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not **manifest** immediately when the activity is undertaken or which occur at a different place as a result of the activity.
Cumulative impacts	Impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
Nature of the impact: The evaluation of the nature is impact specific. Most negative impacts will remain negative, however, after mitigation, significance should reduce: • Positive. • Negative.	
Extent: A description of whether the impact would occur on a scale limited to within the study area (local), limited to within 5 km of the study area (area); on a regional scale i.e. uMhlathuze Local Municipality & KwaZulu-Natal (region); or would occur at a national or international scale.	

Local	1
Area	2
Region	3
National	4
International	5

ASPECT	IMPACT RATING

Duration:

A prediction of whether the duration of the impact would be Immediate and once-off (less than one month), more than once, but short term (less than one year), regular, medium term (1 to 5 years), Long term (6 to 15 years), Project life/permanent (> 15 years, with the impact ceasing after the operational life of the development, or should be considered as permanent).

Immediate	1
Short term	2
Medium term	3
Long term	4
Project life/permanent	5

Severity (extent +duration + intensity)

Intensity: This provides an order of magnitude of whether or not the intensity (magnitude/size/frequency) of the impact would be negligible, low, medium, high or very high. This is based on the following aspects:

- an assessment of the reversibility of the impact (permanent loss of resources, or impact is reversible after project life);
- whether or not the aspect is controversial;
- an assessment of the irreplaceability of the resource loss caused by the activity (whether the project will destroy the resources which are easily replaceable, or the project will destroy resources which are irreplaceable and cannot be replaced);
- the level of alteration to the natural systems, processes or systems.

Negligible	The impact does not affect physical, biophysical or socio-economic functions and processes.	1
Low/potential harmful	The impact has limited impacts on physical, biophysical or socio-economic functions and processes.	2
Medium/slightly harmful	The impact has an effect on physical, biophysical and socio economic functions and processes, but in such a way that these processes can still continue to function albeit in a modified fashion.	3
High/Harmful	Where the physical, bio-physical and socio economic functions and processes are impacted on in such a way as to cause them to temporarily or permanently cease.	4
Very high/Disastrous	Where the physical, bio-physical and socio economic functions and processes are highly impacted on in such a way as to cause them to permanently cease.	5

ASPECT	IMPACT RATING
Incidence (frequency + probability)	

Frequency: This provides a description of any repetitive, continuous or time-linked characteristics of the impact: Once Off (occurring any time during construction or operation); Intermittent (occurring from time to time, without specific periodicity); Periodic (occurring at more or less regular intervals); Continuous (without interruption).

Once Off	Once	1
Rare	1/5 to 1/10 years	2
Frequent	Once a year	3
Very frequent	Once a month	4
Continuous	≥ Once a day/ per shift	5

Probability of occurrence: A description of the chance that consequences of that selected level of severity could occur during the exposure.

Highly unlikely	The probability of the impact occurring is highly unlikely due to its design or historic experience.	1
Improbable	The probability of the impact occurring is low due to its design or historic experience.	2
Probable	There is a distinct probability of the impact occurring	3
Almost certain	It is most likely that the impact will occur	4
Definite	The impact will occur regardless of any prevention measures	5

Risk rating

The risk rating is calculated based on input from the above assessments. The incidence of occurrence is calculated by adding the Extent of the impact to the duration of the impact. The Severity of the impact is calculated based on input from the extent of the impact, the duration and the intensity.

Risk = Severity (extent +duration + intensity) x Incidence (frequency + probability)

Significance: The significance of the risk based on the identified impacts has been expressed qualitatively as follows:

- **low** – the impact is of little importance/insignificant, but may/may not require minimal management
- **medium** - the impact is important, management is required to reduce negative impacts to acceptable levels.
- **high** - the impact is of great importance, negative impacts could render development options or the entire project unacceptable if they cannot be reduced to acceptable levels and/or if they are not balanced by significant positive impacts, management of negative impacts is essential.

ASPECT	IMPACT RATING
	<table><tr><td>Low risk</td><td>0 – 50</td></tr><tr><td>Medium risk</td><td>51 – 100</td></tr><tr><td>High risk</td><td>101 - 150</td></tr></table>

The following key issues have been assessed (Table 11-2):

- Destruction of natural habitat – terrestrial and wetland/riparian habitat
- Potential loss of Species of Special Concern
- Sedimentation and erosion
- Infestation of alien species
- Hydrological impacts

11.1. Loss of vegetation and terrestrial habitat

Vegetation plays an important part in the functioning of ecosystems, as well as maintaining biological processes in the soil, reducing the loss of topsoil and nutrients, and recycling of nutrients. The removal of the natural vegetation will result in a loss of habitat for various fauna and flora species.

Mitigation

- Clearance of indigenous vegetation must be kept to a minimum.
- Localised removal of alien species on a regular basis.
- Bare surfaces should be grassed as soon as possible after construction to minimise time of exposure. Locally occurring indigenous grasses should be used during rehabilitation. Alien invasive grasses such as *Pennisetum clandestinum* (Kikuyu) must not be used.
- Progress of vegetation establishment must be monitored regularly by ECO, with slow recovery requiring intervention to ensure site recovery and integrity, as well as physical stability.
- Where construction occurs close to any plants of high conservation value in areas not required for the CIA development, these must be suitably and visibly demarcated and cordoned off by the ECO prior to, and during the construction phase.
- The necessary permits for removal or destruction of protected species must be obtained from EKZNW and DAFF beforehand.
- Where clearing is required outside of earthwork/construction areas, vegetation should be brush-cut rather than cleared to speed re-establishment following site closure.
- No herbicides may be used on indigenous vegetation, particularly within proximity to wetland areas.

Table 11-2. Impact assessment for wetland impacts.

Impact	Status	Extent	Duration	Severity	Frequency	Probability of occurrence	Significance without mitigation		Significance with mitigation
Loss of vegetation and terrestrial habitat	Negative	2	5	3	5	5	100	MEDIUM	LOW
Loss of wetland habitat	Negative	2	5	5	5	5	120	HIGH	MEDIUM
Potential loss of species of concern	Negative	2	2	5	1	5	54	MEDIUM	LOW
Sedimentation and erosion	Negative	2	5	2	5	2	63	MEDIUM	LOW
Infestation of alien invasive species	Negative	2	5	3	5	5	100	MEDIUM	LOW
Hydrological impacts	Negative	2	5	2	5	4	108	HIGH	MEDIUM

11.2. Loss of wetland habitat

The entire study area lies within a valley bottom and forms part of a larger wetland system that drains towards the Port of Richards Bay. All areas therefore should be regarded as sensitive. Specific mitigation measures for these wetlands have been listed below.

Mitigation

- The no-go boundaries must be demarcated in the field by an independent qualified wetland specialist prior to commencement of construction.
- Prevent excavated material from entering water resources and other sensitive areas.
- No dumping of construction waste material should be allowed.
- After profiling, the disturbed areas should be lightly compacted and reseeded with indigenous species, and riparian/wetland species where relevant.
- Large sediment loads must be prevented from entering watercourses.
- No rubble may be temporarily stockpiled or dumped within the study area.
- Minimize the extent and duration of the hydrological disruption.
- All vehicles should remain on designated roads with no indiscriminate driving through the study area.
- Engineering designs should cater for current wetland conditions to ensure limited impact on the functioning of the wetland.
- All spills should be immediately cleaned up and treated accordingly.

11.3. Potential loss of species of special concern

No Red Data species were observed within the boundaries of the study area. Three protected species, the Swamp fig (*Ficus trichopoda*), Powder-puff tree (*Barringtonia racemosa*) and Marula (*Sclerocarya birrea*) were observed on site during the site visit. *Ficus trichopoda* and *Barringtonia racemosa* was observed in the artificial drainage channels and the remnant coastal forest while *Sclerocarya birrea* was located within the hygrophilous grassland outside of the grassy / sedge freshwater wetland. Based on the proposed amended layout and the EA approved layout, a permit from DAFF will be required prior to removal of these species.

Mitigation

- The necessary permit applications must be obtained prior to destruction / removal of these two species.
- Should any other species of concern be identified, the ECO should be informed and appropriate action taken.

11.4. Sedimentation and erosion

Should the stormwater management design of the engineers not be adequate, erosion problems could result from the proposed CIA development. Furthermore, these designs need to ensure that surface flows reach the demarcated areas to ensure that the wetland areas receive water and remain wet and functional.

Mitigation

- Erosion control structures must be put in place where soil may be prone to erosion.

- Incorporate adequate erosion management measures in order to prevent erosion and the associated sedimentation of the wetland features.
- Management measures may include berms, silt fences, hessian curtains and stormwater diversion away from areas susceptible to erosion. Care should however be taken to avoid additional disturbance during the implementation of these measures.
- Topsoil storage should not exceed a height of 2m.
- During rehabilitation, prompt and progressive reinstatement of bare areas is required. The topsoil layer is to be replaced on top during reinstatement, where applicable.
- The control of soil erosion and siltation associated with construction and operation is important at all locations on site, particularly as the majority of the study area forms part of a wetland system. Both temporary and permanent soil erosion control measures must be used during the construction and operation phases.
- Checks must be carried out at regular intervals to identify areas where erosion is occurring.
- Remedial action, including the rehabilitation of eroded areas and, where necessary, the relocation of the paths causing erosion, is to be undertaken.
- Large sediment loads must be prevented from entering watercourses.
- A Stormwater Management Plan (SMP) must be designed for the study area in its entirety. This must include filtered low-flow dispersion discharge techniques into the demarcated wetland area to ensure that surface water flows can still provide feed to the protected wetland areas. This SMP must be approved by the CA and adherence to this SMP must be included as a condition of the Amendment Authorisation.

11.5. Infestation of alien invasive species

The disturbance of the natural vegetation by the proposed activities may aid exotic species to invade. Utmost care should be taken not to disperse and increase the colonisation of these species.

Mitigation

- Removal of alien species within the construction area must be an ongoing activity throughout the construction phase.
- Successful re-vegetation is crucial to stabilise soils and limit infestation by invasive alien plant species and dominance by ruderal species. Rehabilitation should be undertaken on a progressive basis in these areas.
- This study area should be added to the Municipal alien removal programme, in order to remove exotic vegetation and maintain open space areas free from exotic invasions within the proposed development footprint for the duration of the construction phase.

11.6. Hydrological Impacts

This refers to any alterations in the quantity, timing and distribution of water inputs and through flows within wetland and drainage line, especially taking cognisance of the critical role this study area plays in the larger hydrology of Richards Bay. This study area is the link between various large and important water bodies in the area, and it is critical to ensure functioning of this ecosystem. Construction activities associated with bulk earthworks (such as excavations, stockpiling, reshaping, back-filling and compaction) in the catchment area feeding downstream wetlands can alter natural patterns of surface runoff reaching water resources downslope/downstream. Excavations may impound and redirect water, thus starving downstream water resources. Infilling, compaction and rutting of soils caused by

construction vehicles working outside the wetland also alter the patterns of diffuse surface and sub-surface flows by altering micro-topography and the permeability of soil profiles. Changes in flow patterns reaching aquatic ecosystems does not only affect hydrological functionality and thus ecosystem integrity, but may lead to erosion and sedimentation though increased runoff velocities linked to concentrated flow paths created during construction. Furthermore, without adequate engineering designs such as filtered low-flow dispersion discharge techniques, directing storm water into the wetland system may result in scouring of the wetland which can lead to the formation of concentrated flow paths and erosion channels. Directing stormwater away from the demarcated sensitive area will cause the wetland to deteriorate.

Mitigation:

- Bare areas where vegetation has been removed pose a risk of becoming a sediment load into the wetlands during heavy rainfall or windy conditions. Bare areas should therefore be covered during such events.
- Any potential large sediment loads (i.e. stockpiles) must be contained by covering them.
- Temporary stormwater management structures should be used during construction.
- Any areas damaged as a result of stormwater runoff from the construction site must be rehabilitated immediately.

12. RECOMMENDATIONS

The following should be implemented:

- Permits should be obtained for all required species in terms of the DAFF, KZN Nature Conservation Act as described in Section 9.
- Specific wetland management measures should be implemented, as stipulated in Section 11.2.
- This study area should be added to the Municipal alien removal programme, in order to remove exotic vegetation and maintain open space areas free from exotic invasions within the proposed development footprint for the duration of the construction phase.
- Improve habitat quality in all wetland areas by regular removal of various forms of pollution during the construction phase.
- All rubble, litter and any other type of waste must be removed from the development footprint and areas directly adjacent to the construction areas and regular monitoring of core ecological areas must be undertaken.
- All concrete mixing must take place on an impermeable surface in dedicated areas, to prevent pollution of the soil and surrounding water resources.
- All waste and materials used during the construction must be removed; no waste is to be buried or burned or left in the study area.
- Pesticides should also be discouraged from use during the construction or operational phase of the development.
- Registered herbicides must strictly be applied to alien invasive vegetation only.

13. CONCLUSION

The study area forms part of one of the major conservation corridors of Richards Bay, linking to Thulazihleka Pan and Ngodweni Canal, leading to the Port of Richards Bay. It is surrounded by industrial, urban and residential development. These formalised structures have impacted on the

periphery of the study area mainly through dumping and introduction of alien and invasive species. A few single informal dwellings were located within the area. The majority of the site however is in a highly functional ecological state, comprising of large permanently inundated wetland habitats. This study area is the link between various large and important water bodies in the area, and it is critical to ensure functioning of this ecosystem

The wetlands have been identified and classified per the Department of Water and Sanitation (DWS) and the South African National Biodiversity Institute (SANBI) requirements.

A 50m buffer zone has been proposed around the permanent wetlands – upholding protection of peatlands and permanent wetlands as a proposed compromise between the CIA development and conservation of some of the sensitive areas on the study site. Most of the seasonal wetlands delineated fall within the proposed buffer and are therefore included in the protection. As per the previous approved development layout, these sensitive areas will form a conservation corridor linking the large network of natural drainage systems of the immediate area to the Port of Richards Bay. This conservation corridor is considered sensitive and no development must take place in these areas. It is acknowledged that construction activities will however take place within seasonal and temporary zones of this wetland system, therefore wetlands specific management measures must be strictly implemented and adhered to. These include:

- The no-go boundaries must be demarcated by an independent qualified wetland specialist prior to commencement of construction.
- Removal of alien species within the construction area must be an ongoing activity throughout the construction phase;
- No placement of soil inside the demarcated permanent wetland or buffer area;
- Engineering designs should cater for current wetland conditions to ensure limited impact on the functioning of the wetland;
- Prevent excavated material from entering water resources and other sensitive areas;
- All spills should be immediately cleaned up and treated accordingly;
- No dumping of construction waste material must be allowed;
- Incorporate adequate erosion management measures to limit erosion and associated sedimentation of the water resource;
- Management measures may include berms, silt fences, hessian curtains and stormwater diversion away from areas susceptible to erosion. Care should however be taken to avoid additional disturbance during the implementation of these measures;
- A SMP must be designed for the study area in its entirety, linking to the surrounding areas. This must include filtered low-flow dispersion discharge techniques into the demarcated wetland area to ensure that surface water flows can still provide feed to the protected wetland areas. This SMP must be approved by the CA and be included as a condition of the Amendment Authorisation.
- Water quality monitoring programme must be developed prior to commencement of construction and must be approved by the DWS. A baseline water quality assessment must take place prior to commencement of construction. Thereafter water quality monitoring must take place monthly throughout the construction phase and annually throughout the operational phase of the development.

No Red Data species were observed within the boundaries of the study area. However, two protected species, the Swamp fig (*Ficus trichopoda*) and Powder-puff tree (*Barringtonia racemosa*) were

observed in the remnant swamp forest present in the south-eastern section of the study area, as well as the artificial drainage line along the eastern border of the study area. A Marula tree (*Sclerocarya birrea* subsp. *caffra*) was located in the southern section of the study area. It is likely that other Marula individuals were overlooked during the site visit and therefore it is recommended that a search be launched for this protected species, prior to the commencement of construction. A permit from the DAFF will be required for the removal of any of these three protected tree species.

14. GLOSSARY

Aerobic: having molecular oxygen (O^2) present.
Anaerobic: not having molecular oxygen (O^2) present.
Anthropogenic: of human creation
Delineation (of a wetland): to determine the boundary of a wetland based on soil, vegetation, and/or hydrological indicators (see definition of a wetland).
Endorheic: closed drainage e.g. a pan.
Infilling or Fill: dumping of soil or solid waste onto the wetland surface. Infilling generally has a very high and permanent impact on wetland functioning and is similar to drainage in that the upper soil layers are rendered less wet, usually so much so that the area no longer functions as a wetland.
Mottles: soils with variegated colour patters are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Permanently wet soil: soil which is flooded or waterlogged to the soil surface throughout the year, in most years.
Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
Runoff: total water yield from a catchment including surface and subsurface flow.
Seasonally wet soil: soil which is flooded or waterlogged to the soil surface for extended periods (>1 month) during the wet season, but is predominantly dry during the dry season.
Sedges: Grass-like plants belonging to the family Cyperaceae, sometimes referred to as nutgrasses.
Soil drainage classes: describe the soil moisture conditions as determined by the capacity of the soil and the study area for removing excess water. The classes range from very well drained, where excess water is removed very quickly, to very poorly drained, where excess water is removed very slowly. Wetlands include all soils in the very poorly drained and poorly drained classes, and some soils in the somewhat poorly drained class. These three classes are roughly equivalent to the permanent, seasonal and temporary classes
Temporarily wet soil: The soil close to the soil surface (i.e. within 50 cm) is wet for periods > 2 weeks during the wet season in most years. However, it is seldom flooded or saturated at the surface for longer than a month.
Water regime: When and for how long the soil is flooded or saturated.
Water quality: the purity of the water.
Waterlogged: soil or land saturated with water long enough for anaerobic conditions to develop.
Wetland: 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 under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin et al., 1979).
Wetland catchment: the area up-slope of the wetland from which water flows into the wetland and including the wetland itself.
Wetland delineation: the determination and marking of the boundary of a wetland on a map.

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Addendum A: Curriculum Vitae

Addendum B: Declaration of Independence