WETLAND DELINEATION AND ASSESSMENT FOR A PROPOSED DEVELOPMENT NEAR CLAYVILLE, MIDRAND, GAUTENG PROVINCE

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DOCUMENT SUMMARY DATA

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and Wetland Consulting Services (Pty.) Ltd. and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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DECLARATION OF INDEPENDENCE

Declaration

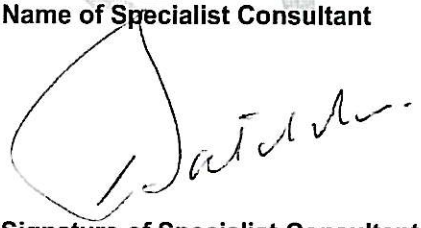
Independent Specialist Consultant

I, Allan Batchelor, Pr.Sc.Nat. Registration Number 400092/06, representing Wetland Consulting Services (Pty) Ltd in my capacity as director, declare that we

- Act as independent specialist consultants, in this application, in the field of wetland ecology, delineation and classification.
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- Have, and will have no vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006; and
- Will provide the competent authority with access to all the information at our disposal regarding the application, whether such information is favourable to the applicant or not.

Wetland Consulting Services (Pty) Ltd
Name of Company

Allan Batchelor
Name of Specialist Consultant



Signature of Specialist Consultant

20-04 -2009
Date

1. BACKGROUND INFORMATION

Wetland Consulting Services (Pty.) Ltd. was appointed by Calgro M3 Holdings to undertake a wetland delineation and assessment for a proposed development near Clayville on the farm Olifantsfontein 410JR in Midrand, Gauteng Province. The wetland delineation undertaken as part of this report will be used to inform development plans for the property and to determine the extent of the developable area.

The requirement to establish the existence and/or extent of wetlands and riparian zones on the property is based on the legal requirements contained in both NEMA as well as the National Water Act which make it an offense to affect a wetland and/or a riparian zone without the necessary authorization.

The above specialist study was undertaken in accordance with the Minimum Requirements for Biodiversity Assessments as published by the GDACE.

2. TERMS OF REFERENCE

The following tasks were identified in order to meet the project objectives:

- Conduct a desktop and field investigation to confirm the presence or absence of wetland and riparian areas within the study area;
- Delineate and map the identified wetland and riparian areas on site;
- Classify wetlands according to their hydro-geomorphic characteristics;
- Determine the present ecological state (PES) of all wetlands and riparian areas on site;
- Provide a report and maps detailing all the information.

3. LIMITATIONS

Due to the scale of the remote imagery used (1:10 000 ortho-photos and Google Earth Imagery), as well as the accuracy of a hand held GPS unit used for capturing coordinates of the boundaries, scale and boundaries cannot be guaranteed beyond an accuracy of approximately 15 meters on the ground. The boundaries will need to be marked in the field and surveyed using conventional survey techniques to provide for more accurate mapping.

4. STUDY AREA

4.1 Location

The site is located approximately 6km south west of Clayville immediately northwest of Ivory Park near Tembisa and also adjacent to the Glen Austin Pan. Most of the study area falls within Ekurhuleni Metropolitan area with a small portion around the Glen Austin Pan falling within the Johannesburg Metropolitan area. Two tributaries of Kaalspruit have their source within the study area, one draining in a south easterly direction and the other in the central portion of the site, to the east. The study area covers approximately 360 hectares, and is being considered for residential development with the exact nature and design of the development to be guided by the results of this and other specialist assessments to be conducted on the property. The location and boundary of the study area is indicated in Figure 1.

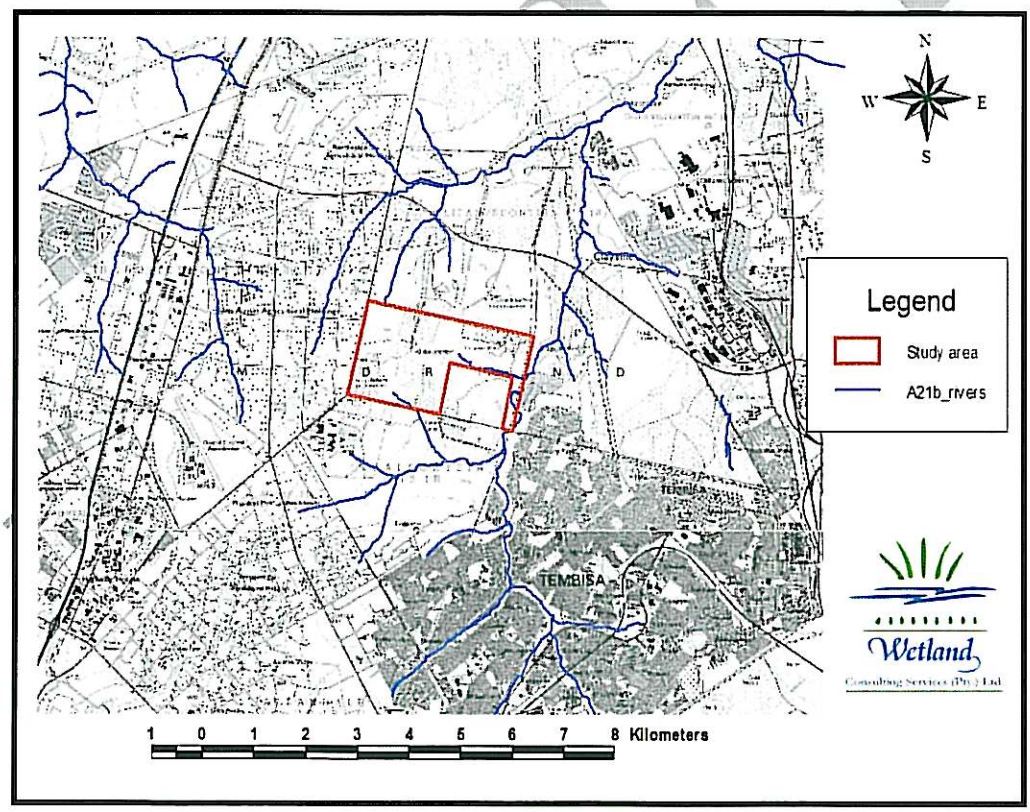


Figure 1 Locality and approximate extent of the study area (1:50 000 topo-cadastral map (2528CC))

4.2 Catchments

The study area falls within Primary Catchment A (Limpopo River Catchment), and at a finer scale within quarternary catchment A 21 B which is drained by the Hennops River(Figure 2). The study area is the source of two tributaries that flow into the Kaalspruit. To the north, just outside the border of the study area is the source of a tributary of the Olifantsspruit, which is itself a tributary of the Kaalspruit.

Table 1: Catchment characteristics for quarternary catchment A 21 B (Midgley, D.C., Pitman, W.V. and Middleton, B.J. 1994)

Quarternary Catchment	Catchment area (km^2)	Mean annual precipitation (mm)	Mean annual run-off (mm)	Potential evaporation (mm)
A21B	527	672	19	1700

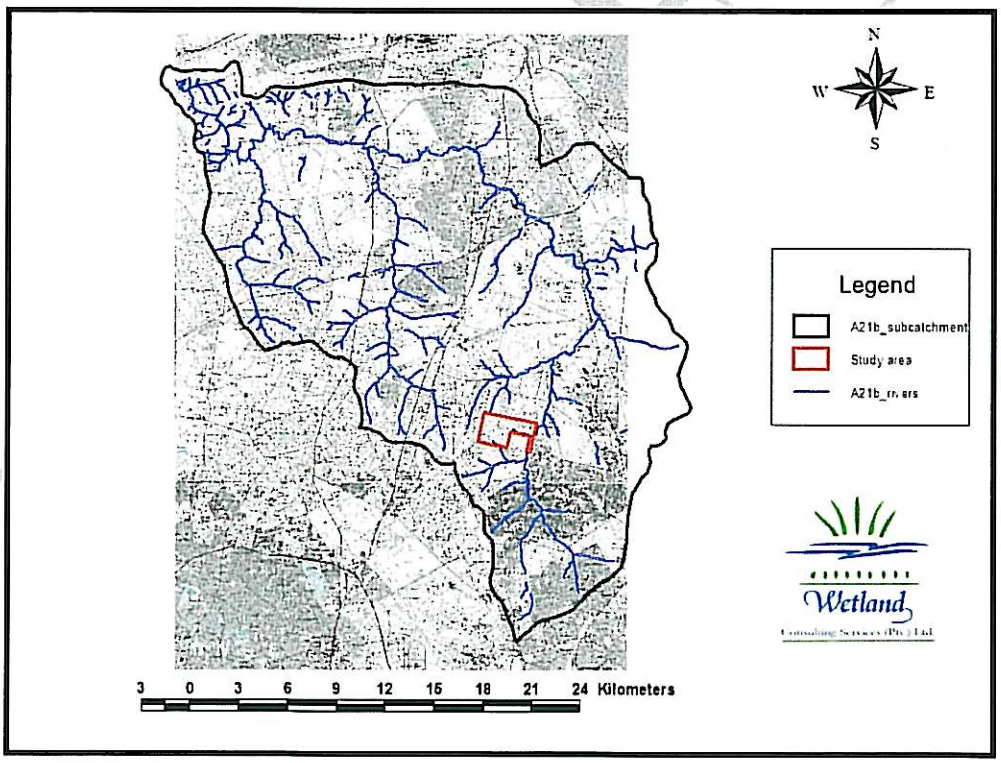


Figure 2: Map showing the size and position of the study area in relation to the quarternary catchment A21B.

4.3 Geology

According to the 1:250 000 geological map of the study area (2528), the study area is underlain Archaean granite and gneiss of the Halfway House Granite (core of the Johannesburg dome) which supports leached, shallow coarsely grained sandy soils which are poor in nutrients (Glenrosa form dominant) (Figure 3 and 4). Granites weather to form a very sandy soil that allows easy infiltration of rain water into the soil profile, thus limiting surface run-off. In areas where an impermeable layer (e.g. hard or soft plinthic layers) within the soil profile creates a shallow perched water table these soils typically form extensive hillslope seepage wetlands. In the absence of such an impermeable layer however, water infiltrates deeper into the soil profile, preventing the formation of wetland conditions on the surface.

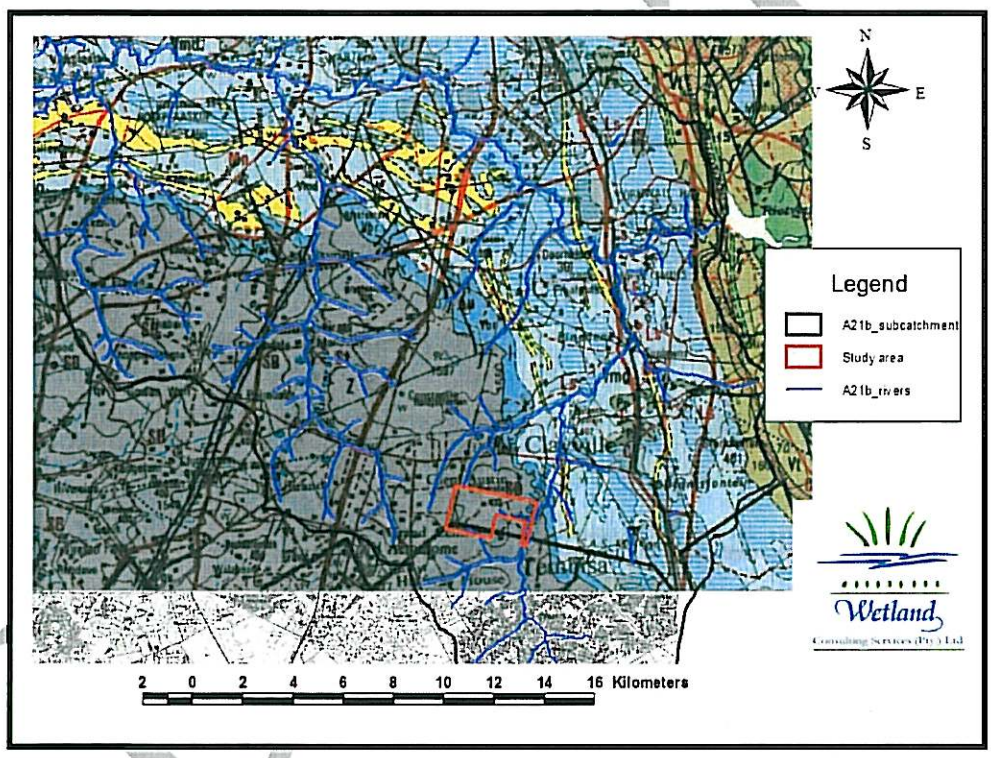


Figure 3 Section of the 1:250 000 geological map showing the study area boundary in relation to the principle geological formations, where Z represents Granite.

Figure 4 Sandy soils of the study site derived from weathered granites with exposed hard plinthic horizons in some areas

4.4 Vegetation

Vegetation classifications have evolved over the years and for purposes of clarity all of these existing classifications are included. For the purpose of this report the latest classification (Mucina & Rutherford, 2006), will be applied. Historical and applicable vegetation classifications for the area are as follows:

- Bankenveld – VT 61 (Acocks, 1988)
- Rocky Highveld Grassland – LR 34 (Low & Rebelo 1998)
- Egoli Granite Grassland- Mucina & Rutherford, 2006

The species composition of the vegetation of the Bankenveld (central variation) is largely determined by the poor, acidic soils, high altitude, cold and frosty winters and regular fires. These factors lead to a vegetation type dominated by sour, wiry grassland. Bredenkamp and van Rooyen (Low & Rebelo, 1998) describe the Rocky Highveld Grassland as a transitional vegetation type between the grasslands of the high inland plateau and the bushveld of the lower inland plateau. Bredenkamp and van Rooyen further postulate that in addition to fire (Acocks), frost plays an important role in the distribution of woody elements. Mucina & Rutherford classify the vegetation of the study area as being *Egoli Granite Grassland – Gm 10* (see **Figure 5** below). This vegetation type is restricted to the Johannesburg Dome area of Gauteng Province (northern Johannesburg, Lanseria and Centurion) and occurs on moderately undulating plains and low hills at altitudes of between 1280 and 1660masl. The vegetation is dominated by *Hyparrhenia hirta* with woody species restricted to the rocky outcrops and sheets. Within these habitats woody species diversity can be high. The vegetation unit is regarded as endangered with only 3% of a target 24% conserved. More than two thirds of the vegetation type has already been transformed by urban development, roads and cultivation with the remainder under threat by the rapid rates of transformation.

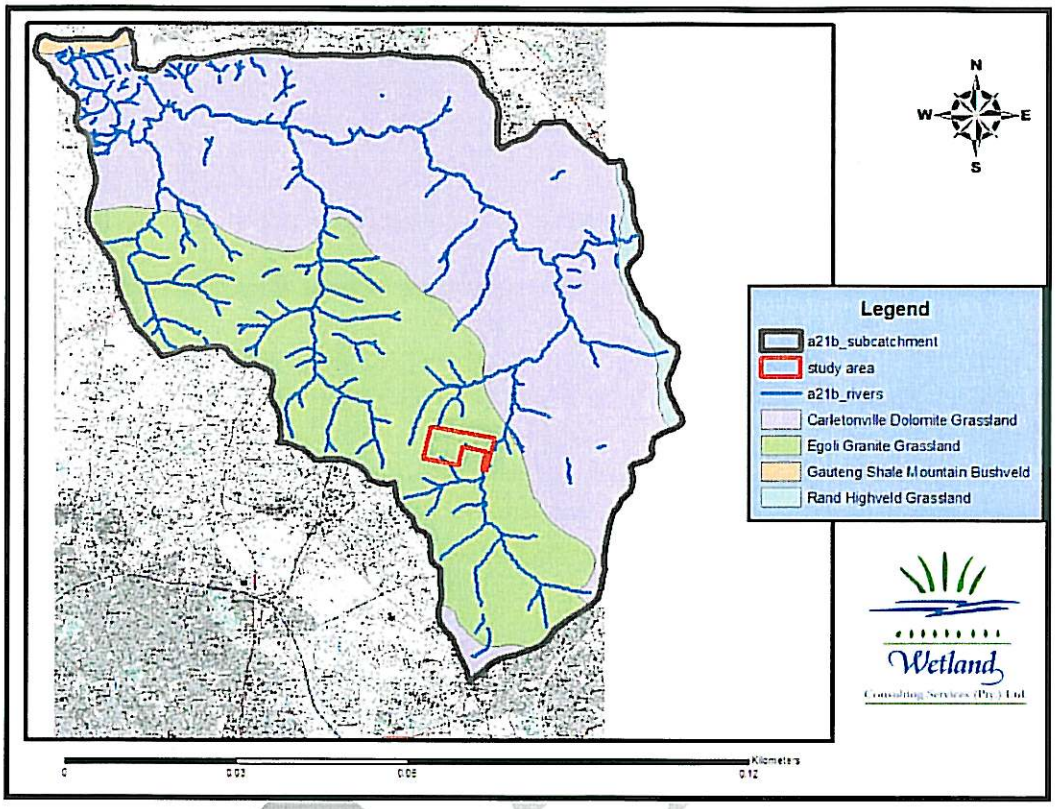


Figure 5 Vegetation types (Mucina & Rutherford, 2006) in the immediate vicinity of the Olifantsfontein property

5. APPROACH

5.1 Wetlands

5.1.1 Wetland Delineation and Classification

The National Water Act, Act 36 of 1998, defines wetlands as follows:

> *"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."*

For the purposes of delineating wetland boundaries use is made of indirect indicators of prolonged saturation, namely wetland plants (hydrophytes) and wetland soils (hydromorphic soils), with particular emphasis on hydromorphic soils where under normal conditions soils must display signs of wetness (mottling and gleying) within 50cm of the soil surface (DWAF, 2005).

A desktop delineation of suspected wetland areas was undertaken by identifying rivers and wetness signatures from the digital base maps using geo-referenced Goggle Earth images. The suspected wetland boundaries were captured using heads up digitising in ArcView 3.2. All identified areas suspected to be wetland were then further investigated in the field.

For field verification the study area was sub divided into transects placed at right angles to the suspected wetlands. A hand held soil augur was used to expose soil profiles along these transects, and the wetland boundary was subsequently determined where the exposed soil profile exhibited redoximorphic features associated with wetness.

The wetlands were subsequently classified according to their hydro-geomorphic determinants based on modification of the system proposed by Brinson (1993), and modified for use locally by Marneweck and Batchelor (2002). This was subsequently revised by Kotze et al (2004). Notes were made on the levels of degradation in the wetlands based on field experience and a general understanding of the types of systems present.

5.1.2 Determination of the Present Ecological State (PES) of Wetlands

The Present Ecological State assessment of the wetlands within the study area was undertaken to determine the extent of departure of the wetlands from a natural state or reference condition. For the purpose of this study, the scoring system as described in the document "*Resource Directed Measures for Protection of Water Resources, Volume 4. Wetland Ecosystems*" (DWAF, 1999) was applied for the determination of the PES.

6. FINDINGS

6.1 Wetlands

The presence of wetlands in the landscape can be linked to the presence of both surface water and perched groundwater. Wetland types are differentiated based on their hydro-geomorphic (HGM) characteristics; i.e. on the position of the wetland in the landscape, as well as the way in

which water moves into, through and out of the wetland systems. A schematic diagram of how these wetland systems are positioned in the landscape is given in Figure 6 below.

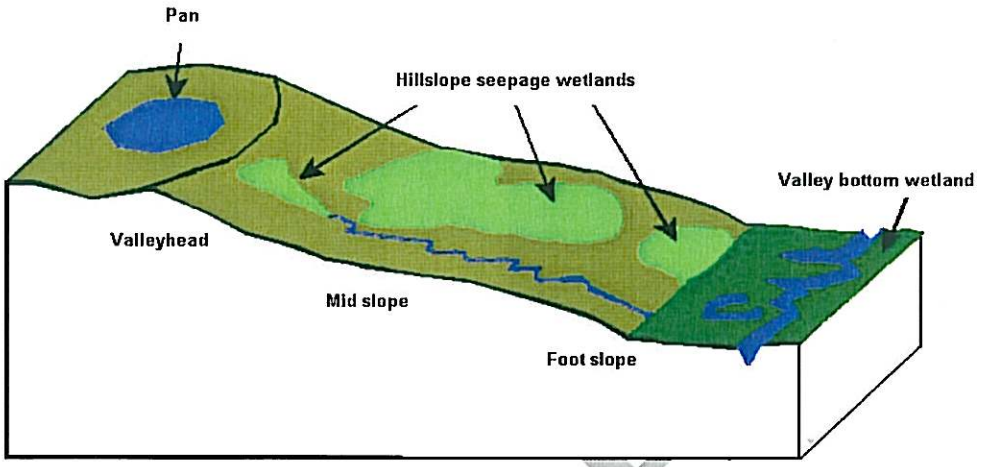


Figure 6: Schematic diagram illustrating the position of the various wetland types within the landscape.

The results of the desktop delineation are illustrated in Figure 7.

Figure 7: A map that shows possible wetland areas on site based on desktop delineation (Thompson et al 2002)

A site visit was undertaken to verify and further define the suspected wetland areas and boundaries from the desktop analysis. Upon arrival at the site, it was immediately apparent that the wetland and the site generally have been severe locally impacted. These impacts include:

- Dumping (litter and building rubble) and infilling;
- Excavation (sand burrowing) resulting in extensive erosion and head cutting in some places;
- Encroachment of alien invasive plants;
- Sewer line inside the wetland area; and
- Road crossing, culverts and excavations resulting to extensive erosion and head cutting in some places

A considerable portion of the study area that was provisionally mapped as possible wetland was found to consist of disturbed soils, characterised by exposed hard plinthic horizon and dominated by *Stoebe vulgaris.* These soils are very shallow and it is believe that the sandy soil layer characteristic of weathered granites has either been intentionally removed for building and construction sand, (there are a number of sand mining operations still active in the area) or has eroded leaving the plinthic horizon exposed, Figure 8.

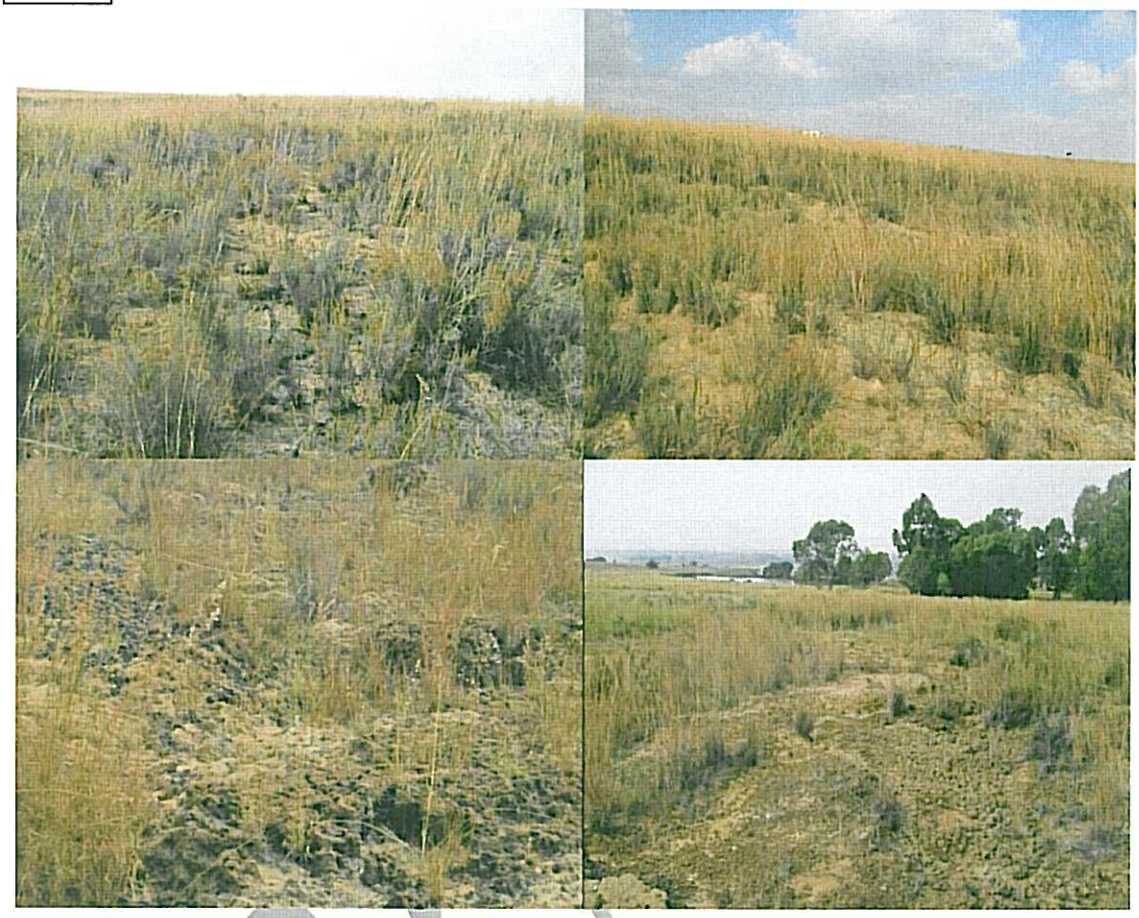


Figure 8: Photographs showing exposed plinthic horizons that were interpreted at desktop level as representing wetlands.

Based on the impacts and landuse practices as mentioned, an investigation on site indicates that most of the areas mapped in the desktop delineation exercise above probably were wetlands, but the lack of either an orthic and/or A horizon precludes their classification as wetlands.

The actual extent of the extant wetlands on site, based on the methods advocated by DWAF, 2005 are depicted in Figure 9.

Using a modification (Marneweck and Batchelor, 2002, Kotze et al., 2004), of the hydrogeomorphic classification system proposed by Brinson, 1993, three types of wetland systems were recognised on the site. These are:

- Hillslope seepage wetland
- Valley bottom wetlands
- Pans.

There are additional areas mapped which consist of eroded incised streams characterised by excessive erosion. These areas have been included as we consider that they fall within the definition of a watercourse in terms of the National Water Act.

Table 2: indicate the extent of wetland areas delineated on site as a percentage of wetland areas recorded and of the study area (360 ha).

HGM Unit	Area (ha)	As % of wetland area	As a % of the study area
Hillslope seepage wetland	6.00	17.29	1.67
Valley Bottom wetland	21.00	60.52	5.83
Pans	7.00	20.17	1.94
Incised streams	0.70	2.02	0.19
TOTAL	***34.7***	***100***	***9.63***

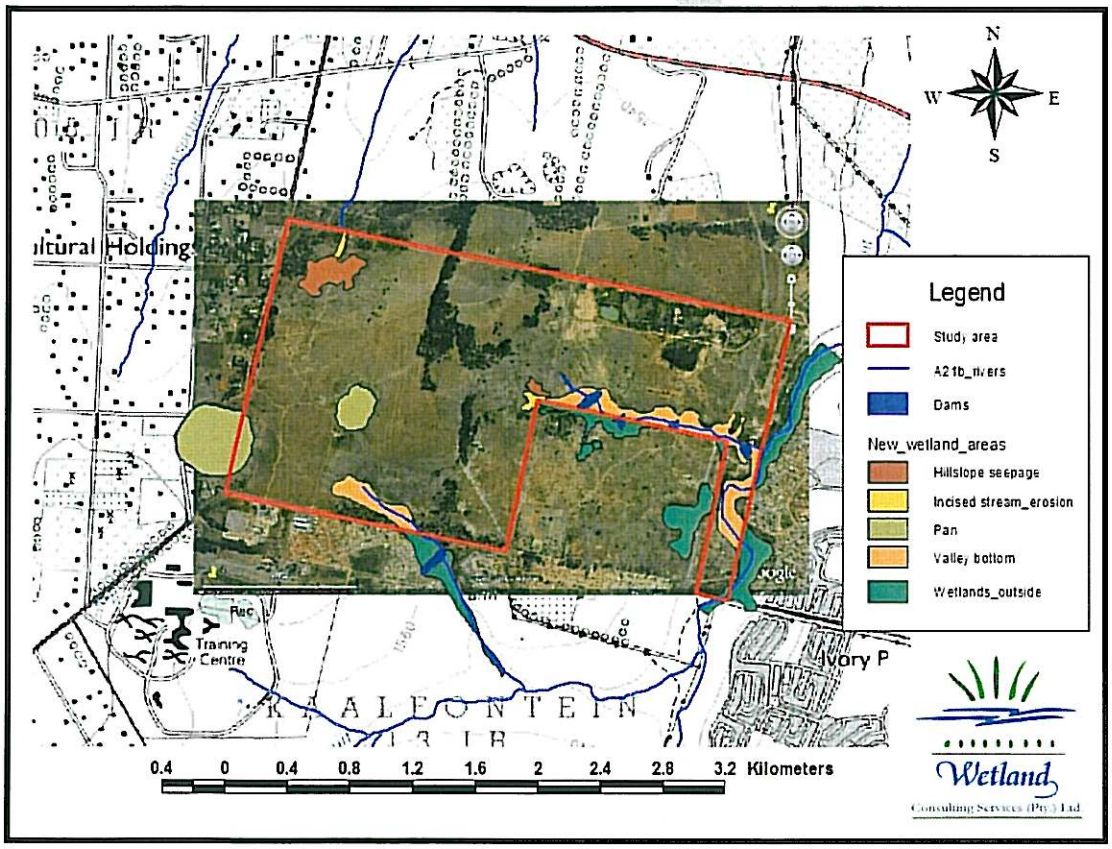


Figure 9 The extent of delineated wetland areas on the site

6.1.1 *Hillslope seepage wetland*

Figure 10. Photographs showing typical hillslope seepage wetlands on the site.

The hillslope seepage wetlands occupy approximately 17% (6ha) of the wetland areas recorded on site, equivalent to 360ha (Figure 9). Hillslope seepage wetlands in this environment are associated with the soils derived from and the weathering profile of the Halfway House Granites, the geological formation on which the site is located (Figure 4). In this environment hill slope seepage wetlands are predominantly seasonal associated with summer rains. Rainfall intercepted by the soils, and which enters the soil profile is intercepted by either a soft or hard layer, referred to as plinthic horizons that act as aquitards. These restrict the vertical movement of water in the soils where because of the generally shallow slopes together with the nature of the soils the water remains within the soil profile for long enough to influence both the soil and the vegetation, typically creating wetland conditions. This intercepted water may express itself where the aquitard approaches the surface or in the valley bottoms where it contributes to stream flow. The hillslope seepage wetlands on site consist of deep sandy soils with mottling and gleying depending on the wetness of the soil and shallow soils underlined by hard plinthic horizon (Figure 11).

Figure 11 Photographs showing mottling and gleying observed in some of the soil samples within the hillslope seepage wetland area on site.

6.1.2 *Valley bottom wetland*

Figure 12. Photographs showing characteristics of the valley bottom wetland.

The valley bottom wetland occupies approximately 60% (21ha) of the wetland areas recorded on site, equivalent to 360ha (Figure 9). Unlike the hillslope seepage recorded on site valley bottom system are characterized by clayey soil, gleyed and dense mottling (Figure 13) in some areas which indicated seasonal variation of water table within this environment.

Figure 13 Photographs showing mottling and gleying observed in some of the soil samples within the valley bottom wetland area on site.

6.1.3 Pan

Figure 14. Views of the larger of the two pans on the site

Two pans were recorded on site and they occupy collectively approximately 60% (21ha) of the wetland areas recorded on site, equivalent to 360ha (Figure 9) with a portion of Glen Austin pan falls within the study area. The pans were characterized by shallow sandy soil in some places underlined by plinthic horizon. The edges of the pan are disturbed including dumping and erosion and they are dominated by *Stoebe vulgaris*. Figure 15 below indicate some of the soil samples augured around the pan and as well as disturbances around the edges.

Figure 15 Photographs showing mottling and gleying observed in some of the soil samples within the pan areas on site.

6.1.4 *Incised stream*

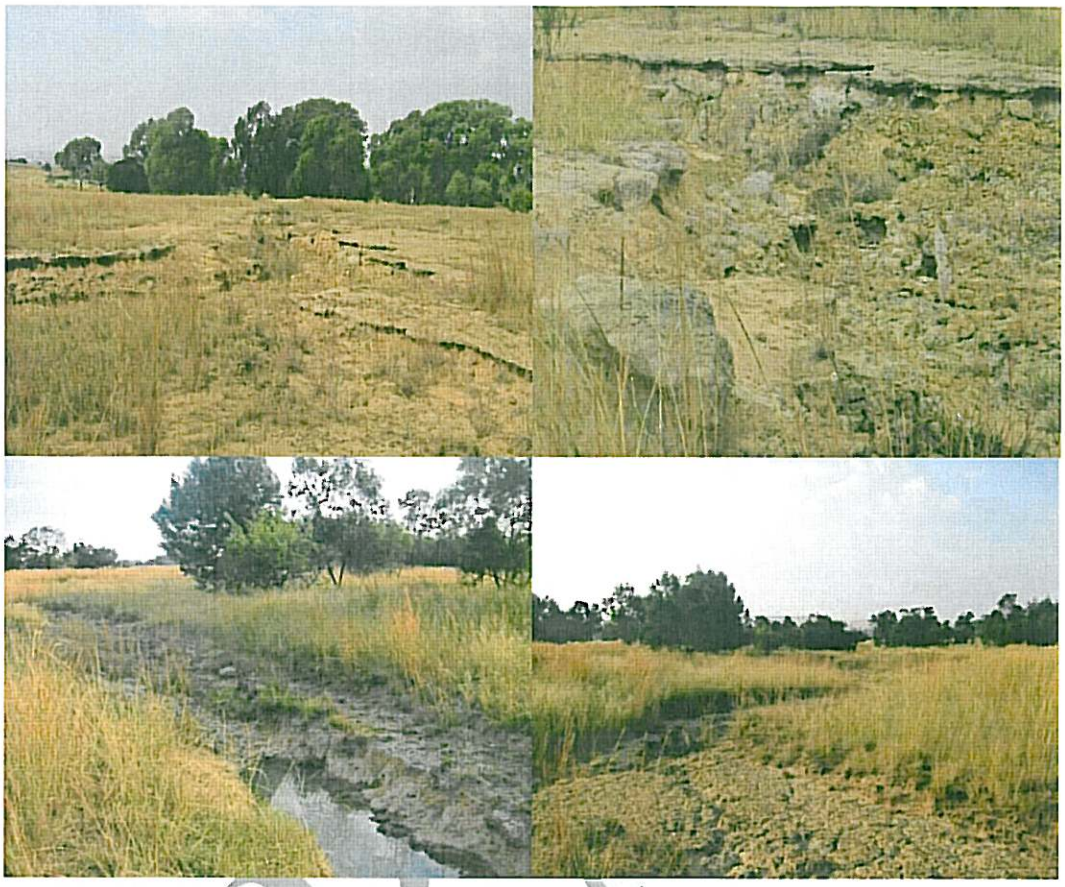


Figure 16. Photographs depicting the erosion channels which is defined in this report as an incised stream.

The incised streams recorded on site occupy approximately 2% (0.7ha) of the wetland areas recorded on site, equivalent to 360ha (Figure 9). Unlike other types of wetland system mentioned above, incised stream are characterized by extensive erosion, exposed hard plinthic horizon and shallow to non top soil in some areas. They are regarded as part of the watercourses on site as they form part of the broader water resources system on and around the site as they maintain connectivity amongst all water courses recorded on and around the site.

6.2 *Present Ecological State (PES) of Wetlands within the study area*

All of the wetlands within and around the study area have been impacted upon to some degree. No pristine wetlands were found to occur within the study area. Evidence was observed on site of transformation of the floristic characteristics of the site. Impacting activities which may have altered the expected floristic composition include grazing, sand burrowing (excavations), impoundments,

road crossings, littering and dumping (building rubble). Some of these activities, and in particular sand mining, has resulted in excessive erosion including active head cutting and gully formation, while littering and dumping and disturbance has encourage the encroachment of alien invasive vegetation. Some of the severe impacts are indicated in Figure 17 below.

Figure 17 Photographs showing some of the impacts observed on site.

The PES was determined for each of the hydro-geomorphic wetland units identified, taking into consideration the observed condition of the wetlands and impacts. The results are summarised in Figure 18 and Table 3 and explanatory notes in table 4 below. Every wetland is rated on a scale of A to F, with A being a natural or unimpacted wetland and F being a completely modified and altered wetland. The PES score has been based on obvious visible physical disturbance as well as observed hydrological changes. The recorded activities/ impacts within the wetland area were area weighted and scores were assigned using tables developed by Marneweck G.C. and Batchelor, A. 2002.adapted from the RDM scoring tables from the DWAF (DWAF, 1999).

The results of this analysis indicated that:

- Hillsope seepage wetlands are moderately to largely modified (PES C/D) in some areas especially where erosion has taken place and alien vegetation invasive encroachments;
- Valley bottom wetlands are largely to seriously modified (PES D/E) especially with the sand mining that has taken place, excessive erosion, and crossings including dumping and littering which has resulted to alien vegetation invasion; and
- Pans, unlike other wetlands system are found to be largely natural to moderately modified (PES B/C) especially along the edges where dumping was observed and some disturbances that has resulted in encroachment by *Stoebe vulgaris*.

Table 3 PES scores for wetlands recorded on site.

HGM Unit	Area (ha)	As % of wetland area	PES
Hillslope seepage wetland	6.00	17.29	C/D
Valley Bottom wetland	21.00	60.52	D/E
Pans	7.00	20.17	B/C
Incised streams	0.70	2.02	E
TOTAL	***34.7***	***100***	***9.63***

Table 4 Table explaining the scoring system used for the PES assessment.

Mean*	Category	Explanation
Within generally acceptable range		
>4	A	Unmodified, or approximates natural condition
>3 and <=4	B	Largely natural with few modifications, but with some loss of natural habitats
>2.5 and <=3	C	Moderately modified, but with some loss of natural habitats
<=2.5 and >1.5	D	Largely modified. A large loss of natural habitat and basic ecosystem function has occurred.
Outside generally acceptable range		
>0 and <=1.5	E	Seriously modified. The losses of natural habitat and ecosystem functions are extensive
0	F	Critically modified. Modification has reached a critical level and the system has been modified completely with almost complete loss of natural habitat.

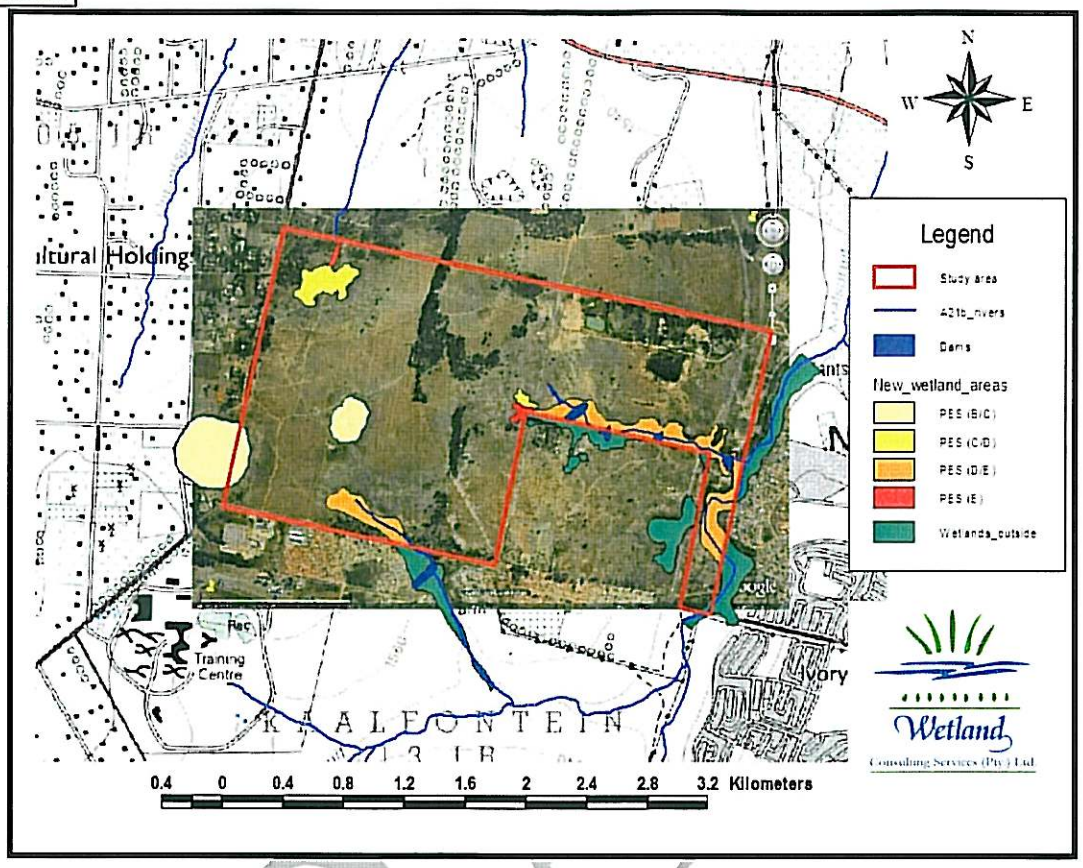


Figure 18 A Map showing the results of the PES assessment.

7. CONCLUSION AND RECOMMENDATIONS

Approximately 10 % of the study area is considered to fall within the definition of a watercourse[1], which includes wetlands, consisting of hillslope seepages; valley bottom wetlands and pans. The wetlands on site form part of a larger water resource system that drains into both Kaalspruit and Olifantspruit and into the Hennops River.

The PES assessment indicated wetlands that range from largely natural to seriously modified systems (rating B/C to E). GDACE require that wetlands be designated as sensitive habitats as they provide goods and services, as well as contributing to biodiversity support that are of value to society. In an effort to ensure their protection they require that wetlands be afforded protection by

[1] Watercourse means –
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the *Gazette*, declare to be a water course, and a reference to a water course includes, where relevant, its bed and banks.
(Definition taken from the National Water Act, Act 36 of 1998)

through the provision of buffers. The normal recommendation is to buffer the wetland perimeter by 30m (within the urban edge) to 50m buffer where the wetland is located outside the urban edge. Both the wetland and the buffer are required to be designated a sensitive area and excluded from consideration for development. This is currently GDACE policy and any attempts to develop within the buffer zone are met with considerable resistance.

The objective of the buffer is to afford protection to the wetland and/or the biodiversity associated with the wetland. It is known that the pans on this property provide a breeding site for bullfrogs (*Pyxicephalus adspersus*) who not only require the pans for breeding but also the surrounding landscape for foraging. Given this it is likely that consideration will need to be given to increasing the buffer zone around specifically the pans to accommodate the requirements of these frogs and to create the necessary corridors and vegetation mosaic to support their preferred prey species. In addition to providing for the frogs, consideration should be given to maintaining open flyways to accommodate the movement of birds that use the pans for roosting, feeding and possibly breeding.

The importance of the property and the wetland habitat in terms of local conservation and spatial connectivity is high and may well be essential in terms of local ecological functioning as a corridor for movement. Given the importance of this particular site from a biodiversity perspective, and the association between the wetlands and biodiversity support, we recommend that the concept of the buffer be extended to include the upper catchment as a whole to ensure that the hydrology currently contributing to not only the wetlands but also to the broader vegetation mosaic and overall productivity of the landscape remains unaltered. (Li et. al, 2008).

Finally, it is also important to note that the wetland and riparian zones form part of the water resource and any development that impacts on the wetland will only be permissible if authorised by a Water Use Licence under Section 21 of the National Water Act and in terms of GN 387 of NEMA.

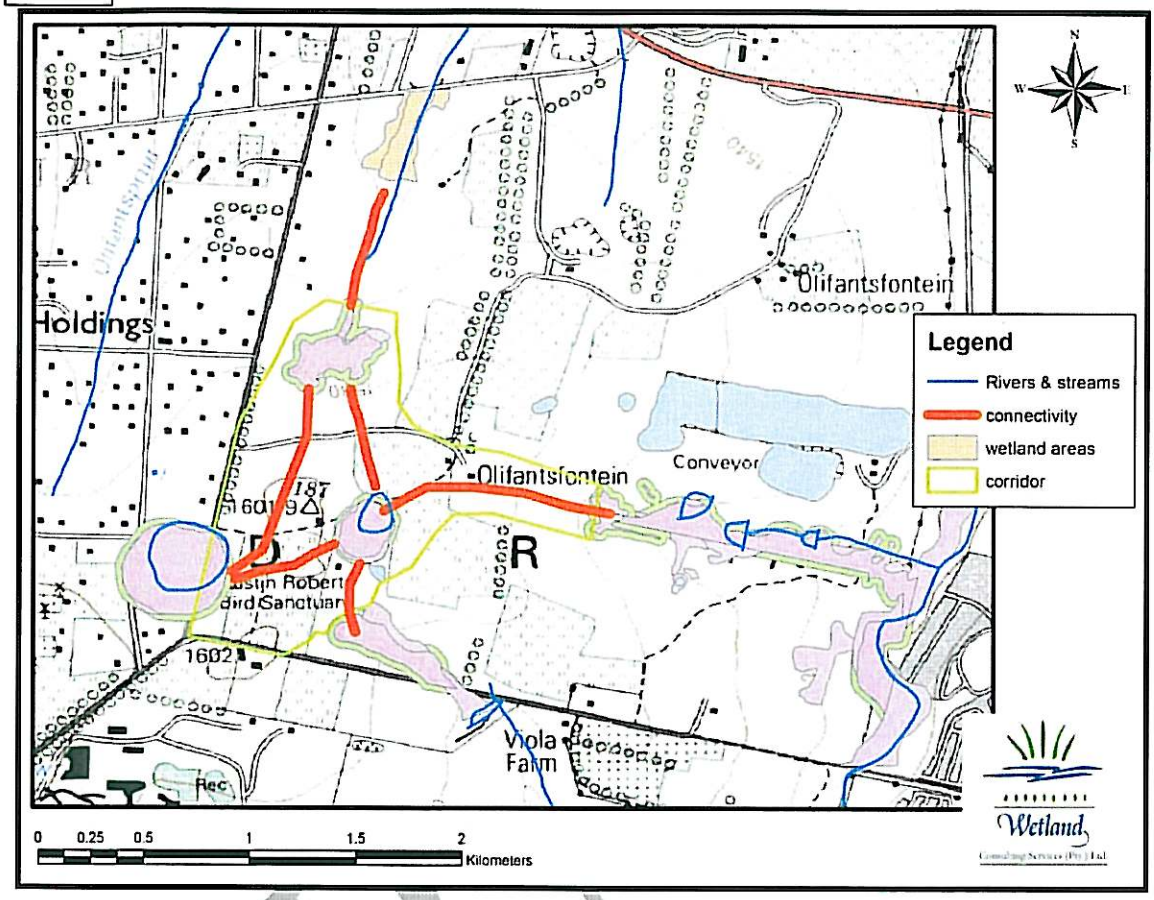


Figure 19 A Map showing the wetlands, connectivity between wetlands 30m buffers applied to wetland boundaries and the suggested corridors.

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