RUSTENBURG STRENGTHENING PHASE 2 (MARANG B)
WETLAND DELINEATION REPORT

PREPARED FOR:

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EXECUTIVE SUMMARY

Farai Dondofema was appointed to conduct a wetland ecological assessment as part of the Environmental Impact Assessment (EIA) process for the Marang 400/88kV substation is one of the four Main Transmission Substations (MTS), which are currently supplying Rustenburg's platinum mining, smelting operations and commercial operations hereafter referred to as the "project footprint". The project footprint will extend over a distance of approximately 5km. The project footprint is situated near the settlement of Boitekong location of Rustenburg town in Rustenburg Local Municipality Local Municipality in Bojanala district Municipality, which is located at the eastern part of Northwest Province and is located within a district, utilised for the Mining.

The purpose of this report is to assess the wetland resources along the project footprint project footprint in order to define the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) thereof, as well as to determine wetland functionality and service provision in terms of ecological and socio-economic functioning of the system, in order to guide construction activities.

Based on the findings of the ecological assessment it is the opinion of the ecologists that the proposed substation extension be considered favourably. However, all mitigation measures and recommendations listed should be adhered to as to ensure the ecology of the proposed construction areas as well as surroundings is protected or adequately rehabilitated in order to minimise the deviations from the PES.

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 DIGES and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, or pertaining to this investigation.

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Specialist Declaration

I, *Farai Dondofema*, declare that I –

- Act as an independent specialist consultant in the field of wetland assessment
- 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, 2010;
- have and will not have any 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 information at my disposal regarding the application, whether such information is favourable to the applicant or not.

Farai Dondofema

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1. Introduction

The increasing human demand for space and life-supporting resources has resulted in a rapid loss of natural wetland and associated riparian areas and ecological degradation in South Africa. When wetland systems are disturbed, indigenous fauna and flora are replaced by exotic species and the environment is converted to sterile landscapes with no dynamic propensity to regenerate or ecological value (Wood *et al*., 1994). The current site which will be referred to as the 'study site' is located near the Hex River, close to the town of Rustenburg in the Northwest Province. Only surface water features along, and within the immediate vicinity of the proposed substation sites and corridors, have been assessed as part of this study; the study does not include an assessment of surface water features within a wider area.

1.1 Definition of Wetlands

The National Water Act defines a wetland as:

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

This definition alludes to a number of physical characteristics of wetlands, including wetland hydrology, vegetation and soil. The reference to saturated soil is very important, as this is the most important factor by which wetlands are defined. Another widely used definition of wetlands is the one used under the Ramsar Convention; wetlands are defined as:

"Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"

1.2 Site Description

The project footprint is situated in Eco-region 7: Western Brankenveld and in Eco-region 8: Bushveld Basin (Kleynhans *et al,* 2005), which is located mainly within the North West, Limpopo and Gauteng Province. This high lying region is characterised by the following Primary boundary determinants:

i. This region has a complex topography that varies from lowlands, hills and mountains to closed hills and mountains with the relief varying from moderate to high. Although various Bushveld and Grassland types occur, Mixed Bushveld is the most definitive vegetation type of the region. Several rivers traverse this region, e.g. the Marico, the Crocodile (west), the Elands (west) and the Pienaars. Some perennial tributaries of these rivers rise in the southern part of the region in particular. The perennial tributary of the Sand River has its source in the northern part of the region.

ii. This region consists predominantly of plains with a low relief with Mixed Bushveld being the definitive vegetation type. In the east plains with a moderate relief and lowlands with a moderate relief occur. Several perennial rivers traverse the region, e.g. The Marico, Elands (West), Crocodile (West), Pienaars and Olifants. Virtually no perennial tributaries arise in the region.

Table 1: Main attributes of the Western Brankenveld Ecoregion 7 and descriptions (Kleynhans *et al*, 2005).

MAIN ATTRIBUTES	**WESTERN BANKENVELD**
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Low Relief; Plains; Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to High Relief; Closed Hills; Mountains; Moderate and High Relief;
Vegetation types (dominant types in bold) (Primary)	Waterberg Moist Mountain Bushveld; Mixed Bushveld; Kalahari Plains Thorn Bushveld (limited); Clay Thorn Bushveld; (limited) Rocky Highveld Grassland; Dry Clay Highveld
Altitude (m a.m.s.l) ((Modifying)	900-1700
MAP (mm) (modifying)	400 to 700
Coefficient of Variation (% of annual precipitation)	20 to 35
Rainfall concentration index	60 to >65
Rainfall seasonality	Early to mid-summer
Mean annual temp. (°C)	14 to 22
Mean daily max. Temp. (°C): February	24 to 32
Mean daily max. Temp. (°C): July	14 to 24
Mean daily min. temp. (°C): February	12 to 20
Mean daily min temp. (°C): July	0 to 6
Median annual simulated runoff (mm) for quaternary catchment	20 to 80, 80 to 100 (limited)

Table 2: Main attributes of the Bushveld Basin Ecoregion 8 and descriptions (Kleynhans *et al*, 2005)

Main Attributes	Bushveld Basin
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Low Relief; Plains; Moderate Relief; Lowlands; Hills and Mountains: Moderate and High Relief; Open Hills; Lowlands; Mountains: Moderate to High Relief; Closed Hills; Mountains: Moderate and High Relief (limited)
Vegetation types (dominant types in bold) (Primary)	**Mixed Bushveld;** Clay Thorn Bushveld; Waterberg Moist Mountain Bushveld (limited)
Altitude (m a.m.s.l) (Secondary)	700-1700 (1700-1900 very limited)
MAP (mm) (modifying)	400 to 600
Coefficient of Variation (% of annual precipitation)	25 to 35
Rainfall concentration index	55 to >65
Rainfall seasonality	Early to mid-summer
Mean annual temp. (°C)	14 to 22
Mean daily max. Temp. (°C): February	22 to 32
Mean daily max. Temp. (°C): July	14 to 24
Mean daily min. temp. (°C): February	12 to 20
Mean daily min temp. (°C): July	0 to 6
Median annual simulated runoff (mm) for quaternary catchment	20 to 100

1.3 Background

Marang 400/88kV substation is one of the four Main Transmission Substations (MTS), which are currently supplying Rustenburg's platinum mining, smelting operations and commercial operations. The substation is supplied via the 3x 400kV power lines, i.e., Matimba-Marang, Bighorn-Marang and Midas-Marang. It comprises of 4 x 315 MVA, 400/88kV transformers and has a capacity of 945 MVA. The recorded peak load was 776MVA in years 2010/11 and 694MVA in years 2011/12. As a result, the Marang 400/88kV will exceed the 400/88kV firm capacity limit by 2015/16. To address these transformation capacity constraints and to align with the 20 year load forecast, Eskom intended to construct a new substation site since the existing substation had space limitations for an extension. Eskom Holdings SOC Ltd has since addressed the challenges faced with extending the existing substation and as such this alternative will also be assessed. This report is a revision of the first report which only assessed the construction of a new substation and 400kV loop in and out power lines.

2. Proposed Project

The proposed project entails the assessment of the following:

i. The assessment of three substation sites and corresponding corridors, for the construction and maintenance of the following:
   - A new 3x 500MVA 400/132kV Main Transmission Substation (MTS), Marang B on approximately ±30 hectares; and
   - ±2km 400kV loop-in-loop-out power line from the existing Bighorn-Marang/Medupi-Marang/ Marang-Midas 400 kV power lines.

ii. The assessment for the existing substation extension.

Location: The proposed project will be in close proximity to the existing 400/88kV Marang Main Transmission substation on Farm Klipgat 281 JQ and Portion 2 of the Farm Elandsheuvel 282 JQ.

2.1 Scope of work

The scope of work as presented to us includes undertaking wetland assessments within the proposed project area. The following information is included in the report:

- Delineated wetland area that indicates the wetland boundaries,
- Description of the HGM wetland type,
- PES and EIS assessment, and
- Recommendations of mitigation measures to be undertaken.

2.2 Study Area

The project location is in close proximity to Boitekong Township within Rustenburg Local Municipality in Bojanala district Municipality, which is located in the eastern part of Northwest Province. The geographical coordinates of the site are as follows:

- **Province**: Northwest
- District Municipality: Bojanala
- Local Municipality: Rustenburg

Name	**Latitude (S)**	**Longitude (E)**
Site 1	25˚36' 46.95"	27 ˚19' 46.38"
Site 2	25˚37' 09.79"	27 ˚20' 47.56"
Site 3	25˚37' 24.08"	27 ˚20' 01.39"
Site 4 (Substation Extension)	25˚36' 50.68"	27 ˚19' 54.85"

The Rustenburg Local Municipality is bordered by Madibeng Local Municipality to the east, the Moses Kotane Local Municipality to the North, the Kgetlengrivier Local Municipality to the west and the Ventersdorp Local Municipality and Merafong City Local Municipality to the South.

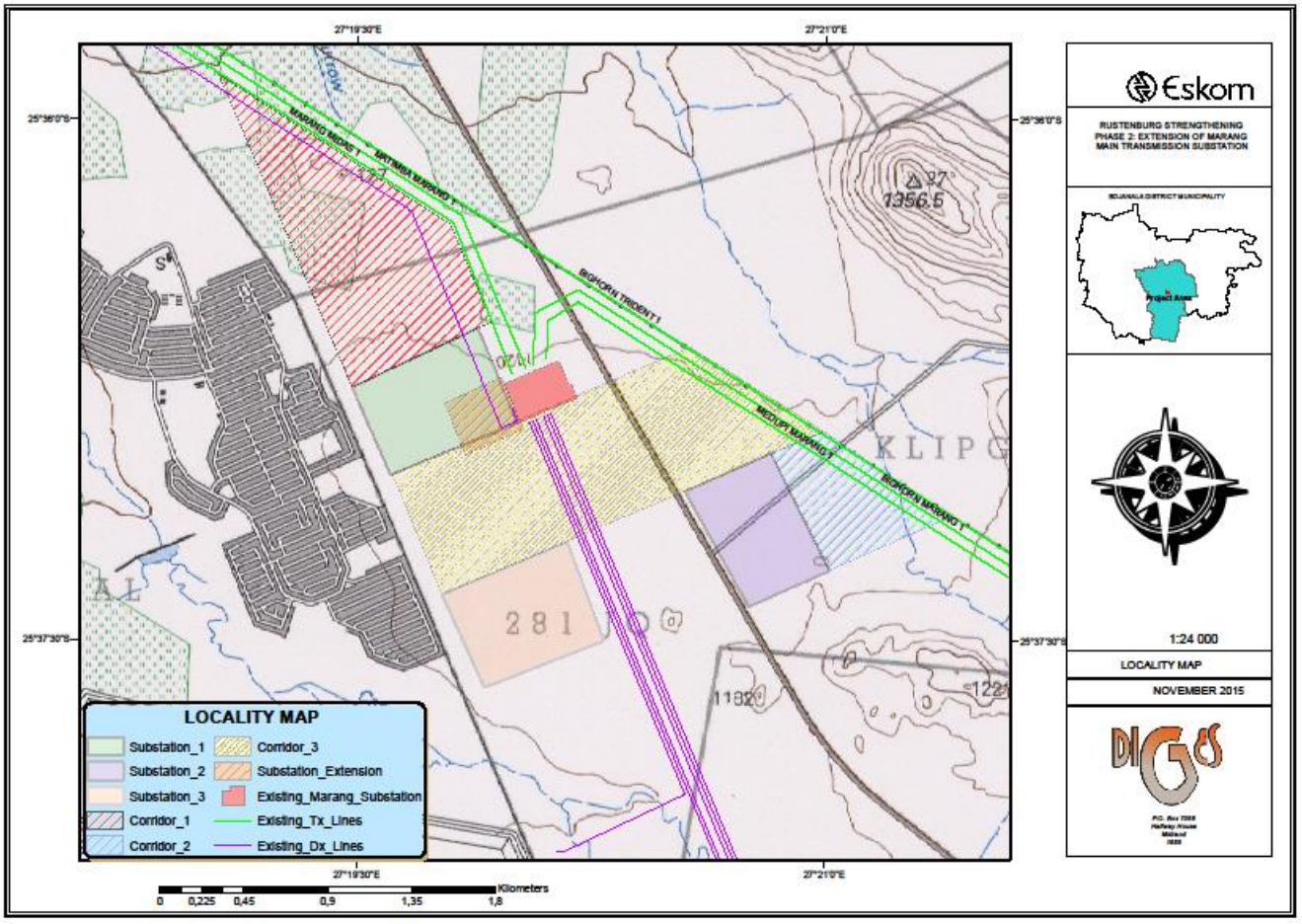


Figure 1: General layout of the study area

2.3 Description of Water Resources on Site

The proposed project entails the assessment of 4 alternatives,i.e., three alternatives for the construction and maintenance of a new 3x 500MVA 400/132kV Main Transmission Substation (MTS), Marang B and 400kV power line and one alternative for the extension of the existing substation. These sites are located within the A22H quaternary catchment. The main River system that runs through this quaternary catchment consists of the Hex River, which has Waterkloospruit as well as the Rooikloofspruit as tributaries. Figure 2 overleaf indicates the water resources within the A22H quaternary catchment in relation to the proposed site locations.

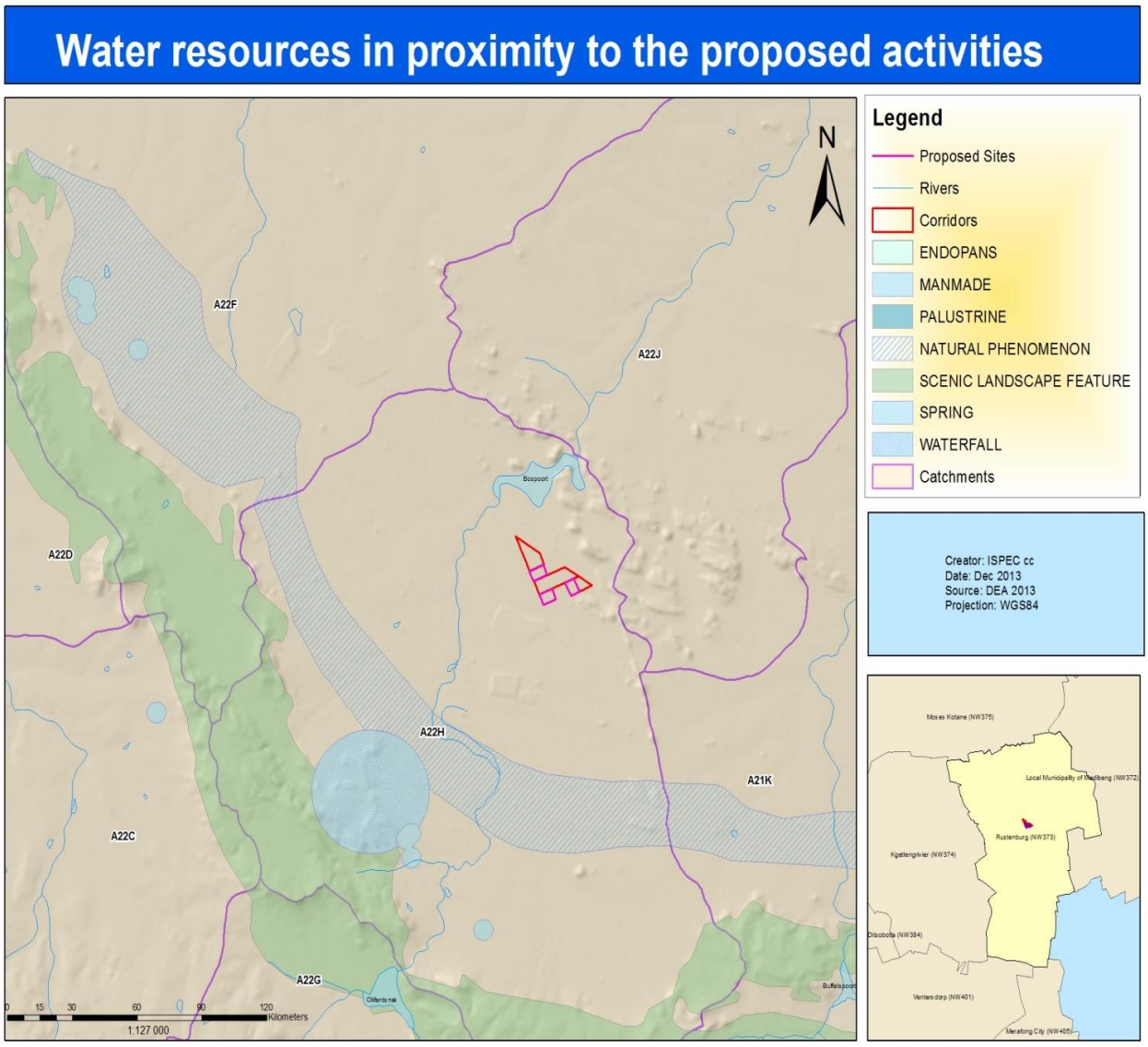


Figure 2: Water resources in proximity to the proposed activities

3. Project Terms of Reference

The assessment will determine the impacts of constructing and operating either Marang B substation and the power line or the substation extension on the aquatic environment of the Hex River and its tributaries. The terms of reference were as follows:

- To undertake a wetland assessment survey on site;
- To provide an indication of the relative conservation importance and ecological function of the study area in terms of Aquatic Ecology;
- To assess the impacts of the development on the ecological integrity of the study area; and;
- To provide recommendation on ecological mitigation measures for the proposed development.

A discussion on the water requirements must include recommendations regarding the proposed system to ensure minimal impacts on the river and surrounding area. Identify and assess the magnitude and significance of the positive and negative impacts associated with the proposed project on nearby tributaries. Describe appropriate mitigation measures to minimize negative impacts or to maximise positive impacts on the river and tributaries and riparian features. The significance of the potential impacts and benefits must be assessed using the prescribed methodology.

4. Limitations

- Ideally a wetland assessment should be carried out over a longer time frame and should be replicated over several seasons. Due to the constraints of time and season, the results were collected and concluded from sample plots laid out in areas as shown in Figure 1.
- General observations upon walking through the proposed study site and a survey of aerial imagery also assisted in the compilation of the sensitivity map. Information about this study relied heavily on data from representative sections of natural grassland.
- As basic faunal sampling was undertaken the floral assessment results specifically the species composition was used as an indication of disturbance and to identify possible faunal habitat from floral data.
- Presence of a few conserved areas in the Marikana Thornveld, time constraints and a high rate of grassland degradation and transformation, comparison with benchmark site was not possible. Instead published species lists from Mucina & Rutherford (2006) were relied upon for data comparison.
- As some species only flower at certain periods of the year, it is necessary to undertake repetitive sampling to discover all the species within the system. It was often difficult, during the study to differentiate between grass species as some were not in flower.

5. Legislative requirements

5.1 National Environmental Management Act, 1998

The National Environmental Management Act (Act 107 of 1998) and the associated Regulations (Listing No R. 544, No R. 545 and R. 546) as amended in June 2010, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.

5.2 National Water Act, 1998

- The National Water Act (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved.
- No activity may therefore take place within a water course unless it is authorised by the Department of Water Affairs (DWA).
- Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from DWA in terms of Section 21.

5.2.1 General Notice 1199 as published in the Government Gazette 32805 of 2009 as it relates to the National Water Act, 1998 (Act 36 of 1998)

Wetlands are extremely sensitive environments and as such, the Section 21 (c) and (i) water use General Authorization does not apply to any wetland or any water resource within a distance of 500 meters upstream or downstream from the boundary of any wetland or estuary. This chapter outlines the requirements of national legislation that is relevant and applicable to the Hex River and its tributaries. The provisions of the National Environmental Management Act (1998) are not repeated here, since details of the activities that are triggered by the development, and are contained in the Environmental Impact Assessment Report. The National Water Act (36 of 1998) has the most relevance to this specialist report, and is therefore elaborated in some detail. Other relevant legislation is presented in a briefer format.

5.2.2 Chapter 4 (Use of water)

Water use, as defined in the Act (Section 21) includes:

a. Taking water from a water resource;
b. Storing water;
c. Impeding or diverting the flow of water in a watercourse;
d. Engaging in a stream flow reduction activity contemplated in section 36;
e. Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
f. Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g. Disposing of waste in a manner which may detrimentally impact on a water resource;

h. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
i. Altering the bed, banks, course or characteristics of a watercourse;
j. Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k. Using water for recreational purposes.

Sub-sections (a), (e) (f),(g), (h), (i) and (k) relate to activities that could directly impact on the Hex River and its tributaries are self-explanatory, whilst (b), (c), (d) and (j) could relate to indirect human impacts affecting a river and or tributary (respectively, recharging an aquifer, with waste or water containing waste - all of which can affect the quantity and quality of the water in the river and or tributary).

5.2.3 Chapter 4, Part 5 (Controlled activities)

This Part allows the Minister to regulate activities having a detrimental impact on water resources by declaring them to be controlled activities. Four such activities, irrigation using waste or water containing waste from certain sources - modification of atmospheric precipitation, altering the flow regime of a water resource as a result of power generation, and aquifer recharge using waste or water containing waste - are identified in the Act as controlled activities. Provision is made for the Minister to declare other controlled activities as the need arises, but in these cases public consultation is required. Following the identification or declaration of a controlled activity an authorisation for that particular category of activity is required under this Act.

5.2.4 Section 37(1) the following are controlled activities:

a) irrigation of any land with waste or water containing waste generated through any;
b) industrial activity or by a waterworks;
c) an activity aimed at the modification of atmospheric precipitation;
d) a power generation activity which alters the flow regime of a water resource;
e) intentional recharging of an aquifer with any waste or water containing waste; and
f) An activity which has been declared as such under section 38.

5.2.5 Section 37 (2) No person may undertake a controlled activity unless such person is authorised to do so by or under this Act.

5.2.6 Chapter 4, Part 6(General Authorisations)

The Department of Water and Environmental Affairs has established geographically-differentiated general authorisations (GA) in terms of Section 21, which covers water use as follows –

a) Controlled activity - Irrigation of any land with waste or water containing waste generated through any industrial activity or by a waterwork (s21(e)) In addition to detailed requirements in respect of the physico-chemical characteristics of the waste, and general requirements for the activity not to impact on a water resource or any

other person's water use, property or land; and not to be detrimental to the health and safety of the public in the vicinity of the activity, irrigation may not take place within less than 100 metres from the edge of a water resource or a borehole which is utilised for drinking water or stock watering, whichever is further; or on land that overlies a Major aquifer.

a. Discharge of waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit (s21(f)), and
b. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process (s21(h)).

5.2.6.1 The GA specifies the physico-chemical characteristics of the waste and volumetric limits for the discharge, beyond which a licence is required.

i. There is a general requirement for the activity not to impact on a water resource or any other person's water use, property or land; and not to be detrimental to the health and safety of the public in the vicinity of the activity.
ii. The GA specifically excludes complex industrial wastewater.
iii. The GA specifically prohibits any person from discharging storm-water runoff from any premises containing waste, or water containing waste emanating from industrial activities and premises, into a water resource.

5.2.6.2 Disposing of waste in a manner which may detrimentally impact on a water resource (s21 (g))

i. The GA deals with the storage of domestic and/or biodegradable industrial wastewater for the purpose of re-use or disposal.
ii. It establishes volumetric limits for storage and disposal, beyond which a licence is required. There is a general requirement for the activity not to impact on a water resource or any other person's water use, property or land; and not to be detrimental to the health and safety of the public in the vicinity of the activity.
iii. The GA limits the disposal onto land of storm water, to storm water runoff from any premises not containing waste or wastewater from industrial activities and premises Wastewater storage dams and wastewater disposal sites must be located: outside of a watercourse; above the 100 year flood line, or alternatively, more than 100 metres from the edge of a water resource or a borehole which is utilised for drinking water or stock watering, whichever is further; and on land that does not overlie, a Major Aquifer.

5.2.6.3 Impeding or diverting the flow of water in a watercourse (s21c)

This GA has been substantially revised since its original publication in 1999; a new GA was published in December 2009 in Government Notice 1199. It is generally applicable throughout the country, except for certain specified areas, none of which include the Kat River or its tributaries.

5.2.6.4 Altering the bed, banks or characteristics of a watercourse s21 (i))

This GA has been substantially revised since its original publication in 1999; a new GA was published in December 2009 in Government Notice 1199. It is generally applicable throughout the country, except for certain specified areas.

In the GA "altering the bed, banks, course or characteristics of a watercourse" means any change affecting the resource quality within the riparian habitat. It is important to note that the GA does not mean that developments that may alter the bed, banks or characteristics of a watercourse. It does mean that such developments may not be authorised in terms of the GA, and will require a water use licence. All the above require the water use to be registered with DWAF, and all require some form of monitoring programme to be implemented, and may require information on the water use to be submitted to DWAF at regular intervals.

5.2.7 Regulations in terms of the NWA

Regulations requiring that a water use be registered (Sections 26 and 69), Government Notice No.R.1352, 12th November 1999.

This is relevant only in a general sense, in that the registration process was intended to identify all water users (in terms of abstraction of water and, to a limited extent, some aspects of waste discharge), and the nature and extent of their use.

Registration was the first step towards general (compulsory) licensing of all water use, one of the main prerequisites for achieving equitable and sustainable water use

Draft Regulations for the use of water for recreational purposes generally and in respect of a government waterworks and surrounding state-owned land, Government Gazette 29413, Notice 1188, and 1st December 2006. This refers to Section 21 (k) of the Act - using water for recreational purposes. The regulations are intended to regulate the recreational use of all water resources, in particular government waterworks (dams).

There is a general provision that the water use does not detrimentally impact any other water use, and that the water use is not harmful or potentially harmful to human health and safety or the water resource and the associated ecosystem.

Other provisions include the requirement to register such uses in terms of Government Notice R1352, and adherence to precautionary practices in respect of, inter alia: general safety on the water; prevention of scour, erosion and sedimentation; compliance with reservations of areas for specific purposes; damage to or removal of riparian indigenous vegetation; and lawful disposal of waste.

An operational plan, to be approved by the responsible authority, must be prepared for high impact and commercial uses, but only when the user is notified in writing by the responsible authority to do so.

Note: DWA's Draft Regulations for the use of water for recreational purposes are currently being scrutinised by the State Law Adviser, who is of the opinion that they cannot be made for water resources other than government waterworks in terms of the National Water Act.

The relevant sections of the Act are detailed below. *Chapter 1 (Definitions)* Section1 finds applicable and defines the following:

"**Catchment"**, in relation to a watercourse or watercourses or part of a Watercourse, means the area from which any rainfall will drain into the watercourse or Watercourses or part of a watercourse, through surface flow to a common point or common points;

"**riparian habitat**" includes 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 land areas;

"**Water management area**" is an area established as a management unit in the national water resource strategy within which a catchment management agency will conduct the protection, use, development, conservation, management and control of water resources;

"**Watercourse**" means –

- A river or spring
- A natural channel in which water flows regularly or intermittently

5.3 The Conservation of Agricultural Resources Act (43 of 1983)

The Conservation of Agricultural Resources Act (43 of 1983) embodies two aspects that contribute to the maintenance of the ecological character of the river and tributary. It requires the maintenance of riparian vegetation (thereby providing a migratory corridor for fauna), and provides a list of invasive alien vegetation that must be controlled or eradicated (thereby reducing the effects of such vegetation on surface water runoff into the river/tributary).

6. METHOD OF INVESTIGATION

6.1 Desktop Study

Wetland specific information resources taken into consideration during the desktop assessment of the project footprint included:

- National Freshwater Ecosystem Priority Areas (NFEPAs), 2011;
- NFEPA water management area (WMA);
- NFEPA wetlands/ National wetlands map;
- Wetland and estuary FEPA;
- FEPA (sub)WMA % area;
- Sub water catchment area FEPAs;
- Water management area FEPAs;
- Fish sanctuaries; and
- Wetland ecosystem types.

6.2 Classification System for Wetlands and other Aquatic Ecosystems in South Africa

A summary of Levels 1 to 4 of the Classification System for Inland Systems are presented in Table 3 and 4 below.

Table 3: Classification structure for Inland Systems, up to Level 3.

<table>
<tr><th colspan="3">WETLAND / AQUATIC ECOSYSTEM CONTEXT</th></tr>
<tr><th>LEVEL 1: SYSTEM</th><th>LEVEL 2:
REGIONAL SETTING</th><th>LEVEL 3: LANDSCAPE UNIT</th></tr>
<tr><td rowspan="4">Inland Systems</td><td rowspan="4">DWA Level 1 Ecoregions

OR

NFEPA WetVeg Groups

OR
Other special framework</td><td>Valley Floor</td></tr>
<tr><td>Slope</td></tr>
<tr><td>Plain</td></tr>
<tr><td>Bench
(Hilltop / Saddle / Shelf)</td></tr>
</table>

Table 4: Classification structure for Inland Systems up to 4

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
River (Channel)	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional stream	Active channel
		Riparian zone
	Upper foothill rivers	Active channel
		Riparian zone
	Lower foothill rivers	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothill rivers	Active channel
		Riparian zone
	Upland floodplain rivers	Active channel
		Riparian zone
Channelled valley-bottom	(not applicable)	(not applicable)
Unchannelled valley-bottom	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Note: 2nd Row of Table provides the criterion for distinguishing between wetland units in each column. Ch. = channelled (outflow/inflow)

The classes used by the South African River Health Program (RHP) are presented in the table below (Kleynhans, 1999a) and will be used as the basis of classification of the systems in

this desktop study.

Table 5: Classification of River Health Assessment Classes in line with the RHP (Kleynhans, 1999a)

Class	Description
A	Unmodified, natural.
B	Largely natural, with few modifications.
C	Moderately modified.
D	Largely modified.
E	Extensively modified.
F	Critically modified.

Studies undertaken by the Institute for Water Quality Studies assessed quaternary catchments as part of the Resource Directed Measures for Protection of Water Resources. In these assessments, the Ecological Importance and Sensitivity (EIS), Present Ecological Management Class (PEMC) and Desired Ecological Management Class (DEMC) were defined, and serve as a useful guideline in determining the importance and sensitivity of aquatic ecosystems prior to assessment, or as part of a desktop assessment. This database was searched for the quaternary catchments of concern in order to define the EIS, PEMC and DEMC. The findings are based on a study undertaken by Kleynhans (1999) as part of "A procedure for the determination of the ecological reserve for the purpose of the national water balance model for South African rivers".

6.3 Inland Systems

In terms of the Classification System, Inland Systems are ***ecosystems that have no existing connection to the ocean***[1] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but ***which are inundated or saturated with water, either permanently or periodically.*** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent (Ollis *et al*, 2013).

For the purposes of the Classification System, wetlands are defined as "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil" (from the South African National Water Act; Act No. 36 of 1998).

6.4 Level 2: Ecoregions

For Inland Systems, the regional spatial framework that has been included at Level 2 of the Classification System is that of the DWA Level 1 Ecoregions for aquatic ecosystems (after

Kleynhans *et al.,* 2005), which are based on broad scale patterns of physiography, climate, geology, soils and vegetation across South Africa. Knowledge of the Ecoregion within which any given project footprint falls, this enables improved interpretation of data.

6.5 Level 2: NFEPA Wet Veg Groups

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups vegetation types across the country according to Biomes, which are then divided into Bioregions (refer to Section B). To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

[1] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

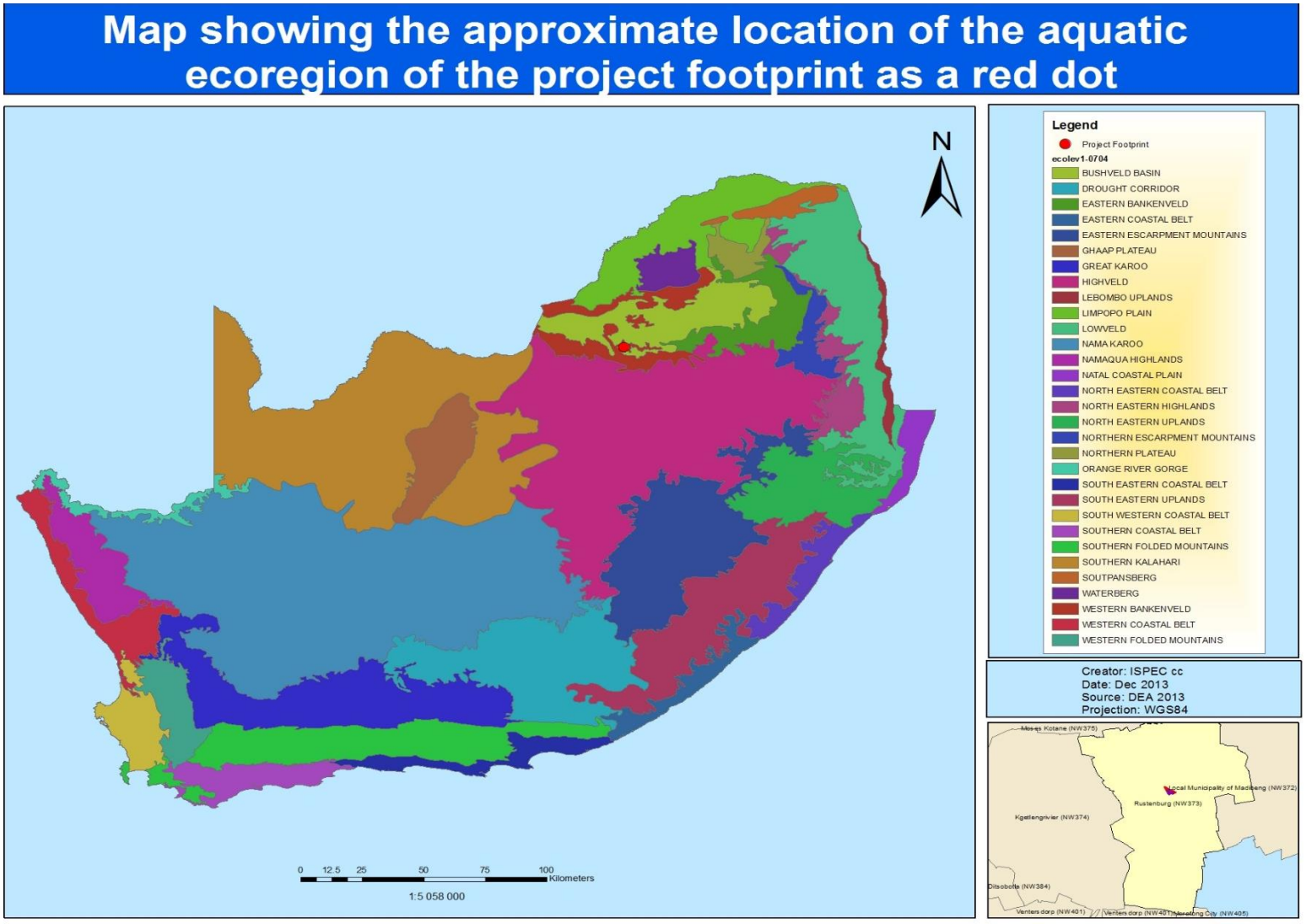


Figure 3: Map showing the approximate location of the aquatic Ecoregion of the project footprint as a red dot.

6.6 Level 3: Landscape Units

At Level 3 of the Classification System for Inland Systems, a distinction is made between four Landscape Units (Table 6) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et. al.* 2013):

- ***Slope*:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley.
- ***Valley floor:*** the typically gently sloping, lowest surface of a valley[2].
- ***Plain:*** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land.
- ***Bench (hilltop/saddle/shelf):*** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

In addition, a schematic diagram of the different landscape settings is shown in the Figure below.

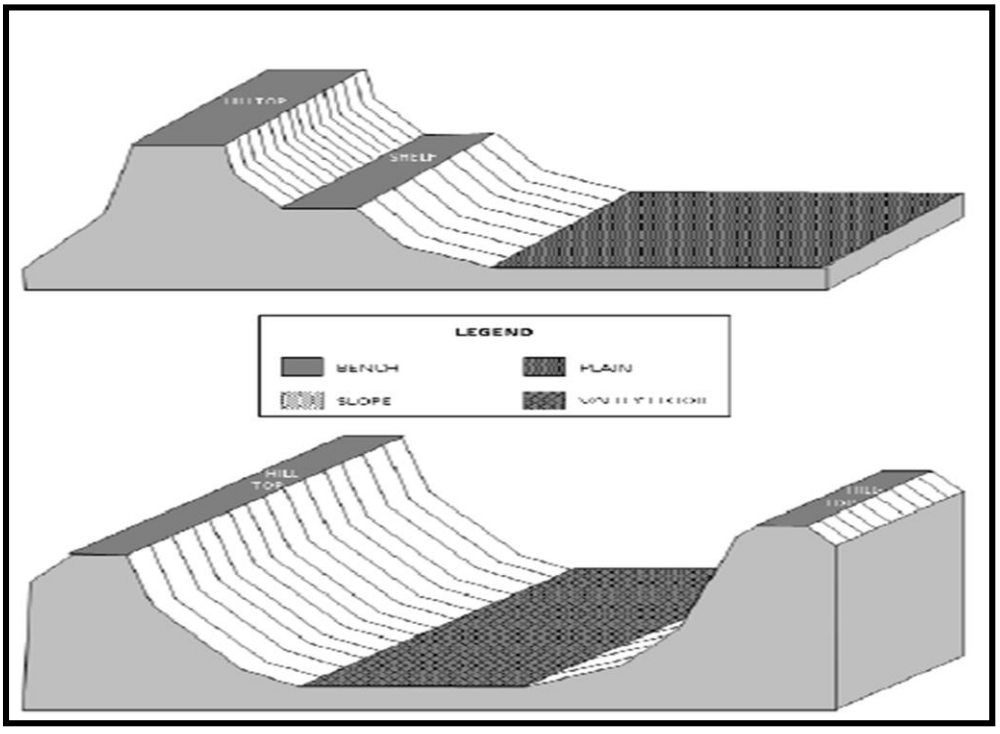


Figure 4: Schematic diagram of the different landscape settings within which an Inland System can occur (Ollis et al., 2009).

[2] Valley: an elongated, relatively narrow region of low land between ranges of mountains, hills, or other high areas (such as sand dunes), often having a river or stream running along the bottom.

6.7 Level 4: Hydrogeomorphic (HGM) Units

Eight primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System, on the basis of hydrology and geomorphology (Ollis *et al*, 2013), namely:

- Channel (River): a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.
- Channelled valley-bottom wetland: a 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.
- Floodplain wetland: the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank.
- Depression: a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- Wetland Flat: a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat.
- Seep: a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the Classification System to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for "channel", "flat" and "valleyhead seep") is used, for example, in the recently developed tools produced as part of the Wetland Management Series (Dada *et al.,* 2007), including WET-Health (Macfarlene *et al.,* 2008) and WET-EcoServices (Kotze *et al.,* 2008).

6.8 Index of Habitat Integrity (IHI)

To assess the Present Ecological State (PES) of the drainage feature the Index of Habitat Integrity (IHI) for South African floodplain, channelled and channelled valley bottom wetland types (DWAF Resource Quality Services, 2007) were used.

The WETLAND-IHI is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The WETLAND-IHI has been developed to allow the NAEHMP to include floodplain and channelled valley bottom wetland types to be assessed. The output scores from the WETLAND-IHI model are presented in A – F ecological categories (Table 6 below), and provide a score of the PES of the habitat integrity of the wetland system being examined.

Table 6: Descriptions of the A – F ecological categories (after Kleynhans, 1996, 1999).

Ecological Category	PES % Score	Description
A	90-100%	Unmodified, natural.
B	80-90%	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially
C	60-80%	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly
D	40-60%	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred. E 20-40% Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
E	20-40%	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	0-20%	Critically / Extremely modified. Modifications have reached a critical level and the system has 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.

6.9 Wetland function assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[3] The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2005). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation
- Stream flow regulation
- Sediment trapping
- Phosphate trapping
- Nitrate removal
- Toxicant removal
- Erosion control
- Carbon storage
- Maintenance of biodiversity
- Water supply for human use
- Natural resources

- Cultivated foods
- Cultural significance
- Tourism and recreation
- Education and research

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the riparian system. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the riparian system.

Table 7: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

6.10 Recommended Ecological Category

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability, but carries a higher risk of ecosystem failure."[4] The Recommended Ecological Category (REC) was determined based on the results obtained from the Present Ecological State (PES), reference conditions and Ecological Importance and Sensitivity (EIS) of the resource (sections above). Followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC. A system may receive the same class for the PES, as the REC if the system is deemed to be in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as to enhance the PES of the riparian system.

Table 8: Description of REC classes

Score	Description
A	Unmodified, natural
B	Largely natural with few modification
C	Moderately modified
D	Largely modified

[3]Department of Water Affairs and Forestry, South Africa. *Version 1.0 of Resource Directed Measures for* Protection of Water Resources, 1999.

6.11 Wetland Zone Delineation

For the purposes of this investigation, a wetland habitat is defined in the National Water Act (1998) as the physical structure and associated vegetation of areas associated with a watercourse. These are commonly characterised by alluvial soils, 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. The wetland and riparian zone delineation took place according to the method presented in the final draft of "*A practical field procedure for identification and delineation of wetlands and riparian areas*" published by the DWA in February 2005. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils and
- The presence of alluvial soils in stream systems.

By observing the evidence of these features, in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA 2005).

Riparian and wetland zones can be divided into three zones (DWA 2005) depending on the duration of soil saturation. The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant part of the rainy season and the temporary zone surrounds the seasonal zone and is only saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. Wetland indicators, in the form of Terrain Unit Indicators, Soil Form Indicators, Soil Wetness Indicators and Vegetation Indicators assist in delineating the boundaries of the various zones and the outer boundary of the temporary zone. Thus the object of the wetland delineation was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

6.12 Recommended Ecological Category (REC)

All results obtained from the South African Wetland Assessment Classification System were used in the determination of the appropriate REC class. The results obtained from the wetland assessment indicate intermediate levels of ecological service provision, with moderately modified PES observed mainly due to commercial agriculture and informal urban development.

[4]Department of Water Affairs and Forestry, South Africa. Version 1.0 of Resource Directed Measures for Protection of Water Resources 1999

Therefore, the REC recommended for the wetlands is Class C (Moderately Modified). Mitigation measures and recommendations stipulated in this report, if followed, are deemed adequate to maintain this REC on a localised scale.

6.13 Wetland Delineation and Sensitivity Mapping

6.13.1 Wetland Delineation

During the assessment, the following temporary zone indicators were used:

- Terrain units were used to determine which parts of the landscape the wetland feature is most likely to occur, as wetlands occupying the valley bottom landscape unit are easily distinguishable and the extent of the associated wetland area can often readily be determined.
- The soil form indicator was used to determine the presence of soils that are associated with prolonged and frequent saturation as well as variation in the depth of the saturated soil zone within 50cm of the soil surface. These features were investigated in order to aid in determining the location of the wetland zones and the location of the temporary zone boundary.
- The vegetation indicator was used in the identification of the wetland boundary through the identification of the distribution of both facultative and obligate wetland vegetation associated with soils that are frequently saturated.

The nature of the proposed development (Substation & Power lines) means that it is necessary to cross the wetland areas within the project footprint. However, where these crossings do occur, it must be ensured that the disturbance footprint is minimised and that the duration of disturbance is limited. Connectivity of the wetland features in the system need to be maintained in order to ensure linear protection of water quality within these systems as well as ensuring the continuity of the habitats and resources. Any activities occurring within the wetland boundary, including rehabilitation, must be authorised by the DWA in terms of Section 21 (c) & (i) of the National Water Act (Act 36 of 1998). These measures are sufficient to maintain the Present Ecological State and to ultimately achieve the REC determined by the South African Wetland Assessment Classification System. Figure 5 illustrates the preferred and Alternative sites as Green, Orange and Red according to the proximity to wetlands. The Impact Assessment discussion in chapter 7 is concentrated on the preferred site as it had the least probability of wetland occurrence and impact.

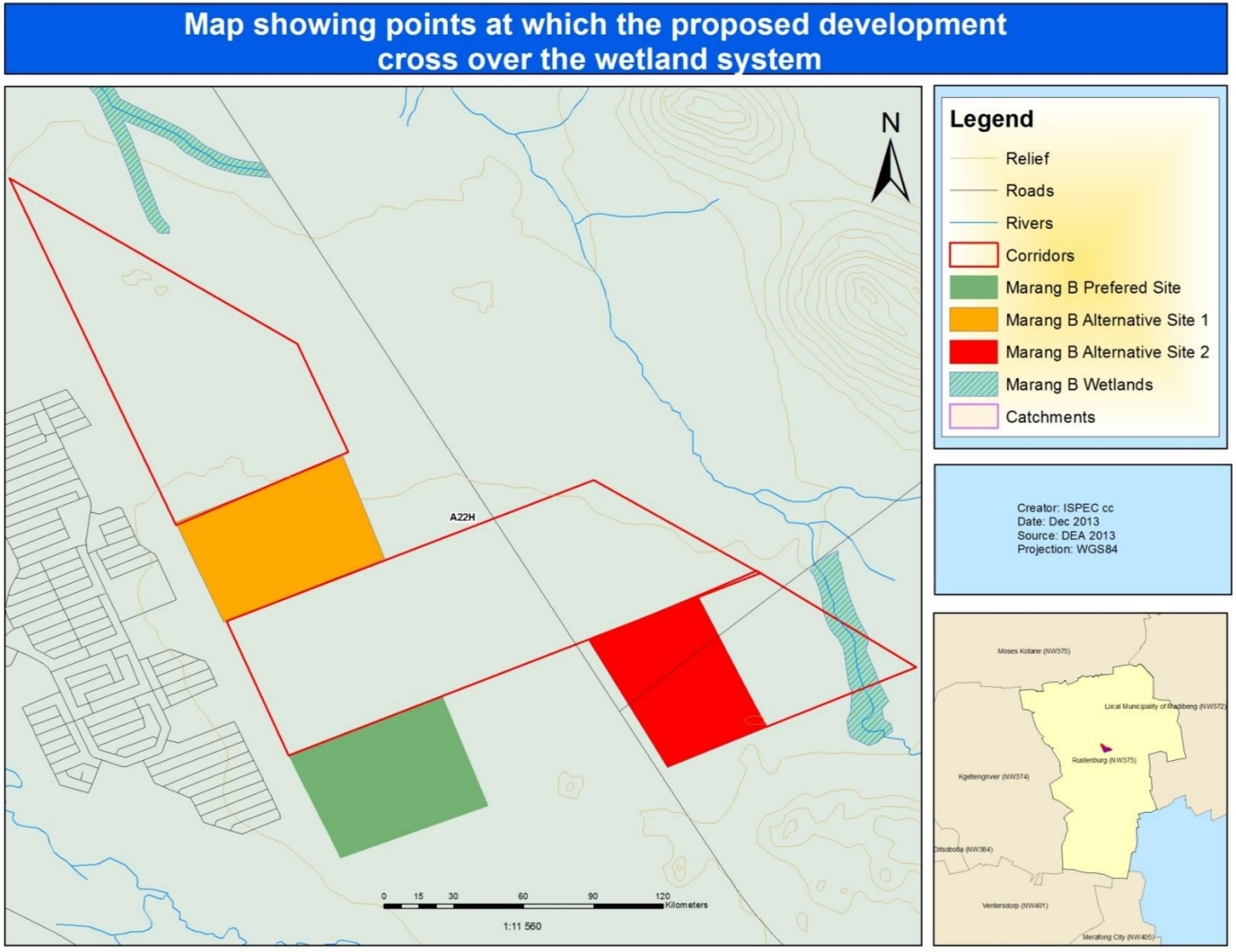


Figure 5: Map showing points at which the proposed road routes cross over the wetland system

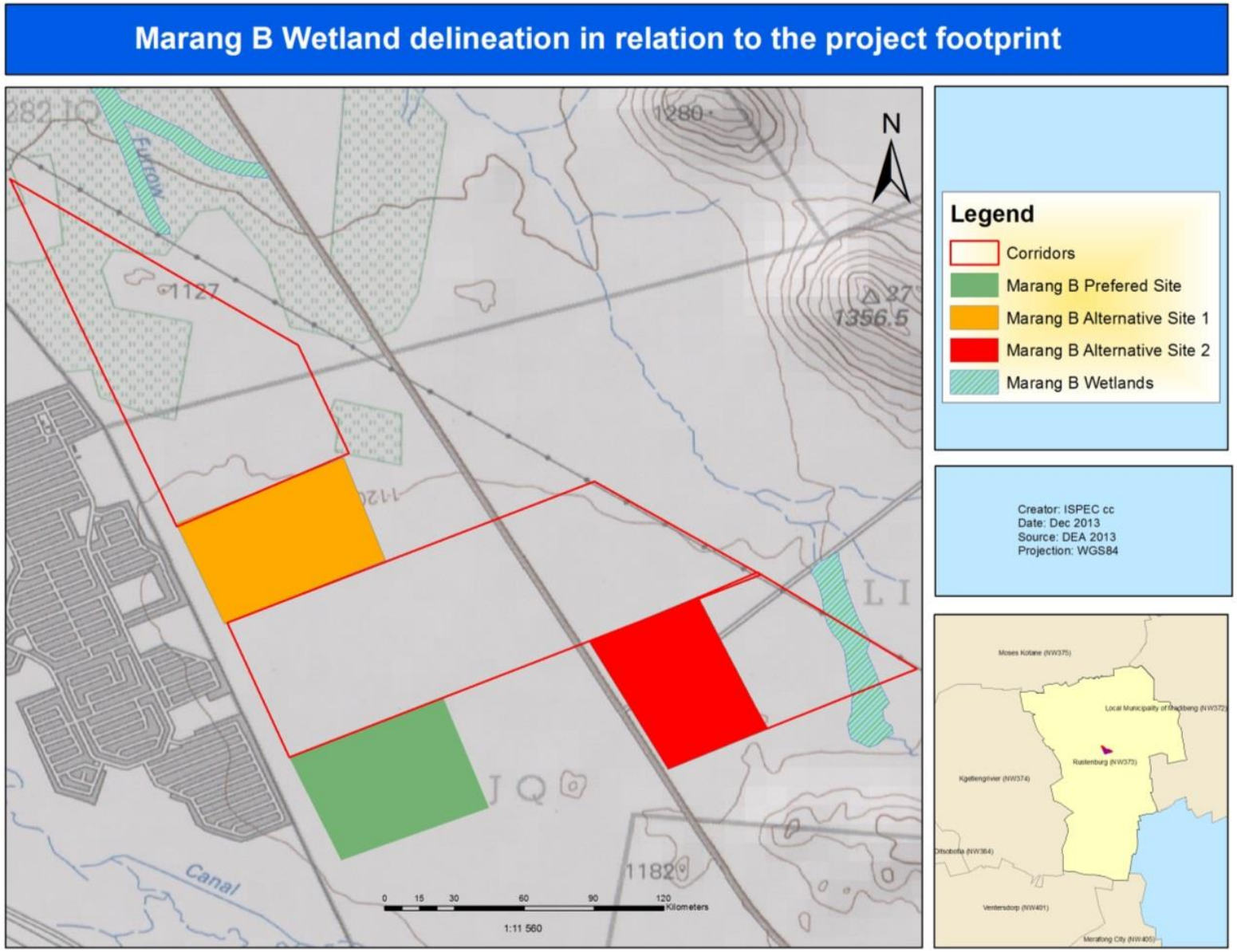


Figure 6: Wetland delineation in relation to the project footprint.

7. RESULTS AND INTERPRETATION

7.1 Wetland Delineation and assessment

7.1.1 Delineation

A digital base map on ArcGIS 10.1 was used to delineate wetland boundaries. Heads-up digitizing (directly from the electronic images) was used to capture the boundaries on the digital images, thus getting around the problems associated with manual transfer and hard copy line thickness errors in relation to on-ground distance, using field verification knowledge, global positioning reference points (GPS) in the WGS84, projection.

A site visit was then undertaken on 30th November 2013 to verify the desktop interpretation of wetland location and extent. Soil auguring was used to look for indicators of hydric conditions (Kotze and Marneweck, 1999) in order to verify whether or not the areas delineated as wetlands in the desktop study met the criteria for classification as true wetlands.

7.1.2 Classification and Assessment

The identified wetlands were classified according to their hydro-geomorphic (HGM) determinants based on a modification of the system first described by Marneweck and Batchelor (2002) and on the system developed by Kotze, Marneweck, Batchelor, Lindley and Collins (2005). This classification system allows for functional assessments to be incorporated into the study. Field assessment data together with available desktop information was used to describe the general current ecological condition of the wetlands in the study area.

The wetlands identified at the site were classified according to hydro-geomorphic (HGM) types, and two HGM wetland types were identified in the study area. A general schematic diagram of how these types are positioned in the landscape is provided in Figure 7. The HGM type within the study area consists of the valley bottoms with a channel. Table 9 describes the wetland types found within the study area.

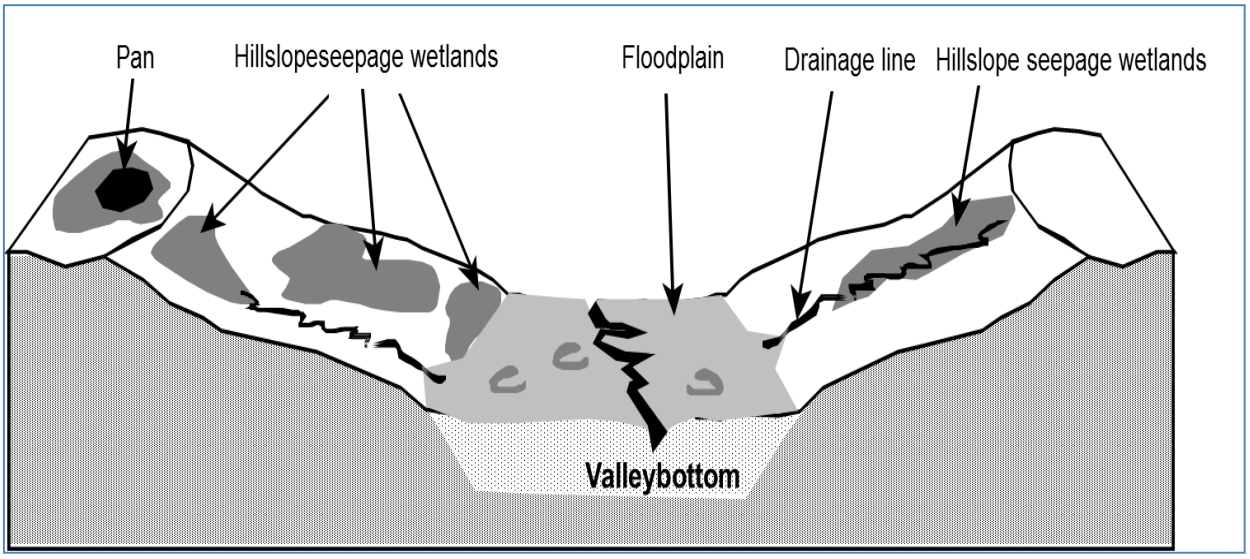
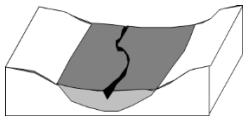


Figure 7: Schematic of HGM wetland types

Table 9: Description of wetland types found within the study site

WETLAND TYPE	DESCRIPTION	INPUT	THROUGHPUT	OUTPUT
Channelled Valley Bottom 	Linear fluvial, net depositional valley bottom surfaces which have a straight channel with flow on a permanent or seasonal basis. Episodic low is thought to be unlikely in this wetland setting. The straight channel tends to flow parallel with the direction of the valley (i.e. there is no meandering), and no ox-bows or cut-off meanders are present in these wetland systems. The valley floor is, however, a depositional environment such that the channel flows through fluvially-deposited sediment. These systems tend to be found in the upper catchment areas.	Receive water inputs from the main channel (when channel banks overspill) and from adjacent slopes, as well as from adjacent hillslope seepage wetlands if these are present.	Surface flow and interflow.	Variable but predominantly stream flow.

7.1.3 Ecoregions

Knowledge of the Ecoregion within which the project footprint is located allows for improved interpretation of data to be made when assessing the ecology of any area (aquatic or terrestrial), as reference information and representative species lists are often available on this level of assessment, which aids in guiding the assessment. The project footprint falls within the Western Bankenveld and Bushveld Ecoregions and is located within the A22H quaternary catchment.

Table 10: Summary of the ecological status of quaternary catchment A22H, based on Kleynhans1999

Catchment	Province	Resource	EIS	PEMC	DEMC
A22H	North West	Hex	Moderate	Class C: (Class D based on desktop certainty)	Class C: Moderately Sensitive System

The points below summarise the impacts on the aquatic resources in this quaternary catchment:

- The aquatic resources within this quaternary catchment have been significantly affected by bed modifications due to the effects of siltation and erosion.
- Moderate impacts from flow modifications have taken place.
- Significant impacts have occurred as a result of introduced in-stream biota.
- Impact due to inundation is high.
- Riparian zones and stream bank conditions are considered to be moderately impacted due to alien vegetation encroachment and bank erosion.
- An impact on the aquatic community, due to altered water quality from informal runoff has affected the system in this area slightly.

In terms of ecological functions, importance and sensitivity, the following points summarise the conditions in this catchment:

- The riverine systems in this catchment have a moderate diversity of habitat types, with some pools, riffles and rapids present.
- The site has a low importance in terms of conservation.

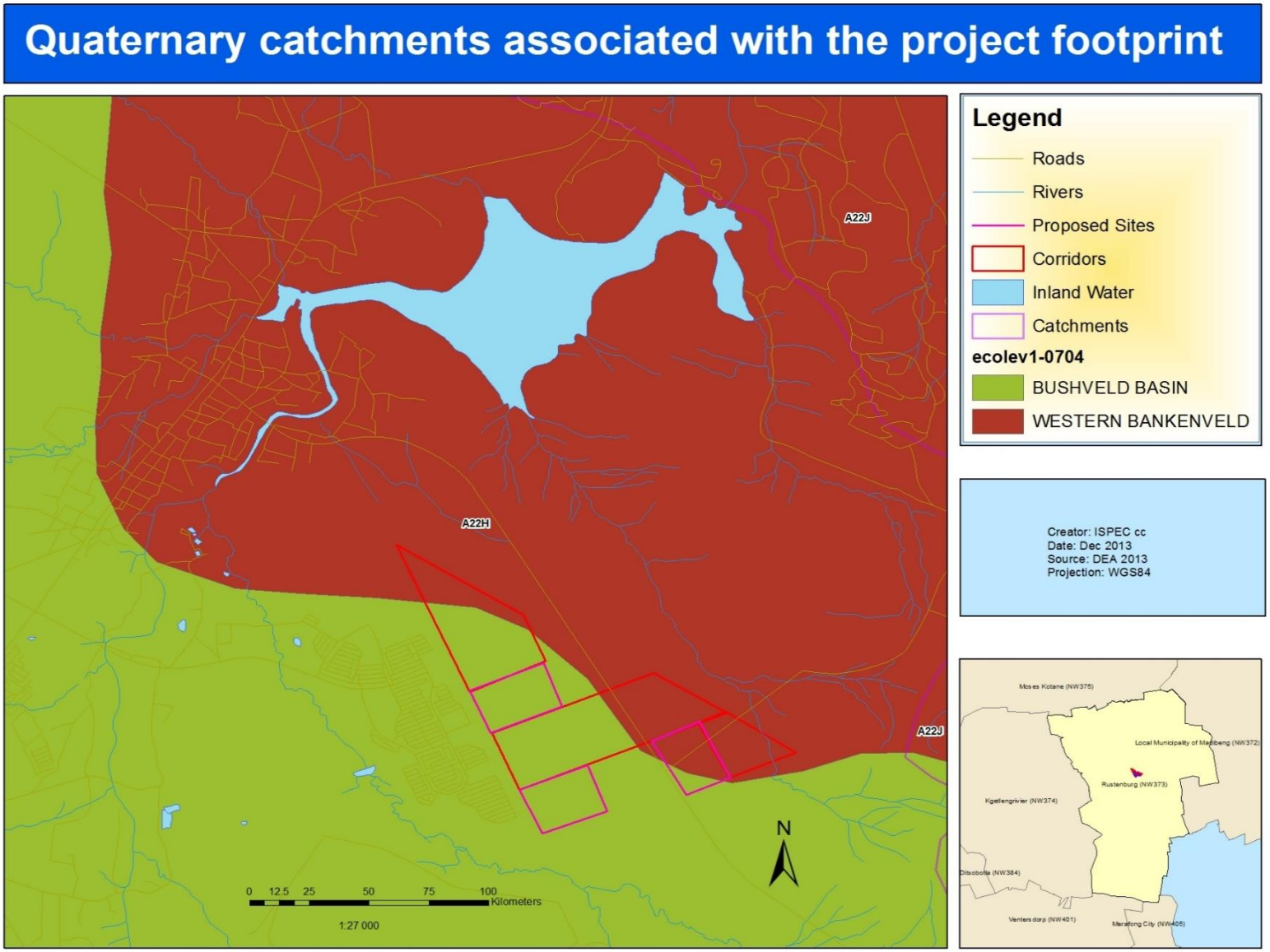


Figure 8: Quaternary catchments associated with the project footprint.

7.2 Wetland System Characterisation

The wetland features identified during the assessment of the project footprint were categorised according to the South African National Biodiversity Institute (SANBI) National Wetland Classification System (2009). The results of the wetland system characterisation are presented in Table 11 below.

Table 11: SANBI National Wetland Classification System (2013).

Crossing reference no.	Level 3: Landscape unit	Level 4 A: HGM Type	Permanent(P) Seasonal(S) Temporary(T)	Description
Fig 8 & 9	Valley floor	Channelled valley bottom wetland	P, S & T	An open conduit with clearly defined margins that continuously or periodically contains flowing water.

7.2.1 Wetlands within and surrounding the study area

The channelled valley bottom wetland below was observed 300m south of substation and corridor alternative 3 and is confined to the non-perennial stream channel, with evidence of outcrops which extends on potions of the stream channel. The main impacts on this wetland system consisted of the housing developments mining activities right next to a wetland and road crossing. The wetland no longer fully functions as a wetland unit due to canalisation and flow modifications. These impacts have changed the hydrological dynamics of the wetland on site. Figure 10 to 13 below indicate some of the impacts that were observed on site.

Figure 9: Road crossing extending over the wetland north of Substation Site 3

Figure 10: Bridge crossing and grazing on wetland north east of site 2

(Coordinate: 25°36'56.23"S; 27°21'10.91"E)

Figure 11: Wetland in the eastern section of Corridor 2

Figure 12: Grazing next to wetland north west of corridor 1

(Coordinates 25°35'41.85"S; 27°19'19.86"E)

- The riverine resources have no sensitivity to flow requirements.

- The area has a moderate importance in terms of migration of aquatic species.
- The area is insignificant in terms of rare and endemic species conservation.
- The ecology of the area is considered to be moderately sensitive to changes in water quality.
- The area has a moderate importance as a source of refugia for aquatic species.
- The catchment can be considered to be moderately sensitive to changes in flow.
- The catchment has a low importance in terms of species richness in the area.

General importance of the project footprint with regards to watercourse conservation and Importance according to the National Freshwater Ecosystems Priority Areas database (2011).

The Freshwater Ecosystem Priority Areas (FEPA)[5] database was consulted to define the aquatic ecology of the wetland systems close to or within the project footprint that may be of ecological importance. Aspects applicable to the project footprint and surroundings are discussed below:

- The project footprint falls within the Crocodile (West) and Marico (WMA) in the Upper Vaal WMA is classified as a FEPA. The WMA is subdivided into several sub-Water Management Areas (subWMA), where catchment or watershed is defined as a topographically defined area, which is drained by a stream, or river network. The SubWMA indicated for the project footprint is the Bospoort Dam subWMA. The Upstream Vaal Dam subWMA is classified as a FEPA.
- No importance in terms of water supply is indicated by the FEPA database for the project footprint.
- No importance in terms of fish sanctuaries is indicated by the FEPA database for the project footprint.
- No importance in terms of wetland conservation is indicated by the FEPA database for the project footprint.
- The project footprint contains Unchannelled Valley Bottom Wetlands, although none of these wetlands are important in terms of the FEPA database.
- No importance is indicated in terms of Amphibian or Crane conservation
- No RAMSAR wetlands are indicated near or on the project footprint.

Thus, the project footprint contains no specific areas of importance in terms of the FEPA database. However, it is important to avoid and where possible, mitigate potential impacts which may pose a threat to the aquatic ecosystems associated with the study area.

[5] www.bgis.sanbi.org

7.3 Wetland Function Assessment

Wetland function and service provision were assessed together within the project footprint for the channelled valley bottom wetlands. The average scores are presented in the following table as well as the radar plot in the figure that follows the table.

Table 12: Channelled valley bottom wetlands wetland functions and service provision.

Ecosystem service	Wetland
	Valley Bottom Wetland
Flood attenuation	2.7
Stream flow regulation	2.0
Sediment trapping	2.8
Phosphate assimilation	3
Nitrate assimilation	3
Toxicant assimilation	2.5
Erosion control	2.3
Biodiversity maintenance	2.1
Carbon Storage	1.2
Water Supply	1.2
Harvestable resources	0.8
Cultural value	0
Cultivated foods	1.6
Tourism and recreation	0
Education and research	0
SUM	25.2
Average score	1.68

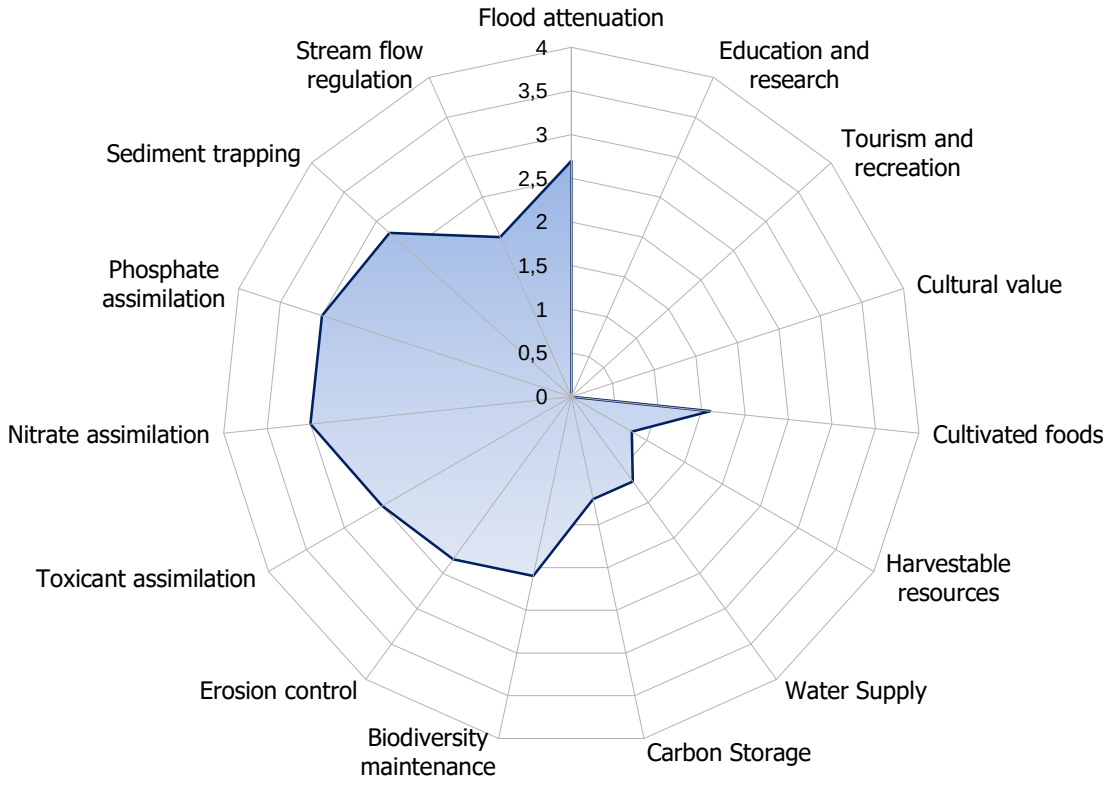


Figure 13: Radar plot of the wetland services provided.

7.4 Index of Habitat Integrity

The Wetland IHI was applied to the wetland features in order to determine the PES of the feature. The results are illustrated in the table below:

Table 13: Criteria and attributes used with the calculation of the PES of the wetland feature.

OVERALL PRESENT ECOLOGICAL STATE (PES) SCORE					
	Ranking	Weighting	Score	Confidence Rating	PES category
DRIVING PROCESSES:		60	1.3		
Hydrology	1	50	0.6	2.2	C
geomorphology	2	30	2.4	3	E
Water Quality	3	10	0.4	4	E/F
WETLAND ACTIVITIES:		50	1	3.1	
Weighting needs to consider the sensitivity of the Wetland	1	40	1	3.1	D/E
(e.g.: nutrient poor wetlands will					

be nmore sensitive to nutrient loading)					
OVERAL SCORE:			0.8	Confidence Rating	
	PES%		37.8		
	PES Category		E	1.4	

From the results of the IHI assessment it is evident that the wetland features obtained an overall PES rating of 37.8%, indicating that the wetland feature falls within PES Category E, the results of this assessment was categorised based on the document by Kleynhans (1999) as part of "A procedure for the determination of the ecological reserve for the purpose of the national water balance model for South African rivers". Table 14 below describes the generic ecological categories.

Table 14: Generic ecological categories for EcoStatus components (modified from Kleynhans 1996 & Kleynhans 1999).

ECOLOGICAL CATEGORY	DESCRIPTION	SCORE (% OF TOTAL)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been	0-19

	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.	

Based on the above assessment, the present ecological status (PES) of wetlands on site is presented in Table 15 below.

Table15: Summary of the present ecological status of water resources

QUATERNARY CATCHMENT	SITE DESCRIPTION	MAIN RIVERS	WETLAND TYPE	PRESENT ECOLOGICAL STATUS	DESCRIPTION
A22H	Marang	Non-perennial stream which is a tributary of the Hex River	Channelled valley bottom	E	Seriously modified

It is recommended that the Ecological category of the water resources within the A22H quaternary catchment is improved. Section below gives considerations for the maintenance of the ecological categories.

Table 16: Functional State of the wetlands those were able to be assessed in the field

Alternative	Wetland Area #	Condition	Primary Function
Substation 1 and Corridor 1	2	Moderate- Anthropogenic impacts (water diversions and altered topography), vegetation moderately disturbed	Flow regulation, improvement of water quality, aquatic and terrestrial habitat, flood attenuation, nutrient spiralling and biogeochemical cycling
Substation 2 and Corridor 2	3	Moderate-Channel incision and erosion evident indicating lowered water table. Slightly disturbed vegetation	Flow regulation, improvement of water quality, aquatic and terrestrial habitat, flood attenuation, nutrient spiralling and biogeochemical cycling
Substation 3 and Corridor 3	0	Good- Vegetation slightly disturbed	Terrestrial habitat biogeochemical cycling, flood attenuation.
Substation Extension	0	Good- Vegetation slightly disturbed	Terrestrial habitat biogeochemical cycling, flood attenuation.

7.5 COMPARATIVE ASSESSMENT OF ALTERNATIVE ROUTES

A structure such as a substation and related power lines will inevitably affect wetlands, surface water resources and other sensitive habitat units that occupy a relatively significant area. It is felt that the site that offers the best balance between socio-economic benefit and least ecological impacts should be implemented so that a greater proportion of the resources can be directed at appropriate mitigation measures that can abate negative impacts. In this instance, each proposed alternative site and corridor has been assessed in order to determine which is least likely to affect the above-mentioned wetlands along the concerned alternatives. Particularly, the estimated numbers of wetlands to be affected were assessed in tandem with the closest alternative site likely to be placed in identified and potentially affected wetlands. The comparative number of wetland crossings and associated factors can be used to assess the four alternatives. Table 16 above indicates that Substation and Corridor Alternative 3 and the

substation extension alternative have less impacts on the wetlands. Substation extension alternative is the preferred sites.

Table 17: Comparative Assessment of Alternatives in terms of wetland crossings

ALTERNATIVES	NUMBER OF WETLANDS CLOSE TO SUBSTATION AND CORRIDOR	SHORTEST DISTANCE BETWEEN WETLANDS AND SUBSTATION AND CORRIDOR (M)
Substation 1 and Corridor 1	2	160
Substation 2 and Corridor 2	3	0
Substation 3 and Corridor 3	0	300
Substation Extension	0	1600

In terms of the results above, the most important factor is the proximity of alternative sites for the substation and/or corridor to be placed within the wetlands. As can be seen, the alternative that is least likely to have the greatest impact on the number of wetlands is **the site for the substation extension**. Alternative Site 1 and 2 are fairly close to wetlands and given the high occurrence of wetland features in the area, means that wetlands will be impacted. Concomitantly, the extensive width of many of the wetlands along these routes mean that a greater number of towers needing to be placed within wetlands. Alternative 2 is approximately 0 m away from wetland while Alternative Site 1 is approximately 190m, alternative site 3 is approximately 300m from wetland and hence share the same fate in terms of potential impacted wetland areas. However, **Alternative 4** has the greatest distance of 1600m from possible wetland. It can be said between these proposed alternatives, **Alternative 4 for substation extension** would be more favourable than alternative route 1 and 2 being the least favourable option. It is therefore strongly recommended that the alternative site with the least number of problems to be placed in wetlands be selected for development.

7.6 CONCLUSIONS AND RECOMMENDATIONS

The proposed Substation, power line routes and the extension of the substation would cross a number of wetland and riverine systems along the alignments. Some of these systems are able to be spanned without the wetland / riverine system being affected. However there are not so many wetland systems along all of the proposed alternative sites. Inevitably, towers would be needed to be placed within wetlands for Alternatives 1 and 2. Consequently, the proposed development will be associated with impacts on the vegetation, soils and hydrology of the wetlands in question. These potential impacts have been taken into account in the comparative assessment of alternatives sites and corridors alternatives avoiding these wetlands have been recommended. As such **Substation Extension site** being the alternative with the least amount of likely impacts to

wetlands is proposed as the best option. Impacts on all wetlands caused by the proposed substation extension could result from poor construction or servitude management practices. However should the mitigation measures proposed be implemented, the impacts of the proposed extension on the wetlands / rivers crossed by the route are likely to be minimised.

8. Impact Assessment

The tables below serve to summarise the significance of perceived impacts on the wetland biodiversity within the project footprint.

Table 18: Impact 1: Loss of Wetland Habitat and Ecological Structure Activities leading to impact

Pre-Construction	Construction	Operational	Rehabilitation
Poor planning leading to the placement of infrastructure within wetlands	Site clearing and the removal of vegetation leading to increased runoff and erosion	Erosion of wetland areas due to altered runoff patterns	Disturbance of soils as part of rehabilitation activities
	Earthworks within the wetlands leading to increased runoff and erosion and altered runoff patterns	Runoff from road surface contaminating surface water and soils	On-going erosion and sedimentation of wetlands due to incorrect rehabilitation
	Topsoil stockpiling adjacent to wetlands and runoff from stockpiles		
	Movement of construction vehicles within wetlands		
	Dumping of construction material into the wetlands		

Table 19: Aspects of wetland ecology affected

Pre-Construction	Construction	Operational	Rehabilitation
	Direct impact on wetland habitat during construction activities	Direct impact on wetland habitat	Direct impact on wetland habitat during rehabilitation
	Contamination of wetland soils	Contamination of wetland soils due to runoff from roads	Compaction and loss of wetland soils during rehabilitation
	Compaction and loss of wetland soils	Changes to the wetland community due to alien invasion vegetation leading to altered habitat conditions	
	Sedimentation and incision leading to altered habitats	Sedimentation and incision leading to altered habitats	

Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Unmanaged	5	3	3	4	5	8	12	66 (Low-Medium)

Essential mitigation measures:

- All development footprint areas should remain as small as possible and should, ideally, not encroach onto sensitive wetland areas.
- It must be ensured that flow connectivity along the wetland features is maintained.
- Re-profiling of the banks of disturbed wetland areas.
- Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles.
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil.
- All spills should be immediately cleaned up and treated accordingly.
- Appropriate sanitary facilities must be provided and all waste removed to an appropriate waste facility.
- Implement alien vegetation control program within wetland areas.
- Monitor all systems for erosion and incision.

Recommended mitigation measures

- Restrict construction to the drier months if possible to avoid sedimentation of wetland features.
- Re-vegetate all disturbed areas with indigenous wetland species.

Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Managed	3	3	2	2	3	6	7	42 (Low)

Probable latent impacts

Proliferation of alien and weed species in disturbed areas will lead to altered vegetation communities within the wetland and riparian areas.

Table 20: Impact 2: Changes to Wetland Ecological and Social-cultural Services Provision Activities leading to impact

Pre-Construction	Construction	Operational	Rehabilitation
Poor planning leading to the placement of infrastructure within wetland areas	Site clearing and the removal of vegetation leading to increased runoff and erosion	Erosion and sedimentation of wetlands leading to loss of wetland habitat	Disturbance of soils as part of rehabilitation activities
	Earthworks in wetland areas leading to increased runoff and Topsoil stockpiling adjacent to wetlands and runoff from stockpiles		Ineffective rehabilitation may lead to habitat transformation and alien On-going erosion and sedimentation of wetlands due to ineffective rehabilitation
	Movement of construction vehicles within wetlands		
	Dumping of construction material into the wetlands		

Table 21: Aspects of wetland ecological and socio-cultural services affected

Pre-Construction	Construction	Operational	Rehabilitation
	Loss of phosphate, nitrate and toxicant removal abilities	Loss of phosphate, nitrate and toxicant removal abilities	Loss of phosphate, nitrate and toxicant removal abilities
	Loss of carbon storage capabilities	Loss of carbon storage capabilities	Loss of carbon storage capabilities
	Inability to support biodiversity	Inability to support biodiversity	Inability to support biodiversity

Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Unmanaged	4	3	4	3	5	7	12	64 (Low-Medium)
Essential mitigation measures: • All development footprint areas should remain as small as possible and should, ideally, not encroach onto surrounding more sensitive wetland areas. • It must be ensured that flow connectivity along the wetland features is maintained. • Re-profiling of the banks of disturbed wetland areas. • Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles. • It must be ensured that all hazardous storage containers and storage areas comply with the relevant • SABS standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • All spills should be immediately cleaned up and treated accordingly. • Appropriate sanitary facilities must be provided for and all waste removed to an appropriate waste facility. • Implement alien vegetation control program within wetland areas.								
Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Managed	3	3	2	3	3	6	8	48 (Low)
Probable latent impacts Proliferation of alien and weed species in disturbed areas will lead to altered vegetation communities within the wetland and riparian features.								

Table 22: Impact 3: Impacts on wetland Hydrological Function Activities leading to impact

Pre-Construction	Construction	Operational	Rehabilitation
Poor planning leading to the placement of infrastructure within wetlands that could result in change of the hydrological regime	Site clearing and the removal of vegetation leading to increased runoff	On-going disturbance of soils with general operational activities	Disturbance of soils as part of rehabilitation activities
	Site clearing and the disturbance of soils leading to increased erosion	Earthworks in the vicinity of wetlands leading to increased runoff and altered runoff patterns	Earthworks in the vicinity of wetlands leading to increased runoff and erosion and altered
	Earthworks in the vicinity of wetlands leading to increased		
	Construction within stream crossings altering stream and base flow patterns and water		
	Topsoil stockpiling adjacent to wetlands and runoff form stockpiles leading to sedimentation of the system		

Table 23: Aspects of wetland hydrology affected

Pre-Construction	Construction	Operational	Rehabilitation
	Incision of wetland areas and erosion of wetland habitat	Incision of wetland areas and erosion of wetland habitat	Incision of wetland areas and erosion of wetland habitat due to inefficient rehabilitation
	Sediment deposition		Sediment deposition due to inefficient rehabilitation

Management	Probability of Impact	Sensitivity of receiving	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Unmanaged	4	3	4	4	5	7	13	69(Medium- high)
Essential mitigation measures: • All development footprint areas should remain as small as possible and should, ideally, not encroach onto surrounding more sensitive wetland areas. • If it is absolutely unavoidable that wetlands will be affected, especially during Pylons and line construction, disturbance to any wetland crossings must be minimised and suitably rehabilitated. • It must be ensured that flow connectivity along the wetland features is maintained. • Reprofiling of the banks of disturbed wetland areas. • Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles. • All vehicles should remain on designated roads with no indiscriminate driving through wetland areas. • Rehabilitate all wetland areas to ensure that wetland functions are re-instated. • Implement alien vegetation control program within wetland areas								
Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Managed	2	3	2	2	3	5	7	35 (Low)
Probable latent impacts • Proliferation of alien and weed species in disturbed areas will lead to altered vegetation communities within the wetland and riparian features.								

8.1 Impact Assessment Conclusion

Based on the above assessment it is evident that there are three possible impacts that may affect the wetland ecology of the area. The table below summarises the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation it is assumed that a high level of mitigation takes place but which does not lead to prohibitive costs. From the table it is evident that prior to mitigation all of the impacts are medium-high level impacts. If mitigation takes place all impacts will be reduced to low level impacts.

Table 24: A summary of the results obtained from the assessment of wetland ecological impacts.

Impact	Unmanaged	Manage
1A:Loss of wetland habitat and ecological structure	Low-Medium	Low
1B:Changes to wetland ecological and sociocultural service provision	Low- Medium	Low
1C: Impacts on wetland hydrological function	Low-Medium	Low

9. CONCLUSION

There seems to be a general trend of Low to medium sensitivity of the study site and a decrease of sensitive features to the western side, where residential areas seem to have taken place with higher intensities.

The extension of the substation must take special cognisance of the drainage lines which represents a threat to the integrity of habitats and freshwater resources if erosion processes continue or are exacerbated. Even though no protected plant and animal species were identified on the site, the site warrants a careful approach to development through keeping the lay-out and construction footprints to a minimum.

Other important recommendations which should be adhered to include the rehabilitation of the weed infested previously cultivated portions of the study site using erosion rehabilitation structures for the river banks and veld restoration techniques.

In general, the majority of the affected area can be reasonably rehabilitated which restores the area to grazing but emphasis should be given on the returning of the area to the original state before farming and mining which is the natural state. But the remaining untransformed portions should be afforded formal protection. As any activities and developments with its associated footprint and impacts can only be possible under strict environmental protection guidelines to ensure prevention of further habitat loss for present flora and fauna as it causes irreversible damage to high biodiversity ecosystems within the Bospoort Dam and any related wetland areas.

10. GLOSSARY

Alien species: Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity

Biodiversity: Biodiversity is the variability among living organisms from all sources including inter alia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Biome: A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.

Conservation: The management of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations.

Ecosystem: Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space.

Ecosystem services: Activities that help to maintain an ecosystem but are not directly part of energy flows and nutrient cycles. Examples include pollination, dispersal, population regulation, and provision of clean water and the maintenance of liveable climates (carbon sequestration).

Endangered: A taxon is endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.

Endemic: Occurring in a particular region, and nowhere else.

Environment: NEMA defines "environment" as "the surroundings within which humans exist and that are made up of the land, water and atmosphere of the earth; micro-organisms, plant and animal life; any interrelationships among and between them and the physical, chemical aesthetic and cultural properties and conditions that influence human health and well-being".

Forb: An herbaceous plant other than grasses

Habitat: Type of environment in which a plant or animal lives.

Indigenous: Any species of plant, shrub or tree that occurs naturally in South Africa

Invasive species: Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas

Rare species: Species, which have naturally small populations, and species, which have been reduced to small (often unstable) populations by man's activities.

Threatened species: Species, which have naturally small populations, and species, which have been reduced to small (often unstable) populations by man's activities.

Red Data: A list of species, fauna and flora that require environmental protection. Based on the IUCN definitions.

Soil: A mixture of organic and inorganic substances, the composition and structure of the latter is derived from the parent rock material. Soil also contains bacteria, fungi, viruses and micro-arthropods, nematodes and worms.

Species diversity: A measure of the number and relative abundance of species (see biodiversity).

Species richness: The number of species in an area or habitat.

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

REFERENCES

Chutter, FM. 1998. Research on the rapid biological assessment of water quality impacts in streams and rivers. Report to the water research commission by Environmentek, CSIR, and WRC report No 422/1/98. Pretoria: Government printer

Dallas HF. 2007. The effect of biotope-specific sampling for aquatic macro invertebrates on reference site classification and the identification of environmental predictors in Mpumalanga, South Africa. African Journal of Aquatic Science 32(2) pp.165-173

Davies B. and **Day J.** 1998. Vanishing waters. University of Cape Town Press. Rondebosch, Cape Town, South Africa.

Davis, B. and Day, J. (1998). Vanishing waters. University of Cape Town Press, Cape Town, South Africa.

Department of Water Affairs (DWA). 1999. South Africa Version *1.0 of Resource Directed Measures for Protection of Water Resources,* [Appendix W1]

Department of Water Affairs (DWA). 1996. South African water quality guidelines vol. 7, Aquatic ecosystems**.**

Department of Water Affairs (DWA). 2005. "A practical field procedure for identification and delineation of wetlands and riparian areas.

Department of Water Affairs and Forestry (DWA). 1999. South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, [Table G2].

Department of Water Affairs and Forestry (DWA). 1999. South Africa. Version 1.0 of Resource Directed Measures for Protection of Water Resources.

Department of Water Affairs and Forestry (DWAF), 2003. A practical guideline procedure for the identification and delineation of wetlands and riparian zones.

Department of Water Affairs and Forestry (DWA). 1999. South Africa. Version 1.0 of Resource Directed Measures for Protection of Water Resources, [Appendix W3].

Department of Water Affairs and Forestry, 2007. External Guideline: Generic Water Use Authorisation Application Process.

Dickens, C. & Graham, M. 2001. South African Scoring System (SASS) version 5. Rapid bio assessment for rivers May 2001.CSIR. http://www.csir.co.za/rhp/sass.html

Dini, J; Cowan, G & Goodman, P. 1998. Proposed wetland classification system for South Africa. First Draft: DWAF, Version 1.0.

Directorate Water Resource Classification. Department of Water Affairs, South Africa, 2011. CLASSIFICATION OF SIGNIFICANT WATER RESOURCES IN THE OLIFANTS WATER MANAGEMENT AREA (WMA 4): Integrated Units of Analysis (IUA) Delineation Report. Report No: RDM/WMA04/00/CON/CLA/0311

Gerber, A & Gabriel, MJM. 2002. Aquatic Invertebrates of South African Rivers. First Edition. Department of Water Affairs: Pretoria, South Africa.

Kleynhans C.J. 1999. A procedure for the determination of the ecological reserve for the purposes of the national water balance model for South African River. Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria

Kleynhans C.J. 2008. River Eco-classification manual for ecosatatus determination (version 2): Module D – Volume 1 fish reponse assessment index (FRAI). Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria.

Kotze D.C., Hughes J.C., Breen C.M. and Klugg J.R. 1994. *The development of a wetland soils classification system for KwaZulu/Natal*. Report to the Water Research Commission by the Institute of Natural Resources and Department of Grassland Science, University of Natal, WRC Report No 501/4/94.

Kotze, D.C. and Marneweck, G.C. 1999. Guidelines for delineating the boundaries of a wetland and the zones within a wetland in terms of the South African Water Act. As part of the development of a protocol for determining the Ecological Reserve for Wetlands in terms of the Water Act Resource Protection and Assessment Policy Implementation Process. Department of Water Affairs and Forestry, South Africa.

Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N.B. 2005. WET-EcoServices – A technique for rapidly assessing ecosystem services supplied by wetlands.

Kotze, D.C., Marneweck, G.C., Batchelor, A.L, Lindley, D.S. and Collins, N.B. 2005. A rapid assessment procedure for describing wetland benefits. Mondi Wetland Project Marneweck, G.C. and Batchelor, A.L. 2002. *Wetland inventory and classification*. In: Palmer, R. W., Turpie, J., Marneweck, G.C. and Batchelor, A.L. (Eds). *Ecological and Economic Evaluation of Wetlands in the Upper Olifants River Catchment*. Water.

McMillan, PH. 1998. *An integrated habitat assessment system (IHAS v2) for the rapid biological assessment of rivers and streams*. A CSIR research project. Number ENV-P-I 98132 for the water resources management programme. CSIR.

National Environmental Management Act (NEMA) 107 of 1998.

National Water Act 36 of 1998. Section 21(c) and (i).

Palmer, R.W.; Turpie, J.; Marneweck, G.C. and Batchelor, **A.L**. (Eds). 2002. Ecological and Economic Evaluation of Wetlands in the Upper Olifants River Catchment. Water Research Commission Report No K5/1162.

Research Commission Report No K5/1162.

Shaw, **P . A .** 1988. Lakes and Pans. In: Moon, B.P. & Dardis, G.F. (Eds) The Geomorphology of Southern Africa. Southern Book Publishers.

South African Biodiversity Institute (SANBI). 2009. Further development of a proposed National wetland Classification System for South Africa. Primary Project Report. Prepared by The Freshwater Consulting group, authors, Ollis, D.; Macfarlane, D.; Job, N.; Sieben, E.; and Snaddon, K.

South African National Biodiversity Institute: BGIS: www.bgis.sanbi.org.

Thirion, C, Mocke, A & Woest, R. 1995. Biological Monitoring of Streams and Rivers Using **SASS 4: A User Manual**. Institute for Water quality Studies, Department of Water Affairs and Forestry. Pretoria. Report No. N0000/REQ/1195.