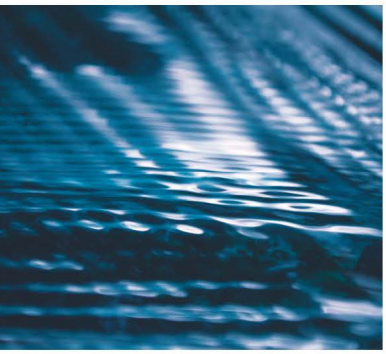
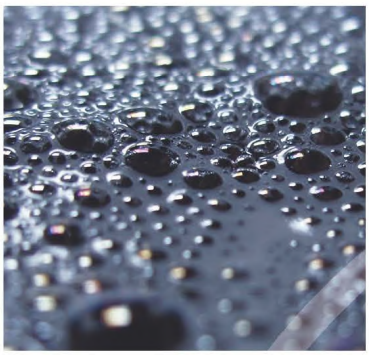
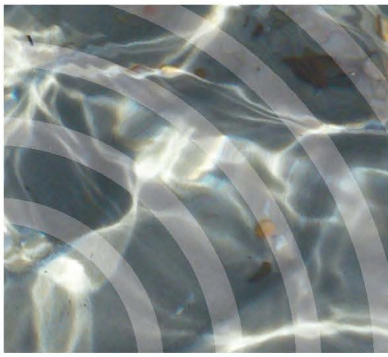


Savannah Environmental (Pty) Ltd:
Wetland Delineation Study for
Tshivhaso Power Plant
April 2016





M²ENCO

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Title:

Wetland Delineation Study for the proposed Tshivhaso Power Plant located on the farm Graaffwater 456 JR near Lephalale, Limpopo Province

Client:

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Report Number:	WET/V1/TSHIVHASO/2016/03
Report Date:	April 2016

EXECUTIVE SUMMARY

The proposed development of the Tshivhaso Coal Fired Power Plant on the farm Graaffwater 456 has the risk to potentially impact on a wetland area that is located within the vicinity of the study area. In order to determine the extent of the wetland within the project area, Savannah Environmental (Pty) Ltd appointed M² Environmental Connections (hereafter referred to as Menco) to conduct a wetland investigation on the farm Graaffwater 456 JR. The objective of the wetland study is to assist the Tshivhaso Coal-Fired Power Plant Project with appropriate planning in order to minimise the risk on the receiving environment.

According to the South African National Biodiversity Institute's (SANBI) Atlas for Freshwater Ecosystem Priority Areas (2011), the project area is not situated within a FEPA with regards to the rivers and wetlands found in the A42J quaternary catchment that forms part of the Limpopo Water Management Area.

The inland watercourse linked to the wetland is a diffuse drainage pathway that forms part of an unnamed tributary of the Mokolo River. The diffuse drainage pathway originates from wilderness area where rainwater is dispersed by means of sheet flow discharges runoff in a north eastern direction towards the Mokolo River. The field survey revealed that the wetland soils are seasonally waterlogged, although a patch of permanently waterlogged soils was encountered at a pan situated central to the sub-catchment. Due to normal seasonal fluctuation the pan was dry.

The wetland falls within the Waterberg Mountain Bushveld Eco Region and described as Central Sandy Bushveld. Based on the hydro-geomorphic setting, the wetland on portion 2 of the farm Eendragpan 451 is a depression type wetland.

The field survey was conducted during the autumn period and therefore the identification of wetland plants was difficult in some cases. Obligatory as well as facultative wetland plants are present in the wetland. The obligatory wetland plants are associated with the areas where permanently waterlogged soils are present. The PES for the Eendrag Pan wetland is a Class B (Largely Natural), with the overall classification in terms of the EIS stated as High. This is indicative of the fact that the Wetland is considered of regional and local importance with several wetland functions still intact. It needs to be noted that a moderate change in ecosystem processes and loss of natural habitat and biota has occurred within the proposed project area contributing towards reduced wetland functionality.

A water use authorisation in terms of section 40 of the National Water Act, Act 36 of 1998 for the section 21(c) and (i) uses must be considered for the proposed power generation development, as it encroaches within the 500 meter buffer zone.

ABBREVIATIONS

ADI	Area of Direct Impact
AII	Area of Indirect Impact
DEAT	Department of Environmental Affairs and Tourism
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EMPR	Environmental Management Programme Report
GIS	Geological Information System
GN	Government Notice
Ha	hectare
I&AP	Interested and Affected Party
Km	Kilometer
km^2	square kilometer
m^2	square meters
m^3	cubic meters
Mbgl	metres below ground level
Menco	M2 Environmental Connections (Pty) Ltd
MPRDA	Mineral and Petroleum Resources Development Act, 2002
NEMA	National Environmental Management Act, 1998
NFEPA	National Freshwater Ecosystem Priority Area
NGO	Non-Government Organisation
NWA	National Water Act, 1998
NWRS	National Water Resource Strategy
PES	Present Ecological State
REC	Recommended Ecological Class
SANBI	South African National Biodiversity Institute
SR	Significance Rating
TWQR	Target Water Quality Range
WULA	Water Use License Application

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Declaration of Independence

I declare that I, Johan Maré, act as the independent specialist for the wetland assessment of this application. I conduct assessments in an objective manner, even when the views and findings might not be favourable to the Applicant. I have the expertise to conduct the assessment and will comply with the Act, regulations and other applicable legislation. I do not have conflicting interests in the undertaking of the activity. I undertake to disclose all material information in my possession that has or may have the potential of influencing any decision to be taken in respect to the application.

Signature of Specialist	
Name of Company	**M2 Environmental Connections (Pty) Ltd (MENCO)**
Date	**22 March 2016**

1. INTRODUCTION

Wetlands are widely recognised as being some of the richest and most productive ecosystems on the planet. Wetlands are protected by Law in South Africa (National Water Act, 1998 (Act 36 of 1998), which 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".

Cennergi (Pty) Ltd is proposing the construction of a coal-fired power station on a site near Lephalale in the Limpopo Province. The power station would have a capacity of up to 600MW. The project is to be known as the Tshivhaso Coal-fired Power Plant. The main infrastructure for the proposed power plant is inclusive of but not limited to the following facilities:

- Office, maintenance area and access roads;
- Coal storage areas and bunkers;
- Coal mill (for grinding the coal into fine material);
- Pipeline for water supply as raw water is expected to be available from the allocation to Exxaro Coal from the Mokolo-Crocodile Water Augmentation Project (MCWAP) Phase 2;
- Coal loading and offloading areas, as well as conveyor belts;
- Power plant production unit/s (boilers / furnaces, turbines, generator and associated equipment, control room);
- Ash dump;
- Water infrastructure such as Raw-Water Storage Dam, purification works and reservoirs;
- A substation; and
- An overhead power line to connect into the Eskom grid.

The development of the power plant is considered in terms of various farms that host sensitive habitats. It is therefore required that the necessary Wetland Assessments be conducted in order provide information on the legal requirements of such activities.

The proposed Tshivhaso Power Plant Project is situated approximately 26 km outside the town of Lephalale, northbound on the R510 route. The locality of the wetland in relation to the project area is depicted in **Figure 1-1**.

The SANBI NFEPA Wetlands as shown in Figure 1-2 were used to determine whether any wetlands of National Importance are found within the region. Based on the locality of wetlands in the area the initial assessment study was conducted during March 2016 and stretched over the adjacent properties and specifically portions of the farm Eendragtpan

451, on which the identified wetland is situated. On a regional scale wetlands of both high and low significance are found within the catchment of the Tshivhaso Power Plant Project. Excluding Eendragtpan, all of these cluster wetlands are situated more than 500 meters away from the project area.

Table 1-1: Farm portions considered as alternatives for infrastructure development

Farm Property Description	Proposed Infrastructure
Graaffwater 456	Power plant (Option 1)
Graaffwater 456	Power plant (Option 1)
Graaffwater 456	Power plant (Option 1)
Graaffwater 456	Ashing facility
Remaining Extent of Appelvlakte 448	Ashing facility

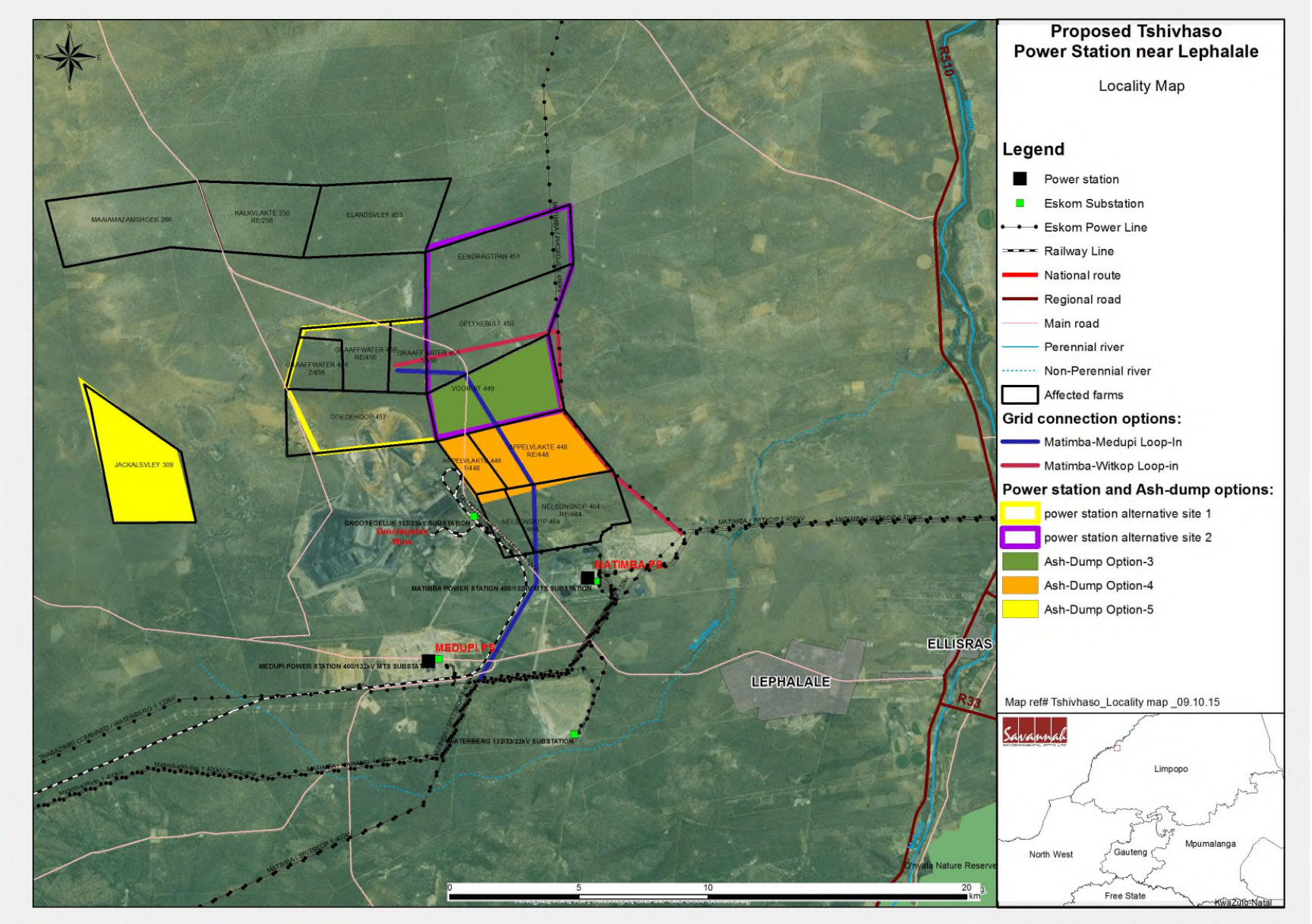


Figure 1-1: Locality Reference Map

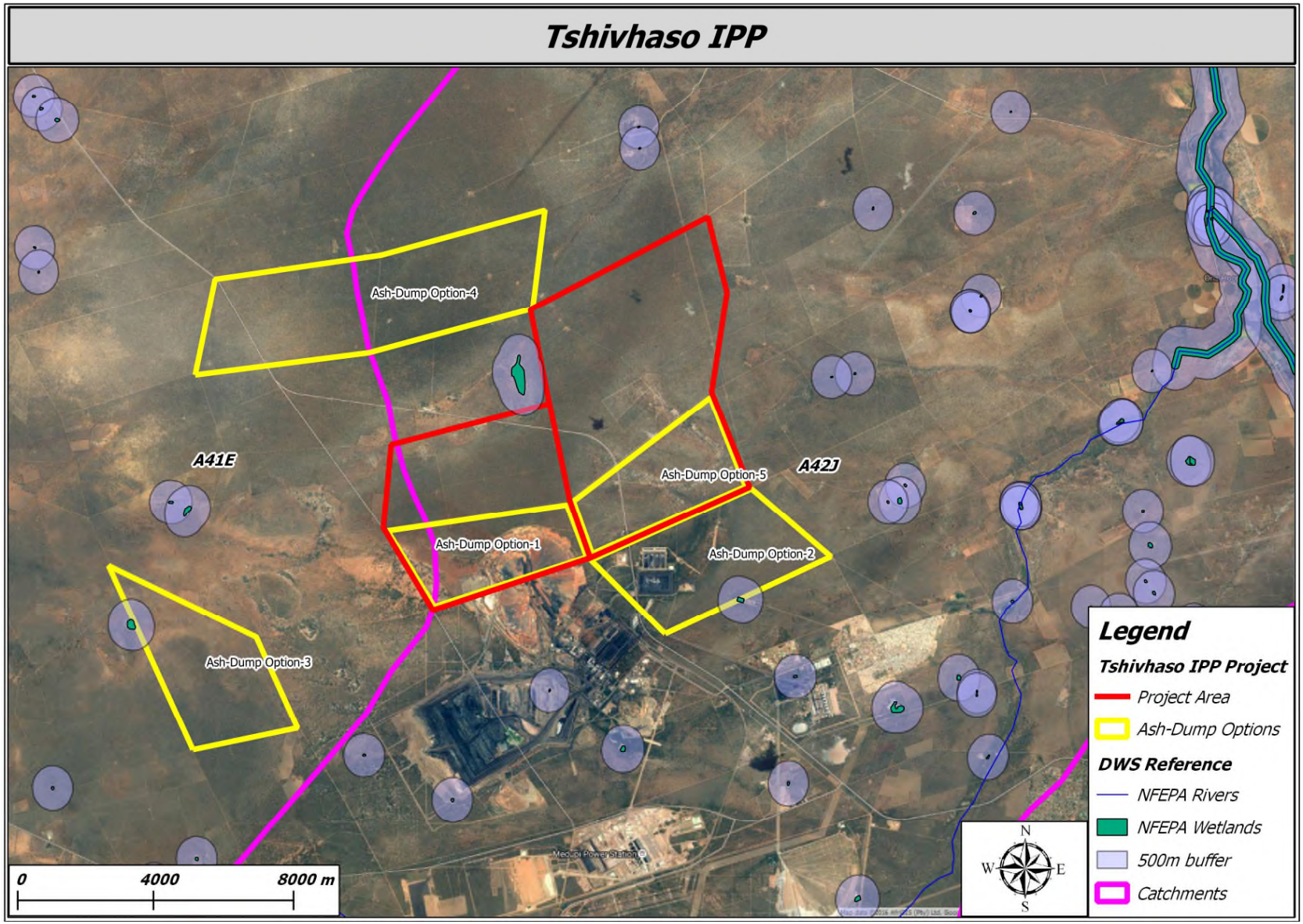


Figure 1-2: SANBI and NFEPA Wetlands in vicinity of the Project Area

2. TERMS OF REFERENCE

Savannah Environmental (Pty) Ltd (hereafter Savannah) was appointed by Cennergi (Pty) Ltd (hereafter Cennergi) to conduct the necessary studies for the Tshivhaso Coal-Fired Power Plant Project and gather all the necessary information needed for the required environmental authorisations. Savannah thereafter appointed M² Environmental Connections (Pty) Ltd (hereafter Menco) to conduct the wetland assessment.

This wetland study was conducted in order to:

- Delineation of areas classified as wetlands;
- Characterization of the wetland units within the project area;
- Identification of wetland vegetation;
- Description of the wetland health;
- Functionality and current status of the delineated wetlands; and
- Identify practicable mitigation measures to reduce negative impacts on the wetland(s) and indicate how these can be implemented.

It was further stated by the client that the specialist studies considers the recommendations regarding available Options made during the Scoping Phase being:

- The power station and ash facility to be established on the Farm Graaffwater site alternative 1 is regarded as the preferred option;
- The ashing facility to be established on the farm Appelvlakte as the preferred alternative site (Option 2) also to be assessed as part of the Environmental Impact Assessment phase; and
- Power line alternative 2 considered the preferred option as sensitive areas are avoided.

3. DOCUMENT LIMITATIONS

In order to obtain definitive data regarding the biodiversity, hydrology and functioning of particular wetlands, studies should ideally be conducted over a number of seasons and over a number of years. This is particularly relevant for the assessment of Ecological Importance and Sensitivity of the wetland which should ideally be informed by multiple biodiversity studies.

However, cost implications and time constraints prevent such long-term studies, and the study therefore relied on information gained during field surveys conducted on 28 March 2016 and 4 August 2016, desktop information for the area, information obtained from provincial conservation authorities and similar organisations, as well as professional judgement and experience gained during similar assessments.

Based on the above statement this particular study has the following limitations:

- This wetland assessment only outlines wetlands directly related to the study area and does not include wetlands outside the scope of work;
- Many other wetlands are found within the drainage of the Mokolo River and its tributaries and are not included in this wetland assessment;
- Wetlands as indicated by the latest SANBI GIS database are indicated in Figure 1-2
- and may or may not align to every extent of the desktop delineation and field delineation conducted as part of this study.
- The buffer zones indicated in are only applicable to the delineated wetland for this study and does not include buffer zones for other wetlands within the area as indicated by the desktop delineation and the SANBI GIS Database for wetlands of national priority.

4. LEGAL ASSESSMENT

As prescribed in Government Notice No. 1199 dated 18 December 2009 "Replacement of General Authorization in terms of Section 39 of the National Water Act, 1998 (Act 36 1998)" for Section 21(c) and (i) water uses, some of the water uses excluded from the GN No. 1199 are related to wetlands and are:

> 6. *This Notice does not-*
> *a) apply to the use of water in terms of section 21(c) and (i) for the rehabilitation of a wetland;*
> *b) apply to the use of water in terms of section 21(c) and (i) within a 500 meter radius from the boundary of any wetland.*

According to the National Water Act, 1998 (Act 36 of 1998) a watercourse refers to:

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 watercourse, and a reference to a watercourse includes, where relevant, its bed and banks;*

In the case that any of the above mentioned activities should or would potentially take place within the 1:50 year flood line or 100m horizontal distance of a watercourse, the following water uses are triggered and a formal application for a water use license need to be applied for:

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

Any construction activities therefore located within 500m of a wetland boundary thus need to be authorized as a water use in terms of Section 21(c) and (i) by means of a License in terms of section 40 of the NWA.

Please refer to Table 4-1 for a comprehensive summary on legislation applicable to wetland protection.

Table 4-1: Legislative framework for Wetland Protection

Legal Instrument	Purpose	Relevance
South African Constitution 108 of 1996 (Act 108 of 1996)	The Constitution is the supreme law of the land and includes the Bill of rights which is the cornerstone of democracy in South Africa and enshrines the rights of people in the country. It includes the right to an environment which is not harmful to human health or well-being and to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures.	The importance of promoting conservation of important areas such as Ramsar/NFEPA sites is recognized in the constitution. The environmental right also provides an obligation to prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development. This provides a strong basis for securing the long-term conservation of Ramsar/NFEPA sites for future generations.
National Environmental Management Act 107 of 1998	The Act includes a set of environmental principles which further concretise the environmental right contained in the Constitution. The 18 Principles and 8 sub-principles address a wide range of aspects and apply to all organs of state. This includes the need to pay particular attention in management and planning to wetland resources, in areas prone to development pressure.	Given the importance of Ramsar/NFEPA sites, it is imperative that development activities with a potential impact on these sites are undertaken in such a manner that impacts to Ramsar/NFEPA sites are avoided, or where they cannot be altogether avoided, are minimized and remedied. In this regards, NEMA provides the legislative backing (including Impact Assessment Regulations) for regulating development and ensuring that a risk-averse and cautious approach is taken when making decisions about activities with a potential impact on Ramsar/NFEPA sites. It also obligates anyone who causes significant pollution or degradation of the environment to take reasonable steps to ensure that further degradation is prevented or minimized.
The National Water Act, 1998 (Act 36 of 1998)	The purpose of the Act is to ensure that the nation's water resources are used, developed, conserved, managed and controlled in ways which ensure that basic human needs are met, equitable access to water is promoted and aquatic ecosystems and their biological diversity is adequately protected.	The NWA provides the legislative backing for protecting water resources, including wetland systems. This therefore supports actions required to safeguard or protect Ramsar/NFEPA sites from impacts to water resources. A key focal area of the act is the implementation of water management and protection strategies to ensure that water resources are sustainably managed. Key aspects here include (i) the classification of water resources; (ii) setting of resource quality objectives; (iii) determining and giving effect to the Reserve; (iv) 'duty of care' to ensure that water resources are not polluted and (v) control

Legal Instrument	Purpose	Relevance
		of emergency incidents. Requirements under the Act can therefore provide considerable support to management of Ramsar/NFEPA sites, particularly where such sites are threatened by poor water resource management. Water use is also strictly regulated under the Act whilst while systems for monitoring of water resources are also prescribed.
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)	The Biodiversity Act provides for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act.	The South African National Biodiversity Institute is established by this Act and is responsible for coordinating and implementing programs such as Working for Wetlands and Working for Water. These programs can provide considerable support to management of Ramsar/NFEPA sites where rehabilitation or control of alien invasive species is problematic. A three-tier hierarchy of plans is also catered for, providing for both spatial and strategic management planning. Of particular relevance, is Biodiversity Management Agreements (BMA) to implement any Biodiversity Management Plan. This is intended to formalise the emerging relationships between government and landowners and communities, but remains an adaptable and flexible option. This conservation option may very well be a vital means of making landowners responsible for managing sections of Ramsar/NFEPA sites eligible to receive assistance from government for land management in future.
Conservation of Agricultural Resources Act, 1967 (Act 43 of 1967)	The purpose of the Act is to control the utilization of the natural agricultural resources of the Republic (including wetlands) in order to conserve the soil, water sources and vegetation and the combating of weeds and invader plants.	Despite little agriculture typically taking place within Ramsar/NFEPA sites, the Act does provide for the Minister to prescribe control measures for the utilization and protection of water resources, including wetlands and the restoration and reclamation of eroded land. Directives issued under this Act may therefore be used to protect and rehabilitate wetland areas.
National Environment Management Act: Protected Areas Act, 2003 (Act 57 of	This Act provides for the protection and conservation of ecologically viable areas	For Ramsar/NFEPA sites declared as Protected Areas, the Act details requirements for the

Legal Instrument	Purpose	Relevance
2003)	representative of South Africa's biological diversity and its natural landscapes and seascapes. It also seeks to provide for the sustainable utilization of protected areas and to promote participation of local communities in the management of protected areas.	management of such areas. This includes various requirements related to management planning and development of a management plan. This includes (i) the need for consultation in preparing a management plan; (ii) the need to take account of integrated development plans of relevant municipalities; (iii) aspects to be included in the management plan. Other aspects such as monitoring and supervision, access control and restrictions relevant to protected areas are also addressed in the Act. For Ramsar/NFEPA sites not yet declared as Protected Areas, the Act provides the vehicle for improving the protection status of such areas in order to further strengthen their protection status.
National Heritage Resources Act, 1999 (Act 25 of 1999)	This legislations aims to promote good management of the national heritage resources, and to enable and encourage communities to nurture and conserve their legacy so that it may be bequeathed to future generations.	This Act provides for the protection and management of heritage resources. This includes the establishment of provincial heritage resources authorities who are responsible for management of heritage resources within each province. Such authorities may provide advice and assistance in managing heritage resources within Ramsar/NFEPA sites.
National Policies and plans		
National Spatial Biodiversity Assessment (NSBA)	The National Spatial Biodiversity Assessment (NSBA) represents South Africa's first national assessment of spatial priorities for conservation action, integrating terrestrial, river, estuarine and marine ecosystems, using available spatial data, biodiversity planning software and a series of expert and stakeholder workshops	The assessment highlights the poor implementation of catchment management planning in South Africa, owing to fragmented institutional arrangements, confusion about overlapping jurisdiction and areas of responsibility, and lack of appropriate management strategies that bring wetlands to the fore in the water and natural resource sectors. This highlights the importance of ensuring that catchment management issues are incorporated into management planning for Ramsar/NFEPA sites.
Strategic Framework for Sustainable Development in South Africa	The development of a broad framework for sustainable development was initiated to provide an overarching and guiding National Sustainable Development Strategy. The Draft Strategic Framework for Sustainable Development (SFSD)	Biodiversity has been identified as one of the key crosscutting trends in the SFSD. The lack of sustainable practices in managing natural resources, climate change effects, loss of habitat and poor land management practices were

Legal Instrument	Purpose	Relevance
	in South Africa (September 2006) is a goal orientated policy framework aimed at meeting the Millennium Development Goals.	raised as the main threats to biodiversity.
The National Water Resources Strategy (DWS, 2013)	The Second Edition of the National Water Resource Strategy (NWRS) describes how the water resources of South Africa will be protected, used, developed, conserved, managed and controlled in accordance with the requirements of the policy and law.	Chapter 5 of the NWRS recognized the importance of wetlands and the need for protection of riparian and wetland buffer areas as well as critical groundwater recharge areas.

5. DESKTOP FINDINGS

5.1 BACKGROUND

According to the South African National Biodiversity Institute's (SANBI) Atlas for Freshwater Ecosystem Priority Areas (2011), the project area is not situated within a FEPA with regards to the rivers found in the A42J quaternary catchment (refer Figure 1-2).

From the SANBI GIS database all the wetlands identified near the proposed Tshivhaso Power Plant area are classified within the Central Sandy Bushveld vegetation group. The wetland on the farm Graaffwater 456 is delineated as depression type wetland. As per recommended wetland delineation methodology all information resources available for decision making regarding the extent of wetlands associated with the study area will be utilized i.e. SANBI GIS Database, desktop delineation and field delineation.

Most of the Limpopo River Catchment falls within the Waterberg Eco region, (elevation of 700 to 900 mamsl), characterised by Lowlands, Hills and Mountains with Moderate and High Relief with numerous wetlands, and underlain the Vryheid formation Karroo Series sediments. Median annual simulated runoff per quaternary catchment varies from 10 to 250 mm. The coefficient of variation for annual simulated runoff per quaternary catchment varies between 20 and 35 % (Kleynhans *et al,* 1998).

5.2 HYDROLOGY

Surface water spatial layers such as the National Freshwater Ecosystems Priority Areas (NFEPA) Wetland Types for South Africa (SANBI, 2010) reflected the presence of several pans and perennial and non-perennial rivers.

The following rivers or their tributaries may be impacted by the Tshivhaso Power Plant activities:

- Mokolo River,
- Mogalakwena; and
- Lephalala

5.3 METHODOLOGY

The assessment was conducted as part of a three phase approach. The first phase consisted of a rapid desktop assessment. The second phase was conducted in field to gather data. The third phase consisted of a second desktop assessment by combining field data and desktop data.

1. Rapid desktop assessment:
    - Google Earth satellite imagery
    - Aerial photographs
    - GIS mapping software (Maverick and Quantum GIS)

2. Field assessment by identifying the presence of one (at least) or more of the following attributes:
    - Wetland/hydromorphic soils
    - Hydrophytes
    - High water table

3. Combining desktop data, field data and calculating the Wetland Index of Habitat Integrity (DWA, 2007) by using the following indices:
    - Present Ecological Status (PES)
    - Ecological Importance and Sensitivity (EIS)
    - Ecosystem Services supplied by wetland

The following sections deal with the Wetland Index of Habitat Integrity as performed as part of the third phase of the study approach.

5.4 LAND-USE

The proposed Tshivhaso Power Plant area is currently used for game (wildlife) and livestock farming. Portions thereof are already subject to anthropogenic development in terms of power generation (Matimba and Medupi Power Stations) as well as coal mining (Grootegeluk).

The wetland is on portion 2 of the farm Eendragtpan 451 as illustrated in **Figure 5-1.**

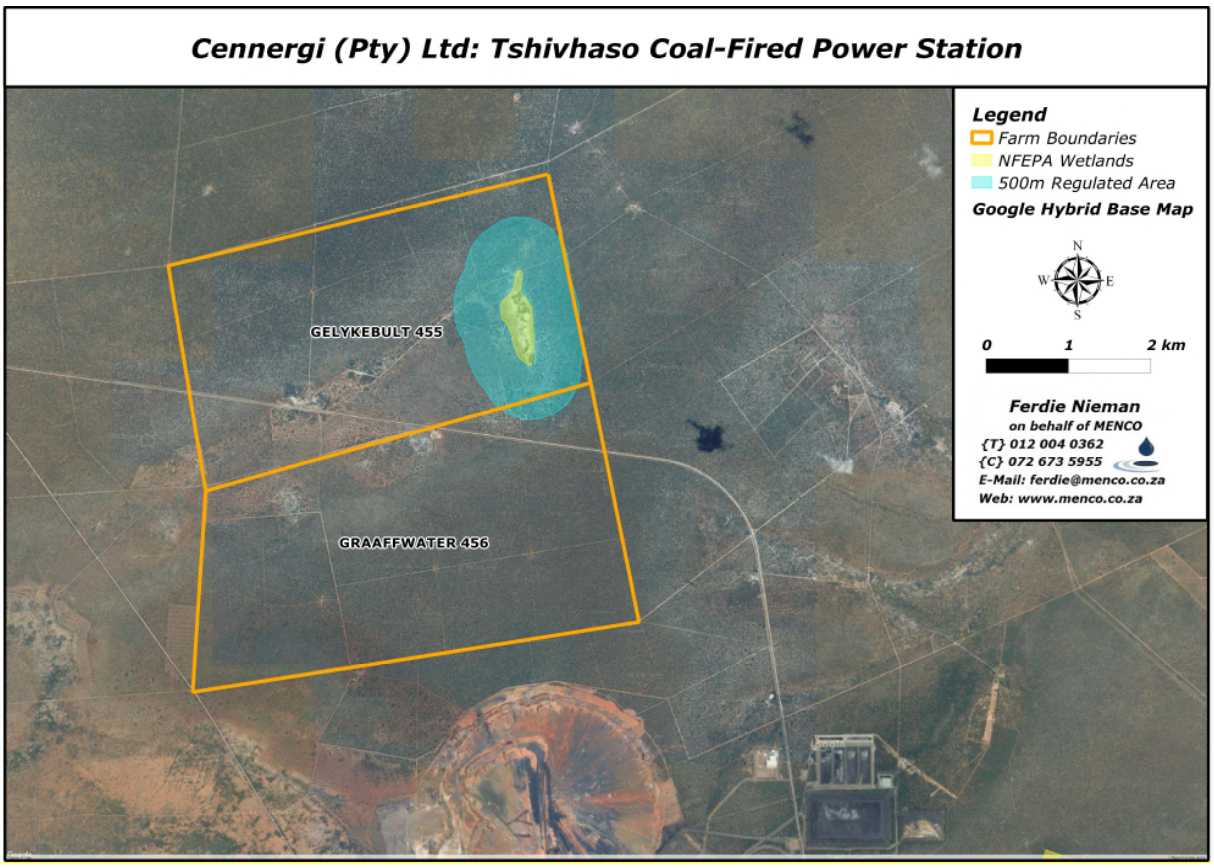


Figure 5-1: Locality of wetland on the farms Gelykebult & Graaffwater

5.5 BIOPHYSICAL DESCRIPTION

Climate

The area receives early to mid-summer rainfall that varies between 300 mm and 600 mm per year. The winters are dry with frost. The average midday temperatures for Lephalale range from 14.8°C in June to 32.1°C in January. The region is the coldest during June when the mercury drops to 2°C on average during the night (SA Explorer, 2010).

Regional Vegetation

The proposed Tshivhaso Power Plant project is situated within the Savanna Biome of South Africa (Rutherford & Westfall, 1994). The vegetation type is described as a well-developed grassy layer with an upper layer of woody plants. The Savanna Biome comprises mainly of 'nutrient rich' or 'nutrient poor' substrates. The nutrient poor savannas are characteristically broad-leaved and without thorns whilst the nutrient rich substrates are fine-leaved and thorny. Nutrient-rich savannas have a high grass layer productivity encouraging land use forms such as grazing. The savannah biome is generally regarded as the backbone of the wildlife and ecotourism industry.

The Savanna Biome can be divided into smaller units known as vegetation units. The Sweet Bushveld region of Limpopo Valley is an important habitat for several plant and

animal taxa (Emery *et al*. 2002). This vegetation type is regarded as not threatened (Least Threatened) with only 1% formally protected in conservation areas. Sweet Bushveld occurs on fertile soils in the dry and hot valleys and is further characterised by thorny, small leaved vegetation dominated by Acacia species.

The Mix Bushveld vegetation unit varies from an open tree savannah to a dense bushveld. The Tshivhaso Power Plant is situated within the Mix Bushveld vegetation unit (Mucina & Rutherford, 2006). The species composition of this vegetation unit comprises of broad-leaved Red Bushwillow and Silver Clusterleaf with grasses such as *Themeda triandra* (Red Grass), *Aristida congesta*, *Digitaria* species as well as *Tristachya leucothrix* and *T. rehmanni* (Mucina & Rutherford, 2006).

The landscape usually includes undulating plains that support short, dense grassland, scattered rocky outcrops with sour grasses and tree species such as *Acacia caffra* (Sweet Thorn), *Celtis africana* (White Stinkwood) and *Diospyros lycioides* subsp. *lycioides* (Blue Bush).

Due to urban development and agricultural pressure within Gauteng and Mpumalanga, the extent of this vegetation unit is becoming limited. Only a small portion of Eastern Highveld Grassland is conserved in statutory reserves like the Nooitgedacht Dam or in private reserves. Almost half of this vegetation type has been transformed by cultivation, plantation, mining and the building of dams and it is therefore classified as an endangered vegetation type (Mucina & Rutherford, 2006). Please refer to **Table 5-2** for the identified wetland vegetation species encountered during the field visit.

Table 5-1: Area Baseline Information

Biome	Savanna Biome	
Ecoregion	Central Bushveld Ecoregion	
Vegetation unit	Waterberg Mountain Bushveld	Central Sandy Bushveld
Landscape features	Plains and slightly undulating landscape. The grass layer is poorly developed with short closed woodland to tall open woodland.	Slightly to moderately undulating terrain with the stratum shorter and shrubbier compared to the Roodeberg Bushveld vegetation unit
Geology and soils	Mainly sandstone, conglomerate, siltstone and shale of the Kransberg and Matlabas	Area is underlain by gneisses and migmatites of the Hout River Gneiss (Randian

	Subgroups (Mokolian Waterberg Group). Mostly sandy soils, red-yellow apedal high base status, also dystrophic or mesotrophic.	Erathem) and the potassium-deficient gneisses of the Goudplaats Gneiss (Swazian Erathem). Soils include deep, greyish sands, eutrophic plinthic catenas, red-yellow apedal freely drained soils.
MAP (mm)	400 – 550 mm	350 - 550 mm
MAT (°C)	37.1°C (Nov) and 0.2°C (Jun)	36.5°C (Nov) and -0.8°C (Jun)
MFD	Frost fairly infrequent	Frost fairly infrequent
Status	Least Threatened	Least Threatened
MAP (mm): Mean Annual Precipitation; MAT: Mean Annual Temperature; MFD: Mean Frost Days; E: Endangered; V: Vulnerable; LC: Least Concerned		

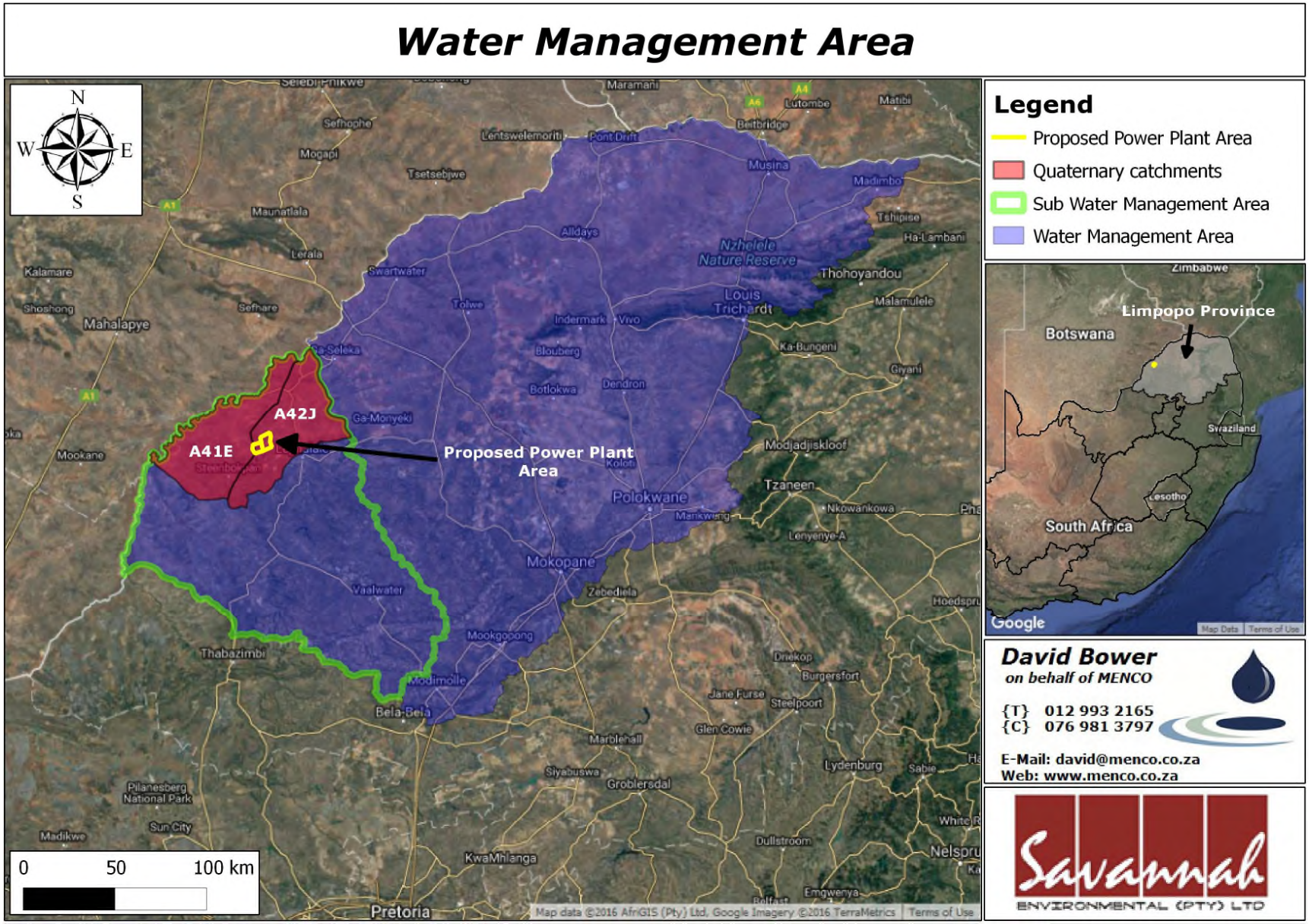


Figure 5-2: Limpopo Water Management Area

Table 5-2: Identified wetland vegetation at Graaffwater

Species	Common description	Comment
Riparian drainage line (Wooded)		
Combretum imberbe	Leadwood	ToPS List Protected
Ormocarpum trichocarpum	Caterpillar bush	
Chloris virgata	Feather-top chloris	
Schoenoplectus spp	Sedge	
Aloe greatheadii var. *davyana*	Spotted aloe	
Zinnia peruviana *	Redstar zinnia	
Vachellia permixta	Hairy acacia	
Ocimum americanum var. *americanum*	Wild basil	
Corbichonia decumbens	Sierkooltjie	
Wetland: Depression/Pan		
Acacia erioloba	Tall tree	Declining, Protected tree
A. mellifera	Small tree	
Euclea undulate	Shrub	Least Threatened
Clerodendrumternatum	Shrub (low)	
Cymbogon validus	Graminoid	Hydromorphic
Digitaria eriantha	Graminoid	
Eragrostis pallens	Graminoid	
E. superba	Graminoid	
Aristida congesta	Graminoid	

6. METHOD OF ASSESSMENT

6.1 WETLAND DELINEATION AND ASSESSMENT

6.1.1 Present Ecological Status

Wetland functionality is defined as a measure of the deviation of wetland structure and function from its natural reference condition. In the current assessment the hydrological, geomorphological and vegetation integrity was assessed for the wetland unit associated with Heuvelfontein in order to provide a Present Ecological Status (PES) score. The health categories used to describe the integrity of wetlands are contained in **Table 6-1**.

Table 6-1: Health categories used for describing Wetlands (WET-Health)

Description	Class Boundary	Health Status
Unmodified natural	>4	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place	>3 and <=4	B
Moderately modified. A moderate change in ecosystem and loss of natural habitats has taken place but the natural habitat remains predominantly intact	>2 and <=3	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred	2	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	>0 and <2	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota	0	F

The present Ecological status (PES) method (DWAF, 1995) was used to establish the integrity of the wetland located on Heuvelfontein 215 IR. This method is based on the modified Habitat Integrity Approach developed by Kleynhans (DWAF, 2005). Anthropogenic modification of the criteria and its attributes can have an impact on the ecological integrity of the wetland as contained in **Table 6-2**.

Table 6-2: Habitat Integrity Assessment criteria for wetlands

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

Attributes above are rated and scored as one of the following:					
Natural/unmodified	5	Largely natural	4	Moderately modified	3
Largely modified	2	Seriously modified	1	Critical modified	0

The PES of the wetland was based on the available information for each criterion listed in **Table 6-2** and the mean score determined (refer **Table 6-3**). This methodology is based on the assumption that extensive degradation of any wetland attributes may determine the PESC (DWAF, 2005).

6.1.2 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) assessment was conducted according to the guidelines as prescribed by the Department of Water and Sanitation (DWAF, 1999). In this guideline DWS defines "ecological importance" of a water resource as an expression of its importance to the maintenance of ecological diversity and function on local and wider scales (regional, national). Ecological sensitivity refers to the system's ability to resist disturbance and its capability to recover disturbance once it has occurred.

In the method outlined by DWS a series of determinates for EIS are assessed for the wetlands on a scale of 0 to 4 (refer **Table 6-3**), where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to determine the EIS of the wetland unit (refer Table 6-4).

Table 6-3: Score sheet for determining EIS

Primary determinants
• Rare and endangered species
• Species/taxon riches
• Diversity of habitat types or features
• Migration route/breeding and feeding site for wetland species
• Sensitivity to change in the natural hydrological regime
• Sensitivity to water quality changes
• Flood storage, energy dissipation and particulate/element removal
Modifying determinants
• Protected status
• Ecological Integrity

Table 6-4: Ecological Importance and Sensitivity categories

Range of median	EIS Category	Category description
>3 and <=4	Very High	Wetlands that are considered ecologically important and sensitive on a national scale. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. Play major role in moderating the quantity and quality of water in major rivers.
<2 and <=3	High	Wetlands that are considered to be ecological important and sensitive. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. Play a role in moderating the quantity and quality of water in major rivers.
>1 and <=2	Moderate	Wetlands that are to be considered to be ecological important and sensitive. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. Play a small role in moderating the quantity and quality of water in major rivers.
>0 and <=1	Low/Marginal	Wetlands that are not ecological important and sensitive at any scale. The biodiversity of these wetlands are ubiquitous and not sensitive to flow and habitat modifications. Play an insignificant role in moderating the quantity and quality of water in major rivers.

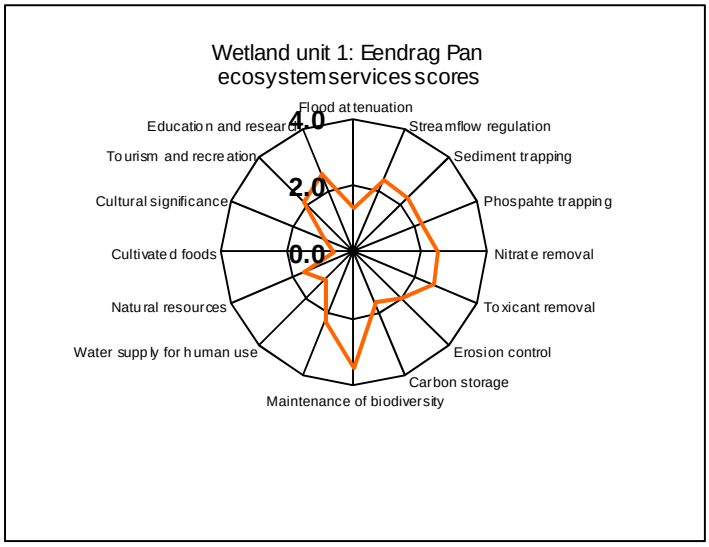
6.1.3 Ecosystem Services supplied by the Wetland

The assessment of the ecosystem services supplied by the identified wetland units was conducted according to the guidelines as described by Kotze et al (2005). A level 2 assessment was undertaken which examines and rates *Natural* as well as *Human* Services.

The following natural services were assessed by means of the Wetland Assessment Datasheet (WetTool):

- Flood attenuation
- Stream flow regulation
- Sediment trapping
- Phosphate trapping
- Maintenance of biodiversity
- Nitrate removal
- Toxicant removal
- Erosion control
- Carbon storage

Ecosystem Services Graph



Scores for each of the above natural services assessment were allocated a class as outlined in **Table 6-5**. These scores were then added to determine the overall level of natural services for the wetland unit using the classes in **Table 6-6**.

Table 6-5: Classes for service scores

Class Boundary	Class Score
0 – 0.99	1
1 – 1.99	2
2 – 2.99	3
3 – 4	4

Table 6-6: Classes for the overall level of natural services provided by a wetland unit

Class Boundaries	Class	Class description
30 – 36	Very high	Unmodified, natural condition
24 – 29.9	High	Largely natural with few modifications
18 – 23.9	Moderate	Moderately modified, but with some loss of natural habitats
12 – 17.9	Low	Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred

6 – 11.9	Very low	Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive
0 - 5.9	Non existent	Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

The following human services indicators were assessed:

- Water supply for human use
- Natural resources
- Cultivated foods
- Cultural significance
- Tourism and recreation
- Education and research

Scores for each of the above human services assessments were allocated a class as outlined in **Table 6-6**. These scores were then added to determine the overall level of human services for the wetland unit using the classes as shown in **Table 6-7**.

Table 6-7: Classes for overall level of human services provided by wetland unit

Class Boundaries	Class	Class description
20 -24	Very high	Local people are extremely dependent on the wetland and benefit from it greatly
16 – 19.9	High	Local people have a high level of dependence on the wetland and benefit from it considerably
12 – 15.9	Moderate	Local people are moderately dependent on the wetland and benefit from it occasionally
8 – 11.9	Low	Local people have a low dependency on the wetland and seldom benefit from it
4 – 7.9	Very low	Local people rarely rely on the wetland and almost never benefit from it
0 – 3.9	Non existent	Local people have no interaction with the wetland and never receive benefits from it.

6.2 RESULTS

The project area is located in the A42J quaternary catchment (Limpopo Water Management Area). The project area is located at the head waters of the Mokolo River system on the watershed between the A42J and A41E catchments. The watercourse linked to the wetland is a diffuse drainage pathway within the catchment of an unnamed tributary to the Sandloop. The PES and EIS (desktop) conducted by the former Department of Water Affairs (2011) for the main tributaries are:

- Mokolo River: PES Class C (Moderately Modified) and EIS Moderate
- Limpopo River: PES Class C (Moderately Modified) and EIS Moderate

Table 6-8: Summarised results for depression wetland at Eendragt

Quaternary	Coordinates	Wetland	PES	EIS	Confidence	REC
A42J	Start 23°35'8.41"S 27°31'56.51"E End 23°35'40.06"S 27°32'0.87"E	Depression	B	High	High	B

Based on the hydro-geomorphic setting, a depression type wetland was identified in the project area. The hydrological benefits from this wetland are indicated in **Table 6-9**. The depression is surrounded by wilderness and is maintained by sheet flow originating on adjacent sub-catchments that feeds into the depression system. Flow within this wetland is predominantly sub-surface and surface flow is generated as a result of rainfall events. It is expected that the flows will be of low energy due to the flat slope of the wetland and the fact that the landscape is covered by natural vegetation preventing the formation of a channel in the system.

The depression wetland is a typical seasonal wetland system and only has surface water resembling a pan during the wet season. **Figure 6-1** shows the outline of the pan situated within the Eendragt wetland system. It will be required to conduct a follow-up visit during the wet season in order to verify the existence of surface water. If the existence of an open water system is validated, water quality data needs to be obtained to provide additional baseline information on the depression wetland in order to ensure a more accurate description of the PES of the system.

Figure 6-1: Dry pan within the Eendragt wetland system

The field survey has also revealed that the wetland soils at several auger points fluctuated from being permanently waterlogged to seasonal mottling. PES for the Eendragt wetland is Class B (largely natural). The overall classification in terms of the EIS is High, indicating that the wetland is considered of Local Importance. The summarised results are contained in Table 6-9 and Table 6-10.

Table 6-9: Hydrological benefits provided by identified wetland units

Wetland	**Generic Hydrological benefits provided by the wetlands**							
Hydro-Geomorphic Type	Flood attenuation		Stream flow regulation	Erosion control	Sediment trapping	PO_4	NO_3	Toxicants
Depression	Early wet Season	Late wet Season						
	0	0	+	+	+	++	++	+
Rating	0 + ++	Benefit unlikely to be provided to any significant extent Benefit likely to be present at least to some degree Benefit very likely to be present (and often supplied to a high level)						

Table 6-10: PES, EIS, Hydro-functional Importance and Direct Human Benefits

Wetland	PES	EIS			Eco services	
		Ecological Importance & Sensitivity	Hydro-Functional Importance	Direct Human Benefits	Natural	Human
Unit 1: Depression	3.3 Class B	3.5 Largely natural	2.3 High	1.5 Moderate	29.4 High	9.1 Low

The wetland delineation manual of South Africa (DWAF, 2005) considers four wetlands indicators in the delineation process namely:

1) terrain unit,
2) soil form,
3) soil wetness and
4) vegetation indicators

While a combination of the four indicators may be used in delineation, the soil wetness indicator is primary and vegetation indicator is confirmatory (DWAF, 2005). This criterion uses the soil forms in the Soil Classification of South Africa to delineate wetlands. The soil forms indicators in the permanent zone include the Champagne, Katspruit, Willowbrook and Rensburg forms. The existence of any of the four soil forms represents a wetland (DWAF, 2005). Please refer to **Figure 6-2** for a description of the wetland soils augured at the site.

Non-diagnostic bleached gleyed soil encountered at the periphery of the wetland. The soil was dry with faint orange oxidized iron oxide mottles present

Figure 6-2: Description of the wetland soil

7. IMPACT RISK ASSESSMENT

The main purpose of this wetland study is to understand the significance of potential impacts and to develop strategies to ensure that impacts can be minimised or mitigated to an acceptable level. The identification of potential issues is broad and covers the construction as well as the operational phase of the proposed project.

Issues or impacts of low significance will not be carried through to the Impact Assessment, with supporting reasons, to ensure that the Impact Assessment phase focuses on the potentially "significant impacts" identified for the proposed project. This section of the Report identifies the full range of potential impacts. No significant impacts were identified that should be investigated in detail in an Impact Assessment Phase.

7.1 IMPACT ASSESSMENT CRITERIA

The criteria for the description and assessment of environmental impacts on the wetland environment were provided by the DWS during the recent consultation process followed for proposed amendments to the regulations. This risk assessment key was referenced from the DWS risk based water use authorisation approach and delegated guidelines. The criteria were drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (DEAT, 1998) in terms of the NEMA.

The level of detail as depicted in the DWS Risk-Based Water Use Authorisation Approach and Delegation Guidelines was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. An explanation of the impact assessment criteria is defined below in
Table 7-1: Explanation of the EIA Criteria.

Table 7-1: Explanation of the EIA Criteria

Spatial Scale/Extent			
Classification of the physical and spatial scale of the impact How big is the area that the aspect is impacting on?			
DWS	**NEMA**	**Description**	**Class**
Area specific	Footprint (F)	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1
Whole site	Site (S)	The impact could affect the whole, or a significant portion of the site.	2
Regional / neighbourhood areas	Regional (R)	The impact could affect the area including the neighbouring farms,	3

		the transport routes and the adjoining towns.	
National	National (N)	The impact could have an effect that expands throughout the country (South Africa).	4
Global	International (I)	Where the impact has international ramifications that extend beyond the boundaries of South Africa.	5

Duration

The lifetime of the impact that is measured in relation to the lifetime of the proposed development.
How long does the aspect impact on the environment and resource quality?

DWS	NEMA	Description	Class
1 day – 1 month, PES, EIS and/REC not impacted	Short (ST)	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase.	1
1 month – 1 year, PES, EIS and/REC impacted but no change in status	Short to Medium(S-M)	The impact will be relevant through to the end of a construction phase (1.5 years)	2
1 year – 10 years, PES, EIS and/REC impacted to a lower status but it can be improved over this period through mitigation	Medium (M)	The impact will last up to the end of the development phases, where after it will be entirely negated.	3
Life of the activity, PES, EIS and/REC permanently lowered	Long (LT)	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter.	4
More than the life of the organisation/facility, PES and EIS scores a E or F	Permanent (P)	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.	5

Probability / Frequency

This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time.
Activity frequency: How often do you do the specific activity?
Frequency of impact: How often does the activity impact on the environment?

DWS		NEMA		Class
Activity frequency	Impact frequency			
Annually or less	Almost never / almost impossible / >20%	Probable (Pr)	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).	1
6 monthly	Very seldom / highly unlikely / >40%	Possible (Po)	The possibility of the impact occurring is very low, due either to the circumstances,	2

			design or experience. The chances of this impact occurring is defined as 25 %.	
Monthly	Infrequent / unlikely / seldom / >60%	Likely (L)	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50 %.	3
Weekly	Often / regularly / likely / possible / >80%	Highly Likely (HL)	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75 %.	4
Daily	Daily / highly likely / definitely / >100%	Definite (D)	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100 %.	5

Magnitude/Intensity/Severity				
The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. How severe does the aspect impact on the environment and resource quality characteristics (flow regime, Water quality, geomorphology, biota, habitat)?				
DWS		**NEMA**		**Class**
Insignificant / non-harmful	1	Insignificant (I)		2
Small / potentially harmful	2	Low (L)	The impact alters the affected environment in such a way that the natural processes or functions are not affected.	4
Significant / slightly harmful	3	Moderate (M)	The affected environment is altered, but functions and processes continue, albeit in a modified way.	6
Great / harmful	4	High (H)	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.	8
Disastrous / extremely harmful and/or wetland(s) involved[1]	5	Very high / Don't know		10
Legal Issues				
How is the activity governed by legislation?				
DWS				

[1] Where "or wetland(s) are involved" it means the activity is located within the boundary (the temporary, seasonal / permanent zone of the wetland)

No Legislation	1
Fully covered by legislation (wetlands are legally covered)[2]	5
Detection	
How quickly can the impacts/risks of the activity be observed on the environment (water resource quality, characteristics) people and property?	
Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

7.2 DETERMINATION OF SIGNIFICANCE

Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. The Significance Rating (SR) is determined as follows:

Equation 1:

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of activity + Frequency of Incident + Legal Issues + Detection
Significance / Risk Rating (SRR) = Consequence + Likelihood

Other aspects to take into consideration in the specialist studies are:

- Impacts should be described both before and after the proposed mitigation and management measures have been implemented.
- All impacts should be evaluated for the full-lifecycle of the development.
- The impact evaluation should take into consideration the cumulative effects associated with this and other facilities which are either developed or in the process of being developed in the region.
- The specialist studies must attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.

7.3 IDENTIFYING THE POTENTIAL IMPACTS

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned probabilities, resulting in a value for each impact (prior to the implementation of mitigation measures). Significance without mitigation is rated on the following scale as contemplated in

[2] Within the outer edge of the 1 in 100 year flood line or delineated riparian area as measured from the middle of the watercourse measured on both banks, or within a 500 m radius from the boundary of any wetland (The boundary of a wetland is the outer edge of the seasonal or temporary zone as delineated for the wetland)

Table 7-2:. In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact.

Table 7-2: Significance Rating Scales without and with mitigation

Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

7.4 AREAS OF INFLUENCE

In order to assess the impact of the proposed mining activities and associated infrastructure on the wetland, various areas of potential impacts have been assessed. The first area is referred to as the "area of direct influence" (ADI) which is the area directly impacted upon by the South Block. The second area is referred to as the "area of indirect influence" (AII) which includes the broader B20F catchment perspective.

Area of direct influence (ADI)

The ADI for water resources is determined by:

- Interception of watercourse and drainage areas by the proposed expansion infrastructure associated with the South Block open pit;
- Reduction of base flow feeding the wetland caused by a drawdown cone resulting from open cast mining;
- Increased storm water runoff at the South Block open pit due to hardened surfaces, roads, and areas of cleared vegetation; and
- Potential for spillage from dirty water containment facilities.

In terms of the EIA methodology, the spatial extent of the ADI is referred to as "Local" and "Site Specific".

Area of indirect influence (AII)

The Area of Indirect Influence (AII) is determined by the boundaries of the Wilge River catchment as a portion of the storm water will drain towards this catchment. In terms of the EIA methodology, the spatial extent of the AII is referred to as "Regional".

Please refer to **Table 7-3**,Table 7-4 and **Table 8-1** for the identification and quantification of risks. Please note that the numbering of risks in **Table 7-3** corresponds with the numbering inTable 7-4.

Table 7-3: Calculation of the severity rating based on the identified impacts at Eendragt Pan Wetland

Activity No[3]	Phases	Activity	Aspect	Impact	Severity				Calculated Severity
					Flow Regime	*Water Quality*	*Habitat*	*Biota*	
CONSTRUCTION PHASE									
1	C, O, D	Clearing of vegetation	Creating access roads for proposed opencast activity	Loss of biodiversity & habitat; impeding the flow of the watercourse to the Saalboom Spruit	1	2	2	2	1.75
2	C	Erection of a fence around power station perimeter	Vegetation maintenance within wetland	Loss of biodiversity and wetland soil compaction caused by machinery	1	1	2	2	1.5
3	C, O, D	Erosion control	Altering the drainage of the catchment	Changing the natural sheet drainage and concentration of stormwater contributes toward siltation, sedimentation and head gully formation	2	3	3	2	2.5
4	C, O, D	Implementation of storm water management system	Disturbance of soils, vegetation and flow within the sub-catchment leading towards siltation	Loss of biodiversity, water quality deterioration, base flow reduction	2	3	3	2	2.5
OPERATIONAL PHASE									
5	O, D	Drainage alteration and changing characteristic of depression wetland	Creating diversion in the natural drainage system, construction of drainage channels and stabilisation with gabion structures	Impeding the flow of water and reduction in recharge of the wetland system. Altered flow contributes toward siltation and sediment deposition in the wetland	4	3	4	3	3.5
6	O, D	Pollution stemming	Increased salinity of	Loss of wetland	4	4	5	4	4.25

[3] The activity number (No) refers to the activities as described under section 7.5: Impact Assessment

Activity No[3]	Phases	Activity	Aspect	Impact	Severity				Calculated Severity
					Flow Regime	*Water Quality*	*Habitat*	*Biota*	
		from ash dump	sub-surface flow causing degradation base-flow feeding depression wetland	biodiversity and functionality, water quality deterioration					
7	O, D	Erosion and siltation of drainage courses	Water management structures surrounding power station foot print concentrate water flow causing increased energy at outlet points		3	3	4	3	3.25
8	O, D	Polluted water management	Containment of dirty water within Pollution Control Dam (PCD) and Stormwater Management Dam (SWMD)	Inadequate containment capacity resulting in spillages and discharges to the receiving environment causing environmental degradation	4	4	3	4	3.75
9	O	Leakage and spillages from pipelines and conveyors	Inappropriate management of water management facilities and infrastructure where unattended leaks and spills could result in water quality deterioration that may end up in the wetland system.	Water quality deterioration may result in a moderate impact on the wetland functionality and loss of biodiversity.	3	4	4	3	3.5
DECOMMISSIONING PHASE									
10	D	Demolition	Release of trapped pollutants causing water quality degradation	Pollutants such as coal fines, ash and polluted water could result in a moderate impact on wetland functionality	2	4	3	3	3.0

Table 7-4: Calculated Risk Rating based on Consequence and Likelihood

Activity No	Severity	Spatial Scale	Duration	Consequence	Frequency of Activity	Frequency of Impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
1	1.75	1	2	**4.75**	3	1	5	2	**11**	**52.25**	Low
2	1.5	1	2	**4.5**	3	1	5	1	**10**	**45**	Low
3	2.5	1	2	**5.5**	3	2	5	2	**12**	**66**	Low/mod
4	2.5	1	2	**5.5**	3	2	5	3	**13**	**71.5**	Low/mod
5	3.5	3	4	**10.5**	4	3	5	3	**15**	**157.5**	Moderate
6	4.25	3	4	**11.25**	4	5	5	3	**17**	**191.25**	High
7	3.25	3	4	**10.25**	4	4	5	3	**16**	**164**	Moderate
8	3.75	3	4	**10.75**	4	4	5	3	**16**	**172**	High
9	3.5	3	3	**9.5**	3	4	5	4	**16**	**152**	Moderate
10	3.0	2	2	**7.0**	3	3	5	3	**14**	**98**	Low/mod

7.5 IMPACT ASSESSMENT

7.5.1 Construction Phase

Activity 1: Clearing of vegetation

The removal of topsoil and vegetation as part of site preparation will result in the encroachment of power station infrastructure to impact on the wetland. There is a slight risk that vegetation clearance will result a low to moderate risk on loss of wetland biodiversity.

Nature: Alteration of the wetland riparian and vegetation regime due to clearance of natural vegetation causing a loss of biodiversity		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Possible (2)	Possible (2)
Significance	**20 (Low)**	**20 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • No specific mitigation is required • Minimize construction footprint to be outside wetland buffer zone and riparian zones; • Minimize disturbance to flow regime and prevent erosion		
Cumulative Impacts: A small percentage of the Savannah biome vegetation will be removed		
Residual Impacts: None		

Activity 2: Fencing

For access control and safety measures the project area needs to be fenced. Holes to be dug in close proximity to the periphery of the wetland boundary have the risk to impact on the wetland vegetation. Construction vehicles need to have access to the area and the utilisation of the service road (as part of a servitude area) will cause compaction of wetland soils. Construction during the wet season will have an increased impact on the wetland area as vehicles may be trapped in wet soil conditions causing increased damage to vegetation. However, these activities during the construction phase have a low significance on the wetland. Based on the location of the power plant and ash dump boundary in relation to the wetland, the impact of the construction and fencing activities are considered low. No specific mitigation measures are required.

Nature: Removal of vegetation, movement of heavy vehicles causing soil compaction, dust fall out and potential for spillages to cause wetland degradation		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Possible (2)	Possible (2)
Significance	**20 (Low)**	**20 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium

Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • No specific mitigation is required • Minimize construction footprint to be outside wetland and riparian zones; • Minimize disturbance to flow regime and prevent erosion		
Cumulative Impacts: A small percentage of the Savannah biome vegetation will be removed. A 4.5 m buffer clearance zone along the fence will increase exposed areas that could contribute towards increased sedimentation		
Residual Impacts: None		

Activity 3: Erosion Control

The change in land use that will take place within the project area where the natural vegetation will be cleared to allow for construction is considered to have a low-moderate risk to impact negatively on the depression wetland in terms of sedimentation. The exposed soils around the wetland are erodible and construction activities poses an increased risk that surface flow re-direction may lead to desiccation of the depression wetland.

Nature: Alteration of the flow regime contributes towards erosion of the catchment resulting in increased sediment, degradation of in-stream riparian habitat and associated decrease in water quality		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Likely (3)	Possible (2)
Significance	**39 (Medium)**	**20 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Compile Work Method Statement and Rehabilitation Plan • Implement GN 704 Regulation and apply for water use license authorisation • Minimize construction footprint to be outside watercourses and riparian zones; • Minimize disturbance to flow regime and prevent erosion		
Cumulative Impacts: Increased disturbance of natural veld will result in more exposed areas susceptible to erosion due to lack of vegetation cover		
Residual Impacts: None		

Activity 4: Polluted Water Management

The non-perennial depression wetland appears to be driven by surface water flow inputs as well as groundwater or sub-surface flow input. The wetland is therefore directly dependant on the water flows from the immediate catchment for seasonal inundation. The soils around the wetland appears to be prone to erodible and storm water discharges to the wetland area may cause head gullies and channelization of the wetland coupled with sedimentation and siltation of the system. There is however a constant threat to the

wetland regarding sediment trapping as the adjacent land use of livestock and game grazing has an increased risk of silt deposition into the wetland during wet conditions.

Nature: Storm water run-off contaminated with suspended solids causing water quality degradation. Storm water augmentation could result in siltation of wetland		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Likely (3)	Possible (2)
Significance	**36 (Medium)**	**20 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Minimize construction footprint to be outside watercourses and riparian zones; • Minimize disturbance to flow regime and prevent erosion		
Cumulative Impacts: A significant percentage of the natural sub-catchment of the Sandloop will be altered		
Residual Impacts: None		

7.5.2 Operational Phase

Activity 5: Drainage alteration

During the Operational Phase the power station will be obliged to implement water management infrastructure. The run of from the dirty footprint of the power plant needs to be contained and the clean water area must be allowed to free drain into the environment. The separation of clean and dirty water system will cause a reduction in catchment yield. Clean runoff will be converted from sheet flow towards dedicated storm water trenches as the non-perennial drainage pathways will be consolidated to be managed as an integrated system.

Nature: Alteration of the flow regime of the catchment resulting in loss of catchment yield, degradation of in-stream riparian habitat and associated decrease in water quality		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly likely (4)	Possible (2)
Significance	**54 (Medium)**	**20 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Minimize construction footprint to be outside watercourses and riparian zones; • Maintain the prescribed buffer zone for wetland protection • Minimize disturbance to flow regime and prevent erosion		
Cumulative Impacts: A significant percentage of the natural sub-catchment of the Sandloop will be altered		

Residual Impacts: None

Activity 6: Ash dump pollution

The preferred option for the operation of the ash dump waste facility is earmarked for implementation on the farm Graaffwater. The locality of the facility is considered upstream of the wetland system (pan and wooded riparian systems) with a flat slope draining towards the east. Base-flow in an impacted aquifer could eventually contribute towards water quality deterioration with a resultant vegetation reduction. Overall a high impact could be expected that could cause wetland functionality to be sacrificed if the ash dump is not managed in a responsible manner.

Nature: Groundwater deterioration due to ingress of pollutants contained within an ash dump that infiltrates the aquifer. Pollution plume migration towards the wetland is considered a reality and coupled with surface water runoff and dust fall out a high impact could be expected if the waste facility is not managed properly		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (5)
Probability	Definite (5)	Highly Likely (4)
Significance	**75 (High)**	**44 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Site selection required to identify area with least risk on the receiving environment • Civil engineering designs required with appropriate liner to minimise ingress of pollutants into aquifer • Conduct geohydrological study to delineate pollution plume migration • Implement groundwater monitoring program • Adhere to legal requirements as contemplated in NEMWA and NWA • Obtain the required environmental authorisations to operate the waste facility • Compile an IWWMP to support the water use application linked to the facility		
Cumulative Impacts: Increased groundwater deterioration in the catchment (aquifer)		
Residual Impacts: Long-term water quality problems (increased salinity)		

Activity 7: Siltation and sedimentation

The anthropogenic changes that have taken place within the region where the natural vegetation was replaced with power generation activities has a moderate risk to impact negatively on the depression wetland in terms of sedimentation. The exposed soils around the wetland are erodible and power plant construction activities poses low risk that surface flow re-direction may lead to desiccation of the depression wetlands.

Nature: Increased footprint of the power plant during the operational phase of the power generation activities will result in concentrated runoff from clean and dirty areas due to hardened surfaces. Dedicated pollution control structures such as PCD's, SWMD and ash dump have the potential to spill and lead to diffuse pollution stemming from spillages. Of set rain events will further contribute towards increased runoff that could result in impacts of moderate significance		
	Without mitigation	**With mitigation**

Extent	Regional (3)	Local (2)
Duration	Long term (4)	Medium term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Highly likely (4)	Likely (3)
Significance	**54(Medium)**	**27 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Water management infrastructure to be designed accordance the specifications of GN 704 Regulations; • Operate containment facilities with 0.8 m free board to minimise risk of pollution • Apply for the required section 21(g) water use authorisations		
Cumulative Impacts: A significant percentage of the natural sub-catchment of the Sandloop will be altered		
Residual Impacts: None		

Activity 8: Stormwater Management Infrastructure

The SWM infrastructure will consist of containment facilities, berms and trenches to channel all dirty water to a SWMD. Inadequate design capacity could result in illegal discharge of polluted water to the environment. The stormwater management infrastructure needs to isolate high potential pollution areas such as the coal stock yard from the environment. Inadequate and poor water management practices will have a high impact on the wetland system if illegal discharges end up in the wetland system

Nature: Illegal discharges and spills from inappropriately designed SWM systems have the potential to cause a high significance impact on the downstream sensitive receptors.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Medium term (3)	Medium term (3)
Magnitude	High (8)	Low (4)
Probability	Definite (5)	Possible (2)
Significance	**60 (High)**	**18 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Design SWM system in accordance with GN 704 requirements • Adhere to principles contained in BPG: G1: Stormwater • Operate system with required 0.8 m free board • Separate clean from dirty water • Maximise clean runoff and minimise dirty water runoff footprint • Implement liner design to protect groundwater from pollution		
Cumulative Impacts: Increased point sources of pollution from industrial footprint has high risk of catchment degradation		
Residual Impacts: Long term water quality impacts causing gradual degradation of the sensitive receptors (wetlands)		

Activity 9: Leakage and Spillages

The power plant will operate utilizing 720,000 m^3 raw water (on an annual basis) with a portion of this water dedicated for the transport of waste or water containing waste to dedicated containment facilities. The waste water supply network has a moderate risk to fail whereby the accidental spillages could have a moderate risk in terms of water quality deterioration.

Nature: Accidental spills and leakages from the raw water supply network as well conveyance of ash could result in impacts of moderate significance if not cleaned up immediately		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	High (5)	Possible (2)
Significance	**50 (Medium)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Construct pipe infrastructure within dirty footprint area • Pipe and conveyor networks to be operated within bunded area; • In event of pipe burst clean up should happen immediately • Report incidents to regulatory authority		
Cumulative Impacts: Increased salt load accumulation in thecatchment.		
Residual Impacts: None		

7.5.3 Decommissioning Phase

Activity 10: Demolition of Power Station Infrastructure

This activity is considered in the long-term as the power plant will have a lifespan of more than forty years. During the demolition of the power plant's infrastructure pollution may occur due to pollutants amongst other that are trapped in the ash pipe system, conveyors, boilers, coal storage plant and storage tanks. These pollutants when released into the environment will cause water quality degradation as sediments will be deposited within the sub-catchment feeding into the wetland system.

Nature: The removal of Power Plant infrastructure by means of blasting and demolition may result in the release of pollutants that could eventually cause water quality degradation. The released pollutants stemming from demolition activities, if not managed properly, could result in the degradation of the receiving environment.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (1)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Possible (2)
Significance	**35 (Medium)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Compile a Rehabilitation Strategic Implementation Program (RSIP) linked to a Closure Plan;		

• Adhere to the mitigation measures as contained in the RSIP and IWWMP followed with monitoring to indicate steady state conditions
Cumulative Impacts: The cumulative impact following the decommissioning phase will be dependent on the efficiency on how the power plant was operated. Several point sources such as PCD and ash dump will remain that will continue to pose a risk to groundwater pollution.
Residual Impacts: Long-term residual impacts stemming from the waste handling facilities will manifest in the catchment that could eventually contributes towards degradation of the wetland system.

7.5.4 Accumulative Risk Assessment

The A41E and A42J quaternary drainage areas are earmarked for heavy industrial development. These developments include existing and proposed power plants such as Medupi, Grootegeluk, Marubeni IPP Coal Fired Power Plant as well as the Tshivhaso Power Plant. These power plants are supplied with coal from the Grootgeluk Mine as well as the proposed Thabametsi coal mine.

Developments of this magnitude have a definite long-term impact on the environment. The waste related facilities have a potential to pollute with the concomitant long-term residual impact. The decreased wilderness land-use with a further increase in disturbed and dirty footprint areas will result in the permanent altering of the drainage characteristics of the Sandloop and its associated wetland systems consisting of pans (depressions) and a cluster of wooded drainage lines. Eventually there will be a loss of wetland diversity and wetland functionality.

8. MITIGATION AND MANAGEMENT PLAN

8.1 MANAGEMENT OBJECTIVE

Rehabilitate degraded areas caused by the proposed Tshivhaso Power Plant project, including the re-establishment of biodiversity and the restoration of key processes which support long term persistence of biodiversity within Eendragt pan. It will be further required to:

- Maintain physical, chemical and biological processes in depression wetland and wooded riparian areas.
- Alien plants and other alien or extra-limital biota: Control and where possible eliminate alien/extra-limital biota to facilitate re-establishment of natural biodiversity pattern and process in invaded areas surrounding the catchment of the wetland.
- Degraded riparian zones: strive towards re-establishment of biodiversity patterns and process within any degraded riparian zone of the Sandloop associated with the proposed Tshivhaso Power Plant project.

8.2 MANAGEMENT AND REHABILITATION ACTIONS

The following management measures and actions in accordance with the recommendations as contained in Table 8-1 could be considered for implementation to promote Integrated Water Resource Management within the A42J quaternary catchment at wetland areas subject to disturbance:

- Improve understanding of freshwater wetlands and their functioning.
- Remove alien vegetation in depression wetland areas.
- Prevent or minimise development within depression wetlands.
- Prioritise areas for alien removal focusing on biodiversity restoration.
- Implement removal programs for priority species and areas (threatened plants),
- Investigate options for the control of alien species (e.g. biological control).
- Control the grazing of extra-limital herbivores within sensitive areas.
- Encourage and facilitate natural recovery of transformed areas.
- Reconciling biodiversity with external threats.

Table 8-1: Mitigation and Management Plan

Objective	Mitigation	Action Plan	Timing	Responsible Person	Significance after Mitigation
Limit or prevent erosion stemming from exposed areas related to the development of the opencast pit and associated infrastructure	Design the surface and stormwater infrastructure to be within the footprint of the project area, separate clean from dirty water and allow discharge of water to designated areas. Vegetate disturbed areas to limit erosion	Limit the loss of the non-perennial depression wetland not to allow any activity within the 500 meter buffer zone	Construction and Operational Phases	SHE: Manager	Low
Limit the alteration of the depression wetland catchment area	Delineate the sub-catchments and ensure that no dirty run-off from the project area transverse the wetland	Implement berms, trenches and storm water management measures in accordance with GN 704 Regulations to ensure no discharge of affected stormwater into the catchment of the wetland	Construction, Operational and Closure Phases	SHE: Manager	Moderate alteration
Limit wetland soil compaction caused by road construction and fencing	Access servitudes should avoid wetland area and no activity allowed in the wetland area	Compacted soil areas in and around the periphery of the wetland will be ripped to break up compacted soil and vegetated with indigenous seed mix	Construction Phase	SHE : Manager	Low
Power station development activities will be planned and managed to ensure no degradation of the wetland below Class B	The non-perennial depression wetland and associated catchment will be regarded as a sensitive environment to be protected by an appropriate buffer zone in which no power generation related activity should be allowed.	Apply for a section 21(c) and (i) water use authorisation and develop a Wetland Rehabilitation Plan.	Operational and Closure Phase	SHE: Manager	Moderate alteration
Prevent surface water contamination that could impact on the functionality of the wetland	All potential pollution risk areas need to be isolated and enclosed within the dirty footprint of the proposed power station	Pollution Control Dams to be designed to cater for the required storage capacity	Construction and Operational Phase	SHE: Manager	Moderate
Restore the natural surface and sub-surface flow dynamics of the wetland system	The original soil profile in the impacted zone should be mimic during rehabilitation to	Relevant specialist to be consulted in the drafting of a Closure Plan. Geohydrological	Closure and Decommissioning Phase	SHE: Manager	Moderate alteration

Objective	Mitigation	Action Plan	Timing	Responsible Person	Significance after Mitigation
	allow for the inter and base flow of the system	study to be conducted to determine the groundwater flow direction. It needs to be determined whether the wetland on the farm Graaffwater is not hydrologically interlinked. Restore the topography to ensure that the catchment remain free draining. Wetland specialist to be consulted in the drafting of a long-term Rehabilitation Plan			

9. DISCUSSION AND RECOMMENDATION

9.1 DISCUSSION

The wetland study conducted for Tshivhaso Power Plant, incorporating the proposed mining activity, was based primarily on the latest dataset available for national and regional wetland systems and was refined with a field investigation.

The importance and existence of this wetland was then further compared to the importance of their management on a regional scale (aquatic biodiversity sub-catchment, quaternary catchment, and National Freshwater Ecosystem Priority Area's (NFEPA's) for rivers and wetlands). FEPA's represent rivers, wetlands and estuaries that are required to maintain a high integrity for the protection of our country's freshwater ecosystems and water resources for human use. This protection is not aimed to exclude the identified areas from human contact, but rather to promote efficient planning and management strategies in and around the power plant areas.

The wetland study revealed that the Wetland PES is Largely Natural with a High EIS Class.

9.2 RECOMMENDATIONS

The proposed Tshivhaso Power Plant project is located within an area of intensive game farming/ecotourism activities. In addition the historic mining activities in the catchment have led to moderate impacts on wetlands within the region that has resulted in an overall degradation of the wetland habitats. Existing impacts observed on site include:

- Extensive grazing (game and livestock) along the boundaries of the wetland;
- Slight erosion along dirt tracks and trampling by game (rhinoceros) within the Eendragt pan have led to increased sedimentation; and
- Presence of alien vegetation encroachment in disturbed areas

For the reasons mentioned above the wetland within the project area has a high biodiversity conservation value when considered on a national scale. It is recommended that the following considerations be taken into account and applied accordingly to ensure protection of the natural resource and to prevent any further degradation of wetlands within the region:

- In terms of Section 40 of the National Water Act, 1998 (Act 36 of 1998), a WULA must be submitted for all activities within 500 m of a wetland.
- Secondly that a minimum of 250 m buffer zone be maintained around the wetland areas wherein no activities are allowed to take place in order to protect the integrity of the wetland as the wetland still remains a priority wetland in the

region with a largely natural condition and high ecological importance and sensitivity class. This buffer zone should be clearly demarcated as a "NO GO" area to prevent any accidental entrance into the area (refer Figure 1-2).

- That all conditions as stipulated in the Work Method Statement and Environmental Management Plan (EMP) be adhered to before commencement of construction activities.
- Any activities that may potentially result in significant adverse effects on the in wetland should be avoided to allow for the implementation of alternatives that are less environmentally harmful. This requires the provision of less harmful alternatives and where these alternatives are not feasible, environmentally sound management and engineering practices should be applied for all areas that may be affected in an adverse way.
- Strict storm-water management practices must be applied and incorporated into management with the aid of a suitably qualified engineer to avoid disposal or spillage of any environmentally harmful materials or waste into the wetland.
- Should the avoidance or minimization of the proposed impacts not be possible, compensatory measures for any damage to the wetland habitat must be provided.
- Should the mitigation measures fail to adequately protect the integrity of the wetland habitat, compensatory measures must be provided.
- The wetland areas should be included in to an open space system in accordance with the spatial planning on a larger scale and should not be fragmented in any way.
- No power generation and/or mining activities should be allowed within any important wetland area as this would adversely affect the species composition and integrity of the overall wetland system. Should there be such activities, and offset strategy should be compiled and implemented.
- Should the development needs to transgress the wetland areas, a water use license authorisation in terms of section 39 or 40 of the National Water Act, 1998 (Act 36 of 1998) for the Section 21(c) and (i) uses must be applied for.

These recommendations should be incorporated into the WULA and EMP and should be considered by the applicant during the Bid process.

10. REFERENCES

Department of Water Affairs and Forestry. (2004). Development of a framework for the assessment of wetland ecological integrity in South Africa. Report No 0000/00/REQ/0904.

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

Department of Water Affairs and Forestry. (2007). Manual for the assessment of a wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types. Report No. N/0000/00/WEI/0407.

Kleynhans, C.J. and Louw, M.D. (2008). River EcoClassification Manual for Ecostatus Determination (Version 20, Module A: Ecoclassification and Ecostatus determination). WRS Report no TT 329/08.

Kotze, D.C., Marneveck, G.C., Batchelor, A.L. & Lindley, D.S. (2004). Wetland Assess: A rapid assessment procedure for describing wetland benefits. 1st draft. Mondi Wetlands Project.

Mucina, L and Rutherford, M.C. (2006). The Biomes and Vegetation of South Africa, Lesotho and Swaziland

Nel, J.L., Driver, A., Strydom, W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J., Nienaber, S., van Deventer, H., Swartz,. E. & Smith-Adao, L.B. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. WRC Report NO TT 500/11.

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

SANBI (2011). Atlas for Freshwater Ecosystem Priority Areas in South Africa