ESKOM HOLDINGS SOC

WETLAND HABITAT IMPACT ASSESSMENT

MEDUPI POWER STATION

01 MAY 2019

WETLAND HABITAT IMPACT ASSESSMENT

MEDUPI POWER STATION

ESKOM HOLDINGS SOC

FINAL

PROJECT NO.: 41101556
DATE: MAY 2019

WSP
BLOCK A, 1 ON LANGFORD
LANGFORD ROAD
WESTVILLE, DURBAN, 3629
SOUTH AFRICA

T: +27 31 240 8800
F: +086 606 7121
WSP.COM

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Final			
Date	May 2019			
Prepared by	Z Nakhooda			
Signature				
Checked by	A Husted (Pr Sci Nat) Reg No. 400213/11			
Signature				
Authorised by	G Matthews			
Signature				
Project number	41101556			
Report number	R01			
File reference	41101556_Medupi_Wetland Habitat Assessment_20190501			

This Wetland Habitat Assessment Report has been prepared by WSP Environmental Proprietary Limited (WSP) on behalf and at the request of Eskom Holdings SOC (Client), to provide the Client with an understanding of the potential impacts the proposed pipeline may have on wetland habitat.

Unless otherwise agreed by us in writing, we do not accept responsibility or legal liability to any person other than the Client for the contents of, or any omissions from, this Report.

To prepare this Report, we have reviewed only the documents and information provided to us by the Client or any third parties directed to provide information and documents to us by the Client. We have not reviewed any other documents in relation to this Report and except where otherwise indicated in the Report.

TABLE OF CONTENTS

TABLES

FIGURES

1 INTRODUCTION

1.1 BACKGROUND

Eskom Holdings SOC (Eskom) proposes to construct a make-up and raw water supply pipeline at the Medupi Coal Fired Power Station on farms Naauw Ontkomen 509 LQ, Portion 0 and Kuipersbult 511 LQ, Portion 0, in Lephalale, Ward 2, Lephalale Local Municipality, Limpopo.

Medupi Power Station is constructing a Flue Gas Desulphurisation (FGD) system to manage sulphur dioxide (SO_2) emissions from each of the six 800 MegaWatt (MW) coal fired steam electric generating units. The FGD Project will result in the addition of wet limestone open spray tower FGD systems to each of the operating units. To support the FGD operation, substantial raw water is required and this water will be supplied from the Mokolo Crocodile Water Augmentation Project – Phase 2 (MCWAP-2).

To deliver this additional water supply, Eskom proposes to construct a raw water supply pipeline of approximately 5 500m in length, in total, within its premises at the Medupi Power Station. The proposed pipeline will comprise two (2) segments (**Figure 1**):

- **Segment 1**: The first segment (raw water pipeline) will collect water from an offtake point of the MCWAP-2 pipeline on the north of the site. This pipeline will transfer water to Eskom's two holding reservoirs (Mokolo Water Reservoir or Crocodile West Water Reservoir). However, water will be taken primarily from the Crocodile West Water Reservoir.
- **Segment 2**: The second segment (FGD makeup water pipeline) of the pipeline collects water from the reservoirs and channels it to the FGD system. The function of the FGD Makeup Water Supply System will be to pre-treat and distribute makeup water from the holding reservoirs to the FGD Process Water Tanks and the Wastewater Treatment Plant.

The existing raw water pump house has provision for a compartment for the FGD raw water pipeline at the Medupi Power Station.

The proposed pipeline and associated infrastructure may potentially require a Water Use Licence Application (WULA) in terms of Section 21 of the National Water Act (NWA) (No. 36 of 1998) or a General Authorisation (GA) as described in Government Notice (GN) 509 of 2016.

1.2 TERMS OF REFERENCE

WSP has been commissioned to undertake a Wetland Habitat Assessment, relating to the proposed pipeline project. The assessment will be undertaken in terms of the requirements of Section 21 of the National Water Act (NWA). The objective of the assessment is to identify wetland and riparian habitats present on the site and within a radius of 500 m from the proposed pipelines.

This is to determine whether the proposed pipeline (construction and operational activities[1]) may impact on the regulated area of a watercourse (i.e. the outer edge of the 1:100-year flood line or delineated riparian habitat; and/or 500m radius from the delineated boundary of a wetland, as defined in GN 509 of 2016). The potential impacts of the proposed pipelines on the identified watercourses will be assessed and associated mitigation recommendations will be provided, which is required in order to conduct the Risk Matrix Assessment (RMA).

The RMA, developed by the Department of Water and Sanitation (DWS) for Water Uses as defined in Section 21(c) and Section 21(i) will be utilised to determine the applicability of a GA or WULA, to the proposed pipeline. The scope of work broadly encompassed the following:

- Review of any existing reports relevant to the study area (if available);

[1] Decommissioning phase not considered as the pipeline is not anticipated to be decommissioned/removed.

- Identification and delineation of wetland and riparian habitats;
- Description of the wetlands and riparian habitats identified;
- A functional assessment of the identified wetlands and riparian habitats;
- A risk assessment considering the impacts that the proposed pipelines may have on the identified wetland and/or riparian habitats; and
- Determine the applicability of a water use license in terms of Section 21 (c) and (i) of the NWA.

2 STUDY AREA

2.1 LOCALITY

The proposed construction of a make-up water and raw water pipeline is to be located at the Medupi Coal Fired Power Station on farms Naauw Ontkomen 509 LQ, Portion 0 and Kuipersbult 511 LQ, Portion 0, in Lephalale, Ward 2, Lephalale Local Municipality, Limpopo Province (23°42'17.75"S, 27°34'3.02"E). The proposed pipeline segments are approximately 2 500m (raw water pipeline) and 3 000m (make-up water pipeline).

Figure 2 shows the proposed pipeline alignment (i.e. preferred pipeline route) indicated in red (egment 1) from an offtake point (which was provided by the DWS) and in yellow (segment 2) from the pump transfer house from the reservoirs to the FGD Plant. The proposed pipeline segments will be within the Medupi Power Station site boundary (preferred route).

2.2 LAYOUT AND DESCRIPTION

2.2.1 CONSTRUCTION ACTIVITIES

The proposed pipeline route will begin at the MCWAP-2 pipeline offtake point, which is to the north of the site, where raw water will be collected from. The pipeline will be buried underground from the offtake point until it reaches the ash conveyor transfer house, where it will move aboveground in order to protect the integrity of this transfer house. After passing through the ash conveyor transfer house, the pipeline will be buried underground again, crossing under the railway line and the Kuipersbult Road until it reaches Eskom's raw water holding dams (reservoirs).

Eskom's raw water holding dams are made up of two compartments, the Mokolo Water Reservoir and the Crocodile West Water Reservoir. Water for the FGD system will be taken primarily from the Crocodile compartment of the raw water holding reservoir.

After raw water is discharged into the reservoirs, the second pipeline segment will be required in order to transfer water from the reservoirs to the FGD system. This pipeline starts from the pump house at the reservoirs, and will mainly collect water from the Crocodile compartment as mentioned before. The pipeline exits the pump house and runs underground on the north side of the existing pipeline. The line turns east of the gravel road on the west of the site boundary and passes under the Kuipersbult Road. The line passes under the railway line and turns east at the station boundary, and runs outside the station boundary for 250m where it enters the rail yard fence. The line runs east alongside the rail yard fence between the existing Power Station National Key Point (NKP) fences. The two inner fences will be relocated to the north of the rail yard. At the eastern end of the rail yard, the pipeline will turn north and then east within the NKP fence. At this point, the pipeline will move above ground. The pipeline will then turn to the north on the east side of Road 3 (Ring Road West). Finally, it will turn into the FGD Raw Water Pre-treatment Plant at the Gypsum Sales Loading Facility.

The pipeline runs within the rail yard and Power Station perimeter fences for the majority of the routing in an area that is not constrained with existing servitudes.

ESKOM

SITE LOCALITY

Legend

- Place Names
- Medupi Power Station
- Regional Routes

N

0 3,200 6,400 9,600 12,800

Metres

DISCLAIMER

The information on this figure was derived from various digital databases available to WSP Environmental (Pty) Ltd. All information is provided "as is" and it must be acknowledged that data, information, and maps are dynamic and in a constant state of maintenance, correction and update. WSP Environmental (Pty) Ltd cannot accept any responsibility for errors, omissions, or positional accuracy where it has not been directly responsible for the production of the data referenced. There are no warranties, expressed or implied, as to the use of this information, including the warranty of merchantability or fitness for a particular purpose. Notification of any errors will be appreciated.

WSP ENVIRONMENTAL (PTY) LTD
BUILDING C, KNIGHTSBRIDGE,
33 SLOANE STREET, BRYANSTON
P O BOX 98867, SLOANE PARK 2152, RSA
Tel +27 (0)11 361 1380, Fax +27 (0)11 361 1381, wspe@wspgroup.co.za

DATA SOURCE:

GARMIN STREETS

PROJECTION: GCS_WGS_1984

PROJECT TITLE:

ESKOM RAW WATER PIPELINE BA & WULA

SCALE: 1:368,121	DRAWN BY: SINENHLANHLA RADEBE
DATE: 2019/04/24	REVIEWED BY: TUTAYI CHIFADZA

FIGURE NO: 1	PROJECT NO: 41101556	REV:

ESKOM

LOCALITY SETTING

Legend

- Segment 1
- Segment 2

N

0 60 120 180 240 300

Metres

DISCLAIMER

The information on this figure was derived from various digital databases available to WSP Environmental (Pty) Ltd. All information is provided "as is" and it must be acknowledged that data, information, and maps are dynamic and in a constant state of maintenance, correction and update. WSP Environmental (Pty) Ltd cannot accept any responsibility for errors, omissions, or positional accuracy where it has not been directly responsible for the production of the data referenced. There are no warranties, expressed or implied, as to the use of this information, including the warranty of merchantability or fitness for a particular purpose. Notification of any errors will be appreciated.

WSP ENVIRONMENTAL (PTY) LTD

WSP HOUSE, 1 ON LANGFORD, LANGFORD ROAD, WESTVILLE 3632
P O BOX 1442, WESTVILLE 3630, RSA
Tel +27 (0)31 240 8860, Fax +27 (0)31 240 8861, wspe@wspgroup.co.za

DATA SOURCE:

PROJECTION: GCS_WGS_1984

PROJECT TITLE:

ESKOM RAW WATER PIPELINE BA AND WULA

SCALE: 1:12,500	DRAWN BY: SINENHLANHLA RADEBE
DATE: 2019/04/30	REVIEWED BY: ZAKARIYA NAKHOODA

FIGURE NO: 1	PROJECT NO: 41101556	REV:

2.2.2 OPERATIONAL ACTIVITIES

The operational phase will commence once the FGD systems are complete and ready to be commissioned. The pipeline will be operated solely to transfer water to the site. Any other works are only needed when maintenance is required on the pipeline.

2.2.3 DECOMMISSIONING ACTIVITIES

The proposed pipeline is expected to operate with no anticipated decommissioning prior to the Medupi Power Station being decommissioned and therefore, the likely impacts of decommissioning cannot be accurately predicted at this stage. However, impacts during decommissioning are likely to be similar in nature to those identified for the construction phase and will be managed as assessed in the Basic Assessment Report (BAR).

2.3 ENVIRONMENTAL SETTING

2.3.1 CLIMATE

The Lephalale area climate is characterised by hot summers and mild winters. The long-term annual average rainfall is 485mm, of which 420mm falls between October and March. The area experiences high temperatures, especially in the summer months, where daily maxima of >40°C are common with an average annual temperature of 21.1°C. The warmest month of the year is January, with an average temperature of 26.0°C. The variation in annual temperature is around 12.0°C. At 14.0°C on average, June is the coldest month of the year

The long-term annual average rainfall is 485mm, of which 420mm falls between October and March. The difference in precipitation between the driest month and the wettest month is 89mm. The average monthly precipitation is shown in **Figure 3** below and also illustrates the number of days specific precipitation amounts are expected on a monthly basis.

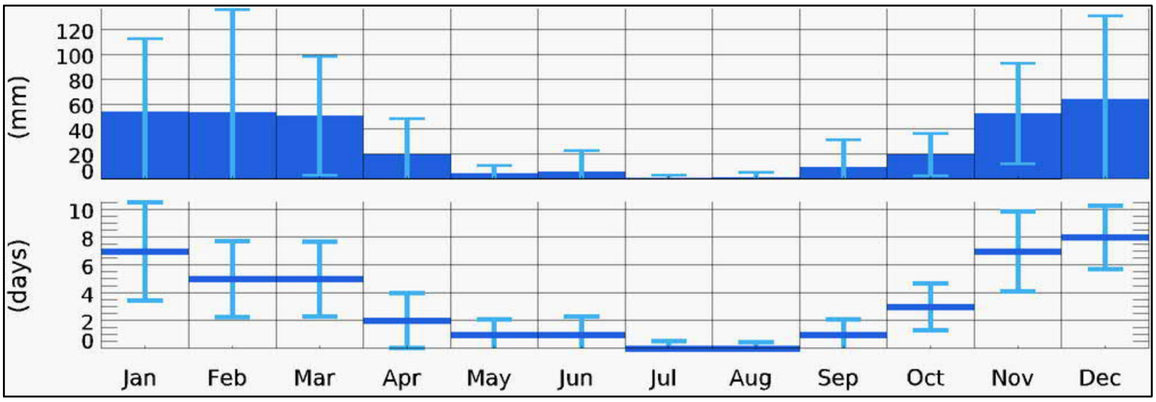


Figure 3: Lephalale Monthly Precipitation (Source meteoblue.com as per April 2019)

The Monthly evaporation data was available for two DWS stations namely A4E003 (23°50'34.52"S and 27°47'58.90"E (30km SE of site)), Zandpan and A4E007 Mokolo Nature Reserve at Mokolo Dam (23°58'32.49"S and 27°43'28.89"E (35km SE of site)). The mean annual evaporation (MAE) for station A4E003 is 2 572mm and is 2 014mm for station A4E007 (Golder & Associates, 2018).

The climate within the Lephalale Municipality and Limpopo Province in general results in a negative climatic water balance and very little water for utilisation by industry, mining, agricultural and domestic land use.

2.3.2 GEOLOGY

Information relating to surface water resources within the study area was obtained from the Hydrogeological Impact Assessment for the Medupi Flue Gas Desulphurisation Retrofit Project Report undertaken by Golder & Associates (2018), including literature cited within the study report.

The regional geology in the area is characterised by sedimentary rocks of the Karoo Supergroup (Ellisras (Council for Geoscience).

The local geology of the area can be subdivided into a northern and southern type. The Matimba Power Station and all its facilities, except for the ash dump, as well as Grootegeluk Mine, lies on Karoo sediments. The existing licensed disposal facility and Medupi Power Station is underlain by the sediments of the Waterberg Group (siliclastic red bed successions). This is part of the up-thrown sediments comprising the fining upward conglomerate-quartzites facies assemblages of the Mogalakwena Formation. The Waterberg sediments are somewhat recrystallized and fully oxidised; hence the hardness and red colour of the rock. A thin but permeable layer of sandy topsoil overlies it (IGS, 2008).

The Eenzaamheid fault separates the Waterberg rocks from the Karoo strata to the north. The proposed raw water pipeline project lies to the south of the fault. South of the fault, the site is generally overlain by sandy soil at surface. On the southern side of the Eenzaamheid fault, below the sandy soil the site is underlain by Waterberg sediments comprising of sandstone, subordinate conglomerate siltstone and shale.

2.3.3 SURFACE WATER

Information relating to surface water resources within the study area was obtained from the Surface Water Impact Assessment and Baseline Report undertaken by Golder & Associates (2018), including literature cited within the study report.

The project area is situated in the Matlabas catchment which is a predominantly flat area of the Limpopo Water Management Area (WMA). Medupi is approximately 19km west of the town of Lephalale and approximately 42km south of the Limpopo River. The catchment is still largely undeveloped with limited water resources and water uses. The Medupi site is situated in the Steenbokpan area which lies in the A42J quaternary catchment.

There are no perennial streams originating within the area itself. The closest perennial river is the Mokolo River into which the non-perennial Sandloop River drains. The Mokolo River flows through A42J to the Limpopo River. The project is situated in the Mokolo catchment, with the non-perennial Sandloop River flowing around the site in an easterly to north-easterly direction to confluence with the Mokolo River approximately 16km downstream of the town of Lephalale. This is a predominantly flat area of the Limpopo Water Management Area (WMA).

2.3.4 GROUNDWATER

Information relating to groundwater resources within the study area was obtained from the Hydrogeological Impact Assessment Study undertaken by Golder & Associates (2018), including literature cited within the study report.

Two distinct and superimposed groundwater systems are present in the geological formations of the coalfields in South Africa. They are the upper weathered aquifer and the system in the fractured rock below.

The Weathered Aquifer System generally occurs in the top 5 to 15m and normally consists of soil and weathered rock. The upper aquifer is associated with the weathered horizon. In boreholes, water may often be found at this horizon. The aquifer is recharged by rainfall.

In a Fractured Aquifer System, grains in the fresh rock below the weathered zone are well cemented, and do not allow significant water flow. All groundwater movement therefore occurs along secondary structures such as fractures, cracks and joints in the rock. These structures are best developed in sandstone and quartzite, hence the better water-yielding properties of the latter rock type. Dolerite sills and dykes are generally impermeable to water movement, except in the weathered state.

From the published hydrogeological maps (DWAF, 1996) the average recharge for the study area is shown as between 10 to 15mm per annum.

From the available data and previous groundwater studies undertaken in the area, groundwater levels ranged from between 4.41 to 69.98m below ground level (mbgl), with the average water level as 30.4mbgl. The groundwater flow from the study area is primarily away from the site, towards the east/south-east and northeast towards the non-perennial Sandloop River.

2.4 STORMWATER MANAGEMENT AT THE POWER STATION

The existing water management system at Medupi includes:

- A dirty water management system to ensure that polluted water at the Power Station and its associated infrastructure, as well as sediment-laden runoff from disturbed areas is separated from clean area runoff and that it is collected in Pollution Control Dams (PCD); and
- A clean water management system to divert water undisturbed by the Power Station's operations around the disturbed project footprint.

The majority of the pipeline is within the Medupi Power Station boundary and thus, any clean or dirty water generated during the construction period will be diverted into the relevant system.

2.5 PREVIOUS WETLAND STUDIES

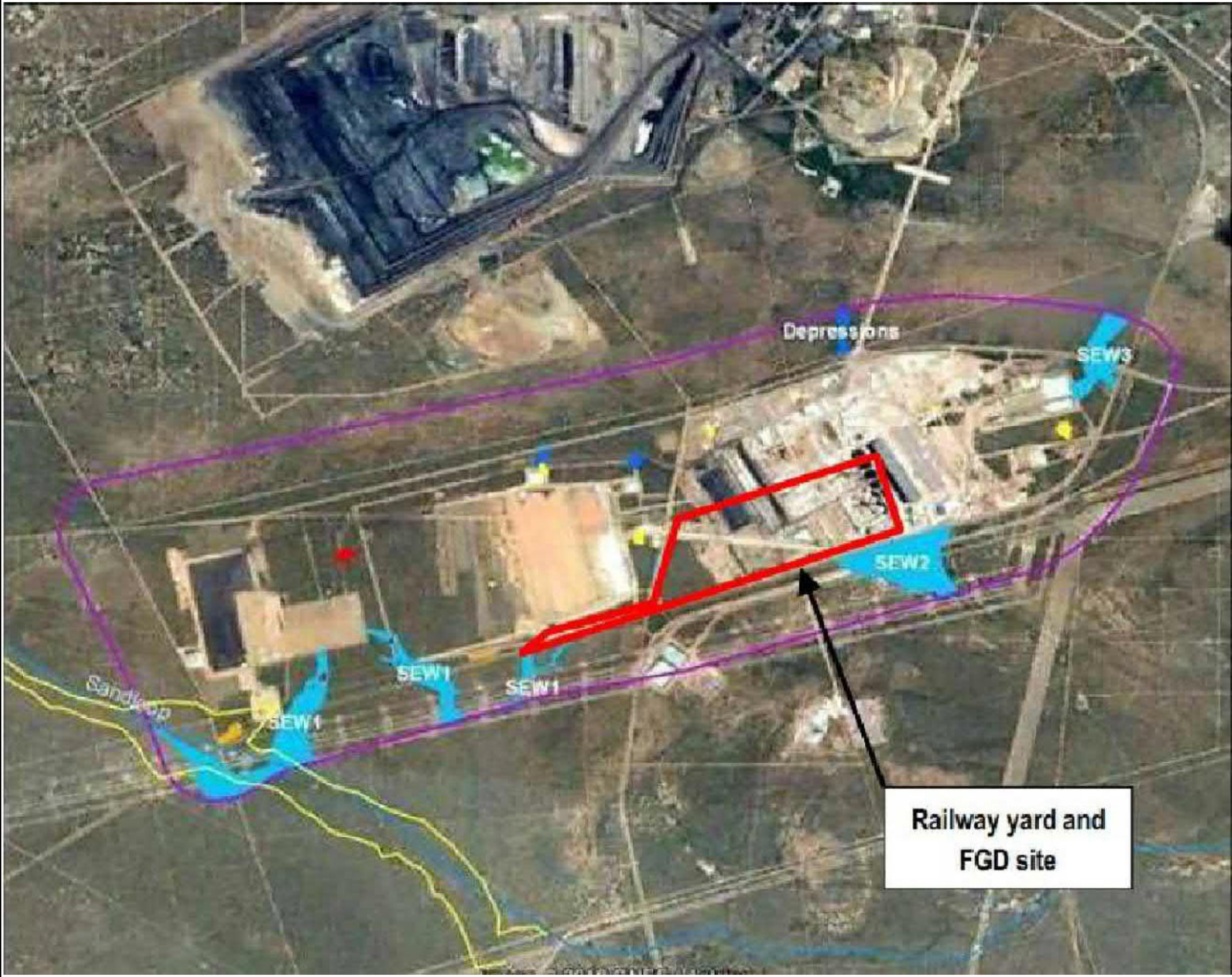
Natural Scientific Services CC (NSS) (2018) identified and delineated watercourses and wetlands at a desktop level within a 500m buffer of the Medupi Power Station and undertook ground truthing during December 2015 and November 2016 within the areas identified. The main focus of the study was to investigate wetlands within the 500m regulated area from the boundary of the Medupi Power Station since most of the Medupi Power Station footprint was already either under construction or totally transformed with the installation of infrastructure and support services.

Referring to **Figure 4**, four hydrogeomorphic (HGM) units were identified within the regulated area, which include two south–east and one north–east draining Washes (SEW 1 – 3), and multiple inward-draining depressions (Dep1). In addition, two excavated areas were encountered on site. It should be noted that portions of the SEW 1 HGM unit forms part of the Sandloop FEPA system. As a consequence, a large portion of the HGM unit is classified as being of Highest Biodiversity Importance and Risk for Mining according to the SANBI Mining and Biodiversity Guidelines.

The Sandloop has a Present Ecological State (PES) of moderately modified (C category) where the loss and change of natural habitats and biota have occurred but the basic ecosystem functions are still predominately unchanged. The Ecological Importance and Sensitivity (EIS) are reported as Moderate and Low, respectively.

ESKOM

NSS CC 2018 Identified Wetlands



Legend

- 1 in 100 Floodline
- Main Rivers
- Depressions to be lost
- Lost Depressions
- Study Area
- Excavations

Wetlands

- Depressions
- Semi Ephemental Wash

N

0 90 180 270 360 450

Metres

DISCLAIMER

The information on this figure was derived from various digital databases available to WSP Environmental (Pty) Ltd. All information is provided "as is" and it must be acknowledged that data, information, and maps are dynamic and in a constant state of maintenance, correction and update. WSP Environmental (Pty) Ltd cannot accept any responsibility for errors, omissions, or positional accuracy where it has not been directly responsible for the production of the data referenced. There are no warranties, expressed or implied, as to the use of this information, including the warranty of merchantability or fitness for a particular purpose. Notification of any errors will be appreciated.

WSP ENVIRONMENTAL (PTY) LTD
WSP HOUSE, 1 ON LANGFORD, LANGFORD ROAD, WESTVILLE 3632
P O BOX 1442, WESTVILLE 3630, RSA
Tel +27 (0)31 240 8860, Fax +27 (0)31 240 8861, wspe@wspgroup.co.za

DATA SOURCE:

PROJECTION: GCS_WGS_1984

PROJECT TITLE:

ESKOM RAW WATER PIPELINE BA AND WULA

SCALE: 1:17,500	DRAWN BY: SINENHLANHLA RADEBE
DATE: 2019/04/30	REVIEWED BY: ZAKARIYA NAKHOODA

FIGURE NO: 2	PROJECT NO: 41101556	REV:

3 EXPERTISE OF THE SPECIALIST

The assessment was conducted by Zakariya Nakhooda with support from various specialists as summarised in **Table 1**. A peer review was undertaken by Andrew Husted of The Biodiversity Company (Pty) Ltd. CVs can be provided on request.

Table 1: Expertise of the Specialists

Name	Qualification	Professional Registration	Experience
Zakariya Nakhooda	BSc Hydrology (Hons) and Environmental Sciences	-	Zakariya Nakhooda has completed a BSc degree in Hydrology and Geography/Environmental Sciences. He has also completed a BSc Honours degree in hydrology at the UKZN, and is currently pursuing an MSc degree in Hydrology. His interests include integrated water resources management, water quality, catchment hydrology and GIS. Zakariya has been involved in water quality assessment projects, wetland assessments and water use license applications.
Andrew Husted	Aquatic & Wetland Ecologist (MSc)	*Pr.Sci.Nat.*	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 13 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.

4 AIMS AND OBJECTIVES

The aim of this assessment is to complete a Wetland Habitat Assessment to meet WULA requirements. The objectives of the report are:

- Identify and delineate wetlands and/ or riparian habitats within 500m of the proposed pipelines;
- Determine the PES, EIS and functional importance of the identified wetlands and/ or riparian habitats; and,
- Determine whether the identified wetlands and/ or riparian habitats have the potential to be impacted on by the proposed pipelines and associated construction and operational activities.

In order to achieve the aforementioned objectives, the following activities were undertaken:

- Desktop identification and delineation of all watercourses (wetlands and riparian zones included) within a 500 m radius of the proposed pipelines utilising available site-specific data;
- Infield delineation and classification of the identified wetlands and riparian habitats;
- Risk/impact probability screening of the identified wetlands and riparian habitats to determine which have any risk of being impacted upon by the proposed pipelines and associated construction and operational activities;
- Determination of the wetlands and riparian habitats that have the potential to be impacted on by the proposed pipeline and associated construction and operational activities;
- Conduct an assessment of the PES, EIS and functional importance (wetland only) of the delineated wetland and riparian habitats; and,

- Compilation of the Risk Matrix Assessment as per GN509 of 2016, to determine the applicability of the relevant Section 21 (c) and (i) regulations (GA or WULA).

5 METHODOLOGY

The methods and tools utilised to conduct the wetland habitat assessment within the study area were determined utilising desktop and in-field assessments together with professional opinion. An in-depth description of each method is provided in the chapters that follow. National and provincial datasets were utilised to supplement the information gathered on site.

5.1 WETLAND IDENTIFICATION AND MAPPING

In order to identify the wetland types present, using Kotze *et al.* (2009) and Ollis *et al.* (2013), a characterisation of hydrogeomorphic (HGM) types was conducted. These have been defined based on the geomorphic setting of the wetland in the landscape (e.g. hillslope or valley bottom wetlands, whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated), how water flows through the wetland (diffusely or channelled) and how water exits the wetland (see **Figure 5** from Ollis *et al.* 2013).

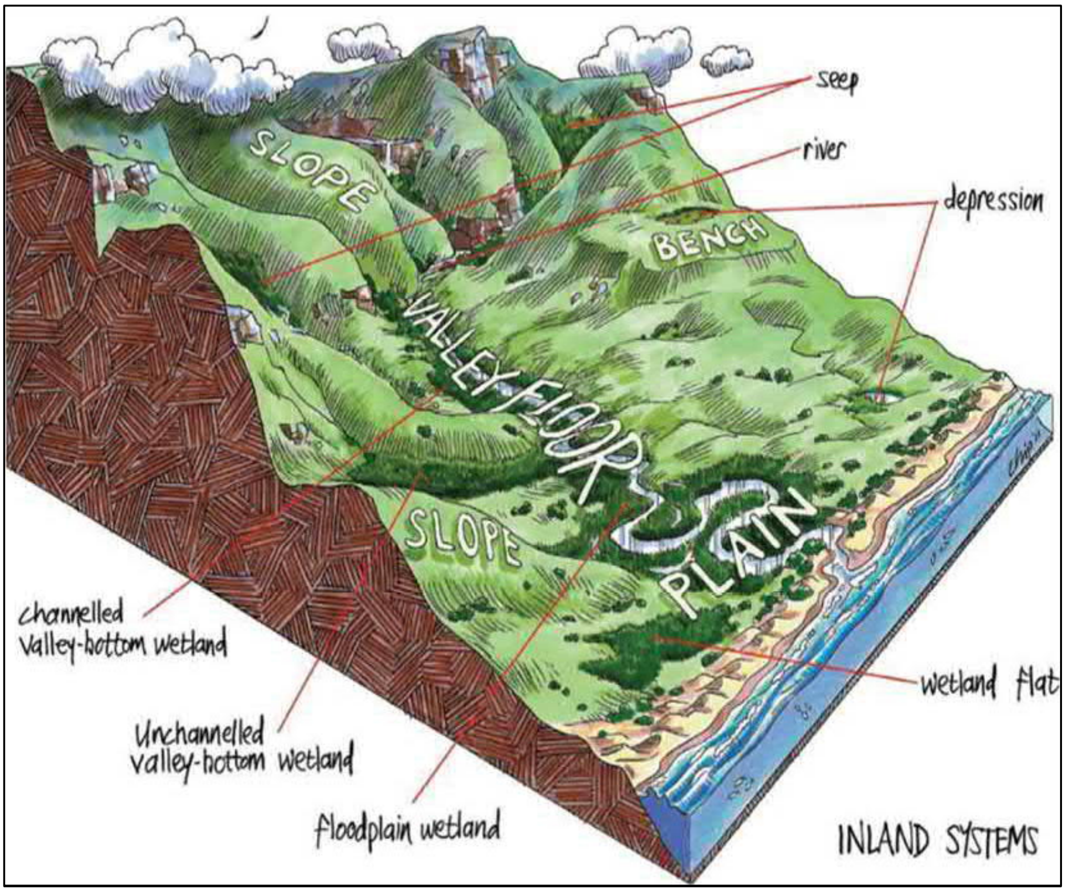


Figure 5: Illustration of wetland types and their typical landscape setting

5.2 DELINEATION

5.2.1 WETLAND DELINEATION

Wetland delineation includes the confirmation of the occurrence of a wetland and the determination of the outermost edge of the wetland. As an initial step, a desktop assessment utilising aerial imagery and available datasets, was conducted to determine potential wetland or riparian habitats. This desktop analysis was vital due to the extent of the area under assessment. Following the desktop assessment, an in-field assessment was conducted on the 18^{th} of March 2019 to groundtruth and assess the desktop-identified wetlands and/or riparian habitats, and identify any potential habitats which may have been overlooked during the desktop assessment phase.

The outer boundary of the wetlands present at the site were identified and delineated according to the DWS wetland delineation manual, 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas' (DWAF, 2005a). The wetland indicators that are utilised in the detailed field delineation of wetlands:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Wetness Indicator identifies the morphological 'signatures' developed in the soil profile as a result of prolonged and frequent saturation(determined through soil sampling with a soil auger and examining the degree of soil mottling and gleying);
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils; and,
- The Soil Form Indicator.

According to the wetland definition used in the NWA, vegetation is the primary indicator, which must be present under normal circumstances. However, in practice, the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role. The reason for this is that vegetation responds relatively quickly to changes in the soil moisture regime or management and may be transformed, whereas the morphological indicators in the soil are far more permanent and will hold the signs of frequent saturation long after a wetland has been drained (perhaps for several centuries).

5.2.2 RIPARIAN ZONE

Riparian zones are described as "the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas", Riparian zones can be thus be distinguished from adjacent terrestrial areas through their association with the physical structure (banks) of the river or stream, as well as the distinctive structural and compositional vegetation zones between the riparian and upland terrestrial areas (**Figure 6**).

Unlike wetland areas, riparian zones are usually not saturated for a long enough duration for redoxymorphic features to develop. Riparian zones instead develop in response to (and are adapted to) the physical disturbances caused by frequent overbank flooding from the associated river or stream channel.

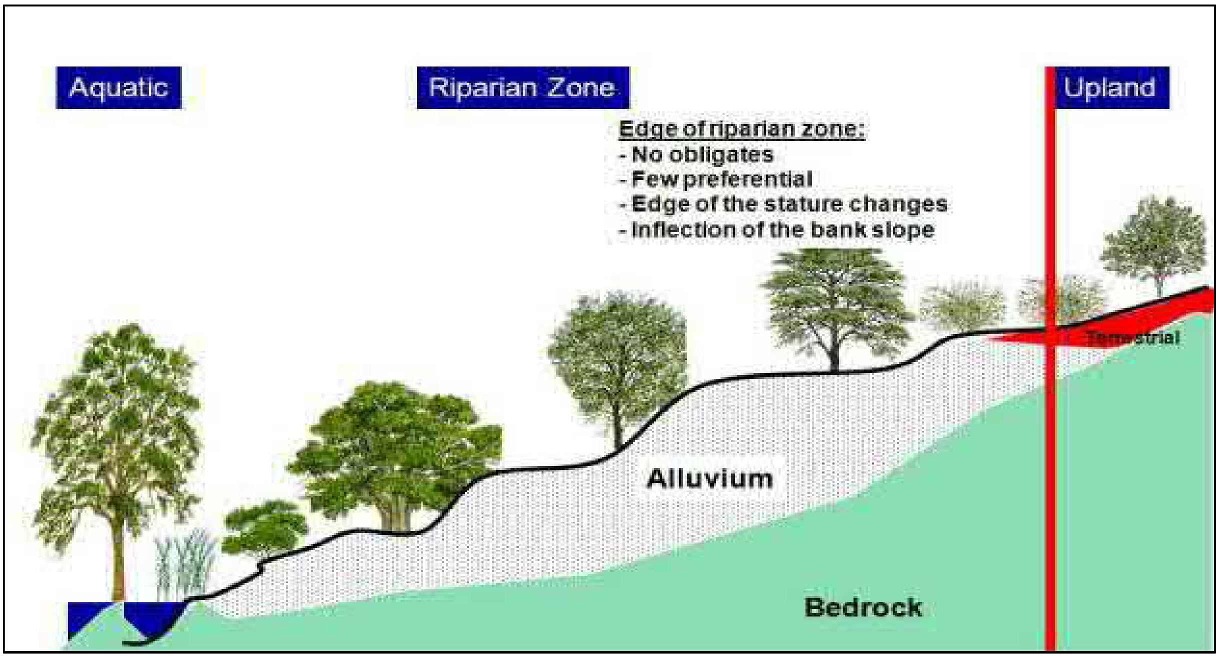


Figure 6: The edge of the riparian zone on one bank of a large river (DWAF 2008)

5.3 WETLAND FUNCTIONAL ASSESSMENT

Functional assessments were developed principally for evaluating the potential impacts of developments which threaten wetland ecosystems, and are used to assess the success of wetland rehabilitation projects, by evaluating the change in wetland functioning over time (DWAF, 2004).

These protocols are usually designed to estimate the change in functioning resulting from the alteration of a wetland (either positive or negative). Minimally-impacted wetlands (within each wetland class) are used as a reference or benchmark. Each function is scored relative to that of reference wetlands in the same locality and class/type and subclass/subtype. The index value of each variable is accompanied by descriptions of estimates and measurements.

WET-Health (described below) is designed for the rapid assessment of the integrity of wetlands. It focuses on the question of how far a system has deviated from its historical, undisturbed reference condition, and does not assess ecosystem services. WET-EcoServices (Kotze *et al.*, 2007), is designed for the rapid assessment of the delivery of ecosystem services by a wetland in its current state. It does not assess how far this state is from the reference condition (i.e., its integrity).

The WET-EcoServices tool (Kotze *et al.*, 2005) allows measurement of ecosystem goods and services (eco-services) provided by a wetland system. Eco-services refer to the benefits obtained from ecosystems. These benefits may be derived from outputs that can be consumed directly, indirectly (which arise from functions or attributes occurring within the ecosystem), or possible future direct or indirect uses (Howe *et al.*, 1991).

The WET-EcoServices tool provides structured guidelines that allow the importance of the wetland to be scored according to its ability to deliver various ecosystem services, shown in **Table 2**.

Table 2: Ecosystem Services Considered in a South African Context

Direct Benefits	Indirect Benefits
Cultural benefits – Cultural heritage – Tourism and recreation – Education and research	**Regulating and supporting benefits** – Flood attenuation – Streamflow regulation – Carbon storage
Provisioning benefits	**Water quality enhancement benefits**

Direct Benefits	Indirect Benefits
– Provision of cultivated foods – Provision of harvestable resources – Provision of water for human use – Biodiversity maintenance	– Sediment trapping – Phosphate assimilation – Nitrate assimilation – Toxicant assimilation – Erosion control

5.4 DETERMINING THE PRESENT ECOLOGICAL STATE (INTEGRITY) OF THE WETLANDS

WET-Health is a tool designed to assess the health (present state) or integrity of a wetland. Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition (Macfarlane *et al*. 2009). This tool is utilised to assess hydrological, geomorphological and vegetation health in three separate modules.

Hydrology is defined in this context as the distribution and movement of water through a wetland and its soils. This module focuses on changes in water inputs as a result of changes in catchment activities and characteristics that affect water supply and its timing, as well as on modifications within the wetland that alter the water distribution and retention patterns within the wetland.

Geomorphology is defined in this context as the distribution and retention patterns of sediment within the wetland. This module focuses on evaluating current geomorphic health through the presence of indicators of excessive sediment inputs and/or losses for clastic (minerogenic) and organic sediment (peat).

Vegetation is defined in this context as the vegetation structural and compositional state. This module evaluates changes in vegetation composition and structure as a consequence of current and historic onsite transformation and/or disturbance.

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. The tool attempts to standardise the way that impacts are calculated and presented across each of the modules. This takes the form of assessing the spatial extent of impact of individual activities and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact.

An overall wetland health score is calculated by weighting the scores obtained for each module and combining them to give an overall combined score using the following formula:

Overall health rating = [(Hydrology*3) + (Geomorphology*2) + (Vegetation*2)] / 7

This overall score assists in providing an overall indication of wetland health/functionality which can in turn be used for recommending appropriate management measures.

Impact scores obtained for each of the modules reflect the degree of change from natural reference conditions. Resultant health scores fall into one of six health categories (A-F) on a gradient from "unmodified/natural" (Category A) to "severe/complete deviation from natural" (Category F) as depicted in **Table 3**.

Table 3: Health categories used by WET-Health for describing the integrity of wetlands

Impact Category	Description	Range	PES Category
None	Unmodified, natural.	0 – 0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 – 1.9	B

Impact Category	Description	Range	PES Category
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 – 3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 – 5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10	F

5.5 DETERMINING THE ECOLOGICAL IMPORTANCE AND SENSITIVITY OF WETLANDS

The Ecological Importance and Sensitivity of the wetlands present was determined by utilising a rapid scoring system. The system has been developed to provide a scoring approach for assessing the Ecological and Hydrological Functions, and the Direct Human Benefits of importance and sensitivity of wetlands. These scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze *et al.* (2008) on the assessment of wetland ecological goods and services from the WET-EcoServices tool (Rountree and Kotze, 2013). The aspects which are assessed in terms of their importance/sensitivity are indicated in **Table 4**. A rating of 0 (low sensitivity / low importance) to 4 (very high) is allocated to each aspect. An overall score is based on the highest score out of the three categories.

Table 4: Elements assessed to determine the Ecological Importance and sensitivity

Ecological/Biological Importance	Hydrological/Functional Importance	Importance of Direct Human Benefits
Biodiversity support – Presence of Red Data species – Populations of unique species – Migration/breeding/feeding sites **Landscape scale** – Protection status of the wetland – Protection status of the vegetation type – Regional context of the ecological integrity – Size and rarity of the wetland type/s present – Diversity of habitat types **Sensitivity of the wetland** – Sensitivity to changes in floods – Sensitivity to changes in low flows/dry season	**Regulating and supporting benefits** – Flood attenuation – Streamflow regulation **Water Quality Enhancement** – Sediment trapping – Phosphate assimilation – Nitrate assimilation – Toxicant assimilation – Erosion control **Carbon Storage**	**Subsistence benefits** – Water for human use – Harvestable resources – Cultivated foods **Cultural benefits** – Cultural heritage – Tourism and recreation – Education and research

Ecological/Biological Importance	Hydrological/Functional Importance	Importance of Direct Human Benefits
– Sensitivity to changes in water quality		
OVERALL IMPORTANCE *(highest out of the three categories)*		

5.6 ECOLOGICAL CLASSIFICATION AND DESCRIPTION

EcoClassification - the term used for the Ecological Classification process - refers to the determination and categorisation of the PES (health or integrity) of various biophysical attributes of watercourses relative to or close to the natural reference condition. The purpose of the EcoClassification process is to gain insights and understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the watercourse.

The WET-Health is a tool designed to assess the health or integrity of a wetland (McFarlane *et al*., 2009). Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. Based on the delineation and classification, the systems identified do comprise of wetland like conditions (i.e. hydrological, geomorphic and vegetation).

The procedure of EcoClassification describes the health of a water resource and derives and formulates management targets / objectives / specifications for the resource. This provides the context for monitoring the water resource within an adaptive environmental management framework.

6 KNOWLEDGE GAPS

Key assumptions and limitations relevant to the assessment included:

- The location and associated infrastructure were determined from information provided by Eskom;
- Wetlands and/or riparian habitats identified for delineation were based on a desktop review of available information (NSS CC, 2018) and through a site inspection. This is reliant on various published data sources (e.g. aerial imagery and mapping) which have been assumed by WSP to be representative of site conditions;
- Site work prioritised wetlands and/or riparian habitats presumed to be at risk by the proposed pipeline;
- The wetland/riparian boundary comprises a gradually changing gradient of wetland/riparian indicators and varies both temporally and spatially; the wetland delineation thus occurs within a certain degree of tolerance;
- It should be recognised that there are several confounding effects on the interpretation of the historic and current extent, and functioning of the respective habitats such as the historic and current industrial practices, roads, infilling, excavations/erosion, etc.;
- The wetland/riparian boundaries within the specific study area (within the 500m regulated boundary) in relation to the proposed pipeline were accurately delineated based on the initial desktop review and site observations. The remaining watercourses (outside the 500m regulated boundary) were delineated at a desktop level and broadly verified in the field to obtain an extent of the wetland/riparian areas;
- This report is assessing the impact of the proposed pipeline and associated activities only; and,
- The findings, results, observations, conclusions and recommendations given in this report are based on WSP's best scientific and professional knowledge as well as available information.

7 RESULTS

7.1 WETLAND DELINEATION

An in-depth desktop assessment, utilising aerial imagery (2004 – 2017) and available datasets (WSP, 2016; NSS CC, 2018), was conducted to determine potential wetland or riparian habitats in the area under consideration. An in-field assessment was conducted during March 2019 and the confirmed wetlands were delineated and assessed, along with additional systems identified during the assessment. A total of three wetlands (D1, D2 and SEW 2) were identified within a 500m radius of the proposed pipelines (**Figure 7**).

7.2 WETLAND UNIT IDENTIFICATION

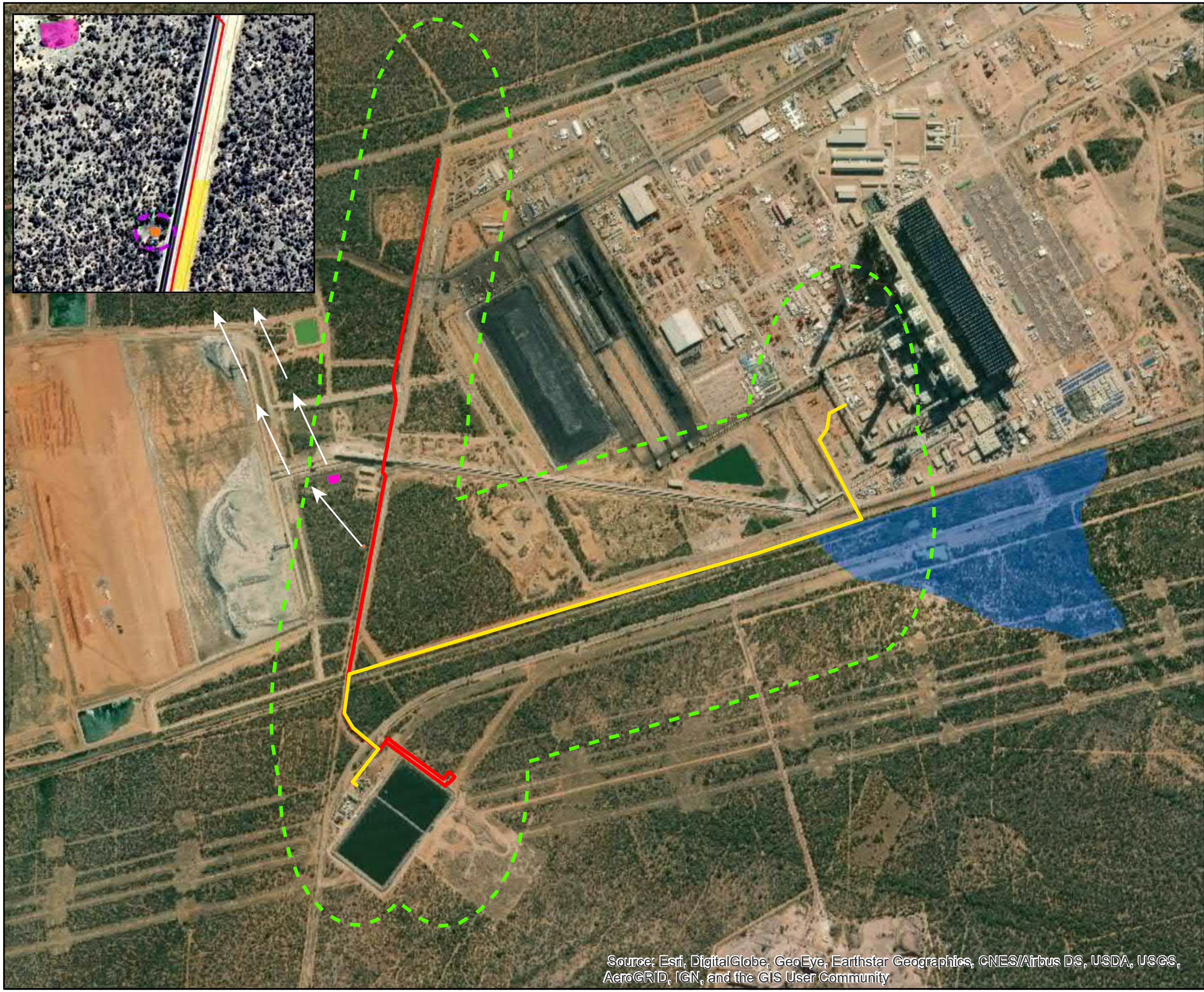
The identified wetlands were classified into respective HGM units and are described below (**Table 5**; **Figure 7**). HGM units D1 and SEW 2 were also identified by NSS CC (2018).

An initial risk screening assessment was undertaken to determine whether the aforementioned wetlands would potentially be impacted on by the proposed pipeline. This followed a qualitative assessment approach that encompassed a rapid risk screening exercise. The screening exercise is not considered a risk matrix assessment and therefore the rating is not a calculated representative of the severity and likelihood that a watercourse may be impacted.

Owing to its proximity, wetland D1 was identified as the only wetland that may potentially be impacted on by the proposed pipeline (**Table 5**). Images of the wetland are contained in **Figures 8** to **10**. The risk matrix assessment was also conducted for this wetland in order to understand and quantify the potential impacts of the proposed pipeline on the wetland.

Table 5: Preliminary Impact Assessment

Wetland ID	HGM Unit	Further Assessment	Justification
D1	Seasonal Depression	**Yes**	This wetland is located approximately 10m away from the to the proposed pipeline route; as such, the construction and operation of the pipeline will have the potential to impact on the wetland.
D2	Seasonal Depression	No	This wetland is located up gradient of the proposed pipeline route; as such, any surface water flows are not anticipated to enter to the wetland. The D2 wetland appears to have been modified due to the presence of the infrastructure associated with the Medupi Power Station.
SEW 2	Semi-Ephemeral Washes (NSS CC, 2018)	No	Although this wetland is located down gradient of the proposed pipeline route, impacts to this wetland have not been considered as there exists a railway line between this wetland and the proposed pipeline. The railway line is on a raised platform, therefore any surface water runoff from this area would be restricted from entering the SEW 2 wetland.



ESKOM

IDENTIFIED WETLANDS
WITHIN 500M

Legend

- Segment 1
- Segment 2
- 10m Buffer
- 500m Buffer
- Laydown Area
- SEW 2
- D1
- D2

N

0 90 180 270 360 450

Metres

DISCLAIMER

The information on this figure was derived from various digital databases available to WSP Environmental (Pty) Ltd. All information is provided "as is" and it must be acknowledged that data, information, and maps are dynamic and in a constant state of maintenance, correction and update. WSP Environmental (Pty) Ltd cannot accept any responsibility for errors, omissions, or positional accuracy where it has not been directly responsible for the production of the data referenced. There are no warranties, expressed or implied, as to the use of this information, including the warranty of merchantability or fitness for a particular purpose. Notification of any errors will be appreciated.

WSP ENVIRONMENTAL (PTY) LTD
WSP HOUSE, 1 ON LANGFORD, LANGFORD ROAD, WESTVILLE 3632
P O BOX 1442, WESTVILLE 3630, RSA
Tel +27 (0)31 240 8860, Fax +27 (0)31 240 8861, wspe@wspgroup.co.za

DATA SOURCE:

PROJECTION: GCS_WGS_1984

PROJECT TITLE:

ESKOM RAW WATER PIPELINE BA AND WULA

SCALE: 1:17,500	DRAWN BY: SINENHLANHLA RADEBE	
DATE: 2019/04/30	REVIEWED BY: ZAKARIYA NAKHOODA	
FIGURE NO: 7	PROJECT NO: 41101556	REV:

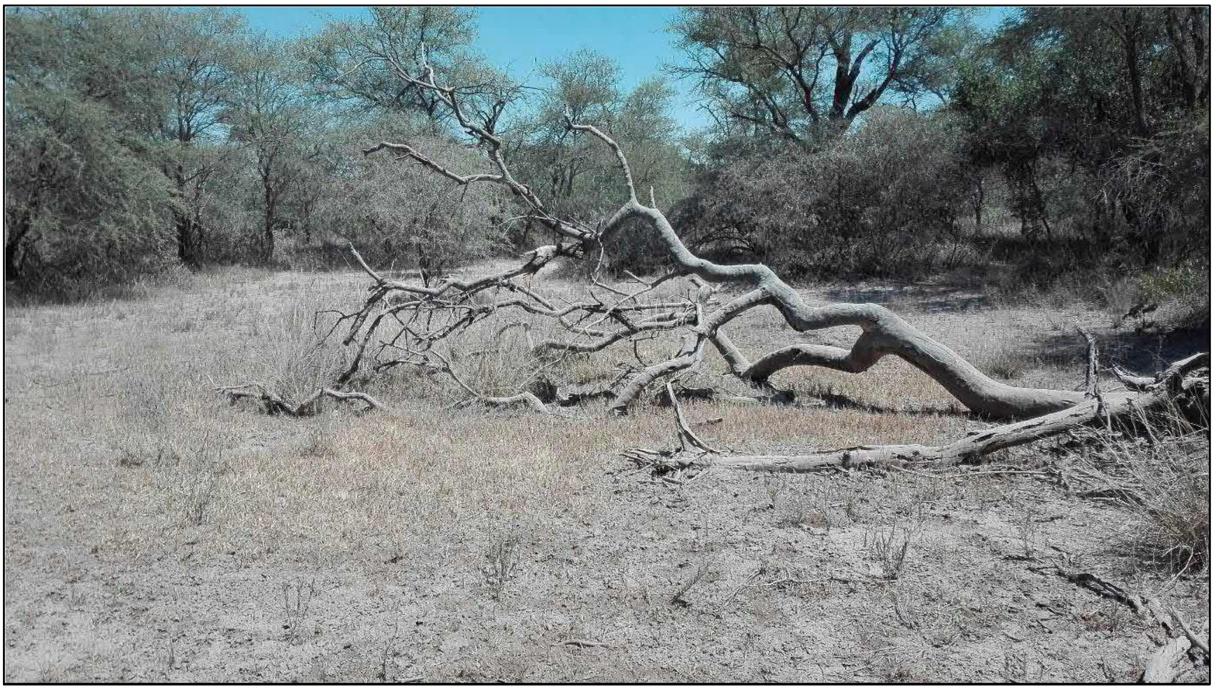


Figure 8: Wetland D1

Figure 9: Dry Surface Soil within D1

Figure 10: Railway Line between the Proposed Pipeline and SEW 2

7.3 WETLAND UNIT SETTING

The setting of the identified wetland unit were classified as per **Table 6** below:

Table 6: Wetland Unit Setting

<table>
<tr><th>Unit</th><th>Regional Setting (Level 2)</th><th>Landscape Setting (Level 3)</th><th colspan="2">HGM Unit (Level 4)</th><th colspan="2">Hydrological Regime (Level 5)</th><th>Descriptors (Level 6)</th></tr>
<tr><td rowspan="3">D1</td><td rowspan="3">Central Bushveld Group 4 (NFEPA WetVeg)</td><td rowspan="3">Plain</td><td colspan="2">Depression</td><td>Level 5A</td><td>Intermittently Inundated</td><td rowspan="3">Natural</td></tr>
<tr><td>Level 4B</td><td>Endorheic</td><td rowspan="2">Level 5B</td><td rowspan="2">Intermittently Saturated</td></tr>
<tr><td>Level 4C</td><td>Non Channelled inflow</td></tr>
</table>

7.4 DESCRIPTION AND FUNCTIONALITY OF WETLAND TYPE

A depression is a wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates. Depressions may be flat-bottomed (in which case they are often referred to as pans) or round-bottomed and may have any combination of inlets and outlets or lack these completely (Ollis *et al*., 2013).

Most depressions occur either where the water table intercepts the land surface, or in semi-arid settings where a lack of sufficient water inputs prevents areas where water accumulates from forming a connection with the open drainage network. The dominant water inputs and outputs of a depression are dictated primarily by the outflow and inflow drainage characteristics (Ollis *et al*., 2013). The hydrodynamics of a depression are, however, typically dominated by vertical water level fluctuations. Many depressions do not have any outward (downstream) drainage or any inflow channels. These types of aquatic ecosystems are not connected to a river network and are sometimes referred to as 'isolated depressions'(Ollis *et al*., 2013).

The depression wetland unit identified (D1) on site is characterised by its endorheic character and is circular in shape. The D1 wetland is a relatively small enclosed basin and is typically ephemeral in nature, usually being intermittently filled to shallow water levels during the rainy season. This is typical of the depressions that are found in this region.

7.5 THE PES ASSESSMENT OF THE D1 WETLAND

The PES assessment of a wetland is based on an understanding of both catchment and on-site impacts and the impact that these aspects have on the wetland hydrology, geomorphology and vegetation. The level 1 WET-Health assessment determined the PES of the D1 wetland as being moderately modified resulting in a loss of natural habitat and biota ('C' Class) (**Table 9**).

Table 7: PES Assessment of Depression D1

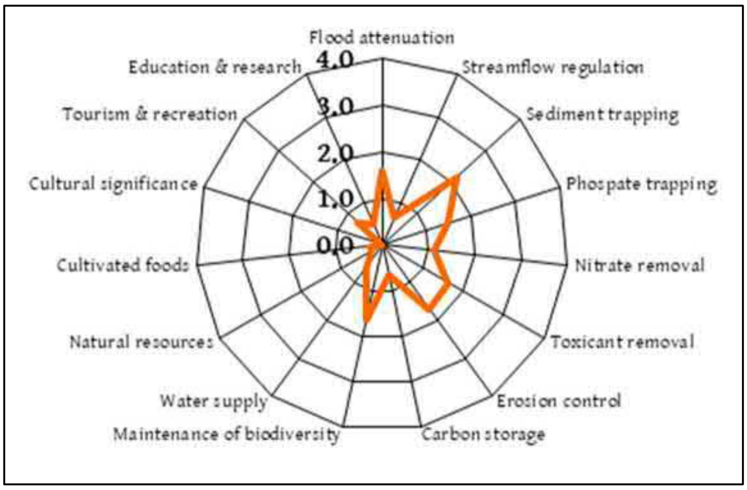
Aspect	PES Score (out of 10)	Class	Justification (Impact Description)
Hydrology	**3.5**	**C: Moderately Modified**	The surrounding land use has changed from natural to now containing the Power Station and associated infrastructure. Beside the D1 wetland, there exists an access road where trucks transport ash on a frequent basis. The changes to the surrounding landscape has had an impact on hydrology of the wetland. The hydrological integrity of the wetland is assessed to deteriorate slightly over the next 5 years.
Geomorphology	**2.9**	**C: Moderately Modified**	The surrounding land use has changed from natural to now containing the Power Station and associated infrastructure. Beside the D1 wetland, there exists an access road where trucks transport ash on a frequent basis. The changes to the surrounding landscape has had an impact on geomorphology of the wetland. The increased sediments from the adjacent road and the ash dump have contributed to the modifications of this system. The geomorphological integrity of the wetland is assessed to deteriorate slightly over the next 5 years.
Vegetation	**3.4**	**C: Moderately Modified**	The surrounding land use has changed from natural to containing the Power Station and associated infrastructure. As a result, the natural vegetation has been altered. The vegetation integrity of the wetland is assessed to deteriorate slightly over the next 5 years.
Overall	**3.3**	**C: Moderately Modified**	**Moderately Modified**. A significant change in ecosystem processes and loss of natural habitat and biota and has occurred.

7.6 WETLAND ECOLOGICAL FUNCTIONAL ASSESSMENT

The overall goods and services provided by the wetland (D1) were assessed as being mostly low to moderate (**Table 10**). Indirect services are the most important and include water quality enhancement, maintenance of biodiversity and erosion control. Bullfrogs have been located within this system.

Table 8: EcoServices of the D1 Depression

Ecosystem Goods & Services	Overall Score (out of 4)
Flood attenuation	1.6
Streamflow regulation	0.7
Sediment trapping	**2.2**
Phosphate trapping	**1.5**
Nitrate removal	1.1
Toxicant removal	**1.6**
Erosion control	**1.7**
Carbon storage	0.7
Maintenance of biodiversity	**1.6**
Water supply for human use	0.6
Natural resources	0.3
Cultivated foods	0.3
Cultural significance	0.0
Tourism and recreation	0.7
Education and research	0.5



7.7 ECOLOGICAL IMPORTANCE AND SENSITIVITY

The D1 wetland was assessed as having an overall moderate EIS (**Table 11**) driven by the hydrological functional importance, i.e. erosion control, water quality enhancement and maintenance of biodiversity. This is due to the current functionality of the wetland and the surrounding land use. It is not classified as 'Wetland FEPA' (Nel *et* *al*., 2011) and is thus not considered important in meeting national wetland conservation targets. The wetland has low direct benefits to society mainly due to the lack of harvestable resources.

Table 9: The EIS Assessment for the D1 Wetland

Unit	Ecological/ Biological Importance	Functional/ Hydrological Importance	Direct Benefits to Society	Overall Importance (/4)	
D1	1.33	1.38	0.40	1.38	**Moderate**

8 IMPACT ASSESSMENT

The Integrated Water Resource Management (IWRM) approach is an internationally-accepted approach to sustainable Water Resource Management. It recognises the inter-relatedness and relationship between watercourse-level processes and components (resource quality characteristics). An activity associated with the proposed pipelines can impact any of the resource ecosystem drivers (flow regime, water quality, geomorphological) or responses (habitat, biota) and this will have a knock-on effect on potentially all the other drivers and or responses. Therefore, any activity that has the ***potential to pose a risk*** to the resource quality characteristics constitutes a water use in terms of Section 21(c) and (i).

The specific direct, indirect and cumulative impacts are determined by looking at the impact the proposed pipeline may have on the habitat, biota, water quality and/or flow regime of a watercourse. These are broad categories that encapsulate the impacts that could potentially affect the functioning of a watercourse. The majority of activities will affect more than one characteristic due to their complex interrelatedness and therefore the identified impacts below were not placed distinctly into these specific descriptive categories.

The mitigation of negative impacts on biodiversity and ecosystem goods and services is a legal requirement for authorisation purposes. It requires proactive planning that is enabled through a mitigation hierarchy, which strives to first avoid disturbance of ecosystems and loss of biodiversity, then, to minimise, rehabilitate and finally offset any remaining significant residual negative impacts on biodiversity (DEA, 2013).

There are generic best practice mitigative measures that are required to be implemented with every potential development to ensure the application of the most appropriate combination of environmental control measures and strategies, to protect water resources and the surrounding environment. These measures are generally defined within a project-specific Environmental Management Programme (EMPr), however, in the absence of an EMPr, the best practice specifications within the DWS '*Integrated Environmental Management Series – Environmental Best Practice Specifications*': '*Construction*' (DWAF 2005b) & '*Operation*' (DWAF 2005c) guidelines should be implemented, along with the project-specific mitigative measures outlined.

A summary of the risk assessment is presented in (**Tables 10** and **11)**, together with associated mitigative measures presented in **Section 9**. All risk ratings associated with the assessment scored **Low** owing to the footprint of the proposed development and the transformed nature of the surrounding environment.

Table 10: Impact Assessment (Wetland D1) – Severity and Consequence

Aspect	Impact	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial Scale	Duration	Con-sequence
Construction Phase									
Surface Water Flows	– Potential for increased toxic chemicals to enter the wetland; and, – Increased surface water runoff.	3	2	2	1	**2**	1	2	**5**
Waste Disposal	– Waste may enter the wetland (e.g. general and construction waste).	0	2	1	2	**1.25**	1	2	**4.25**
Effluent Management	– Effluent generated on site may enter the wetland.	1	2	1	1	**1.25**	1	2	**4.25**
Vegetation Clearing	– Decreased roughness; – Increased runoff (volume and velocity); and, – Soil compaction.	2	1	2	2	**1.75**	1	2	**4.75**
Excavation, infilling, use of machinery	– Potential hydrocarbon leaks/spills entering the wetland; and – Increased sediment input.	0	3	3	3	**2.25**	1	2	**5.25**
Operational Phase									
Water Management	– Potential for increased water flows to enter the wetland as a result of pipe leaks	2	1	1	1	**1.25**	1	3	**5.25**
Inspections and the use of machinery (Maintenance)	– Potential hydrocarbon leaks/spills entering the wetland; and, – Increased sediment input.	0	2	2	2	**1.5**	1	3	**5.5**

Table 11: Impact Assessment (Wetland D1) – Risk Rating

Aspect	Impact	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
Construction Phase								
Surface Water Flows	– Potential for increased toxic chemicals to enter the wetland; and, – Increased surface water runoff.	1	1	5	2	9	**45**	**L**
Waste Disposal	– Waste may enter the wetland (e.g. general and construction waste).	1	1	1	1	5	**21.25**	**L**
Effluent Management	– Effluent generated on site may enter the wetland.	1	2	5	1	9	**38.25**	**L**
Vegetation Clearing	– Decreased roughness; – Increased runoff (volume and velocity); and, – Soil compaction.	1	2	5	1	9	**42.75**	**L**
Excavation, infilling, use of machinery	– Potential hydrocarbon leaks/spills entering the wetland; and – Increased sediment input.	1	2	5	1	9	**47.25**	**L**
Operational Phase								
Water Management	– Potential for increased water flows to enter the wetland as a result of pipe leaks	1	1	5	1	8	**42**	L
Inspections and the use of machinery (Maintenance)	– Potential hydrocarbon leaks/spills entering the wetland; and, – Increased sediment input.	1	1	5	1	8	**44**	**L**

8.1 RECOMMENDED MITIGATIVE MEASURES

The following mitigative measure are recommended in order to minimise any potential impact from the proposed pipeline on the D1 wetland:

- Best practice standards must be followed for the construction and operation of the proposed pipeline;
- Construction method statements are to be adhered to. These method statements should consider the environmental facets associated with the wetland such as hydrological flow regimes, flora and fauna. These should be approved by DWS;
- Existing access routes must be utilised;
- The identified wetland (D1) must be demarcated as no-go areas during construction;
- Seeing that the wetland is approximately 10m away from the proposed pipeline, it is recommended that this area (between the wetland and the proposed pipeline) be designated as a buffer no-go area;
- The laydown area within the vicinity of the Wetland D1 must be on the opposite side of the proposed pipeline route to where the wetland is located as indicated in **Figure 7**. This area should include a berm to prevent sediment entering the D1 wetland during a rainfall event;
- A site layout plan must be compiled indicating the limits of disturbance associated with the proposed developments in relation to the identified sensitive areas (i.e. wetlands). No-go areas and any stormwater infrastructure must be indicated on this plan together with erosion and sediment controls and measures;
- During construction, sediment control measures must be adopted in order to prevent sediments entering the wetland;
- The pipelines must be inspected regularly for any leaks;
- Machinery and equipment must be inspected regularly for faults and possible leaks. If required, servicing of these should occur off site;
- A Spill Response Plan must be available for any spills that occur during construction and operation;
- The construction site camp and stockpile locations must not be located within sensitive areas. These should be located in already disturbed areas and kept to a minimal size. Appropriate measures (Stormwater Management Plan) should be taken to ensure that sediments from these stockpiles do not enter the D1 wetland. Rehabilitation should occur to these areas once construction has been completed;
- Water required during the construction process should be sourced from an external contractor as and when required. This will be transported to site via a water tanker.

9 CONCLUSIONS

A total of three HGM units were identified within 500m of the proposed raw water pipelines, namely:

- D1- Depression;
- D2- Depression; and,
- SEW2- Semi-Ephemeral Washes.

Depressions D1 and D2 are located within 500m of pipeline segment 1, transferring water from an offtake point to the holding reservoir, whilst SEW2 is located adjacent to pipeline segment 2, transferring water from the holding reservoir to the FGD Process Water Tanks and Wastewater Treatment Plant.

The wetland habitat risk assessment determined that the proposed construction and operation of the pipelines may have the potential to impact the identified D1 (depression) wetland. The D1 wetland was assessed to have a PES of C (Moderately Modified) owing to the transformed nature of the surrounding land use and its influence on the D1 wetland. The EIS of the D1wetland was assessed as being moderate, driven by the hydrological functional importance, i.e. erosion control, water quality enhancement and maintenance of biodiversity.

The proposed pipelines are not anticipated to contribute to the direct loss of wetland habitat or biota. This is however dependant on construction plans and protocols in place during these phases.

The potential impacts to the identified wetlands would be from incorrect construction methods and operational activities of the proposed construction activities. If the stipulated mitigative measures, including adherence to the DWS Environmental Best Practice Guidelines and the Work Method Statement, then the impacts are deemed to be of low significance.

Prior to undertaking the proposed activities, construction method statements and emergency response plans must be developed, with specific consideration given to the environment, including wetland habitats. It is envisaged that the implementation of these would provide sufficient mitigation measures in order to reduce the environmental impact.

It is the specialist opinion then that the proposed pipeline may then be registered with the DWS under a General Authorisation (GA) in terms of Section 21(c) and 21(i).

REFERENCES

- Department of Water Affairs and Forestry. 2005a. A practical field procedure for identification and delineation of wetland and riparian areas. Edition 1, September 2005. DWAF, Pretoria.
- Department of Water Affairs and Forestry. 2005b. Environmental Best Practice Specifications: Construction. Integrated Environmental Management: Sub-Series No. IEMS 1.6. Third Edition. Pretoria.
- Department of Water Affairs and Forestry. 2005c. Environmental Best Practice Specifications: Operation. Integrated Environmental Management: Sub-Series No. IEMS 1.6. Third Edition. Pretoria.
- Department of Water Affairs and Forestry. 2009. DWAF Training Manual: National Water Act Section 21(c) and (i) Water Uses. Version: November 2009.
- Golder & Associates. 2018. Hydrogeological Impact Assessment Study. Report Ref
- Golder & Associates. 2018. Surface Water Impact Assessment and Baseline Report. Report Ref 1415879-310165-2.
- Kotze, D., Marneweck, G., Batchelor, A., Lindley, D. and Collins, N. 2009. WET-EcoServices: A technique for rapidly assessing ecosystem services provided by wetlands. Wetland Management Series. Water Research Commission Report TT 339/09.
- Macfarlane, D., Kotze, D., Ellery, W., Walters, D., Koopman, V., Goodman, P. and Goge, M. 2009. WET-Health: A technique for rapidly assessing wetland health. Wetland Management Series. Water Research Commission Report TT 340/09.Mc
- Mucina, L. and Rutherford, M. C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- Natural Scientific Services CC. 2018. Biodiversity and Wetland Assessment for the FGD Project at Medupi Power Station-Lephalale, Limpopo. Ref 2112.
- Ollis, D., Snaddon, K., Job. N. and Mbona. N. 2013. Classification system for wetland and other aquatic ecosystems in South Africa. User manual: inland systems. SANBI biodiversity series 22. SANBI Pretoria.
- Rountree, M.W. and Kotze, D.C. 2013. Appendix A3: Ecological Importance and Sensitivity Assessment. In: Rountree, M. W., Malan, H.L., and Weston, B.C. Eds. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). WRC Report No. 1788/1/12. Pretoria
- WRC. 2015. Water Resources of South Africa 2012 Study (WR2012). Retrieved from http://waterresourceswr2012.co.za/resource-centre.

APPENDIX