DIGBY WELLS ENVIRONMENTAL

Mutsho Power Project and Associated Infrastructure

Surface Water Assessment Scoping Report

Project Number:
SAV4689

Prepared for:
Mutsho Power (PTY) LTD
On behalf of
Savannah Environmental Consultant (PTY) LTD

August 2017

Digby Wells and Associates (South Africa) (Pty) Ltd
Co. Reg. No. 2010/008577/07. Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191.
Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 069 6801, info@digbywells.com, www.digbywells.com

This document has been prepared by Digby Wells Environmental.

Report Type:	Surface Water Assessment Scoping Report
Project Name:	**Mutsho Power Project and Associated Infrastructure**
Project Code:	**SAV4689**

Name	Responsibility	Signature	Date
Mashudu Rafundisani	Report Writer		August 2017
Andre van Coller	1st Review		August 2017
Graham Trusler	2nd Review		August 2017

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

CBIPPPP	Coal Baseload Independent Power Producer Procurement Programme
CFB	Circulating Fluidised Bed
EIA	Environmental Impact Assessment
FGD	Flue Gas Desulphurisation
ha	Hectares
IPP	Independent Power Producer
km	Kilometres
m^2	Square metre
m^3	Cubic metre
m	Metre
MAE	Mean Annual Evaporation
mamsl	Metres above mean sea level
WRC	Water Research Commission
WMA	Water Management Area
WSP	Water Service Provider
ZLED	Zero Liquid Effluent Discharge

1 INTRODUCTION

Digby Wells Environmental (hereafter Digby Wells) has been appointed by Savannah Environmental (Pty) Ltd to undertake a surface water assessment for the establishment of a Coal-fired Power plant near Makhado, in Limpopo Province. This document is a scoping phase report to summarise the current baseline conditions and to propose the scope of work and methodology to be followed for the EIA phase.

1.1 Project Description and Location

The proposed project area is situated in the magisterial district of Vhembe, in the Limpopo Province, approximately 40 km north of the town Makhado and 7 km south-west of Mopane Town. The regional and local setting is illustrated on Figure 1-1 and Figure 1-2.

Once developed, the proposed plant would form part of the Department of Energy's (DoE's) Coal Baseload Independent Power Producer (IPP) Procurement Programme (CBIPPPP).

Due to the lack of a detailed project description at this stage, it is assumed that the facility comprises either of a conventional Pulverised Coal (PC) (with Flue Gas Desulphurisation (FGD)), or Circulating Fluidised Bed (CFB) coal-fired power plant.

The type of infrastructure required to support the coal-fired power plant would ultimately be dependent on the type of technology selected for implementation. For the purposes of this report, it is assumed that a coal-fired power plant would typically comprise of the following key components and associated infrastructure:

- Power island consisting of:
  - Pulverised Coal (PC) with Flue Gas Desulphurisation (FGD), or Circulating Fluidised Bed (CFB) boiler technology.
  - Electrostatic Precipitator (ESP) / Bag filtration systems and Flue / smoke stacks.
  - Direct or indirect air cooling systems.
  - Balance of plant components (including steam turbines and generators etc.).
- Coal and limestone rail spur and / or road offloading systems.
- Coal crusher (for CFB); or coal milling plant (for PC).
- Strategic and working coal stockpiles.
- Limestone storage and handling area (for use with CFB or PC technology).
- Ammonia storage and handling area (for use in flue gas clean up with PC technology).
- Ash dump.
- Water infrastructure. This could include:
  - Raw water storage dams.

  - Water supply pipelines and booster stations.
  - Pollution control dams.
  - Water treatment plant (WTP).
  - Wastewater treatment plant (WWTP).
  - Stormwater management systems.
- HV yard and substation components with HV overhead transmission lines connecting to Eskom infrastructure.
- Control room, office / administration, workshop, storage and logistics buildings.
- Upgrading of external roads and establishment of internal access roads.
- Security fencing and lighting.

A footprint of approximately 600ha would be required for the power station and associated infrastructure. The type of technology selected for implementation would ultimately have influence on the project layout and development footprint (i.e. the area of land required for development). While the power generation components require limited space, supporting areas for the establishment of coal and other raw material stockpiles, and an ash dump increase the development footprint. The outcomes of the Site Screening Assessment are therefore expected to be applicable to the siting of a new CFB or PC (with FGD) power plant, or alternatively a more advanced and lower impact alternative. The selection of alternative technologies and optimisation of the layout during the project design phase therefore presents the opportunity for impacts associated with the project on the receiving environment and sensitive receptors to be reduced.

Therefore, this will serve as preliminary surface water scoping report and a detailed impact assessment will be conducted once the type of technology and infrastructure layout has been finalised.

1.2 Water Supply

The Musina LM is a Water Service Provider (WSP) while the Vhembe DM is the Water Services Authority (WSA). The Vhembe DM is therefore responsible for the implementation of all water projects and planning processes, and the provision of infrastructure; whereas the Musina LM is responsible for the operation and maintenance of bulk and reticulated water and sanitation infrastructure; including the extraction, purification, reticulation, billing and connecting of new customers. The Musina LM is also responsible for operating and maintaining the waste water reticulation scheme.

The Musina LM does not supply any water to Agriculture or Forestry but only to Industrial/Commercial and Domestic users. The Musina LM has a maximum water production of 17mg/d (equivalent to 64 352m^3/day), of which 70% is used for domestic and 30% is used for commercial purposes. Water shortages are experienced during drought seasons, when the pumping efficiency is not at its maximum due to scarcity of water from the source. Musina water quality is classified under Class 1 of the South African national drinking water standards (SANS 241) (i.e. suitable for lifetime consumption), (Savannah Environmental, March 2017)

At this stage, it has not been indicated where the proposed project will be sourcing water from and this will be included in the EIA phase.

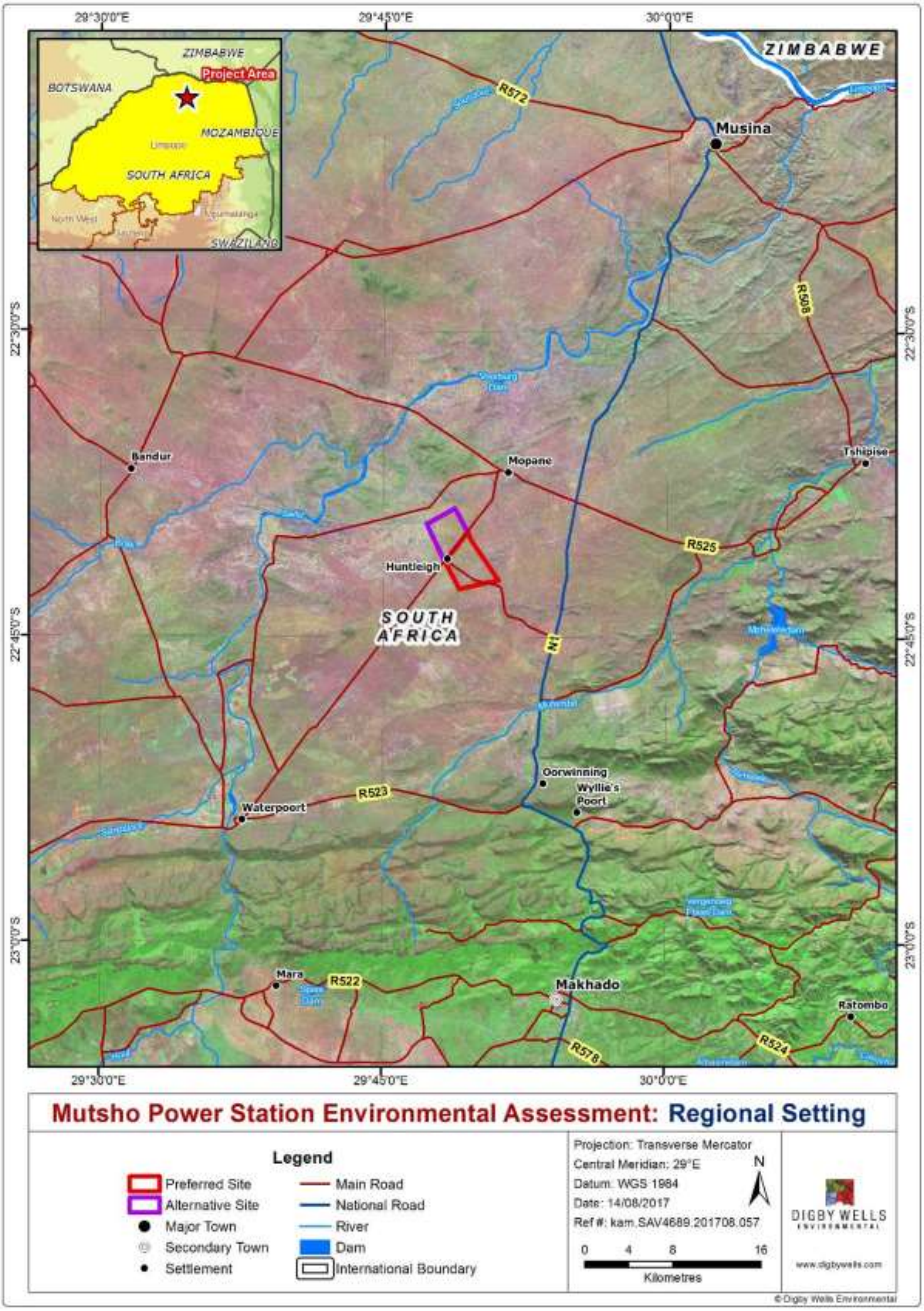

Figure 1-1: Regional Setting

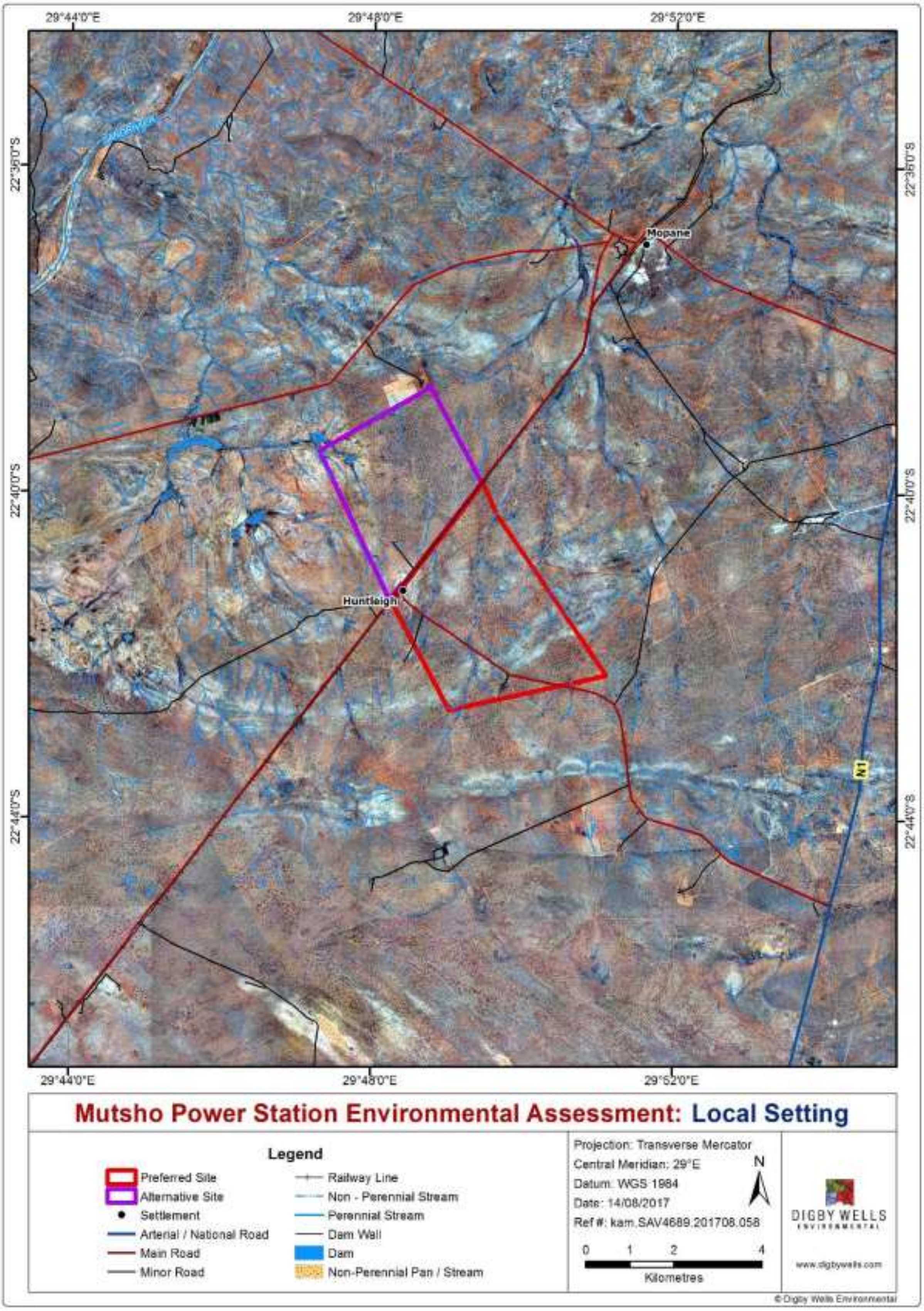

Figure 1-2: Local Setting

2 BASELINE ENVIRONMENT

2.1.1 Surface Water Hydrology

South Africa is divided into 9 Water Management Areas (WMA) (Revised National Water Resource Strategy, 2012), managed by their own water boards. Each of the WMAs is made up of quaternary catchments which relate to the drainage regions of South Africa, ranging from A to X (excluding O). These drainage regions are subdivided into four known divisions based on size. For example, the letter A represents the primary drainage catchment; A2 for example will represent the secondary catchment; A21 represents the tertiary catchment and A21D would represent the quaternary catchment which is the lowest subdivision in the Water Resources of South Africa, 2012 manual. Each of the quaternary catchments has associated hydrological parameters.

The project area is located in the A71K quaternary catchments of the Limpopo WMA as revised in the 2012 water management area boundary descriptions (government gazette No. 35517), this is shown in Figure 5 2. The surface water attributes of the affected quaternary catchment namely Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR), and Mean Annual Evaporation (MAE) were obtained from the Water Resources of South Africa 2012 Study (WR2012) and are summarised in Table 2 1.

Table 2-1: Summary of the surface water attributes of the A71K quaternary catchment

Catchment	Area (km^2)	MAP (mm)	MAR $m^3 * 10^6$	MAE (mm)
A71K	1668	305	7.28	2000

The A71K quaternary catchments has a net area of 1 668 km^2 which receives an average of 305 mm of rainfall per annum with an average potential evaporation rate of 2 000 mm per annum. The natural inflow and outflow from rainfall and evaporation results in a negative water balance for most open water storage facilities.

Sand River is the only major river within this quaternary catchment (approximately 8 km from the project area), it consists of several tributaries on both sides of the river and the Sand River flows into the Limpopo River which is 50 km away from the project area. Few drainage lines exist within the demarcated project area.

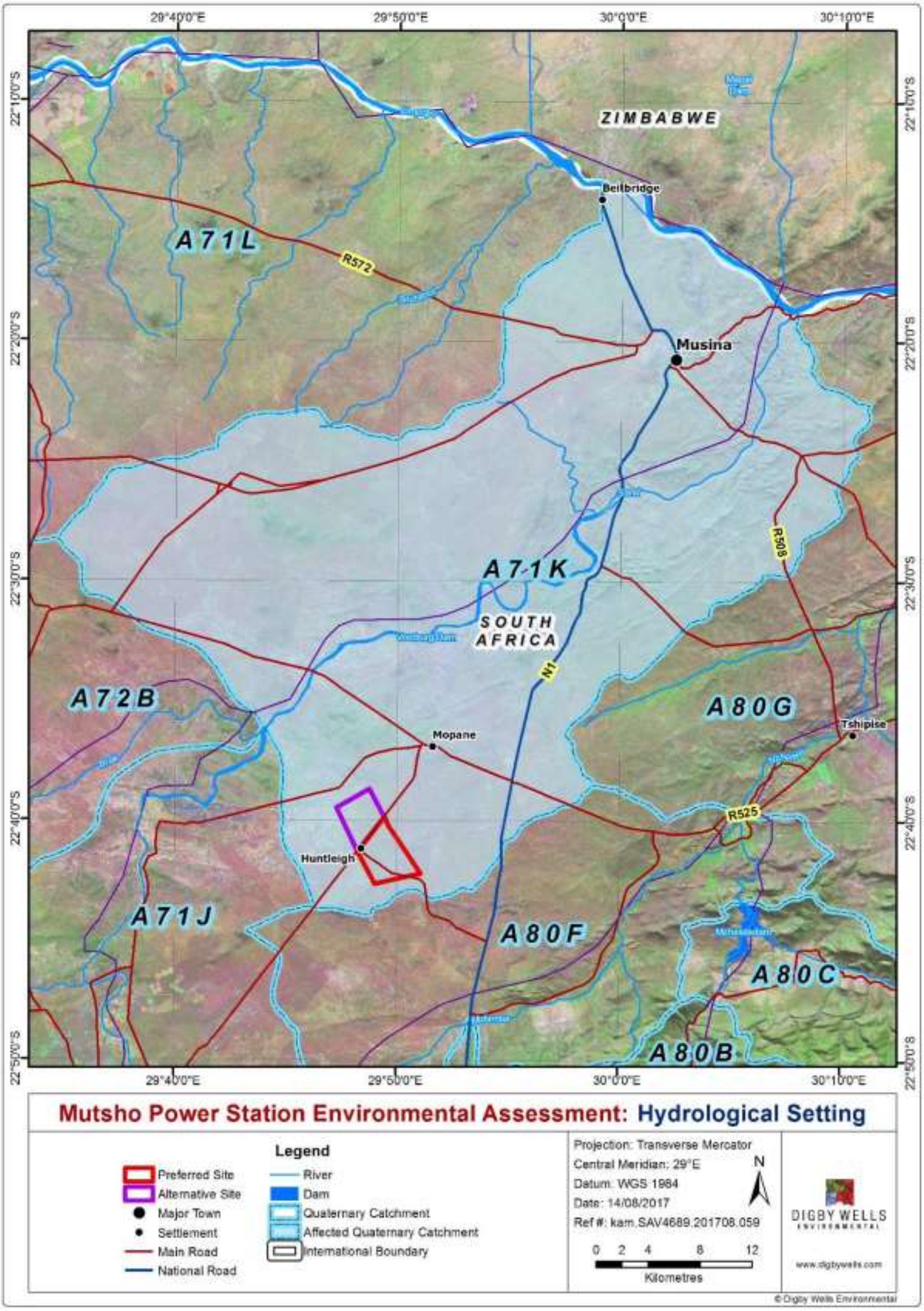

Figure 2-1: Hydrological Setting

2.1.2 Climate

The project area is situated in a semi-arid zone to the north of the Soutpansberg. The regional climate is strongly influenced by the east-west orientated mountain range which represents an effective barrier between the south-easterly maritime climate that is influenced from the Indian Ocean and the continental climate that has influences (predominantly the Inter-Tropical Convergence Zone and the Congo Air Mass) coming from the north.

The mountains give rise to wind patterns that play an important role in determining local climates. These wind effects include wind erosion, aridification and air warming (WSM LESHIKA, 2013)

This monthly climatic data of the rainfall and evaporation zones in which the project area is located is provided below.

2.1.2.1 Rainfall

Table 2-2 presents the average monthly rainfall for the quaternary catchment A71K. This is based on the average monthly rainfall data for the period 1920 to 2009, (WR2012).

Table 2-2: Summary of rainfall data extracted from the WR2012

Month	MAP (mm)
January	62.6
February	50.8
March	37.4
April	15.1
May	5.7
June	3.9
July	1.8
August	0.9
September	7.8
October	21.4
November	45.8
December	52.0
MAP	**305**

From the rainfall data above, higher rainfall values (52 mm, 62.6 mm and 50.8 mm) were recorded for the months of December, January and February respectively whilst the minimum or lowest rainfall was recorded in August. In general, this area receives a MAP of 305 mm per annum.

2.1.2.2 Evaporation

Monthly evaporation data was obtained from the WR2012 manual. The evaporation obtained is based on Symons Pan evaporation measurements and needs to be converted to lake evaporation. This is due to the Symons Pan being located below the ground surface and painted black which results in the temperature in the water being higher than that of a natural open water body. The Symons Pan figure is then multiplied by a lake evaporation factor to obtain the adopted lake evaporation figure which presents the monthly evaporation rates of a natural open water body. The MAE was calculated to be 1 681 mm per annum. Table 2-3 is a summary of the average monthly evaporation for the A71K quaternary catchment.

Table 2-3: Summary of evaporation data

Months	Lake Evaporation Factor	Lake Evaporation (mm)
January	0.84	175.2
February	0.9	149.4
March	0.9	149.4
April	0.9	122.1
May	0.9	114.0
June	0.9	91.8
July	0.8	100.9
August	0.8	120.2
September	0.8	146.3
October	0.8	169.5
November	0.82	164.5
December	0.83	177.3
Total	**N/A**	**1681**

Higher evaporation rates are experienced throughout the whole year with the highest being 177 mm during December.

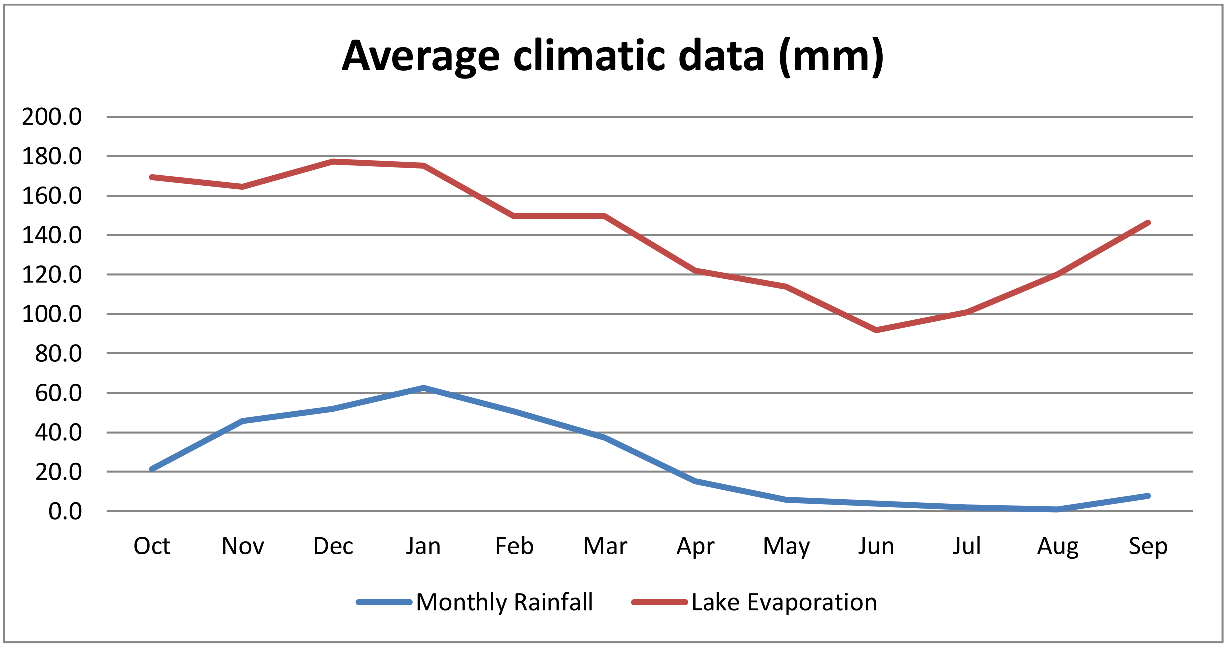

Figure 2-2: Summary of the average monthly climatic data for A71K quaternary catchment

3 LAND AND WATER USES

The predominant present land use in the wider area is agriculture with potential for mining, whilst the main use of surface water in the area is agricultural (irrigation) and possibly limited abstraction for mining activity.

The water requirements within the Sand catchment are large compared to the rest of the WMA, with irrigation comprising the largest water user. The majority of the irrigation sector's water requirements are met by the extraction of groundwater reserves via boreholes in the Sand / Limpopo Rivers which have been over-exploited. Although the urban requirements are high, a large portion of water is supplied through transfers from other WMAs (Savannah Environmental, March 2017).

4 HYDROLOGICAL SENSITIVITY

A preliminary or desktop sensitivity analysis on the affected farms indicates that there are few well-defined drainage lines and several runoff pathways or washes. Washes can be defined as those areas which show visible signs of occasional water movement and sediment transport, but which do not receive sufficient runoff to develop characteristic soils or vegetation associated with wetlands or drainage lines, these are a characteristic feature of arid and semi-arid environments and are related to the occurrence of occasional intense rainfall events within areas of low total rainfall

A defined drainage line on the north-western part of Farm Du Toit 563 comprise of a significant floodplain in which an artificial impoundment has also been constructed. This drainage line flows northwards towards the Sand River, and exhibits typical vegetation attributes. The presence and ecological contribution of these attributes increases the habitat diversity of the Farms and, ultimately, the perceived sensitivity (Savannah Environmental, March 2017)

Vriendin 589 farm portion is mainly comprised of the washes. The identified drainage line in this study area has been classified as highly sensitive whilst all the washes are considered moderate or less sensitive. The sensitivity map is shown in Figure 4-1.

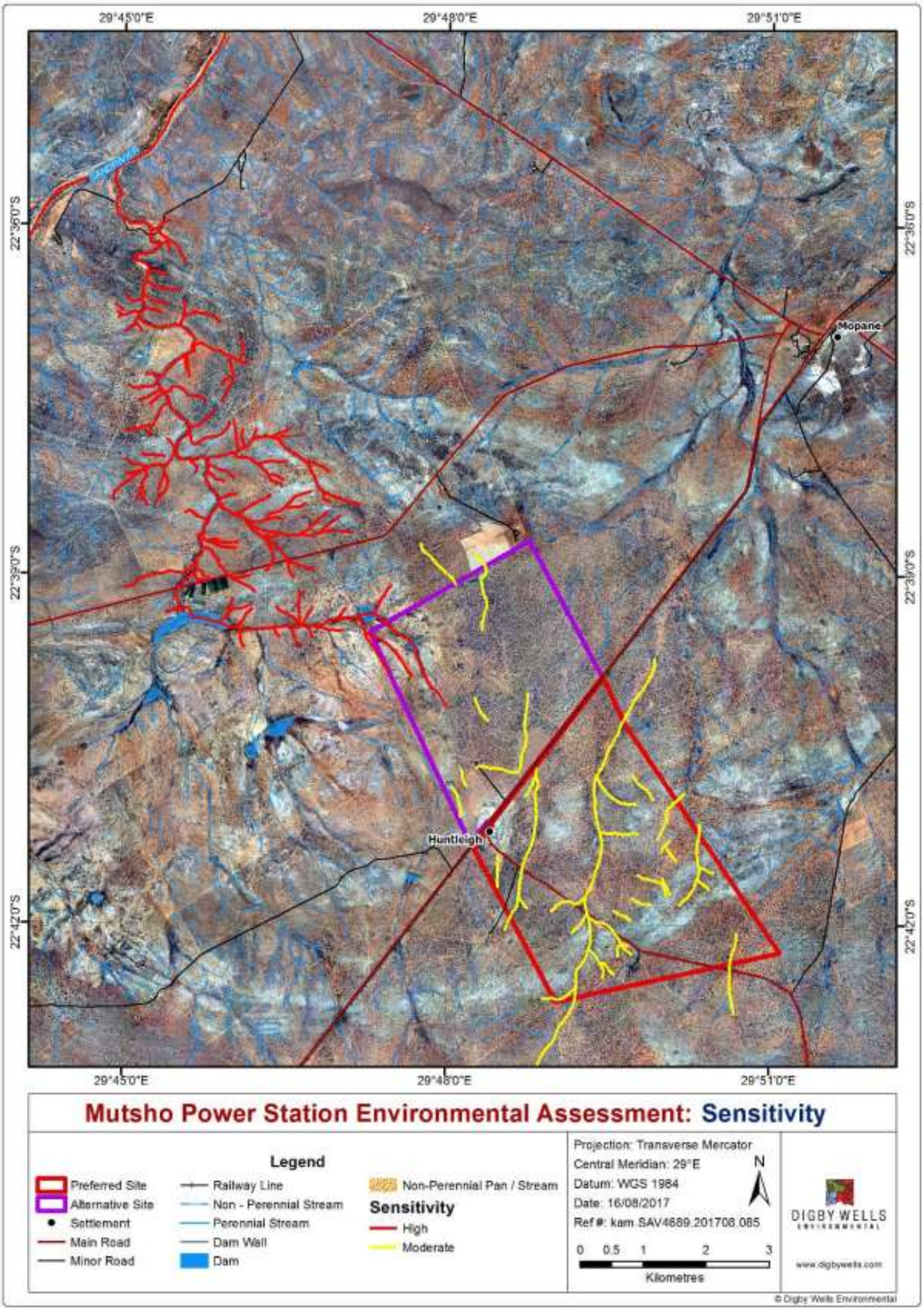

Figure 4-1: Sensitivity Analysis

5 POTENTIAL SURFACE WATER IMPACTS

The potential surface water impacts were assessed considering the three phases of the life of project: the construction, operation and decommissioning phases.

5.1 Construction Phase

The main activities during the construction phase that could result in surface water impacts are associated with the site clearing and construction of the various parts of the power station infrastructure, including the pollution control dams, ash dump and coal stockpile. Table 5-1 summarises potential surface water impacts identified during the construction phase.

Table 5-1: Identified Potential Impacts during the construction phase

Impact: Siltation of the nearby water course (streams) **Desktop Sensitivity Analysis of the Site:** From the desktop assessment, vegetation in the area is dispersed with moderately closed shrubveld. There is a potential for erosion during high rainfall events that could possibly lead to siltation of the streams.			
Issue	**Nature of Impact**	**Extent Impact**	**Impacted Areas**
Siltation of the water resources	Surface water quality	Local	The immediate drainage line or unnamed streams within and around the project area
***Description of expected significance of* impact** Site clearing through the removal of the topsoil will further expose the soils and leave it prone to erosion. This will cause siltation on the streams when runoff from the cleared areas finds its way into the streams. However, this impact is not expected to be highly significant due to the fact that sediments may settle before reaching the sands river.			
Gaps in knowledge & recommendations for further study A site visit will be undertaken to assess and verify the onsite hydrological characteristics and this will enable a thorough identification of potential surface water impacts.			

<table>
<tr><td colspan="4">Impact:
Siltation of the nearby water course (streams)

Desktop Sensitivity Analysis of the Site:
From the desktop assessment, vegetation in the area is dispersed with moderately closed shrubveld. There is a potential for erosion during high rainfall events that could possibly lead to siltation of the streams.</td></tr>
<tr><td>Issue</td><td>Nature of Impact</td><td>Extent Impact</td><td>Impacted Areas</td></tr>
<tr><td colspan="4">Impact:
Contamination of the nearby water course (streams)
Desktop Sensitivity Analysis of the Site:
The Sands River which is the major river in which most of the drainages or unnamed streams in and around the project site drain into it. Is currently classified as class c which implies that it has been moderately modified, this mainly due to high irrigational uses on the Sands river</td></tr>
<tr><td>Issue</td><td>Nature of Impact</td><td>Extent Impact</td><td>Impacted Areas</td></tr>
<tr><td>Contamination of the nearby water course (streams)</td><td>Surface water quality</td><td>Local - Regional</td><td>The surrounding streams (including the Sands river may be affected</td></tr>
<tr><td colspan="4">Description of expected significance of impact
Hydrocarbon spillages from vehicular machinery or fuel storage areas and general waste material spillages during construction may lead to contamination of the water course when runoff from such areas reports into the streams. This impact may be highly significant to the in-stream habitat and downstream water users.</td></tr>
<tr><td colspan="4">Gaps in knowledge & recommendations for further study
Collection of water samples and gathering of any available water quality data for the surrounding streams will be done on the EIA phase to establish the baseline water quality prior to commencement of this project. This will help to monitor and detect if there are impacts from the proposed project and allow for immediate mitigation measures.</td></tr>
</table>

5.1.1 Possible Mitigation Measures

- Clearing of vegetation must be limited to the demarcated project site, and the use of existing access roads must be prioritised so as to minimise construction of new access roads in these areas.

- If possible, construction must be prioritized during dry seasons to prevent or minimise erosion during construction phase.
- The runoff from the upstream clean water catchment must be diverted away from the project site into the natural environment.

5.2 Operational Phase

The activities associated with the power generation that could potentially impact the groundwater include: ash disposal, coal stockpiling, dirty water dams, domestic and other solid waste sites, chemical and fuel storage and sewage. Table 5-2 present the identified potential impacts during the operational phase.

Table 5-2: Identified Potential Impacts during the operational phase

Impact: Contamination of the nearby water course (streams) **Desktop Sensitivity Analysis of the Site:** The Sands River which is the major river in which most of the drainages or unnamed streams in and around the project site drain into it. Is currently classified as class c which implies that it has been moderately modified, this mainly due to high irrigational uses on the Sands river			
Issue	**Nature of Impact**	**Extent Impact**	**Impacted Areas**
Contamination of the nearby water course (streams)	Surface water quality	Local - Regional	The surrounding streams (including the Sands river may be affected
Description of expected significance of **impact** Contamination of the nearby water course when runoff emanating from the dirty areas (ash dump, stockpile area, plant area) reports into the nearby water courses. This impact may be highly significant to the in-stream habitat and downstream water users.			
Gaps in knowledge & recommendations for further study Collection of water samples and gathering of any available water quality data for the surrounding streams will be done on the EIA phase to establish the baseline water quality prior to commencement of this project. This will help to monitor and detect if there are impacts from the proposed project and allow for immediate mitigation measures.			

Impact: Reduction in runoff catchment yield **Desktop Sensitivity Analysis of the Site:** The project area is situated in a semi-arid zone to the north of the Soutpansberg with minimal rainfall over the year which results in very low runoff yield. Agricultural activities on the surrounds also are dependent on the Sands River for irrigational purposes.			
Issue	**Nature of Impact**	**Extent Impact**	**Impacted Areas**
Reduction in runoff catchment yield	Surface water quantity	Local - Regional	The surrounding streams (including the Sands river may be affected
***Description of expected significance of* impact** Runoff from all the contaminated areas will be contained in the dirty water dams; this reduces the amount of runoff reporting to the natural clean catchment. The proposed area only makes up 0.5 % of the total quaternary catchment area and thus the impact may be of low significant. Also, The operations will need a water source to be able to provide for industrial and potable requirements.			
Gaps in knowledge & recommendations for further study Storm water management plan will need to be developed to ensure separation of clean and dirty water. This will also ensure that dirty areas within the project area is minimised to limit the runoff loss into the natural catchment			

5.2.1 Possible Mitigation Measures

- All dirty water runoff should be contained into the dirty water dam for re-use.
- Project activities must only be undertaken within the demarcated footprint area to minimise dirty areas.
- Clean runoff water emanating from upstream should be diverted away from the project area into the natural environment.
- The various water sources need to be assessed to ensure that they can provide for the operations needs in a sustainable manner and in line with governance needs in the catchment.
- Water use needs to be reduced to the minimum required as this is a dry catchment.

5.3 Decommissioning Phase

The closure phase is characterised by the decommissioning of the power plant and associated infrastructure, including the coal stockpile and PCD. However the ash dump will remain on surface even after closure. Table 5-3 present the identified potential impacts during the decommissioning phase.

Table 5-3: Identified Potential Impacts during the Decommissioning Phase

Impact: Siltation of the nearby water course (streams) **Desktop Sensitivity Analysis of the Site:** From the desktop assessment, vegetation in the area is dispersed with moderately closed shrubveld. There is a potential for erosion during high rainfall events that could possibly lead to siltation of the streams.			
Issue	**Nature of Impact**	**Extent Impact**	**Impacted Areas**
Siltation of the water resources	Surface water quality	Local	The immediate drainage line or unnamed streams within and around the project area
Description of expected significance of **impact** Removal of the power plant infrastructure will again expose the soils and leave it prone to erosion. This may cause siltation on the streams when runoff from the cleared areas finds its way into the streams. However, this impact is not expected to be highly significant due to the fact that sediments may settle before reaching the Sands River.			
Gaps in knowledge & recommendations for further study A site visit will be undertaken to assess and verify the onsite hydrological characteristics and this will enable a thorough identification of potential surface water impacts.			

<table>
<tr><td colspan="4">Impact:
Contamination of the nearby water course (streams)
Desktop Sensitivity Analysis of the Site:
The Sands River which is the major river in which most of the drainages or unnamed streams in and around the project site drain into it. Is currently classified as class c which implies that it has been moderately modified, this mainly due to high irrigational uses on the Sands river</td></tr>
<tr><td>Issue</td><td>Nature of Impact</td><td>Extent Impact</td><td>Impacted Areas</td></tr>
<tr><td>Contamination of the nearby water course (streams)</td><td>Surface water quality</td><td>Local - Regional</td><td>The surrounding streams (including the Sands river may be affected</td></tr>
<tr><td colspan="4">Description of expected significance of impact
Contamination of the nearby water course when runoff emanating from the dirty areas (ash dump, stockpile area, plant area) reports into the nearby water courses. This impact may be highly significant to the in-stream habitat and downstream water users.</td></tr>
<tr><td colspan="4">Gaps in knowledge & recommendations for further study
Collection of water samples and gathering of any available water quality data for the surrounding streams will be done on the EIA phase to establish the baseline water quality prior to commencement of this project. This will help to monitor and detect if there are impacts from the proposed project and allow for immediate mitigation measures.</td></tr>
</table>

5.3.1 Possible Mitigation Measures

- The entire storm water management infrastructure should be in place until other infrastructure has been decommissioned.
- The ash dam may also be sealed by the placement of soil over it and the planting of vegetation in order to prevent erosion and the generation of dust.
- Post closure monitoring should also continue for at least three years.

6 EIA PHASE SURFACE WATER ASSESSMENT

6.1 Terms of Reference

A detailed surface water impact assessment will be conducted to assess and identify potential impacts that may arise from the proposed establishment of the Mutsho Power Project and associated infrastructure.

6.2 Study Objectives

The objectives of this surface water impact assessment include:

- Site assessments to verify the hydrological characteristics of the project area and the surrounds;
- Collection of water samples on the surrounding streams to determine baseline water quality;
- Review of the developed storm water management plan to ensure separation of clean and dirty water;
- Make recommendations for the siting of infrastructure to minimise impacts; and
- Conduct a detailed impact assessment to determine the potential surface water impacts that could emanate from the project and its associated activities.

6.3 Scope of Work and Methodology

6.3.1 Site Assessment

A site visit will be undertaken to assess and verify the onsite hydrological characteristics to enable identification of potential surface water impacts. The site visit will also serve to collect water samples for analysis to establish the baseline water quality status prior to commencement of the proposed coal-fired power station;

6.3.2 Storm Water Management Plan

A storm water management plan will be developed in accordance with the Government Notice 704 (GN 704) of the National Water Act 1998 (Act 36 of 1998) (NWA), which relates specifically to the separation of clean and dirty water within a mining area or related activities.

With the assumption that this will be developed by the engineers or persons responsible for design of infrastructure layout, the developed SWMP will only be reviewed by Digby Wells to ensure if it fulfils the purpose of clean and dirty water separation.

Comments and recommendations will be made if there is need for any amendment on the developed SWMP.

6.3.3 Impact Assessment

Detailed surface water impact assessment will include:

- Defining potential surface water impacts that could result from the proposed project and its associated activities. Once impact have been identified, a rating system that takes into consideration the intensity, duration, spatial scale and probability of the impacts to determine the significance of the identified impacts;
- Recommending mitigation measures to prevent and/or minimise the identified potential surface water impacts over the life of project; and

- Recommend monitoring program and EMP that will be used as a tool to detect any surface water impact.

7 REFERENCES

Department of Water and Sanitation notice 509 of 2016. General authorisation in terms of section 39 of the NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998) for water uses as defined in section 21(c) or section 21(i)

National Water Act (NWA), 1998 (Act No. 36 of 1998);

Savannah Environmental (Pty) Ltd, March 2017. Environmental Site Screening Assessment for the proposed Coal-Fired Power Plant Near Makhado

WSM Leshika Consulting (PTY) Ltd, October 2013. Surface Water Assessment for the Environmental Impact assessment Final Report.

WR2012, "*Water Resources of South Africa, 2012 Study (WR2012)*", Water Research Commission, Pretoria.