Surface Water Assessment for the Proposed Tshivhaso Power Plant

M²ENCO

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Project Title: Surface Water Assessment Report for the Tshivhaso Coal-Fired Power Plant in Lephalale, Limpopo Province

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EXECUTIVE SUMMARY

An Environmental Impact Assessment is required for the proposed construction of the new coal-fired Tshivhaso Coal-Fired Power Plant and associated infrastructure in the Waterberg region near Lephalale. The Tshivhaso Coal-Fired Power Plant precinct will include the Power Plant infrastructure, administration complex, high voltage yard and infrastructure for a water treatment works, waste water treatment plant, water supply pipelines and storage facilities. In addition a coal stockyard will be required, an ash disposal facility, an ash and coal conveyor system as well as pollution control facilities such as storm water management infrastructure and pollution control dams with associated collection system.

The proposed development falls within the Limpopo Water Management Area and specifically the Mokolo River catchment. The footprint of the Tshivhaso Coal-Fired Power Plant falls predominately within the A42J quaternary drainage area and borders A41E quaternary drainage area. Water quality in these drainage regions is regarded as good.

The surface water scoping report has revealed several potential impacts that need to be further investigated as part the EIA phase. The issues identified that may have a significant impact on water resources and which would require mitigation include:

- Increased water demand on the regional water supply scheme that is currently in equilibrium
- Water quality deterioration in the A42J and A41E quaternary drainage regions due to increased salinity stemming from the ash dam, potential for spillage from pollution control dams, coal stockyard, conveyor system, polluted storm water runoff and disposal of waste water effluent
- Several activities may cause deterioration of the groundwater sources such as ash disposal, coal stockyard and waste water containment facilities
- The infrastructure layout of the proposed Tshivhaso Coal-Fired Power Plant that could cause a reduction in catchment yield due to storm water containment
- The increase in mining and power generation activities in the catchment will result in significant accumulative impacts on the surface water environment

In order to ensure that appropriate mitigatory measures are enforced the applicant will need to adhere the requirements of the National Water Act, 1998 (Act 36 of 1998). In this instance the applicant will have to apply for a water use license from the Department of Water and Sanitation.

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1 INTRODUCTION

1.1 BACKGROUND

M^2 Environmental Connections (Pty) Ltd (Menco) was appointed to conduct the water specialist impact assessment as part of the Environmental Impact Assessment (EIA) for the development of the proposed Tshivhaso Coal-Fired Power Plant and associated infrastructure in the Lephalale (Ellisras) area, Limpopo Province.

The proposed project area is located within the Waterberg region of the Limpopo Water Management Area (refer Figure 1.1).

1.2 PURPOSE OF THE STUDY

The purpose of the surface water impact assessment is to evaluate the potential surface water impacts at the different sites that make up the proposed development and the proposed infrastructure, in order to identify any fatal flaws related to surface water impacts, and to identify potential sources of surface water contamination.

Cennergi needs to apply for Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) for the proposed Tshivhaso Coal-Fired Power Plant and associated infrastructure. In addition, Cennergi needs to apply for the required water use licenses in terms of Section 40 of the National Water Act, 1998 (Act 36 of 1998).

1.3 STRUCTURE OF THIS REPORT

A Scoping phase was conducted as a procedure for determining the extent and approach for the EIA phase. The Environmental Impact Assessment Report for the hydrological study will comprise of the following chapters:

Chapter	Content
1	Introduction and Background
2	Description of the project and the main infrastructure components
3	Description of the affected surface water environment
4	Identify and assess impacts
5	Over-view of the impact methodology
6	The conclusions and recommendations
7	Report references

The following key tasks will be addressed through the EIA phase:

- Involvement of regulatory authorities and key stakeholders (Interested and Affected Parties);
- Identification and selection of feasible alternatives to be addressed in the EIA phase;
- Identification and assessment of significant impacts associated with each alternative to be examined during the EIA phase;
- Conducting of specific studies for the EIA phase as well as adhering to regulatory requirements to support the application for the needed environmental authorisations.

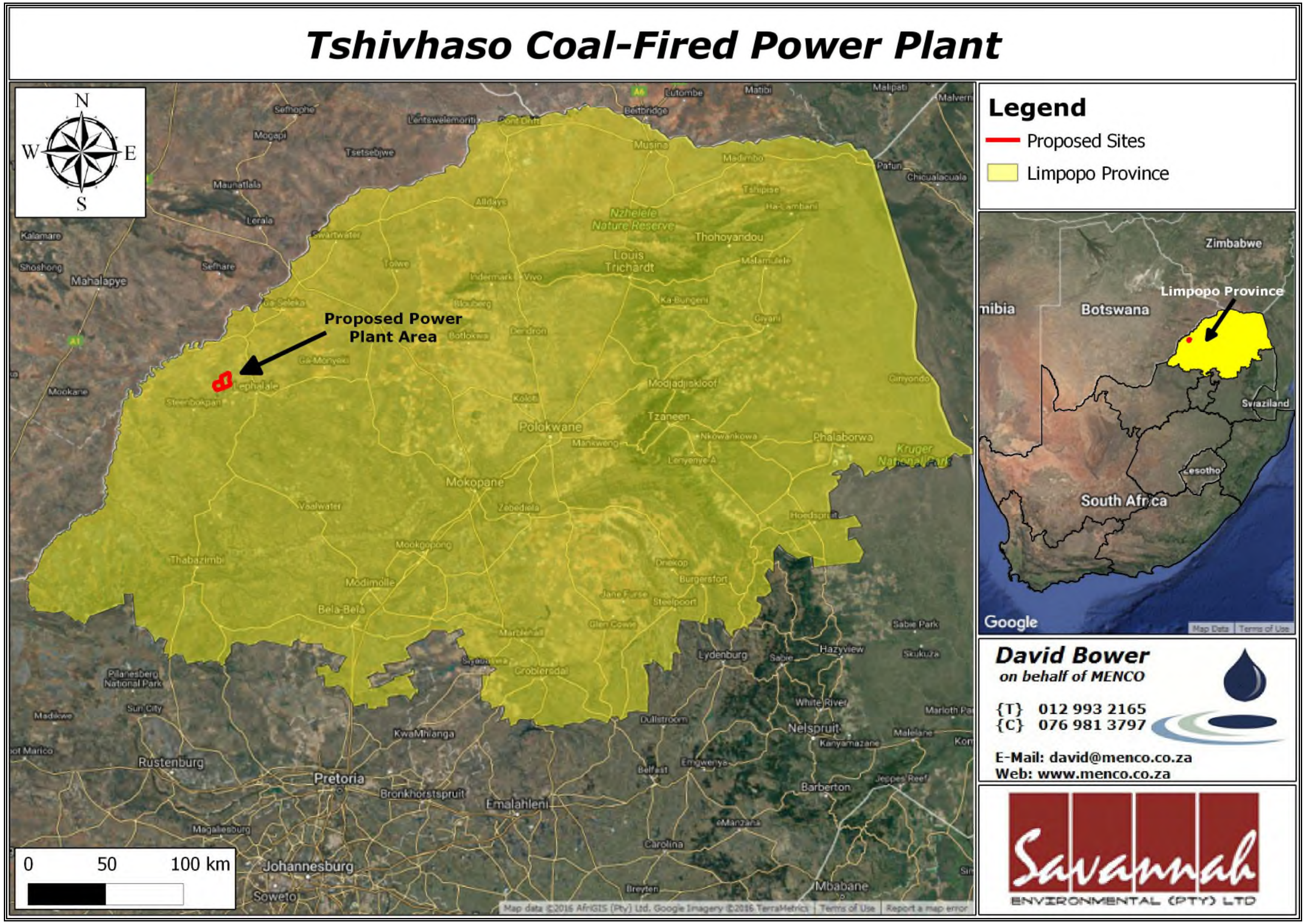

Figure 1-1: Regional Locality of Development

2 SURFACE WATER

2.1 DESCRIPTION OF AQUATIC ENVIRONMENT

2.1.1 Affected River Basin

Due to the low rainfall that is experienced in the Limpopo Province, relatively little surface runoff is generated in the Limpopo Water Management Area. The various drainage areas for the Limpopo WMA are described in **Table 2-1**:. The runoff is highly seasonal, variable with intermittent flow in many of the tributaries. The exception in the Limpopo WMA is the Waterberg which is relatively well-watered with strong base-flows.

Most of the surface runoff in the WMA is contributed by the Mokolo and Mogalakwena Rivers. Both of these rivers originate in the Waterberg and drain much of the Waterberg catchment as depicted in **Figure 2-1**. A summary of the MAR together with the ecological component of the Reserve are provided in **Table 2-9** with respect to the tributaries of the Limpopo River within the sub-catchment.

Table 2-1: Description of quaternary drainage area within WMA 1

Catchment/Sub-area	Quaternary Drainage Areas
Matlabas / Mokolo	A41A-E and A42A-H
Lephalala	A50A-J
Mogalakwena	A61A-H, 62A-J and 63A-E
Sand	A71A-L and A72A-B
Nzhelele / Nwanedzi	A80A-J

The surface water study area for the Tshivhaso Coal-Fired Power Plant falls within the Limpopo Water Management Area. The Mokolo River and Matlabas River are two of the seven major rivers in the Limpopo WMA. The catchments are mostly independent of each other and the rivers drain into the Limpopo River. The Crocodile (West) and Marico WMA borders the Limpopo WMA in the south-west.

Figure 2-1: Delineation of the Mokolo Water Management Area

2.1.2 Resource Classification and Reserve

The water resources within the vicinity of the project area include:

- Sandloop;
- Mokolo River;
- Matlabas River;
- Tambotie River
- Riet Spruit ; and
- Limpopo River

These rivers have been classified by the Department of Water Affairs as being perennial (apart from Sandloop that is non-perennial river) having a Present Ecological Status (PES) of Class C, implying a moderately impacted river system. The Status of the River Report (2006) for the Mokolo River has classified the Middle Mokolo Region as follows:

- Ecostatus: Fair
- EIS: Moderate

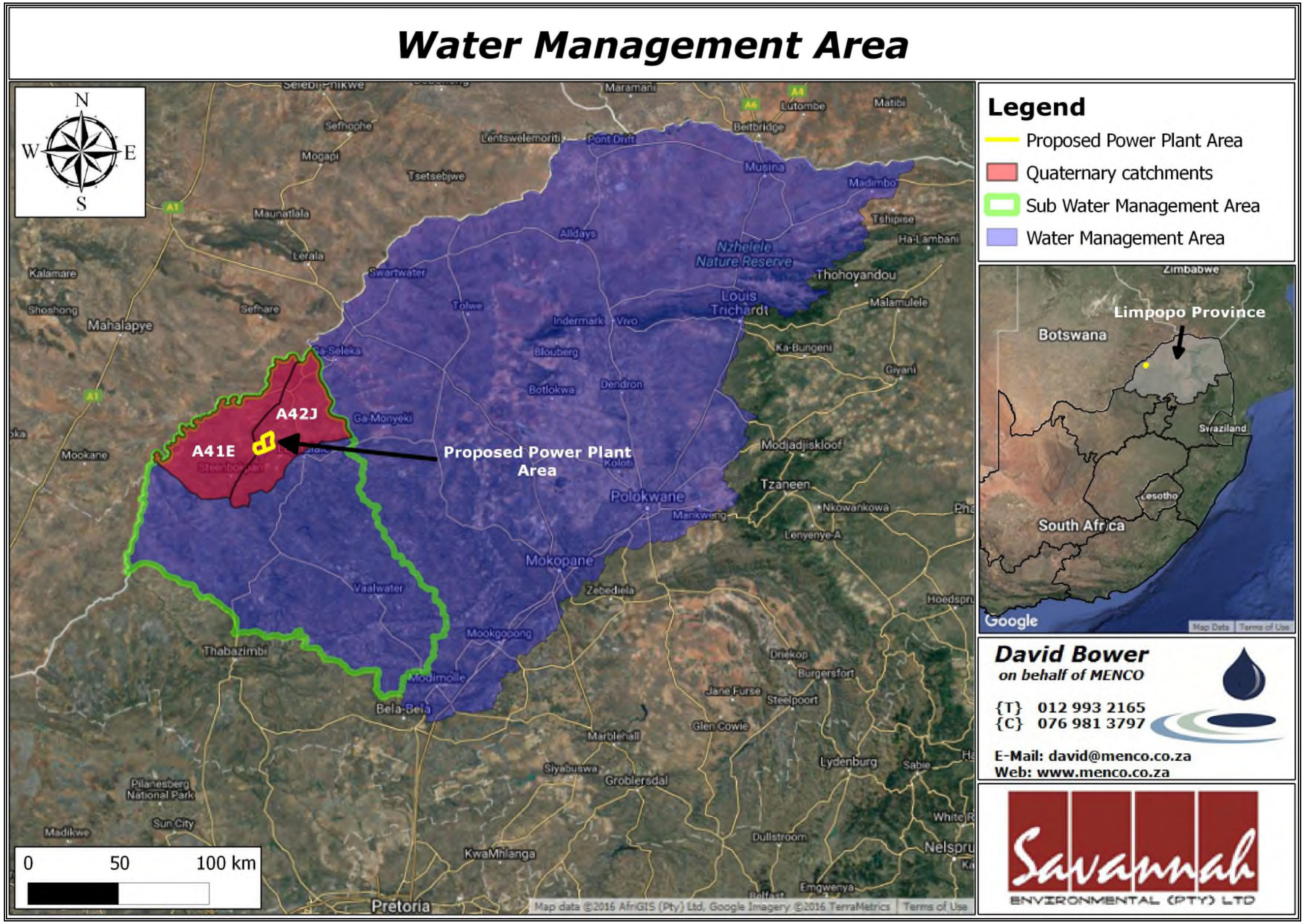

Figure 2-2: Study area in relation to the A42J and A41E catchment

2.1.3 Quaternary Catchment

Mokolo Sub-catchment

The Mokolo catchment is situated in the Limpopo Province and covers an area of 8387 km^2. The catchment stretches from the Waterberg Mountains through the upper reaches of the Sand River, and includes the Mokolo Dam and a number of small tributaries that join the main Mokolo stem up to the point of confluence with the Limpopo River. The smaller tributaries of the Mokolo River include the Tambotie, Rietspruit and Poer-se-Loop.

Water use in the Mokolo catchment comprises 87% agricultural use with 13% allocated for industrial (which include mining and power generation), as well as domestic water supply to the Water Service Provider sectors.

The Mokolo River and its tributaries rise in the western part of the Waterberg between 1200 and 1600 mabsl. The Mokolo originates in a flattish, open area with numerous koppies and flows northerly through a steep gorge emerging above the town of Vaalwater. From Vaalwater the river flows through a flat area until it enters the Mokolo Dam. It flows through another gorge before entering the Limpopo Plain near the confluence with the Riet Spruit. From the confluence the Mokolo River flows through flat sandy areas until it reaches the Limpopo River.

Matlabas Sub-catchment

The Matlabas sub-catchment is largely undeveloped with limited water resources and use. The area covers 6014 km^2. The catchment is dry with non-perennial flow and hence no sustainable yield. The limited water use in the Matlabas is mostly from groundwater, which is under exploited.

There are no significant dams in this catchment and a significant portion of the water need is augmented from groundwater sources due to low assurance of the run-off river yields. New water use allocations in this key area can only be made from groundwater or from additional yield which could conceivably be created by the construction of dams.

2.1.4 Rainfall, Runoff and Evaporation

The regional climate is characterized by a semi-arid climate, i.e. low to moderate rainfall, hot dry summers, and high evaporation rates.

Rainfall

The mean annual precipitation (MAP) in the area is ~650 mm/a (Weather Bureau, Pretoria). The long-term monthly rainfall data for the A42 quaternary area is given in **Table 2-2**:. Some 81% of rainfall falls between October and March each year, with the peak rainfall month being January.

Table 2-2: Long-term mean monthly rainfall for Lephalale

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Tot
A42A	50	99	112	121	104	80	42	14	6	4	5	13	650
A42B	50	100	113	125	110	86	41	14	6	4	5	13	666
A42C	49	97	111	126	109	85	41	12	6	6	5	14	660

Temperature

The project site is located approximately 900 m above sea level. Maximum temperatures during summer exceed 30°C and maximum winter temperature averages 23°C.

Table 2-3: Minimum and maximum temperatures

(°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	12,2	11,2	10,7	8,7	0,8	2,3	1,7	1,7	1,8	2,4	5,2	9,9
Maximum	34,3	33,3	30,6	34,0	31,7	29,3	27,0	27,2	25,8	35,2	36,7	36,0

2.2 SURFACE WATER QUALITY

2.2.1 Background Water Quality

Water quality data was obtained from the database of the Directorate: Resource Quality Studies for two points in the Mokolo River. The upstream point was at the weir on the Mokolo Dam (A4H10: WMS A42-90332). Water quality data is available from 3 January 1984 until 16 February 2010.

The second monitoring point is located within the Mokolo River, downstream of the proposed development site at Moordrift. The DWA reference point for the monitoring station is A4H13: WMS A42_90334. The water quality data is available from 16 February 1994 until 4 July 2007.

The water quality for the affected catchment is reflected in **Table 2-4** with the location of the points described in **Table 2-6**. It is evident that the water quality is good with no variable exceeding the Target Water Quality Range (TWQR) for drinking water.

Table 2-4: Background water quality data for Mokolo River

Variable	90332	90334	TWQR
Electrical Conductivity in mS/m	8.1	8.8	<70
pH	7.1	7.4	6.5 – 9.0
Sodium as Na in mg/l	5.2	6.5	<100
Potassium as K in mg/l	1.7	1.4	0-50
Calcium as Ca in mg/l	5.1	5.0	<32
Magnesium as Mg in mg/l	2.3	2.7	<30
Chloride as Cl in mg/l	6.7	7.9	0-100
Sulphate as SO_4 in mg/l	4.6	4.8	0-200
Total Alkalinity as TAL in mg/l	23.2	27.2	-
Fluoride as F in mg/l	0.14	0.13	0-1
Phosphate (PO_4) as P in mg/l	0.02	0.017	<5
Nitrate (NO_3) and Nitrite (NO_2) as N in mg/l	0.015	0.05	<6
Ammonium (NH_4) as N in mg/l	0.12	0.033	0-1

In addition, water quality data is also available for the confluence of the Riet Spruit (at Samevloei Dam) with the Mokolo River on the farm Zandpan 63 LQ. The median values for some variables monitored at station A4H14 are provided below:

Table 2-5: Background water quality data for the Riet Spruit

Variable	Concentration/Limit
Total Dissolved Solids (TDS)	49.1 mg/l
Electrical Conductivity (EC)	5.68 mS/m
pH	7.12
Sulphate (SO_4)	5.9 mg/l

Water quality for this monitoring point is also indicative of good quality with no variables of concern noted. The low sulphate concentrations as a Key Performance Indicator of mining related pollution illustrate low impact from this industry on the catchment.

Table 2-6: Location of monitoring points in Mokolo River

Monitoring Station	Longitude	Latitude
Mokolo Dam: A42_90332	23° 58'20.06" S	27° 43'33.38" E
Moordrift: A42_90334	23° 36'06.69" S	27° 44'28.67" E

Monitoring Station	Longitude	Latitude
Confluence: A42_189537	23° 14'28.24" S	27° 43'06.54" E

2.2.2 Water Quality Objectives

A preliminary intermediate Reserve study for the A42 catchment had been conducted by the Department of Water Affairs during July 2007 under reference 26/8/3/3.

Table 2-7: Resource Quality Objectives for A42J catchment

Variable	RQO and Eco Specification for PES
$MgSO_4$ (mg/l)	95^{th} percentile must be ≤ 16 mg/l
Na_2SO_4 (mg/l)	95th percentile must be ≤ 20 mg/l
$MgCl_2$ (mg/l)	95th percentile must be ≤ 15 mg/l
$CaCl_2$ (mg/l)	95th percentile must be ≤ 21 mg/l
NaCl (mg/l)	95th percentile must be ≤ 45 mg/l
$CaSO_4$ (mg/l)	95th percentile must be ≤ 351 mg/l
EC (mS/m)	95th percentile must be ≤ 30 mS/m
pH	5^{th} and 95^{th} percentiles must range from 6.5 to 8.0
DO (mg/l)	5^{th} percentile of the data must be ≥ 7 mg/l
TIN	50^{th} percentile must be ≤ 0.25 mg/l
PO_4-P	50^{th} percentile must be ≤0.015 mg/l
Chl-a	50^{th} percentile must be ≤ 10 µg/l

2.3 SURFACE WATER QUANTITY

2.3.1 Catchment and Sub-catchment

The project area falls within quaternary drainage areas A41 and A42. A preliminary determination of Reserve for Water Quantity in terms of sections 14(1)(b) and 17(1)(a) of the NWA had been conducted to support water use license applications. The water quantity for the affected catchment is contained in

Table 2-8.

Table 2-8: Water Quantity Reserve for the A42E quaternary drainage area

EWR	QC	Resource	PES	Reserve[1] (Basic Human)	Interim Flow[2]	MAR[3]	Present Flow[4]
1A	A42C	Mokolo	C/D	0.048	Maintain	84.84	68.8
1B	A42E	Mokolo	B/C	0.09	Maintain	135.03	109.0
2	A42F	Mokolo	B/C	0.103	Maintain	196.2	163.2
3	A42G	Mokolo	B/C	0.111	Maintain	214.5	156.5
4	A42G	Mokolo	C	0.111	Maintain	253.3	176.5
5	A42G	Mokolo floodplain	D	As for EWR 4			

In order to maintain the present day flow downstream of the Mokolo Dam up to EWR 4 site, the operating rule that has been applied by DWA to release water to irrigators downstream of the dam must remain in force. This entails the release of 16 million m^3 per annum if the dam is at 50% of its full supply capacity (FSC) and 5 million m^3 if the storage drops to below the 50% FSC. It should be noted that water from the Mokolo Dam is fully allocated.

2.3.2 Mean Annual Runoff

The Matlabas/Mokolo sub-catchment is described in terms of the A41 and A42 drainage areas. The proposed site for the Tshivhaso Coal-Fired Power Plant falls within the A41E and A42J quaternary drainage areas. A42J covers an area of 1.815 km^2 and A41E covers an area of 1.943 km^2. The natural MAR for the various sub-areas as well as Reserve requirements is contained in **Table 2-9**.

Table 2-9: Natural MAR for the Limpopo WMA

Sub-area	Natural MAR ($x10^6$ m^3/a)	Ecological Reserve
Matlabas / Mokolo	382	76
Lephalala	150	17
Mogalakwena	269	41
Sand	72	10
Nzhelele / Nwanedzi	113	12
TOTAL	**986**	**156**

[1] *Total Reserve equals the present day hydrology inclusive of Ecological Reserve and Basic Human Needs*
[2] *Maintenance of the current operating of the system was recommended as interim measure*
[3] *Natural Mean Annual Runoff at EWR sites measured in million m^3/annum*
[4] *Present day flow (based on 2007) in million m^3/annum*

2.3.3 Flood Volumes

Flood peaks and volumes for recurrence intervals of 1:20, 1:50 and 1:100 years and the regional maximum flood had been determined for the A41E and A42J sub-catchment using the UP Flood model (refer Table 2-10: Peak flow calculations (m^3/s)). The calculations were based on the drainage areas as contained in Table 2-11: Normal dry weather flow for A42J. The flood volumes and flood lines will be comprehensively addressed as a specialist study during the EIA and WULA phase.

Table 2-10: Peak flow calculations (m^3/s)

Sub-catchment	1: 10	1: 20	1: 50	1: 100
A42J	2.926	3.732	5.007	6.354
A41E	0.982	1.254	1.683	2.137

2.3.4 Normal Dry Weather Flow

The Sandloop system is classified as non-perennial and only flows during high rainfall events. The normal dry weather flow is zero (refer Table 2-11: Normal dry weather flow for A42J).

Table 2-11: Normal dry weather flow for A42J

Site	Catchment	MAR	Low flow maintenance	Drought flows	High flows
	km^2	X 10^6 m^3/annum			
Mokolo at EWR 4	8387	253.3	34.19	11.39	11.90
Sandloop (A42J)	1815	54	2.43	2.53	3.27
Rietspruit (A41E)	1940	38	1.71	0.08	2.3

2.3.5 Drainage Density

A field survey revealed that no major (first order) drainage lines on the property of the proposed IPP Tshivhaso Coal-Fired Power Plant will be disturbed. Several diffuse drainage pathways will be altered that will require an authorization in terms of section 21(c) and (i) of the NWA.

2.4 *SURFACE WATER USES*

The water uses in the catchment broadly comprises the following:

- 87% for agricultural activities; and
- 13% for the industrial, mining, power generation and domestic water supply service sectors.

According to the Internal Strategic Perspective as conducted by DWS (Report WMA 01/000/0304), it is reported that at present the water availability and water use in the catchment are in balance. The water demand will however increase with the new developments proposed in the Mokolo River catchment (including expansion of mining activities and new Power Stations).

2.5 WATER USERS

Several water users had been identified located within close proximity to the project area. These water users that are dependent on water supply from the Mokolo Dam Water Scheme include:

- Lephalale Local Municipality with a total population of more than 100,000 inhabitants. Potable water supply is provided to residents and industries located within the towns of Lephalale, Onverwacht and Maropong.
- Several cattle, game and agricultural farming activities including the Ferroland Private Game Reserve. Water allocation to the Mokolo Irrigation Board is reported to be 75 Mm^3.
- Grootgeluk Mine which is owned by Exxaro (Pty) Ltd. The total allocation to Grootgeluk is 9.9 Mm^3, with the actual use by the mine around 4 Mm^3/a. The balance is for water supplied by Exxaro to domestic users. This function was recently transferred to the Local Municipality.
- Medupi and Matimba Power Stations which are owned by Eskom Holdings. Eskom has an allocation of 7.3 Mm^3/annum but the total average use is reported as 3.59 Mm^3/annum

2.6 WATER AUTHORITY

The Department of Water and Sanitation act as the Regional Water Authority through their office that is located in Polokwane. The Lephalale Local Municipality is the appointed Water Service Provider who has the responsibility to supply potable water to the area.

2.7 WETLANDS

The location of wetlands on the property, the extent thereof and an indication of the significance as well as the biological diversity of these has been determined by a separate specialist study. The outcome of the study will be integrated into the water management plan to be developed as part of resource protection as required in terms of the National Water Act, 1998.

2.8 SOURCES OF WATER

Water supply and demand for the area is addressed through the Mokolo Dam Water Supply Scheme. There are no further allocations available from the Mokolo Dam. In order to ensure a sustainable supply of water the DWS has initiated the MCWAP Project.

The DWS has appointed the TCTA as Implementing Agent to commence with the MCWAP Project that consisted out of two phases namely:

Phase 1: A pipeline parallel to the existing pipeline, to augment the supply from Mokolo Dam.

This is to supply in the growing water requirement and also to supply more water for the interim period until a transfer pipeline from the Crocodile River(West) can be implemented. The system will utilise the available yield from Mokolo Dam. Phase 1 consists of the following:

- Rising main from Mokolo Dam to Wolvenfontein balancing dams;
- Gravity line from Wolvenfontein to Matimba Power Station; and
- Gravity line from Matimba Power Station to Steenbokpan.

Phase 2: Transfer scheme from the Crocodile River (West) at Vlieëpoort near Thabazimbi to the Lephalale area via a system consisting of:

- A weir and abstraction infrastructure, including a balancing reservoir, desilting works, and a high lift pumpstation at Vlieëpoort (near Thabazimbi);
- Transfer system (approximately 100 km): consisting of three potential pipeline routes for the rising main pipeline, with the preferred route running primarily parallel to the railway line;
- A Break Pressure Reservoir;
- An Operational Reservoir; and a
- Delivery system, consisting of a gravity pipeline (approximately 30km) running from the Operational Reservoir to the Steenbokpan area, connecting to the Phase 1 works

Alternatively the development of a well field in the area could be considered as potential source of water. The geohydrological study revealed that the yield from boreholes in the project area will not support a sustainable supply of raw water.

Obtaining water rights from existing irrigation farmers is also a potential source of water but it will contribute towards a shortage of food supply in the region.

2.9 WATER USE AUTHORISATION

The proposed Tshivhaso Coal-Fired Power Plant development proposed by Cennergi constitutes several water uses that need to be authorized in terms of section 40 of the National Water Act, 1998. In terms of section 21 of the NWA the bulk of the water uses at the proposed Tshivhaso Coal-Fired Power Plant could be defined as a section 21(g) water uses: Disposing of waste in a manner which may detrimentally impact on a water resource. The following section 21(g) water uses are relevant to the Tshivhaso Coal-Fired Power Plant:

- Disposal of slurry onto the Ash Dam
- Storing and disposal of water containing waste into a Pollution Control Dam
- Storing and disposal of storm water containing waste into SWM Dam

In addition the Tshivhaso Coal-Fired Power Plant needs to apply for a section 21(a) water use (taking of water) from the Mokolo Dam Water Supply Scheme and a section 21(b) for the storage of water. The waste water treatment works will be subject to a section 21(f) water use.

A section 21(c) and (i) water use is also triggered in terms of water uses that transects water courses in terms of pipelines, conveyances, storm water management infrastructure and waste disposal facilities that potentially fall within the protective buffer zone of sensitive areas.

Future water demands for the full development of the Power Plant to a 1200 MW unit could be obtained from the MCWAP Phase 2. This would entail an amendment in terms of section 52 of the NWA to the current application.

3 DESCRIPTION OF THE PROPOSED PROJECT

3.1 DESCRIPTION OF THE PROPOSED SITE

The proposed Tshivhaso Coal-Fired Power Plant site is situated in the Lephalale area close to the Grootgeluk Mine. The preferred site for the development will be on the farm Graaffwater 456 with additional sites investigated that include Goedehoop 457, or Eendragtpan 451, Gelykebult 450 and Vooruit 449.

No perennial surface water streams or standing water bodies were observed on the properties. The only concerns related to the project site are the demand for water during the construction and operational phases (Phase 1 and 2 of Power Plant development) and whether the existing bulk water supply via the Mokolo Schemes (MCWAP Phases 1 and 2) can cope with the increase in demand, and the management of stormwater on the site.

3.2 DESCRIPTION OF THE PROPOSED COAL-FIRED POWER PLANT

The Tshivhaso Coal-Fired Power Plant will be a zero liquid effluent discharge (ZLED) plant. This means that all plant processes will be optimised for minimisation of water demand and all effluents will be collected and either be re-used or evaporated on site.

The water demand for the Tshivhaso Coal-Fired Power Plant is set at 1,500,000 m^3 per annum. This consumption rate is at full completion of the Tshivhaso Coal-Fired Power Plant (1200MW) and relates to a usage rate of 0.144 l/kWh. Raw water storage will be required on site with storage capacity of 120 000m^3. It is foreseen that the Tshivhaso Coal-Fired Power Plant with its associated infrastructure layout will be developed on a 50 hectare footprint.

3.3 PLANT REQUIREMENTS

The technologies that are under consideration for the Tshivhaso Coal-Fired Power Plant are Circulating Fluidised Bed (CFB) and Pulverised Coal (PC). The preferred technology is however CFB for the reason that it would allow for reduced water consumption. A pulverised coal plant requires additional coal washing and flue-gas desulphurisation processes that would increase the water demand for the proposed project.

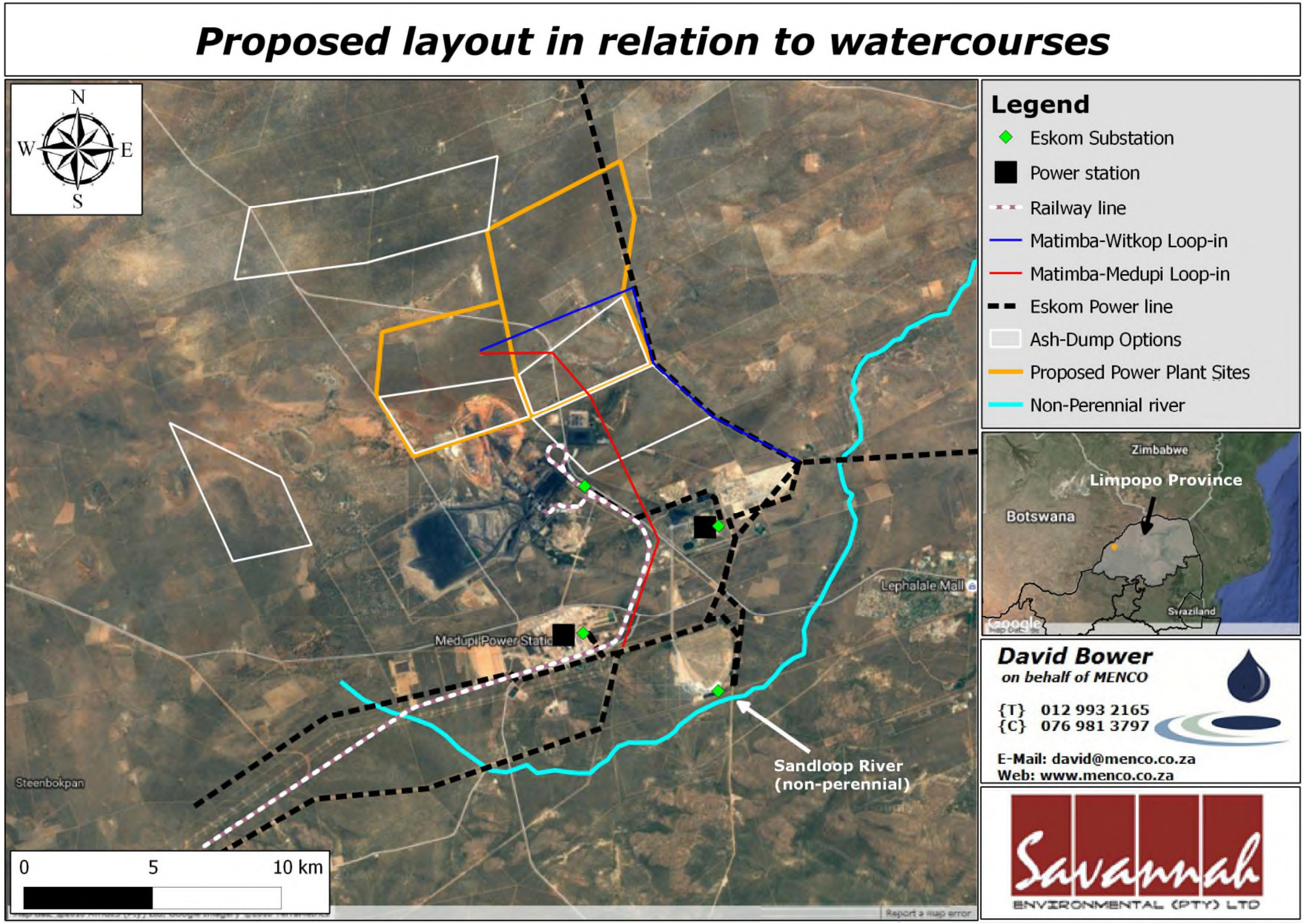

Figure 3-1: Proposed Layout in relation to water resources

3.3.1 Boiler Plant

The main advantage of CFB plants is that an extremely wide range of fuels can be burnt in a variety of combinations and that the span of carbon, sulphur, moisture and ash contents of the fuels burnt in CFB plants is quite large. This is also applicable for the range of heating value of all these fuels. The high grade fuels of the CFB firing system can also burn all kinds of low-quality fuels which are not suitable for use in a pulverised fuel boiler system. Combination of these fuels, as well as fuel variability, is also possible during the life-cycle of the IPP Tshivhaso Coal-Fired Power Plant.

The extremely high ash content of the proposed coal, together with its low calorific value (RoM 12.5 MJ/kg) is an important factor in determining which technology gets selected. The proven ability of CFB technology to operate successfully with high ash content coal, qualifies the CFB to be considered for the planned project.

3.3.2 Turbine Plant

The proposed plant with a capacity of 1200MW a three pressure stage steam turbine with HP, IP and LP pressure stage is considered the most favourable design. This design with the envisaged capacity of the units enables the achievement of 40 to 45% efficiency.

The generator design envisaged is likely to be a two-pole three phase synchronous turbo-generator with hydrogen gas cooling and closed circuit liquid cooling. The rotor that is rigidly coupled to the turbine carries a single stage radial-flow fan for circulating hydrogen-gas coolant inside the machine. The electrical power will be taken out at the main terminals underneath the generator.

The generator will be equipped with two main cooling circuits, consisting of direct gas cooling of field winding (rotor) and iron core, and liquid cooling of the armature winding (stator), winding connections and terminal bushings.

3.3.3 Condensing Plant

Due to the limited availability of water, a dry-cooling system is likely to be applied (i.e. fans).

In the Dry Cooling-Tower design, a closed intermediate water circuit is applied to transport the condenser heat load to the cooling tower. The heat is transferred to the ambient air by convection. The cooling towers are cell types with mechanical draft or natural draft. Cooling water for auxiliary cooling systems can be extracted from the main closed cooling water system.

In the Dry Air-Cooled Condenser design, the usual water cooled condenser is substituted by the air cooled, fin-type heat exchange surfaces arranged in a close proximity to the steam turbine building. The steam inlet is at the top of the condenser tube elements. Air-cooled condensers are mechanical draft type cooling systems with high power consumption. Cooling water for auxiliary cooling systems can be extracted from the main closed cooling water system, as well.

3.3.4 Flue-gas Handling

Removal of particulates may be affected through bag-filters or electrostatic precipitators, which will be installed in the flue gas duct. These technologies have a removal efficiency of well above 99% and should satisfy the environmental regulations. The new boiler units will be equipped with state-of-the-art dust filter units in order to meet the applicable World Bank emission limit for PM of 50 mg/Nm³.

The available coal analyses demonstrate a sulphur content of max. 2%, this result in a relatively high SO_2 content in the flue gas, exceeding the World Bank limits. Therefore desulphurisation would be necessary to meet the World Bank requirements. However, desulphurisation with min. 70% efficiency is usually required by the local environment authority. For the Pulverised Coal-Fired Plant a wet flue-gas desulphurization process using lime or Sorbent as absorbent will be required which also produces gypsum or stabiliser as the final product, but which is not necessary in the case of Circulating Fluidised Bed Plant because of injection of Sorbent into the circulating fluid bed combustor.

The emission concentration of NOx in the flue gas with Low NOx burners (as required by local regulations) should be well below the applicable World Bank standard of 750 mg/Nm³. Therefore additional mitigation measures for NOx (SCR / SNCR) are not considered necessary.

3.3.5 Coal Handling and Storage

Run-of-Mine coal will be supplied from the new coal-mine development which is adjacent to the Grootgeluk Mine. Coal properties are provisional (based on Grootgeluk RoM), and confirmation of coal qualities needs to be obtained during final design to ensure compliance with CFB Boilers requirement. The requirements for CFB Boilers are specified in **Table 3-1**.

Table 3-1: Coal specification for CFB Boilers

Solid Fuel	Value	Unit
Fuel Name: Fields tone CV 12.5		
Fuel supply temperature	25	C
Heating Values (at 25°C)		
LHV (moisture and ash included)	11 329	kJ/kg
HHV (moisture and ash included)	12 499	kJ/kg
Ultimate Analysis (weight %)		
Moisture	5%	%
Ash	55	%
Carbon	23.9	%
Hydrogen	4.8	%
Nitrogen	0	%
Chlorine	0.07	%
Sulphur	1	%
Oxygen	10.23	%
Total	100	%
Proximate analysis		
Moisture	5	%
Ash	55	%
Volatile Matter	20	%
Fixed Carbon	20	%
Total	100	%
Ash Characteristics		
Fouling	Severe	
Ash initial deformation temperature (reducing atm)	991.6	°C
Ash softening temperature (reducing atm)	991.6	°C

The raw coal bunkers, within the boiler-house, shall be sized for 12 to 24 hours storage capacity. Each bunker supplies one dedicated coal mill or feed to the boiler. To avoid caking and vapour formation the bunker the bunker design shall consider: rounding of the bunker corners and adequate sloping of the walls to eliminate coal hanging, and lining of the hopper slopes and partly the vertical walls with stainless steel.

A Working Stockyard shall be sized for 15-days working storage at full capacity, immediately adjacent to the Power Plant, utilising stackers for storage and reclaimers for the extraction of coal from the stockyard, and conveying to the raw coal bunkers. A Strategic Stockpile shall be sized for 30-days seasonal storage at full capacity, situated on the Tshivhaso Coal-Fired Power Plant site, with coal being conveyed from the adjacent mines, utilising stackers for storage and reclaimers for the extraction of coal from the stockyard, and conveying to the Working Stockpile.

Measures are to be taken to handle the coal under wet-or enclosed conditions in order to prevent dust escaping. Therefore closed or covered bunkers, soils, transport facilities, trucks, etc. will be provided as far as possible. Dust from open coal stockyards and ash dumps has to be minimised by appropriate water spray systems.

3.3.6 Sorbent Handling and Storage

There are 22 mines which could supply the required sorbent within reasonable transport distance. Of these 15 are in the province or adjacent provinces. Well-known mining names include PPC, Lafarge, Agrilime and Latilla (Data from DIRECTORY D11/2004 – Producers of Industrial Minerals Commodities in South Africa, 2004, issued by the Director, Mineral Economics).

The source under most consideration at the moment is the Dwaalboom Mine, which has the added advantage that coal is sent to the PPC plant from Grootgeluk and can be returned by the same rail-trucks back to the Grootgeluk rail-siding from where the sorbent can either be trucked to the Power Plant site or conveyed with suitable off-loading and storage facilities at the rail-siding, which will need to be incorporated into the IPP EIA. A further potential source of calcrete has been identified south of the current Grootgeluk Mine, which pending quality requirements of the IPP, could be mined and trucked or conveyed onto the Power Plant site.

Sorbent will arrive on site either by truck or conveyor and be transferred and stored under a covered stacking and reclaiming area, adjacent to the Coal Working Stockpile, being transferred to Sorbent bunkers in the boiler-house, via the same conveyors, as required.

3.3.7 Description of the Ash Dump

The ash dumps are proposed to be situated near the Tshivhaso Coal-Fired Power Plant on the preffered Graaffwater 456 farm. Farms Vooruit 449 and Appelvlakte 448 are additional ash dumps sites. A conveying system will link the Tshivhaso Coal-Fired Power Plant with the ash dump. Ash will initially be conveyed at a rate of 660 tons/hour.

The footprint of the ash dump is 500ha and has a life expectancy of 40 years. The ash dumped will be appropriately design to cater for a bottom seal and further equipped with drainage facilities to direct any polluted water and effluent to pollution control dams or a Waste Water Treatment system.

3.3.8 Ash Dump Site Selection Criteria

A site visit was conducted on 16 August 2016 attended by representatives of Menco and Exxaro Coal. The purpose of the site visit was to obtain baseline information regarding the possible ash dump sites which are the following:

- Site A: Graafwater 456
- Site B: Appelvlakte 448
- Site C: Vooruit 449

The assessment criteria that had been used were the following:

1. Proximity to an environmental sensitive receptor
2. Water supply utility availability
3. Site Capacity and Accessibility
4. Raw material accessibility and availability
5. Legal Matters
6. Neighborhood Compatibility (Spatial and Demographic)

Selection criteria were established to provide a comprehensive and quantifiable evaluation of the multiple variations of the site options proposed for consideration to house the Ash dump planned to for the proposed Tshivhaso Power Plant Project. These criteria have been used to compare the relative viability of each site to accommodate the proposed ash facility.

Above is an itemized list of the criteria, along with specific weighting that were considered when evaluating each variation and option. After each question was answered, a relative score was assigned to each criterion and recorded on the scoring sheet summary below. Scores were awarded using a range of 1 – 5, as follows:

5 = excellent
4 = above average
3 = average
2 = below average
1 = poor

The sites that have been considered as depicted in **Table 3-2** include:

- Site A: Graafwater 456
- Site B: Appelvlakte 448
- Site C: Vooruit 449

Table 3-2: Site selection for Tshivhaso Power Plant Ash Dump

Criterion#	1	2	3	4	5	6	Total	Average
Site A	3	4	4	3	3	3	**20**	**3,33**
Site B	3	3	2	3	2	3	**16**	**2,67**
Site C	2	3	2	3	3	3	**16**	**2,67**

Since the average score for the selected sites are between 2 and 4 ranging between below to above average, it can be concluded that **Site A** (representing Graafwater) is more appropriate.

3.3.9 Description of the Coal Stockpile

The coal stockpile will make provision for the storage of 700 000 ton coal conveyed from the adjacent mines. The coal storage facility will cater for a 30 day demand for the Tshivhaso Coal-Fired Power Plant and will be concrete lined to prevent pollution of groundwater resources.

3.4 SURFACE WATER INFRASTRUCTURE

A potable and raw water pipeline will be required for the Tshivhaso Coal-Fired Power Plant project. This pipeline will run from the water connection points from the DWS pipeline which is expected to be available from the Mokolo-Crocodile Water Augmentation Project (MCWAP) Phase 2, to the site. An allocation of 1.5 million m^3 per annum is proposed for the Tshivhaso Coal-Fired Power Plant.

Other infrastructural requirements for surface water include:

- Storm water handling and reticulation;
- Storm water containment dam;
- Potable treatment plant and storage facility;
- Storage of raw water (reservoir); and
- A sewerage treatment plant and sewerage pump station with possible tie-in to the sewage plant currently operated by the Municipality.

3.5 WATER POLLUTION MANAGEMENT FACILITIES

3.5.1 Wastewater Treatment

The Tshivhaso Coal-Fired Power Plant will be a zero liquid effluent discharge plant. This means that all plant processes will be optimised for minimisation of water demand and all effluents will be collected and either re-used or evaporated on site. In case not all treated waste water can be re-used for ash wetting or irrigation within the plant area, it will be discharge to an evaporation pond to be installed at the plant site. The pond will be bottom sealed with chemically and mechanically resistant fabric for ground water protection and sufficiently sized to take up all treated waste water. All waste-water systems will be designed to meet the World Bank standard for discharge into surface waters.

A relatively small amount of steam cycle blow down water arises during operation of the plant, which is necessary to maintain the quality of the steam cycle water. This water is slightly contaminated with salts, corrosion products and residues of dosing chemicals. After neutralisation this blow-down water can be reused for ash wetting or conditioning to prevent particulate emissions from the ash storage yard.

Oil contaminated drains from the plant area will be directed to an oil / water separator system consisting of an oily water retention basin, oil skimmer, plate separator and oil holding tank. Contaminated drains and wash water will be collected and treated in a batch treatment system capable of precipitating and neutralising the waste water by adding flocculating / precipitating aids and / or caustic / acid.

Effluents from boiler acid cleaning procedures will be collected in a waste water tank and neutralised. After precipitation of the solids the clear water phase is discharged to the cooling water outfall channel. The spray water and preparatory water from coal storage yard and ash storage will be collected. The drain water will also be collected, treated and dewatered in the on-site process waste treatment system. The treated water will be used for ash wetting.

The sewage and grey water coming from toilets, showers, canteens and laundry will be discharged to a new sewage treatment plant. The sewage plant will consist of primary settlement, sludge tanks, extended aeration devices and sludge separators to provide the required acceptable effluent quality, a sterilization chamber and a chlorination contact tank. The sewage will be treated prior to re-use for irrigation or discharge into the on-site evaporation pond. The sewage sludge separated from the treatment process will be used as fertilizer in agriculture.

The on-site process waste water treatment system will include pH-adjustment, mechanical filters, mechanical clarifiers, flocculent chemical dosing, sludge thickeners, and filter presses. The clear treated effluent will be discharged to the on-site evaporation pond.

Solid wastes and sludge arising during operation will be collected and stored at site until a reasonable amount has accumulated. Chemical wastes will be collected and stored separately in a safe manner. All wastes will be transported off-site by road and disposed of according to the local standard.

3.5.2 Water Treatment Plant

As air-cooled condensing will be used for the steam cycle, the water quantity required is the make-up water for the plant water steam cycle process, and the auxiliary cooling system. For a PC boiler plant the additional water for the FGD process, and for coal-washing to improve the coal quality necessary, has to be taken into consideration.

Potable water and a raw water pipeline will be needed for the Project. The water pipeline will run from the water connection points to the site. Supply of raw water from the Mokolo-Crocodile Water Augmentation Project (MCWAP) Phase 2, could be allocated for the project.

The Department of Water and Sanitation is currently implementing the first phase of the Mokolo and Crocodile (West) Water Augmentation Project (MCWAP), consisting of a new pump station with a total pumping capacity of 1.3m³/s fed from the Mokolo Dam outlet works, and a new 42.7 km pipeline generally running parallel to the existing pipeline, from the pump station to the Point of Supply close to Matimba Coal-Fired Power Plant.

The completion of MCWAP 1 will allow for the full abstraction of the unused yield from the dam still available for allocation, with Exxaro having a preliminary agreement with DWS to receive an additional 2 million m³ per annum for the proposed Thaba-Metsi Mine and associated Power Station. However, this total does not include the water requirement for the proposed Tshivhaso Coal-Fired Power Plant. The total water requirement for coal supply to a 1200MW Tshivhaso Coal-Fired Power Plant is estimated at 1.5 million m³ per annum, which limits the total Tshivhaso Coal-Fired Power Plant capacity (possibly 1200MW) in the interim.

Water properties are provisional (based on Mokolo raw-water properties), but consideration has to be given to the possibility under MCWAP 2 for water from the Crocodile River being utilised instead of MCWAP 1. If this scenario is implemented the timeline for development of the Tshivhaso Power Plant Project will be delayed as it will be subject to water supply from MCWAP 2.

3.5.3 Ash Disposal

In the CFB process the ash produced consists of two fractions. The bed ash fraction (about 15%) removed from the fluidised bed and the 85% fraction fly ash, which is collected in the electrostatic precipitators. Both will have to be disposed of either on the Ash-Dump or in the Mine-Pit, because the content of unburned carbon in the bed ash and the high $CaSO_4$ content in the fly ash make them unsuitable for further use.

The ash handling system to be implemented for the proposed new power station will be designed to evacuate the fly ash as well as furnace bottom ash from the unit. The ash will, after intermediate storage in a silo, be transported via conveyors to the ash-dumping site.

It is likely that ash and other by-products will be conveyed to the dump, within the Tshivhaso Coal-Fired Power Plant precinct, where it is stacked and spread. The ash dumps would have to be able to accommodate the likely total volume of ash and other by-products that would be generated throughout the Tshivhaso Coal-Fired Power Plant's life-span. The ash dump would be continuously rehabilitated over time, using accepted rehabilitation methods. Rehabilitation measures shall include, reshaping, application of topsoil and re-vegetation with an acceptable grass species.

3.6 STORM WATER

Storm water management infrastructure that serves to separate clean and dirty water shall be designed to comply with Regulation 704 of the National Water Act of 1998. Storm water diversion canals will be required. Clean and dirty water separation will be achieved through the construction of a series of canals which will be designed to function up to the 1:50 year time of concentration storm runoff and to not suffer any significant damage up to the 1:10 year event. The clean diversion canals will not be lined except where erosion is expected to be a significant problem. Clean storm water diversions will be discharged to surface water. Erosion protection and appropriate energy dissipation structures will be provided at each discharge point.

Dirty areas will be reduced to a minimum to reduce the quantity of dirty water that has to be collected and treated within the Tshivhaso Coal-Fired Power Plant water circuit. Storm water management infrastructure will be established to prevent suspended solids and other pollutants from the construction sites from entering watercourses. Good housekeeping will be practised to reduce the pollution potential to a minimum.

3.7 WATER BALANCE

A schematic diagram, which links up the flow of water to and from the facilities as described in Sections 3.1 – 3.6, is required for the water use authorization process. The diagram should also show the water supply source, the water discharge point(s), evaporation areas and potential seepage points. Each step in the diagram should indicate the estimated flow, in m^3/day, into and out of the facility, whether it is pumped or gravity fed, piped or an open channel flow, clean or dirty water and, where appropriate the storage capacity of the dams. The water balance will be addressed in detail in the water use license application.

3.8 DISTURBANCE OF WATER COURSES

The site selection of the Tshivhaso Coal-Fired Power Plant considered the location of water courses situated within the footprint of the proposed development. The infrastructure will not be located within the 1: 100 year flood line of any watercourse. Therefore, no water courses will be disturbed.

4 OVERVIEW OF IMPACT ASSESSMENT METHODOLOGY

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

Issues or impacts of low significance will not be carried through to the Impact Assessment, with supporting reasons, to ensure that the Impact Assessment phase focuses on the potentially "significant impacts" identified for the proposed project.

4.1 IMPACT ASSESSMENT CRITERIA

The criteria for the description and assessment of environmental impacts were drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the NEMA.

The level of detail as depicted in the EIA regulations was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. An explanation of the impact assessment criteria is defined below in **Table 4-1**.

Table 4-1: Explanation of the EIA criteria

Extent	
Classification of the physical and spatial scale of the impact	
Footprint (F)	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Site (S)	The impact could affect the whole, or a significant portion of the site.
Regional (R)	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
National (N)	The impact could have an effect that expands throughout the country (South Africa).
International (I)	Where the impact has international ramifications that extend beyond the boundaries of South Africa.
Duration	
The lifetime of the impact that is measured in relation to the lifetime of the	

proposed development.	
Short (ST)	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase.
Short to Medium(S-M)	The impact will be relevant through to the end of a construction phase (1.5 years)
Medium (M)	The impact will last up to the end of the development phases, where after it will be entirely negated.
Long (LT)	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter.
Permanent (P)	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
Intensity	
The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. The intensity is rated as	
Low (L)	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
Medium (M)	The affected environment is altered, but functions and processes continue, albeit in a modified way.
High (H)	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Probability	
This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:	
Probable (Pr)	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).
Possible (Po)	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined as 25 %.
Likely (L)	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50 %.
Highly Likely (HL)	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75 %.
Definite (D)	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100 %.

In order to assess each of these factors for each impact, the following ranking scales will be used.

Table 4-2: Assessment Criteria: Ranking Scales

PROBABILITY		MAGNITUDE / INTENSITY	
Description / Meaning	Score	Description / Meaning	Score
Definite/don't know	5	Very high/don't know	10
Highly likely	4	High	8
Likely	3	Moderate	6
Possible	2	Low	4
Improbable	1	Insignificant	2
DURATION		**SPATIAL SCALE / EXTEND**	
Description / Meaning	Score	Description / Meaning	Score
Permanent	5	International	5
Long Term	4	National	4
Medium Term	3	Regional	3
Short term	2	Local	2
Temporary	1	Footprint	1/0

4.2 DETERMINATION OF SIGNIFICANCE

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

Equation 1:

Significance Rating (SR) = (Extent + Intensity + Duration) x Probability

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

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

4.2.1 Identifying the Potential Impacts Without Mitigation Measures (WOM)

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

Table 4-3: Significance Rating Scales without mitigation

SR < 30	Low (L)	Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
30 < SR < 60	Medium (M)	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR > 60	High (H)	Impact is significant, mitigation is critical to reduce impact or risk. Resulting impact could influence the decision depending on the possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.

4.2.2 Identifying the Potential Impacts with Mitigation Measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact. Significance with mitigation is rated on the following scale as contemplated in **Table 4-4**.

Table 4-4: Significance Rating Scales with mitigation

SR < 30	Low (L)	The impact is mitigated to the point where it is of limited importance.
30 < SR < 60	Medium (M)	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
SR > 60	High (H)	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

4.3 AREAS OF INFLUENCE

In order to assess the impact of the proposed Tshivhaso Coal-Fired Power Plant and associated infrastructure on surface water resources, various areas of potential impacts have been assessed. The first area is referred to as the "area of direct influence" (ADI) which is the area directly impacted upon by the proposed developments. The second area is referred to as the "area of indirect influence" (AII) which includes the broader catchment perspective.

4.3.1 Area of direct influence (ADI)

The ADI for water resources is determined by:

- Interception of watercourse and drainage areas due to the proposed construction of the Tshivhaso Coal-Fired Power Plant, haulage routes and conveyor system;
- Increased abstractions from the Mokolo Dam supply scheme and discharges to the sewage treatment works, and therefore the Mokolo River;
- Increased storm water runoff at the Tshivhaso Coal-Fired Power Plant site due to hardened surfaces, roads, and areas of cleared vegetation; and
- Potential for spillage from Ash Dam, Pollution Control Dam as well as coal stock yard

In terms of the EIA methodology, the spatial extent of the ADI is referred to as "Local" and "Site Specific". The impact assessment was based on the preferred alternative of a water supply from the CMWAP Phase 1 as the applicant has engaged with the WSP of the area to fulfil their demand requirements from this particular water source.

4.3.2 Area of indirect influence (AII)

The Area of Indirect Influence (AII) is determined by the boundaries of the Mokolo WMA, with the main emphasis on catchment supplying water to the Tshivhaso Coal-Fired Power Plant. In terms of the EIA methodology, the spatial extent of the AII is referred to as "Regional".

5 IDENTIFIED IMPACTS

5.1 CONSTRUCTION PHASE (PHASE 1 AND 2)

Based on Google observations, site visits and available topographical maps made during the scoping phase as well as consideration of the infrastructure requirements of the proposed development of the Tshivhaso Coal-Fired Power Plant, the primary concern is the management of storm water runoff from the sites, in particular the separation of clean and dirty water and the subsequent management of dirty water.

The site is relatively flat, with the natural drainage flowing in an easterly direction towards the Sandloop sub-catchment. In order to ensure that there is sufficient storage capacity to manage the additional water from the Tshivhaso Coal-Fired Power Plant, an assessment of the storm water management plan for this section of the development will need to be undertaken as part of the WULA process.

A large area will be cleared for construction activities. It should be noted that if wetlands (riparian wetlands) are present on the project site, they are considered as most sensitive areas due to their unique species composition and ecosystem functioning. Wetlands are considered a water resource and should be assessed as an integral part of the surface water study.

It is noted that riparian wetlands in the affected catchment are classed as arid ecosystems and almost impossible to rehabilitate.

The following potentially negative impacts on the surface associated with the construction phase have been identified:

- Clearance of vegetation to prepare site for construction;
- Storage of hazardous chemical substances;
- Storage of fuel and oil;
- Cement and concrete batching;
- Transportation of material to site and the storage of material on site; and
- Dust as a result of construction activities.

The abovementioned impacts associated with the construction phase are generic and can be adequately managed through the implementation of a construction Environmental Management Plan.

Nature: Alteration of the flow regime of the catchment resulting in loss of catchment yield, degradation of in-stream riparian habitat and associated decrease in water quality		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Likely (3)	Possible (2)
Significance	**36 (Medium)**	**20 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Minimize construction footprint to be outside watercourses and riparian zones; • Minimize disturbance to flow regime and prevent erosion		
Cumulative Impacts: A significant percentage of the natural sub-catchment of the Sandloop will be altered as a result of numerous developments in the region		
Residual Impacts: None		

Construction related pollution consists of spillages (i.e. vehicle and construction machinery fuels) as well as disturbed soil which could potentially pollute and increase sediment loads in surrounding watercourses.

Nature: Pollution (i.e. oil, diesel and chemical spills) and increased sediment loads could flow via stormwater from surrounding construction area resulting in disturbances and degradation of ecological status of watercourses.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	High (8)	Low (4)
Probability	Definite (5)	Possible (2)
Significance	**65 (High)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	positive
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation: • Ensure that the appropriate design facilities (berms, stormwater channels etc.) are constructed before construction • Minimize construction footprint to be outside watercourses and riparian zones; • Check all construction vehicles on a daily routine for the leaking of oil or other substances. If leaks or repairs are detected, vehicles should be removed from the site and repaired at designated bunded and paved repair area.
Cumulative Impacts: A significant percentage of the natural sub-catchment of the Sandloop will be altered as a result of hydrocarbon spills.
Residual Impacts: None

5.2 OPERATIONAL PHASE

The following potentially negative impacts on the surface water associated with the operational phase have been identified:

- Possible increase in the regional demand for water from the Mokolo Dam Supply Scheme.
- Potential contaminated storm water run-off from the coal storage stockyard.
- Contaminated runoff from the ash dam
- Risk of over-flow from the storm water dams into the Sandloop drainage system.
- Possible contamination of surface water resources as a result of transportation of ash to the ash dam caused by pipe burst on the site.

5.2.1 Regional water demand

As with most rivers in the Limpopo Province, catchment pressure and limited water resources are causing reduced flows, which in turn are limiting the ability of the rivers to sustainably meet environmental (reserve) requirements. However, there is an on-going demand for development within the region that further stresses the available water resources. It is important for water reconciliation studies that these future developments be recognised and incorporated in the regional demand for the Lephalale area.

The Lephalale Municipality is dependent on the Mokolo Catchment for its water supply and is anticipating a substantial bloom in the local economy. Amongst other, the following industrial developments will have an increased demand for water supply:

- Eskom are investigating the possibility of expanding Matimba Coal-Fired Power Plant;
- In conjunction with the possible expansion to Matimba Coal-Fired Power Plant, a feasibility study is being undertaken for a water transfer scheme to the Mokolo Dam, including modifications to the dam (raising of the dam wall);
- Tshivhaso Coal-Fired Power Plant will be supplied with coal from the new Thabametsi Coal Mine;
- Marubeni is investigating the possibility to construct a IPP Power Plant (i.e. the authorised Thabametsi Power Station) in close proximity to the Tshivhaso Coal-Fired Power Plant;
- The development of the above industries will support the development of secondary industries. The result will be an increased demand for water supply from the Mokolo Scheme

Table 5-1: Water Demand on Quaternary Catchment A42J

Quaternary Catchment	Water Resource	Name of Applicant	Water Use	Volumes Abstracted
A42J	Mokolo River	Mr. W Spies	21(a)	35 000 m^3/a
A42J	Mokolo River	Mokolo Irrigation Board	21(a)(b)	180 000 m^3/a
A42J	Mokolo River	Commiphora Home Owners Association	21(a)(f)	49 000 m^3/a
A42J	Sandloop River	Eskom Holdings (Matimba Power Station)	21(a)(b)(c)(e)(f)(g)(i)	6 500 000 m^3/a
A42J	Sandloop River	Eskom Holdings (Medupi Power Station)	21(a)(b)(c)(e)(f)(g)(i)	2 600 000 m^3/a
A42J	Mokolo River	Mr. JJ van der Westhuizen	21(a)	35 000 m^3/a
A42J	Mokolo River	Mr. W Ross	21(a)	5 000 m^3/a
A42J	Mokolo River	Mr. JC Malherbe	21(a)	70 000 m^3/a
Total volume abstracted annually				**9 474 000 m^3/a**

Considering the water users within the catchment (refer Table 5-1) it is clear that the concern of water scarcity needs to be addressed to allow for the industrial development in the area.

Nature: The abstraction of water for the operation of the power station could have an impact on the supply from Mokolo Dam, Reserve and associated aquatic environment as well as other users in the Lephalale geographical region. Surrendering of agricultural water in terms of section 25(2) applications will reduce the food production in the region		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Low (4)
Probability	Highly likely (4)	Possible (2)
Significance	60 (High)	22 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Installation of dry cooling technology to reduce water consumption at the power station, implementation of Circulating Fluidized Bed (CFB) as no flue gas desulphurisation would be necessary, implementation of the Water Demand and Conservation Plan, implementation of waste minimisation strategies, water re-use and recycling, monitoring programmes, adherence to specifications of the MCWAP		
Cumulative Impacts: Increased bulk water supply to region that is already water stressed will result in frequent water shortages, reduction in catchment yield and less water available for crop production		
Residual Impacts: No		

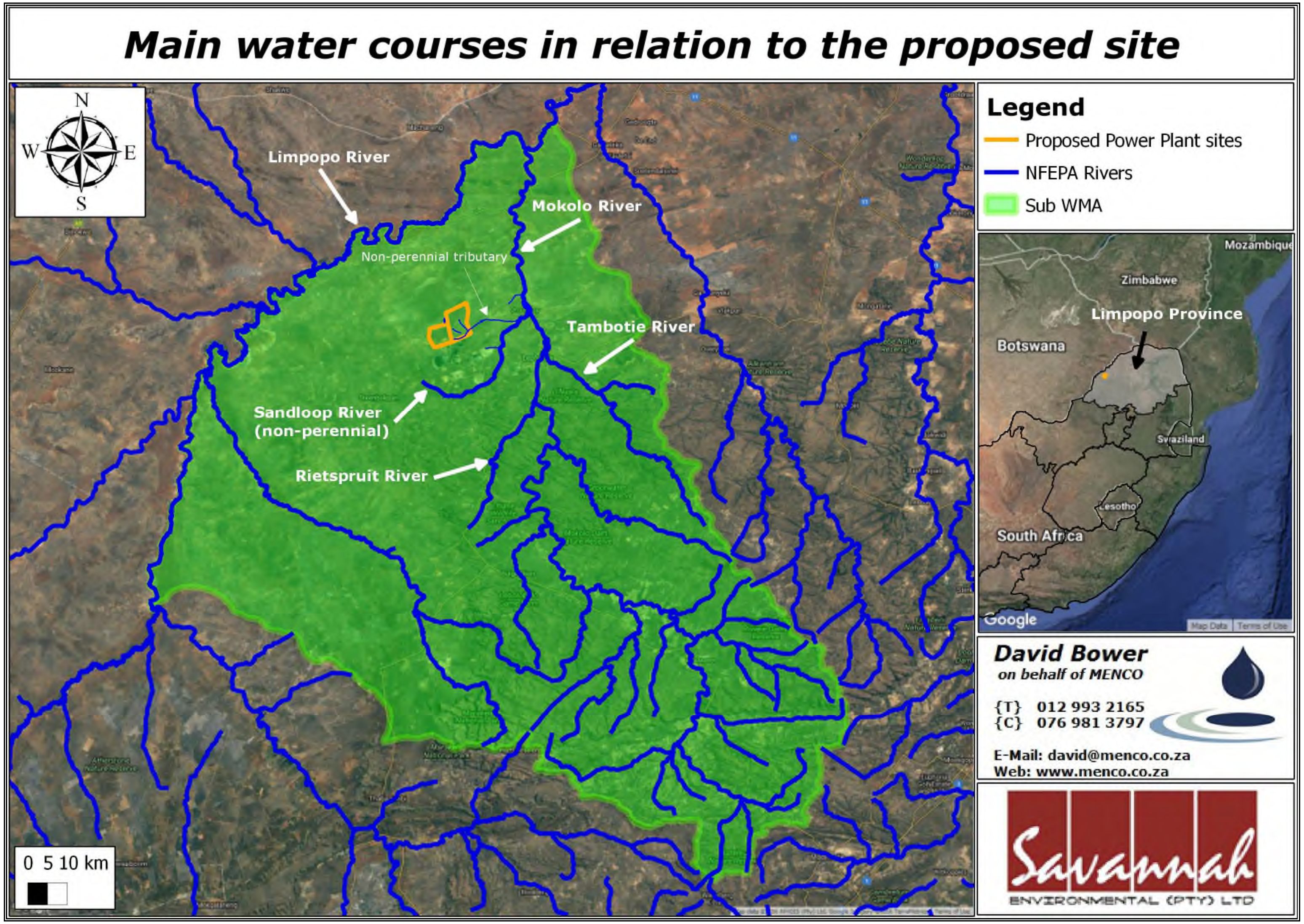

Figure 5-1: Freshwater Ecosystem Priority Areas

5.2.2 Water Quality

Several activities during the operational phase could contribute towards water quality deterioration. These impacts stem from contaminated runoff from the ash dump as well as the coal stockyard. In the event that pollution control facilities fail to contain poor quality water, spillages to the environment will cause negative impacts on the water quality and aquatic ecology of the region. The impact will be significant and long-term and will extend beyond the boundaries of the project area. It should be noted that the project footprint falls within a Fresh Water Priority Area (refer **Figure 5-1**). With the implementation of mitigatory measures the impact could be rated low to moderate.

Nature: Raw materials, chemicals, liquid fuels and liquid waste products used in the operation of the power station could contaminate the water resources (surface and groundwater) in the area contributing towards water quality degradation.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Low (4)
Probability	Highly likely (4)	Likely (3)
Significance	**60 (High)**	**30 (Low/Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: Implementation and on-going management of water pollution control facilities such as PCD and storm water drainage system, oil and silt traps, separate clean and dirty water systems, adequate storage capacity and follow ZED policy, obtain water use authorisation, install monitoring program		
Cumulative Impacts: Deterioration of water quality in the Mokolo River in the long term with loss of biodiversity		
Residual Impacts: Possible build-up of hazardous components within the footprint of the power station (ash dump, PCD, coal stockpile)		

5.2.3 Storm water impacts

The management of storm water runoff is required to avoid spillage of contaminated water, reuse and recycling water and storm water wherever possible, treatment of water for reuse or discharge, and as a last resort, discharging storm water in compliance with Department of Water and Sanitation's limits. The mean annual precipitation for Lephalale is about 650 mm/year of which about 80% falls between October and March with rainfall peaking in January. The development of the Tshivhaso Coal-Fired Power Plant and hardened surfaces on the site would lead to an increase in runoff. Some of this runoff may be contaminated with oils or grease, or chemicals used on the Power Plant site.

It would be practical to dispose of clean storm water runoff to the Sandloop. However, due to the distance to the river (some 3km) it is proposed that a storm water detention dam be constructed to accommodate all clean water runoff from the developed area. This water could be recycled and reused to reduce the demand for raw water supply. It is recommended that a number of considerations be taken into account in the design of the dam:

- Evaporation offers a practical solution due to the high mean annual evaporation of 2500 mm compared with the rainfall of 650 mm. Evaporation ponds are common practice in water resource management and are utilised by adjacent developments.
- If the dam is considered for pollution control purposes, it should be lined and available water be pumped to areas where it could be used for dust suppression.
- If pollution is expected from the power plant, a silt/oil trap should be constructed in the outfall pipeline to limit the impact thereof.
- The sizing of the storage dam would depend on what the water would be used for, the site geology, the hardened developed area as well as environmental considerations. The client proposed that the storage dam be constructed with a capacity of 120 000 m^3.

The mitigation of this potential impact needs to be addressed in the Environmental Management Plan.

Nature: Spillage of storm water containing waste could lead to water resource degradation		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Likely (3)	Possible (2)
Significance	**39 (Medium)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High

Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: Pollution control infrastructure to be designed in accordance with GN 704 specifications, water use to be licensed for appropriate regulation and control, dams to be appropriately managed and maintained for life-cycle of the facility		
Cumulative Impacts: Increased waste load to the receiving environment		
Residual Impacts: Sediments with increased toxicity levels		

5.2.4 Transportation and conveying impacts

Coal dust and spilled ash may have an impact on the Sandloop. The coal being transported from the mines to the Tshivhaso Coal-Fired Power Plant is native to the area and the impact may only be a slight increase in the suspended sediment load in the Sandloop. However, the Sandloop is dry for most of the year and it flows infrequently during the high rainfall summer months. This impact would probably be very low, and restricted to the site where the haul road or conveyor crosses the unnamed tributaries to the Sandloop. Mitigation of this potential impact needs to be addressed in the Project EMPr and the Integrated Water and Waste Management Plan.

Nature: Transport of coal will result in spillages of coal dust and ash either by falling off the conveyer and or blown by strong winds which will fall onto the surrounding environment.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Low (4)
Probability	Highly likely (4)	Likely (3)
Significance	**60 (High)**	**30 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Minimize construction footprint to be outside watercourses and riparian zones; • Minimize disturbance to flow regime and prevent erosion • Compile work method statement/Riparian rehabilitation plan • Apply for section 21(c) (i) water use authorisation		

Cumulative Impacts: A significant percentage of the natural sub-catchment of the Mokolo River and its tributary the Sandloop will be altered
Residual Impacts: None

5.2.5 Construction of pipeline

Construction of pipeline will impact the watercourse as it will cross several drainage systems impacting the riparian zones therefore altering the water flows of the natural watercourses.

Nature: Construction of pipeline from the raw water supply point will cross several drainage systems impacting on the drainage lines and riparian zones		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly likely (4)	Possible(2)
Significance	**52 (Medium)**	**20 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: • Minimize construction footprint of pipeline to ensure little disturbance to watercourses and riparian zones (e.i. pipeline runs above ground) • Minimize disturbance to flow regime and prevent erosion • Compile work method statement/Riparian rehabilitation plan • Apply for section 21(c) (i) water use authorisation		
Cumulative Impacts: A significant percentage of the natural sub-catchment of the Mokolo River and its tributary the Sandloop will be altered		
Residual Impacts: None		

5.2.6 *Ash Disposal*

Ash has the potential to pollute water resources which is generally associated with the change of pH of the water body. With the change of pH caused by the ash, salts and metals are mobilised that could leach into ground and surface water bodies. The method and mechanism of ash disposal will determine the extent and magnitude of the impact. The rate at which elements are leached from ash dumps depends on the form in which the element is present, the location of the element within the ash matrix as well as whether the pollutant has been absorbed onto the particle surface or not. Elements or pollutants in a chemically stable matrix are less readily available to be leached from the ash dump. The most likely elements to be leached from the ash dump are those that have adsorbed onto the surface of the ash particles.

The above ground storage of ash will potentially result in impacts on ground and surface water. Therefore the ash dump will be lined as per DWS requirements.

Nature: The disposal of ash will contribute towards an increased risk of point and diffuse pollution in the catchment. Pollution of the environment will stem from ingress of runoff into the aquifer, spills from the system, dust fall out that could increase salinity within the catchment		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Likely (3)	Possible (2)
Significance	**Moderate (39)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • Adherence to the requirements as depicted in NEMWA and NWA in terms of liner designs. • Application for a water use license (section 21(g) • Adherence to GN 704 Regulations supported by civil engineering design reports • Monitoring of surface and groundwater resources		
Cumulative Impacts: Ground water resource contamination rendering the utilisation of the aquifer for water supply unfit for use in the long run		
Residual Impacts: Increased salinity of water resources		

6 ENVIRONMENTAL MANAGEMENT PROGRAMME

To ensure that Cennergi solidify their performance the Company has developed an integrated business management model to guide the lifecycle of their operational activities. This approach requires a multidisciplinary team working together from the planning and feasibility stages of a project to post-closure. The approach also ensures that all environmental legal requirements are integrated into the process of project planning and closure. A fundamental element of this obligation is that the business unit holding any permit, energy regulation authorisation or Environmental Authorisation will carry out the environmental management, rehabilitation of land disturbed by its operations and closure activities as per the following legal requirements:

- Environmental management programme (EMPr) approved in terms of the NEMA and regulations
- NWA water use license (IWUL) conditions
- NEMA Environmental Authorisation conditions
- Aim of building a good working relationship with all relevant government departments for ease of authorisations and approvals throughout the life of the power station
- National heritage resources agency (SAHRA)

6.1 ENVIRONMENTAL AND MANAGEMENT OBJECTIVES

OBJECTIVES:

- Create competitive advantage for Cennergi through innovative biodiversity management
- Ensure continued business operations through compliance to legislation and non-statutory best practice
- Sustainable waste management that is a competitive advantage for Cennergi
- Ensure availability and security of supply, efficient and responsible use of scarce water resources and regulatory compliance

6.1.1 Water Use and Management

The Power Station will follow a zero discharge policy and the pollution control facilities and associated water management infrastructure will be designed in accordance with the requirements as contained in GN 704 Regulations.

In this instance clean water separation from dirty water on the Power Station footprint will be induced allowing direct runoff of clean water towards natural watercourses and containment of dirty water. Surfaces within the dirty areas will be kept to a minimum to reduce the volume of dirty runoff generated by plant production activities. This affected water will be collected in a settling pond from where the dirty water will be recycled for further use.

6.1.2 Surface Water Management

The following surface water management objectives will be applicable for the proposed Power Station:

- Identify any potential risks from the project on the surface water resource;
- Protect and conserve the aquatic and surface water environment from any impacts;
- Protect and conserve the wetlands from any impacts related to the Power Station;
- Prevent the aquatic and surface water environment from degrading due to the activities of the Power Station;
- Optimize water use;
- Strive for zero effluent discharge site (ZED);
- Preserve the water resources in line with the management objectives of the Proto Limpopo CMA/DWS for the management unit;
- Implement requirements of Water use authorisation to be obtained from the relevant regulatory body; and
- Ensure compliance with GN 704

6.1.3 Storm water Management

Storm water management will be based on the objective of separating clean water from dirty water and therefore encompass the key principle of pollution prevention. The following objectives will apply:

- Keep clean water clean;
- Collect and contain dirty water;
- Ensure sustainable storm water management over Power Station life cycle; and
- Compliance with Regulations as contained in GN 704

6.2 MANAGEMENT OBJECTIVES AND STRATEGIES

The following water resource management objective and strategies will be adopted:

- Quantitative and qualitative assessment of the water resources on the property area to effectively conduct Integrated Water Resource Management;

- Minimisation and where possible prevention of water pollution stemming from the Power Station and associated activities by compliance with and adherence to management commitments as specified in the EMPR;
- Appropriate storm water management over the entire footprint of the project area to ensure reduction in silt load and erosion
- Assessment of the cumulative impacts from adjacent mining and power generation activities with the implementation of appropriate management measures to ensure sensitive downstream water users are not detrimentally impacted

6.3 CONSTRUCTION PHASE: TSHIVHASO POWER STATION

In terms of the Power Station's construction phase the following management and mitigation measures are required to prevent and/or reduce environmental impacts:

- Obtain the necessary Water Use License from the DWS as regulatory authority
- Development of an Integrated Water and Waste Management Plan (as part of the WULA);
- Wetland and riverine areas to be considered as no go zones unless authorisation is obtained;
- Separation of clean and dirty water systems;
- Containment of all contaminated water in dedicated pollution control design facilities;
- Re-use, recycle and minimise all waste water generated on the site; and
- Implementation of compliance monitoring program with associated auditing and reporting

Project component/s	Construction of the Power Station infrastructure
Potential Impact	➢ Clearance of project foot print could lead to increased sedimentation and siltation of watercourses ➢ Road construction, pipelines and conveyance to alter the natural characteristics of the drainage system ➢ Accidental spills could lead to water pollution
Activity/risk source	➢ Power station located within quaternary drainage A41E and A42J that has PES and EIS category of C with largely undisturbed areas of ephemeral and episodic drainage patterns
Mitigation: Target/Objective	➢ Water quality (for surface and groundwater) should adhere and comply with the Resource Quality

	Objectives set for the catchment; ➢ Eco-classification for the affected catchment in terms of PES and EISC shall be maintained at **Class C**

Mitigation: Action/Control	Responsibility	Timeframe
• The construction of roads and road servitudes (disturbance zones) in or adjacent to the wetland/riparian zone is to be managed and strictly controlled to minimize damage to the impoundment, rivers and wetlands.	Contractor	Demarcate areas with daily inspections
• In-stream habitat conditions (with regard to the river's morphology) should be recreated as far as possible; this pertains to those areas where construction activities have disturbed the in-stream habitat beyond the operational footprint of the pipeline crossings, culverts or bridges.	Contractor	Demarcate areas with daily inspections

Performance Indicator	Re-establish the natural environment as soon as possible
Monitoring	• Where vegetation removal has occurred adjacent to the new pipeline route, ash dump site and Power Station Complex, monitoring should take place to ensure successful re-establishment of natural vegetation. Alien vegetation should be removed from these disturbed areas on an ongoing basis to ensure the successful re-vegetation by indigenous species. • When dead trees and other debris collect at the base of bridges and culverts they create hydraulic obstacles resulting in the scouring (erosion) of the downstream banks (and this may also lead to an excessive soil deposition upstream of the bridge/culvert). It is therefore essential that a long-term monitoring and maintenance plan be implemented by the applicant whereby the applicant will be obligated to maintain bank stability (i.e. to control any erosion that has taken place as a result of the crossing infrastructure) as well as to clear any debris away from the base of the bridges and culverts (especially after high rainfall and flood events).

6.4 Operational Phase: Power Station

Project component/s	Operational phase of the Power Station infrastructure
Potential Impact	• Ash disposal to potentially degrade surface and groundwater resources • Accidental spills could lead to water pollution • Runoff from coal stockpiles, ashing plant area and power station surface infrastructure to pollute water resources
Activity/risk source	Power station located within quaternary drainage A41E and A42J that has PES and EIS category of C with largely undisturbed areas of ephemeral and episodic drainage patterns
Mitigation: Target/Objective	Description of the target; include quantitative measures and/or dates of completion

Mitigation: Action/Control	Responsibility	Timeframe
Stormwater Control • Dirty and clean stormwater should be separated systems. Dirty stormwater to be contained • The erosion down verges on the approach to a water course should be minimised by including frequent discharge points with energy dissipaters before discharging storm water into the adjacent grasslands (where applicable). • Infiltration down the verges of the roads rather than surface runoff should be encouraged (this could for example include the use of grassed swales, Hyson Cells or grass blocks). The construction of small detention ponds filled with *Phragmites* reeds would allow sediment and debris/litter to be trapped before entering the main drainage lines. • Where storm water enters the water resource sediment and debris trapping, as well as energy dissipation control structures should be put in place. • Litter traps should be incorporated into the stormwater designs to ensure that litter runoff from the site cannot enter the Mokolo River catchment or other tributaries (Sandloop) directly.	Tshivhaso Appointed Civil Engineer SHE: Manager	During construction phase Daily inspection
Water Pollution Control Facilities • Turbidity, sedimentation and chemical changes to the composition of the water must be limited.	SHE: Manager Civil Engineer	Commence during Construction phase On-going with daily

Mitigation: Action/Control	Responsibility	Timeframe
• The possibility of spillages should be catered for in the design of the infrastructure development where, pollution control dams or attenuation ponds prior to the discharge of storm water could be contained. • Storm water systems to be designed in such a way that it can be easily sealed off after the occurrence of a spill. If a spill occurs during the operational phase of the water use, a qualified team of experts will need to be consulted, rehabilitation plan drawn up and implemented and the Regional DWA Office should be informed immediately.		inspections
General • Dirty water collection at the station drains and sumps • Clean water diversion (bunds/ canals). • Good housekeeping (clean-up of spills and minimise informal storage of materials) • Leak detection through inspection • Good housekeeping (maintenance of equipment) • Storm water diversion upstream of the facilities • Either run off will be contained in paddocks for collection and evaporation or run off will be captured in the drain system and channelled to the PCD compartment. • Monitor seepage at PCD on a	SHE: Manager	On-going throughout life of operation

Mitigation: Action/Control	Responsibility	Timeframe
quarterly basis • Isolate pollution sources with roofs, concrete bases, traps, sumps and bund walls (e.g. diesel/petrol storage, wash bays and workshops) • Roads will be surfaced • Vehicle maintenance will be conducted on bunded concrete surfaces		

Performance Indicator	Zero Spillages, leaks or discharges
Monitoring	• As per approved monitoring plan

7 CONCLUSION

The primary surface water impacts associated with the development of the Tshivhaso Coal-Fired Power Plant, ash dump and transport of coal to the Power Plant are the potential impacts on the regional water balance, water quality degradation due to waste water discharges, storm water management at the Tshivhaso Coal-Fired Power Plant, and possible impacts on the Sandloop where the haul road or conveyor system would cross the drainage system.

- Tshivhaso Coal-Fired Power Plant site – an investigation of the impact on regional water resources found that water demand of the Tshivhaso Coal-Fired Power Plant would contribute significantly to the growth in demand on the WCDM water supply system. The Department of Water and Sanitation is currently addressing the water needs for the catchment.
- Ash dump site – A storm water management system should be designed for the Tshivhaso Coal-Fired Power Plant site to ensure that sufficient storage capacity is created on site to accommodate storms with a 1:50 year return period (GN 704 Regulations), spillage frequencies should be less than 1 percent, taking into account the long-term rainfall record applicable to the project site and any abstraction for reuse from the storm water dams, and to ensure that there is efficient separation of clean water and dirty water. Only clean water should be discharged to the storm water system. Contaminated water should be contained and treated on site.
- The storm water management system should comply with the Department of Water Affairs' Best Practise Guidelines (DWAF, 2006). The EMPr for the Tshivhaso Coal-Fired Power Plant should also address measures to contain oil spills, good waste management practices, guidelines for the storage, handling, use and disposal of chemicals, etc.
- The disposal of effluent from the waste water treatment works needs to adhere to the Resource Quality Objectives set for the Mokolo River sub-catchment to prevent degradation of water quality and the River Health Class.
- Transportation corridor – Good dust suppression practices should be applied to prevent spillage of coal or ash material along the haul road or conveyor.
- A monitoring network for surface and groundwater needs to be implemented that is further supported by biological and wetland monitoring
- Tshivhaso Coal-Fired Power Plant must apply for the identified water uses and conduct the required studies to compile an Integrated Water and Waste Management Plan

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