Department of Water and Sanitation

Report No: P WMA 03/000/00/6923/4

WP11393

CROCODILE EAST WATER PROJECT (CEWP)

MODULE 1: TECHNICAL FEASIBILITY STUDY

Pre-Feasibility Study: Environmental Screening Report

June 2023

Final

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DOCUMENT INDEX

This report forms part of the series of reports issued as part of the project Crocodile East Water Project (CEWP) Module 1: Technical Feasibility Study.

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LIST OF ACRONYMS

As	Arsenic
AR	Affected Reach
CBA	Critical Biodiversity Area
CEWP	Crocodile East Water Project
cfu	Colony Forming Units
Cr	Chromium
CR	Critically Endangered
DFFE	Department of Forestry, Fisheries and the Environment
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EN	Endangered
EIA	Environmental Impact Assessment
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Area
FSL	Full Supply Level
GN	Government Notice
IHI	Index of Habitat Integrity
IUCMA	Inkomati Usuthu Catchment Management Agency
LC	Least Concern
LM	Local Municipality
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MBSP	Mpumalanga Biodiversity Sector Plan
Mn	Manganese

MTPA	Mpumalanga Tourism and Parks Agency
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NEM:PAA	National Environmental: Protected Areas Act, 2003 (Act 57 of 2003)
NFEPA	National Freshwater Ecosystem Priority Area Project
NH_3	Ammonia
NPAES	National Protected Areas Expansion Strategy
NR	Nature Reserve
NT	Near Threatened
ONA	Other Natural Areas
PA	Protected Area
PNR	Private Nature Reserve
RQO	Resource Quality Objectives
SCC	Species of Conservation Concern
SO_4	Sulphate
SWSA	Strategic Water Source Area
TEC	Target Ecological Category
TWQG	Target Water Quality Guideline
VU	Vulnerable
WC/WDM	Water Conservation and Water Demand Management
WMA	Water Management Area
WWTW	Wastewater Treatment Works

LIST OF UNITS AND SYMBOLS

cfu/100 ml	Colony Forming Units per 100 ml
km	Kilometre
kV	Kilo Volt
m	Metres
mamsl	Metres above Mean Sea Level
mg/l	Milligram per Litre
mm	Millimetre
mS/m	Milli Siemens per Metre

GLOSSARY OF TERMS

Catchment	The land area drained by a river and its tributaries.
Critical Biodiversity Area	Areas that are required to meet biodiversity targets for species, ecosystems or ecological processes. These include: • All areas required to meet biodiversity pattern targets and to ensure continued existence and functioning of species and ecosystems, special habitats and species of conservation concern; • Critically Endangered ecosystems; and • Critical linkages to maintain connectivity
Ecological Support Area	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of Protected Areas or CBAs, as well as for delivering ecosystem services
Endemic	Restricted or exclusive to a particular geographic area, occurring nowhere else. Endemism refers to the occurrence of endemic species.
Groundwater	Groundwater is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water.
Moderately or Heavily Modified Areas	Areas that have been modified by anthropogenic activity.
Other Natural Areas	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character.
Protected Area	Areas that are formally protected by law and recognised in terms of the National Environmental: Protected Areas Act, 2003 (Act 57 of 2003). Includes protected areas declared through the biodiversity stewardship programme.
Strategic Water Source areas	Areas of land that either: (a) supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b).
Surface Water	Surface water is water on the surface of the earth such as in a stream, river, dam, wetland or ocean.

1 INTRODUCTION

1.1 Background to Study

The water of the Crocodile (East) River Catchment in Mpumalanga has been fully allocated, yet the water requirements, especially domestic water requirements, continue to grow. The system is under stress, and it cannot fully meet the environmental water requirements as well as the reliability / assurance of supply for both the agricultural and municipal water uses.

The situation will worsen in the short term if water conservation and water demand management (WC/WDM) measures are not fully implemented. In the medium to long term, WC/WDM measures will not be sufficient to provide for the increase in domestic water requirement. The yield of the water resource will have to be increased by means of **additional storage**.

Both public and commercial sectors have requested development of **additional yield** through **storage** within the **Crocodile (East) River Catchment**. Due to the long lead-time required in developing new dams, the construction of an additional dam in the Crocodile River Catchment has to be investigated without delay.

Taking cognisance of the above-mentioned and based on previous studies and investigations carried out in the past, the following **four proposed dams** within the **Crocodile (East) River Catchment** were recommended for further study as part of this Study (WP11393: Module 1: Technical Feasibility Study):

- Mountain View Dam on the Kaap River.
- Montrose Dam on the Crocodile East River.
- Boschjeskop Dam on the Nels River.
- Strathmore Off-Channel Storage Dam, near the confluence of the Kaap and Crocodile rivers.

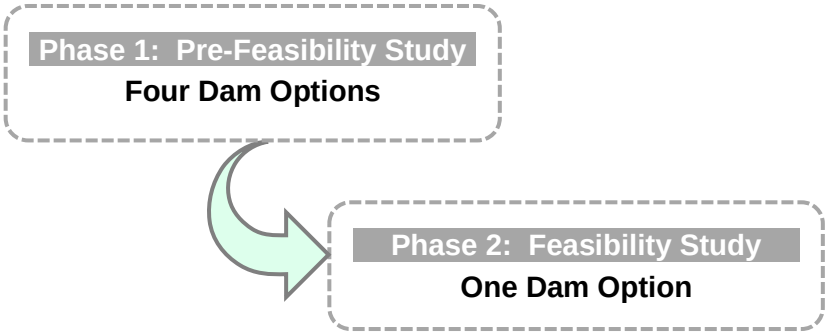
This Technical Feasibility Study will be undertaken in two separate phases, as follows:

Phase 1: Pre-Feasibility Study

The Pre-Feasibility Study (Phase 1) will be undertaken for the above-mentioned **four** proposed dams within the Crocodile (East) River Catchment.

Phase 2: Feasibility Study

Under the Phase 1: Pre-Feasibility Study, **one** of the possible four dam options will be selected and recommended for further study and development to a **feasibility level** of detail in the Phase 2: Feasibility Study.



1.2 Study Area

The Crocodile (East) River Catchment in Mpumalanga is located in the north-east of the country and forms part of the larger Inkomati River Basin. The water of the Inkomati River Basin is shared between Mozambique, South Africa and Eswatini. A map of the Study Area is included in **Figure 1-1**.

Engineering investigations and studies for the respective dams and associated infrastructure will **each** have their **specific focus** and **study area** and will also apply to dam access, advanced infrastructure for the dam and the possible relocation of services (roads, rail, etc).

However, with respect to the Water Resources task (water demands, yield analysis, future water balance, the development of short-term stochastic yield reliability curves, updating of the water resources planning model, etc.) of the Study, the study area will cover the **whole** of the **Crocodile (East) River Catchment** (see **Figure 1-1**).

The Crocodile (East) River Catchment comprises of the following four tertiary catchments as indicated in **Figure 1-2**:

- Upper Crocodile Catchment (X21)
- Middle Crocodile Catchment (X22)
- Lower Crocodile Catchment (X24)
- Kaap Catchment (X23)

Important tributaries of the Crocodile River include the following:

- Kaap River
- Elands River
- Nels River
- White River

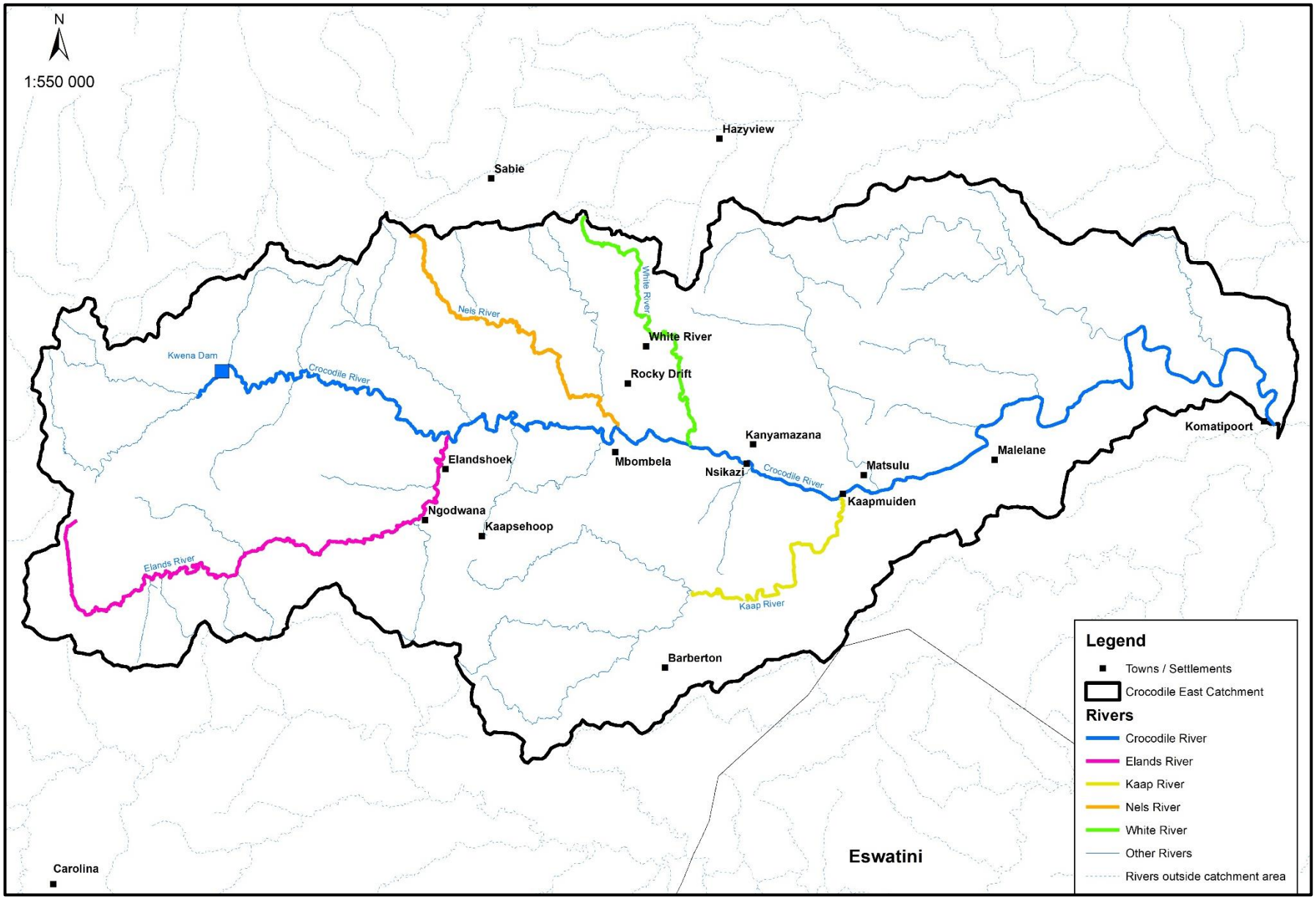


Figure 1-1: Crocodile River Catchment

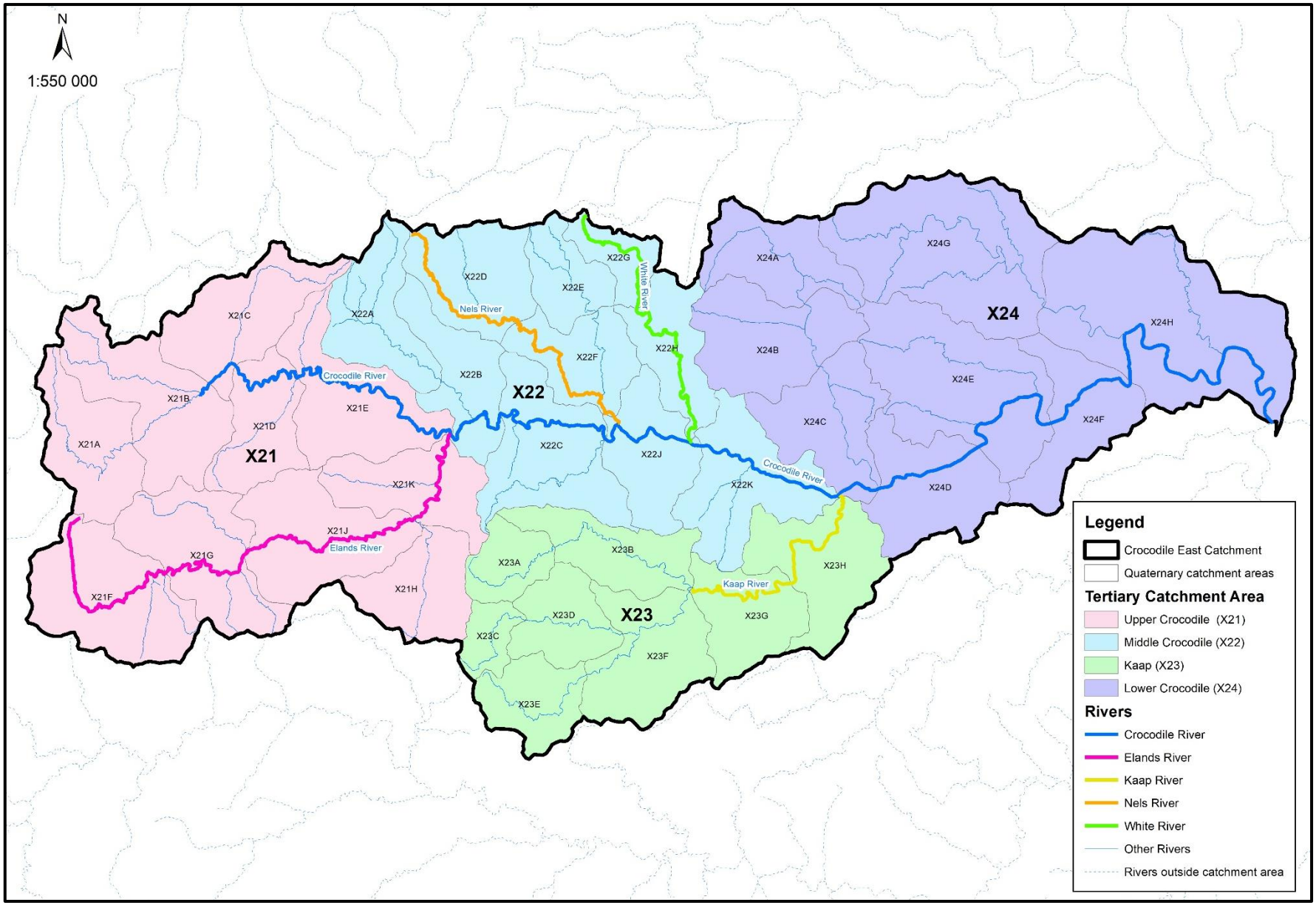


Figure 1-2: Crocodile East River: Tertiary Catchments

The following District and Local Municipalities fall within the Crocodile (East) River Catchment:

- Ehlanzeni District Municipality
  - Bushbuckridge Local Municipality
  - City of Mbombela Local Municipality
  - Nkomazi Local Municipality
  - Thaba Chweu Local Municipality
- Gert Sibande District Municipality
  - Chief Albert Luthuli Local Municipality
- Nkangala District Municipality
  - Emakhazeni Local Municipality

The Crocodile River Catchment is rural in nature, with agriculture being the main economic activity. The high rainfall escarpment catchments of the Upper and Middle Crocodile and Kaap catchments have significant areas of commercial forestry.

The Upper Crocodile Catchment is relatively undeveloped with small domestic and irrigation demands. The Middle Crocodile Catchment has large areas of controlled irrigation and urban demands in the Mbombela LM. The Kaap River Catchment is dominated in the lower eastern part by significant areas of controlled irrigation. Water is transferred into the Kaap River Catchment from the Lomati and Shiyalongubo dams for urban users (Umjindi Local Municipality which was disestablished and merged with Mbombela Local Municipality to establish the City of Mbombela Local Municipality) and agriculture (Louw's Creek Irrigation Board). The Lower Crocodile Catchment has large areas of controlled irrigation and smaller urban/domestic demands for the Nkomazi LM.

The only major dam in the catchment is the Kwena Dam in the Upper Crocodile River Catchment. The dam is approximately 60 km west of Mbombela on the main stem of the Crocodile East River or in the upper reaches of the Crocodile East Catchment. The dam is far from the water demand centers and therefore makes it difficult to regulate and manage water distribution to supply demands as required by the users.

1.3 Proposed Dams

Four proposed dams (listed below) will be investigated during the Pre-Feasibility Phase (Phase 1) of this Study. Only **one** will be selected and recommended for further study in the Feasibility Phase (Phase 2) of the Study. It is, however, possible that the second-best option could be taken forward at a later stage.

- Mountain View Dam on the Kaap River.
- Montrose Dam on the Crocodile East River.
- Boschjeskop Dam on the Nels River.
- Strathmore Off-Channel Storage Dam, near the confluence of the Kaap and Crocodile rivers.

The regional orientation of the **four proposed dam sites** is indicated in **Figure 1-3**.

1.4 Purpose of Report

The purpose of this Report is to present the results of an Environmental Screening exercise as part of the Phase 1: Pre-Feasibility Study based on information available from previous studies and publicly available datasets. The focus of this Environmental Screening is on the biophysical aspects and a separate socio-economic assessment will be conducted as part of the Phase 2: Feasibility Study.

The objective is to identify fatal flaws, conduct high level ranking of the dam options based on environmental sensitivities and anticipated impacts. This will form part of the multi-criteria decision matrix (ranking system) to be applied to the four dam options to enable a uniform comparison with the objective of identifying the most feasible option to be taken forward in the Phase 2: Feasibility Study.

A more detailed Environmental Screening will be conducted of the selected dam option during the Phase 2: Feasibility Study, which will include screening of the enviro-legal aspects.

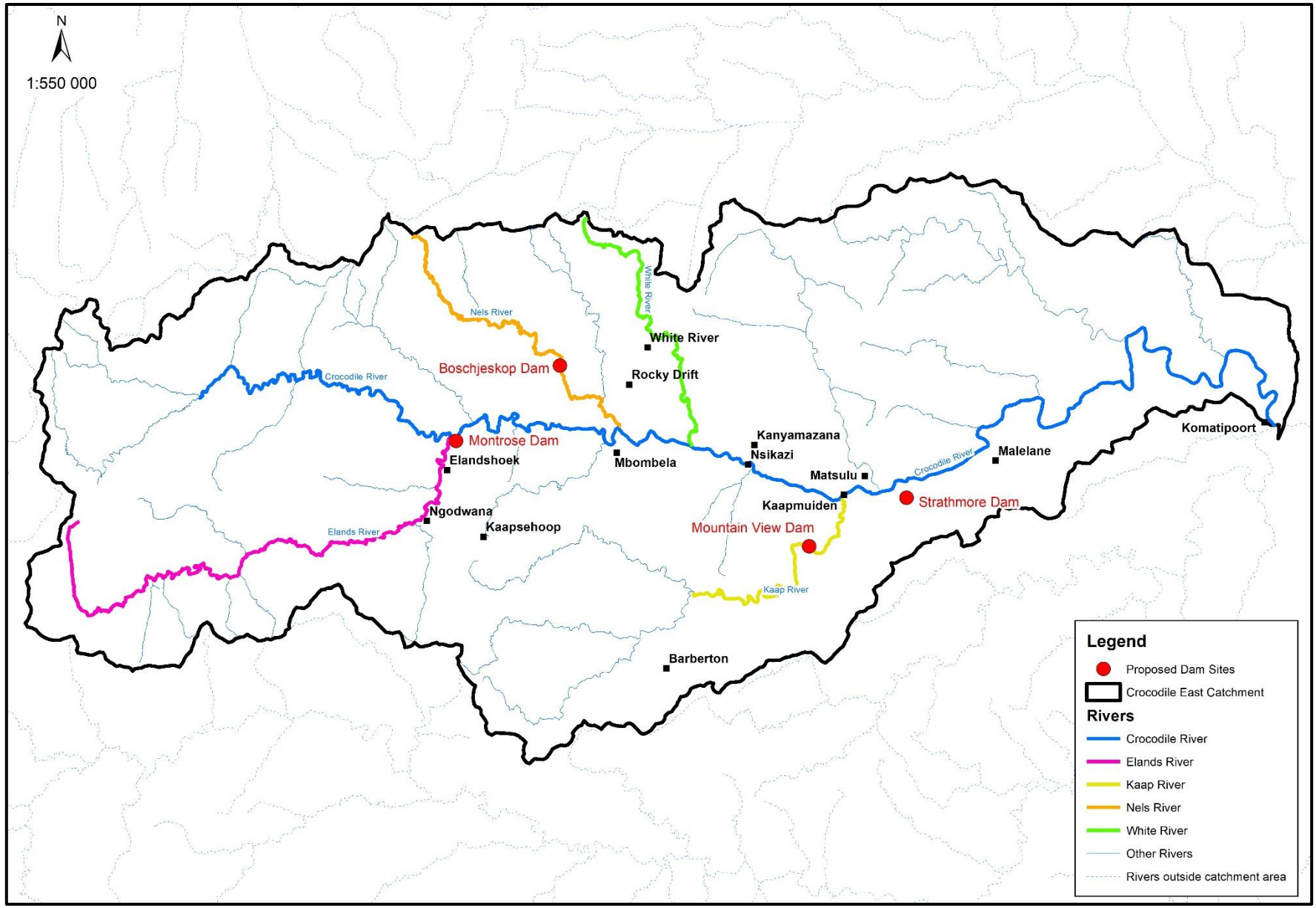


Figure 1-3: Regional Context of Four Proposed Dam Sites

1.5 Structure of Report

The report is structured as follows:

- **Section 1** provides a background of the Study, an overview of the Study Area, including the purpose and structure of this Report.
- **Section 2** describes the approach and methodology for the environmental screening process. The rating approach based on the sensitivity of each proposed site and the potential risks posed by the proposed dam development is also addressed.
- **Sections 3 to 6** include the environmental screening assessments for each of the dam options in terms of the following:
  - Topography
  - Climate
  - Geology
  - Soil, Land Use, Land Capability and Agricultural Potential
  - Rivers and Wetlands
  - Terrestrial Ecology
  - Freshwater Ecology
  - Archaeological and Heritage Resources
- **Section 7** provides an overview of the potential environmental impacts identified, and the extent to which it was incorporated in the rating of the dam options.
- **Section 8** includes the ratings assigned to the environmental aspects assessed in **Sections 3 to 6** for each dam option. The ranking of the dam options in terms of their respective overall environmental scores is also addressed.
- **Section 9** indicates the Study references.

2 APPROACH AND METHODOLOGY

2.1 Baseline Environmental Description

The following biophysical aspects were considered in the Environmental Screening:

- Topography
- Climate
- Geology
- Soil, Land Use, Land Capability and Agricultural Potential
- Terrestrial Ecology
- Freshwater Ecology
- Archaeological and Heritage Resources

A high-level, qualitative assessment was made of potential socio-economic aspects. This included aspects such as the potential re-settlement of people, loss of jobs (e.g., farmworkers, tourism related), change in sense of place and visual impact.

The following information sources were used to inform the baseline environmental description, identify environmental sensitivities, and to inform the environmental aspects that could be impacted:

- Historic information from previous assessments of the dam options;
- Water Quality Status reports and Ecostatus reports published by the Inkomati-Usuthu Catchment Management Agency (IUCMA);
- Mpumalanga Biodiversity Sector Plan (MBSP);
- Biodiversity data from the web based Environmental Screening tool developed by the Department of Forestry, Fisheries and Environment (DFFE);
- Studies conducted as part of the Phase 1: Pre-Feasibility study, specifically the Evaluation of the Downstream Ecological Impacts (report number P WMA 03/000/00/6922/2).

2.1.1 Water Quality Status Reports

The IUCMA conducts surface water quality within the Inkomati-Usuthu Water Management Area (WMA). Water quality is measured by means of physio-chemical, microbiological and

eutrophication monitoring programme(s) conducted monthly through grab sampling and continuous monitoring through five water quality probes installed within the WMA. An annual water quality status report is compiled to assess and report water quality status, trends and compliance with the set standards/objectives for the water resource (IUCMA, 2022).

The 2021/2022 Annual Water Quality Status Report was used to inform the current water quality description for the four dam options. The data reported in the 2021/2022 Report was collected over a period of 12 months, from January 2021 to December 2021.

The water quality monitoring points assessed by the IUCMA are shown in **Figure 2-1**.

Compliance with the indicator parameters is measured against the Resource Quality Objectives (RQO) as published in Government Notice (GN) 1616 dated 30 December 2016, or the Target Water Quality Guideline (TWQG) limits where the RQOs are not available. Refer to **Table 2-1** for a summary of the standards used by the IUCMA to assess compliance.

Table 2-1: Resource Quality Objectives and Target Water Quality Guideline Limits used by IUCMA in Annual Water Quality Assessment (IUCMA, 2022)

Parameter	Unit of measurement	RQO	TWQG
pH		6.5 – 8.0	6.5 – 8.5
Electrical Conductivity (EC)	mS/m	30 55	40
Phosphate	mg/l	0.015 0.025 0.075 0.125	0.025
E. coli	cfu/100ml	120 130	130
Ammonia (NH_3)	mg/l	--	1 (Domestic)
Sulphate (SO_4)	mg/l	--	30 (Industry)
Arsenic (As)	mg/l	0.02	--
Manganese (Mn)	mg/l	0.18	--
Chromium (Cr) VI	mg/l	0.014	--

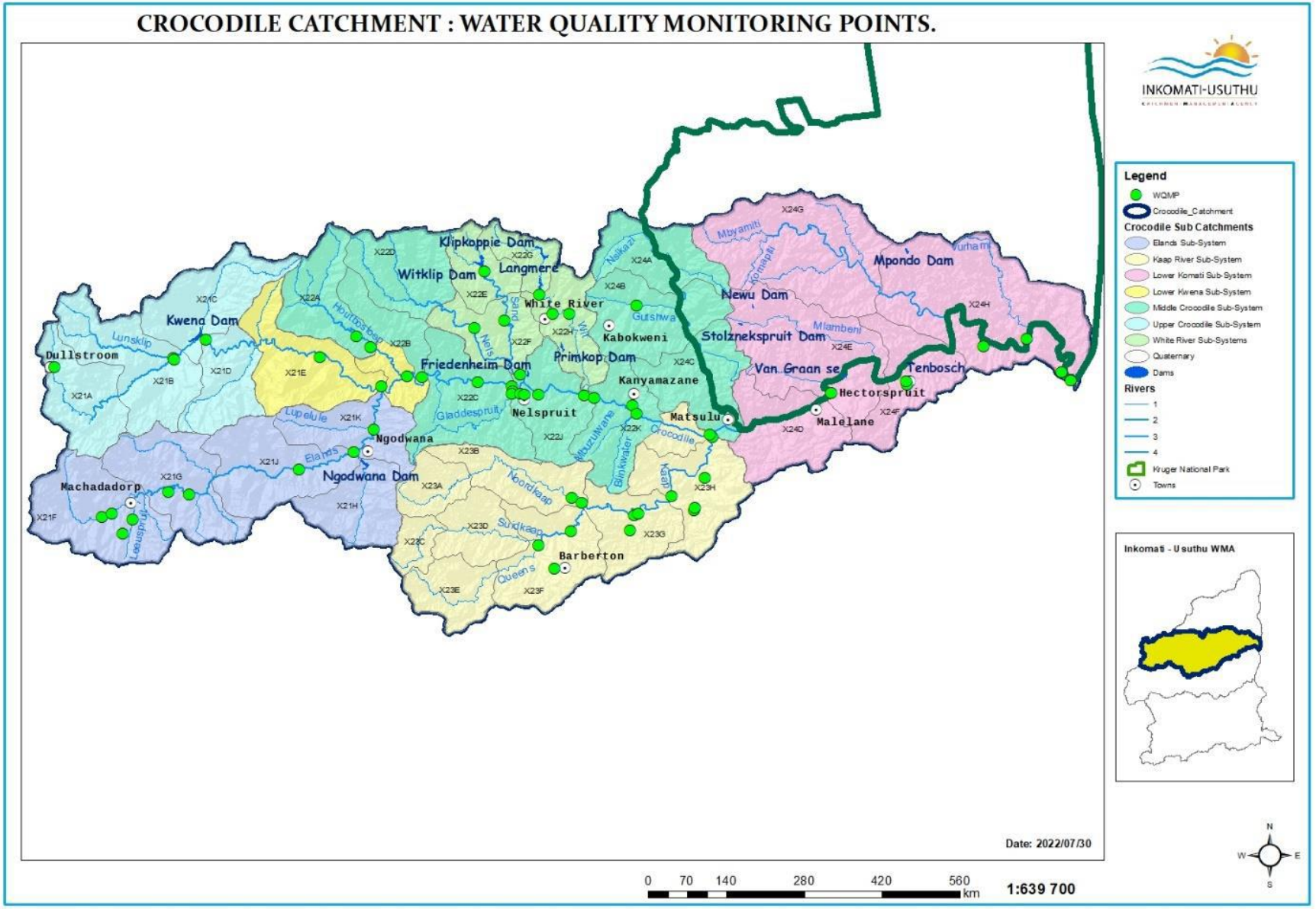


Figure 2-1: Water Quality Monitoring Points for Crocodile River WMA (IUCMA, 2022)

2.1.2 Ecostatus Reports

The following two Ecostatus Reports compiled for the IUCMA were reviewed:

- Ecostatus Report for the Elands River Catchment issued in May 2017 with the outcome of biomonitoring using macro-invertebrates and fish that was conducted during September and October 2016 at 17 sampling locations in the catchment. The main aim of this study was to determine in-stream conditions during low flow conditions in the drought period. This report complemented the Ecostatus study of the Crocodile River catchment conducted in 2017 as discussed below (IUCMA, 2017).
- Ecostatus Report for the Crocodile River Catchment issued in January 2018, reporting on biomonitoring conducted at 40 sampling locations in the catchment during June to September 2017. The main aim of this study was to determine the Present Ecological State (PES) of the river using the following (IUCMA, 2018):
  - Fish Response Assessment Index (FRAI)
  - Macro-Invertebrate Response Assessment Index (MIRAI)
  - Riparian Vegetation Response Assessment Index (VEGRAI)
  - Index of Habitat Integrity (IHI) models
  - Utilization of water quality data to determine an integrated present state for water quality using the Physico-chemical driver Assessment Index (PAI) model.

  The biomonitoring points assessed in the Crocodile catchment is shown on **Figure 2-2**.

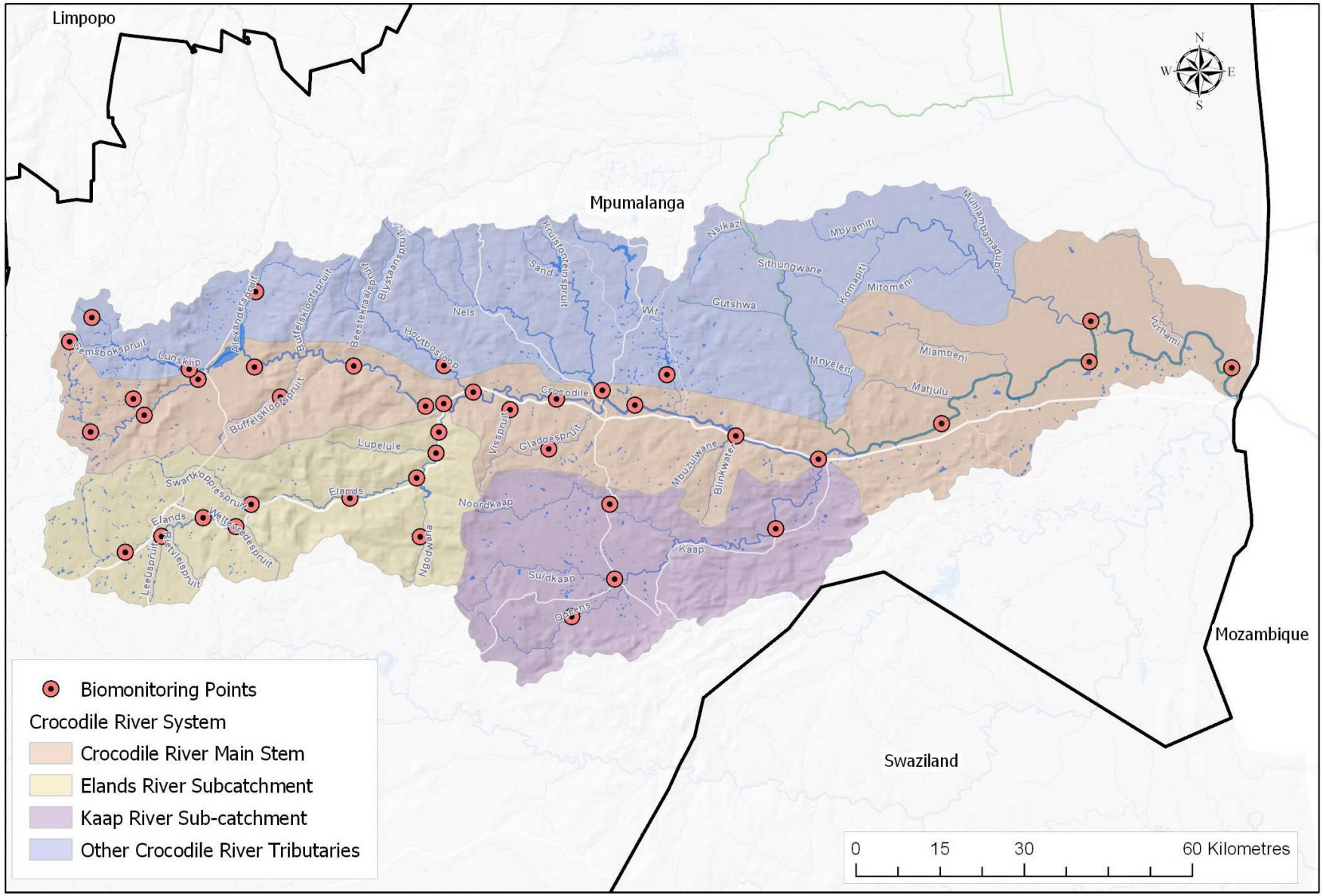


Figure 2-2: Crocodile Catchment Biomonitoring Points (IUCMA, 2018)

2.1.3 Mpumalanga Biodiversity Sector Plan

The MBSP is a spatial tool that comprises a set of maps of biodiversity priority areas accompanied by contextual information and land-use guidelines. The main purpose of the MBSP is to provide the most recent and best quality biodiversity information to inform land-use and development planning, environmental assessments and regulation, and natural resource management. This is achieved through map(s) of terrestrial and freshwater areas that are important for conserving biodiversity pattern and ecological processes, referred to a Critical Biodiversity Area (CBA) maps, or maps of biodiversity priority areas. The MBSP has been developed at a relatively fine spatial scale (1:10 000 – 1:25 000) that can be used for planning at local and district municipal level, as well as provincial levels (MTPA, 2014).

Information used from the MBSP as obtained from the SANBI BGIS website includes:

- Soils: general description and soil classes;
- Land cover (2010), augmented by verification using recent satellite imagery and observations made during the site visits;
- Freshwater CBA maps;
- Vegetation Types and Terrestrial CBA maps.

The CBA maps show the following five broad map categories:

Protected Areas (PA)

Areas that are formally protected by law and recognised in terms of the National Environmental: Protected Areas Act, 2003 (Act 57 of 2003) (NEM:PAA). This category includes contract protected areas declared through the biodiversity stewardship programme.

Critical Biodiversity Areas (CBAs)

Areas that are required to meet biodiversity targets for species, ecosystems or ecological processes. These include:

- All areas required to meet biodiversity pattern targets and to ensure continued existence and functioning of species and ecosystems, special habitats and species of conservation concern (SCC);
- Critically Endangered ecosystems; and
- Critical linkages to maintain connectivity.

These are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species.

The CBA sub-categories and an explanation thereof are provided in **Appendix A**.

Ecological Support Areas (ESAs)

Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of Protected Areas or CBAs, as well as for delivering ecosystem services.

ESAs need to be maintained in at least a functional and often natural state, supporting the purpose for which they were identified.

The ESA sub-categories and an explanation thereof are provided in **Appendix A**.

Other Natural Areas (ONAs)

Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character. These areas perform a range of biodiversity and ecological infrastructural functions (MTPA, 2014).

Moderately or Heavily Modified Areas

Areas that have been heavily modified by anthropogenic activity. These are for the most part no longer natural, and do not contribute to biodiversity targets. Some of these areas may, however, still provide limited biodiversity and ecological infrastructural functions but, their biodiversity value has been significantly and, in many cases, irreversibly compromised (MTPA, 2014).

2.1.4 Environmental Screening using DFFE Screening Tool

The Screening Tool developed by the Department of Forestry, Fisheries and Environment (DFFE) provides a platform to investigate on a high level, the environmental sensitivities of a specific site in relation to a proposed activity or development. Although it is a legal requirement to compile a screening report generated by the National Web Based Environmental Screening Tool in terms of Section 24(5)(h) of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and submit such report as part of an application in terms of the NEMA Environmental Impact Assessment (EIA) Regulations, the Screening Tool also is a useful tool to determine likely sensitivities at an early stage of project development and to guide further detailed assessments to be undertaken.

The screening tool can be accessed at: https://screening.environment.gov.za/screeningtool.

The tool was therefore used in this Environmental Screening conducted as part of the Phase 1: Pre-Feasibility Phase studies to identify potential sensitivities within the proposed dam basins and the surrounding area based on the following Themes provided for in the tool:

- Biodiversity related:
  - Aquatic Biodiversity
  - Terrestrial Biodiversity
  - Plant Species
  - Animal Species
- Cultural and Heritage
- Land use related: Agricultural (which includes soil and land capability sensitivities).

Note that although the Defense, Paleontological and Civil Aviation Themes form part of the Screening Tool, these aspects were not considered in this environmental screening exercise.

The Site Sensitivity Report for each of the dam basins was generated using the on-line tool. In addition, an assessment was also done for a larger area around the dam basin to indicate any potential sensitivities in the immediate surrounding area.

2.2 Rating and Ranking of Options

The screening assessment was undertaken using a rating approach, based on the sensitivity of each proposed site and the potential risks posed by the proposed dam development (refer to **Table 2-2**). The lower the rating, the greater the potential impact, with a value of 0 (zero) considered a potential Fatal Flaw. The information considered in this assessment is discussed in **Section 2.1**.

It should be noted that the assessment was based on the worst-case scenario, i.e., the highest proposed dam wall identified for each of the dam options to date.

Table 2-2: Rating System used in Assessing Potential Impacts

Rating		Description
Least concern / impact	**5**	Proposed development has no, or very limited, potential negative impact or could result in a positive impact.
Limited concern / impact	**4**	Proposed development has limited potential impacts.
Uncertain / impact can be mitigation	**3**	Proposed development has potential negative impacts that can be mitigated, or where the potential impact associated with the proposed development is uncertain based on available information.
Significant impact	**2**	Proposed development has potential negative impacts that could be mitigated, resulting in residual negative impact which may be acceptable.
Very Significant Impact	**1**	Proposed development has potential negative impacts that could potentially be mitigated, resulting in residual negative impact. This may include the need to develop off-set strategies.
Fatal Flaw	**0**	Potential impacts cannot be mitigated and the proposed development should not be considered based on available information.

3 MONTROSE DAM: AFFECTED ENVIRONMENT

3.1 Locality

The proposed Montrose Dam is located on the Crocodile River some 2 km downstream of the confluence of the Elands and Crocodile Rivers, approximately 22 km west of Nelspruit within the Mbombela LM.

The approximate site co-ordinates are Latitude 25°27'17" and Longitude 30°43'34" (refer to **Figure 3-1**).

Taking account of the deep soils on the right flank of the river, the Montrose Dam is conceived as a clay cored and roller compacted concrete gravity composite structure with a wall height of up to 100 m (to Full Supply Level (FSL)). For a dam between 70 and 90 m high, the storage capacity of the dam will vary between 104.5 and 253.8 million m^3. For a dam height of 90 m, the local yield will be 155 million m^3/a.

The impoundment backs up in both rivers and depending on the height of the dam wall constructed, could flood parts of the N4 Highway (including the Montrose interchange and changes thereto which are currently under construction), the R539 (Schoemanskloof road), a portion of the Elandshoek township, as well as cultivated and undisturbed areas.

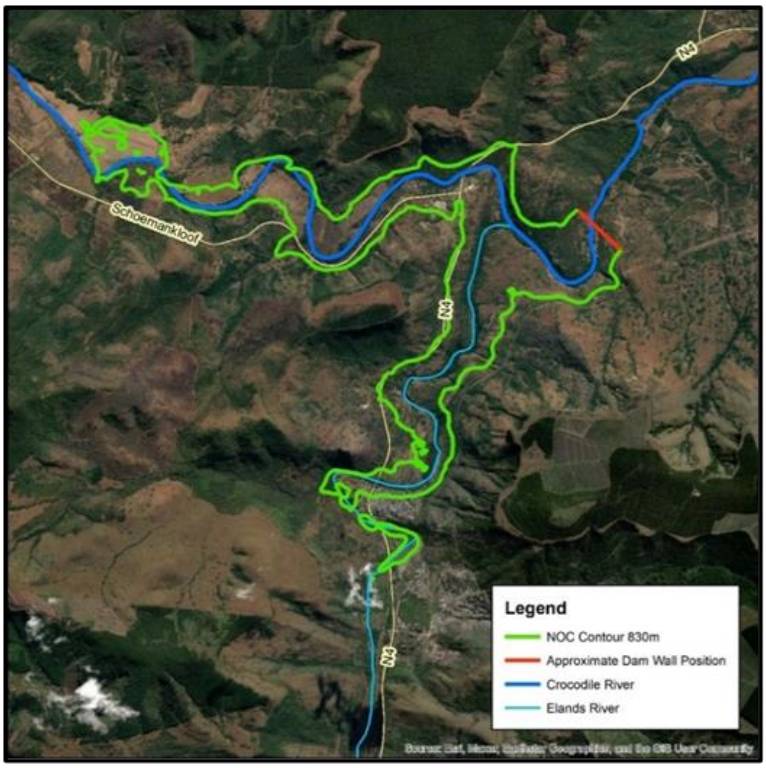


Figure 3-1: Montrose Dam: Locality

3.2 Topography

The Elands River rises in a gentle sloping Highveld zone near the town of Machadodorp at an elevation of 1 904 metre above mean sea level (mamsl), initially flowing in a southerly direction, changing in an easterly direction towards its confluence with the Crocodile River (IUCMA, 2017).

The dam basin comprises a steep gorge cut into the granite bedrock where the Elands River and Crocodile River meet at an elevation of 772 mamsl, downstream of the Montrose Falls. A photograph showing typical topography in the vicinity of the dam wall is shown in **Figure 3-2**.

Figure 3-2: Montrose Dam: General View towards Dam Wall

3.3 Climate

The Lowveld is characterized by a subtropical climate. Summers are hot and somewhat humid with high precipitation. Winters are dry, with relatively warm temperatures during the day and lower temperatures at night. The average monthly and annual maximum and minimum temperature, as well as precipitation for Nelspruit is shown in **Table 3-1**.

The mean Annual Precipitation is 800 – 1 000 mm, and the mean Annual Evaporation is 1 300 – 1 400 mm (DWA, 2008).

Table 3-1: Average Temperature and Precipitation for Nelspruit (SAWS, 2010)

Month	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Average maximum temperature (°C)	29	29	28	27	25	23	23	25	27	27	27	28	27
Average minimum temperature (°C)	19	19	18	14	10	6	6	9	12	14	17	18	13
Average precipitation (mm)	127	108	90	51	15	9	10	10	26	75	115	131	767
Average precipitation days	14	12	12	7	4	2	2	3	5	11	15	14	100

3.4 Geology

The site is underlain by granite of the Nelspruit Suite and is located close to the contact between undifferentiated schists, volcanics, chert and lavas of the Onverwacht Group, Barberton Supergroup, and serpentinized dunite, harburgite, orthopyroxene, gabbro and anorthosite.

Outcrop of massive granite occurs on the lower- and mid-slope areas of the left flank and therefore overburden of very limited thickness is expected. The river section is covered by alluvial deposits, the thickness of which is uncertain, but might be as much as 5 m to 10 m. On the flatter right flank, the underlying granites are expected to be deeply weathered and the unconsolidated overburden comprising sandy to gravelly soils is expected to be poorly developed (< 2 m in thickness). Occasional core-stones and boulders might occur and the weathering profile is likely irregular (DWA, 2008).

3.5 Soil, Land Use, Land Capability and Agricultural Potential

3.5.1 Land Use

The area is largely characterised by unmodified habitat, with areas of cultivation along the Crocodile River within the proposed dam basin. Significant cultivation has taken place along the Crocodile River upstream of the proposed dam basin, as well as further downstream. Limited cultivation has taken place along the Elands River within the dam basin and in the upstream reach. The Elandshoek township is located next to the Elands River upstream of the proposed dam site. A portion of the township will be inundated if the dam is developed.

A 275 kV powerline is located within the proposed dam basin and crosses the Elands River twice. This powerline will be impacted by the proposed dam developments and will need to be re-aligned.

Areas further to the north, southwest and southeast of the dam basin are characterised by afforestation. The Land Cover map showing the key land uses from the MBSP is shown in **Figure 3-3**.

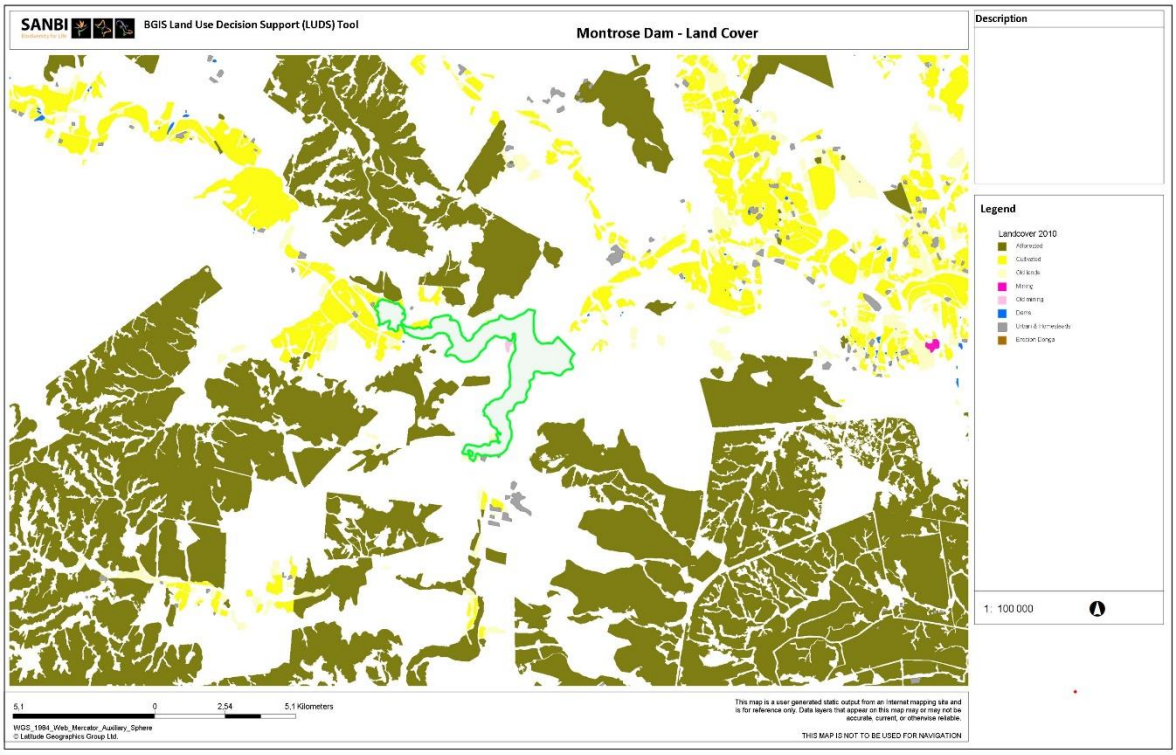


Figure 3-3: Montrose Dam: Land Cover (MBSP)

3.5.2 Soil

Within the area of inundation on the Elands River, soils with minimal development are present, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime is generally present in part or most of the landscape. Within the area of inundation of the Crocodile River, red and yellow soils with low to medium base status is present (refer to **Figure 3-4**).

Soils within the dam basin and surrounding areas are classed as freely drained, structureless soils.

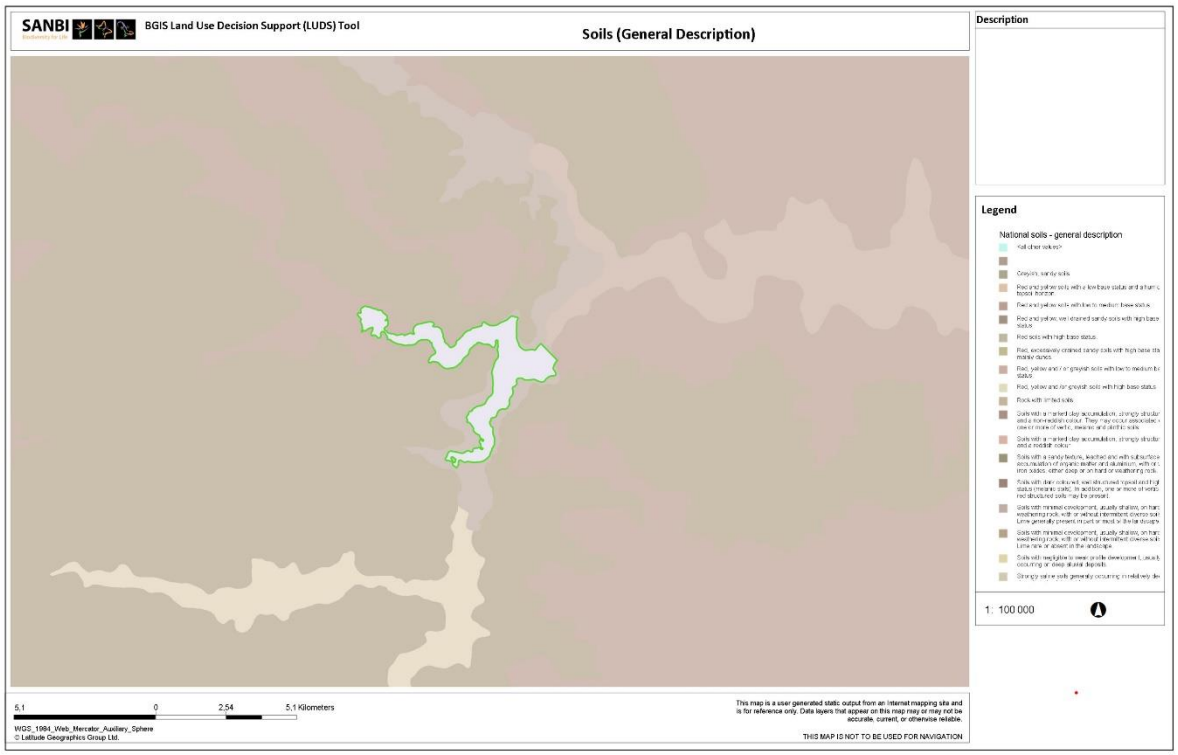


Figure 3-4: Montrose Dam: Soils (MBSP)

3.5.3 Agricultural Sensitivity

The area of inundation on the Crocodile River is characterised with a Very High agricultural sensitivity rating according to the DFFE Screening Tool (refer to **Figure 3-5**), indicating an area with high land capability rating. This corresponds to the extent of existing agricultural activities along the Crocodile River (Schoemanskloof Valley), specifically fruit production.

The area of inundation on the Elands River is largely characterised by Low to Moderate land capability and agricultural sensitivity rating, with a number of areas characterised by Moderate to High land capability rating. Some areas of Low to Very Low land capability were also identified.

Development of the dam will therefore result in the loss of soils with high agricultural potential along the Crocodile River.

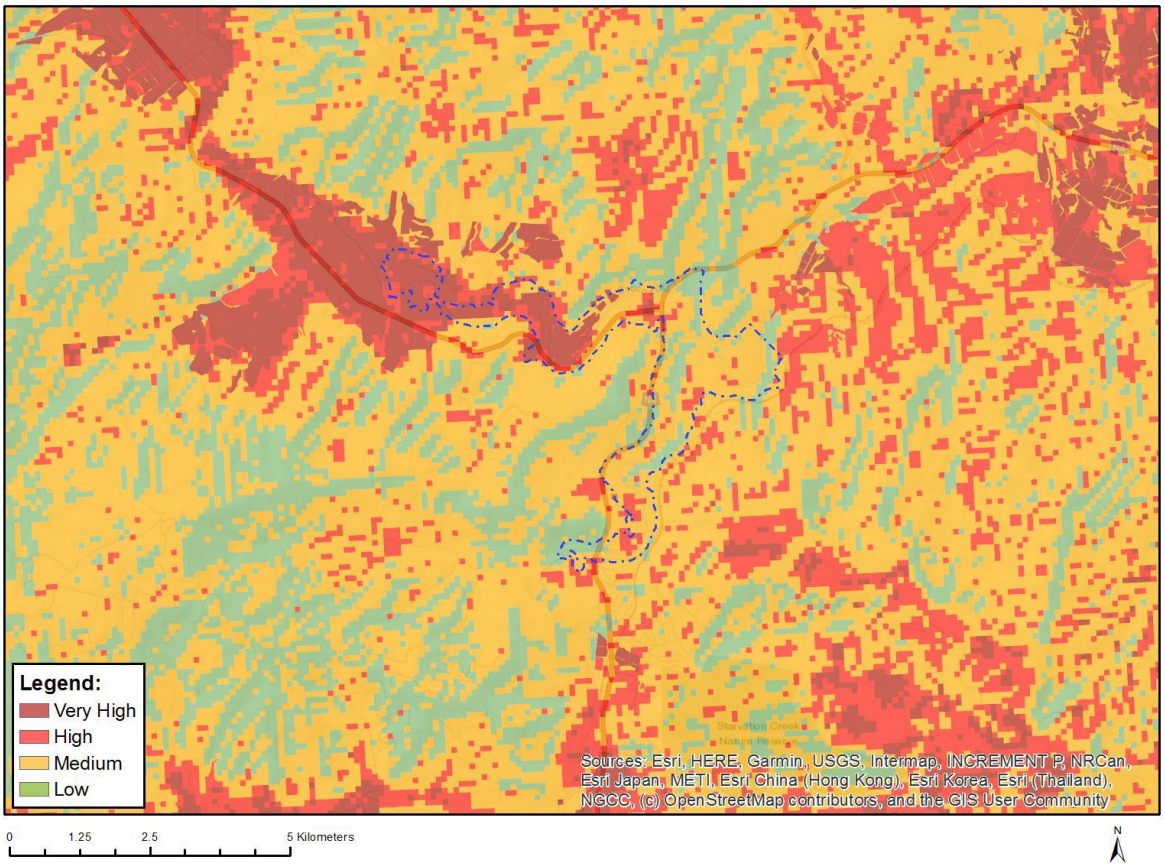


Figure 3-5: Montrose Dam: Agricultural Sensitivity (DFFE Screening Tool)

3.6 Rivers and Wetlands

The Elands River extends approximately 118 km from its source at Machadodorp to its confluence with the Crocodile River. Two waterfalls form natural barriers on the river, one at the Waterval Boven Tunnel between Waterval Boven and Waterval Onder, and one downstream from Ngodwana before the confluence of the Elands River with the Crocodile River. The total Elands River Catchment area is 1 573 km^2 ((IUCMA, 2017).

The Crocodile River rises at an altitude of 2 000 mamsl near Dullstroom in the Steenkampsberg Mountains. The Upper Crocodile Catchment is characterised by steep sided valleys, with sharply defined cliff slopes on the eastern edge of the Escarpment. From the Escarpment the river levels out in the Kwena Dam Basin, from where the Crocodile River winds along the Schoemanskloof valley down to the Montrose Falls and confluence of the Elands River. The Crocodile River Catchment has an area of 10 440 km^2 (IUCMA, 2018).

3.6.1 Strategic Water Source Areas

The proposed Montrose Dam is located within a Strategic Water Source Area (SWSA) as shown on **Figure 3-6**. SWSA are areas of land that either:

(a) supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or

(b) have high groundwater recharge and where the groundwater forms a nationally important resource; or

(c) areas that meet both criteria (a) and (b) (CSIR, 2023).

SWSA produce more than 50% of Mpumalanga's runoff in only 10% of the land surface area (MTPA, 2014). Development of a dam within these areas will change the hydrology and the extent to which these areas contribute to the system.

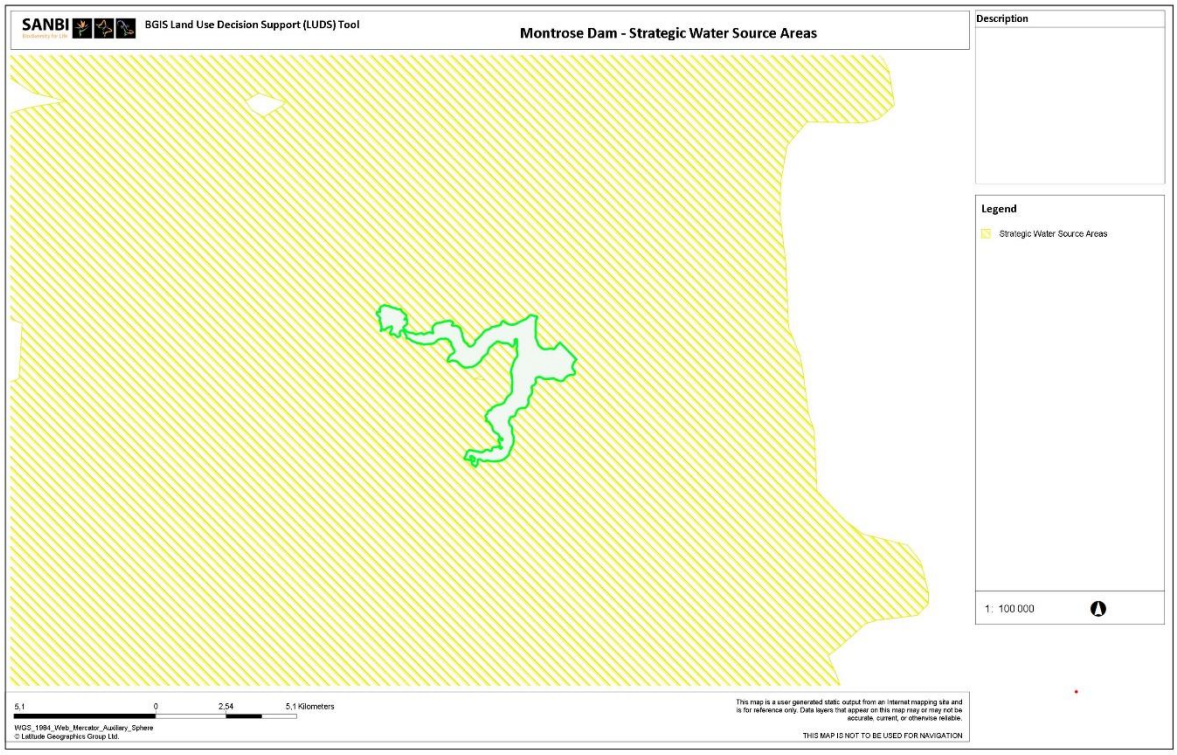


Figure 3-6: Montrose Dam: Strategic Water Source Areas (MBSP)

3.6.2 NFEPA Rivers and Wetlands

The Elands River is a free-flowing river and has been designated as a Flagship River from its point of origin down to the confluence with the Crocodile River (**Figure 3-7**). The Elands River is categorized as a FEPA river and has been assigned a Present Ecological State (PES) of

Class C, Moderately Modified. The Elands River and its tributaries have been identified as freshwater priority environments for fish conservation and are listed as a fish sanctuary.

The Crocodile River upstream of its confluence with the Elands River has been designated as a Fish Support Area for critically endangered (CR) and endangered (EN) fish species. The Crocodile River downstream of the confluence has been designated as a FEPA river. The river has a PES of Class C, Moderately Modified.

Further downstream of the proposed dam basin between Elandshoek and Nelspruit, a number of wetlands have been identified, none of which has been designated as FEPA wetlands.

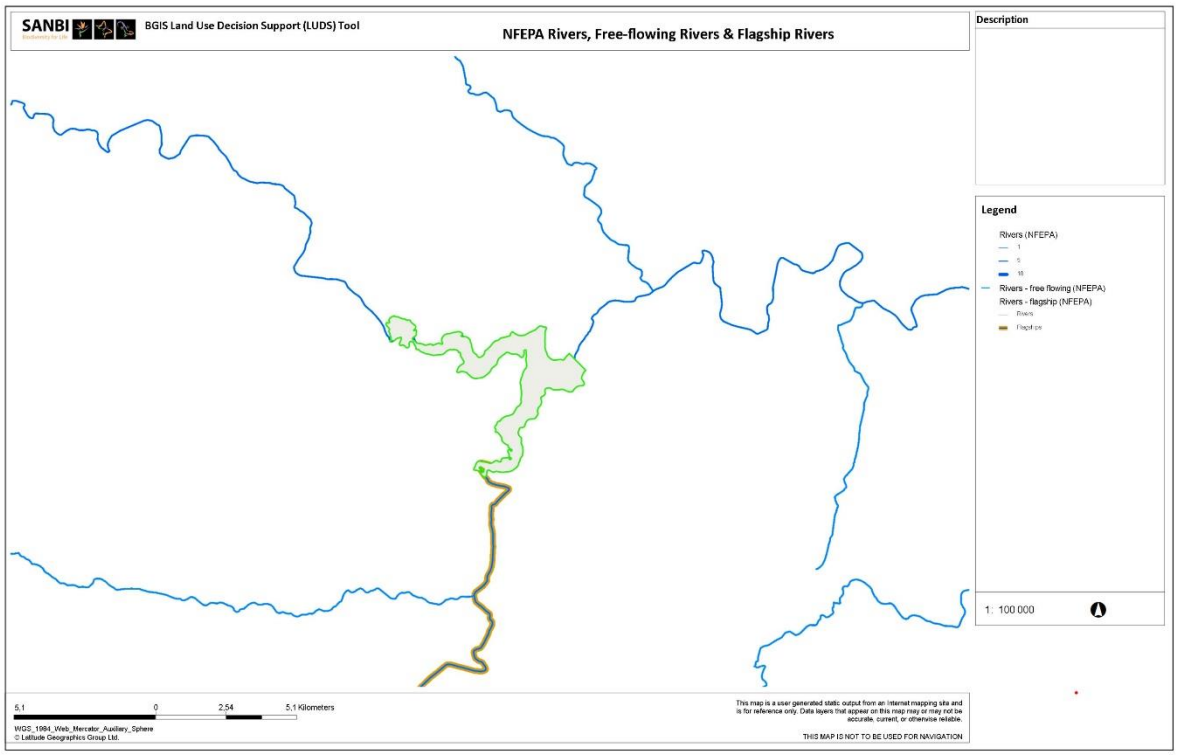


Figure 3-7: Montrose Dam: NFEPA Rivers and Wetlands (MBSP)

3.6.3 Water Quality

The water quality status for the Crocodile River catchment as assessed in terms of indicator parameters is shown in the figures in **Appendix B**. The proposed Montrose Dam is located in the Upper Crocodile sub-catchment (refer to **Figure 2-1**) and the 2021 water quality status report by the IUCMA shows the following with regard compliance of the water quality with the standards used (refer to **Table 2-1**):

- pH levels throughout the sub-catchment complies with the TWQG;
- EC complies with the RQO (Aquatic Ecosystem drivers) throughout the sub-catchment;

- The average SO_4 concentration shows non-compliance with the TWQG (Industry: Category 1) of 30 mg/l, except for the Elands River at Hemlock upstream of the Sappi Ngodwana Mill;
- Ammonia (NH_3) concentrations within the sub-catchment comply with the TWQG (Domestic) of 1 mg/l;
- Manganese (Mn) and Phosphate (PO_4) complies with the RQO;
- Elevated *E. coli* levels above the RQO of 130 cfu/100 ml were observed for the sub-catchment, except in the headwaters and Kwena Dam (IUCMA, 2022).

No information is available for the status of Arsenic (As) in the Upper Crocodile for the 2021 monitoring period.

The water quality therefore is generally of good status, except for impacts associated with industrial activities (paper mill) and residential/township developments.

3.7 Freshwater Ecosystems

3.7.1 Aquatic biota

The catchment is known to have diverse aquatic habitats, some of which are highly sensitive to changes in flow and water quality, as well as providing important refuge for aquatic biota. It is also regarded as an important link in terms of connectivity for the survival of biota (particularly eels, birds and invertebrates) upstream and downstream and is subsequently regarded as sensitive to modification (DWA, 2008).

A very high proportion of aquatic biota is expected to occur in the quaternary catchment, which is dependent on permanently flowing water during all phases of their life cycle, particularly *Chiloglanis bifurcus* (Inkomati Rock Catlet), *Chiloglanis pretoriae* (Shortspine Suckermouth/Catlet), *Amphilius uranoscopus* (Common Mountain Catfish) and *Barbus argenteus* (DWA, 2008).

A unique population of *Labeobarbus polylepis* (Bushveld Smallscale Yellowfish) is present at the cascades at the proposed dam site in the Elands River. Inundation of these cascades as a result of the development of the dam may bring this genetically distinct population into contact with downstream populations of the cascades (DWA, 2008).

The Ecostatus Report for the Elands River catchment compiled for the 2016 drought period, shows the following for the Lindenau monitoring site, approximately 110 km downstream from the source of the Elands River and upstream from the proposed Montrose Dam Site:

- Based on MIRAI, stream conditions were categorised as a category C/D (largely modified), with taxa associated with slow to moderate flows dominant. The absence of some of the sensitive taxa were attributed to chemical water quality.
- Six of the expected nine indigenous fish species were collected. Two extra-limital indigenous species were recorded at this site, *Enteromius paludinosus* during the 2012 survey and *Micralestes acutidens* for the 2016 survey. The most abundant expected fish species recorded was *Chiloglanis pretoriae*.
- The Fish Ecostatus was calculated as 79.1% for this reach based on all available information. As a result, this reach is categorized as Ecological Category B/C (slightly to moderately impaired with a high to moderate diversity and abundance of species) (IUCMA, 2017).

A summary of the 2017 Ecostatus for reach number X21K-00997 on the Elands River (from the Lupelule River to the confluence of the Elands River with the Crocodile River downstream from Montrose Falls) is provided below, which includes a comparison with the Ecostatus determined in 2012 and 2016.

Reach Code	Site Code	River	GPS (dd.ddddd)	Elevation (m a.s.l.)	SQR Length (km)	PES Category	Fish Ecostatus	Invertebrate Ecostatus	Instream Ecostatus	Riparian Vegetation Ecostatus	Integrated Ecostatus	TEC	Biomonitoring Year
X21K-00997	X2ELAN-EHOEK	Elands	S-25.49440 E 30.70222	832	11.0	C	B 84%	B 86.9%	B 85.45%	C 70%	B 82.36%	C 70%	2012
							BC 79.1%	CD 60.6%	C 69.85%	C 77.5%	C 71.38%		2016
							C 76.4%	C 72.7%	C 74.55%	C 77.5%	C 75.14%		2017

Five of the expected nine fish species were collected during the 2017 survey, which represents a decline of two species from previous surveys. Noted of concern was the absence of *Labeobarbus polylepis* and *Enteromius paludinosus*. The absence of *Chiloglanis bifurcus* and the decrease in abundance of *Chiloglanis pretoriae* indicate disruptions in the flow regime and reduced water quality standards to sensitive species. The calculated Fish Ecostatus rating for this reach was 76.4% based on all available information, resulting in an Ecological Category C (moderately impaired with low diversity of species and abundance). This is a category lower than the 2012 survey results (84%; Category B) (IUCMA, 2018).

For Macro-invertebrates, the 2017 SASS5 results indicate deterioration from Category B (slightly impaired) to Category C (moderately impaired) when compared to 2012. Conditions based on MIRAI were rated as Category C (moderately impaired) in 2017. The deterioration is mainly attributed to water with elevated Total Dissolved Solids (TDS) from the Elands River

entering the Crocodile River further upstream. Analysis of long-term chemical water quality data indicates that the Elands River is one of the fastest deteriorating rivers in Mpumalanga (IUCMA, 2018).

The overall Riparian Ecostatus based on the Vegetation Condition and the Riparian IHI was determined as a Category C (moderately modified) (IUCMA, 2018). This is similar to the 2012 Ecostatus assessment.

The Integrated Ecostatus was determined at 75.14%, or Category C (moderately modified) and therefore the TEC of Category C appears to be met. Modified habitat with loss and change of natural habitat and biota has occurred in terms of frequencies of occurrence and abundance. The basic ecosystem functions are still predominantly unchanged.

For the Crocodile River at Montrose, the Ecostatus information for reach X21E-00943 is provided below. This reach starts at the Crocodile's confluence with the northern Buffelskloofspruit to downstream of the Montrose Falls, at the confluence with the Elands River.

Reach Code	Site Code	River	GPS (dd.ddddd)	Elevation (m a.s.l.)	SQR Length (km)	PES Category	Fish Ecostatus	Invertebrate Ecostatus	Instream Ecostatus	Riparian Vegetation Ecostatus	Integrated Ecostatus	TEC	Biomonitoring Year
X21E-00943	X2CROC-RIETV	Crocodile	S-25.38818 E 30.56574	921	38.0	C	C 75.9%	C 73%	C 74.45%	D 50%	C 69.56%	BC 78.5%	2012
	X2CROC-POPLA* EWR 3		S-25.45275 E 30.68099	817			BC 81.4%	BC 80.9%	BC 81.2%	C 72.5%	C 76.8%		2017
	X2CROC-MONTR		S-25.44861 E 30.71010	808									

A total of nine indigenous species of fish are expected to occur in this reach of which seven were collected during the 2017 survey. *Chiloglanis bifurcus*, was recorded in low abundance. This species was not found during the 2012 survey. The calculated mean Fish Ecostatus rating was 81.37%, placing this reach in an Ecological Category of B/C (slightly impaired) (IUCMA, 2018).

For Macro-invertebrates, the 2017 SASS5 results indicated slight improved conditions compared to 2012. The Invertebrate Ecostatus based on MIRAI were rated as slightly to moderately impaired (Category BC - 81%) in 2017 (IUCMA, 2018).

The overall Riparian Ecostatus was determined as Category C (72.5%) indicating that the riparian vegetation for this reach is Moderately Modified (IUCMA, 2018).

The Integrated Ecostatus was determined as Category C (76.8%), i.e. moderately modified habitat with loss and change of natural habitat and biota has occurred in terms of frequencies of occurrence and abundance. The basic ecosystem functions were still predominantly unchanged. The Target Ecological Category (TEC) of Category BC (largely natural with a few modifications) was therefore not met (IUCMA, 2018).

The Montrose Falls in the Crocodile River is currently a natural migration (distribution) barrier in the system, which prevents some fish species from colonising the upper reaches of the Crocodile River. Currently seven indigenous fish species are expected to occur directly upstream of the Montrose Falls, while at least 13 species may be present downstream of the Falls. Flooding of the waterfall as a result of the proposed dam development would result in an unnatural pathway for fish species (both indigenous and alien species) not currently present in the upper Crocodile River, to colonise this reach. The natural fish assemblage of the Crocodile River upstream and potentially also downstream of the Montrose Falls will be changed as a result of competition for food and habitat, potential hybridization and genetic mixing of species that would have previously been isolated or separated. This impact will be specifically detrimental to *Chiloglanis bifurcus* and may result in the eradication of this fish species (DWS, 2023).

3.7.2 Mpumalanga Biodiversity Sector Plan

In terms of freshwater ecology biodiversity planning areas, the Elands River is categorised as CBA River since it is a FEPA free-flowing river. The surrounding areas are designated as ESA since it is FEPA river catchments (refer to **Figure 3-8**). The Crocodile River and surrounding areas are categorized as ESA due to it being fish support areas.

The land-use planning guidelines provided in the MBSP (MTPA, 2014) indicate that any impact which could result in an impact on CBA areas, should be avoided. There is therefore no flexibility in land-use options for CBA Rivers and the proposed development of a dam within this system is not aligned with the biodiversity planning targets.

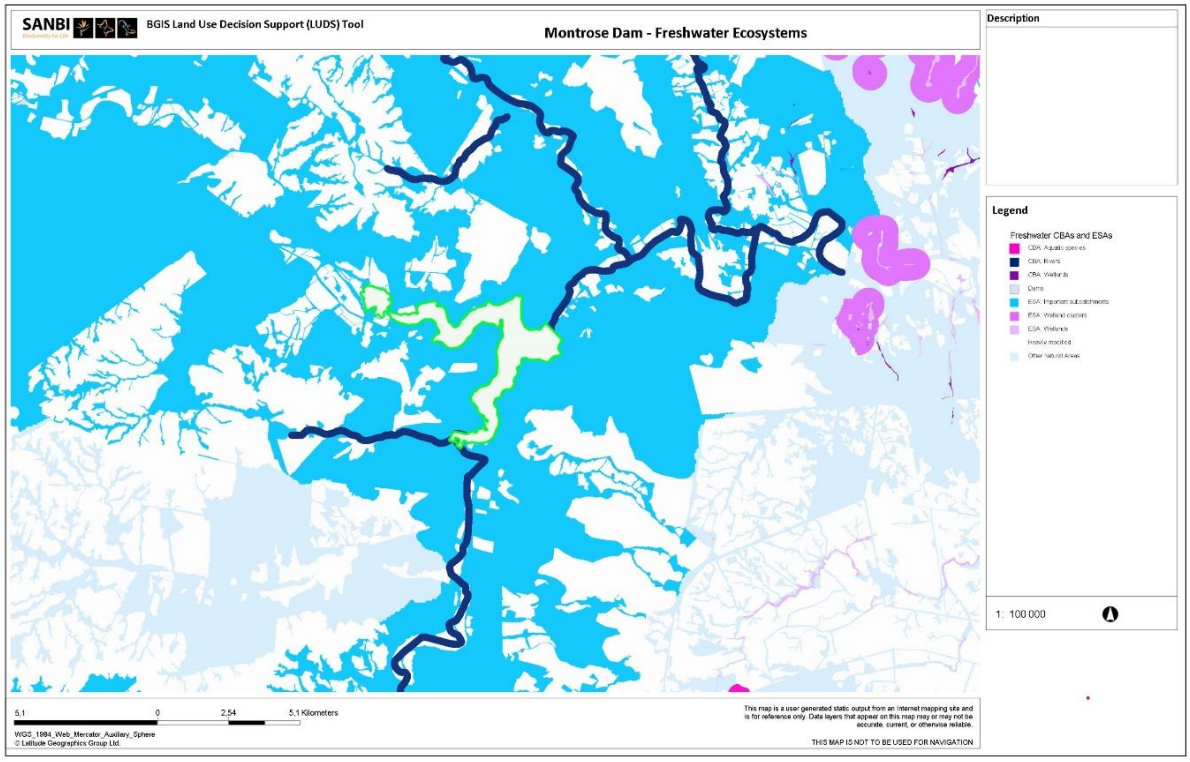


Figure 3-8: Montrose Dam: Freshwater CBA Map (MBSP)

3.7.3 Aquatic Biodiversity Sensitivity Rating: DFFE Screening Tool

The proposed dam basin and surrounding area is rated as Very High Aquatic Biodiversity Sensitivity (refer to **Figure 3-9**) since it is located within a Freshwater CBA, SWSA, FEPA catchment areas and due to the presence of wetlands (as described in more detail above).

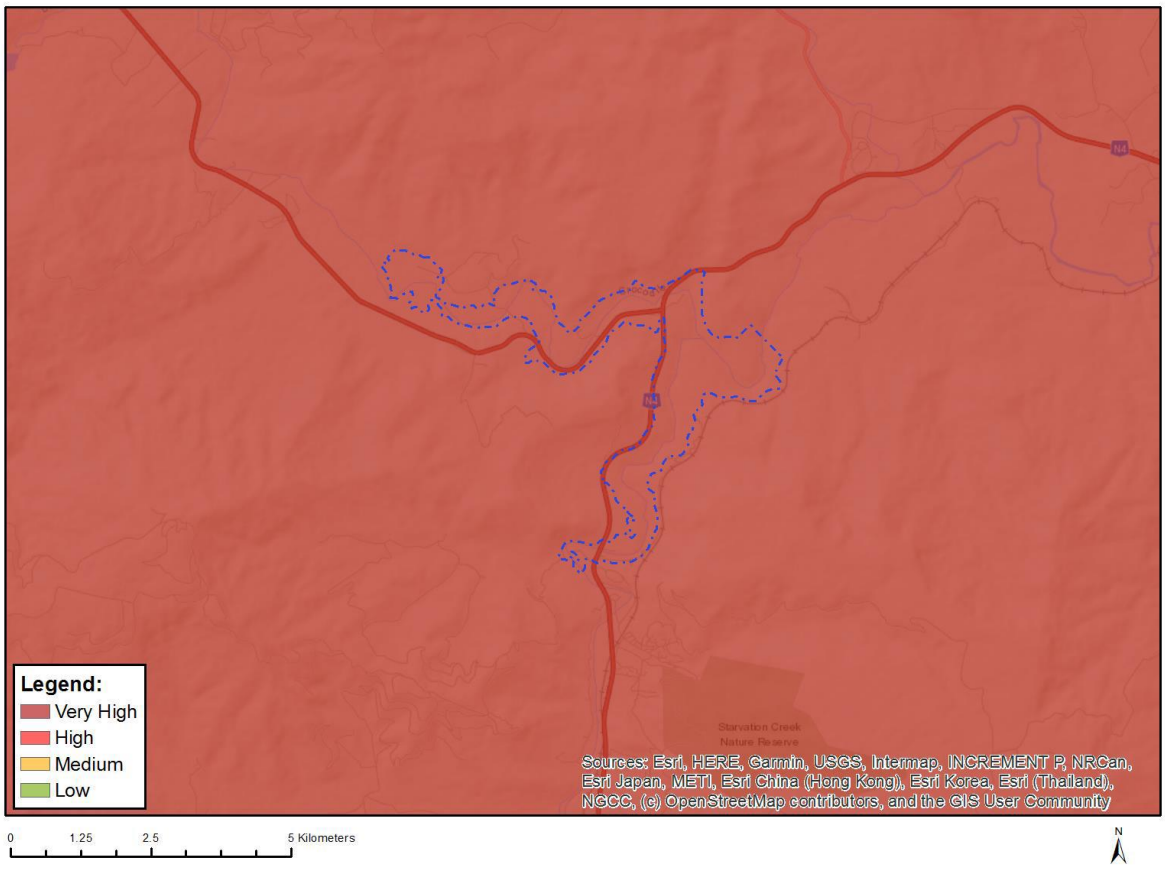


Figure 3-9: Montrose Dam: Aquatic Biodiverstiy Sensitivity (DFFE Screening Tool)

3.8 Terrestrial Ecosystems

3.8.1 Flora

The proposed dam basin and directly adjacent areas are located within the Legogote Sour Bushveld vegetation type of the Savanna biome (refer to **Figure 3-10**). The Legogote Sour Bushveld has been identified as Threatened Ecosystem (with conservation status of Vulnerable (VU)).

Further to the north and west, the vegetation type changes to the Northern Escarpment Dolomite Grassland of the Grassland biome in the Mesic Highveld Grassland bioregion.

To the south of the basin, the vegetation type is Northern Escarpment Quartzite Sourveld of the Grassland biome.

Further to the east and northeast, some areas of the Barberton Serpentine Sourveld of the Savanna Biome (Lowveld Bioregion) are present.

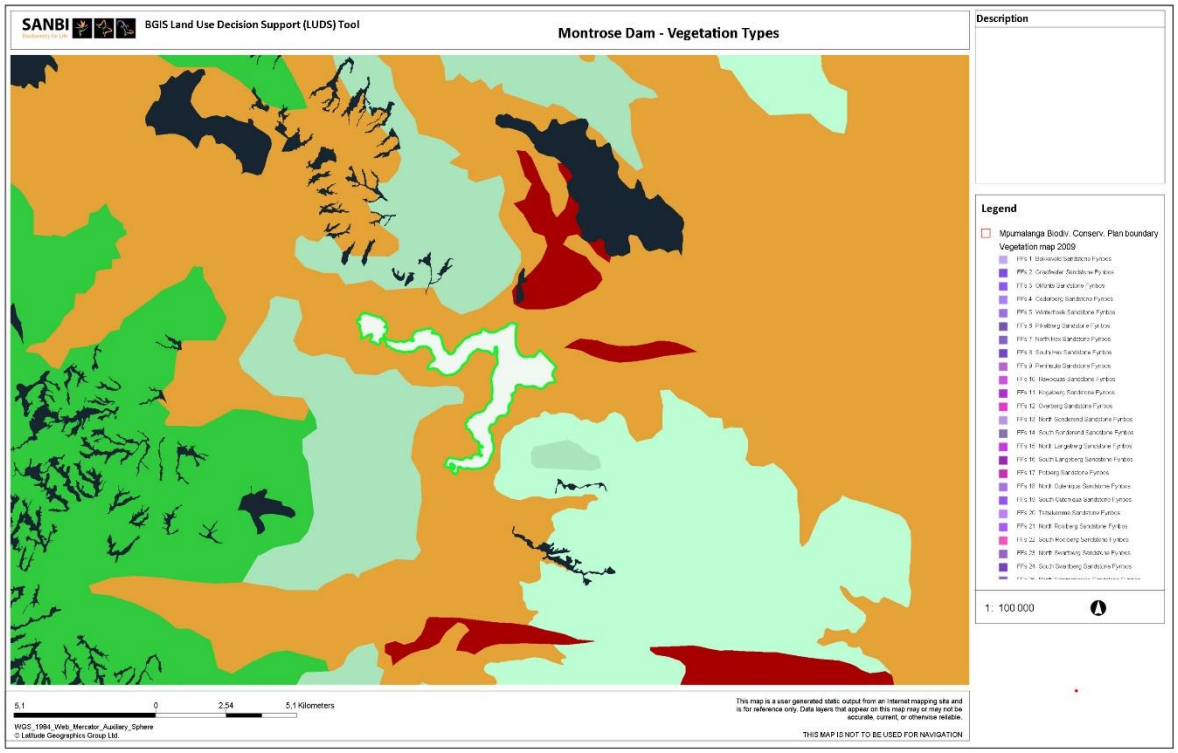


Figure 3-10: Montrose Dam: Vegetation Types (MBSP)

The area of potential dam development is in the Wolkberg Centre of Endemism (DWA, 2008). The Wolkberg Centre of endemism extends from Kaapsehoop in the south, along the Black Reef and Chuniespoort formations of the Mpumalanga Escarpment and northward into Limpopo Province. The geology comprises mainly quartzites and dolomites and many of the plant endemics are directly associated with soils (MTPA, 2014).

One floral species of conservation importance was indicated to be located within the area in previous studies, namely *Aloe simii* (Critically Endangered (CR)) (DWA, 2008).

In terms of the DFFE Screening Tool, the proposed development site has a Medium Plant Species Sensitivity Rating as indicated on **Figure 3-11**. Known and potential species identified for the area include *Streptocarpus denticulatus* (VU), which is endemic to South Africa. In addition, five plant SCC that are known or expected to occur within the proposed development footprint are also listed in the Screening Report generated from the DFFE Screening Tool. Some of these are sensitive to illegal harvesting and therefore their names are omitted from the Screening Report and consequently also from this report. These sensitive plant species have a conservation status of CR, Endangered (EN) and VU.

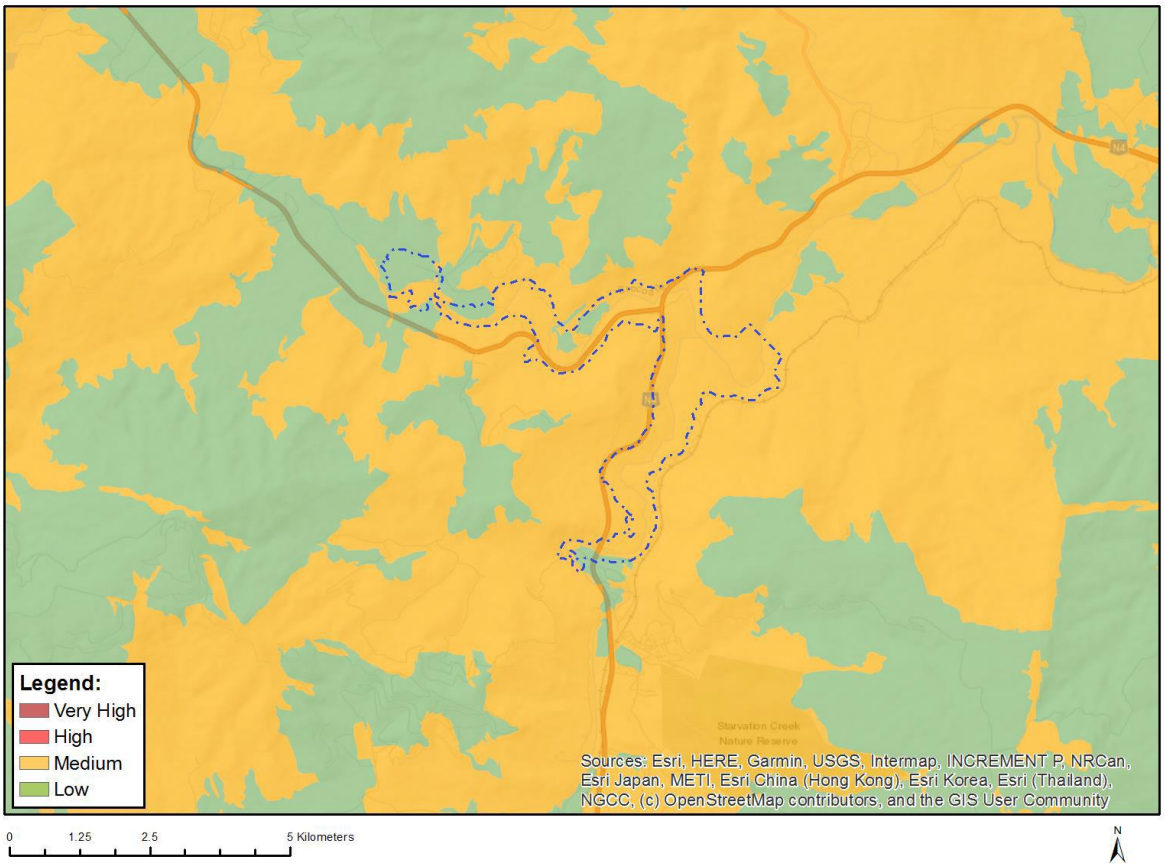


Figure 3-11: Montrose Dam: Plant Species Sensitivity (DFFE Screening Tool)

3.8.2 Fauna

Seven terrestrial faunal species of conservation importance known to occur within the area were identified in previous assessments:

- *Amblysomus hottentotus meesteri* (Meester's Golden Mole; VU);
- *Ephippiorhynchus senegalensis* (Saddle-billed Stork; CR);
- *Bucorvus leadbeateri* (Southern Ground Hornbill; VU);
- *Sarothrura affinis* (Striped Flufftail; VU);
- *Bradypodion transvaalense* (Dwarf Chameleon; VU);
- *Cordylus warreni barbertonensis* (Barberton Girdled Lizard; VU);
- *Platysaurus wilhelmi* (Wilhelm's Flat Lizard; VU) (DWA, 2008).

In addition, known and potential species identified for the area in the DFFE Screening Tool are shown in **Table 3-2**. Specific concerns exist regarding the potential impact of the proposed development on an active Crowned Eagle nest site (*Stephanoaetus coronatus*) within the area (M. Lőtter, 2023, personal communication).

Table 3-2: Montrose Dam: Known and Potential Faunal Species (DFFE Screening Tool)

Class	Scientific Name	Common Name	Sensitivity (DFFE Screening Tool)	Conservation Status
Aves	*Ciconia nigra*	Black Stork	High	LC
	Stephanoaetus coronatus	Crowned Eagle	High	NT
	Geronticus calvus	Southern bald ibis	High	VU
	Podica senegalensis	African finfoot	Medium	LC
	Sagittarius serpentarius	Secretary bird	Medium	EN
	Aquila rapax	Tawny eagle	Medium	EN
Mammalia	*Cercopithecus albogularis schwarzi*	Samango monkey	Medium	EN
	Chrysospalax villosus	Rough-haired golden mole	Medium	VU
	Crocidura maquassiensis	Makwassie musk shrew	Medium	VU
	Dasymys robertsii	African Marsh Rats	Medium	NT
	Lycaon pictus	African wild dog	Medium	EN
	Ourebia ourebi ourebi	Oribi	Medium	LC
Insecta	*Lepidochrysops irvingi*	Irving's blue butterfly	Medium	VU
Invertebrate	*Thoracistus jambila*	Jambila Seedpod Shieldback	Medium	EN
	Doratogonus praealtus	Millipede	Medium	DD

In terms of the DFFE Screening Tool, the proposed development site has a High Animal Species Sensitivity Rating (refer to **Figure 3-12**).

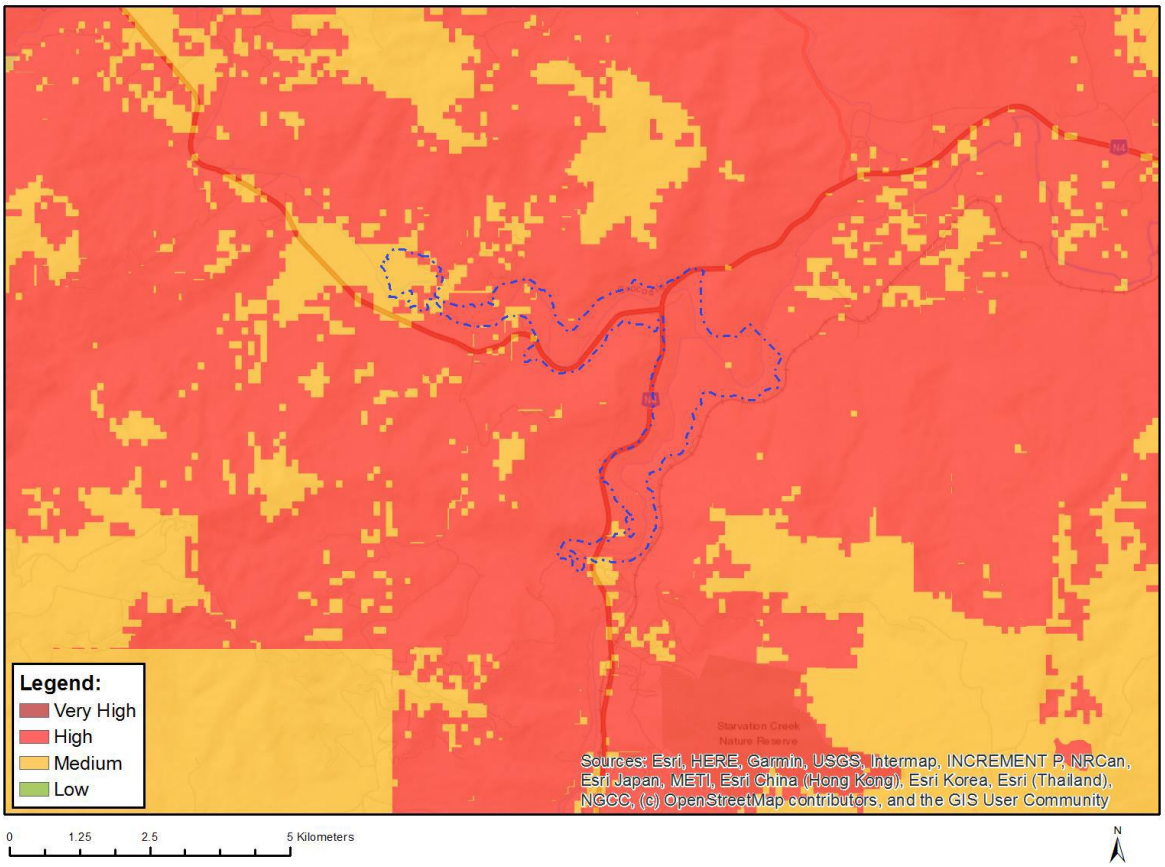


Figure 3-12: Montrose Dam: Animal Species Sensitivity (DFFE Screening Tool)

3.8.3 Mpumalanga Biodiversity Sector Plan

The area in which the proposed Montrose Dam basin is located, is largely categorised as CBA Irreplaceable in terms of Terrestrial Ecosystems. The areas upstream and downstream of the dam on the Crocodile River are also largely categorised as CBA Irreplaceable (refer to **Figure 3-13**).

The area of inundation on the Elands River is also located within an ESA, due to the buffer zone around the Protected Areas located to the south of the proposed dam basin (refer to **Section 3.8.4**).

The areas upstream and downstream of the dam on the Crocodile River are also largely categorised as CBA Irreplaceable. Areas along the Crocodile River which is cultivated are categorized as Heavily Modified.

In terms of the planning/development guidelines provided in the MBSP, CBA Irreplaceable areas are to be maintained in a natural state with no further loss of habitat or species. These

areas should therefore be avoided in terms of the mitigation hierarchy (MTPA, 2014). Waterworks[1] should not be located within CBA or ESA areas.

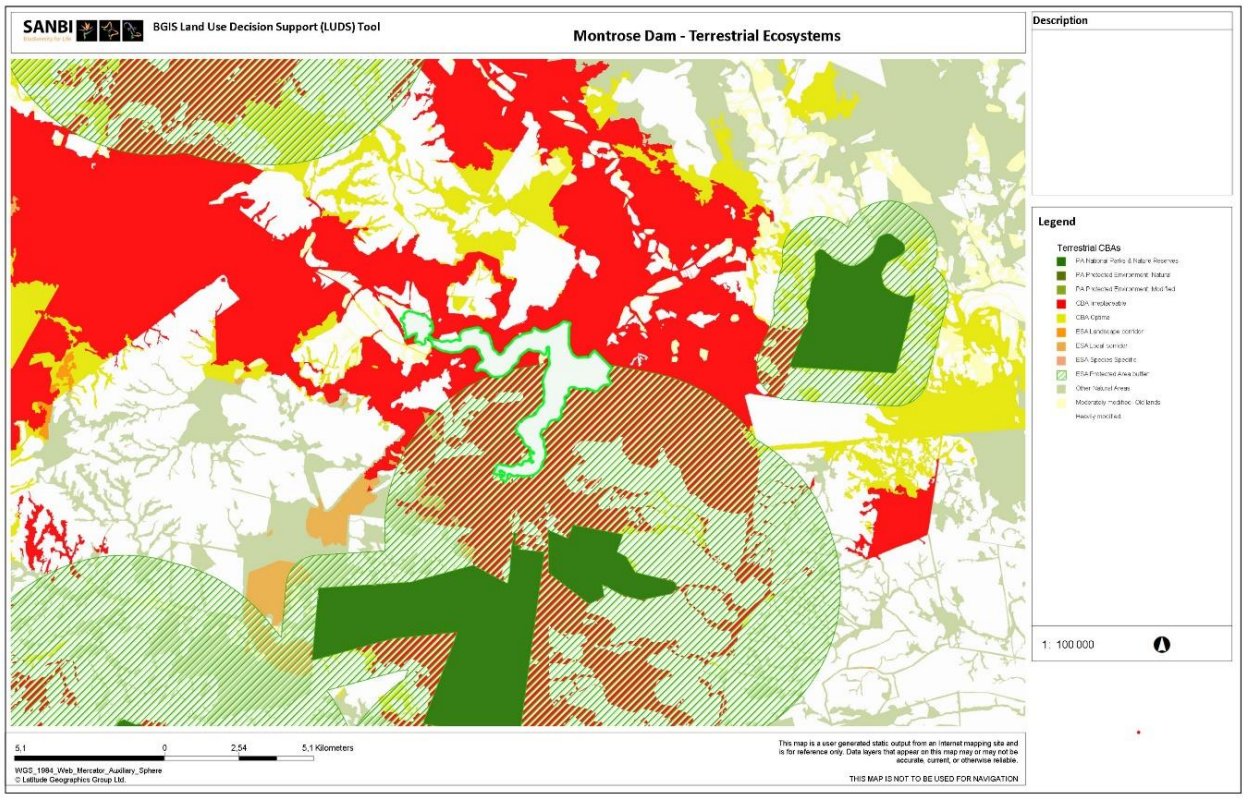


Figure 3-13: Montrose Dam: Terrestrial CBA Map (MBSP)

3.8.4 Protected Areas

Two Protected Areas are located approximately 1 km to the south of the proposed dam basin, i.e., the Starvation Creek Nature Reserve (NR) to the southeast and the Red Acres Private Nature Reserve (PNR) to the southwest as shown on **Figure 3-13**. The Vischspruit PNR is located > 3.5 km to the northeast of the proposed dam. The current management status of these PAs needs to be confirmed.

Large portions of the proposed dam basin are located within areas identified for expansion in the National Protected Areas Expansion Strategy (NPAES) (refer to **Figure 3-14**).

[1] This category includes a wide range of infrastructural installations serving rural and urban areas, including wastewater treatment works, bulk water transfer schemes, impoundments and energy-generation facilities (powers station, wind farms) (MTPA, 2014).

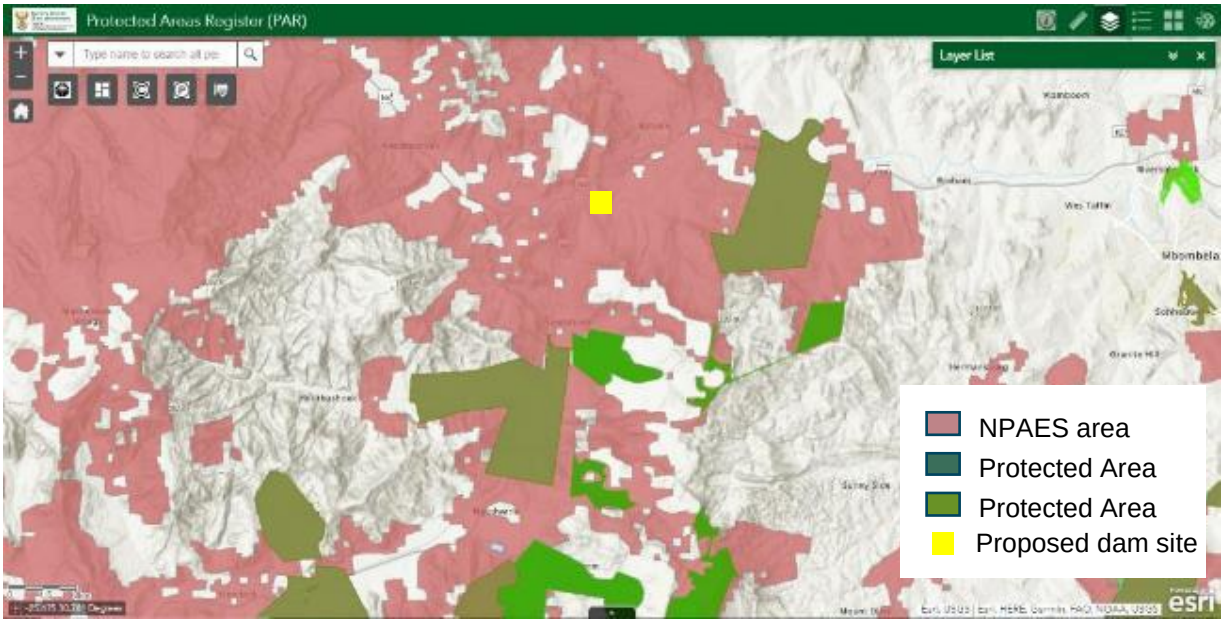


Figure 3-14: Montrose Dam: Protected Areas and Protected Areas Expansion Strategy (DFFE Protected Areas Register Interactive Map Viewer, accessed 15 April 2023)

3.8.5 Terrestrial Biodiversity Sensitivity Rating: DFFE Screening Tool

According to the DFFE Screening Tool, the proposed development site and surrounding area has a Very High Terrestrial Biodiversity Sensitivity Rating (refer to **Figure 3-15**). This is due to the fact that the proposed dam site is located within a Terrestrial CBA Irreplaceable area, within a Vulnerable Ecosystem, SWSA and FEPA Sub-catchments as per the MBSP and as described in the preceding sections. In addition, the area also forms part of the NPAES.

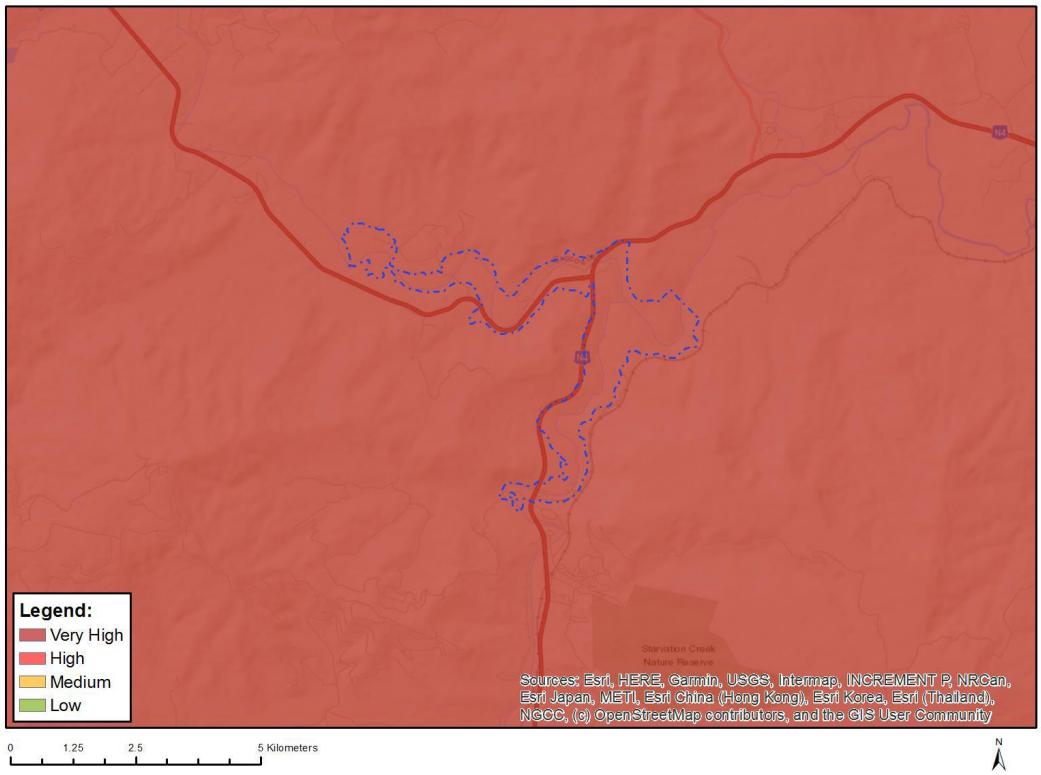


Figure 3-15: Montrose Dam: Terrestrial Biodiversity Sensitivity (DFFE Screening Tool)

3.9 Archaeological and Heritage

In terms of the DFFE Screening Tool, the proposed development site has a Sensitivity Rating of Very High due to its proximity within 2 km of a Grade II Heritage Site, or within 100 m of an Ungraded Heritage Site (refer to **Figure 3-16**).

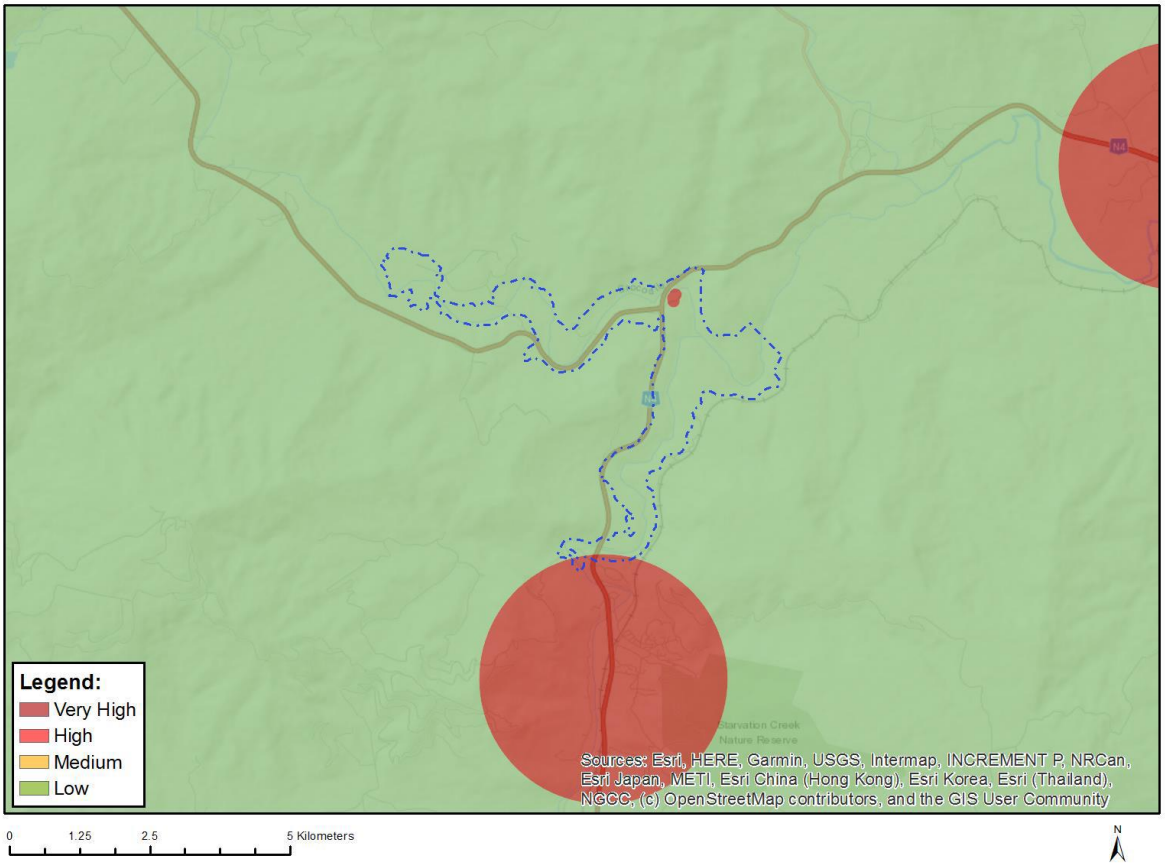


Figure 3-16: Montrose Dam: Archaeological and Heritage Sensitivity (DFFE Screening Tool)

4 MOUNTAIN VIEW DAM: AFFECTED ENVIRONMENT

4.1 Locality

The proposed Mountain View dam site is situated on the Kaap River approximately 4 km west of Louw's Creek and 14 km southwest of Kaapmuiden within the Mbombela LM. It is approximately 13 km upstream of the confluence of the Kaap River with the Crocodile River.

The approximate site co-ordinates are Latitude 25°36'45" and Longitude 31°16'15" (refer to **Figure 4-1**).

A roller compacted concrete arch dam with a central uncontrolled spillway provided with Robert's splitters discharging into a tail pond has been proposed. The dam can be up to 110 m high (to FSL). For a wall height between 77 and 87 m, the storage capacity of the dam will be between 155.3 and 229.2 million m³ and the local yield between 25 and 34 million m³/a.

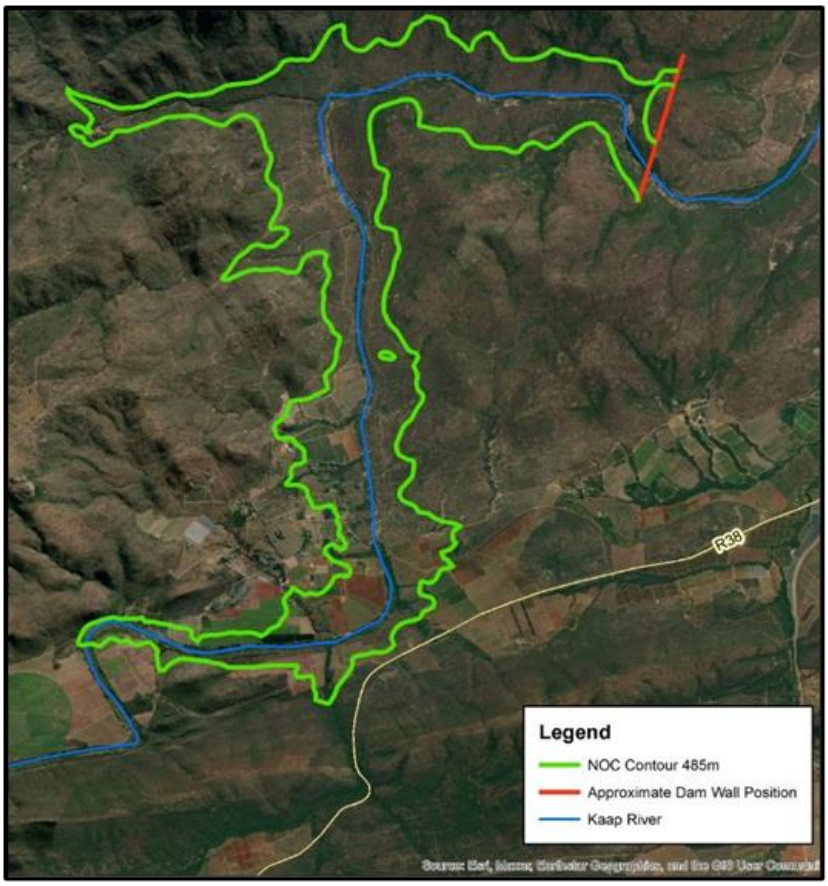


Figure 4-1: Montrose Dam: Locality

4.2 Topography

At the proposed dam site, the Kaap River cuts a narrow valley through the Crocodile Gorge Mountains, resulting in steep, rocky slopes on either side of the river (JIBS, 2001b). A general topographical view is shown in **Figure 4-2**.

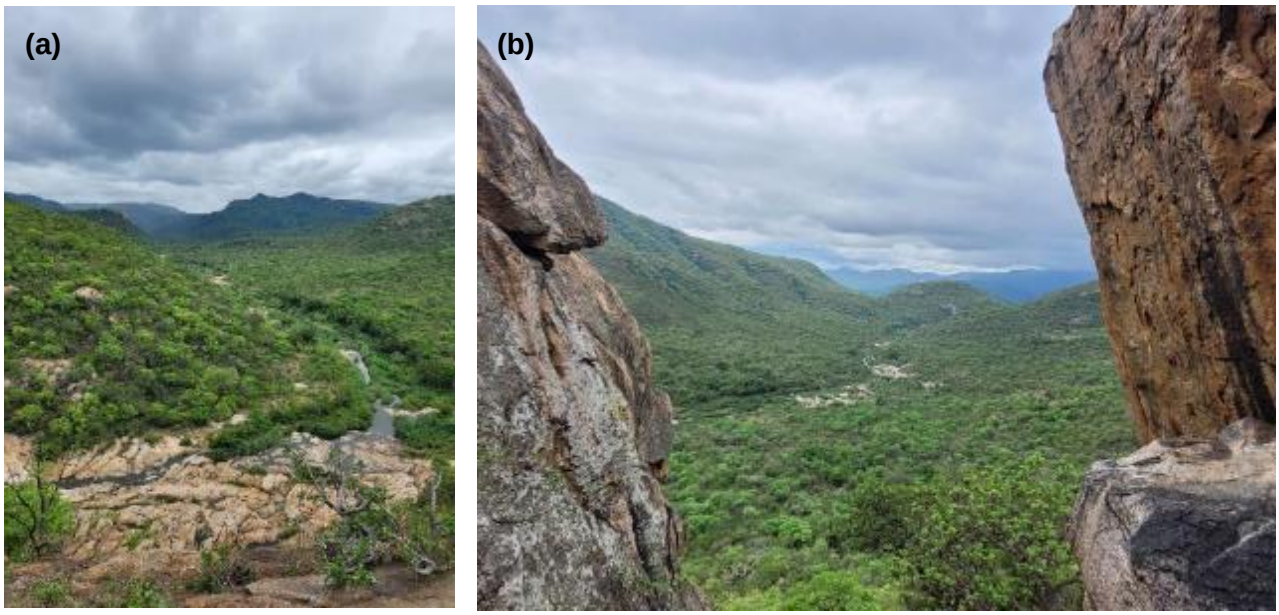


Figure 4-2: Montrose Dam: (a) View towards Dam Basin and (b) View towards Dam Wall

4.3 Climate

Climate is similar to that described for the Montrose site in **Section 3.3**, with local variation in temperature and precipitation that could be expected.

4.4 Geology

The site is underlain by gneiss of the Stentor Pluton. Diabase dykes are recognized in the vicinity of the centreline. Previous geological investigations indicate extensive outcrop of unweathered granite gneiss within the river section, although patchy alluvium is also present with thickness up to 1 m. The two flanks essentially comprise unweathered granite gneiss. Unconsolidated overburden and completely weathered rock generally do not extend deeper than 2.5 m to 4 m, although completely weathered horizons are present at depth. These weathered horizons might represent weathered diabase intrusions. Boreholes revealed a very closely spaced jointing on the right flank. At least two major joint orientations are recognized, striking north-east and south-east, respectively (DWA,2008).

4.5 Soil, Land Use, Land Capability and Agricultural Potential

4.5.1 Land Use

The upper reaches of the area to be inundated along the Kaap River are characterized by large areas of irrigated agriculture and other tourism related developments. The remaining area of the dam basin is undisturbed / unmodified habitat. An existing weir is present close to the proposed dam wall.

Agricultural land use dominates the area further along the Kaap River downstream of the proposed dam site (refer to **Figure 4-3**).

The R38 road between Kaapmuiden and Barberton is located to the south and east of the proposed dam, linking with the N4 national highway further to the north. This road will not be impacted by the proposed dam development. A railway line runs along the Kaap River to the south of the proposed dam and a portion of this line will be inundated by the proposed dam development.

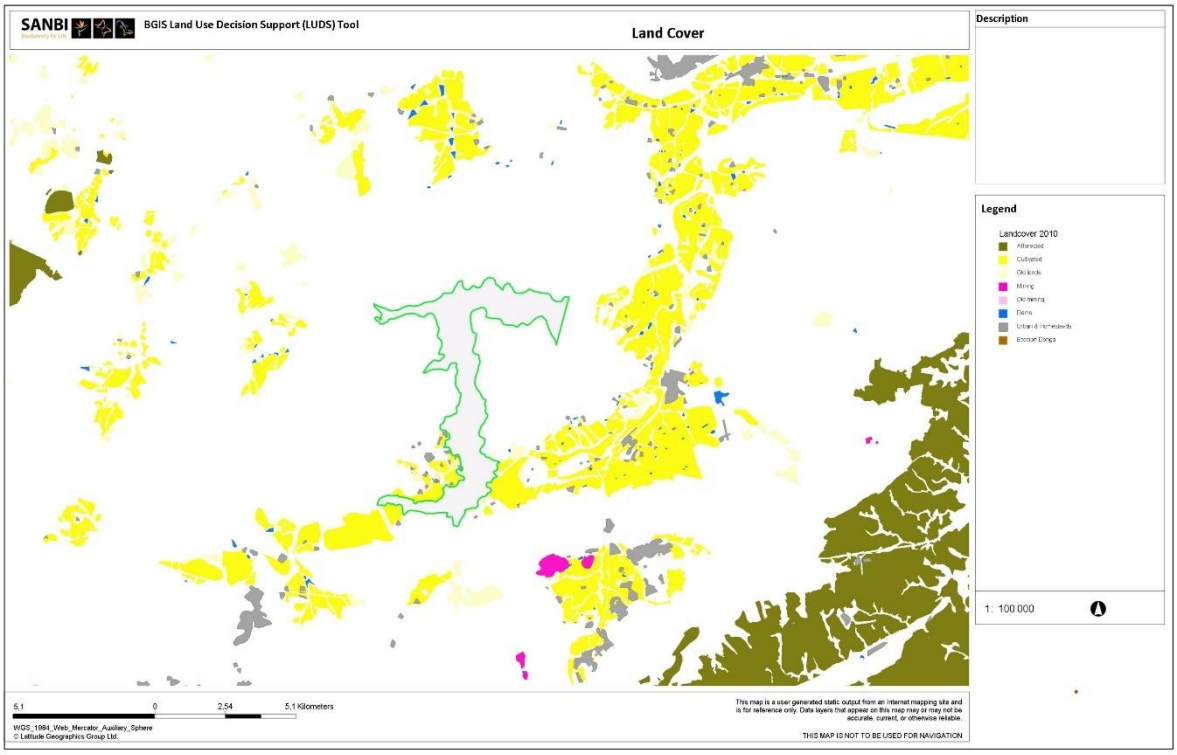


Figure 4-3: Mountain View Dam: Land Cover (MBSP)

4.5.2 Soil

In the northern portion of the proposed dam basin and the surrounding areas, rock with limited soils is present (refer to **Figure 4-4**). In the southern section where agricultural activities take place, the soils are well drained, dark reddish soils having a pronounced shiny, strong blocky structure (nutty), usually fine (red structured soils). In addition, one or more of vertic and melanic soils may be present.

The southern most section of the proposed dam basin is characterized by soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime is generally present in part or most of the landscape.

Within the proposed dam basin, the following soil classes are expected:

- Association of Classes 1 to 4: Undifferentiated structureless soils
- Freely drained, structureless soil
- Non-soil land classes.

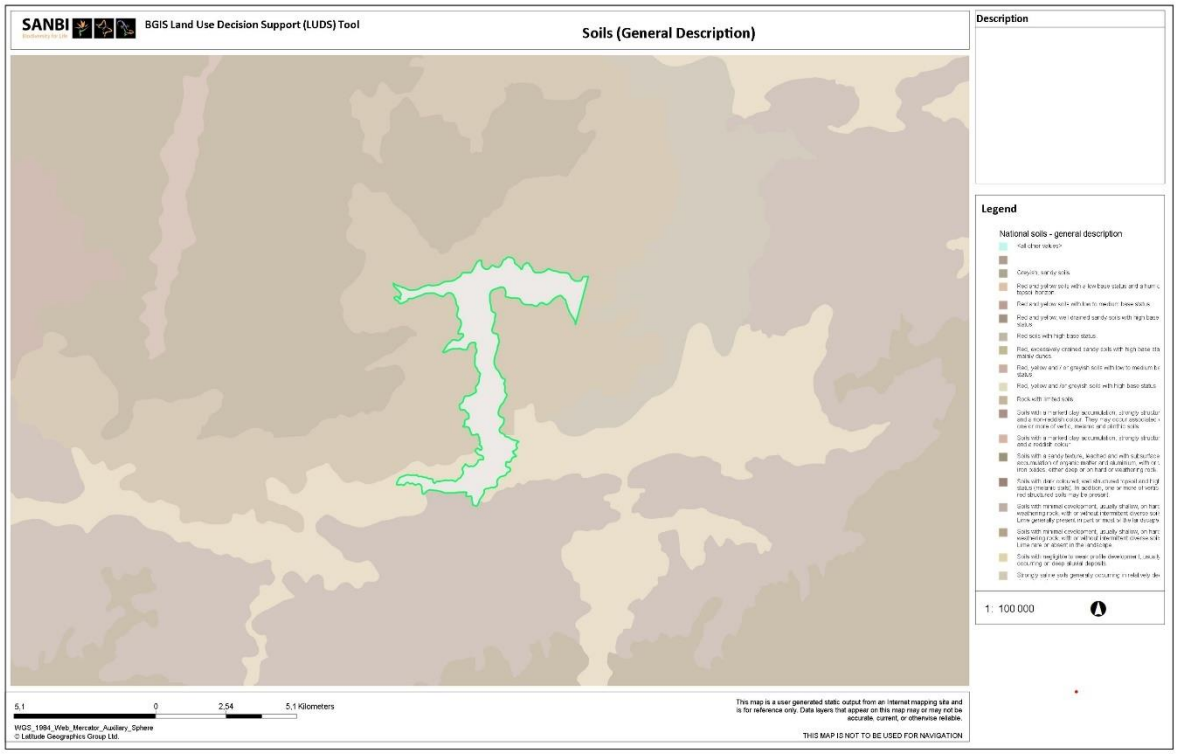


Figure 4-4: Mountain View Dam: Soils (MBSP)

4.5.3 Agricultural Sensitivity

The southern portion of the dam basin has Very High and High Agricultural Sensitivity Rating in the DFFE Screening Tool due to the high land capability rating of the soils and the extent of existing agriculture (refer to **Figure 4-5**). The remainder of the dam basin has Low to Medium sensitivity rating, with High to Very High sections interspersed.

Development of the proposed dam will therefore result in loss of soils with High agricultural potential.

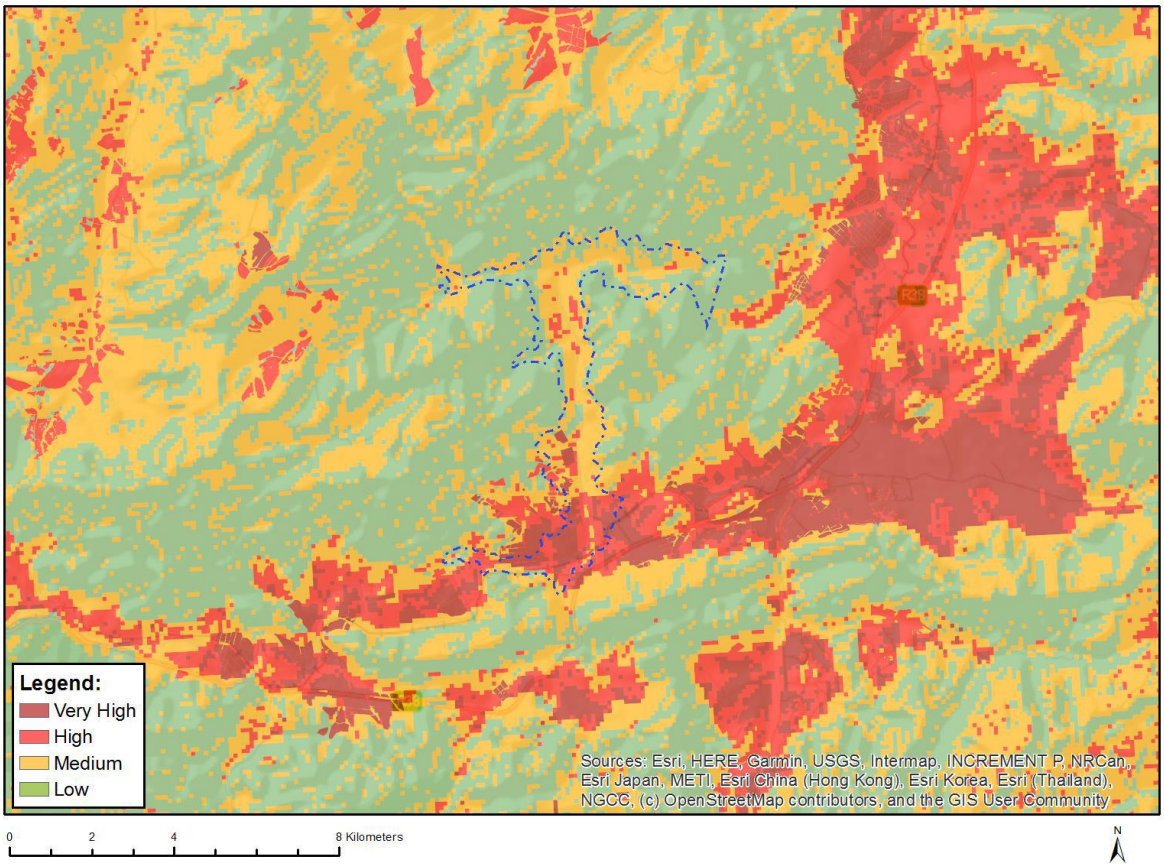


Figure 4-5: Mountain View Dam: Agricultural Sensitivity (DFFE Screening Tool)

4.6 Rivers and Wetlands

4.6.1 Strategic Water Source Areas

Although the proposed dam basin is not located within a SWSA, an area directly to the north of the proposed dam basin has been identified as a SWSA as shown in **Figure 4-6**. It is not expected to have a significant direct impact on the SWSA.

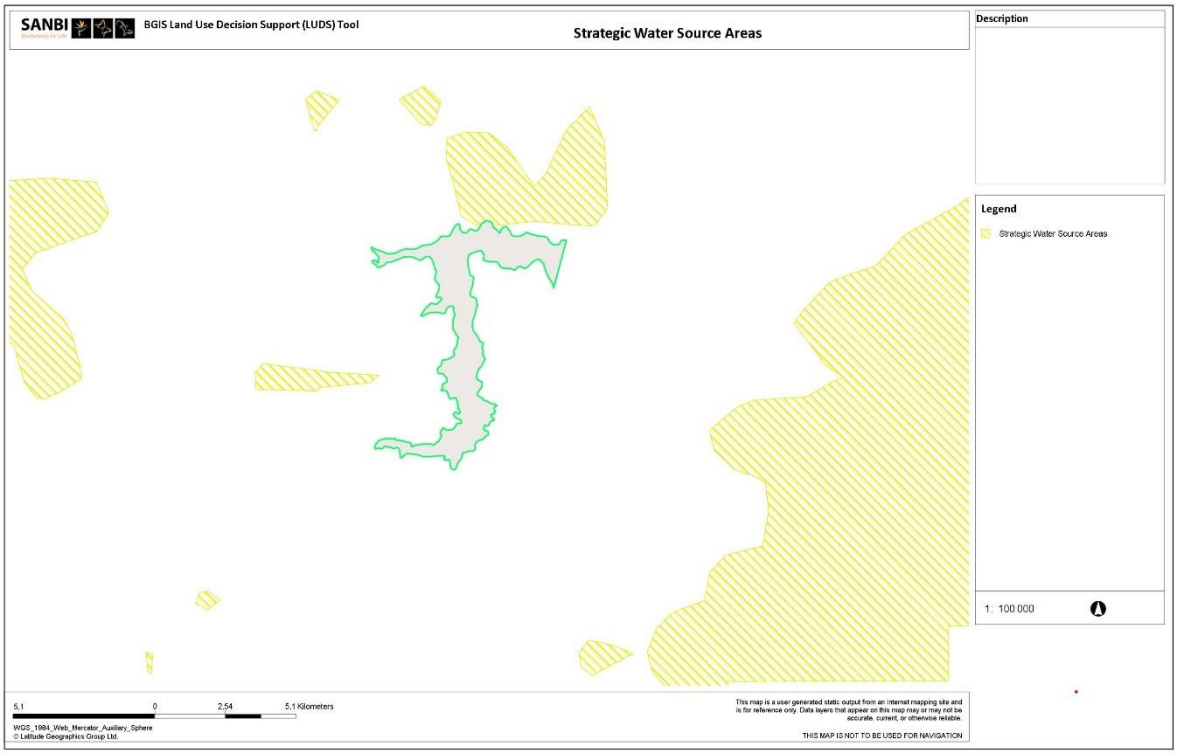


Figure 4-6: Mountain View Dam: Strategic Water Source Areas (MBSP)

4.6.2 NFEPA Rivers and Wetlands

The proposed dam is located on the Kaap River (with PES of C: Moderately modified). The Kaap River is designated as an Upstream Management Area in terms of NFEPA. Human activities need to be managed within these rivers and sub-quaternary catchments to prevent degradation of downstream fish sanctuaries and fish migration areas.

A number of wetlands is located in the surrounding area, none of which is designated as FEPA wetlands.

4.6.3 Water Quality

The proposed Mountain View Dam is in the Kaap River sub-catchment and the 2021 water quality status report by the IUCMA shows the following with regard to compliance with the standards used (refer to **Table 2-1**), and as graphically depicted in **Appendix B**:

- pH levels throughout this sub-catchment complies with the TWQG;
- EC complies with the RQO (Aquatic Ecosystem drivers) throughout the sub-catchment;
- Average SO_4 concentration shows non-compliance with the TWQG (Industry: Category 1) of 30 mg/l, except for the Noordkaap upstream of Consort Mine and Kimberley Creek;
- NH_3 concentrations within the sub-catchment comply with the TWQG;

- Mn complies with the RQO;
- As concentrations complies with the RQO in the upper reaches, but non-compliance is indicated for the Noordkaap, Louws Creek and after the confluence of the Kaap River with Louws Creek. The impact is attributed to gold mine activities in the area as well as illegal gold mining activities within Louws Creek and its tributaries.
- PO_4 complies with the RQO for most of the time except downstream of the New Consort Water Treatment Works;
- Elevated *E. coli* levels above the RQO of 130 cfu/100 ml were observed for the sub-catchment (IUCMA, 2022).

Water quality within the catchment therefore indicates impact associated with land uses such as mining and township/residential developments.

4.7 Freshwater Ecosystems

4.7.1 Freshwater Ecosystems

The catchment is known to have moderately diverse aquatic habitats on a local scale, some of which are highly sensitive to flow-related and water quality changes during certain seasons, as well as providing important refuge for aquatic biota at a local scale. It is also regarded as an important link in terms of connectivity for the survival of biota upstream and downstream and is subsequently regarded as sensitive to modification. A high proportion of aquatic biota that is dependent on permanently flowing water during all phases of their life cycle is expected in the catchment, specifically *Opsaridium peringueyi* (Southern Barred Minnow; LC) and *Chiloglanis pretoriae* (Shortspine suckermouth) (DWA, 2008).

The 2017 Ecostatus for the X23G-01057 reach on the Kaap River is shown below. The reach starts at the confluence of the Suid-Kaap and Noord-Kaap Rivers, to where the Kaap River confluences with the Crocodile River.

Reach Code	Site Code	River	GPS (dd.ddddd)	Elevation (m a.s.l.)	SQR Length (km)	PES Category	Fish Ecostatus	Invertebrate Ecostatus	Instream Ecostatus	Riparian Vegetation Ecostatus	Integrated Ecostatus	TEC	Biomonitoring Year
X23G-01057	X2KAAP-HONEY EWR 7	Kaap	S-25.64947 E 31.24286	453	48.1	D	C 72.2%	C 74.4%	C 73.52%	D 50%	C 66.99%	C 70.09%	2012
							C 71.2%	C 76.1%	C 73.7%	C 72.5%	C 73.4%		2017

During the 2017 assessment, only six of the expected 21 indigenous fish species were collected. The fish assemblage consisted primarily of Cyprinidae, of which three of the

expected nine species were collected in relative abundance, i.e., *Enteromius trimaculatus, Labeo molybdinus* and *Labeobarbus marequensis*. For the rheophilic flow sensitive species *Amphilius uranoscopus* and *Chiloglanis pretoriae* were either absent or collected in relative low abundance. The calculated Fish Ecostatus rating for this reach was 71.2%, resulting in an Ecological Category of C (moderately impaired with low diversity of species) (IUCMA, 2018).

The SASS5 results, based on MIRAI, indicates moderately impaired (76%) or Category C conditions in 2017 (IUCMA, 2018).

The overall Riparian Ecostatus was determined as Category C (72.5%) indicating that the riparian vegetation is moderately modified (IUCMA, 2018).

The Integrated Ecostatus was determined at 73.4% or Category C (moderately modified habitat with loss and change of natural habitat and biota has occurred in terms of frequencies of occurrence and abundance. The basic ecosystem functions are still predominantly unchanged, and the TEC was therefore met (IUCMA, 2018).

4.7.2 Mpumalanga Biodiversity Sector Plan

Areas where agricultural activities are taking place are categorized as Heavily Modified in terms of the Freshwater CBA map (refer to **Figure 4-7**). The largest portion of the dam basin is characterized as ONA. A small area at the existing weir in the vicinity of the proposed dam wall is categorized as an ESA due to the presence of wetlands.

In terms of the development guidelines in the MBSP, ONA should be regarded as natural areas that are potentially available for changes in land-use, subject to an environmental authorization process. These areas still provide important ecosystem services, particularly as buffers around rivers and wetlands to reduce siltation and improve water quality (MTPA, 2014).

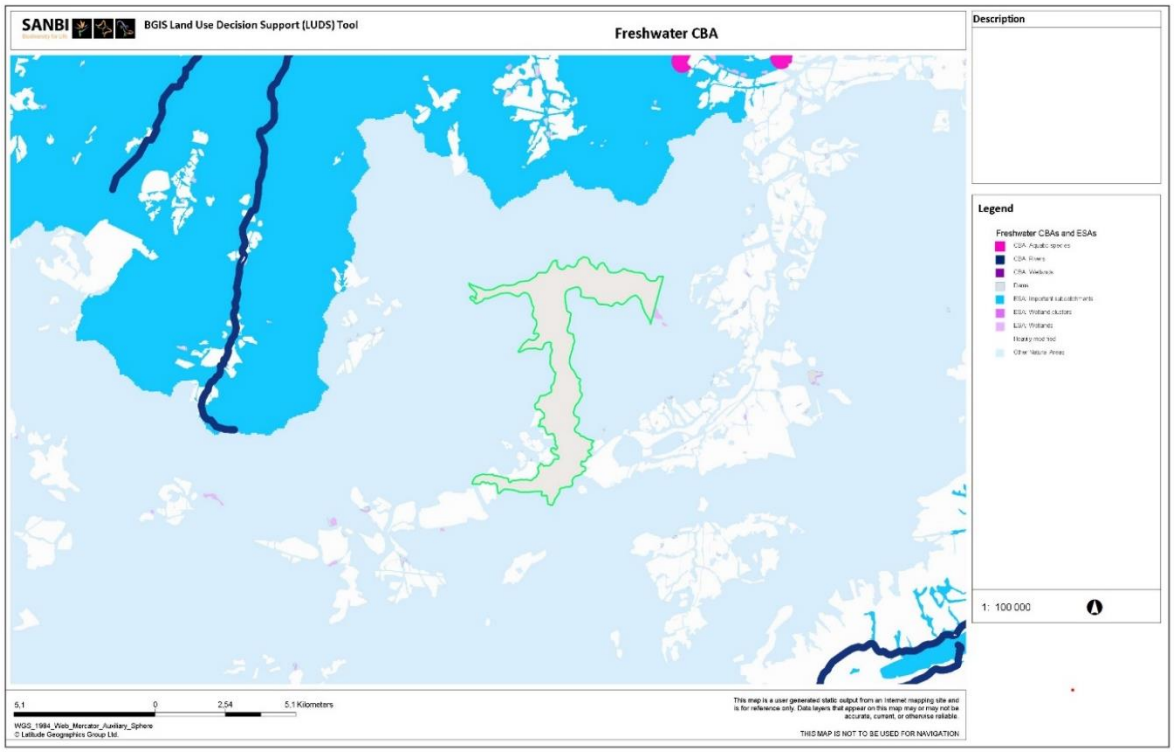


Figure 4-7: Mountain View Dam: Freshwater CBA Map (MBSP)

4.7.3 Aquatic Biodiversity Sensitivity Rating: DFFE Screening Tool

The Kaap River itself has a Very High Sensitivity Rating in terms of aquatic biodiversity due to its importance as an upstream management area as indicated in **Figure 4-8**. The remainder of the dam basin has a Low sensitivity rating.

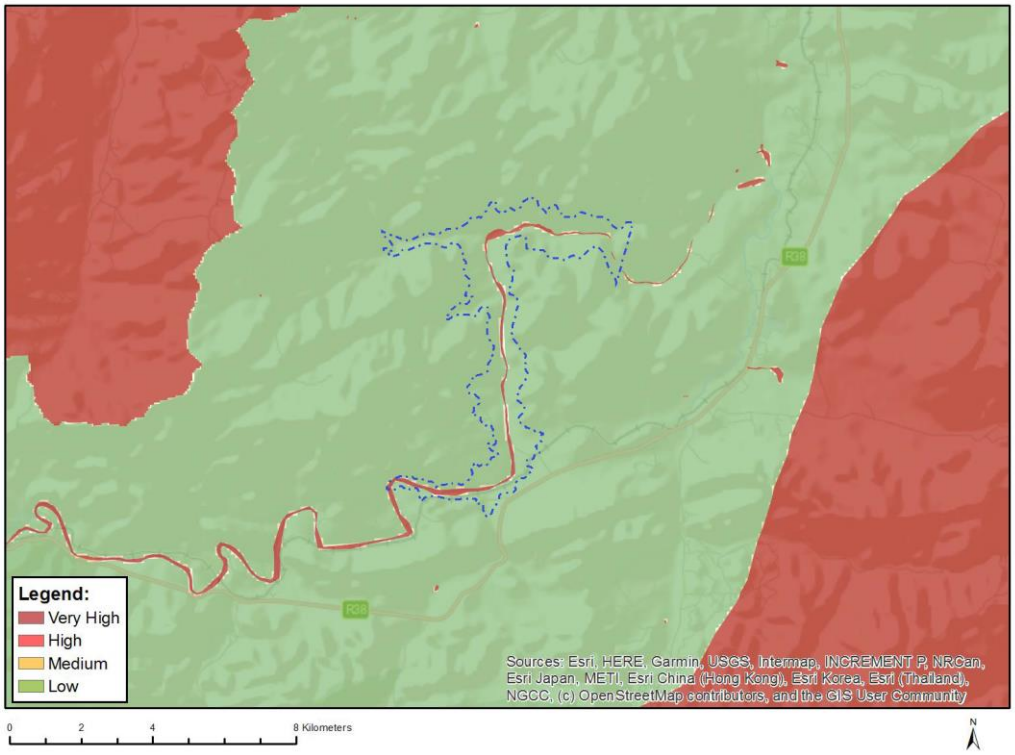


Figure 4-8: Mountain View Dam: Aquatic Biodiverstiy Sensitivity (DFFE Screening Tool)

4.8 Terrestrial Ecosystems

4.8.1 Flora

Vegetation types within the dam basin includes the Malelane Mountain Bushveld and Granite Lowveld vegetation type of the Savanna Biome in the Lowveld Bioregion (refer to **Figure 4-9**). A small section of the Barberton Serpentine Sourveld is located in the south of the dam basin along the R38 road. Further to the south of the proposed dam, the vegetation type changes to the Kaalrug Mountain Bushveld. The Barberton Serpentine Sourveld and Kaalrug Mountain Bushveld are endemic ecosystems in Mpumalanga.

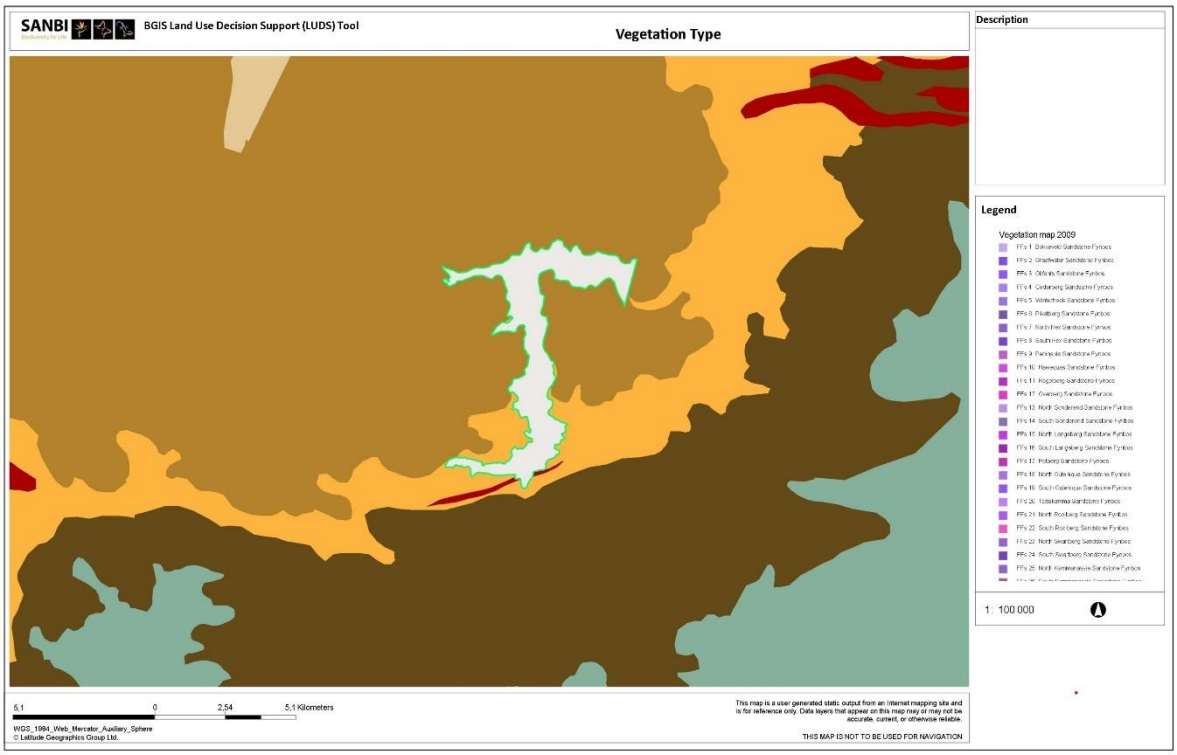


Figure 4-9: Mountain View Dam: Vegetation Types (MBSP)

The dam basin is not located within any Threatened Ecosystem. There are a number of Threatened Ecosystems located at a distance (> 5km) of the proposed dam basin.

In terms of the DFFE Screening Tool, the dam basin largely has a Medium Plant Species Sensitivity Rating, with Low sensitivity towards the south of the basin as indicated on **Figure 4-10**.

Known and potential species plant identified for the area in the DFFE Screening Tool are shown in **Table 4-1**.

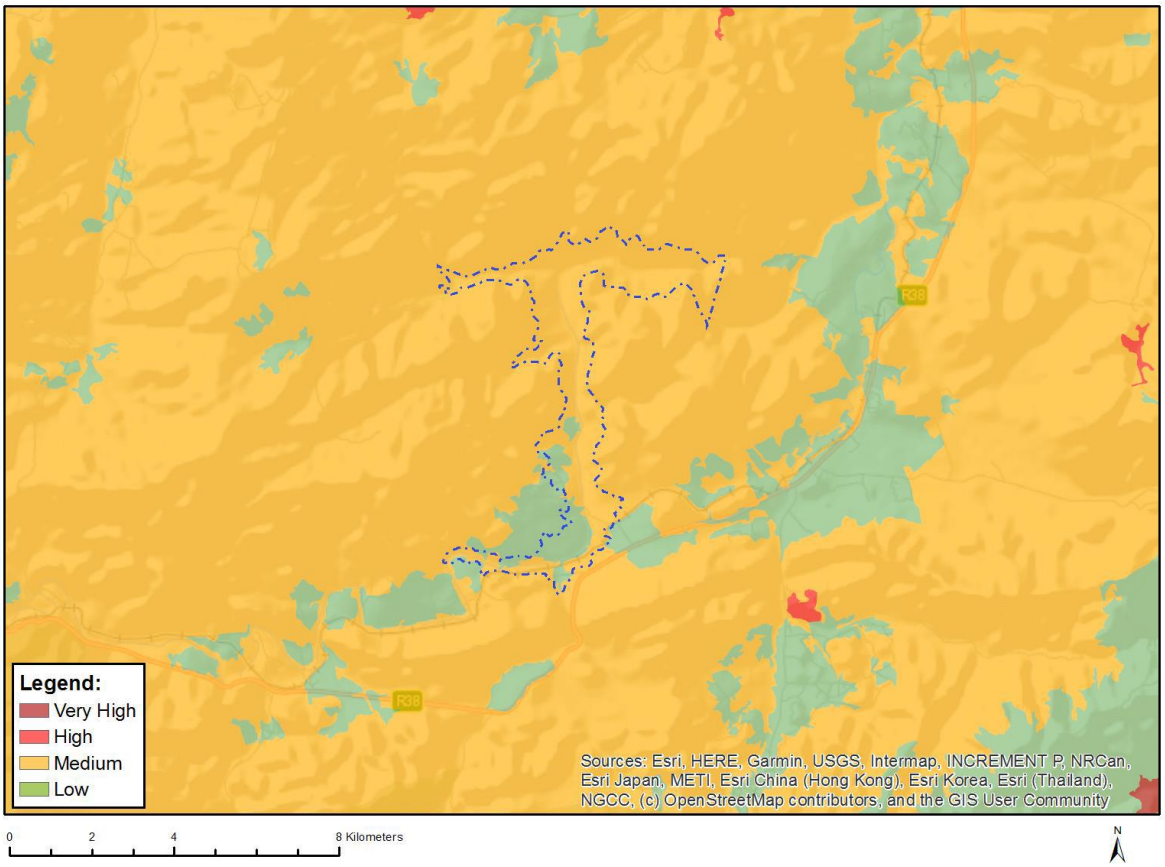


Figure 4-10: Mountain View Dam: Plant Species Sensitivity (DFFE Screening Tool)

Table 4-1: Mountain View Dam: Known and Potential Floral Species (DFFE Screening Tool)

Scientific Name	Common Name	Sensitivity (DFFE Screening Tool)	Conservation Status
Faurea macnaughtonii	Rooiboekenhout	Medium	Rare
Ocotea bullata	Stinkwood	Medium	VU
Ocotea kenyensis	Mock Stinkwood	Medium	VU
Thorncroftia longiflora		Medium	Rare
Streptocarpus fasciatus		Medium	VU
Macledium zeyheri subsp. thyrsiflorum		Medium	VU
Prunus africana	Red Stinkwood	Medium	VU
Eight sensitive plant species			VU EN CR

4.8.2 Fauna

Five faunal species of conservation importance are known to occur within the area:

- *Rhinolophus blasii empusa* (Peak-saddle Horseshoe Bat; EN),
- *Ephippiorhynchus senegalensis* (Saddle-billed Stork; CE),
- *Bucorvus leadbeateri* (Southern Ground Hornbill; VU),
- *Aspedilaps scutatus intermedius* (Lowveld Shieldnose Snake; VU)
- *Cordylus warreni barbertonensis* (Barberton Girdled Lizard; VU) (DWA, 2008).

In the 2001 assessment of this dam option, a number of faunal species that are likely to occur within and around the proposed dam site were identified, namely:

- *Afroedura multiporis haackei* (flat gecko species),
- *Python sebae natalensis* (South African Rock Python)
- *Crocodylus noliticus* (Nile Crocodile)
- *Dipsadoboa aulica* (Marbled Tree Snake), restricted to the Lowveld and along large rivers and riverine forests. Recorded on the farm Kaapmuiden 212 JU.
- *Zygaspis violacea* (Violet warm-lizard), a small fossorial species restricted in distribution. Recorded on the farm Bushbuck 251 JT and in Low's Creek.
- *Cacosternum nanum* (Bronze caco), which inhabits shallow seasonal pans with emergent vegetation, as well as marshy terrain and vegetation fringing streams. Recorded at Low's Creek.
- *Cordylus warren babertonensis* (Barberton girdled-lizard) likely to occur in the dam basin (JIBS, 2001b).

The presence of these species will need to be confirmed with onsite investigations.

In terms of the DFFE Screening Tool, the proposed development site has a HIGH Animal Species Sensitivity Rating (refer to **Figure 4-11**). Known and potential species identified for the area are shown in **Table 4-2**. Specific concerns exist regarding the potential impact of the proposed development on an active Crowned Eagle nest site (*Stephanoaetus coronatus*) within the area (M. Lőtter, 2023, personal communication).

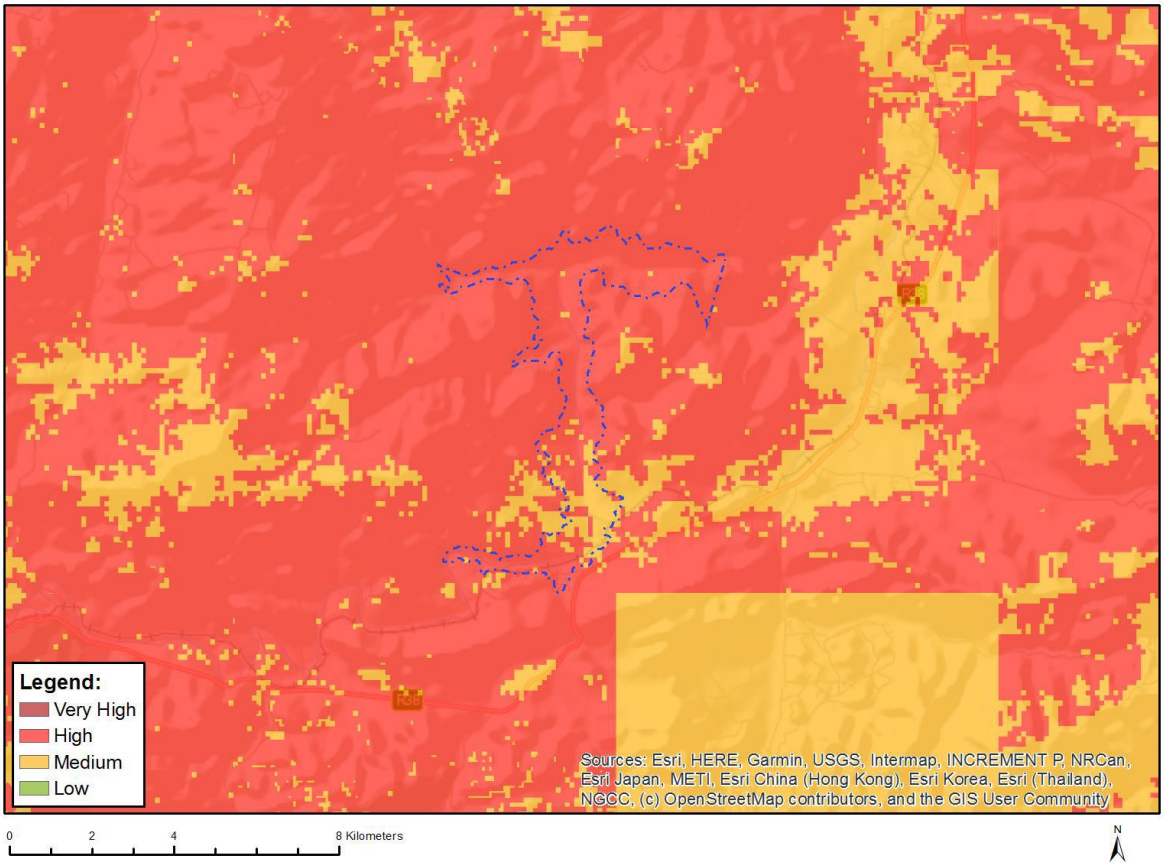


Figure 4-11: Mountain View Dam: Animal Species Sensitivity (DFFE Screening Tool)

Table 4-2: Mountain View Dam: Known and Potential Faunal Species (DFFE Screening Tool)

Class	Scientific Name	Common Name	Sensitivity (DFFE Screening Tool)	Conservation Status
Aves	*Stephanoaetus coronatus*	Crowned eagle	High	NT
	Podica senegalensis	African finfoot	Medium	LC
	Terathopius ecaudatus	Bateleur	Medium	EN
	Ciconia nigra	Black stork	Medium	LC
	Aquila rapax	Tawny eagle	Medium	LC
	Aquila verreauxii	Verreaux's eagle	Medium	LC
Mammalia	*Cercopithecus albogularis schwarzi*	Samango monkey	Medium	EN
	Crocidura maquassiensis	Makwassie Musk Shrew	Medium	VU

Class	Scientific Name	Common Name	Sensitivity (DFFE Screening Tool)	Conservation Status
Mammalia	*Dasymys robertsii*	Robert's shaggy rat	Medium	NT
	Lycaon pictus	African wild dog	Medium	EN
	Sensitive mammal species			VU
Reptilia	*Crocodylus niloticus*	Nile crocodile	Medium	VU
Invertebrate		Forest invertebrate	Medium	

4.8.3 Mpumalanga Biodiversity Sector Plan

Dam basin is largely located within an area categorized as ESA (landscape and local corridors, as well as buffer zone around Protected Areas) and ONA. An area of approximately 6.8 ha in the south of the dam basin has been categorized as CBA Irreplaceable and will be inundated should the dam be developed.

The reason for this CBA Irreplaceable area is that it provides a critical link, or migration corridor. Other options for linkages exist and this small CBA Irreplaceable area is therefore not foreseen to be a fatal flaw (M. Lőtter, 2023, personal communication).

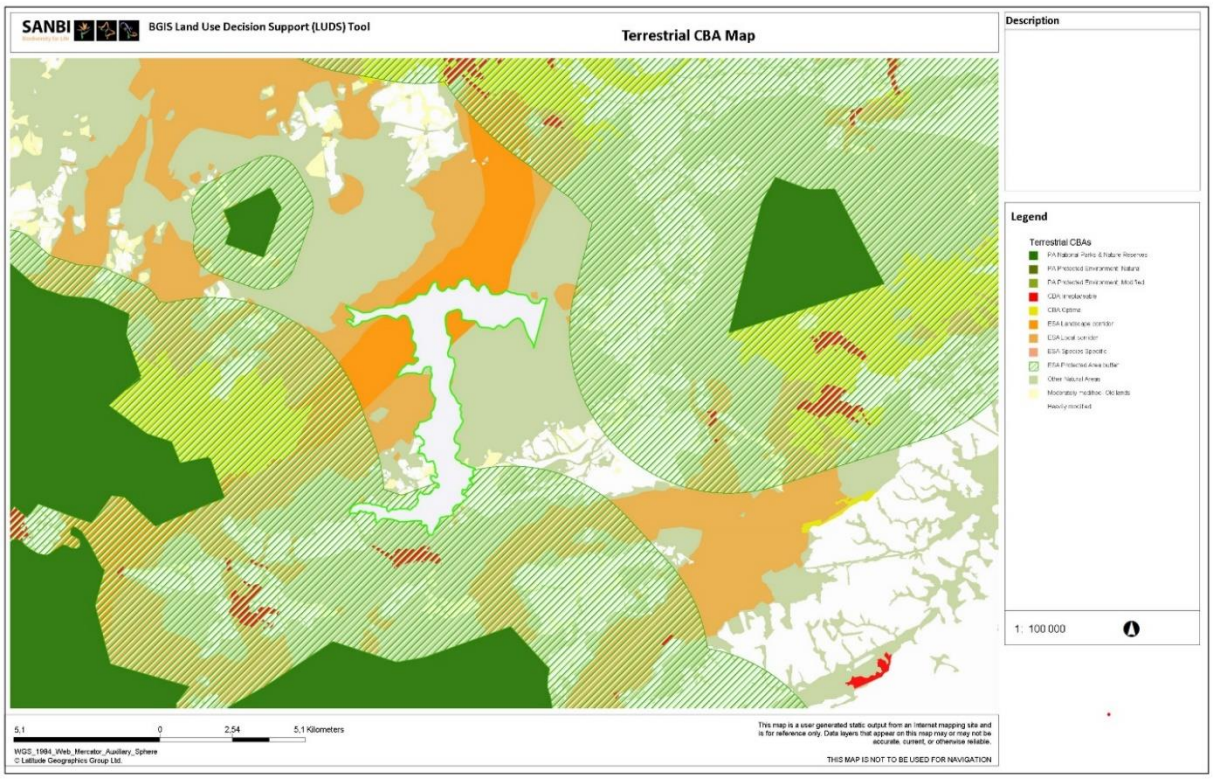


Figure 4-12: Mountain View Dam: Terrestrial CBA Map (MBSP)

4.8.4 Protected areas

The Boondocks PNR is located approximately 3 km northwest of the proposed dam (refer to **Figure 4-12**). The Methethomusha Nature Reserve is located approximately 9 km to the north of the proposed dam and the Kruger National Park approximately 12 km to the northeast.

The Mountainlands Nature Reserve is located > 2 km to the south of the proposed dam.

Development of the dam is not expected to have a direct impact on these PAs.

The northern area of the dam basin is, however, located within an area identified in the NPAES as indicated in **Figure 4-13**.

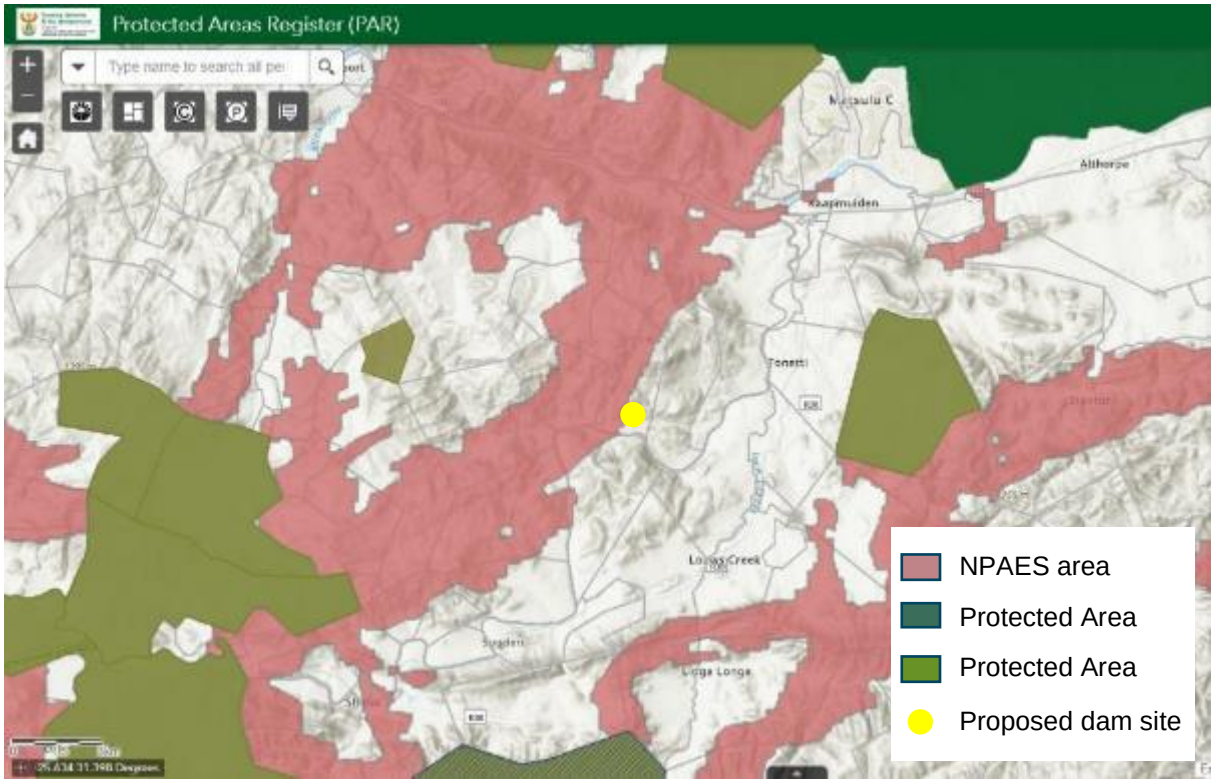


Figure 4-13: Mountain View Dan: Protected Areas and Protected Areas Expansion Strategy (DFFE Protected Areas Register Interactive Map Viewer, accessed 15 April 2023)

4.8.5 Terrestrial Biodiversity Sensitivity Rating: DFFE Screening Tool

As indicated on **Figure 4-14**, the northern portion of dam basin has Very High sensitivity rating attributed to the following CBA Irreplaceable areas, ESA (landscape and local corridor) and NPAES (see sections above for details):

The southern portion has a Low sensitivity rating, except for the area directly associated with the Kaap River due to ecological support function provided.

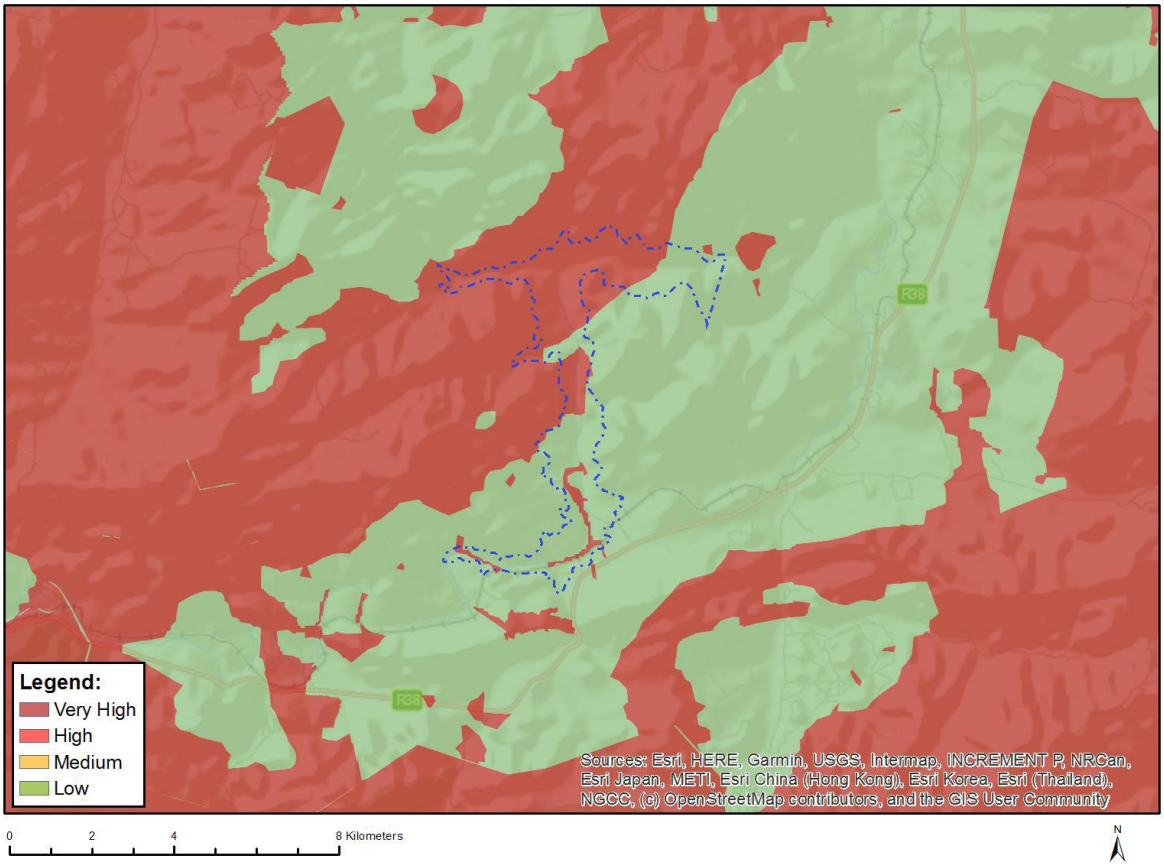


Figure 4-14: Mountain View Dam: Terrestrial Biodiversity Sensitivity (DFFE Screening Tool)

4.9 Archaeological and Heritage

In the DFFE Screening Tool, one area is identified to the south of the dam basin with a potential High sensitivity rating due to its proximity (within 150 m) of a Grade IIIa Heritage site (refer to **Figure 4-15**). The remainder of the dam basin has a Low sensitivity.

Some areas with High Archaeological and Heritage Sensitivity Rating were identified in the areas surrounding the proposed dam site.

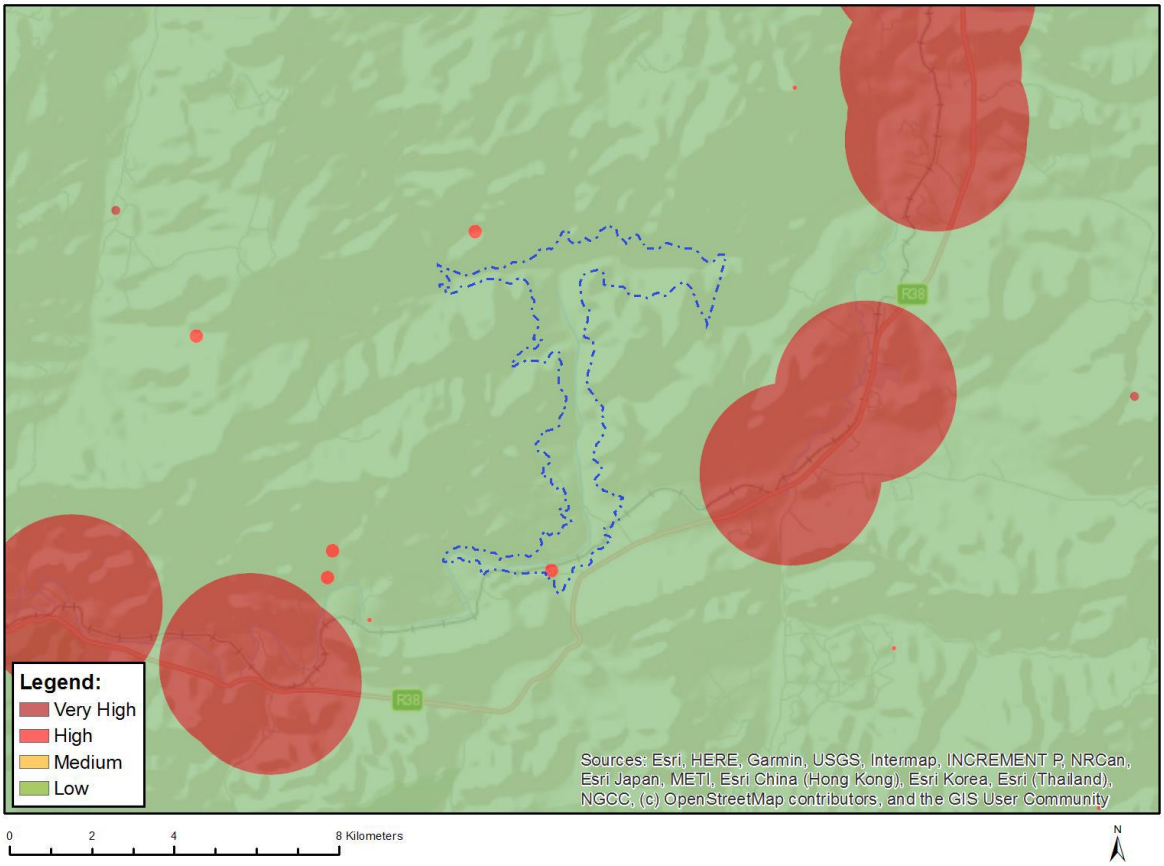


Figure 4-15: Mountain View Dam: Archaeological and Heritage Sensitivity (DFFE Screening Tool)

5 BOSCHJESKOP DAM: AFFECTED ENVIRONMENT

5.1 Locality

The proposed Boschjeskop Dam is located north of Brondal and approximately 10 km west of White River within the Thaba Chweu LM. Access to the dam is from the surfaced road between the R37 and R537 provincial roads, which connects Brondal and White River.

The approximate site co-ordinates are Latitude 25°21'07" and Longitude 30°52'21" (see **Figure 5-1**).

It has been proposed that an embankment dam be constructed in a valley of the Nels River. A central roller compacted concrete section is foreseen. The dam can be up to 70 m high (to FSL). For a dam 40 to 45 m high, the storage capacity of the dam will vary between 75.6 and 101.0 million m³. For a dam height of 45 m, the local yield will be 19.5 million m³/a.

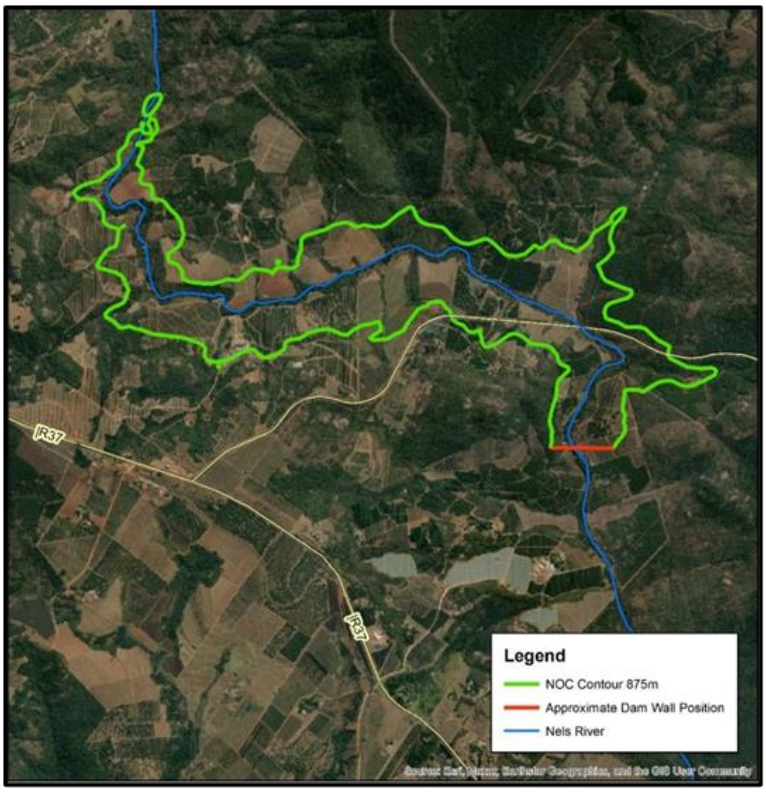


Figure 5-1: Boschjeskop Dam: Locality

5.2 Topography

Both flanks of the dam rise to significant heights above river level. The left flank is gently sloping while the right flank is significantly steeper and the site is therefore asymmetrical. The

basin of the dam broadens out behind the dam wall and floods the aforementioned road (DWA, 2008). A general topographical view for the proposed dam is shown in **Figure 5-2**.

Figure 5-2: Boschjeskop Dam: Topographical View

5.3 Climate

Climate conditions are similar to that described in **Section 3.3**, with a slightly higher expected MAP of 1 000 – 1 200 mm.

5.4 Geology

The site is close to the contact between coarse-grained granite and granite / migmatite of the Nelspruit Suite.

Unweathered, massive granite bedrock outcrops occur within the river section and unconsolidated alluvium is restricted to the riverbanks. A prominent joint set is recognized striking sub-parallel to the river (i.e., perpendicular to the centreline). Although sub-outcrops of highly weathered granite bedrock occur in places on the lower flanks, the flanks are generally expected to be deeply weathered, with residual soils likely to reach significant thickness (DWA, 2008).

5.5 Soil, Land Use, Land Capability and Agricultural Potential

5.5.1 Land Use

Large areas of the dam basin have been cultivated (including macadamia, citrus and avocado) or afforested (eastern portion of the area to be inundated). The surrounding areas are also characterized by significant agricultural and afforestation activities (refer to **Figure 5-3**).

Infrastructure to be inundated includes part of the surface road, gravel roads, irrigation systems, powerlines and various other structures associated with the farming activities (homesteads, workshops, stores etc.).

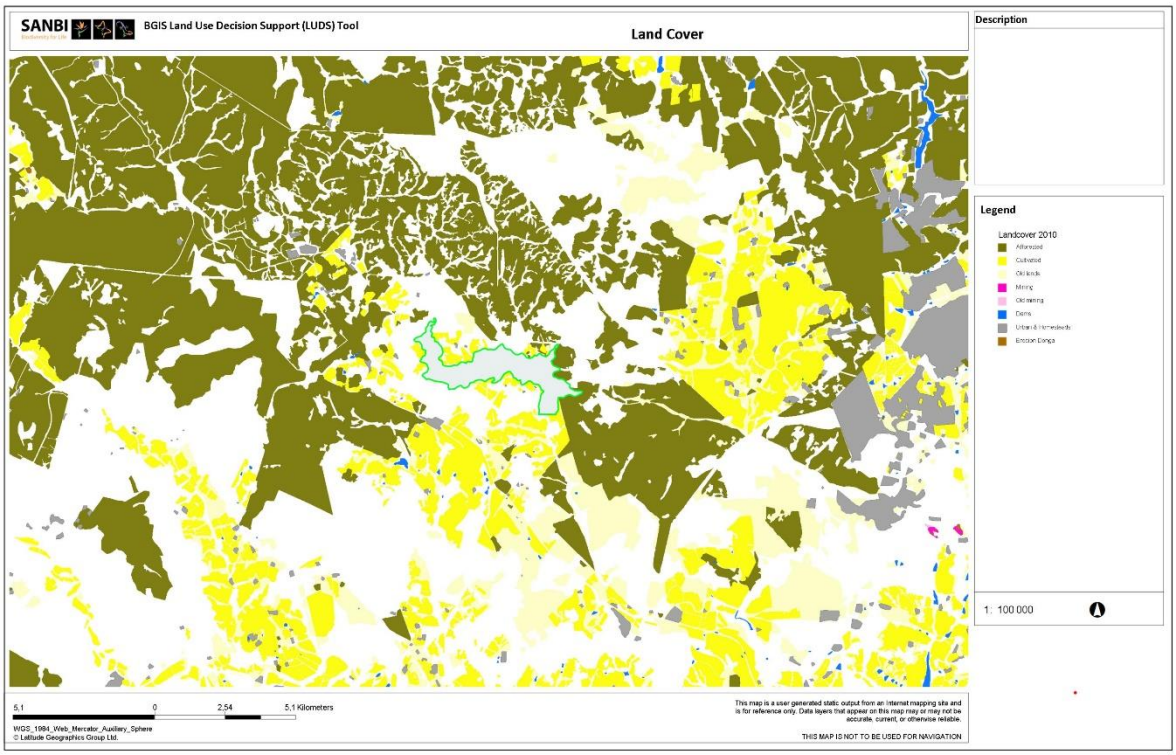


Figure 5-3: Boschjeskop Dam: Land Cover (MBSP)

5.5.2 Soil

Soils within the proposed dam basin are expected to be red and yellow soils with low to medium base status (refer to **Figure 5-4**). Soils are classed as freely drained, structureless soils in terms of the MBSP.

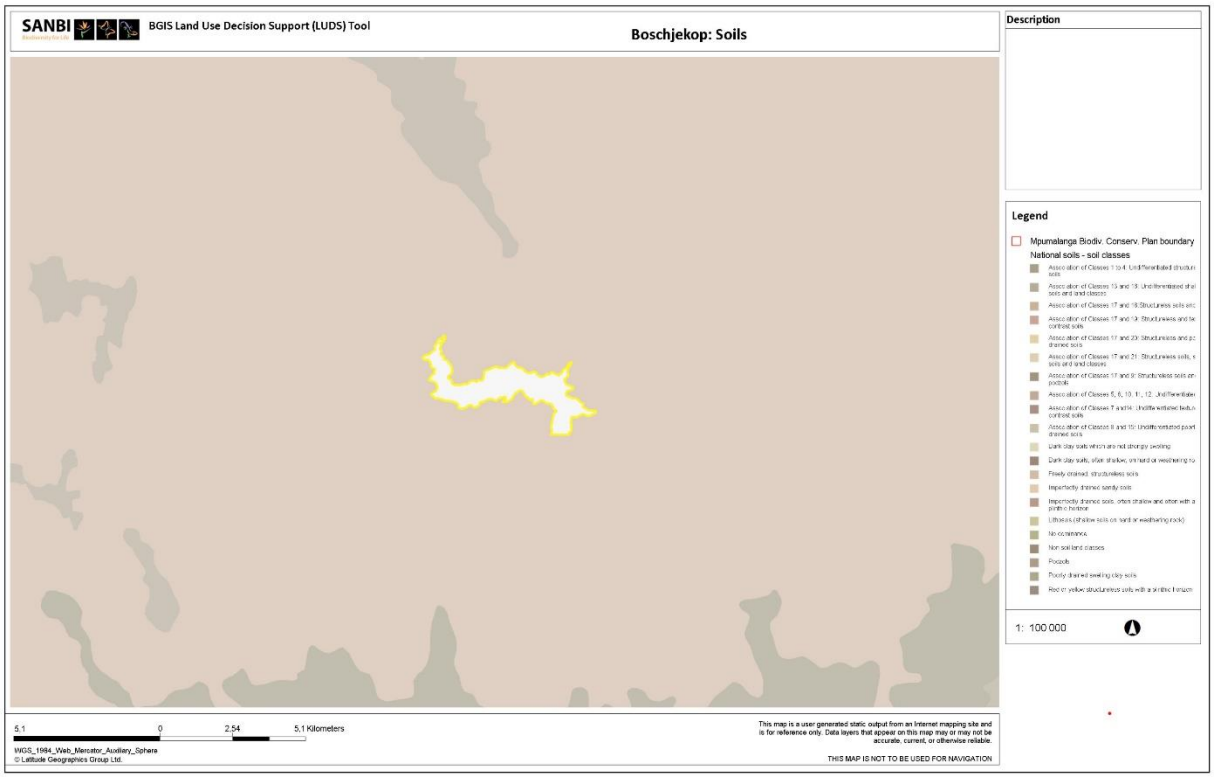


Figure 5-4: Boschjeskop Dam: Soils (MBSP)

5.5.3 Agricultural Sensitivity

The dam basin is characterized by High to Very High Agricultural Sensitivity Rating due to high land capability of the soils and the extent of existing agricultural activities (refer to **Figure 5-5**).

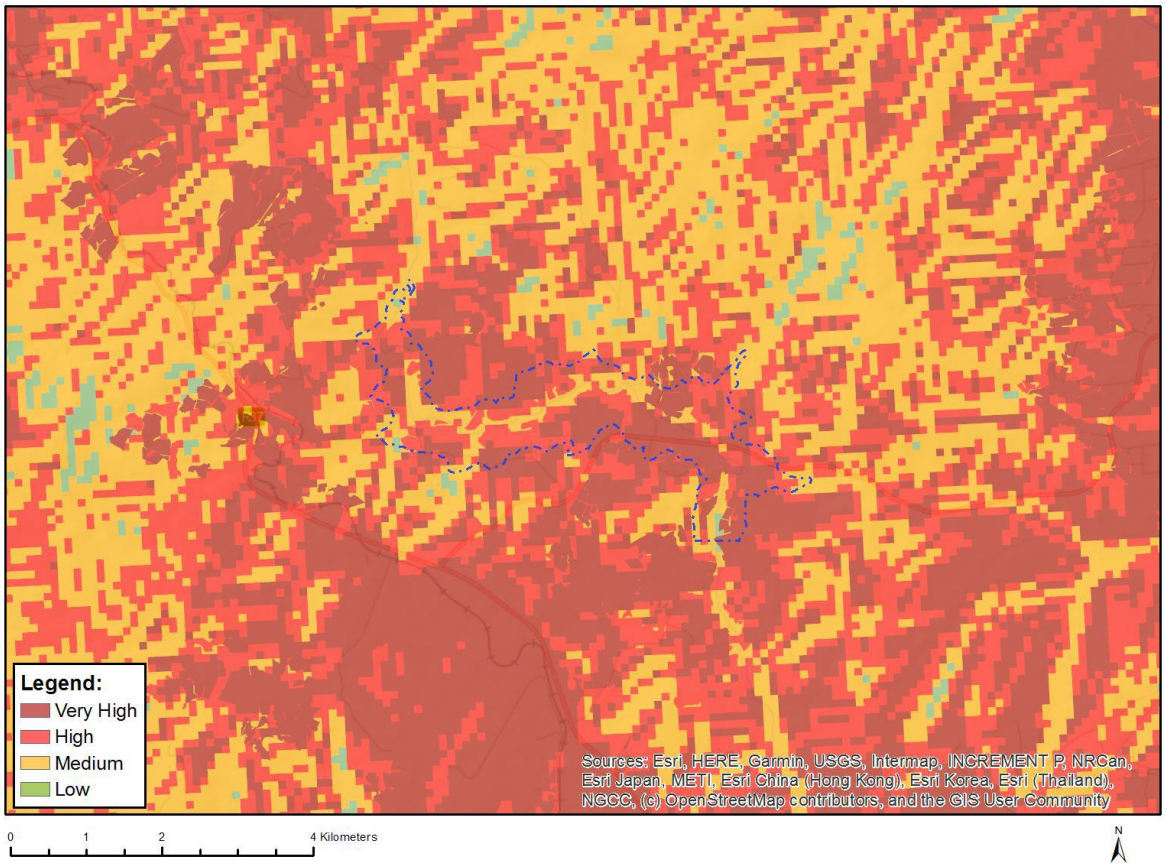


Figure 5-5: Boschjeskop Dam: Agricultural Sensitivity (DFFE Screening Tool)

5.6 Rivers and Wetlands

5.6.1 Strategic Water Source Areas

A small portion of the upper reaches of the dam basin is located within a SWSA as indicated on **Figure 5-6**. The catchments upstream of the proposed dam have been identified as SWSA.

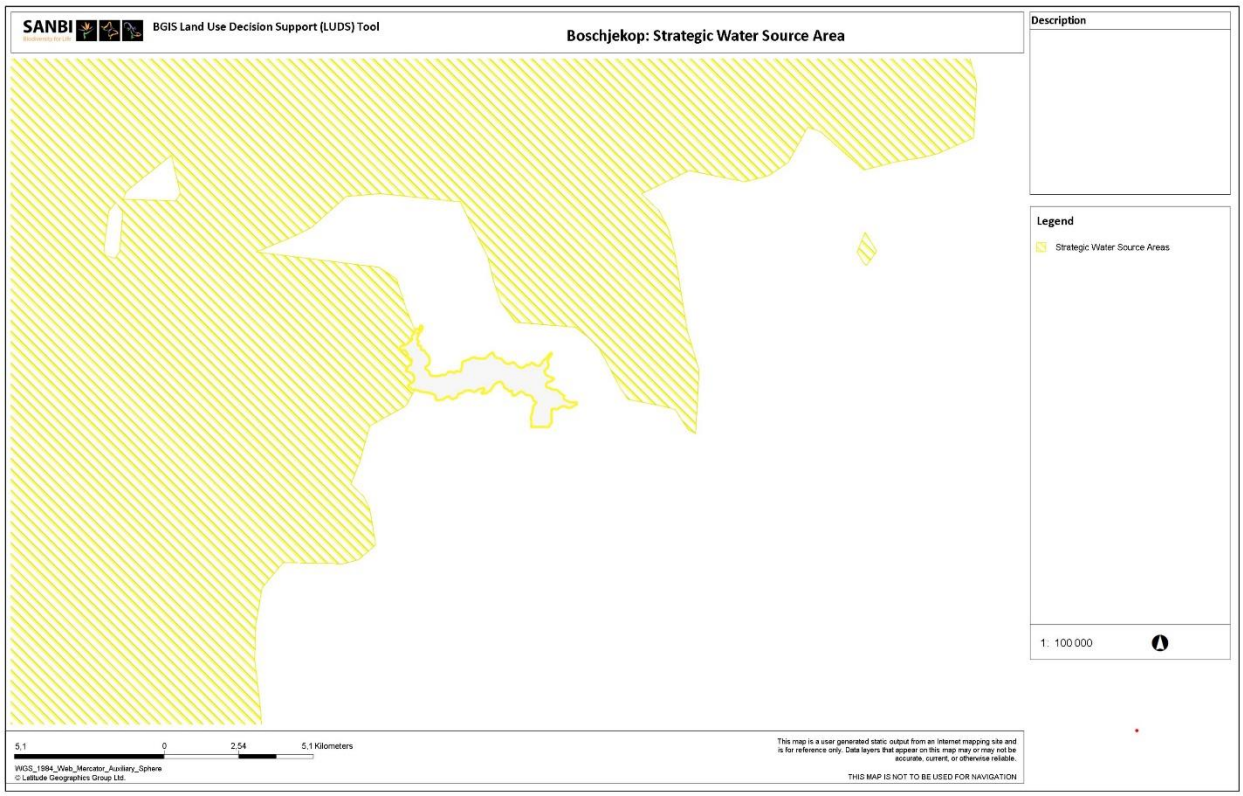


Figure 5-6: Boschjeskop Dam: Strategic Water Source Areas (MBSP)

5.6.2 NFEPA Rivers and Wetlands

The proposed Boschjeskop dam is located on the Nels River (Class C, Moderately modified). The Nels River has been designated as a Fish Support Area for CR and EN fish species. A FEPA wetland cluster is located to the southwest of the proposed dam but will not be directly impacted by the proposed development.

5.6.3 Water Quality

The proposed Boschjeskop Dam is in the Middle Crocodile sub-catchment and the 2021 water quality status report by the IUCMA shows the following with regard to compliance with the standards used (refer to **Table 2-1**), and as graphically depicted in **Appendix B**:

- pH levels throughout this sub-catchment complies with the TWQG;
- EC complies with the RQO (Aquatic Ecosystem drivers) throughout the sub-catchment;
- Average SO_4 concentration shows compliance with the TWQG (Industry: Category 1);
- NH_3 concentrations within the sub-catchment comply with the TWQG except the Gladdespruit and Besterspruit;
- Mn and As concentrations comply with the RQO;

- PO_4 concentrations complies with the RQO for most of the time except downstream of the White River and Kabokweni Water Treatment Works;
- Elevated *E. coli* levels above the RQO were observed for the sub-catchment, except at the Longmere Dam and Crocodile River at Karino (IUCMA, 2022).

The catchment therefore shows some indication of water quality impacts as a result of the land use activities.

5.7 Freshwater Ecosystems

5.7.1 Freshwater Ecosystems

Quaternary catchment X22F is expected to have a very high proportion of aquatic biota that is dependent on permanently flowing water during all phases of their life cycle, particularly *Opsaridium peringueyi, Chiloglanis bifurcus, Chiloglanis pretoriae, Amphilius uranoscopus* and *Barbus argenteus*. Two aquatic faunal species of conservation importance are known to occur within the area, namely *Chiloglanis bifurcus* (CR) and *Opsaridium peringueyi* (LC).

The catchment is known to have moderately diverse aquatic habitats (i.e., on a local scale), some of which are highly sensitive to flow-related and water quality changes, as well as providing important refuge for aquatic biota at a national scale. It is regarded as a moderately important link in terms of connectivity for the survival of biota (particularly eels and birds) upstream and downstream and is subsequently regarded as moderately sensitive to modification (DWA, 2008).

Migration of the catadromous *Anguilla mossambica,* as well as some potadromous species (specifically *Labeobarbus marequensis*) to the upper reaches of the Nels River will be impacted by the proposed dam. The catchment upstream of the dam is, however, a relatively small catchment (DWS, 2023).

5.7.2 Mpumalanga Biodiversity Sector Plan

A large portion of the dam basin is located within Freshwater ESA as indicated on **Figure 5-7** due to fish support function provided by the ecosystems.

Land use activities which are not consistent with keeping the natural habitat and biota in ESA important sub-catchments intact, are not preferrable in terms of the development guidelines contained in the MBSP (MTPA, 2014).

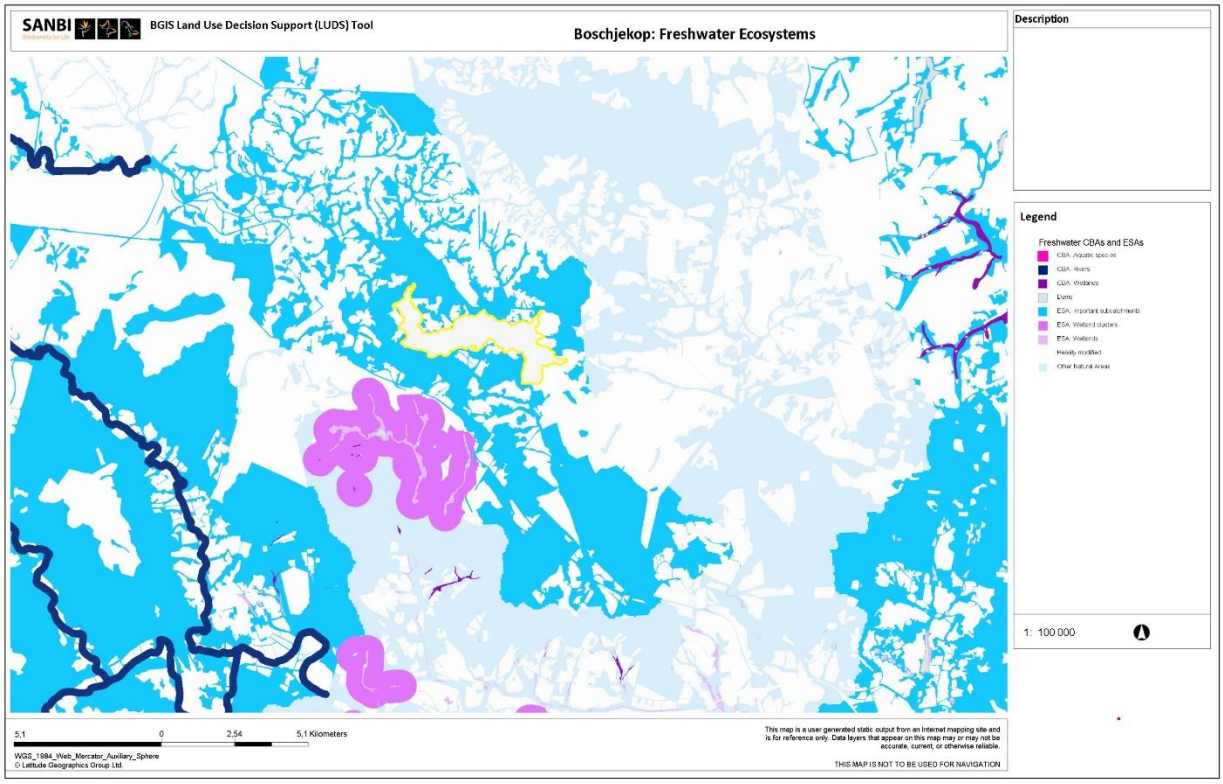


Figure 5-7: Boschjeskop Dam: Freshwater CBA Map (MBSP)

5.7.3 Aquatic Biodiversity Sensitivity Rating: DFFE Screening Tool

The largest portion of the dam basin has a Very High Aquatic Biodiversity Sensitivity Rating (refer to **Figure 5-8**) due to its proximity to a SWSA and fish support areas. The southern portion has a Low sensitivity rating.

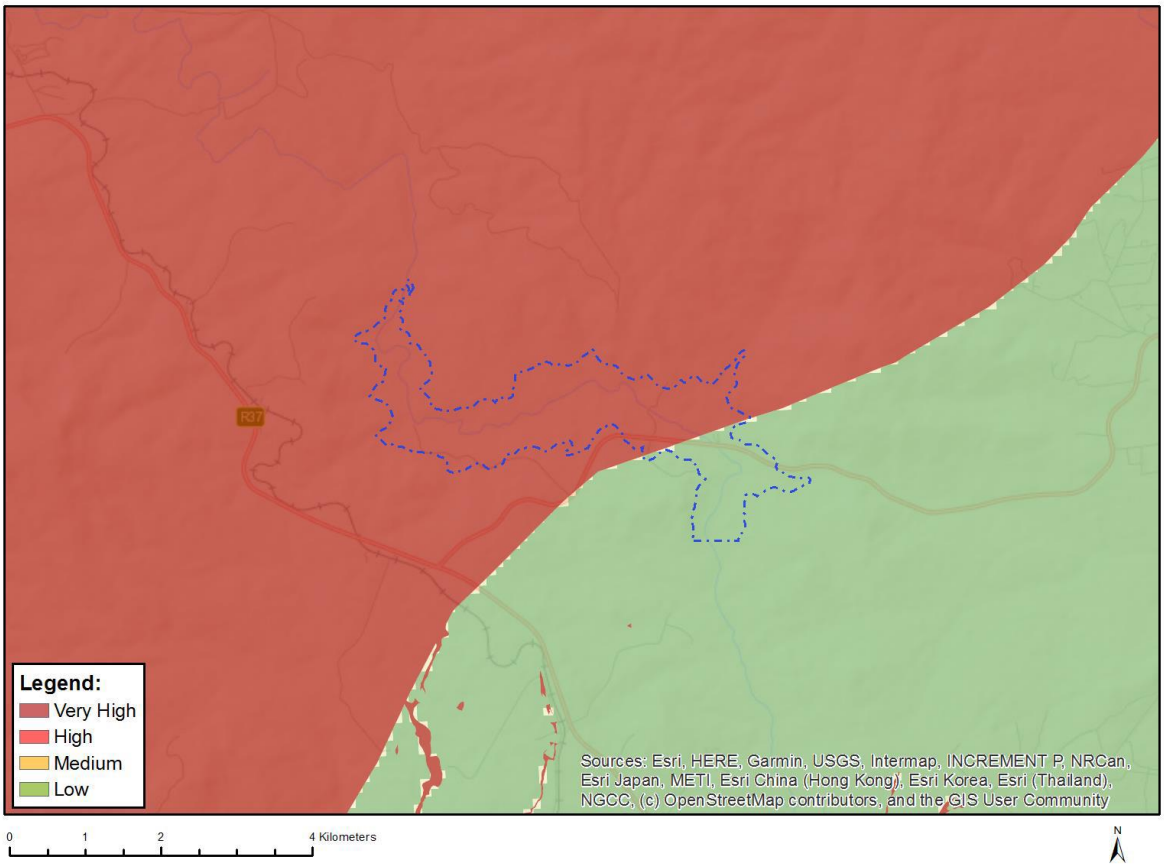


Figure 5-8: Boschjeskop Dam: Aquatic Biodiversity Sensitivity (DFFE Screening Tool)

5.8 Terrestrial Ecosystems

5.8.1 Flora

The proposed dam site is located within the Legogote Sour Bushveld vegetation unit of the Savanna Biome in the Lowveld Bioregion as indicated on **Figure 5-9**. To the north of the site, the vegetation type changes to the Northern Escarpment Quartzite Sourveld of the Grassland Biome in the Mesic Highveld Grassland Bioregion.

The Legogote Sour Bushveld has been identified as a Threatened Ecosystem (VU).

One floral species of conservation importance is potentially located within the area, namely *Aloe simii* (CR) (DWA, 2008).

In terms of the DFFE Screening Tool, the proposed dam basin has a Medium to Low Flora Species Sensitivity Rating as indicated on **Figure 5-10**. Reference is made to five sensitive plant species (VU, EN, CR) known or that could potentially be located within the dam basin.

To the north and west of the proposed dam, the vegetation type changes to Northern Escarpment Quartzite Sourveld.

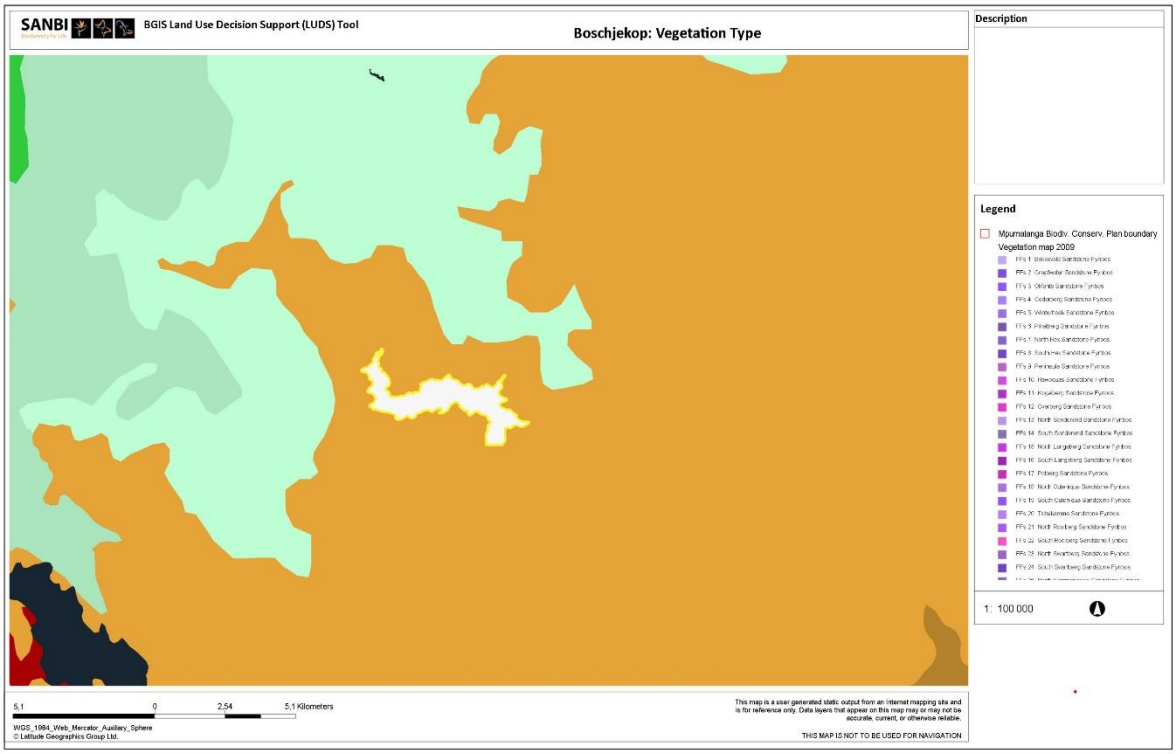


Figure 5-9: Boschjeskop Dam: Vegetation Types (MBSP)

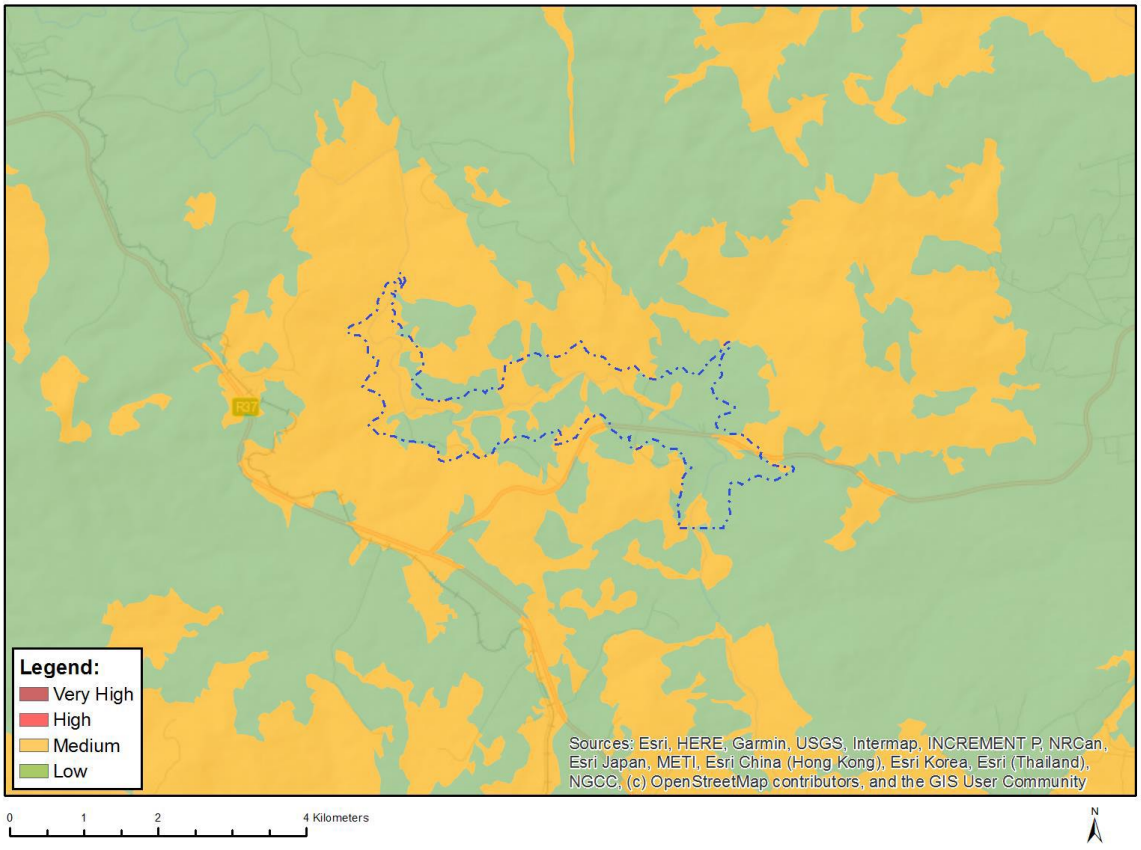


Figure 5-10: Boschjeskop Dam: Plant Species Sensitivity (DFFE Screening Tool)

5.8.2 Fauna

Six terrestrial faunal SCC importance are known to occur within the area:

- *Amblysomus hottentotus meesteri* (Meester's Golden Mole; VU),
- *Ephippiorhynchus senegalensis* (Saddle-billed Stork; CR),
- *Bucorvus leadbeateri* (Southern Ground Hornbill; VU),
- *Sarothrura affinis* (Striped Flufftail; VU),
- *Cordylus warreni barbertonensis* (Barberton Girdled Lizard; VU)
- *Platysaurus wilhelmi* (Wilhelm's Flat Lizard; VU) (DWA, 2008).

In terms of the DFFE Screening Tool, the proposed development site has a High Animal Species Sensitivity Rating (refer to **Figure 5-11**). Known and potential species identified for the area are shown in **Table 5-1**.

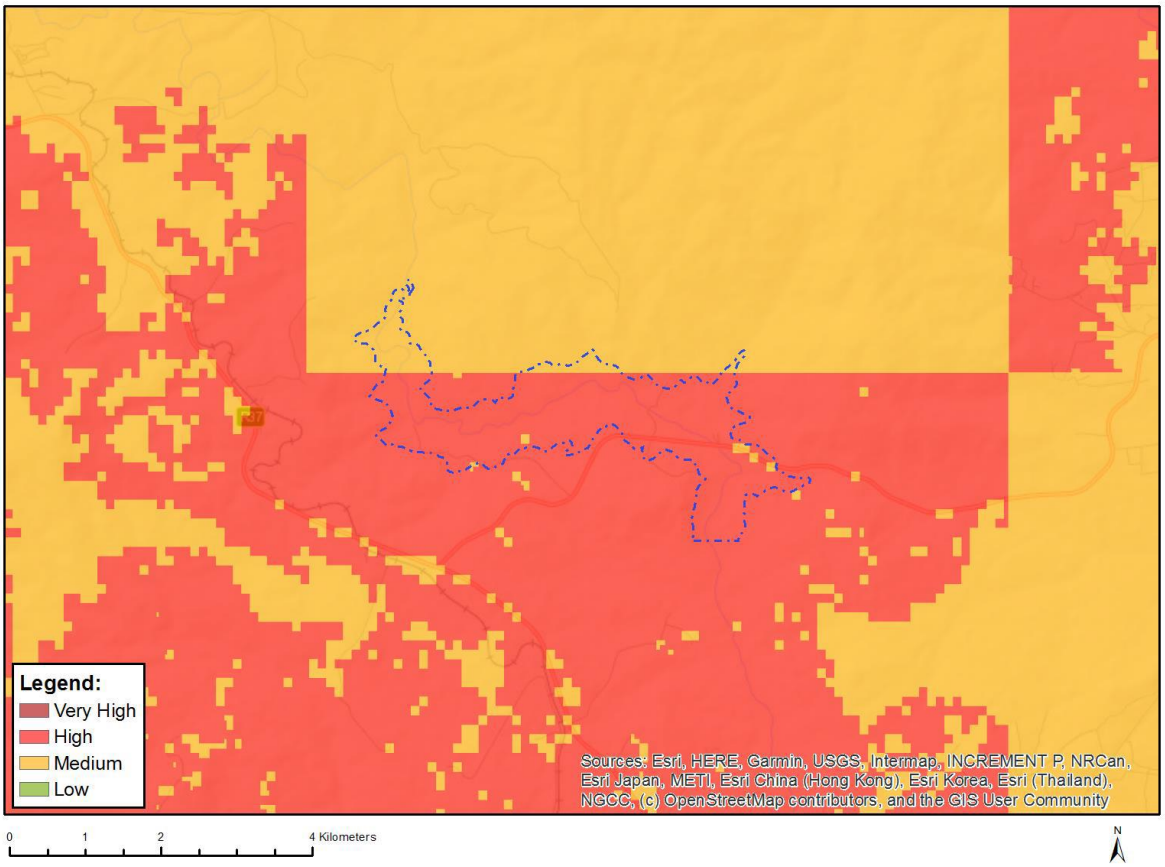


Figure 5-11: Boschjeskop Dam: Animal Species Sensitivity (DFFE Screening Tool)

Table 5-1: Boschjeskop Dam: Known and Potential Faunal Species (DFFE Screening Tool)

Class	Scientific Name	Common Name	Sensitivity (DFFE Screening Tool)	Conservation Status
Aves	*Geronticus calvus*	Southern bald ibis	High	VU
	Stephanoaetus coronatus	Crowned eagle	High	NT
	Podica senegalensis	African finfoot	Medium	LC
	Sagittarius serpentarius	Secretary bird	Medium	EN
	Geronticus calvus	Southern bald ibis	Medium	VU
	Aquila rapax	Tawny eagle	Medium	LC
Mammalia	*Cercopithecus albogularis schwarzi*	Samango monkey	Medium	EN
	Chrysospalax villosus	Rough-haired golden mole	Medium	VU
	Crocidura maquassiensis	Makwassie Musk Shrew	Medium	VU
	Dasymys robertsii	Robert's shaggy rat	Medium	NT
	Lycaon pictus	African wild dog	Medium	EN
	Ourebia ourebi ourebi	Oribi	Medium	LC
Invertebrate	*Thoracistus jambila*	Jambila Seedpod Shieldback	Medium	EN
Insecta	*Lepidochrysops irvingi*	Irving's blue butterfly	Medium	

5.8.3 Mpumalanga Biodiversity Sector Plan

The dam basin is located in areas categorized as ONA, Heavily or moderately modified and CBA Optimal (refer to **Figure 5-12**). The CBA Optimal area (~ 88 ha) is located almost centrally in the dam basin and extends to the north beyond the area to be inundated. This CBA area is associated with the watercourse and unmodified habitat. No specific SCC are associated with this CBA Optimal area (M. Lőtter, 2023, personal communication).

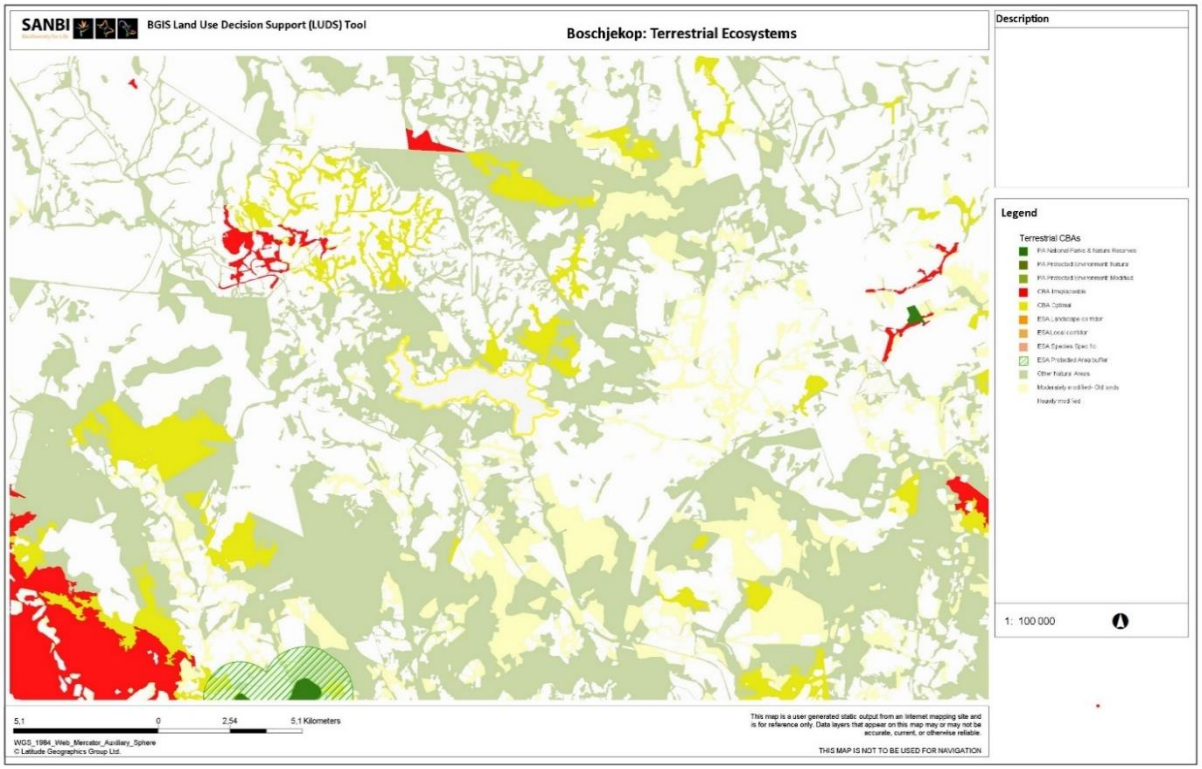


Figure 5-12: Boschjeskop Dam: Terrestrial CBA Map (MBSP)

5.8.4 Protected Areas

The proposed dam is not located within, or close to any Protected Areas or areas identified within the NPAES (see **Figure 5-13**). The area of potential dam development is however adjacent to the Wolkberg Centre of Endemism (DWA, 2008).

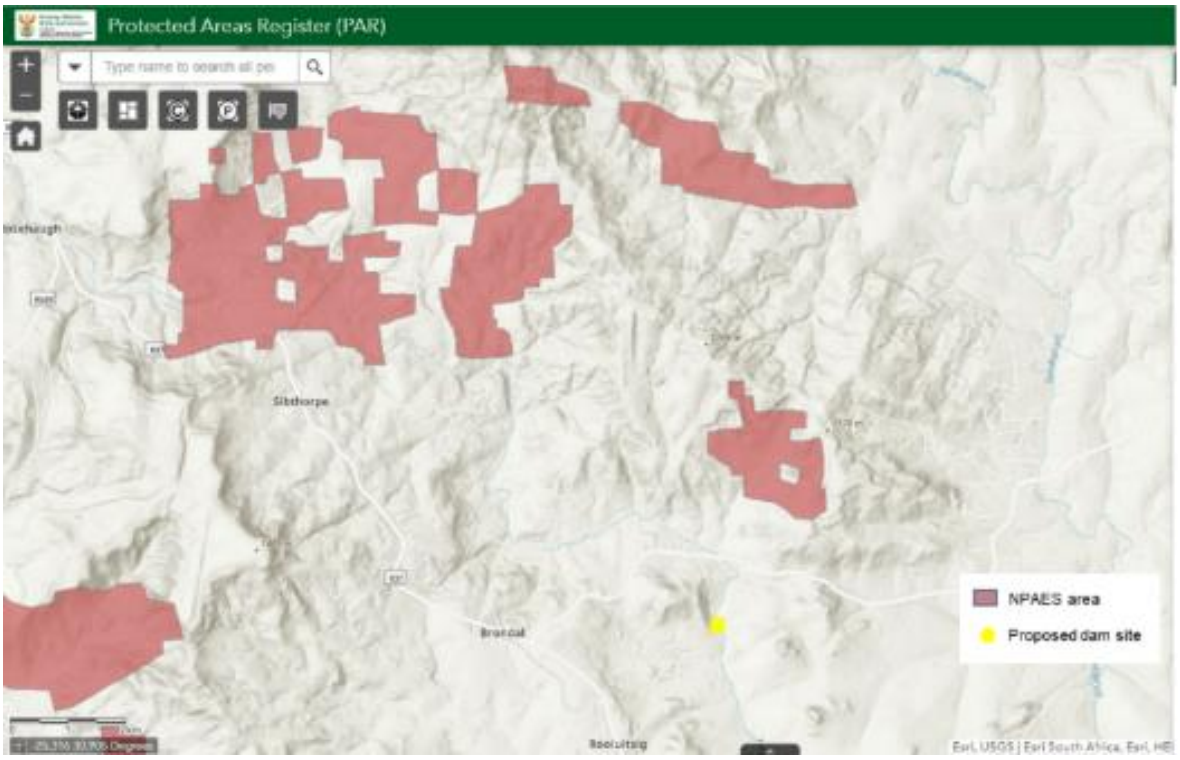


Figure 5-13: Boschjeskop Dam: Protected Areas and Protected Areas Expansion Strategy (DFFE Protected Areas Register Interactive Map Viewer, accessed 15 April 2023)

5.8.5 Terrestrial Biodiversity Sensitivity Rating: DFFE Screening Tool

The proposed development site has a Very High Terrestrial Biodiversity Sensitivity Rating using the DFFE Screening Tool as a result of CBA (refer to **Figure 5-14**), proximity to SWSA and the fact that it is located within a vulnerable ecosystem as discussed in the preceding sections.

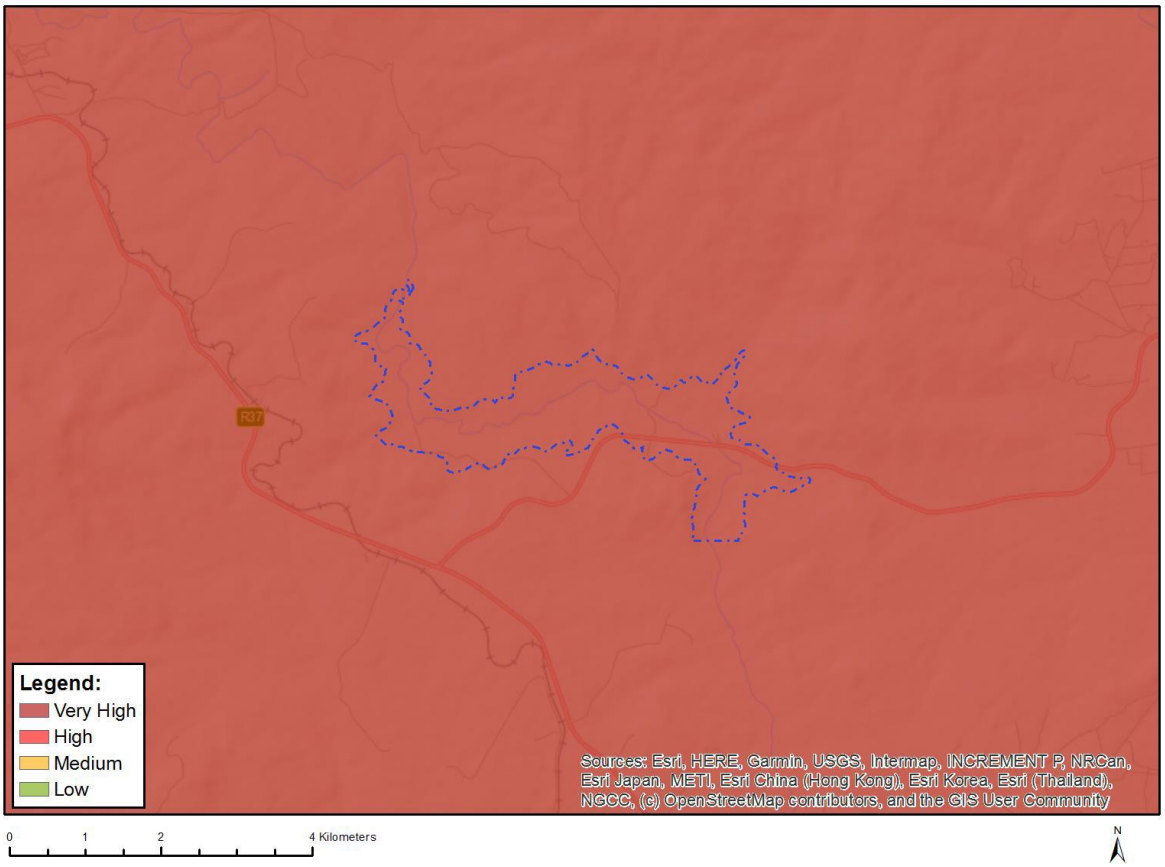


Figure 5-14: Boschjeskop Dam: Terrestrial Biodiversity Sensitivity (DFFE Screening Tool)

5.9 Archaeological and Heritage

In terms of the DFFE Screening Tool, the proposed dam basin and surrounding area has a Low sensitivity rating (see **Figure 5-15**). This is based on the Archeological and Heritage information informing the DFFE screening tool.

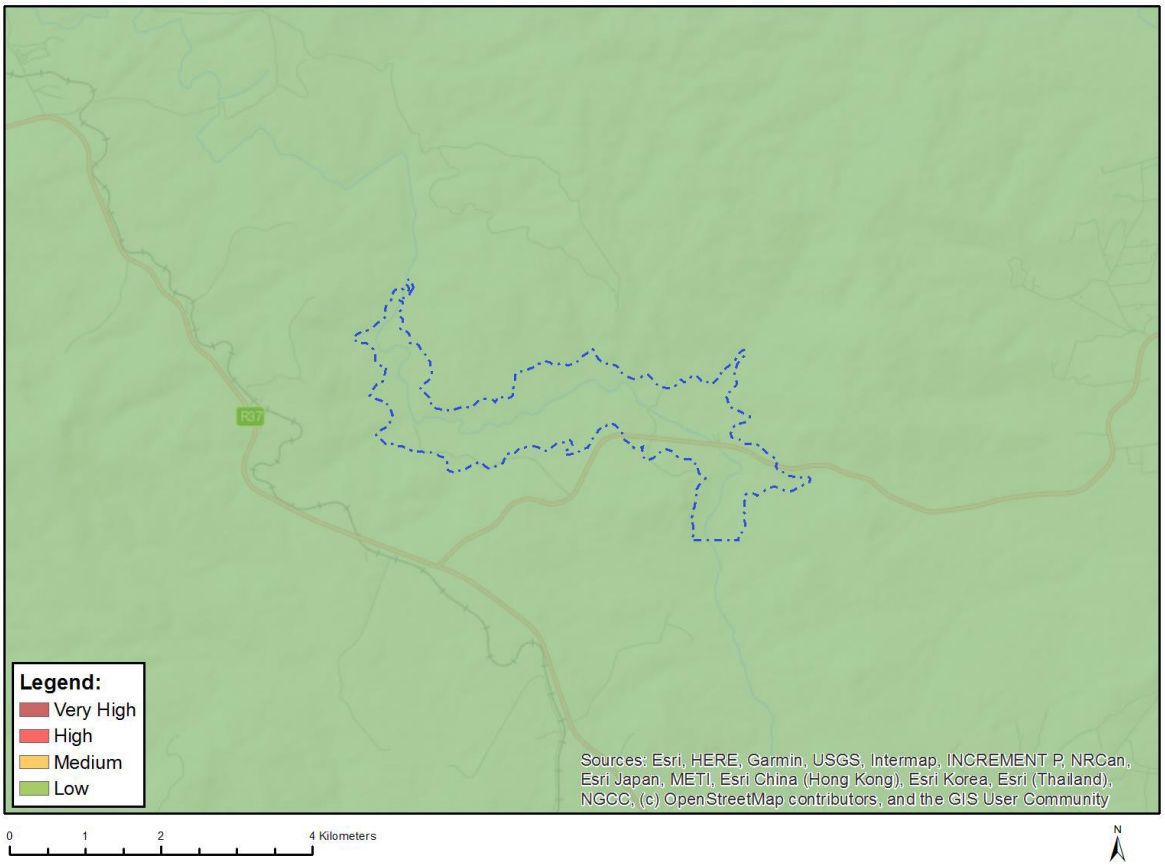


Figure 5-15: Boschjeskop Dam: Archaeological and Heritage Sensitivity (DFFE Screening Tool)

6 STRATHMORE DAM: AFFECTED ENVIRONMENT

6.1 Locality

The proposed off-channel dam is located on the southern side of the N4 national highway, approximately halfway between Kaapmuiden and Malelane in the Nkomazi LM. The dam is to be constructed in a range of hills aligned more-or-less east-west and parallel to the N4 highway. The dam will require at least two separate dam walls.

The approximate co-ordinates of the proposed Strathmore Off-Channel Dam are Latitude 25°36'45" and Longitude 31°16'15", and for the second dam wall are Latitude 25°32'07" and Longitude 31°25'31" (refer to **Figure 6-1**).

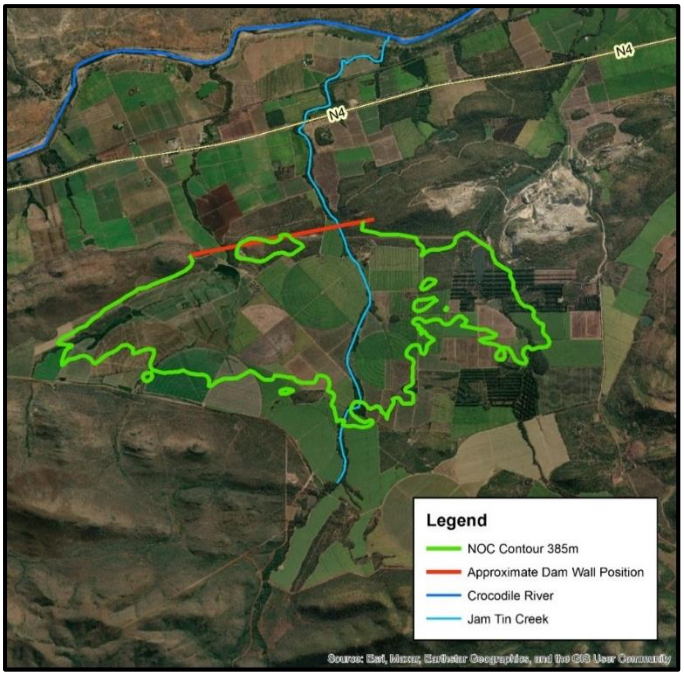


Figure 6-1: Strathmore Dam: Locality

The absence of a visible rock outcrop at the western site implies an embankment dam is best suited. A dam with a height of 32 to 42 m (to FSL) is envisaged. The storage capacity of the dam will vary between 59.1 and 113.8 million m³. For a dam with a height of 22 to 32 m, the optimum yield will vary from 38.5 to 76.0 million m³/a, for pumping rates of 1.43 to 4.44 m³/s.

It should be noted that Phase 1 Pre-feasibility investigations have since shown that this option will likely include an abstraction weir of approximately 4 m high. The Environmental Screening was undertaken before this was introduced and therefore does not take this aspect into account.

6.2 Topography

The proposed dam will be located in a range of hills aligned approximately east – west and parallel to the N4. Construction of two separate dam walls will be required, with the two sites roughly symmetrical. The flanks on the westernmost site are more gently sloping than the easternmost site where the flanks are steep (DWA,2008). A general topographical view of the proposed dam location is shown in **Figure 6-2**.

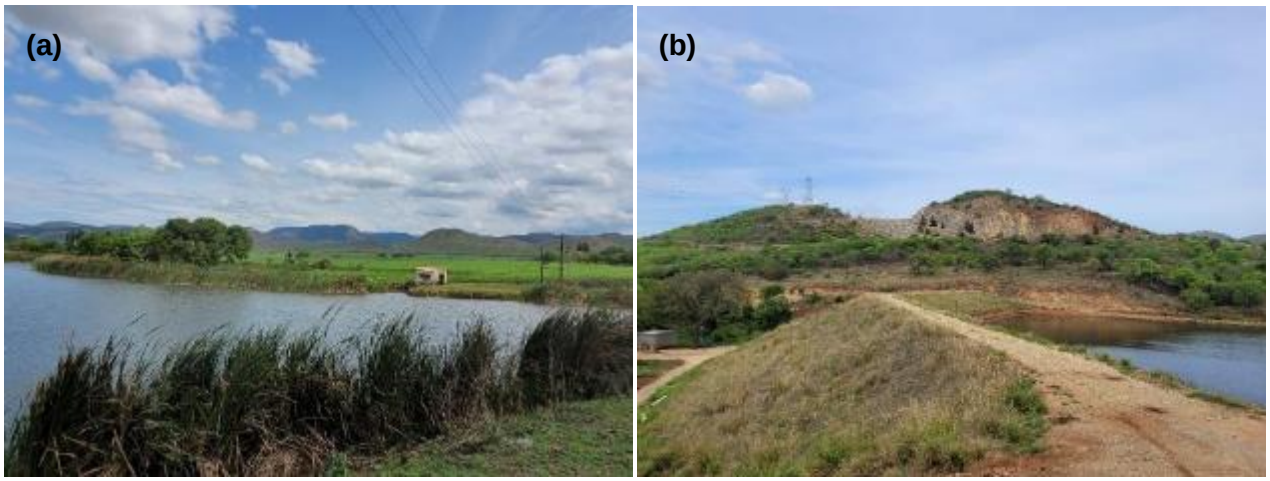


Figure 6-2: Strathmore Dam: (a) Topographical View towards Southwest showing existing farm dam and (b) View towards East with Magnesite Mine in background and existing farm dam in foreground

6.3 Climate

The dam is located within the summer rainfall region, with rainfall normally from October to March. The area has a MAP of 800 – 1 000 mm and MAE of MAE 1 400 – 1 500 mm (DWA 2008).

6.4 Geology

The centrelines are underlain by undifferentiated schists, volcanics, banded ironstones, chert and lavas of the Onverwacht Group, Barberton Supergroup. The range of hills in which the proposed dam walls will be located is associated with economic magnesite deposits. The Strathmore Magnesite Mine is located directly to the east of the proposed dam.

Bedrock outcrop is almost entirely absent on the westernmost site, with the exception of a singular area of scattered outcrop identified. Alluvial deposits are expected to underlie the central portion but the thickness of these sediments is not known (DWA, 2008).

The central portion of the easternmost centreline is also covered by alluvial deposits which are presumably of substantial thickness (potentially 15 – 20 m). Alluvial deposits appear to

comprise both coarse and fine fractions. No outcrop was observed during previous investigations. Although bedrock occurs at shallow depths, the bedrock conditions in terms of weathering and degree of jointing was not confirmed during previous investigations (DWA, 2008).

6.5 Soil, Land Use, Land Capability and Agricultural Potential

6.5.1 Land Use

The proposed dam basin is largely within cultivated area (sugarcane and fruit) (refer to **Figure 6-3**). The Strathmore Magnesite Mine is located directly to the east of the proposed dam. The N4 highway is located approximately 1.4 km to the north. Limited unmodified areas are located directly to the northeast and northwest of the proposed dam basin.

Other infrastructure to be inundated include gravel roads, three farm dams, powerlines, irrigation systems and various other structures associated with the farming activities (homesteads, workshops, stores etc.).

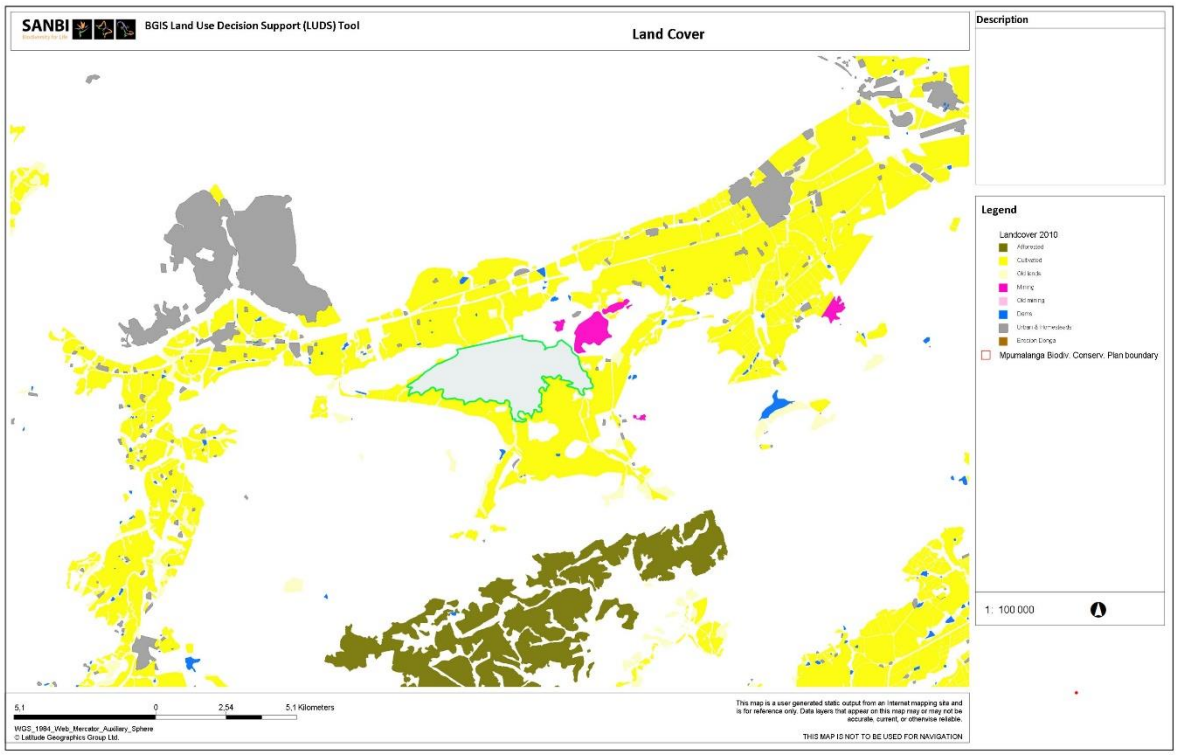


Figure 6-3: Strathmore Dam: Land Cover (MBSP)

6.5.2 Soil

The proposed dam basin is characterized by well drained, dark reddish soils having a pronounced shiny, strong blocky structure (nutty), usually fine (red structured soils). In addition, one or more of vertic and melanic soils may be present (refer to **Figure 6-4**).

In the surrounding areas, soils with minimal development are present, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime is generally present in part or most of the landscape.

Soil within the dam basin is classed as freely drained and structureless.

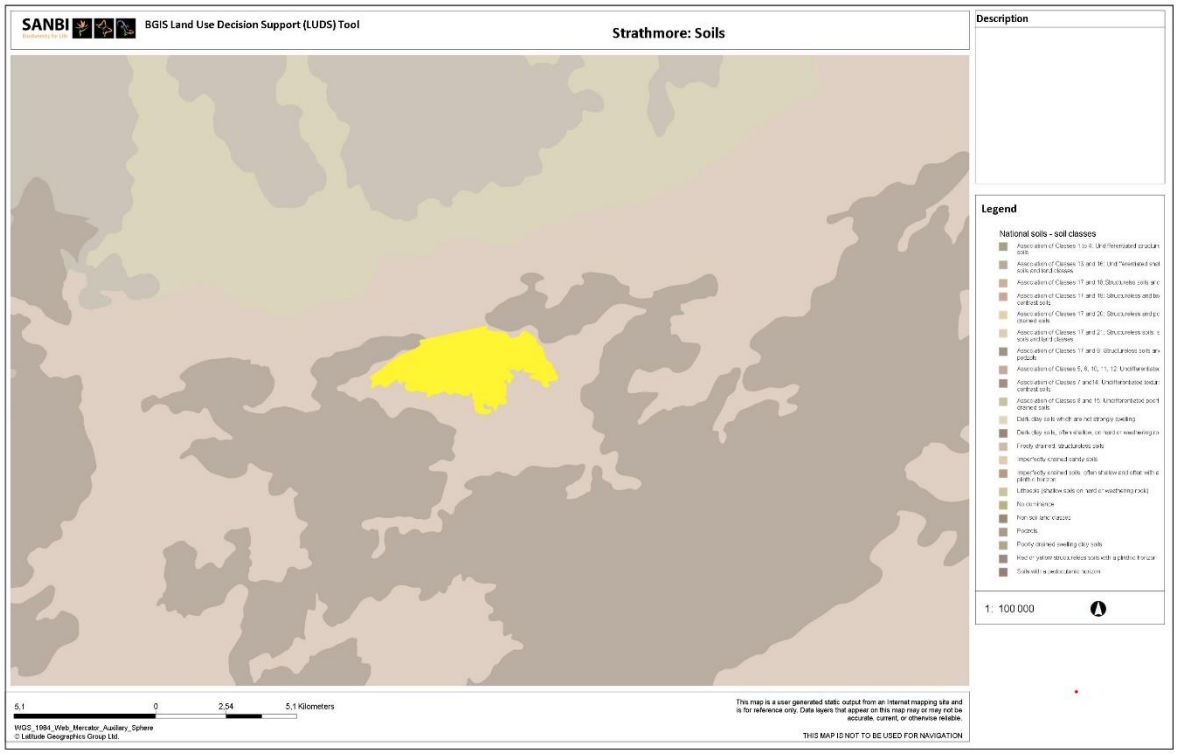


Figure 6-4: Strathmore Dam: Soils (MBSP)

6.5.3 Agricultural Sensitivity

The largest part of the dam basin is rated as High or Very High sensitivity due to soils with a land capability rating and the extent of current agricultural activities as shown in **Figure 6-5**.

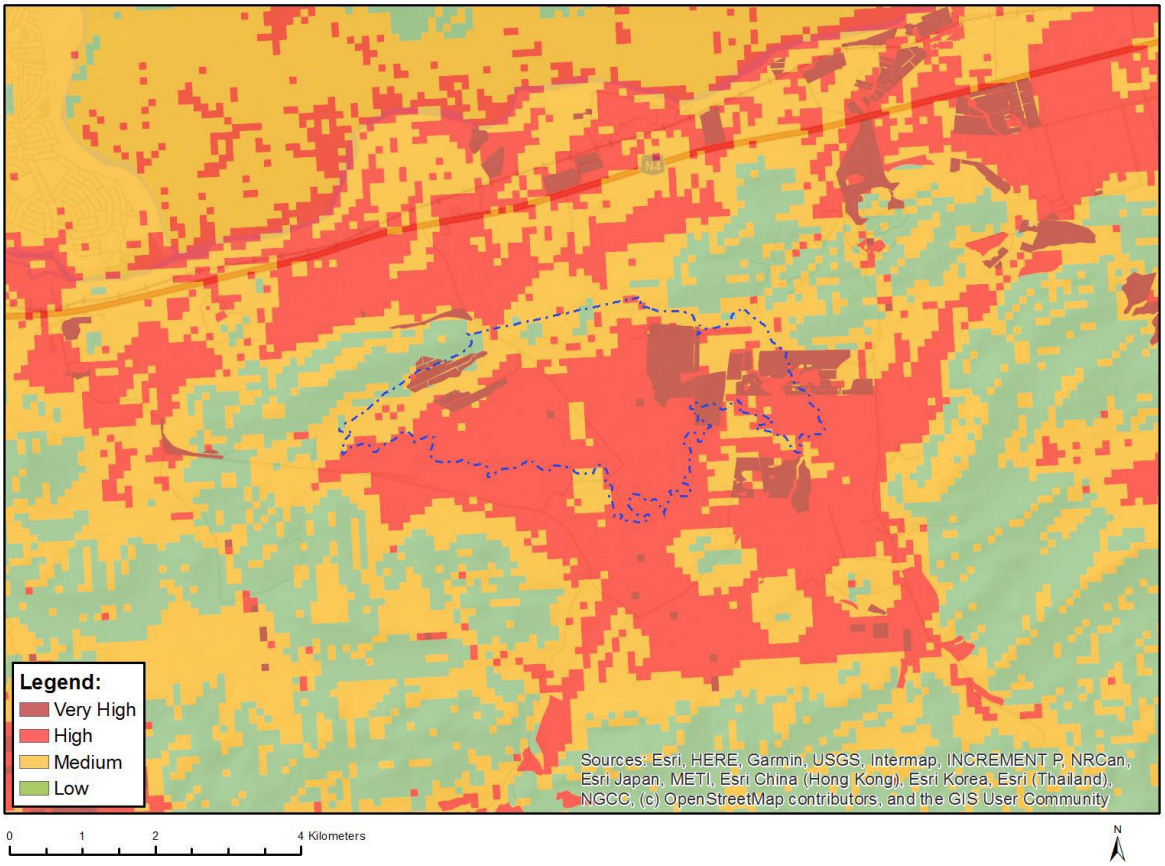


Figure 6-5: Strathmore Dam: Agricultural Sensitivity (DFFE Screening Tool)

6.6 Rivers and Wetlands

6.6.1 Strategic Water Source Areas

The proposed dam is not located within a SWSA, but some SWSA are located around the proposed site, some notably associated with the Kaalrug Mountainlands ecosystem to the south (refer to **Figure 6-6**). No impacts are expected on these areas as a result of the proposed development.

Figure 6-6: Strathmore Dam: Strategic Water Source Areas (MBSP)

6.6.2 NFEPA Rivers and Wetlands

Jam Tin Creek is designated as a Fish Support Area and the Crocodile River is located < 2 km north of the proposed dam (Class C, Moderately modified) and is designated as a FEPA river. A number of wetlands are located in the vicinity of the proposed, none of which is designated as FEPA wetlands.

6.6.3 Water Quality

The proposed Strathmore off-channel Dam is in the Lower Crocodile sub-catchment and the 2021 water quality status report by the IUCMA shows the following with regard to compliance with the standards used (refer to **Table 2-1**), and as graphically depicted in **Appendix B**:

- pH levels throughout this sub-catchment complies with the TWQG;
- EC does not comply with the RQO (Aquatic Ecosystem drivers) in some areas of the sub-catchment, including downstream of the Kabokweni wastewater treatment works (WWTW), a tributary of the Crocodile River at Tenbosch, Hectorspruit upstream and downstream of the Hectorspruit WWTW, and the tributary downstream of the Komati WWTW;
- Average SO_4 concentration shows non-compliance with the TWQG (Industry: Category 1);

- NH_3 concentrations within the sub-catchment comply with the TWQG except the Hectorspruit and an unnamed tributary downstream of the Komatipoort WWTW and a tributary of the Gutshwa River downstream of the Kabokweni WWTW;
- Mn concentrations with the RQO except on an unnamed tributary downstream of the Komatipoort WWTW;
- PO_4 concentrations complies with the RQO except downstream of the Komatipoort WWTW, as well as upstream and downstream of the Hectorspruit WWTW;
- Elevated *E. coli* levels above the RQO were observed for the sub-catchment (IUCMA, 2022).

No information available for Arsenic concentrations for the Lower Crocodile sub-catchment in the 2021 Annual Report. Water quality shows impacts associated with the land use activities.

6.7 Freshwater Ecosystems

6.7.1 Freshwater Ecosystems

The proposed dam's outlet will be on Jam Tim Creek, a drainage line which is not a significant resource (DWS, 2023).

The catchment is known to have a high diversity of aquatic habitats (rated at a provincial/regional scale), some of which are highly sensitive to flow-related and water quality changes during certain seasons, as well as providing important refuge for aquatic biota at a provincial/regional scale. Approximately 20 species of fish have been recorded. The catchment also provides an important link in terms of connectivity for the survival of biota (particularly eels) upstream and downstream and is subsequently regarded as sensitive to modification (DWA, 2008).

It is expected that a very high proportion of aquatic biota that is dependent on permanently flowing water during all phases of their life cycle will be present in the catchment. Specifically, *Opsaridium peringueyi, Chiloglanis swierstrai, Chiloglanis pretoriae* and *Barbus eutaenia*. One aquatic faunal species of conservation importance is known to occur within the area, namely *Opsaridium peringueyi* (Southern Barred Minnow; LC) (DWA, 2008).

Anguilla mossambica (NT) and *Oreochromis mossambicus* (VU) are present, but no notable impact expected (DWS, 2023).

6.7.2 Mpumalanga Biodiversity Sector Plan

A portion of the dam basin and the unmodified surrounding areas have been categorized as ESA due to the fish support function provided by these areas (refer to **Figure 6-7**).

Land use activities which are not consistent with keeping the natural habitat and biota in ESA important sub-catchments intact, are not acceptable in terms of the development guidelines contained in the MBSP (MTPA, 2014).

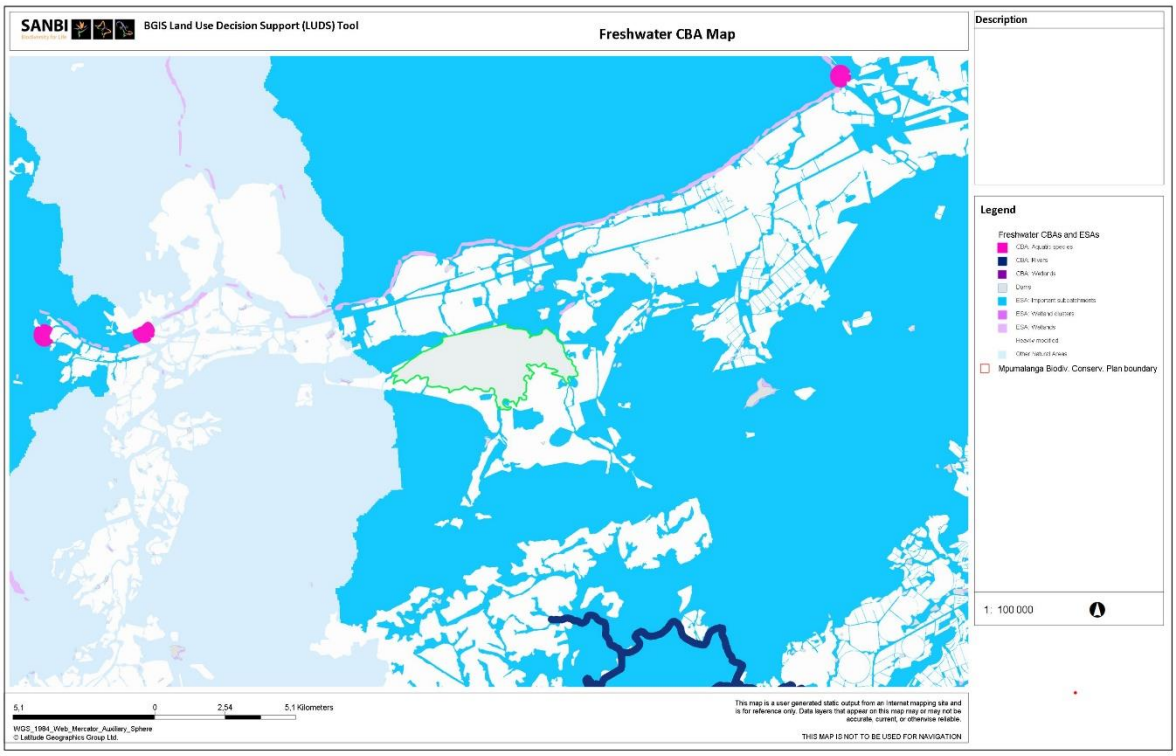


Figure 6-7: Strathmore Dam: Freshwater CBA Map (MBSP)

6.7.3 Aquatic Biodiversity Sensitivity Rating: DFFE Screening Tool

The southern sections of the dam basin are rated as Very High sensitivity due to wetlands and its proximity to SWSA (refer to **Figure 6-8**).

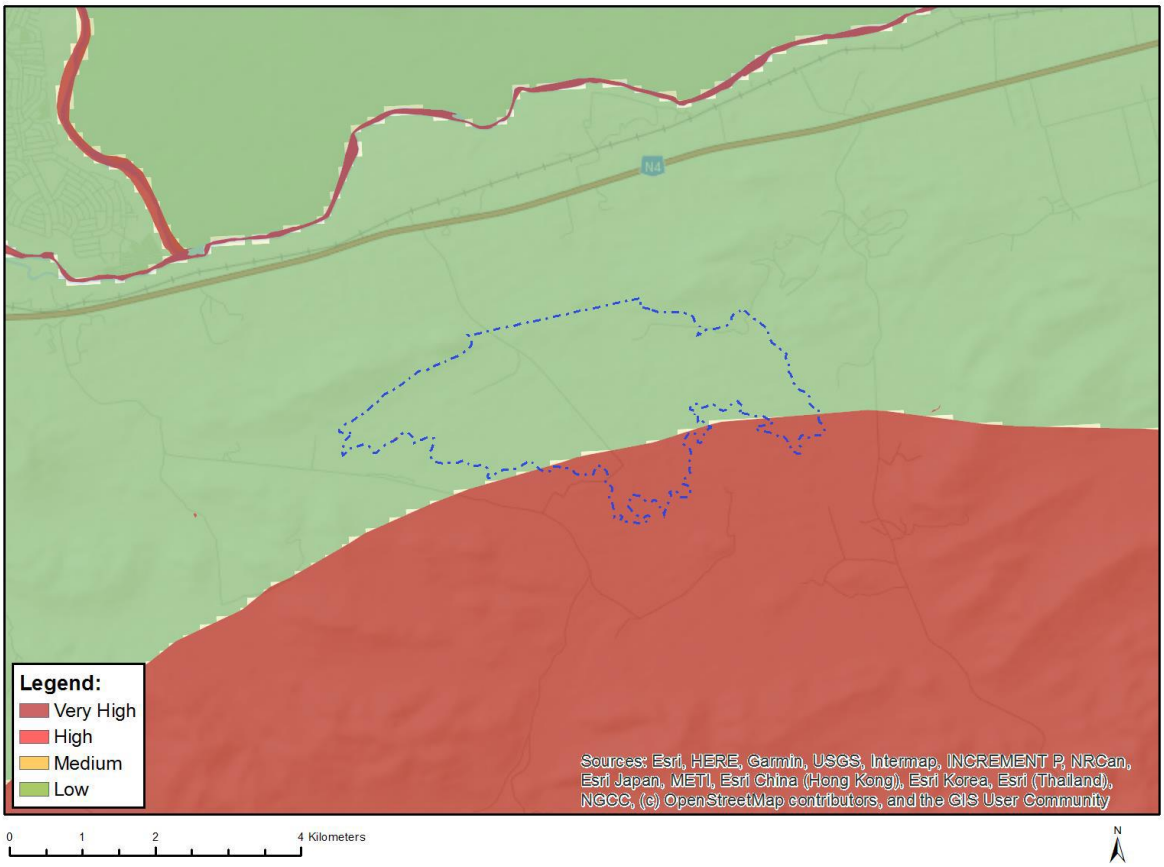


Figure 6-8: Strathmore Dam: Aquatic Biodiversity Sensitivity (DFFE Screening Tool)

6.8 Terrestrial Ecosystems

6.8.1 Flora

The proposed dam site is located within the Kaalrug Mountain Bushveld of the Savanna Biome in the Lowveld Bioregion as indicated on **Figure 6-9**. Directly to the north of the dam basin the vegetation type changes to Barberton Serpentine Sourveld. A portion of dam basin to south also extends into this vegetation type.

The proposed dam basin not located within threatened ecosystem (refer to **Figure 6-10**). The Kaalrug Mountainlands threatened ecosystem (VU) is located < 2 km to the south of the proposed dam basin. The Crocodile Gorge Granite Mountainlands threatened ecosystem (VU) is located further away to the northwest of the proposed dam basin.

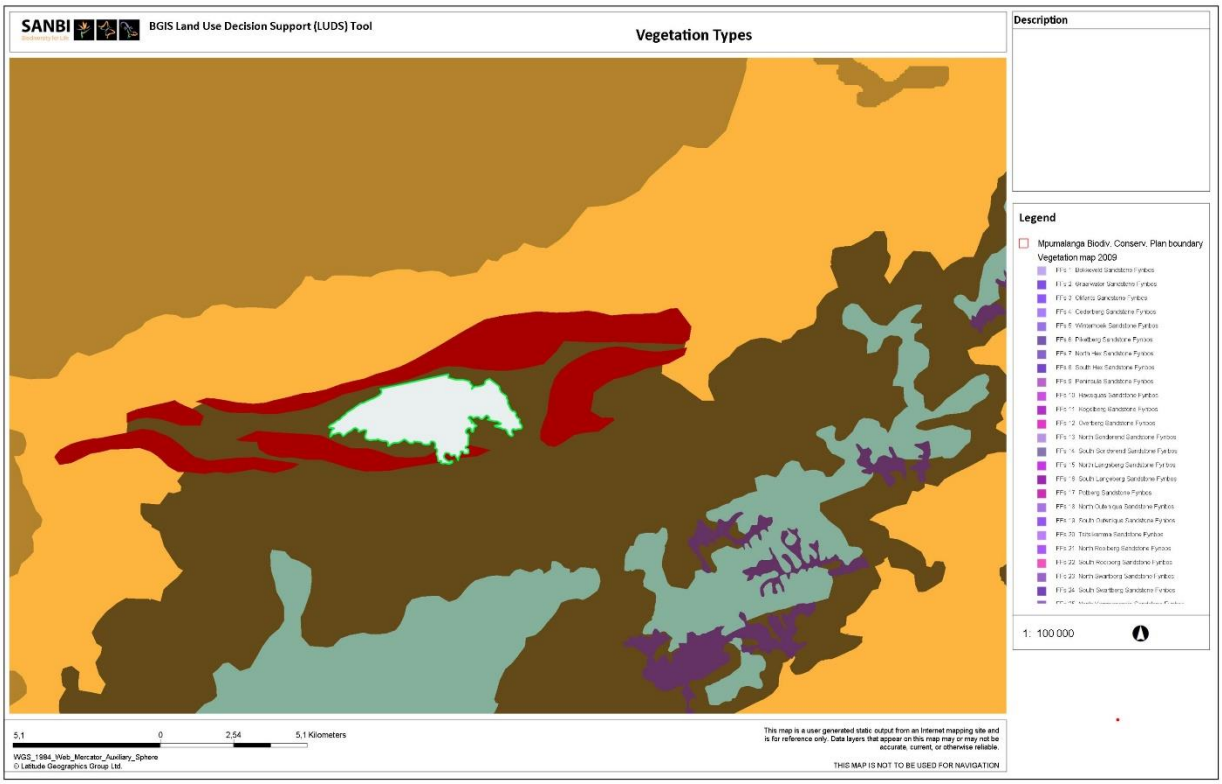


Figure 6-9: Strathmore Dam: Vegetation Types (MBSP)

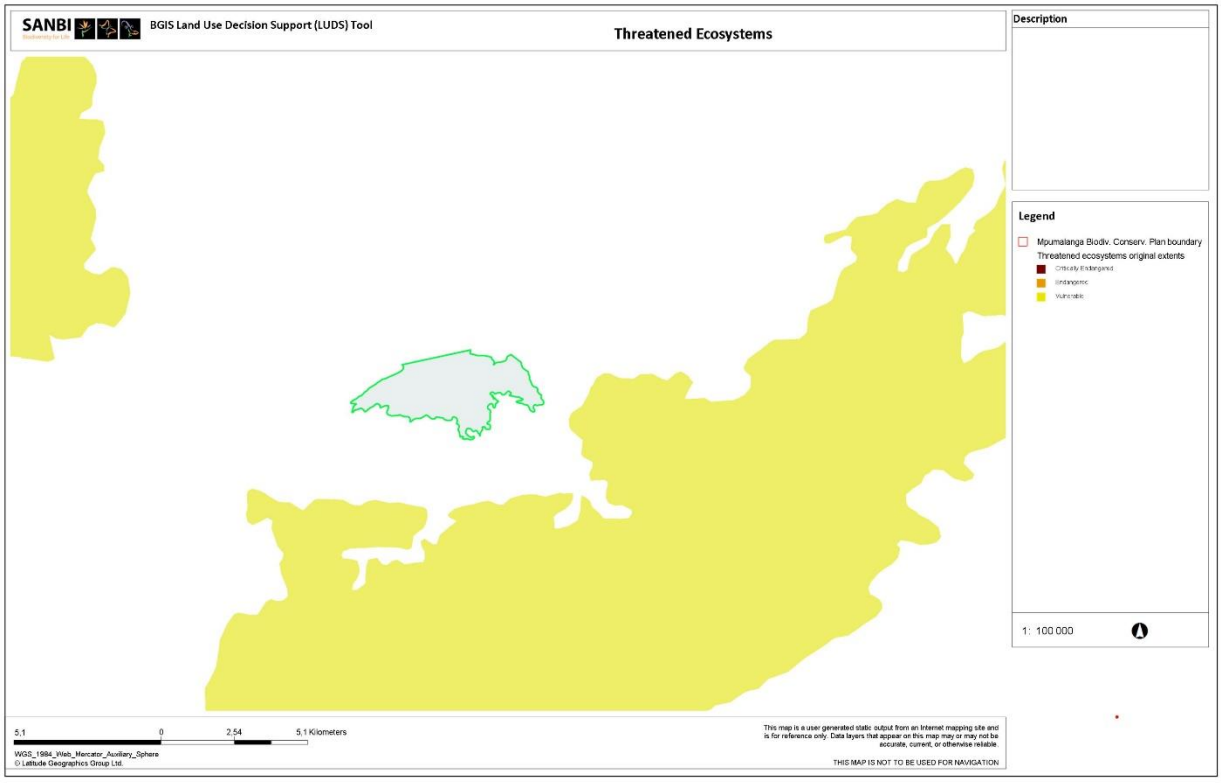


Figure 6-10: Strathmore Dam: Threatened Ecosystems (MBSP)

In terms of the DFFE Screening Tool, the dam basin is largely located in areas with Low sensitivity rating, with some areas to the north, east and west with Medium sensitivity rating.

Known and potential species identified for the area includes *Macledium zeyheri* subsp. *thyrsiflorum* (VU), as well as two Sensitive plant species with conservation status of VU and EN.

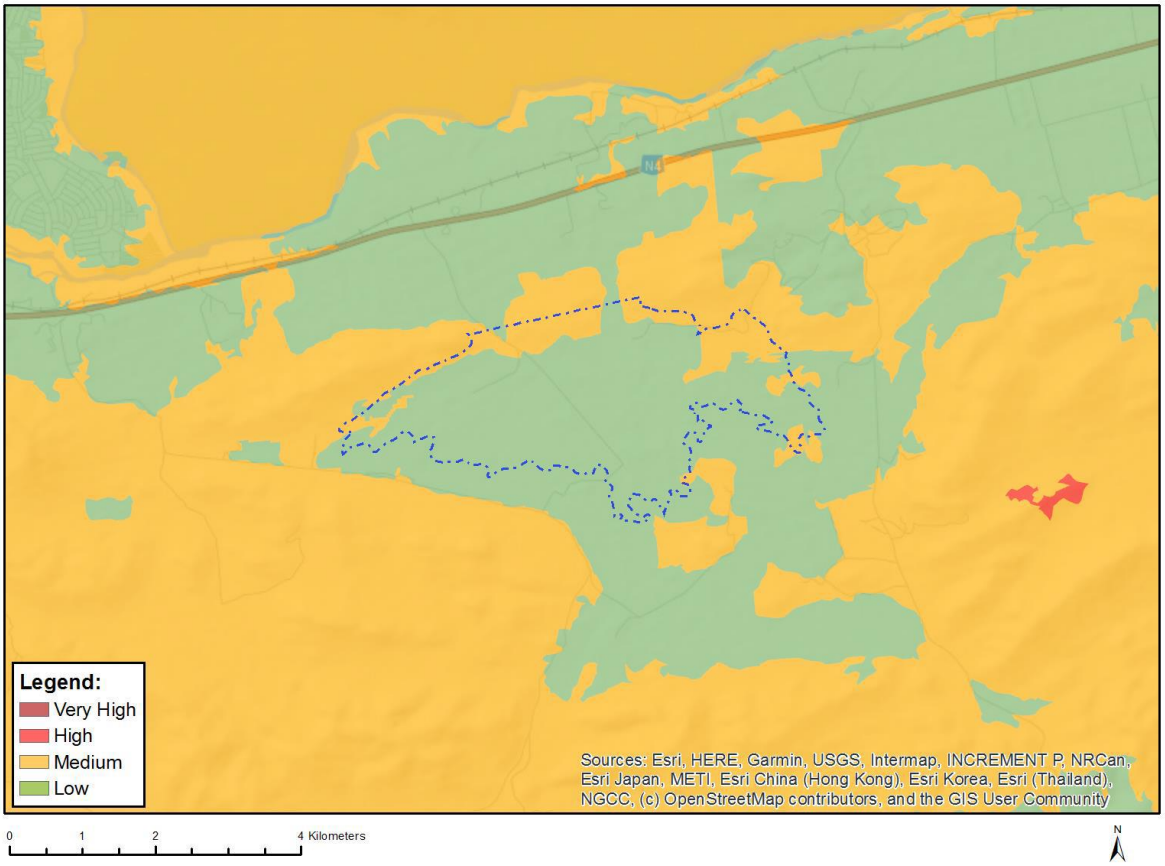


Figure 6-11: Strathmore Dam: Plant Species Sensitivity (DFFE Screening Tool)

6.8.2 Fauna

In the 2001 assessment of this dam option, three faunal SCC were indicated to occur within the area:

- *Ephippiorhynchus senegalensis* (Saddle-billed Stork; CR),
- *Bucorvus leadbeateri* (Southern Ground Hornbill; VU),
- *Aspedilaps scutatus intermedius* (Lowveld Shieldnose Snake; VU) (JIBS, 2001b).

Due to the age of these studies and the level of assessment undertaken at the time, the presence of these species needs to be confirmed.

In terms of the DFFE Screening Tool, the proposed development site has a HIGH Animal Species Sensitivity Rating as indicated in **Figure 6-12**. Known and potential species identified for the area are shown in **Table 6-1**.

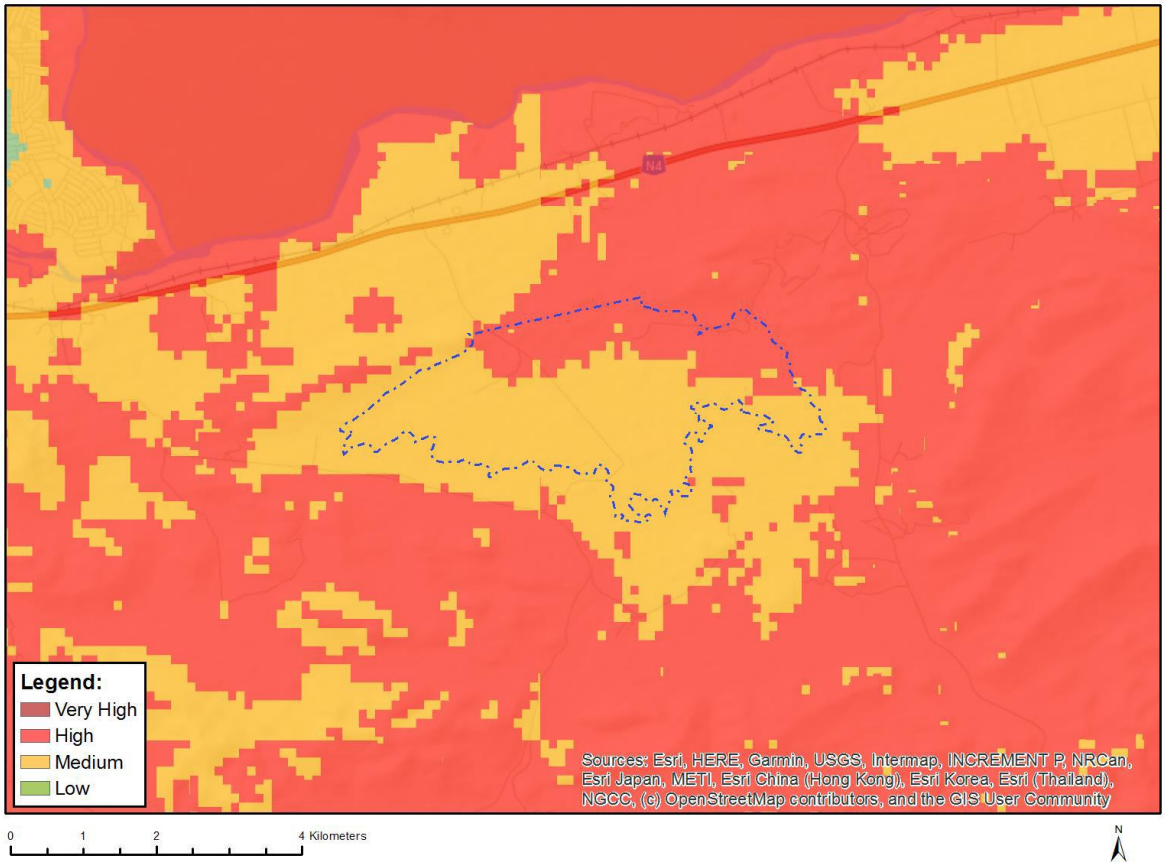


Figure 6-12: Strathmore Dam: Animal Species Sensitivity (DFFE Screening Tool)

Table 6-1: Strathmore Dam: Known and Potential Faunal Species (DFFE Screening Tool)

Class	Scientific Name	Common Name	Sensitivity (DFFE Screening Tool)	Conservation Status
Aves	*Torgos tracheliotos*	Lappet-faced Vulture	High	EN
	Podica senegalensis	African finfoot	Medium	LC
	Terathopius ecaudatus	Bateleur	Medium	EN
	Stephanoaetus coronatus	Crowned eagle	High	NT
	Polemaetus bellicosus	Martial Eagle	High	EN
	Gorsachius leuconotus	White-backed Night heron	High	LC

Class	Scientific Name	Common Name	Sensitivity (DFFE Screening Tool)	Conservation Status
Aves	*Mycteria ibis*	Yellow-billed Stork	High	LC
	Hydroprogne caspia	Caspian Tern	Medium	LC
	Aquila rapax	Tawny eagle	Medium	LC
	Sensitive species			CR
Mammalia	*Crocidura maquassiensis*	Makwassie Musk Shrew	Medium	VU
	Dasymys robertsii	Robert's shaggy rat	Medium	NT
	Lycaon pictus	African wild dog	Medium	EN
	Sensitive species			VU

6.8.3 Mpumalanga Biodiversity Sector Plan

The dam basin is located within an ESA, i.e., within the 10 km buffer zone of Protected Areas (specifically Kruger National Park) as indicated on **Figure 6-13**. Areas to the west of the proposed dam are categorized as ESA due to its functionality as a corridor, as well as CBA Irreplaceable area to the northwest associated with a watercourse.

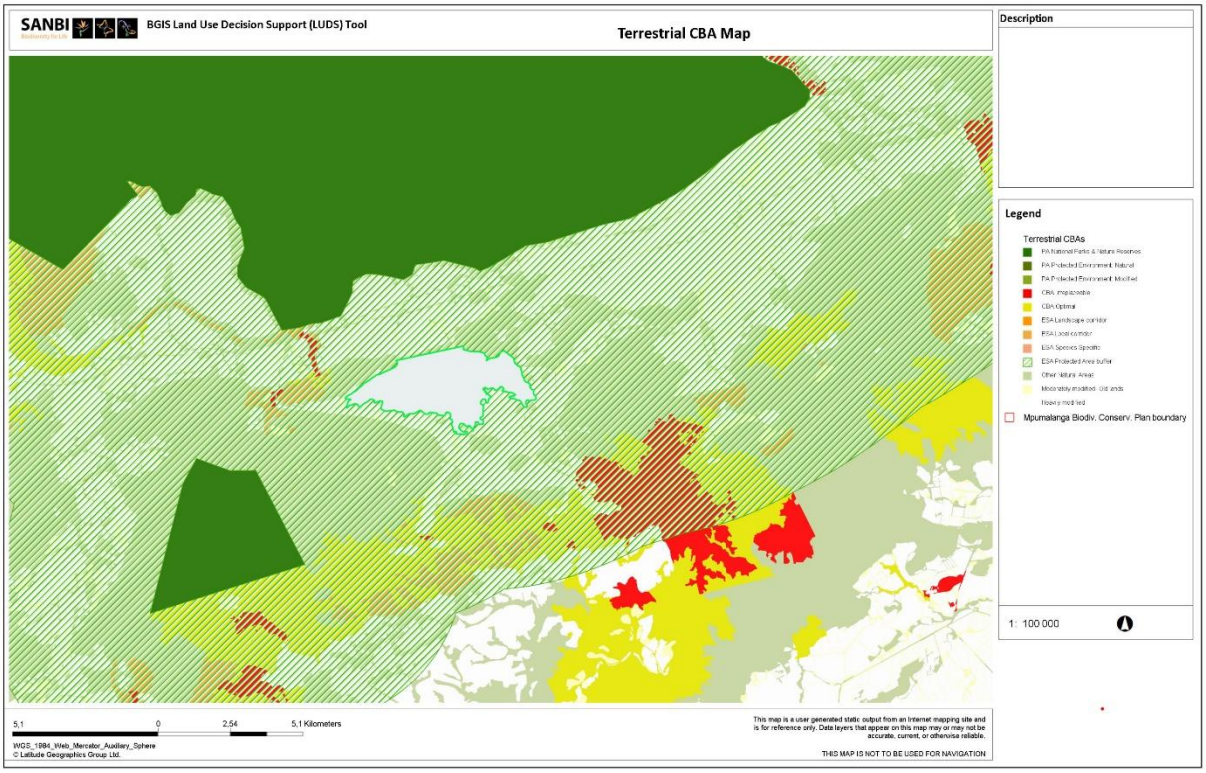


Figure 6-13: Strathmore Dam: Terrestrial Ecosystem CBA Map (MBSP)

6.8.4 Protected Areas

The proposed dam is not located within a Protected Area. The Kruger National Park is located < 2 km north of the proposed dam (refer to **Figure 6-14**). The Dumaneni Reserve (informal land-based protected area) is located > 5km to the east of the proposed dam and the Stenson Estate PNR approximately 6 km to the southwest of the proposed dam wal. These are not expected to be impacted directly by the proposed development.

An area to the west of the proposed dam has been included in the NPAES. This area corresponds with the area identified as CBA Irreplaceable in the MBSP. This area is outside of the proposed dam basin.

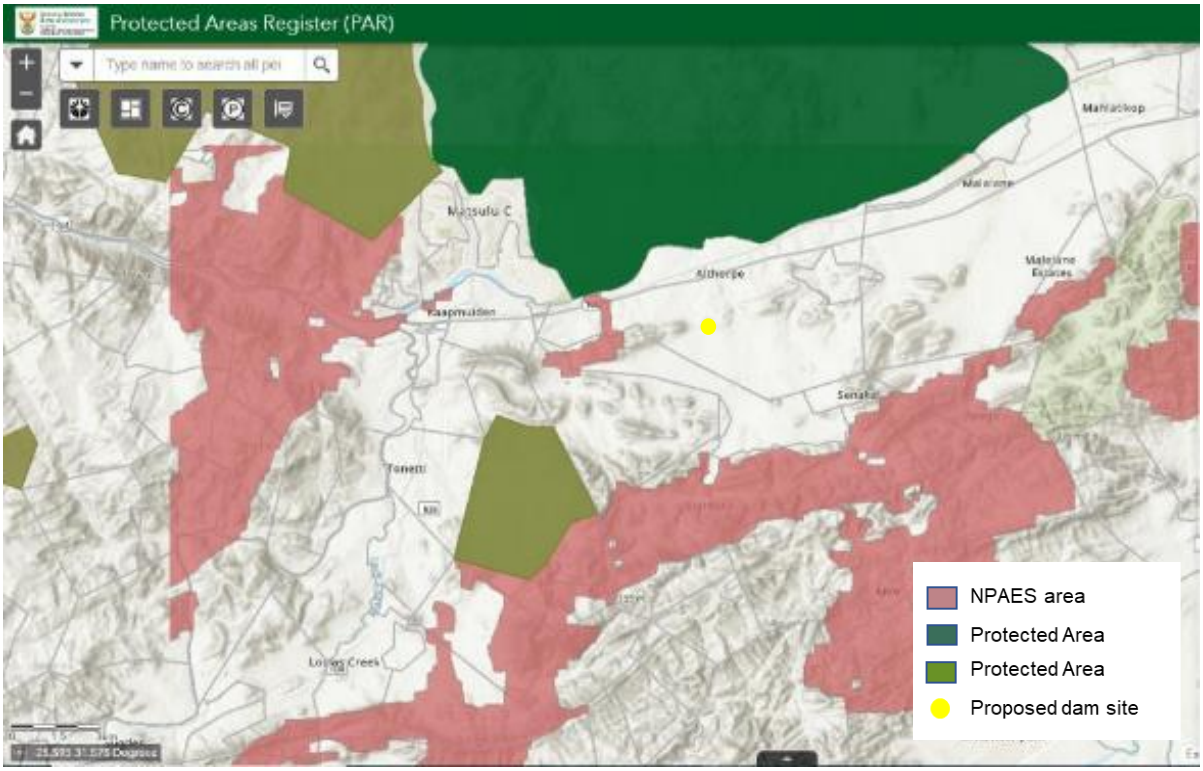


Figure 6-14: Strathmore Dam: Protected Areas and Protected Areas Expansion Strategy (DFFE Protected Areas Register Interactive Map Viewer, accessed 15 April 2023)

6.8.5 Terrestrial Biodiversity Sensitivity Rating: DFFE Screening Tool

The dam basin is located within an area with a Low Terrestrial Biodiversity Sensitivity Rating as indicated on **Figure 6-15**. Areas of Very High sensitivity are present to the north and south of the proposed dam, associated with existing Protected Areas or areas included in the NPAES.

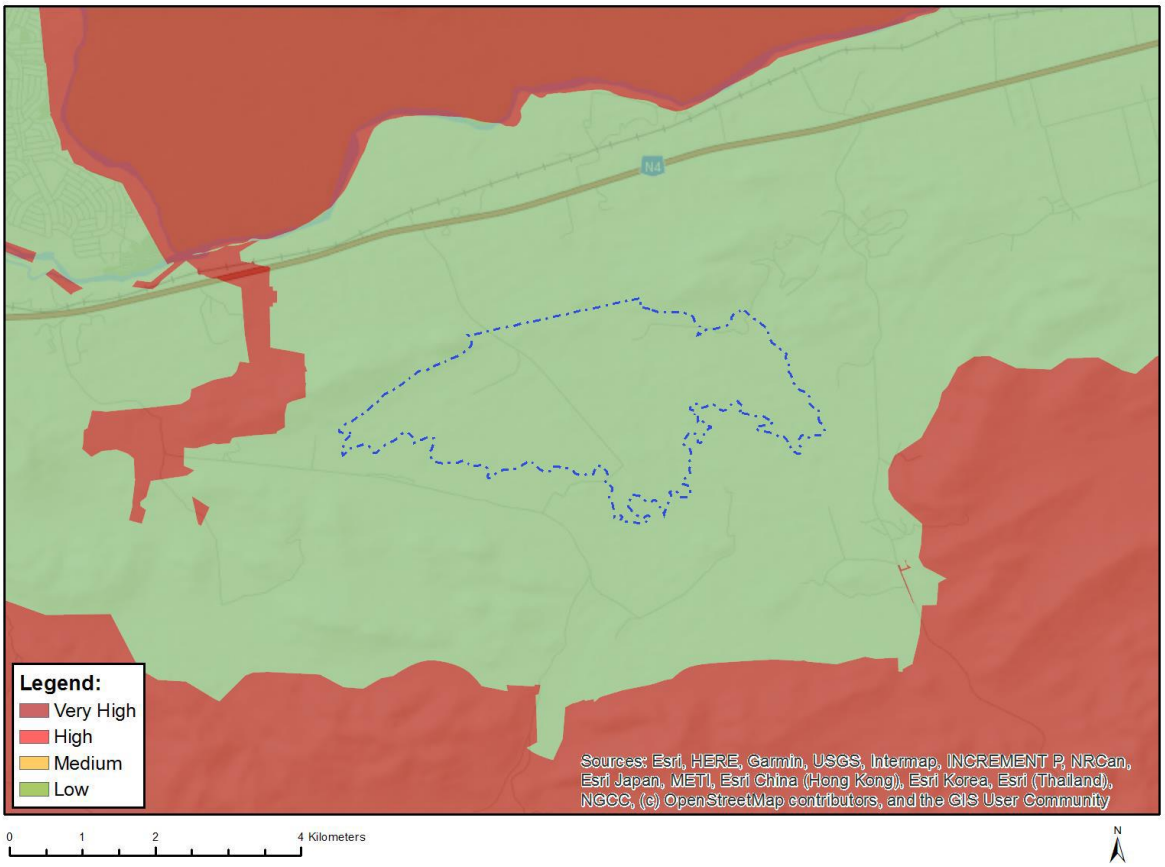


Figure 6-15: Strathmore Dam: Terrestrial Biodiversity Sensitivity (DFFE Screening Tool)

6.9 Archaeological and Heritage

The entire dam basin is rated as Low sensitivity based on the information informing the DFFE Screening Tool (refer to **Figure 6-16**).

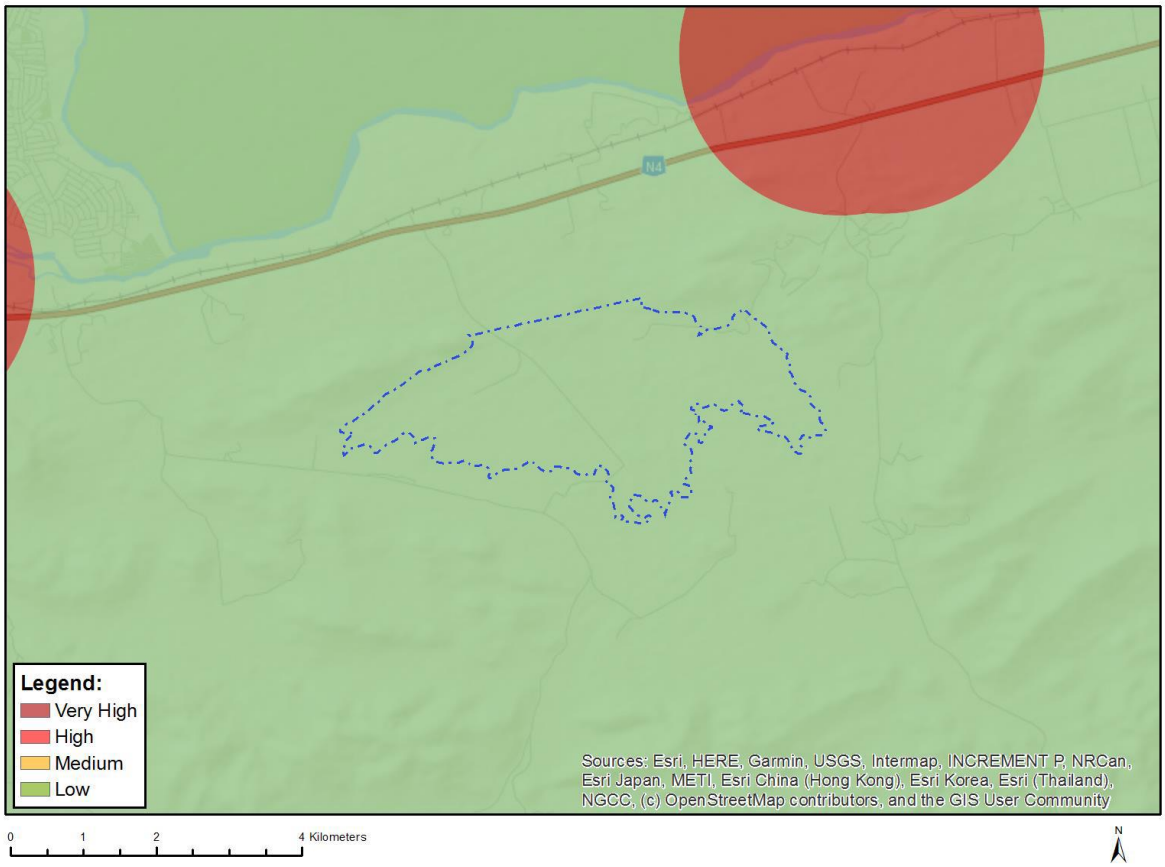


Figure 6-16: Strathmore Dam: Archaeological and Heritage Sensitivity (DFFE Screening Tool)

7 POTENTIAL ENVIRONMENTAL RISKS

This Environmental Screening Report considers a range of factors and sensitivities in order to assess and rank the sites from an environmental perspective as part of the multicriteria analysis. A further detailed assessment of the environmental risks associated with the top-ranking site will be conducted during the Environmental Screening to be done as part of the Phase 2: Feasibility Study. This will ultimately inform the EIA and associated specialist studies to be undertaken by the Environmental Assessment Practitioner.

The potential impacts identified, and the extent to which it was incorporated in the rating of the dam options, are listed in **Table 7-1**. The information considered is discussed in **Section 2**.

Table 7-1: Potential Environmental Impacts

Aspect	Description of Potential Impact	Extent to which included in Rating System and Level of Certainty
Topography	• Inundation of watercourses / river valleys. • Alteration of slope, morphology, and function. • Potential erosion on steep slopes	Yes, high level assessment. To be investigated in more detail as part of EIA.
Climate	• Potential change in micro-climate locally, which could result in climate related changes or events as a result of large water bodies not previously present in the area. • Contribution of proposed development to greenhouse gas (GHG) emissions and therefore climate change. • Implications of global climate change on the area in which the project is located and the functionality of the proposed scheme.	Not considered due to lack of information and therefore the high level of uncertainty in rating the options. To be investigated in detail in the EIA.
Geology	• Unsuitable geological foundation conditions. • Geological stresses and potential seismic occurrence. • Insufficient sources of construction material.	Not included in environmental rating *per se*, but to be considered as part of multicritertia assessment in assessing the options.
Soil, Land Use, Land Capability and Agricultural Potential	• Vegetation clearance as part of the dam construction, development of construction roads and material lay-down areas etc. could result in erosion • Loss of topsoil • Alteration of the land-use due to construction activities and inundation. • Loss of natural areas due to construction and inundation. • Loss of soils with high Agricultural Potential as a result of construction activities and inundation.	Yes. Medium level of certainty. Soil and agricultural sensitivity (based on land capability) information used from MBSP and DFFE Screening Tool respectively. Not verified in any further detail.
Rivers, Wetlands and Freshwater Ecosystems	• Change in flow regime. • Change in seasonal flow patterns. • Impact on fish populations, especially those dependent on a lotic system. • Migration of fish species prevented or reduced. • Inundation of habitats for various aquatic species. • Loss of habitat due to fragmentation of the river system. • Fragmentation of aquatic populations.	Yes. High level of certainty since information on FEPA and SWSA is published and accepted. Information on known and expected species to occur based on biomonitoring and previous assessments.

Aspect	Description of Potential Impact	Extent to which included in Rating System and Level of Certainty
	• Potential threat to indigenous fish species due to the creation of a habitat that is suitable for alien fish species. • Potential suitable conditions created for aqautic alien and invasive plant species not observed in the river reach previously • Change in geomorphology: Channel incision and bed armouring, bank erosion and sedimentation • Deterioration of water quality • Loss of riparian vegetation and habitats. • Loss of areas identified to be of importance to meet Provincial conservation targets. • Change in Ecological Category downstream and the ability to meet the TEC, and the success to operate the Ecological Water Requirements (EWR) in the Lower Crocodile River.	Provincial conservation targets based on systematic biodiversity planning are known and published. Impact on downstream assessed by specialists.
Terrestrial Ecosystems	• Loss and disturbance of fauna and flora, including SCC. • Destruction and/or change in habitats. • Loss of connectivity of ecosystems. • Loss of areas identified to be of importance to meet Provincial conservation targets. • Increase in Alien and Invasive Species due to vegetation clearance	Yes. Information on known and expected species to occur based on previous studies and information in DFFE Screening Tool (site verification not conducted). Provincial conservation targets based on systematic biodiversity planning are known and published.
Groundwater	• Alteration of groundwater flow and levels due change in groundwater-surface water interaction.	No, due to lack of information. To be addressed in EIA Phase.
Heritage and Cultural Resources	• Loss of, or damage to, sites of historical, archaeological and cultural significance.	Yes, based on high-level information available in DFFE Screening Tool, therefore of low level of certainty.
Visual and Aesthetics	• Adverse impact on visual quality and sense of place due to construction activities • Visual disturbance of landscape character due to inundation of valley	No, due to lack of information (implied in the assessment of topographical impacts). To be addressed in EIA Phase as part of social assessment

Aspect	Description of Potential Impact	Extent to which included in Rating System and Level of Certainty
Air Quality	• Dust generated as a result of construction activities • Impact on air quality as a result of emissions from vehicular movements and equipment (e.g. generators) during construction.	No, construction related impacts not considered in ranking of options and to be addressed in EIA Phase.
Noise	• Increased noise levels as a result of construction activities such as vehicle movement, drilling, blasting, excavation and compaction) as well as operational activities.	No, construction related impacts not considered in ranking of options and to be addressed in EIA Phase.
Traffic Impact	• Increased vehicular movement on roads for the transportation of material, equipment and construction personnel.	No, construction related impacts not considered in ranking of options and to be addressed in EIA Phase.
Socio-economic	• Displacement of households currently residing in the area due to resettlement. • Loss of livelihood associated with agricultural, tourism and other land uses. • In-migration of people during the construction phase in search of perceived job opportunities, resulting in social risks such as increased theft and other security risks, as well as potential health concerns. • Impoundment of water may result in a safety hazard. • Potential risk to downstream communities in the event of failure of the dam due to tecnhical issues or significant seismic events.	Not specifically. Some aspects inferred in other aspects such as loss of agricultural land (resulting in loss of farming jobs) and infrastrcuture to be inundated (resulting in potential resettlement if townhip). Socio-economic assessment to be undertaken as part of Phase 2 Feasbility Study.

8 RATING AND RANKING OF SITES

8.1 Montrose Dam

The ratings for the Montrose Dam option are shown in **Table 8-1**. The main aspects to note regarding this option is the expected impact on unique aquatic species present within this FEPA river. Development of the dam and flooding of the Montrose Falls in the Crocodile River will create an unnatural pathway for indigenous and alien fish species not currently present in the upper Crocodile River and result in colonisation of this reach. A change in the natural fish assemblage of the Crocodile River upstream and potentially also downstream of the Montrose Falls can be expected, as a result of competition for food and habitat as well as potential hybridization and genetic mixing of species that would have previously been isolated or separated. This impact will be of concern for all species present, but especially for the Critically Endangered *Chiloglanis bifurcus.* Although mitigation measures such as the construction of barriers to prevent alien or predatory fish moving upstream of the dam could be implemented, this was not considered at this stage due to the potential environmental impact associated with the barriers themselves and the uncertainty regarding its efficiency (DWS, 2023). The potential fatal flaw is therefore based on an evaluation without considering any mitigation measures.

It is also expected that the development will result in a drop in the Ecostatus of the AR downstream of the dam and the next AR. This is regarded as a potential fatal flaw and although fatal flaws can in some cases be mitigated, it would require evaluation of a different scenario in the ranking process (DWS, 2023).

From a terrestrial ecosystem perspective, the dam is located within a CBA Irreplaceable area and in terms of the MBSP development guidelines, there is no flexibility in terms of land use options for CBA Irreplaceable areas. Any impact which could impact on these systems should be avoided. Development of a dam at this location is therefore regarded as a potential fatal flaw from a terrestrial perspective as well. It should be noted that this assumes the worst-case scenario of the dam wall height of up to 100 m. If mitigation through for example a reduction of the dam wall height, the potential impacts may be mitigated to some extent.

Table 8-1: Environmental Rating: Montrose Dam Option

Aspect	Site Sensitivity and Potential Impact	Rating
Topography		
Topography	Largely undisturbed topography along Elands River. Visual impact on river valleys. Steep slopes which could lead to erosion.	2
Soil, Land Use, Land Capability and Agricultural Potential		
Land Use	Largely unmodified habitat along Elands River, with cultivation along the Crocodile River. Significant infrastructure impacted (e.g., portion of N4 highway, R539 road, new Montrose interchange, portion of Elandshoek township and potential resettlement of households).	2
Loss of arable land / high land capability / agricultural potential	Loss of soils with high agricultural potential. Very High sensitivity rating (DFFE Screening Tool) along the Crocodile River.	2
Rivers, Wetlands and Freshwater Ecosystems		
Strategic Water Source Area	Located within SWSA	1
NFEPA Rivers and Wetlands	Elands River and Crocodile River downstream of the proposed dam are FEPA rivers. Elands River is a free flowing and flagship river. Fish sanctuary and fish support areas to be impacted.	1
Impact on Fish	Endemic (CR) and unique fish species will be impacted. Change in migration patterns.	**0**
Impact on Aquatic Maro-invertebrates	Change in flow resulting in alteration of species composition. Migration barrier to species that need to move between reaches.	2
Impact on Freshwater Conservation Targets	Elands River categorised as CBA River.	**0**
Impact on downstream freshwater ecology	Identified as potential Fatal Flaw in specialist assessment due to the degree to which the TECs can be met (drop in Ecostatus in Affected Reach (AR) directly downstream and in next AR), as well as the impact on critically endangered fish species.	**0**
Terrestrial Ecosystem		
Impact on Fauna	Several SCC (CR, VU and EN) will be impacted.	2

Aspect	Site Sensitivity and Potential Impact	Rating
	Specific concern regarding impact on an active Crowned Eagle nest site. Loss of habitat and species.	
Impact on Flora	Legogote Sour Bushveld will be impacted. Identified as Threatened Ecosystem. Several SCC (CR, VU and EN) may be impacted, including *Aloe simii* (CR).	2
Impact on Terrestrial Conservation Targets	Area identified as CBA Irreplaceable and therefore should remain in natural state.	**0**
Threat to Protected Areas or NPAES	Within NPAES.	2
Heritage and Cultural Resources		
Loss of sites of historical, archaeological and cultural significance	Potentially within close proximity of Heritage Sites	2
	Overall Environmental Score	**18**

8.2 Mountain View Dam

The ratings for the Mountain View Dam option are shown in **Table 8-2**. The area to be inundated is largely undisturbed, except for agricultural activities on the southern side. A small area which has been categorised as CBA Irreplaceable will be inundated. The reason for this area is that it provides a critical link, or migration corridor. However, it has been indicated that this is not foreseen to be a fatal flaw since other options for linkages exist. Concern, however exists regarding the impact of the proposed development on an active Crowned Eagle nest site (M. Lőtter, 2023, personal communication).

Known and expected faunal and floral SCC will be impacted. Development of the dam will result in a drop in the Ecostatus of the AR directly downstream of the dam.

Table 8-2: Environmental Rating: Mountain View Dam

Aspect	Site Sensitivity and Potential Impact	Rating
Topography		
Topography	Largely undisturbed terrain with remarkable views that will be disturbed. Steep slopes which could lead to erosion.	2

Aspect	Site Sensitivity and Potential Impact	Rating
Soil, Land Use, Land Capability and Agricultural Potential		
Land Use	Agricultural and residential areas in the southern section, therefore resettlement of households and potential loss of jobs. Large areas of dam basin are however unmodified habitat. Portion of railway line to be inundated.	2
Loss of arable land / high land capability / agricultural potential	Loss of existing cultivated land / soil with high agricultural potential. Very High Agricultural Sensitivity Rating (DFFE Screening Tool).	2
Rivers, Wetlands and Freshwater Ecosystems		
Strategic Water Source Area	Not within SWSA. Area directly to north indicated as SWSA	4
NFEPA Rivers and Wetlands	Located within Upstream Management Area of FEPA river	2
Impact on Fish	Known SCC will be impacted. Migration barrier to *Anguilla massambica* will be created. Favourable habitat for alien species may be established.	2
Impact on Aquatic Maro-invertebrates	Change in distribution of migratory *Macrobranchilum* prawn from coastal breeding sites expected. Change in flow will impact on breeding and migration.	2
Impact on Freshwater Conservation Targets	Largely designated as Heavily Modified and ONA, with small area designated as ESA area at proposed dam wall.	3
Impact on downstream freshwater ecology	Drop in Ecostatus expected in AR directly downstream. Higher rating for ability to achieve EWR in Lower Crocodile catchment compared to other dam options.	2
Terrestrial Ecosystem		
Impact on Fauna	Some SCC (VU, EN and NT) known or expected to occur. Specific concern regarding impact on active Crowned Eagle nest site. Habitat and/or species loss.	2
Impact on Flora	Some SCC (VU, EN and CR) known or expected to occur. Habitat and/or species loss. Not within threatened ecosystem.	3
Impact on Terrestrial Conservation Targets	Largely ESA and ONA. Identified as important corridor. Small area (6.8 ha) identified as CBA Irreplaceable which is unlikely to present a fatal flaw since other linkages/corridors exist.	1

Aspect	Site Sensitivity and Potential Impact	Rating
Threat to Protected Areas or NPAES	Not located within PA, but located within NPAES due to the ecological corridor it provides.	2
Heritage and Cultural Resources		
Loss of sites of historical, archaeological and cultural significance	High Sensitivity rating (DFFE Screening Tool) due to potential proximity to Heritage Site(s).	3
	Overall Environmental Score	**32**

8.3 Boschjeskop Dam

The ratings for the Boschjeskop Dam option are shown in **Table 8-3**. Development of the dam will result in significant loss of agricultural soils. Impact on downstream ecosystems were identified as a potential fatal flaw by the specialist due to the degree to which the TECs can be met. Although fatal flaws can in some cases be mitigated, it would require evaluation of a different scenario in the ranking process (DWS, 2023).

Table 8-3: Environmental Rating: Boschjeskop Dam

Aspect	Site Sensitivity and Potential Impact	Rating
Topography		
Topography	Existing changes in landscape due to agricultural and afforestation development. Further changes expected as a result of inundation of river valley. Potential for erosion on steep slopes where present.	3
Soil, Land Use, Land Capability and Agricultural Potential		
Land Use	Largely disturbed – agriculture and afforestation. Therefore, resettlement of households and potential loss of jobs. Infrastructure associated with agricultural activities and portion of provincial road to be inundated.	4
Loss of arable land / high land capability / agricultural potential	Significant loss of agricultural soils. Very High Agricultural sensitivity rating (DFFE Screening Tool).	1
Rivers, Wetlands and Freshwater Ecosystems		
Strategic Water Source Area	A small portion of the upper reaches of the dam basin is located within SWSA.	3
NFEPA Rivers and Wetlands	Fish Support Area for CR and EN fish species.	2

Aspect	Site Sensitivity and Potential Impact	Rating
Impact on Fish	SCC known to occur, including *Chiloglanis bifurcus* (CR). Species composition and distribution to be impacted by barrier. Migration of *Anguilla mossambica* and other species to be affected. Suitable habitat could be created for alien species.	1
Impact on Aquatic Maroinvertebrates	Impact on breeding and migration. Change in flow resulting in alteration of species composition.	2
Impact on Freshwater Conservation Targets	ESA due to fish support areas.	2
Impact on downstream freshwater ecology	Identified as potential Fatal Flaw which needs further investigation. Drop in Ecostatus for AR downstream of dam and the next AR (however less significant compared to the Montrose Dam option).	**0**
Terrestrial Ecosystem		
Impact on Fauna	SCC (VU, EN, NT) known/expected to occur. Loss of habitat and species.	3
Impact on Flora	Legogote Sour Bushveld is a Threatened ecosystem. SCC may be impacted, including *Aloe simii* (CR).	2
Impact on Terrestrial Conservation Targets	CBA Optimal, ONA, Modified habitat. CBA Optimal could provide some flexibility in land use	2
Threat to Protected Areas or NPAES	Not located in PA or NPAES. Next to Wolkberg Centre of endemism	4
Heritage and Cultural Resources		
Loss of sites of historical, archaeological and cultural significance	Low sensitivity	4
	Overall Environmental Score	**33**

8.4 Strathmore Dam

The ratings for the Strathmore Dam option are shown in **Table 8-4**. The main impact is expected to be the significant loss of agricultural soils. From a terrestrial and ecological sensitivity, the impacts are not expected to be significant and could likely be mitigated. The proposed dam is located within an ESA for both Freshwater and Terrestrial ecosystems in terms of the biodiversity conservation targets.

Table 8-4: Environmental Rating: Strathmore Dam

Aspect	Site Sensitivity and Potential Impact	Rating
Topography		
Topography	Existing changes in landscape due to agricultural development. Further changes expected as a result of inundation.	3
Soil, Land Use, Land Capability and Agricultural Potential		
Land Use	Largely modified due to agricultural activities. Potential resettlement of households and loss of jobs. Adjacent to magnesite mine.	4
Loss of arable land / high land capability / agricultural potential	Significant loss of Agricultural soils. Very High Agricultural sensitivity rating (DFFE Screening Tool).	1
Rivers, Wetlands and Freshwater Ecosystems		
Strategic Water Source Area	Not located within or close to SWSA	4
NFEPA Rivers and Wetlands	Jam Tin Creek not a significant resource. Potential implications on downstream Crocodile River.	3
Impact on Fish	One SCC known. Not notable impact expected.	3
Impact on Aquatic Maroinvertebrates	Potential impact on abundance.	3
Impact on Freshwater Conservation Targets	Located in ESA.	2
Impact on downstream freshwater ecology	Not expected to result in change of TEC. Not expected to achieve EWR in Lower Crocodile catchment compared to other dam options.	3
Terrestrial Ecosystem		
Impact on Fauna	SCC (CR, EN, NT, VU) known / expected to occur. Not within threatened ecosystem.	3
Impact on Flora	SCC (VU and EN) known / expected to occur.	3
Impact on Terrestrial Conservation Targets	Located in ESA.	3

Aspect	Site Sensitivity and Potential Impact	Rating
Threat to Protected Areas or NPAES	Not within PA or NPAES.	4
Heritage and Cultural Resources		
Loss of sites of historical, archaeological and cultural significance	Low	4
	Overall Environmental Score	**43**

8.5 Ranking of Sites

A summary of the rating of the sites and the associated ranking are provided in **Table 8-5**.

The Montrose Dam option has the lowest environmental rating due to the sensitivity of the terrestrial and freshwater ecosystems which will be impacted as a result of the development. Of specific concern is the potential impact on fish assemblage and the potential eradiation of the Critically Endangered *Chiloglanis bifurcus.* The potential fatal flaws as a result of the expected impact on the terrestrial and aquatic ecosystems has been identified considering an option without any mitigation measures.

The proposed Off-channel Strathmore Dam option has the highest environmental score and is therefore the best ranking option.

The Mountain View and Boschjeskop Dam options are similar in terms of their environmental rating. The Boschjeskop site is already transformed due to agricultural, afforestation and other land uses. Significant loss of agricultural soils will occur. The Mountain View site is largely undisturbed with agricultural activities in the southern section. Significant loss of natural habitat as well as some soils with high agricultural potential will occur. Specific concerns exist regarding the impact of the proposed Mountain View Dam development on an active Crowned Eagle nest and this aspect will need further assessment by a specialist. Based on the information in the DFFE Screening Tool, the Mountain View site could also have an impact on Cultural and Heritage resources. The Boschjeskop Dam option, however, has a potential fatal flaw due to the downstream ecological impact, which would require further investigation. Although fatal flaws can in some cases be mitigated, it would require evaluation of a different scenario in the ranking process.

Table 8-5: Ranking of Sites

Aspect	Montrose	Mountain View	Boschjeskop	Strathmore
Topography				
Change in topography	2	2	3	3
Soil, Land Use, Land Capability and Agricultural Potential				
Land Use	2	2	4	4
Loss of arable land / high land capability / agricultural potential	2	2	1	1
Rivers, Wetlands and Freshwater Ecosystems				
Strategic Water Source Area	1	4	3	4
NFEPA Rivers and Wetlands	1	2	2	3
Impact on Fish	0	2	1	3
Impact on Aquatic Maro-invertebrates	2	2	2	3
Impact on Freshwater Conservation Targets	0	3	2	2
Impact on downstream freshwater ecology	0	2	0	3
Terrestrial Ecosystem				
Impact on Fauna	2	2	3	3
Impact on Flora	2	3	2	3
Impact on Terrestrial Conservation Targets	0	1	2	3
Threat to Protected Areas or NPAES	2	2	4	4
Heritage and Cultural Resources				
Loss of sites of historical, archaeological and cultural significance	2	3	4	4
Overall Rating	**18**	**32**	**33**	**43**
Ranking	**4**	**3**	**2**	**1**

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APPENDICES

Appendix A MBSP Biodiversity Priority Areas: Sub-Categories (MTPA, 2014)

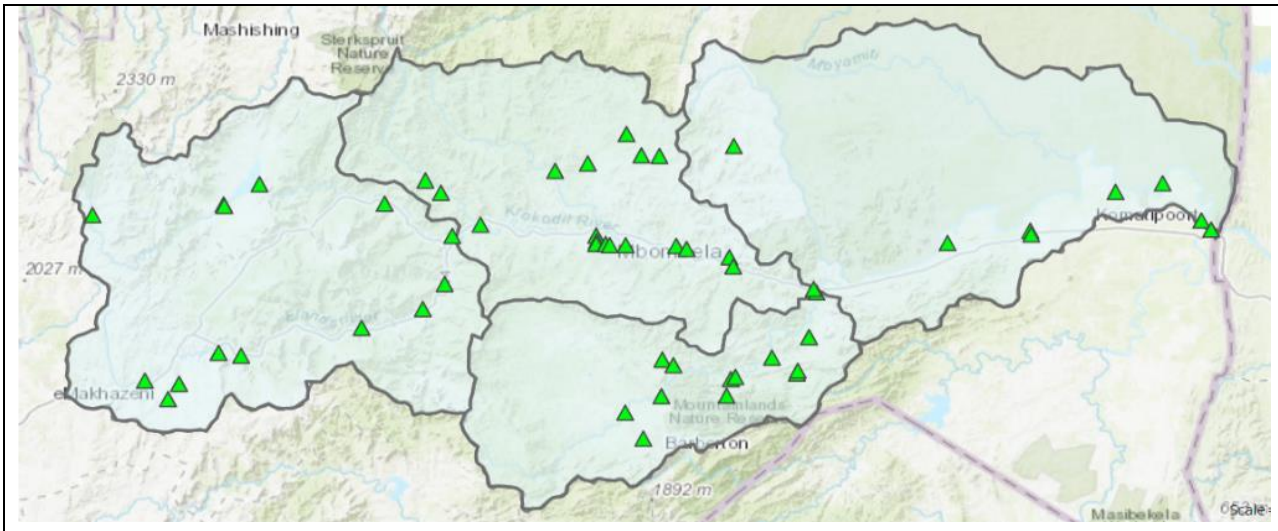
TERRESTRIAL CBA			
Map Category	**Description**	**Sub-Category**	**Description**
Protected Areas	Areas that are formally protected by law and recognised in terms of the Protected Areas Act, including contract protected areas declared through the biodiversity stewardship programme.	**National Parks & Nature Reserves**	Includes formally proclaimed National Parks, Nature Reserves, Special Nature Reserve, and Forest Nature Reserves.
		Protected Environments: Natural	Includes Protected Environments, declared in terms of Protected Areas Act (Act 57 of 2003, as amended).
		Protected Environments: Modified	Heavily modified areas in formally proclaimed Protected Environments.
Critical Biodiversity Areas (CBA)	All areas required to meet biodiversity pattern and process targets; Critically Endangered ecosystems, critical linkages (corridor pinch-points) to maintain connectivity; CBAs are areas of high biodiversity value that must be maintained in a natural state.	**CBA: Irreplaceable**	*These are areas required to meet conservation targets and with irreplaceability values of more than 80%; Critical linkages in the landscape that must remain natural; as well as Critically Endangered Ecosystems*
		CBA Optimal	*These areas are optimally located to meet both the various biodiversity targets and other criteria defined in the analysis. Although these areas are not 'irreplaceable' they are the most efficient land configuration to meet all biodiversity targets and design criteria.*
Ecological Support Areas (ESA)	Areas that are not essential for meeting targets, but that play an important role in supporting the functioning of CBAs and that deliver important ecosystem services	**ESA: Landscape Corridor**	*Areas representing the best option to support landscape-scale ecological processes, especially allowing for adaptation to climate change impacts.*
		ESA: Local Corridor	*Finer-scale alternative pathways that build resilience into the corridor network by ensuring connectivity between climate change focal areas, reducing reliance on single landscape-scale corridors.*
		ESA: Species specific	*Areas required for the persistence of particular species. Although these may be production landscapes, a change in land-use may result in loss of this species from the area. (Only one species-specific ESA was included in the analysis — an over-wintering site for blue cranes).*
		ESA: Protected Area Buffers	*Areas surrounding PAs that moderate the impacts of undesirable land-uses that may affect the ecological functioning or tourism potential of PAs. (Buffer distance varies according to reserve status: National Parks — 10 km; Nature Reserves — 5 km buffer; Protected Environments — 1 km buffer).*
Other Natural Areas (ONA)	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.		

TERRESTRIAL CBA			
Map Category	**Description**	**Sub-Category**	**Description**
Moderately or Heavily Modified Areas	Areas in which significant or complete loss of natural habitat and ecological function has taken place due to activities such as ploughing, hardening of surfaces, open-cast mining, cultivation and so on.	**Heavily Modified**	*All areas currently modified to such an extent that any valuable biodiversity and ecological functions have been lost.*
		Moderately Modified: Old lands	*Old cultivated lands that have been allowed to recover (within the last 80 years), and support some natural vegetation. Although biodiversity pattern and ecological functioning may have been compromised, the areas may still play a role in supporting biodiversity and providing ecosystem services*

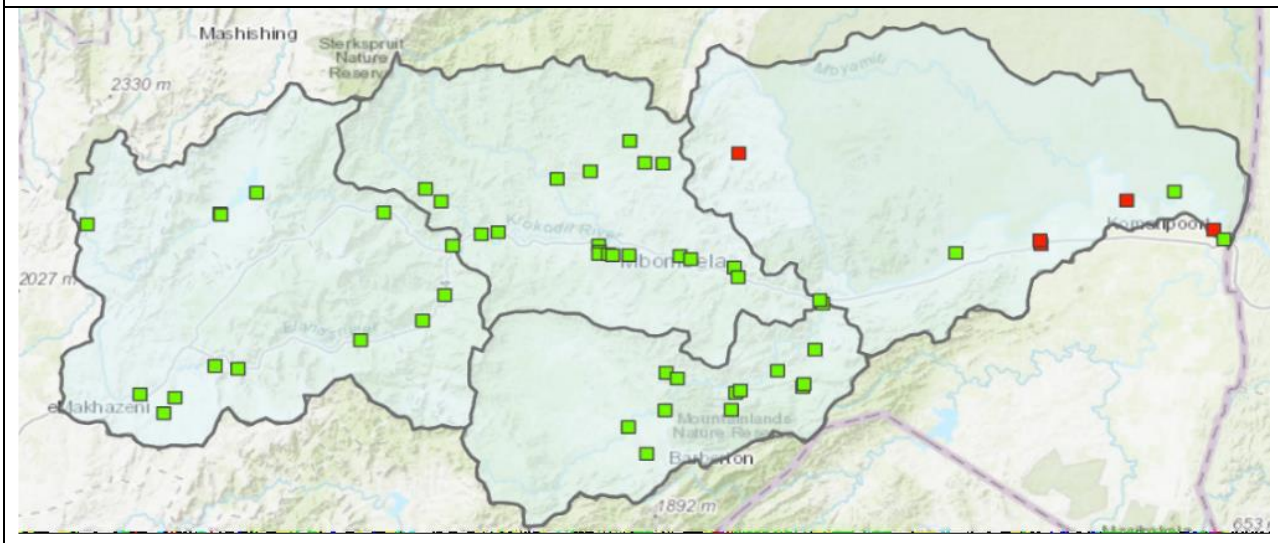
FRESHWATER CBA			
Map Category	**Description**	**Sub-Category**	**Description**
Critical Biodiversity Areas (CBA)	All areas required to meet biodiversity pattern and process targets; CBAs are areas of high biodiversity value that should be maintained in a natural or near-natural state	**CBA: Rivers**	*Rivers, with a 100 m buffer, that need to be maintained in a good ecological condition in order to meet biodiversity targets for freshwater ecosystems. This category includes Freshwater Ecosystem Priority Area (FEPA) rivers and all FEPA free-flowing rivers. The FEPA rivers include those required to meet biodiversity targets for threatened fish species.*
		CBA: Wetlands	*Important wetlands needed for meeting biodiversity targets for freshwater ecosystems, including FEPA wetlands. The ecological condition of these wetlands needs to be maintained or improved, and their loss or deterioration must be avoided.*
		CBA: Aquatic Species	*Areas considered critical for meeting the habitat requirements for selected aquatic invertebrate species (dragonflies, damselflies, crabs). These species are known to occur only at one or a few localities and are at high risk of extinction if their habitat is lost. Fish species are included under the CBA River category.*
Ecological Support Areas (ESA)	Areas that are not essential for meeting targets, but that play an important role in supporting the functioning of CBAs and that deliver important ecosystem services	**ESA: Wetland Clusters**	*Clusters of wetlands embedded within a largely natural landscape to allow for the migration of fauna and flora between wetlands.*
		ESA: Wetlands	*All non-FEPA wetlands. These wetlands support the hydrological functioning of rivers, water tables and freshwater biodiversity, as well as providing a host of ecosystem services through the ecological infrastructure that they provide.*
		ESA: Important Sub-catchments	*Sub-catchments that either contain river FEPAs and/or Fish Support Areas.*
		ESA: Fish Support Area 	*Sub-catchments that harbour fish populations of conservation concern, based on FEPA data augmented with regional data sets.*
		ESA: Strategic Water Source Areas	*High rainfall areas that produce 50% of Mpumalanga's runoff in only 10% of the surface area, thus supporting biodiversity and underpinning regional water security*
Other Natural Areas (ONA)	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.		

FRESHWATER CBA			
Map Category	**Description**	**Sub-Category**	**Description**
Heavily Modified Areas	Areas in which significant or complete loss of natural habitat and ecological function has taken place due to activities such as ploughing, building of dams, hardening of surfaces, open-cast mining, cultivation, and so on.	**Heavily Modified**	*Heavily Modified: All areas currently modified to such an extent that any valuable biodiversity and ecological function has been lost*
		Heavily Modified: Dams	*Artificial water bodies that have impacted on wetland or river ecosystems. These areas may still have a recharge effect on wetlands, groundwater and river systems and may support river- or water-dependent fauna and flora, such as water birds and wetland vegetation.*

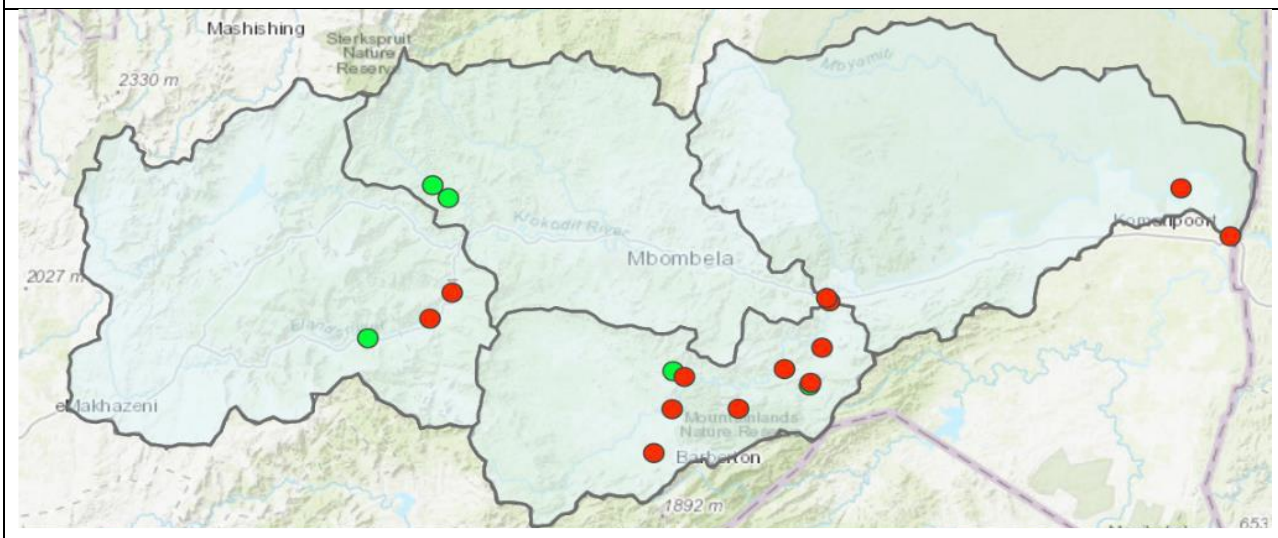
Appendix B Water Quality Status (IUCMA, 2022)



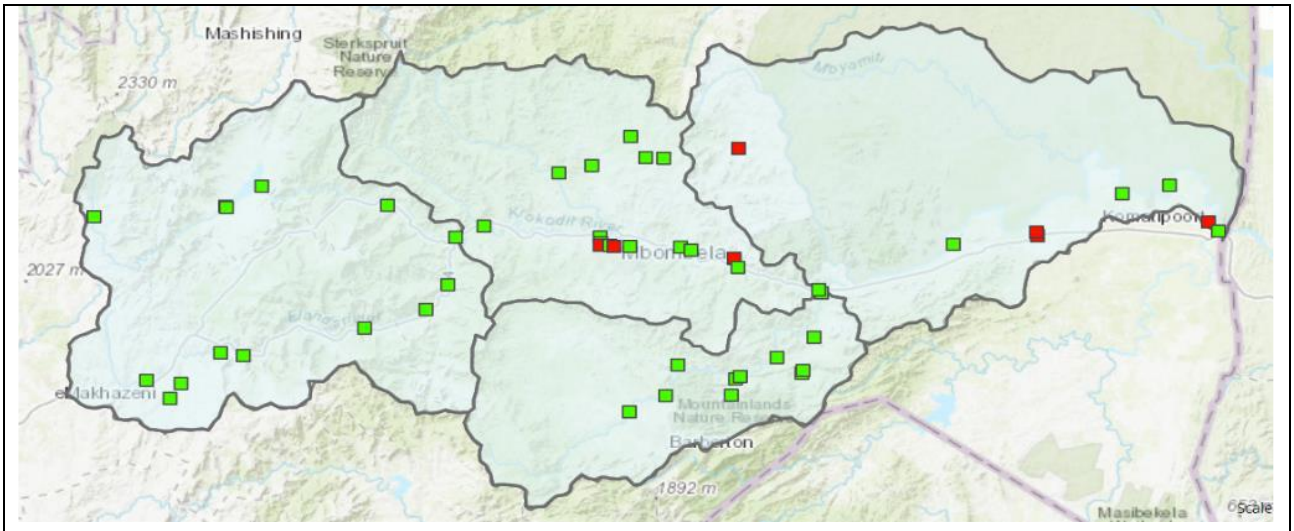
pH



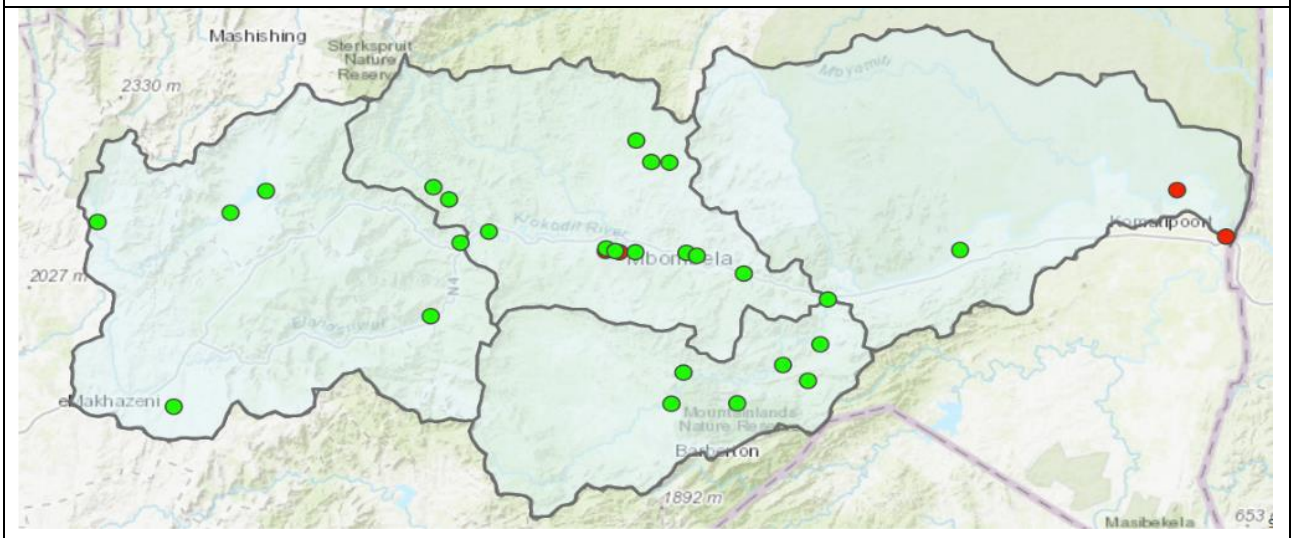
Electrical Conductivity (EC)



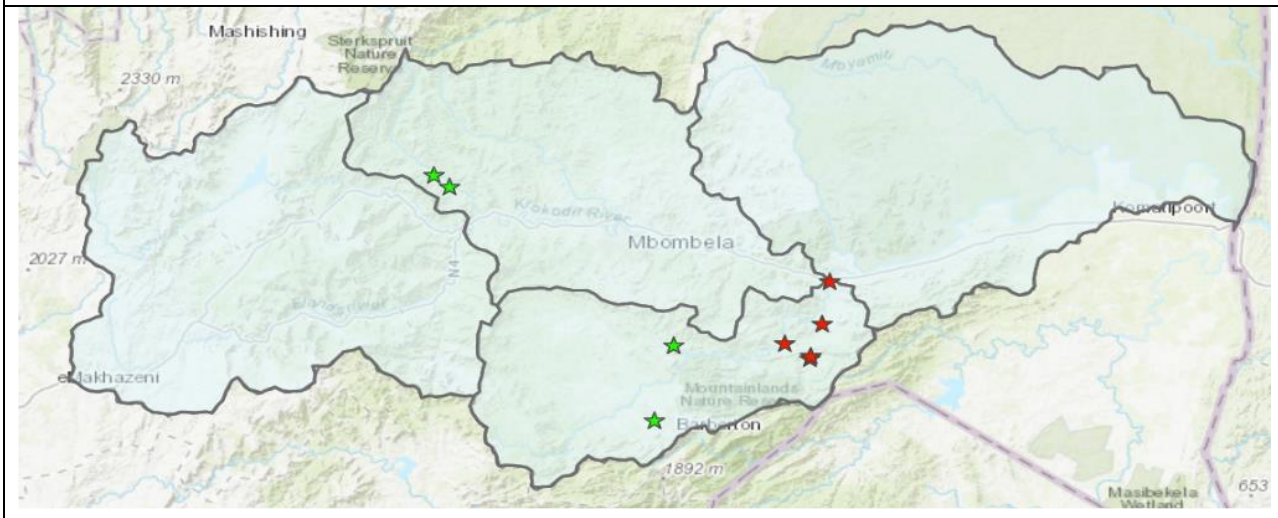
Sulphate (SO_4)



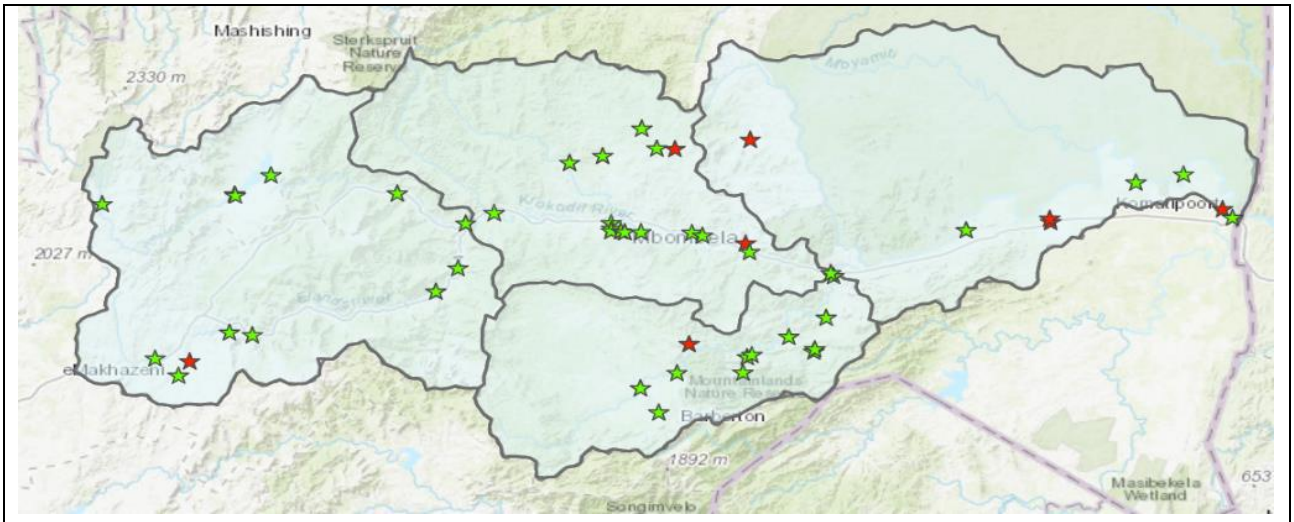
Ammonia (NH_3)



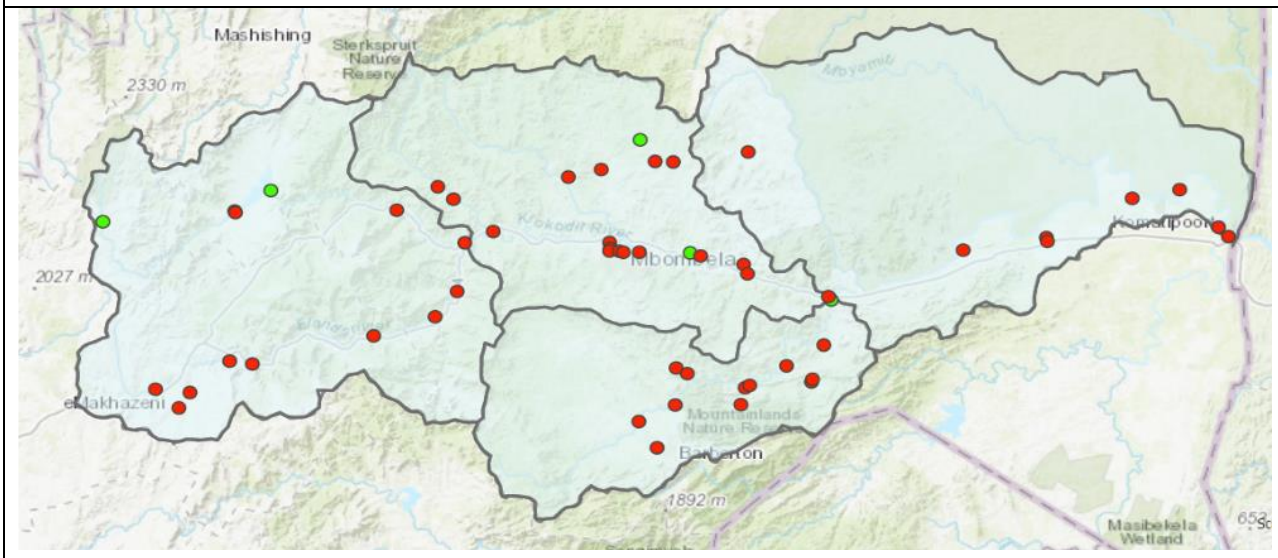
Manganese (Mn)



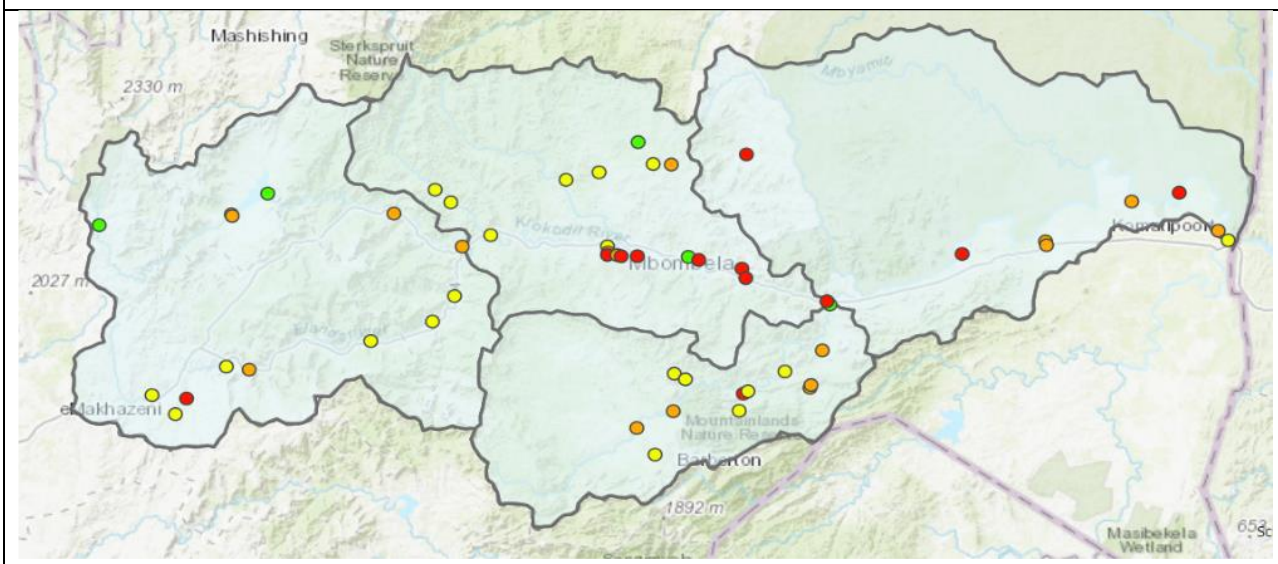
Arsenic (As)



Phosphate (PO_4)



E. coli **(compliance with RQO of 130 cfu/100 ml)**



E. coli **(compliance with 1 000 cfu/ml)**