GOVERNMENT OF THE KINGDOM OF ESWATINI, MINISTRY OF NATURAL RESOURCES AND ENERGY - DEPARTMENT OF WATER AFFAIRS

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF THE PROPOSED MBABANE - MANZINI CORRIDOR DAM PROJECT, ESWATINI

ESIA REPORT

23 JUNE 2021 FINAL

VOLUME 2 of 3

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C-1 MORPHO-DYNAMICS ASSESSMENT

GOVERNMENT OF THE KINGDOM OF ESWATINI, DWA MINISTRY OF NATURAL RESORCES AND ENERGY - DEPARTMENT OF WATER AFFAIRS

MBABANE - MANZINI CORRIDOR DAM PROJECT: MORPHODYNAMIC ASSESSMENT

01 MARCH 2021

CONFIDENTIAL

MBABANE - MANZINI CORRIDOR DAM PROJECT: MORPHODYNAMIC ASSESSMENT

MORPHODYNAMIC ASSESSMENT

GOVERNMENT OF THE KINGDOM OF ESWATINI, DWA MINISTRY OF NATURAL RESORCES AND ENERGY - DEPARTMENT OF WATER AFFAIRS

DRAFT
CONFIDENTIAL

PROJECT NO.: 41101262
DATE: MARCH 2021

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WAIVER

Purpose and basis of preparation of this Report

This Morphodynamic Assessment Report (Report) was prepared by WSP Environmental (Pty) Ltd for the account of GOVERNMENT OF THE KINGDOM OF ESWATINI, DWA MINISTRY OF NATURAL RESORCES AND ENERGY - DEPARTMENT OF WATER AFFAIRS, to provide the Client an understanding of the morphology of the proposed Nondvo Dam site including associated morphodynamic impacts.

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

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

TERMINOLOGY USED

Acronym	Description
AfDB	African Development Bank
BAP	Baseline Assessment Protection
BP	Best Practice
CNHS	Critical Natural Habitats
CRR	Comment and Response Register
DWA	Department of Water Affairs
EAP	Environmental Action Plan
EEA	Eswatini Environment Authority
EEAA	Eswatini Environmental Authority Act
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
ENTC	Eswatini National Trust Commission
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management and Monitoring Plan
EPAP	Equator Principles Action Plan
EPFI	Equator Principles Financial Institution
EPs	Equator Principles
EPP	Ezulwini Power Plant
EWA	Eswatini Water Act
EWSC	Eswatini Water Services Corporation
GDP	Gross Domestic Product
ICP	Informed Consultation and Participation
IESIA	Integrated Environmental and Social Assessment
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
IWRMP	Integrated Water Resources Master Plan
JMRBWRS	Joint Maputo River Basin Water Resources Study
MAP	Mean Annual Precipitation
MAR	Morphodynamic Assessment Report
Min OL	Minimum Operating Level
MMA	Maphanga Mitchell Associates
masl	Meters above sea level
NDP	National Development Plan
NDS	National Development Strategy
NGOs	Non-Governmental Organisations
OHS	Occupational Health and Safety
PAP	Project Affected People
PSs	Performance Standards
QAQC	Quality Assurance and Quality Control
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SADC	Southern African Development Community

Acronym	Description
SP	Studio Pietrangeli
SQR	Sub Quaternary Reach
TIA	Tripartite Interim Agreement
ToR	Terms of Reference
UTM	Universal Transverse Mercator
WB	World Bank
WRB	World Reference Base
WSP	WSP Environmental (Pty) Ltd
WPCR	Water Pollution Control Regulations

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Expertise	Karen King is a professional hydrologist and soil scientist (Pr. Sci.Nat, M.Sc.) She has over 14 years' work experience and specialises in mining/development hydrology, water quality and quantity monitoring, water resources planning, catchment-scale hydrological modelling, flood studies, water balances, stormwater management planning, wetland delineation, water research, agricultural studies, soil science and related risk assessments and management plans. She has been primarily involved in the engineering hydrology and soil science fields as a hydrologist in various engineering consultancies both in South Africa and in the United Kingdom. Karen has undertaken work in 7 countries and is currently studying toward a Ph.D.

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1 TERMS OF REFERENCE

WSP Environmental (Pty) Ltd (WSP) was commissioned by the Eswatini Department of Water Affairs (hereafter referred to as DWA) to undertake a morphodynamic impact assessment for the proposed Nondvo Dam project located approximately 7 km northeast of Mhlambanyatsi Town within the Kingdom of Eswatini. The local and regional settings of the site are shown in **Figures 1** and **2**, respectively.

1.1 PROJECT BACKGROUND

The Government of Eswatini, Ministry of Natural Resources and DWA are in the process of assessing the feasibility of the construction of a multipurpose dam (the Mbabane - Manzini Corridor Dam (Nondvo Dam)), in order to provide potable water to Mbabane and Manzini (see **Figure 2**). The stored water could also be used for irrigation and for improving the output of hydropower plants further downstream.

The proposed Nondvo Dam would be located on a tributary of the Lusushwana River (see **Figure 2**). The site was identified for this purpose based on an initial multi-criteria selection process developed during the execution of the Joint Maputo River Basin Water Resources Study (JMRBWRS) (JMRBWRS, 2008), which was jointly undertaken by the Kingdom of Eswatini, the Republic of South Africa and the Republic of Mozambique.

The project corresponds with the National Development Plan (NDP) 2014/15 – 2016/17. The National Development Strategy (NDS) also confirms the Eswatini government's priority to improve storage capacity for renewable water resources through the development of two dams; the Nondvo Dam being one of these. The project is quoted in the Government Programme of Action 2013-2018 and aligns with the Southern African Development Community (SADC) strategies and the principles stated in the Tripartite Interim Agreement between the three riparian countries of the Maputo River Basin (Eswatini, South Africa and Mozambique).

A Bankable Feasibility Study for the Nondvo Dam, complete with conceptual design specifications, an Environmental and Social Impact Assessment (ESIA) and a Resettlement Policy Framework (RPF) are being generated. This document represents the morphodynamic assessment specialist input into the ESIA.

1.2 PROJECT ALTERNATIVES

An assessment of project alternatives was undertaken by Studio Pietrangeli (SP) (SP, 2017) in order to identify alternatives to satisfy the water demand in the Mbabane/Manzini region to the year 2050.

The study identified that a new dam is necessary to increase the water supply to the area to allocate some of the water resources for irrigation purposes, without any reduction in the current energy production at Ezulwini Power Plant (EPP).

Of the numerous studied alternatives, ultimately no single project in isolation was shown to be able to meet all the relevant requirements. As such, three potential solutions were selected as the most promising, comprising a combination of project alternatives. The three solutions identified included the following (see **Figure 3**):

- Preferred Alternative – reservoir elevation ranges from 950 to 975 masl; Minimum Operating Level (Min OL) 950 masl
- Alternative 1 –500 m downstream of the preferred alternative; reservoir elevation ranges from 940 to 980 masl; Min OL 930
- Alternative 2 – 800 m downstream of Alternative 1; reservoir elevation ranges from 930 to 980 masl; Min OL 915 masl; within the Mlilwane Game Sanctuary Reserve

2 SCOPE AND PURPOSE OF REPORT

This document forms Phase 2 of a two-phased study forming part of the project ESIA. Phase 2 includes a detailed geomorphological assessment within which the present geomorphological state of the environment was assessed based on the potential disturbances identified onsite.

Phase 1 covered the scoping phase of this study, which included a desktop assessment of the regional geomorphological settings including potentially affected areas in respect of climate, geology, soils and relief.

3 ASSUMPTIONS AND LIMITATIONS

The following assumptions were made and limitations were identified within this study:

— As the three alternatives are within the same area, the impacts identified are relevant to all of them;
— No areas have yet been assigned for the relocation of local people; the suitability of the relocation areas could thus not be assessed at this stage, as the Resettlement Report for the project is being undertaken, and
— No flora and fauna assessments were considered within this assessment, as these studies have been undertaken within a separate report.

4 LEGAL FRAMEWORK

The Eswatini regulatory framework establishes well-defined requirements and standards for environmental and social management of infrastructure developments. The primary environmental and social legislation and international standards applicable to the project are listed below:

— The Eswatini Water Act, 2003 (Act No. 7 of 2003);
— The Eswatini Environmental Authority Act, 1992 (Act No. 15 of 1992);
— The Environmental Management Act, 2002 (Act No. 5 of 2002);
— The Water Pollution Control Regulations, 1999;
— The AfDB Integrated Environmental and Social Assessment (IESIA) Guidelines (AfDB 2009; AfDB 2015);
— The World Bank's Environmental and Social Safeguard Policies - OP/BP 4.01 Environmental Assessment;
— Equator Principles - Principle 1: Review and Categorisation;
— Equator Principles - Principle 2: Environmental and Social Assessment;
— Equator Principles - Principle 3: Applicable Environmental and Social Standards;
— Equator Principles - Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
— IFC Performance Standards (PS) (IFC, 2012) - PS1 - Assessment and Management of Environmental and Social Risks and Impacts;
— World Bank's Environmental and Social Safeguard Policies - OP/BP 4.02 Environmental Action Plans; and,
— Protocol on Shared Watercourses in the Southern Africa Development Community (SADC).

5 BASELINE ENVIRONMENTAL DESCRIPTION

5.1 SITE LOCATION

The proposed Nondvo Dam will be located approximately 7 km northeast of the town of Mhlambanyatsi, south of the city of Mbabane. The local and regional settings of the site are shown in **Figures 1** and **2**, respectively.

5.2 DRAINAGE AND HYDROLOGY

The proposed project area falls within the Joint Maputo River Basin. The project area is located within the Pongola-Mtamvuma Water Management Area formerly known as the Usutu to Mhlatuze Water Management Area and within the W56C Quaternary Catchment. The specific river reaches considered for this study was a 34 km reach as delineated by the W56C-1514 Sub Quaternary Reach (SQR). The Lusushwana and Mbabane Rivers drain quaternary Catchment W56C, within which the proposed dam will fall.

The proposed Nondvo Dam will be situated downstream of the existing Luphohlo Dam and will extend along the Lusushwana River. The Lusushwana River is a tributary of the Usutu River above its confluence with the Pongolo River (see **Figure 4**).

The Lusushwana River originates on the interior plateau of South Africa and drains an area of approximately 1190 km^2. It is a tributary of the Lusutfu River, forming the northern portion of the catchment of the Maputo Basin, and drains in an easterly direction to its confluence with the Pongola River.

5.3 CLIMATE

The Kingdom of Eswatini's climate is generally subtropical with hot wet summers (about 75% of the annual rainfall falls between October to March) and cold dry winters (April-September). The Kingdom's physiographic zones range from sub-humid and temperate in the Highveld to semi-arid and warm in the Lowveld (SP, 2018).

Mean Annual Precipitation (MAP) ranges from about 1500 mm in the northern Highveld to 500 mm in the southern Lowveld. Precipitation varies considerably from year to year, which can lead to periods of flash flooding or drought.

The mean annual temperature varies from 17°C in the Highveld to 22°C in the Lowveld. These temperatures are zonal averages, with some variation across zones.

5.3.1 *RAINFALL*

Rainfall data was sourced from the hydrological study undertaken by SP (SP, 2018). **Table 1** shows the list of selected rainfall stations (see **Figure 4**) and the relevant datasets, and **Figures 5** and **6** represent the MAP and mean monthly precipitation, respectively. The coordinate system found in **Table 1** is the Universal Transverse Mercator (UTM) coordinate system and coordinates are provided in metres. The MAP recorded by the selected stations ranges dramatically between 240 mm and 1400 mm per annum. It was decided that the San Roy Farm rainfall station with a MAP of 525 mm is the most representative of the site based on distance from the site and length of data recorded.

Figure 1: Locality of the Project Area

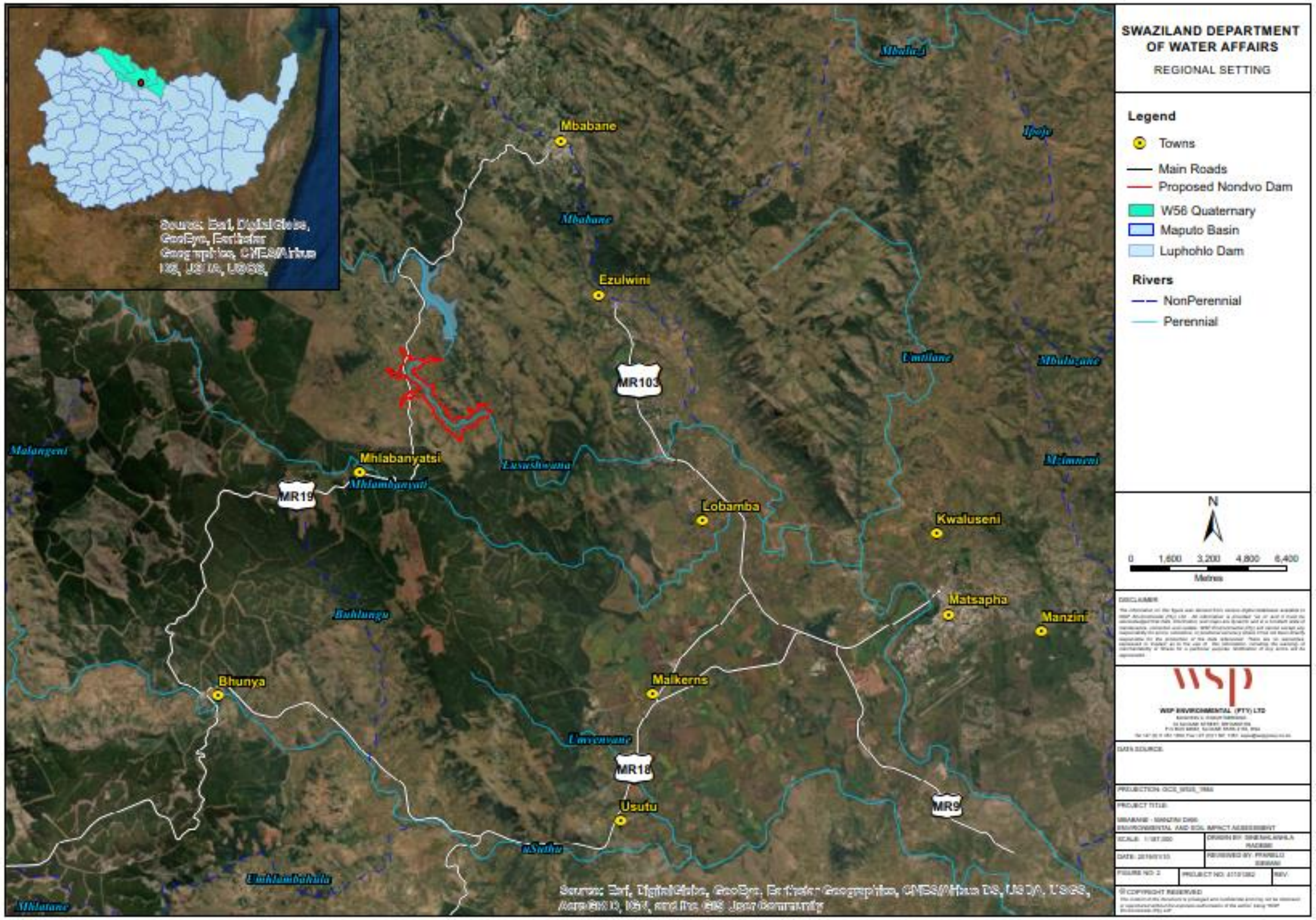


Figure 2: Regional Setting of the Project Area

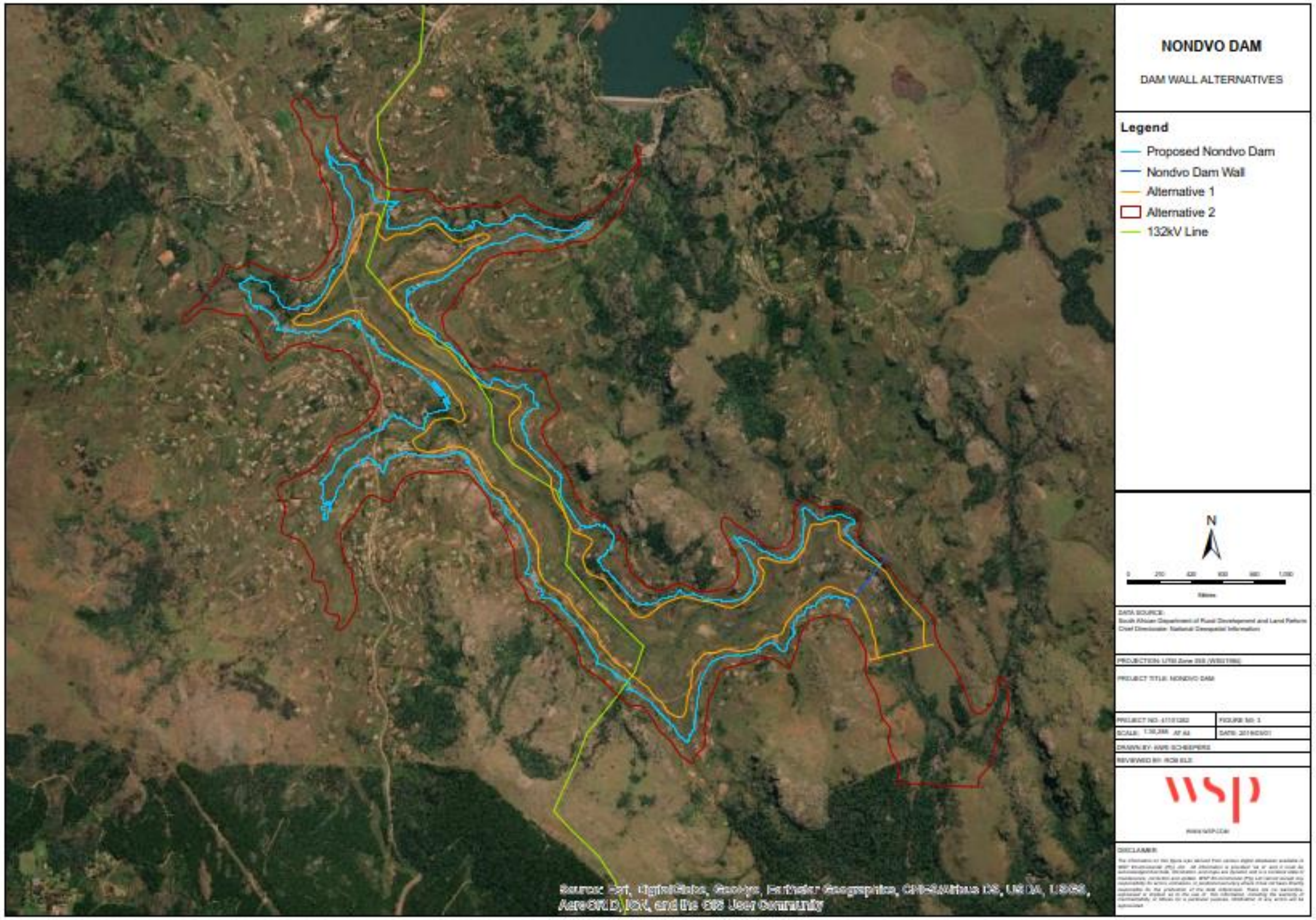


Figure 2: Dam Wall Alternatives

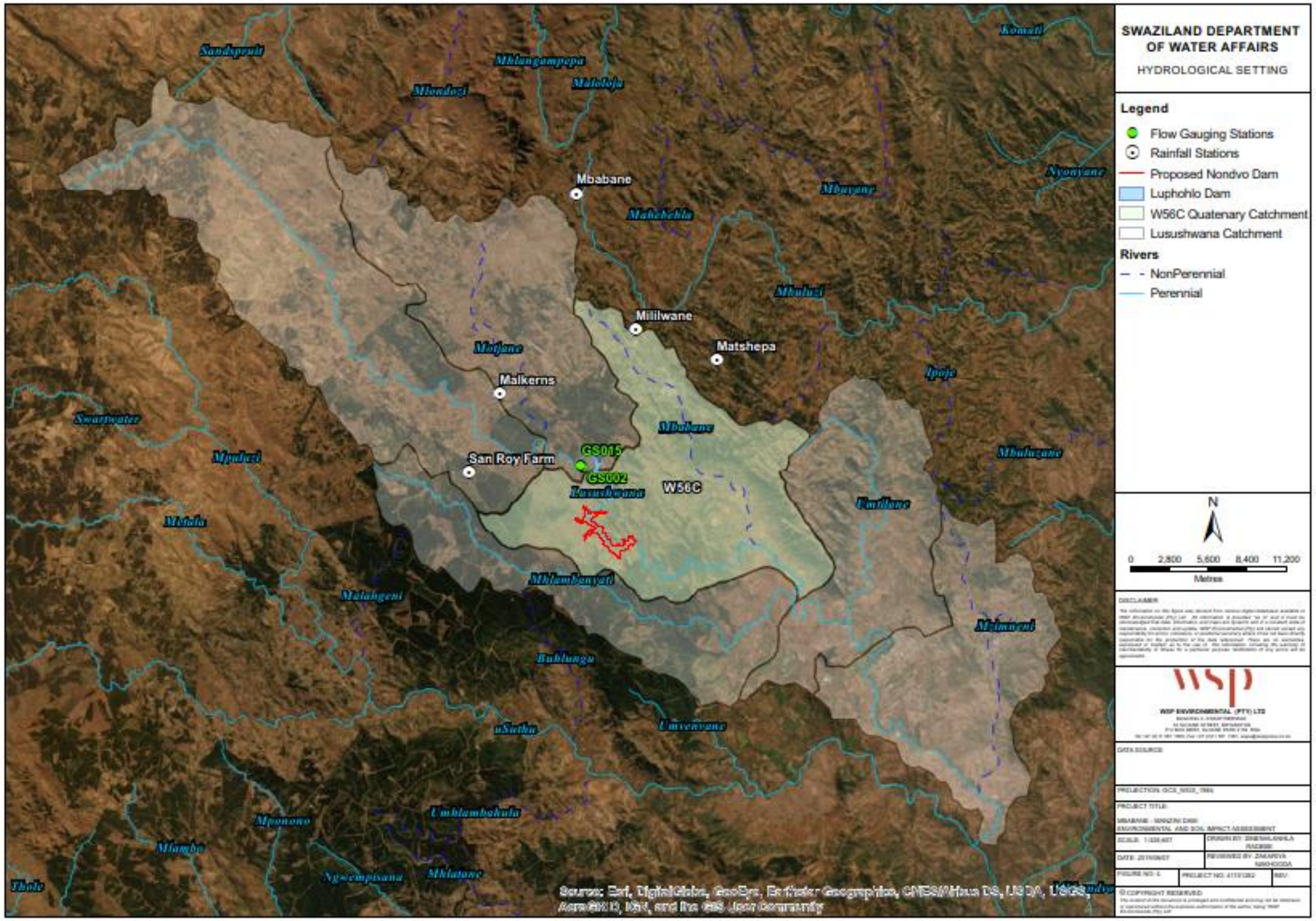


Figure 3: Hydrological Setting

Table 1: Rainfall Stations and their Properties (SP, 2018)

Station Name	Coordinates		Data Period	No of years of data	MAP (mm)
	East (m)	South (m)			
Mbabane	308 155.4	7 100 747.6	1989; 2000-16	17	1397
Matshepa	318 320.7	7 088 705.7	2002-12; 2014-16	14	718
Mililwane	312 297.7	7 090 835.6	2000-01; 2003; 2011-16	9	602
Malkerns	302 379.1	7 086 255.0	2000-2015	16	972
Malolotja	316 274.5	7 082 759.4	2000-01; 2003-04; 2007-16	14	844
Milawula	303 847.6	7 091 859.3	2001-04; 2006; 2009-12; 2016	10	245
San Roy Farm	300 468.3	7 080 684.7	2000-2011	12	525

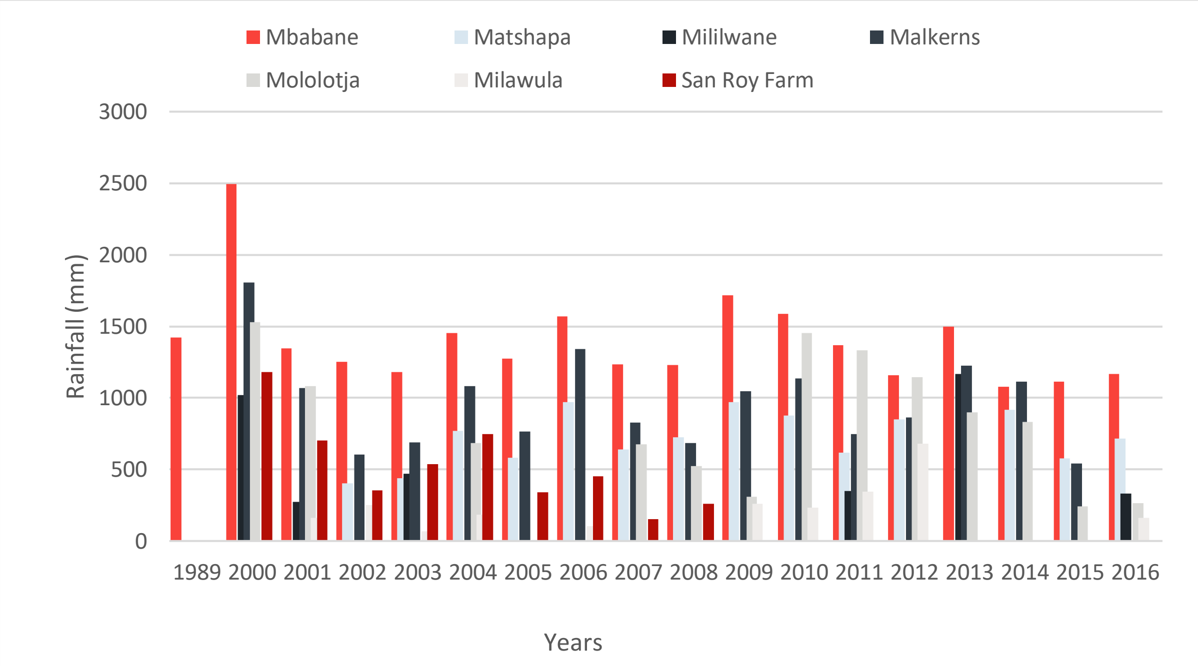


Figure 4: MAP at Selected Meteorological Stations (Source: SP, 2018)

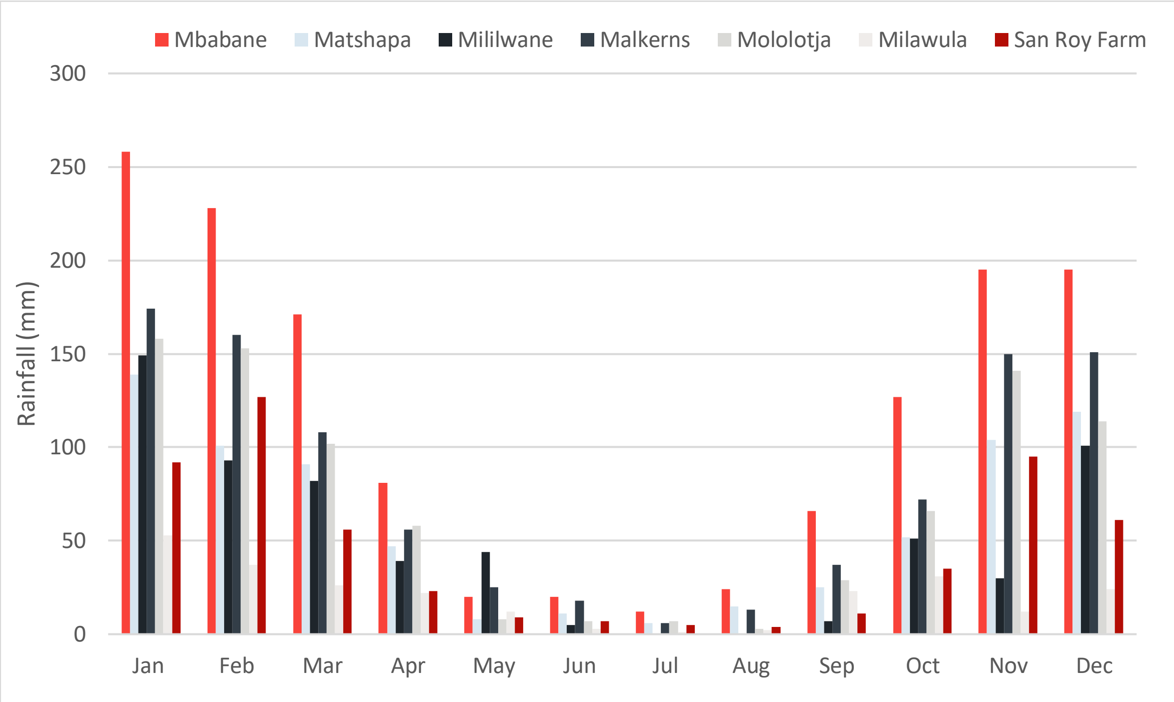


Figure 5: Mean Monthly Rainfall at Selected Meteorological Stations (Source: SP, 2018)

5.4 RIVER DISCHARGE

Daily flow records for streams located within, and surrounding, the catchment relevant to the Nondvo Dam are necessary for understating the flow regime within the area. Several gauging stations recording daily flow are located along the Lusushwana River and its tributary. **Table 2** presents the river discharge stations and their properties and **Figure 7** presents annual runoff for the selected stations.

Table 2: River Discharge Stations and their Properties (SP, 2018)

<table>
<tr><th rowspan="2">Station Code</th><th rowspan="2">River</th><th colspan="2">Coordinates</th><th rowspan="2">Catchment (km^2)</th><th rowspan="2">No. of Years of Data</th></tr>
<tr><th>East (m)</th><th>South (m)</th></tr>
<tr><td rowspan="2">**GS 002**</td><td rowspan="2">Lusushwana</td><td rowspan="2">308,446</td><td rowspan="2">7,080,979</td><td rowspan="2">1209</td><td>8</td></tr>
<tr><td>46</td></tr>
<tr><td>**GS 004**</td><td>Mbuluzi</td><td>319,792</td><td>7,099,441</td><td>171</td><td>44</td></tr>
<tr><td>**GS 006**</td><td>Usuthu</td><td>368,744</td><td>7,047,430</td><td>-</td><td>47</td></tr>
<tr><td>**GS 009**</td><td>Usuthu</td><td>301,330</td><td>7,063,330</td><td>-</td><td>59</td></tr>
<tr><td rowspan="2">**GS 015**</td><td rowspan="2">Lusushwana</td><td rowspan="2">308,284</td><td rowspan="2">7,081,093</td><td>561</td><td>8</td></tr>
<tr><td>-</td><td>39</td></tr>
<tr><td>**GS 024**</td><td>Lusushwana</td><td>327,864</td><td>7,070,171</td><td>-</td><td>26</td></tr>
<tr><td>**GS 033**</td><td>Lusushwana</td><td>291,926</td><td>7,088,873</td><td>-</td><td>26</td></tr>
<tr><td>**GS 043**</td><td>Lusushwana</td><td>313,362</td><td>7,081,973</td><td>-</td><td>8</td></tr>
</table>

Two gauging stations were identified to be of key importance for understanding the river; the first is located just upstream of the Luphohlo Dam (GS015) and the second is located upstream of the waste treatment plant of Matsapha and Lake Mkinkomo (GS002) (see **Figure 4**). Based on the data from these two gauging stations, the highest monthly average flow (i.e. runoff trend) is shown to be reached in February, following which the river flows decrease slowly to reach minimum values in August and September. The mean annual flow is 11.5 m^3/s (363 Mm^3/year) and 3.5 m^3/s (120 Mm^3/year), respectively, at GS002 and GS015. Daily flow records have been collected from both DWA and SEC databases and reviewed.

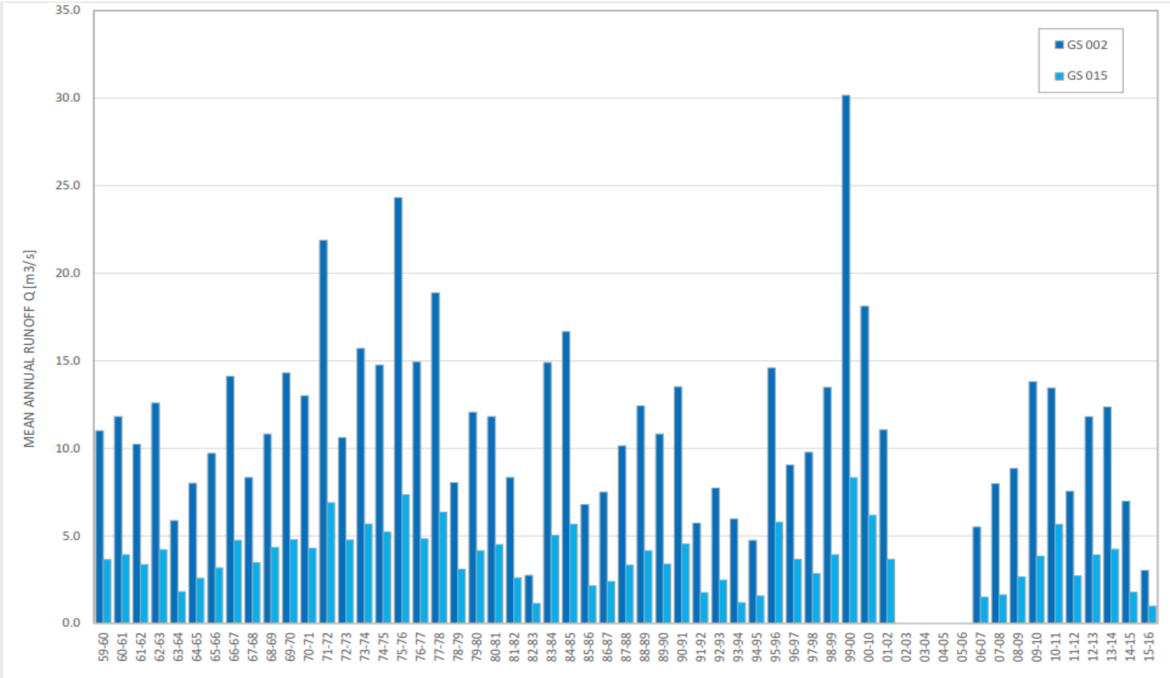


Figure 6: Average Annual Runoff Trends at GS002 and GS015 (Source SP, 2018)

5.5 TOPOGRAPHY

The topography within the project area is characterised by steep slopes with deep, narrow valleys. At an altitude of 1040 masl along the Lusushwana River, the project site is situated along a valley with the Luphohlo mountain range rising steeply to a summit of 1404 masl at a distance of 4 km to the northeast. Between 0.5 km and 1.5 km to the west, the terrain rises to summits ranging from 1100 m to 1172 masl (**Figure 8**). The area is also characterised by rocky outcrops and seasonal streams with steep rocky banks (SP, 2018).

Figure 7: Topography around the Project Area

5.6 GEOLOGY

The Nondvo Dam site is underlain by granitic rock that is affected by doleritic dykes mainly trending NW-SE and smaller dykes trending NE-SW. There are rock outcrops along the riverbanks and riverbeds. The rock is characterized by gneiss cut by pegmatite veins. The slopes are characterized by sub-outcropping rock at some places while at higher elevations gneiss-rounded outcrops are visible.

5.7 IDENTIFIED SOILS ON SITE

According to the World Reference Base (WRB) system, the general Nondvo Dam study area is dominated by Ferralsols, Regosols and Leptosols. A Ferralsol is a red and/or yellow weathered soil whose colours result from an accumulation of metal oxides, particularly iron and aluminium. These soils are formed on geologically old parent materials, are typically well-drained and have a low erosion hazard.

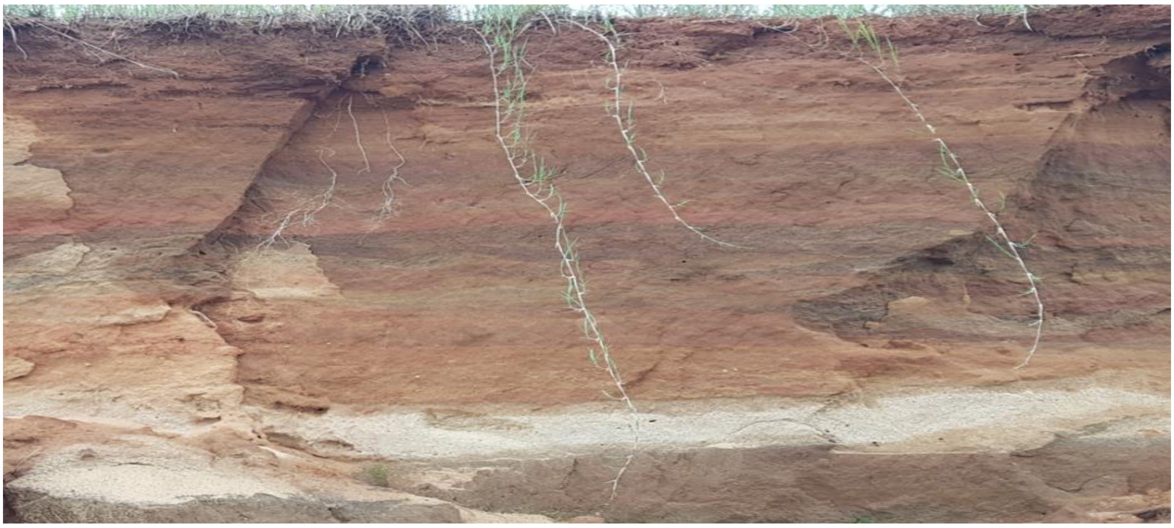
A Regosol is very weakly developed mineral soil in unconsolidated materials. Regosols are extensive in eroding lands, in particular in arid and semi-arid areas and mountainous regions.

A Leptosol is a very shallow soil over hard rock or highly calcareous material or a deeper soil that is extremely gravelly and/or stony.

While the area surrounding the Nondvo Dam site appeared to be dominated by Ferralsols (**Photograph 1**), evidence of Regosols (**Photograph 2**) and Leptosols (**Photograph 3**) was also found.

Photograph 1: Evidence of Ferralsols found at the Nondvo Dam Site

Photograph 2: Evidence of Regosols found at the Nondvo Dam Site



Photograph 3: Evidence of Leptosols found at the Nondvo Dam Site

5.8 LAND USE

The project area consists of a mixture of naturally vegetated areas as well as plantations and agricultural areas. There is evidence of densely populated rural development within the Mantabeni and Siphocosini communities with residential homesteads and subsistence farming practices that include crop production and livestock grazing.

The residential development areas have peri-urban characteristics in that they are situated on the fringe of the Mbabane and Ezulwini urban areas and, although separated from these urban areas by a mountain range, their landscape is a transition between town and country.

Social amenities such as public schools, clinics, shops, churches and the two *Imiphakatsi* (Royal Kraals) of Siphocosini and Mantabeni are interspersed among the homesteads, predominantly in close proximity to the paved main road (MR19).

To the north of the project site is Luphohlo Dam; a multipurpose dam where the primary use is hydropower generation. Secondary uses include recreation and potable water supply. To the west is the Luphohlo mountain range on which Mlilwane Wildlife Sanctuary is situated and extends 10 km southward. A private commercial forestry plantation (in which the private company village of Mhlambanyatsi is situated) is located 4 km south of the site.

6 SCOPE OF WORK / METHODOLOGY

6.1 SITE VISIT

A two-day site visit was undertaken by WSP on the 13th and 14th February 2019 to determine the general catchment and site-specific morphodynamic characteristics. Mid-February is mid-Summer and the wet season, therefore the relevant rivers were flowing strongly and the riverside vegetation was very overgrown. No specialised equipment was used during the site visit and no modelling was undertaken thereafter. A photographic log highlighting the main features of the site is shown in **Table 3.**

Table 3: Photographs Showing the Channel Morphology of the Lusushwana River

6.2 IMPACT ASSESSMENT METHODOLOGY

This section provides a description of the methodology adopted to establish the potential morphodynamic impacts associated with the proposed development of the Nondvo Dam.

6.2.1 *METHODOLOGY*

The determination and assessment of impacts were based on the following criteria:

- Nature of the impact;
- Significance of the impact;
- Consequence of the impact;
- Extent of the impact;
- Duration of the impact;
- Probability of the impact;
- Degree to which the impact:
  - can be reversed;
  - may cause irreplaceable loss of resources, and
  - can be avoided, managed or mitigated.

Following international good practice, additional criteria have been included to determine the significance of the potential impacts. These include consideration of the following:

- Magnitude of the impact or extent to which environmental resources are going to be affected;
- Sensitivity of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor), and
- Severity of the impact, measured by the importance of the consequences of change (high, medium, low or negligible) by considering the magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

It should be noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance has been assessed with and without mitigation measures in place. Potential impacts have been assessed in respect of the following criteria:

a) The **nature**; a description of what causes the effect, what will be affected and how it will be affected.

Table 4: Nature or Type of Impact

Nature or Type of Impact	Definition
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).

Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

b) The **physical extent**.

Table 5: Physical Extent Rating of Impact

Score	Description
1	The impact will be limited to the site
2	The impact will be limited to the local area
3	The impact will be limited to the region
4	The impact will be of national scope or level
5	The impact will be international

c) The **duration**, wherein it is indicated whether the lifetime of the impact will be:

Table 6: Duration Rating of Impact

Score	Description
1	On impact
2	Of a short duration (0-5 years)
3	Medium term (5–15 years)
4	Project life
5	Indefinite

d) **Reversibility:** An impact is either reversible or irreversible. The level of reversibility is the ability of an environmental receptor to rehabilitate or restore itself after the activity has caused environmental change (i.e. how long before impacts on receptors cease to be evident).

Table 7: Reversibility of an Impact

Score	Description
1	Reversible: Recovery without rehabilitation
3	Recoverable: Recovery with rehabilitation
5	Irreversible: Not possible despite action

e) The **magnitude** of the impact on ecological processes, quantified on a scale from 0-10, where a score is assigned.

Table 8: Magnitude Rating of Impact

Score	Description
0	Very low and will have no effect on the environment
1	Low and will not result in an impact on processes
2	Low and will cause a slight impact on processes
3	Moderate and will result in processes continuing but in a modified way
4	High - processes are altered to the extent that they temporarily cease
5	Very high and results in complete destruction of patterns and permanent cessation of processes

f) The **probability** of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:

Table 9: Probability Rating of Impact

Score	Description
1	Very improbable (probably will not happen)
2	Improbable (some possibility, but low likelihood)
3	Probable (distinct possibility)
4	Highly probable (most likely)
5	Definite (impact will occur regardless of any prevention measures)

g) The **significance**, which is determined through a synthesis of the characteristics described above (refer to formula below) and can be assessed as low, medium or high.

h) The status, which is described as either positive, negative or neutral.

i) The degree to which the impact can be reversed.

j) The degree to which the impact may cause irreplaceable loss of resources.

k) The degree to which the impact can be mitigated.

The significance is determined by combining the above criteria in the following formula:

$$Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$$

$$[S = (E + D + R + M) \times P]$$

Where the symbols are as follows:

Symbol	Criteria	Description
S	Significance Weighting	Refer to Table 10: Significance Weightings of an Impact
E	Extent	Refer to Table 5: Physical Extent Rating of Impact
D	Duration	Refer to Table 6: Duration Rating of Impact
R	Reversibility	Refer to Table 7: Reversibility of an Impact
M	Magnitude	Refer to Table 8: Magnitude Rating of Impact
P	Probability	Refer to Table 9: Probability Rating of Impact

The significance score can therefore range from 3 (minimum) to 100 (maximum). The significance weightings are defined as Low, Medium and High, as such the scoring system has been allocated accordingly to define the significance weighting, as identified in Table 10.

Table 10: Significance Weightings of an Impact

Significance Rating (Negative)	Significance Rating (Positive)	OVERALL SCORE
Very Low	Very Low	4-15
Low	Low	16-30
Medium	Medium	31-60
High	High	61-80
Very High	Very High	81-100

The impact significance without mitigation measures was assessed (but are not representative of the proposed development's actual extent of impact) and are included to facilitate an understanding of how and why mitigation measures were identified. The residual impact is what remains following the complete and correct application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during project implementation to verify that actual impacts are the same as those predicted in the ESIA.

7 RESULTS AND DISCUSSION

This section describes identified potential morphodynamic impacts that are likely to arise as a result of the construction, operational and decommissioning phases of the proposed Nondvo Dam, and indicates proposed mitigation measures to manage the identified impacts.

The impact assessment undertaken within this phase of the study involved the identification of potential impacts to the physical environment as well as downstream water users. As mentioned, the impact assessment was conducted for, and is relevant to, the following three alternatives (see **Figure 3**):

- Preferred Alternative – reservoir elevation ranges from 950 to 975 masl; Minimum Operating Level (Min OL) 950 masl
- Alternative 1 – 500 m downstream of the preferred alternative; reservoir elevation ranges from 940 to 980 masl; Min OL 930
- Alternative 2 – 800 m downstream of Alternative 1; reservoir elevation ranges from 930 to 980 masl; Min OL 915 masl; within the Mlilwane Game Sanctuary Reserve

7.1 CONSTRUCTION PHASE

The following potential impacts were identified and assessed for the Nondvo Dam construction phase:

Impact 1: Soil Erosion

Soil erosion is not a very significant potential problem at the Nondvo Dam site, as the area is dominated by Ferralsols, which are not inherently erosive. However, any areas of sparse land cover will still leave the soil vulnerable to the erosive influences of wind and water. Furthermore, Regosols and Leptosols were identified covering smaller areas of the site, and are significantly more erosive, owing to their lack of macrostructure and depth, respectively. Development of the area will lead to some erosion during the construction phase of the development, and mitigation measures will need to be put in place to prevent eroded areas from spreading. This has the potential to have a cumulative effect on the soils identified at the sites, as eroded areas will spread until measures are put in place to stop the erosion.

Impact 2: Bank Erosion

Bank erosion is often associated with the evolution of meanders, which might occur as a result of construction of the proposed dam. Additionally, during construction of the dam, vegetation may be removed and the removal or disturbance of protective vegetation from stream banks may result in bank erosion which, in turn, might result in the following:

- Streambed lowering or infill;
- Inundation of bank soils followed by a rapid drop in flow after flooding;
- Saturation of banks from off-stream sources; and,
- Redirection and acceleration of flow around the streams.

Impact 3: Sedimentation

The risk of sedimentation is directly linked to the risk of erosion, as eroded soil particles may end up in nearby watercourses as sedimentation. As erosion is a risk at the site, and the site is close to watercourses, sedimentation is inherently also a risk. As erosion may have a cumulative effect, the sedimentation effect would also be cumulative.

Impact 4: River Flow Modification

The initial changes in flow associated with the construction of a dam will result in environmental impacts. Life in and around a river evolves and is conditioned on the timing and quantities of river flow. Changes in the quantity and timing of water flow impact aquatic and riparian life, which can disturb the ecological network of a river system (Brierley and Fitchett, 2000).

Impact 5: River Bed Disturbance

River bed deepening or incising might occur due to the construction of the proposed dam which, in turn, might result in lowering of water levels in the watercourse. Change in flow regime can affect vegetation on river banks. It can further change the morphological qualities of the riverbed and banks, which influence the amount of water transportation and the rise and fall in the elevation of the bed.

Impact 6: River Morphology

The dam construction site will trap sediment and prevent the normal sediment load distribution downstream of the river. Consequently, a major impact on the downstream river channel could be to make it deeper and narrower (Beck, 2001). Additional morphological impacts may include:

— Reduced natural function, water quality, oxygen, turbid flow and available river habitats;
— Changes in water temperature, which can affect the species in the river and the environment needed for spawning;
— Alteration of the topography in and around the proposed dam site due to the construction activities;
— Alteration of the geology of the area at the dam construction site (dam wall site);
— Incision may occur immediately downstream of the dam;
— Channel narrowing in which peak flows are affected;
— Loss of secondary channel;
— Colonization of bars by vegetation and sediment trapping, and
— Alluvial fans stabilization.

Impact 7: Water Quality Degradation

An element of water contamination from hazardous substances is anticipated during the construction of a dam. This occurs as a result of leaks or spills of concrete onto soil or water resources, as well as oils, fuel, grease (from construction vehicles) and sewage from temporary on-site ablution facilities. Changes to downstream oxygen levels and increased algae blooms are likely.

Impact 8: Loss of Topsoil

Although topsoil will be lost from the site during the construction phase, it can potentially be transferred to an alternative area for continued cultivation.

Impact 9: Change in Surface Profile

The surface profile of the site will be changed during the construction phase. This will affect water flow, sedimentation and erosion patterns. This cannot be mitigated against.

7.2 OPERATIONAL PHASE

The following risks were identified and assessed for the operational phase:

Impact 1: Sedimentation

The existence of a dam implies channelization of runoff which may lead to erosion and sedimentation in a downstream receiving watercourse. An operational dam will alter the amount of sediment production, retention and transportation in the system. According to White (2000), water released from a dam is likely to be relatively clear because of sedimentation within the dam. Clear water has the capacity to carry more sediment than turbid water. The release of clear water, therefore has the potential to increase erosion and cause the collapse of river banks in the river downstream of the dam. Consequences of sedimentation can include:

- Sedimentation within the dam resulting in less sediment deposition downstream which implies less change in the stream morphology;
- Trapping of silt in dams that deprive downstream watercourses of maintenance materials and nutrients that help make them productive ecosystems;
- Elevated turbidity that is likely to impact on macroinvertebrates and fish, particularly predatory species that rely on sight for feeding; and,
- Vulnerability of spawning sites, eggs and larval stages of most species due to increased sediment.

Impact 2: Flooding

The existence of a dam tends to reduce the effect of flooding downstream, yet flooding of a drainage basin can be caused by the overtopping of upstream dams as a result of prolonged periods of rainfall (International Rivers, 2007). Flooding results in major changes of river morphology. Major effects of flooding include the creation of bars, pools and rapids, which then influence the morphology of the river.

Impact 3: River Morphology

The proposed dam will trap sediment, especially heavy gravels and cobbles, and thus prevent the normal sediment load distribution downstream of the dam site. A major impact on the downstream river channel could be to make it deeper and narrower (Beck, 2001). Additional impacts of a dam may include:

- Reduced natural function, water quality, oxygen, turbid flow and available river habitats;
- A dam can affect water temperature, which can affect the species in the river and the environment needed for spawning which may affect river shape;
- Alteration of the topography in and around the proposed Nondvo Dam site might be altered due to the construction of the dam;
- Alteration of the geology of the area at the dam construction site (dam wall site);
- Incision may occur immediately downstream of the dam;
- Channel narrowing thus peak flows are affected;
- Loss of secondary channel;
- Colonization of bars by vegetation and sediment trapping; and,
- Alluvial fans stabilization.

Impact 4: Water Quality Degradation

The trapping and consequent stagnation of water as a result of the existence of a dam causes physical, thermal and chemical changes to the previously-flowing water, which can cause a serious decline in the quality of the water in and downstream of the reservoir.

Impact 5: River Flow Modification

The existence of a dam will change the river flow, which is likely to result in the following impacts:

- Change in flow can affect the slope of upstream and downstream watercourses;
- Reduction of flow might result in loss of turbulent flow and may reduce dissolved oxygen concentrations and impoundment;
- Changes in velocity and volumes of flow would influence erosion thereby changing the natural shape of the streams;
- Altering the seasonality of flows;
- Changing the frequency, duration, magnitude, timing, predictability and variability of flow events, and
- Altering surface and subsurface water levels.

Impact 6: Erosion

Soil erosion is not a very significant potential problem at the Nondvo Dam site, but areas of sparse land cover will leave the soil vulnerable to the erosive influences of wind and water. Continual use, monitoring and management of an operational dam will lead to some erosion, and measures will need to be put in place to prevent eroded areas from spreading. This will have a cumulative effect on the soils identified at the sites, as eroded areas will spread until measures are put in place to stop the erosion.

7.3 DECOMMISSIONING PHASE

The following potential impacts were identified and assessed for the Nondvo Dam decommissioning phase:

Impact 1: Sedimentation

Dam decommissioning alters the amount of sediment production, retention and transportation in a system. According to White (2000), water released from a dam is likely to be clear because of sedimentation within the dam – this will naturally change as a dam is decommissioned. Clear water has the capacity to carry more sediment than turbid water. Stopping releases of clear water from a now-decommissioned dam is therefore likely to:

— Increase sediment deposition downstream which implies a change in the stream morphology, and
— Reintroduce maintenance materials and nutrients to the downstream environment.

Impact 2: River Flow Modification

The change in flow downstream of a recently-decommissioned dam will result in continuous environmental impacts. Life in and around a river evolves and is conditioned on the timing and quantities of river flow. Changes in the quantity and timing of water flow impact aquatic and riparian life, which can disturb the ecological network of a river system (Brierley and Fitchett, 2000). Decommissioning of a dam might result in the following impacts:

— Change in flow can affect the slope of upstream and downstream watercourses;
— Increases in flow might result in the introduction of turbulent flow and may increase dissolved oxygen concentrations;
— Changes in velocity and volumes of flow would influence erosion thereby changing the natural shape of the streams;
— Altering (reintroducing) the seasonality of flows;
— Changing the frequency, duration, magnitude, timing, predictability and variability of flow events; and,
— Altering surface and subsurface water levels.

Impact 3: Flooding

The decommissioning of a dam is likely to increase the effect of flooding downstream. Major effects of flooding include the creation of bars, pools and rapids which then influence the morphology of the river.

Impact 4: River Morphology

Decommissioning of the Nondvo Dam will affect the functioning of the river up-and downstream of the dam, water quality, oxygen, turbid flow and available river habitats, as well as a change in water temperature (likely cooler), which could affect the species in the river. The topography in and around the site will be altered, and the channel downstream will likely change shape, affecting peak flows.

Impact 6: Water Quality Degradation

Potential water contamination from hazardous substances is anticipated during the decommissioning of a dam. This includes leaks or spills of oil from moving trucks onto soil or water resources, as well as fuel, grease (from construction vehicles) and sewage from temporary on-site ablution facilities. Some change to downstream oxygen levels are likely, as is an increased likelihood of algae blooms.

Impact 7: River Bed Disturbance

Decommissioning of the dam will likely result in increased water levels in the watercourse. Change in flow regime can affect vegetation on river banks. It can further change the morphological qualities of the riverbed and banks, which influence the amount of water transported and the rise and fall in the elevation of the bed.

Impact 8: Erosion

Soil erosion is not a very significant potential problem at the Nondvo Dam site, but areas of sparse land cover will leave the soil vulnerable to the erosive influences of wind and water. Decommissioning will lead to some erosion, and measures will need to be put in place to prevent eroded areas from spreading. This has the potential to have a cumulative effect on the soils identified at the sites, as eroded areas will spread until measures are put in place to stop the erosion.

8 IMPACT ASSESSMENT

Tables 11 to **14** represent the construction, operational and decommissioning phases of the proposed development of Nondvo Dam, as well as the expected cumulative effects of the three stages, accounting for the fact that there is an existing dam upstream of the study site. These tables highlight the potential impacts as identified in Section 7, the main receptors thereof, and the ease of mitigation thereof. Values for the magnitude, physical extent, reversibility, duration and the probability of the impacts have been given, and the overall significance of the impacts has been calculated in accordance with the equation presented in Section 6. These values have then been assessed a second time, assuming that the mitigation measures outlined in Table 15 are correctly implemented.

Table 11: Risk Assessment Matrix for Construction Phase

Impact number	Receptor	Description	Stage	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
					M	E	R	D	P	S	Rating	M	E	R	D	P	S	Rating
Impact 1: Soil Erosion	Soil, watercourse and habitats	Soil erosion is not a very significant potential problem at the Nondvo Dam site, but areas of sparse land cover will leave the soil vulnerable to the erosive influences of wind and water, and development (digging up) of the area will lead to some erosion during the construction phase of the development. Measures will need to be put in place to prevent eroded areas from spreading. This could have a cumulative effect on the soils identified at the sites, as eroded areas will spread until measures are put in place to stop the erosion.	Construction	Medium	**3**	**2**	**3**	**4**	**4**	**48**	**N2**	**2**	**2**	**3**	**2**	**3**	**27**	**N1**
				Significance	**N2 - Medium**							**N1 - Low**						
Impact 2: Bank Erosion	Soil, watercourse and habitats	Bank erosion is often associated with the evolution of meanders, which might occur as a result of the construction of the proposed dam. Additionally, during the construction of the dam, removal or disturbance of protective vegetation from stream banks may result in bank erosion.	Construction	Medium	**3**	**2**	**3**	**5**	**4**	**52**	**N2**	**2**	**1**	**3**	**3**	**4**	**32**	**N2**
				Significance	**N2 - Medium**							**N2 - Medium**						
Impact 3: Sedimentation	Watercourse and habitats	The risk of sedimentation is directly linked to the risk of erosion, as eroded soil particles may end up in nearby watercourses as sedimentation. As erosion is a risk at the site and it is close to watercourses, so is sedimentation. As erosion will have a cumulative effect, so will sedimentation.	Construction	Medium	**3**	**3**	**3**	**2**	**5**	**55**	**N2**	**2**	**2**	**3**	**2**	**5**	**45**	**N3**
				Significance	**N2 - Medium**							**N2 - Medium**						
Impact 4: River Flow Modification	Watercourse and habitats	The initial changes in flow associated with the construction of a dam will result in environmental impacts. Life in and around a river evolves and is conditioned on the timing and quantities of flow. Changes in the quantity and timing of flows impact aquatic and riparian life, which can disturb the ecological network of a river system.	Construction	Low	**3**	**3**	**3**	**4**	**5**	**65**	**N3**	**2**	**3**	**3**	**3**	**5**	**55**	**N2**
				Significance	**N3 - High**							**N2 - Medium**						
Impact 5: River Bed Disturbance	Watercourse and habitats	River bed deepening or incising might occur due to the construction of the proposed dam which, in turn, might result in lowering of water levels in the watercourse. Change in flow regime can affect vegetation on river banks. It can further change the morphological qualities of the riverbed and banks, which influence the amount of water transportation and the rise and fall in the elevation of the bed.	Construction	Low	**3**	**2**	**5**	**4**	**5**	**70**	**N2**	**2**	**2**	**5**	**3**	**5**	**60**	**N2**
				Significance	**N2 - Medium**							**N2 - Medium**						
Impact 6: River Morphology	Watercourse and habitats	The dam construction site will trap sediment and prevent the normal sediment load distribution downstream of the river. Consequently, a major impact on the downstream river channel could be to make it deeper and narrower, among a number of related morphological impacts.	Construction	Low	**3**	**3**	**5**	**3**	**5**	**70**	**N3**	**3**	**2**	**5**	**3**	**5**	**65**	**N3**
				Significance	**N3 - High**							**N3 - High**						
Impact 7: Water Quality Degradation	Watercourse and habitats	An element of water contamination from hazardous substances is unavoidable during the construction of a dam. This occurs as a result of leaks or spills of concrete onto soil or water resources, as well as oils, fuel, grease (from construction vehicles) and sewage from temporary on-site ablution facilities. The likelihood of changes to downstream oxygen levels and increased algae blooms are likely. The use of drip	Construction	Low	**3**	**3**	**3**	**2**	**5**	**55**	**N2**	**1**	**2**	**3**	**2**	**5**	**45**	**N2**

Impact number	Receptor	Description	Stage	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
					M	E	R	D	P	S	Rating	M	E	R	D	P	S	Rating
		trays, regular servicing of vehicles and demarcation of working zones will help to limit the contamination, however.																
				Significance	**N2 - Medium**							**N2 - Medium**						
Impact 8: Loss of Topsoil	Soil	Although topsoil will be lost from the site during the construction phase, it can potentially be transferred to an alternative area for continued cultivation	Construction	High	**4**	**1**	**3**	**4**	**4**	**44**	**P2**	**1**	**1**	**3**	**2**	**2**	**14**	**N1**
				Significance	**N2 - Medium**							**N1 - Low**						
Impact 9: Change in Surface Profile	Soil, watercourse and habitats	The surface profile of the site will be changed during the construction phase. This will affect water flow, sedimentation and erosion patterns. This cannot be mitigated against.	Construction	Low	**3**	**2**	**5**	**5**	**5**	**75**	**P3**	**3**	**2**	**5**	**5**	**5**	**75**	**N3**
				Significance	**N3 - High**							**N3 - High**						

Table 12: Risk Assessment Matrix for Operational Phase

Impact number	Receptor	Description	Stage	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
					M	E	R	D	P	S		M	E	R	D	P	S	Rating
Impact 1: Sedimentation	Watercourse and habitats	The existence of a dam implies channelization of runoff which is likely to lead to erosion and sedimentation in a downstream receiving watercourse. An operational dam will alter the amount of sediment production, retention and transportation in the system. Water released from a dam is likely to be clear because of sedimentation within the dam. Clear water has the capacity to carry more sediment than turbid water. The release of clear water is therefore likely to increase erosion and collapse of river banks downstream of the dam.	Operational	Low	**3**	**3**	**3**	**4**	**4**	**52**	**N2**	**2**	**2**	**3**	**3**	**4**	**40**	**N2**
				Significance	**N2 - Medium**							**N2 - Medium**						
Impact 2: Flooding	Watercourse and habitats	The existence of a dam tends to reduce the effect of flooding downstream, yet flooding of a drainage basin can be caused by the overtopping of upstream dams as a result of prolonged periods of rainfall. Flooding results in major changes in river morphology. Major effects of flooding include the creation of bars, pools and rapids which then influence the morphology of the river.	Operational	Low	**3**	**3**	**3**	**4**	**4**	**52**	**N2**	**2**	**2**	**3**	**3**	**3**	**30**	**N1**
				Significance	**N2 - Medium**							**N1 - Low**						
Impact 3: River Morphology	Watercourse and habitats	The proposed dam will trap sediment, especially heavy gravels and cobbles, and thus prevent the normal sediment load distribution downstream of the dam site. A major impact on the downstream river channel could be to make it deeper and narrower, among a number of other potential impacts	Operational	Low	**3**	**3**	**3**	**4**	**4**	**52**	**N2**	**2**	**2**	**3**	**3**	**4**	**40**	**N2**
				Significance	**N2 - Medium**							**N2 - Medium**						
Impact 4: Water Quality Degradation	Watercourse and habitats	The trapping and consequent stagnation of water as a result of the existence of a dam cause physical, thermal and chemical changes to the previously-flowing water, which can cause a serious decline in the quality of the water in and downstream of the reservoir.	Operational	Low	**4**	**3**	**3**	**4**	**4**	**56**	**N2**	**2**	**2**	**3**	**3**	**4**	**40**	**N2**
				Significance	**N2 - Medium**							**N2 - Medium**						
Impact 5: River Flow Modification	Watercourse and habitats	The existence of a dam is likely to result in changes in flow, which can affect the slope of the watercourse, loss of turbulent flow, reduced dissolved oxygen concentrations and impoundment; changing the natural shape of the streams; altering the seasonality of flows; changing the frequency, duration, magnitude, timing, predictability and variability of flow events, and altering surface and subsurface water levels.	Operational	Low	**3**	**3**	**3**	**4**	**5**	**65**	**N3**	**2**	**2**	**3**	**2**	**5**	**45**	**N2**
					N3 - High							**N2 - Medium**						

Impact number	Receptor	Description	Stage	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
					M	**E**	**R**	**D**	**P**	**S**		**M**	**E**	**R**	**D**	**P**	**S**	**Rating**
Impact 6: Soil Erosion	Soil, watercourse and habitats	Soil erosion is not a very significant potential problem at the Nondvo Dam site, but areas of sparse land cover will leave the soil vulnerable to the erosive influences of wind and water. Continual use, monitoring and management of an operational dam will lead to some erosion, and measures will need to be put in place to prevent eroded areas from spreading. This will have a cumulative effect on the soils identified at the sites, as eroded areas will spread until measures are put in place to stop the erosion.	Operational	Medium	**3**	**3**	**3**	**2**	**5**	**55**	**N2**	**2**	**2**	**3**	**3**	**3**	**30**	**N1**
					N2 - Medium							**N1 - Low**						

Table 13: Risk Assessment Matrix for Decommissioning Phase

Impact number	Receptor	Description	Stage	Ease of Mitigation	M	E	R	D	P	S	Rating	M	E	R	D	P	S	Rating
Impact 1: Sedimentation	Watercourse and habitats	Dam decommissioning leads to erosion and consequent sedimentation, and alters the amount of sediment production, retention and transportation in a system. Water released from a dam is likely to be clear because of sedimentation within the dam – this will naturally change as a dam is decommissioned. Clear water has the capacity to carry more sediment than turbid water. Halting releases of clear water from a now-decommissioned dam is therefore likely to increase sediment deposition downstream which implies changes in the stream morphology, and affects releases of silt that were formerly trapped by the dam, reintroducing maintenance materials and nutrients to the downstream environment.	Decommissioning	Low	3	3	3	2	5	55	N2	2	2	3	2	5	45	N2
					N2 - Medium							**N2 - Medium**						
Impact 2: River Flow Modification	Watercourse and habitats	The change in flow downstream of a recently-decommissioned dam will result in continuous environmental impacts. Life in and around a river evolves and is conditioned on the timing and quantities of river flow. Changes in the quantity and timing of water flows impact aquatic and riparian life, which can disturb the ecological network of a river system.	Decommissioning	Low	3	3	3	4	5	65	N3	2	3	3	3	5	55	N2
					N3 - High							**N2 - Medium**						
Impact 3: Flooding	Watercourse and habitats	Decommissioning of a dam is likely to increase the effect of flooding downstream. Major effects of flooding include the creation of bars, pools and rapids which then influence the morphology of the river.	Decommissioning	Low	3	3	3	2	4	44	N2	2	2	3	2	3	27	N1
					N2 - Medium							**N1 - Low**						
Impact 4: River Morphology	Watercourse and habitats	Decommissioning of the Nondvo Dam will affect the functioning of the river up-and downstream of the dam, water quality, oxygen, turbid flow and available river habitats, as well as a change in water temperature, which could affect the species in the river. The topography in and around the site will be altered, and the channel downstream will likely change shape, affecting peak flows.	Decommissioning	Low	3	3	3	2	4	44	N2	2	2	3	2	4	32	N2
					N2 - Medium							**N2 - Medium**						
Impact 5: Water Quality Degradation	Watercourse and habitats	Potential water contamination from hazardous substances is largely unavoidable during the decommissioning of a dam. This includes leaks or spills of oil from moving trucks onto soil or water resources, as well as fuel, grease (from construction vehicles) and sewage from temporary on-site ablution facilities. The likelihood of changes to downstream oxygen levels and increased algae blooms are high.	Decommissioning	Low	3	3	3	2	5	55	N2	1	2	3	2	5	45	N2
					N2 - Medium							**N2 - Medium**						
Impact 6: River Bed Disturbance	Watercourse and habitats	Decommissioning of the dam may result in increased water levels in the watercourse. Change in flow regime can affect vegetation on river banks. It can further change the morphological qualities of the riverbed and banks, which influence the amount of water transported and the rise and fall in the elevation of the bed.	Decommissioning	Low	3	2	5	4	5	70	N2	2	2	5	3	5	60	N2
					N2 - Medium							**N2 - Medium**						
Impact 7: Soil Erosion	Soil, watercourse and habitats	Soil erosion is not a very significant potential problem at the Nondvo Dam site, but areas of sparse land cover will leave the soil vulnerable to the erosive influences of wind and water. Decommissioning will lead to some erosion, and measures will need to be put in place to prevent eroded areas from spreading. This will have a cumulative effect on the soils identified at the sites, as eroded areas will spread until measures are put in place to stop the erosion.	Decommissioning	Medium	3	2	3	4	4	48	N2	2	2	3	2	3	27	N1

Impact number	Receptor	Description	Stage	Ease of Mitigation														
					M	E	R	D	P	S	Rating	M	E	R	D	P	S	Rating
					N2 - Medium							N1 - Low						

Table 14: Cumulative Risk Assessment Matrix for the proposed Nondvo Dam

Impact Number	Receptor	Description	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
				M	E	R	D	P	S	Rating	M	E	R	D	P	S	Rating
Impact 1: Sedimentation	Watercourses and habitats	Construction, operation and decommissioning of the dam will lead to multiple changes in runoff which will lead to changes in erosion and sedimentation in the area around and downstream of the study area. This is exacerbated by the existing dam upstream of the site. As the majority of the soils in the area are not erosive, the extent of sedimentation can be limited by correctly undertaking mitigation measures.	Medium	**3**	**3**	**3**	**4**	**4**	**52**	**N2**	**3**	**2**	**3**	**4**	**4**	**48**	**N2**
			Significance	**N2 - Medium**							**N2 - Medium**						
Impact 2: River Flow Modification	Watercourses and habitats	The change in flow downstream of a dam associated with the construction, operational and decommissioning stages of the dam will result in continuous environmental impacts. Life in and around a river evolves and is conditioned on the timing and quantities of river flow. This is compounded by the fact that there is an existing dam upstream of the site.	Low	**3**	**3**	**5**	**5**	**5**	**80**	**N3**	**3**	**2**	**5**	**4**	**5**	**70**	**N3**
			Significance	**N3 - High**							**N3 - High**						
Impact 3: Flooding	Watercourses and habitats	Flooding results in major changes in river morphology. The three phases of the proposed dam will affect the levels and extent of flooding downstream in different ways. Major effects of changes in flooding regimes include the creation and reduction of bars, pools and rapids which influence the morphology of the river. The existing dam upstream of the proposed Nondvo Dam will mitigate against the flooding extent.	Low	**3**	**2**	**3**	**4**	**4**	**48**	**N2**	**2**	**2**	**3**	**2**	**3**	**27**	**N1**
			Significance	**N2 - Medium**							**N1 - Low**						
Impact 4: River Bed Disturbance	Watercourses and habitats	River bed changes are likely to occur during the construction and decommissioning phases of the proposed Nondvo Dam which, in turn, will result in intermittent increasing and lowering of the water levels. Change in flow regime will affect vegetation on river banks.	Low	**3**	**2**	**5**	**5**	**5**	**75**	**N3**	**2**	**2**	**5**	**4**	**5**	**65**	**N3**
			Significance	**N3 - High**							**N3 - High**						
Impact 5: River Morphology	Watercourses and habitats	The proposed dam will trap sediment, especially heavy gravels and cobbles, during the construction and operational phases, and release silt during the decommissioning phase, thereby altering the normal sediment load distribution downstream of the dam site. The dam upstream of the site will compound the sediment trapping effect.	Low	**3**	**3**	**5**	**5**	**5**	**80**	**N3**	**2**	**2**	**5**	**4**	**5**	**65**	**N3**
			Significance	**N3 - High**							**N3 - High**						
Impact 6: Bank Erosion	Soil, watercourse and habitats	Bank erosion is often associated with the evolution of meanders, which is likely to occur as a result of the construction of the proposed Nondvo Dam, especially when one bank is silting and the opposite bank is eroding. Additionally, during the construction of the dam, protective vegetation may be removed or disturbed, resulting in bank erosion.	Medium	**3**	**2**	**3**	**5**	**4**	**52**	**N2**	**2**	**1**	**3**	**3**	**4**	**32**	**N2**
			Significance	**N2 - Medium**							**N2 - Medium**						
Impact 7: Water Quality Degradation	Watercourses and habitats	A level of water contamination is unavoidable during the construction and decommissioning phases of the proposed dam, and, to a lesser extent, the operational phase. This includes leaks or spills of concrete, oils, fuel, grease (from vehicles) and sewage from ablution facilities. Unmanaged and unmitigated pollution throughout the dam phases will have a cumulative effect on the surrounding watercourses.	Low	**4**	**3**	**3**	**4**	**5**	**70**	**P3**	**2**	**2**	**3**	**4**	**5**	**55**	**N2**
			Significance	**N3 - High**							**N2 - Medium**						
Impact 8: Soil Erosion	Soil, watercourse and habitats	Development of the area will lead to some erosion during all phases of the development, and measures will need to be put in place to prevent eroded areas from spreading. As the majority of the soils in the area are not highly erosive, this can be contained if mitigation measures are correctly implemented. Erosion throughout the subsequent phases will have a cumulative effect on erosion.	Medium	**3**	**2**	**5**	**5**	**4**	**60**	**P2**	**2**	**1**	**5**	**4**	**3**	**36**	**N2**
			Significance	**N2 - Medium**							**N2 - Medium**						

Impact Number	Receptor	Description	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
				M	E	R	D	P	S	Rating	M	E	R	D	P	S	Rating
Impact 9: Change in Surface Profile	Soil, watercourse and habitats	The surface profile of the site will be changed during the construction phase. This will affect water flow, sedimentation and erosion patterns. This cannot be mitigated against.	Low	**3**	**2**	**5**	**5**	**5**	**75**	**N3**	**3**	**2**	**5**	**5**	**5**	**75**	**N3**
			Significance	**N3 - High**							**N3 – High**						

9 MANAGEMENT AND MITIGATION MEASURES

Table 15 highlights recommended mitigation measures associated with the impacts identified in Section 8, the project phases during which the mitigation measures are relevant, as well as the recommended responsible person. Associated costs and applicable safeguards could not be established at this stage of the study.

Table 15: Recommended Mitigation Measures for the proposed Nondvo Dam Project

Impact	Mitigation Action	Responsible Person	Phase of Project	Associated Cost	Applicable Safeguards
Impact 1: Sedimentation	The IFC (2007) guidelines specify that sedimentation control management be undertaken by a reduction and prevention of off-site sediment transport using measures such as settlement ponds and silt fences, where practical. Compacted surfaces must be kept to a minimum and vegetation rehabilitation needs to be implemented within the site, to prevent excessive runoff coupled with erosion, leading to sedimentation. An engineering solution is required to avoid the dam wall acting as a sediment trap and allowing the release of sufficient sediment which can be transported by the (below dam) river velocity to reduce the impact on the sandy stream banks and river habitats. The implementation of soil erosion mitigation measures will also mitigate against sedimentation (see Impact 8).	Eswatini DWA Maintenance and Operations department	— Construction — Operation — Decommissioning	Silt Fence: R200pm with pegs (based on 10 stages of 100m per river bank) E25 000 Rehabilitation: R100ppph (based on 6mo. daily rehabilitation and 3 months maintenance, team of 3) E30 000 *Engineering Solution: (R200-R500/m3 storage capacity (Peter Townsend))*	None
Impact 2: River Flow Modification	Where river flow modification is a result of changes in erosive and sedimentation processes, anti-erosion structures that run laterally assist with removing fortifications, in order to allow natural erosion processes to return along a river's banks, thus increasing sediment supply to areas where river flow modifications have caused a decrease in sediment volumes. In the absence of scientific studies quantifying the impacts of artificial daily river level fluctuations on fauna populations, implementation of a maximum flow rate downstream of the dam wall is recommended as a precautionary approach to limit impacts on the downstream environment.	Eswatini DWA Maintenance and Operations division	— Construction — Operation — Decommissioning	Silt Fence: R200pm with pegs (based on 10 stages of 100m per river bank) E25 000	None
Impact 3: Flooding	The proposed Nondvo Dam would require flood-control measures, such that the reservoir level be kept below a certain elevation before the onset of the wet season. Floods must be controlled by redirecting excess water to purpose-built canals or floodways, which divert the water to temporary holding ponds or other bodies of water where there is a lower risk of flooding. Flood patterns must be retained through dam operating rules.	Eswatini DWA Maintenance and Operations division	— Construction — Operation — Decommissioning	Canals: (Based on excavation at R200/m^3 (10m wide, 50m long, natural earth, no rock excavations)) E15 000	None
Impact 4: River Bed Disturbance	Retain habitats (including fallen trees and branches) unless they compromise flow conveyance. Use sensitive vegetation management techniques that do not impact on identified habitats. These could include hand-picking or selective cutting of in-channel and bankside vegetation, coppicing or pollarding trees instead of felling them, only removing vegetation from the centre of the channel, and limiting cutting to specific areas where there is a flow conveyance issue. Use boat-mounted vegetation cutting equipment to allow work to be undertaken in the main channel without disturbing the margins and banks.	Eswatini DWA Maintenance and Operations division	— Construction — Decommissioning	Habitat Retention Work: R200ppph (based on 3 years of quarterly site work, for 1 week, team of 3) E18 000	None
Impact 5: River Morphology	In order to increase the morphological diversity of the Lusushwana River, the following environmental improvements must be implemented: — Riffle construction; — Bar construction; — Boulder placement; — Deflectors;	Eswatini DWA Maintenance and Operations division	— Construction — Operation — Decommissioning	Environmental Improvement Work: R100ppph (based on 3 years of quarterly site work, for 1 week, team of 3)	None

Impact	Mitigation Action	Responsible Person	Phase of Project	Associated Cost	Applicable Safeguards
	— Two-stage channels; — Installing large woody debris; and — Narrowing over-widened channels.			E9 000	
Impact 6: Bank Erosion	Vegetation establishment must be promoted through bank restoration and the installation of engineering structures (e.g. gravel embankments, riprap, gabions) and ecological engineering to recreate shoreline habitats similar to those found along the natural rivers and ravines within the project area.	Eswatini DWA Maintenance and Operations division	— Construction	R200ppph (based on 6 months' manual work, for team of 3), plus R1500ppph (based on 1 weeks' design work) E68 000 Gabion baskets E30 000 (based on R4000per basket, with rocks, assuming along 100m; plus based on 2 months' manual work, for team of 3), plus R1500ppph (based on 1 weeks' design work)	None
Impact 7: Water Quality Degradation	Chemical spill clean-up kits must be stationed at all sites where spills are probable. Several staff must be trained in the chemical clean-up procedure and at least one member of this unit must be on duty at all times; During the construction and decommissioning phases: — On-site vehicles must be well-maintained; — Drip trays must be placed under leaking vehicles; and — On-site pollutants must be contained in a bunded area and on an impermeable surface. During the site operational phase: — Maintain control of substances entering the site; — Provide adequate disposal facilities; and — Enforce a non-polluting environment.	Eswatini DWA Maintenance and Operations department	— Construction — Operation — Decommissioning	Chemical Spill Kit (at R1500 each, assuming 20 are needed): E2 000 Drip Trays (at R400, assume 40 needed): E1 000	None
Impact 8: Soil Erosion	The underlying soil erosion protection plan incorporates 5 strategies taken from the International Finance Corporation (World Bank) Environmental, Health and Safety Guidelines for Mining, 2007 (IFC, 2007). These guidelines are applicable to projects outside of the mining sphere and can be used to guide construction, operation and decommissioning activities at the proposed Nondvo Dam site: — Placement of soil stockpiles so as to prevent exposure to wind and water erosion. — Access and haul roads should have gradients or surface treatment to limit erosion, and road drainage systems should be provided. — Terracing, slope reduction, runoff velocity limitation and the installation of appropriate drainage should be incorporated into the site management plan to limit soil erosion. — Stockpiled topsoil as well as areas left bare must be revegetated to protect against erosion, discourage weeds and maintain active soil microbes. — Progressive rehabilitation of disturbed land should be carried out to minimize the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff.	Eswatini DWA Maintenance and Operations department	— Construction — Operation — Decommissioning	Soil erosion protection plan: R200ppph (based on 6 months' manual work, for team of 10), plus R1500ppph (based on 2months' design work) E170 000	None

10 MONITORING PLAN

Table 16 highlights that the water quality monitoring plan included in the Basin Assessment Protection study should be carried out during all project phases.

Table 16: Monitoring Plan for the proposed Nondvo Dam

Monitoring Action	Parameter Being Monitored	Method	Location	Frequency	Responsible Person	Phase of Project	Associated Cost	Applicable Safeguards
Water Quality Monitoring	As outlined in the Basin Assessment Protection Report					Construction, Operational and Decommissioning Phases	Laboratory cost-dependent	None

11 CONCLUSIONS

11.1 CONSTRUCTION PHASE

Impacts of significance identified within the construction phase of the proposed development of Nondvo Dam include:

Bank Erosion – the significance of which is Medium post-mitigation, as bank erosion is very likely to occur and not easy to mitigate against;

Sedimentation – the significance of which is Medium post-mitigation, as a level of sedimentation is inevitable;

River Flow Modification – the significance of which is Medium post-mitigation, largely because the probability of river flow modification remains high;

River Bed Disturbance – the significance of which is Medium post-mitigation, as this is inevitable during the construction of a dam;

Water Quality Degradation – the significance of which is Medium post-mitigation, as an element of water contamination from hazardous substances is expected during the construction of a dam;

Change in Surface Profile – the significance of which is High post-mitigation, as a significant change in surface profile is inevitable and immitigable when constructing a dam, and

River Morphology – the significance of which is High post-mitigation, as a number of morphological changes are inevitable and difficult to reverse during the construction of a dam.

11.2 OPERATIONAL PHASE

Impacts of significance identified within the operational phase of the proposed development of Nondvo Dam include:

Sedimentation – the significance of which is Medium post-mitigation, as an operational dam will significantly alter the amount of sediment production, retention and transportation in a system;

River Morphology – the significance of which is Medium post-mitigation, as the aforementioned sedimentation load distribution changes will affect the river morphology;

Water Quality Degradation – the significance of which is Medium, as the stagnation of water causes a serious decline in water quality in and downstream of the dam, and

River Flow Modification – the significance of which is Medium post-mitigation, as the existence of a dam means that the probability of changes in river flow is high.

11.3 DECOMMISSIONING PHASE

Impacts of significance identified within the decommissioning phase of the proposed development of Nondvo Dam include:

Sedimentation – the significance of which is Medium post-mitigation, as the inevitable halting of releases of clear water from a now-decommissioned dam is likely to increase sediment deposition downstream;

River Morphology – the significance of which is Medium post-mitigation, as the aforementioned inevitable sedimentation changes imply a change in the river morphology and will affect the functioning of the river up-and downstream of the now-decommissioned dam;

River Flow Modification – the significance of which is Medium post-mitigation, as inevitable changes in the quantity and timing of water flows impact aquatic and riparian life, which can disturb the ecological network of a river system, and

Water Quality Degradation – the significance of which is Medium post-mitigation, as an element of water contamination from hazardous substances is expected during the decommissioning of a dam.

11.4 CUMULATIVE EFFECTS

Impacts of significance identified as a result of the cumulative effect of all three phases of the development of the proposed dam, accounting for the fact that another dam exists upstream of the proposed development site, include:

11.4.1 *MEDIUM SIGNIFICANCE*

The significance of the underlying impacts is medium; the first three impacts are related to erosion, which, while not extensive at the site, is inevitable, especially over the lifetime of the proposed dam project. This impact is not immitigable, however. The fourth impact is water quality degradation, the significance of which is medium as it is unavoidable but not immitigable over the lifetime of the proposed dam project.

Soil Erosion - the significance of which is Medium post-mitigation as construction, operation and decommissioning of the dam will lead to multiple changes in runoff which will lead to changes in erosion and sedimentation in the area around and downstream of the study area. This is exacerbated by the existing dam upstream of the site. As the majority of the soils in the area are not erosive, the extent of sedimentation can be limited by correctly undertaking mitigation measures. These include the placement of soil stockpiles so as to prevent exposure to wind and water erosion; access and haul roads should have gradients or surface treatment to limit erosion, and road drainage systems should be provided; terracing, slope reduction, and runoff velocity limitation and the installation of appropriate drainage should be incorporated into the site management plan to limit soil erosion. Further to this, stockpiled topsoil, as well as areas left bare must be revegetated to protect against erosion, discourage weeds and maintain active soil microbes, and progressive rehabilitation of disturbed land should be carried out to minimize the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff.

Bank Erosion - the significance of which is Medium post-mitigation as bank erosion is often associated with the evolution of meanders, which is likely to occur as a result of the construction of the proposed Nondvo Dam, especially when one bank is silting and the opposite bank is eroding. Additionally, during the construction of the dam, protective vegetation may be removed or disturbed, resulting in bank erosion. To mitigate against bank erosion, vegetation establishment should be promoted through bank restoration and the installation of engineering structures (e.g. gravel embankments, riprap, gabions) and ecological engineering to recreate shoreline habitats similar to those found along the natural rivers and ravines within the project area.

Sedimentation - the significance of which is Medium post-mitigation as construction, operation and decommissioning of the dam will lead to multiple changes in runoff which will lead to changes in erosion and sedimentation in the area around and downstream of the study area. This is exacerbated by the existing dam upstream of the site. As the majority of the soils in the area are not erosive, the extent of sedimentation can be limited by correctly undertaking mitigation measures. An engineering solution is required to avoid the dam wall acting as a sediment trap and allowing the release of sufficient sediment that can be transported by the (below dam) river velocity to reduce the impact on the sandy stream banks and river habitats.

Water Quality Degradation - the significance of which is Medium post-mitigation as a level of water contamination is unavoidable during the construction and decommissioning phases of the proposed dam, and, to a lesser extent, the operational phase. This includes leaks or spills of concrete, oils, fuel, grease (from vehicles) and sewage from ablution facilities. Unmanaged and unmitigated pollution throughout the dam phases will have a cumulative effect on the surrounding and downstream environment. During the operational phase, the stagnation of the water will have a negative effect on the quality of the water in the reservoir and downstream. Chemical spill clean-up kits must be stationed at all sites where spills are probable. Several staff should be trained in the chemical clean-up procedure, and at least one member of this unit must be on duty at all times. During the construction and decommissioning phases, on-site vehicles should be well-maintained, drip trays should be placed under leaking vehicles, and on-site pollutants should be contained in a bunded area and on an impermeable surface. During the site operational phase control of substances entering the site should be maintained, adequate disposal facilities should be provided, and a non-polluting environment should be enforced.

11.4.2 *HIGH SIGNIFICANCE*

The significance of the underlying impacts are high; all relate to inevitable, significant changes in the aquatic environmental landscape and, where mitigation measures will have an effect, the changes will affect processes continually and such that the environmental functioning is changed.

River Flow Modification - the significance of which is High post-mitigation as the change in flow downstream of a dam associated with the construction, operational and decommissioning stages of the dam will result in continuous environmental impacts. Life in and around a river evolves and is conditioned on the timing and quantities of river flow. This is compounded by the fact that there is an existing dam upstream of the site. Where river flow modification is a result of changes in erosive and sedimentation processes, anti-erosion structures that run laterally assist with removing fortifications, in order to allow natural erosion processes to return along a river's banks, thus increasing sediment supply to areas where river flow modifications have caused a decrease in sediment volumes. In the absence of scientific studies quantifying the impacts of artificial daily river level fluctuations on fauna populations, implementation of a maximum flow rate downstream of the dam wall is recommended as a precautionary approach to limit impacts on the downstream environment.

River Bed Disturbance - the significance of which is High post-mitigation as river bed changes are likely to occur during the construction and decommissioning phases of the proposed Nondvo Dam which, in turn, will result in intermittent increasing and lowering of the water levels. Change in flow regime will affect vegetation on river banks. Habitats, including fallen trees and branches, should be retained unless they compromise flow conveyance. Sensitive vegetation management techniques that do not impact on identified habitats should be used; these could include hand-picking or selective cutting of in-channel and bankside vegetation, coppicing or pollarding trees instead of felling them, only removing vegetation from the centre of the channel, and limiting cutting to specific areas where there is a flow conveyance issue. Boat-mounted vegetation cutting equipment should be used to allow work to be undertaken in the main channel without disturbing the margins and banks.

River Morphology - the significance of which is High post-mitigation as the proposed dam will trap sediment, especially heavy gravels and cobbles, during the construction and operational phases, and release silt during the decommissioning phase, thereby altering the normal sediment load distribution downstream of the dam site. The dam upstream of the site will compound the sediment trapping effect. In order to increase the morphological diversity of the Lusushwana River, riffle and bar construction, boulder placement, deflectors and two-stage channels could be implemented, and large, woody debris could be installed. Over-widened channels could also be narrowed.

Change in Surface Profile - the significance of which is High post-mitigation as the surface profile of the site will be changed during the construction phase. This will affect water flow, sedimentation and erosion patterns. This cannot be mitigated against.

11.5 RECOMMENDATIONS

The following recommendations should be considered to limit the potential of the proposed development to impact the surrounding environment:

- The water quality monitoring programme, as detailed in the River Basin Protection study, should be implemented as early as possible to assess the impact on the Lusushwana River and surrounding water bodies;
- The mitigation measures outlined in **Table 15** should be implemented to decrease the risks associated with the proposed dam development activities.

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APPENDIX

C-2 BASIN PROTECTION ASSESSMENT

GOVERNMENT OF THE KINGDOM OF ESWATINI, MINISTRY OF NATURAL RESOURCES AND ENERGY - DEPARTMENT OF WATER AFFAIRS

MBABANE - MANZINI CORRIDOR DAM PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

BASIN PROTECTION ASSESSMENT

01 MARCH 2021

FINAL DRAFT

MBABANE - MANZINI CORRIDOR DAM PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

BASIN PROTECTION ASSESSMENT

GOVERNMENT OF THE KINGDOM OF ESWATINI, MINISTRY OF NATURAL RESOURCES AND ENERGY - DEPARTMENT OF WATER AFFAIRS

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Project number	41101262			
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WAIVER

Purpose and basis of preparation of this Report.

This Basin Protection Assessment (Report) has been prepared by WSP Environmental Proprietary Limited (WSP) and on behalf and at the request of the Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy - Department of Water Affairs (Client), to provide the Client with an understanding of the environmental impacts associated with the proposed Mbabane – Manzini Dam Project.

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

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

ACRONYMS

ACRONYM	DESCRIPTION
AfDB	African Development Bank
BP	Best Practice
CMP	Comprehensive Management Plan (used interchangeably with ESMP)
CNHS	Critical Natural Habitats
CRR	Comment and Response Register
DWA	Department of Water Affairs
EAARR	Environmental Audit, Assessment and Review Regulations (2000)
EAP	Environmental Action Plan
EEA	Eswatini Environment Authority
EEAA	Eswatini Environmental Authority Act
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
ENTC	Eswatini National Trust Commission
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan (used interchangeably with CMP)
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
EPAP	Equator Principles Action Plan
EPFI	Equator Principles Financial Institution
EPs	Equator Principles
EWA	Eswatini Water Act
EWPCR	Eswatini Water Pollution Control Regulations
EWSC	Eswatini Water Services Corporation
FAO	Food and Agriculture Organization
FPIC	Free, Prior, and Informed Consent
GDP	Gross Domestic Product
GHG	Greenhouse Gases
ICP	Informed Consultation and Participation
IESIA	Integrated Environmental and Social Assessment
IFC	International Finance Corporation
ISRIC	International Soil Reference and Information Centre
IUCN	International Union for Conservation of Nature
IUSS	International Union of Soil Sciences
IWRMP	Integrated Water Resources Master Plan
JE	Jones Environmental (PTY) Ltd
JMRBWRS	Joint Maputo River Basin Water Resources Study
masl	Meters above sea level

ACRONYM	DESCRIPTION
MAP	Mean Annual Precipitation
MMA	Maphanga Mitchell Associates
MSDS	Material Safety Data sheets
MSU	most sensitive uses
NDS	National Development Strategy
NGOs	Non-Governmental Organisations
OHS	Occupational Health and Safety
PAP	Project Affected People
PAH	Project Affected Household
PCR	Physical Cultural Resources
PSs	Performance Standards
QAQC	Quality Assurance and Quality Control
RAP	Resettlement Action Plan
RCC	Roller-Compacted Concrete Dam
RPF	Resettlement Policy Framework
RoW	Right of Way
RWG	Resettlement Working Group
SADC	Southern African Development Community
SANAS	South African National Accreditation System
SEP	Stakeholder Engagement Plan
SMP	Sediment Management Plan
SP	Studio Pietrangeli
SQR	Sub Quaternary Reach
SWMP	Storm Water Management Plan
TDS	Total Dissolved Solids
ToR	Terms of Reference
USDA	United States Department of Agriculture
VEC	Valued Ecosystem Components
WB	World Bank
WHO	World Health Organization
WMA	Water Management Area
WQMP	Water Quality Monitoring Programme
WRB	World Reference Base
WSP	WSP Environmental (Pty) Ltd

DETAILS OF THE SPECIALIST

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Expertise	Zakariya Nakhooda is a hydrologist with 2.5 years' experience in environmental consulting. His key areas of interest include hydrological modelling, flood risk, stormwater management planning, freshwater habitat assessments, water quality assessments and water use licensing applications. He has been involved in a number of projects where he has used his hydrological background to undertake environmental risk assessments and provide practical project outcomes and actions.

Aspect	Detail
Specialist	Greg Matthews
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Expertise	Greg Matthews (*Pr.Sci.Nat*) has over 20 years' experience in environmental water resource assessment and management related projects. His specialities include water management and sustainability, environmental risk appraisal, surface- and groundwater assessment (quality and quantity), flood risk, stormwater management, integrated water management planning, and contaminated land assessment. Greg has been involved and delivered in numerous projects where he has used his extensive background successfully in the assessment of environmental impacts and risk to water resources to allow practical and pragmatic outcomes to be determined.

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1 TERMS OF REFERENCE

WSP Environmental (Pty) Ltd (WSP) was commissioned by the Eswatini Department of Water Affairs (DWA) (the client) to undertake a River Basin Protection Assessment for the proposed multipurpose Nondvo Dam[1]. The Dam located approximately 12 km south of the city of Mbabane, along the south-eastern boundary of the Hhohho Region, Eswatini (**Figure 1**). The Dam is on the Lusushwana River approximately 7 km downstream of the Luphohlo Dam wall (**Figure 2**).

This report follows on from the Basin Protection Assessment, Scoping Report (WSP, 2019) and includes site observations together with a detailed river basin impact assessment within which the present state of the environment has been assessed and the potential impacts resulting from the proposed Nondvo Dam identified.

1.1 PROJECT BACKGROUND

The Kingdom of Eswatini (abbreviated in this document as Eswatini, and also known as Swaziland) is a small landlocked country in Southern Africa, bordering Mozambique and South Africa. It covers an area of 17 360 km^2 and has a population of 1.39 million (mid-2012). The country is largely mountainous with 75.8% of the population living in rural areas with livelihoods predominantly dependent on subsistence agriculture.

The nature of the hydrological network of Eswatini, comprising rivers shared between several states upstream and downstream, coupled with highly seasonal patterns with relatively long periods of drought makes the management of the country's surface water resources very difficult and vulnerable to climatic change. Economic and demographic growth of the country as well as changes in the water usage patterns have resulted in a significant increase in the demand for water resources. It has been identified that the size of the existing infrastructure and the capacity of equipment will soon be inadequate to satisfy the water demand. Furthermore, in Eswatini, all 'normal flow' in the rivers, most of them being of transboundary, has been allocated under the arrangements of the international treaties. 'Normal flow' is water that has been calculated as being available 80% of the time during the driest month of the year. Therefore, the only water that can be made available for allocation is surplus flow (during floods and rainy season) through harnessing this flow in large storage reservoirs. This means that currently no water allocation can be made to any new developments as the water demand far exceeds the existing 'normal flow' requirements. This is a major challenge limiting further social and economic development in the country.

As a response to these constraints the Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy and the DWA intend to better exploit surface water resources by storing surplus water, made available during flooding periods, above the allocated abstraction limits established by the Tripartite Agreement signed with South Africa and Mozambique. The stored water is then intended to be released as required for the various downstream usages. The main purpose of the proposed Nondvo Dam project is for the storage of water for the supply of potable water to Mbabane and Manzini. A Joint Maputo River Basin Water Resources Study (JMRBWRS) was jointly undertaken by the Kingdom of Eswatini, the Republic of South Africa and the Republic of Mozambique (Skoy Plancenter Ltd, 2008) During this study a multi-criteria selection process was developed and the Mbabane-Manzini Corridor, specifically the Nondvo Dam project was identified due to its proximity to the cities of Mbabane and Manzini where the future water demand is the identified to be highest.

A possible secondary benefit of the proposed dam is the potential for utilising the Nondvo Dam head for small scale hydropower generation. Additionally, the stored water could also be used for irrigation and for improving the output of run-of-river hydropower plants further downstream.

The Proposed Mbabane-Manzini Corridor Dam in reference to the geographical area that will be served by the dam, whilst the term "Nondvo Dam" is the official shortened version of the project title in reference to the dam's location whereupon it will harvest surface flows along the Lusushwana River and its tributary, the Nondvo River. The terms "Mbabane-Manzini Corridor Dam" and "Nondvo Dam" are therefore used interchangeably throughout the project's study documentation.

[1] Mbabane - Manzini Corridor Dam

Figure 1: Regional Setting

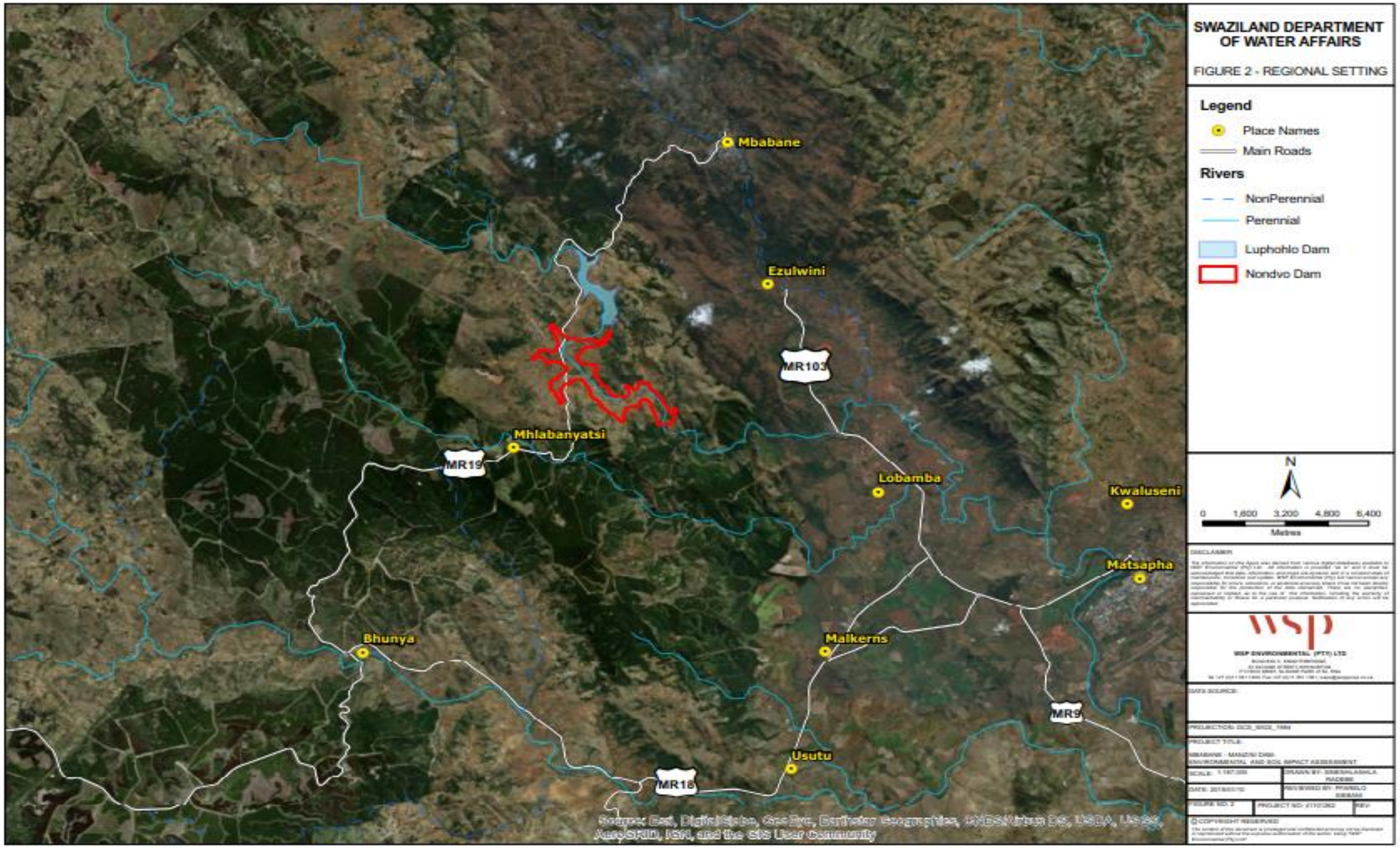


Figure 2: Locality Setting

The proposed project components can be summarised as follows:

— A head dam with a storage capacity of 15 Mm^3, to satisfy the various demands projected up to the year 2045, combined with the necessary systems for controlling water intakes, water releases and flood evacuation.
— Associated components include:
  ▪ A small hydropower plant component which could be installed at the foot of the dam; and
  ▪ An appropriate conveyance means to conduct the water to the treatment facilities of the potable water distribution urban system.

In terms of the Environmental Management Act, 2002 (Act No. 5 of 2002), the proposed Project is categorised as a Category 3 project, requiring a full Environmental Impact Assessment (EIA) study to be undertaken and submitted to the Eswatini Environmental Authority (EEA) for consideration prior to project implementation.

1.2 PROJECT ALTERNATIVES

An assessment of project alternatives was undertaken by Studio Pietrangeli (SP) (2017) in order to identify alternatives to satisfy the water demand in the Mbabane/Manzini Region up to 2050.

The study identified that, in each case, a new dam is necessary to increase the water supply and to allocate some of the water resources for irrigation purposes, without any reduction in the current energy production at Ezulwini Power Plant.

The evaluation of the scenarios was conducted through a sensitivity analysis aimed at understanding the effects of the dam type selection and reservoir elevation on water supply volume, energy production and the costs of construction. The main conclusions were:

— The type of dam does not affect the cost of the dam, therefore Studio Pietrangeli (SP) (2017) suggests selecting the Roller Compacted Concrete (RCC) type, which is safer;
— The dam Alternative 1 or Preferred Alternative is to be preferred in terms of supplied volume versus height of the dam;
— The dam Alternative 2 has the disadvantage to be in the Mlilwane Game Sanctuary reserve;
— The extent of resettlement is limited and acceptable for reservoir elevation minor of 960 meters above sea level (masl), which assures the entire demand for water supply purposes up to 2050 and the water demand for irrigation; and
— In case of reservoir elevation greater than 960 masl, the extent of resettlement increases considerably.

On the basis of the above considerations, SP (2017) selected as optimum layout the RCC dam located at the Alternative 1 site, with a Full Supply Level of 960 masl. The supplied volume with an assured yield of 95% is 9.8 Mm^3/year. As such, the focus of this report is on basin protection in relation to the Alternative 1 setting (**Figure 1**).

2 ASSUMPTIONS AND LIMITATIONS

The following limitations and assumptions were identified as part of the assessment:

— The information in this report is represented by conditions present at the time of the site inspection;
— The focus of this report is on the Lusushwana River Basin and associated impacts on the proposed Nondvo Dam;
— The focus of this report is on Alternative 1, which is the preferred alternative and its associated impacts on the basin;
— At the time of the site inspection, no areas had been identified for the relocation of local people; the suitability of the relocation areas could thus not be assessed at this stage; and
— Flora and fauna assessments have not been considered within this assessment as these studies have been undertaken independently.

3 LEGAL FRAMEWORK

The Eswatini regulatory framework establishes well-defined requirements and standards for environmental and social management of infrastructure developments. The primary environmental and social legislation and policies and international standards applicable to the project are as follows:

- The Eswatini Water Act, 2003 (Act No. 7 of 2003);
- The Eswatini Environmental Authority Act, 1992 (Act No. 15 of 1992);
- The Environmental Management Act, 2002 (Act No. 5 of 2002);
- The Eswatini Water Pollution Control Regulations, 1999;
- The World Bank's Environmental and Social Safeguard Policies - OP/BP 4.01 Environmental Assessment;
- IFC Performance Standards (PS) (IFC, 2012) - PS1 - Assessment and Management of Environmental and Social Risks and Impacts; and,
- The World Bank's Environmental and Social Safeguard Policies - OP/BP 4.02 Environmental Action Plans.

4 MAPUTO RIVER BASIN CHARACTERISTICS

The proposed Nondvo Dam is located within the Maputo River Basin (**Figure 1**). The Basin is bordered by the Umbeluzi and Incomati Basins to the north, and the Umhlatuze coastal catchment to the south. The land area of the Maputo basin is about 30 000 km^2. The headwaters of the basin originate in South Africa, and the main tributaries flow through the southern half of Eswatini (Usuthu) and further south through South Africa (Pongola), before joining on the South Africa / Mozambique border and flowing to the estuary in Maputo Bay (Blackhurst, 2008). The Maputo River basin incorporates the Usuthu, Pongola, and Ngwavuma Rivers. The Usuthu sub-basin is comprised of the Lusushwana, Mpuluzi, Usuthu (main stem), Ngwempisi, and Mkhondvo Catchments. The climate and land use characteristics for the Maputo basin is as follows.

4.1 CLIMATE

The Maputo Basin falls within the summer rainfall region of Southern Africa. Rainfall is seasonal with approximately 80% of rainfall occurring between the months of October and March. The rainfall pattern over the Basin varies owing to the variations in altitude. The highest rainfall occurs in the northern and central mountainous areas, where rainfall is in excess of 1 500 mm (Beuster & Clarke, 2008), while the low-lying eastern parts of the Basin receiving rainfall of less than 600 mm (Beuster & Clarke, 2008). Tropical cyclonic storms, which originate in the Indian Ocean, occasionally occur in the Maputo River Basin.

High temperatures are experienced during summer, with maximum temperatures of 40º C in the higher-lying areas increasing to over 47º C in the low-lying eastern parts of the Basin (Blackhurst, 2008), and minimum temperatures in winter of below 0º C in the high lying areas. Annual evaporation ranges between 1 400 and 1 600 mm (Blackhurst, 2008).

4.2 LAND USE

There are three main rivers located within the Maputo River Basin, the Usuthu, Pongola and the Maputo Rivers (Blackhurst, 2008). The Usuthu River forms the northern portion of the catchment of the Maputo Basin and drains in an easterly direction to its confluence with the Pongola River.

The predominant land-use in the western part of the catchment of the Usuthu River is commercial timber plantations. These fall mostly within the South African portion of the catchment, with substantially less occurring in the Eswatini portion. The main urban centres in the Maputo Basin are all located in the catchment of the Usuthu River. These are Mbabane, Manzini in Eswatini and Piet Retief in South Africa.

The Pongola River comprises the southern portion of the catchment of the Maputo Basin, and drains in an easterly direction to its confluence with the Usuthu River. There is very little land-use development in the catchment, with afforestation forming the main land-use in the western portion. The most concentrated agricultural development in the Pongola River catchment occurs upstream of the Ponglapoort Dam. This consists mainly of sugar cane, with smaller areas of grain and orchards being cultivated.

The small section of the catchment downstream of the confluence of the Usuthu and Pongola Rivers falls mainly within Mozambique and is the only portion of the catchment where the river is called the Maputo River. The area consists of a low-lying coastal plain with extensive wetlands. The only significant water-consuming land-use is the irrigation of crops, mainly rice, in the vicinity of Salamanga, and the cultivation of eucalypt plantations in the same area, although the wetlands contribute to flood attenuation. There are two small urban settlements in this catchment, namely Catuane and Salamanga.

Small towns and rural settlements are spread throughout the Basin. They obtain their water supplies either from groundwater or diffuse surface water sources (Blackhurst, 2008).

5 LUSUSHWANA RIVER BASIN CHARACTERISTICS

5.1 CLIMATE

Eswatini's climate is generally subtropical with hot wet summers (October to March - approximately 75% of the annual rainfall falls within the period) and cold dry winters (April to September). Eswatini's physiographic zones show different climatic conditions, ranging from sub-humid and temperate in the Highveld to semi-arid and warm in the Lowveld (Studio Pietrangeli, 2018).

Mean annual rainfall ranges from about 1 500mm in the northern Highveld to 500 mm in the southern Lowveld. Precipitation varies considerably on an annual basis, which may lead to periods of flash flooding or drought.

Mean annual temperature varies from 17°C in the Highveld to 22°C in the Lowveld. These temperatures are zonal averages, with some variation across zones.

5.2 RAINFALL

The project site falls within the summer rainfall region of Southern Africa. The rainfall pattern over the project area varies considerably, mainly because of the variation in altitude. The highest rainfall occurs in the northern and central mountainous areas, with annual rainfall in excess of 1 500 mm, while the low-lying eastern parts of the project area receive rainfall of less than 600 mm. Precipitation is noted to vary considerably from year to year, potentially leading to periods of flash flooding or drought.

Rainfall data was sourced from the hydrological study undertaken by Studio Pietrangeli (2018). **Table 1** shows the list of selected rainfall stations and the relevant dataset, and **Figures 3** and **4** represent the Mean Annual Precipitation (MAP) and mean monthly precipitation, respectively. The MAP recorded by the selected stations ranges between 240 mm and 1400 mm per annum.

According to the previous studies, the Lusushwana River, belongs to the part of the Maputo Basin receiving, the highest amount of rainfall, with the MAP in the vicinity of Mbabane on the escarpment being approximately 1 400 mm per year.

Table 1: Rainfall Stations and their Properties (Studio Pietrangeli, 2018)

Station Name	Coordinates UTM-WGS84		Data Period of Data	No of years of Data	MAP (mm)
	East (m)	South (m)			
Mbabane	308 155.4	7 100 747.6	1989; 2000-16	17	1397
Matshapa	318 320.7	7 088 705.7	2002-12; 2014-16	14	718
Mililwane	312 297.7	7 090 835.6	2000-01; 2003; 2011-16	9	602
Malkerns	302 379.1	7 086 255.0	2000-2015	16	972
Malolotja*	311 838.4	710 7086.1	2000-01; 2003-04; 2007-16	14	844
Milawula*	393 084.2	710 0927.3	2001-04; 2006; 2009-12; 2016	10	245
San Roy Farm	300 468.3	7 080 684.7	2000-2011	12	525
Coordinates are not accurate and are based on the town location not the rainfall station					

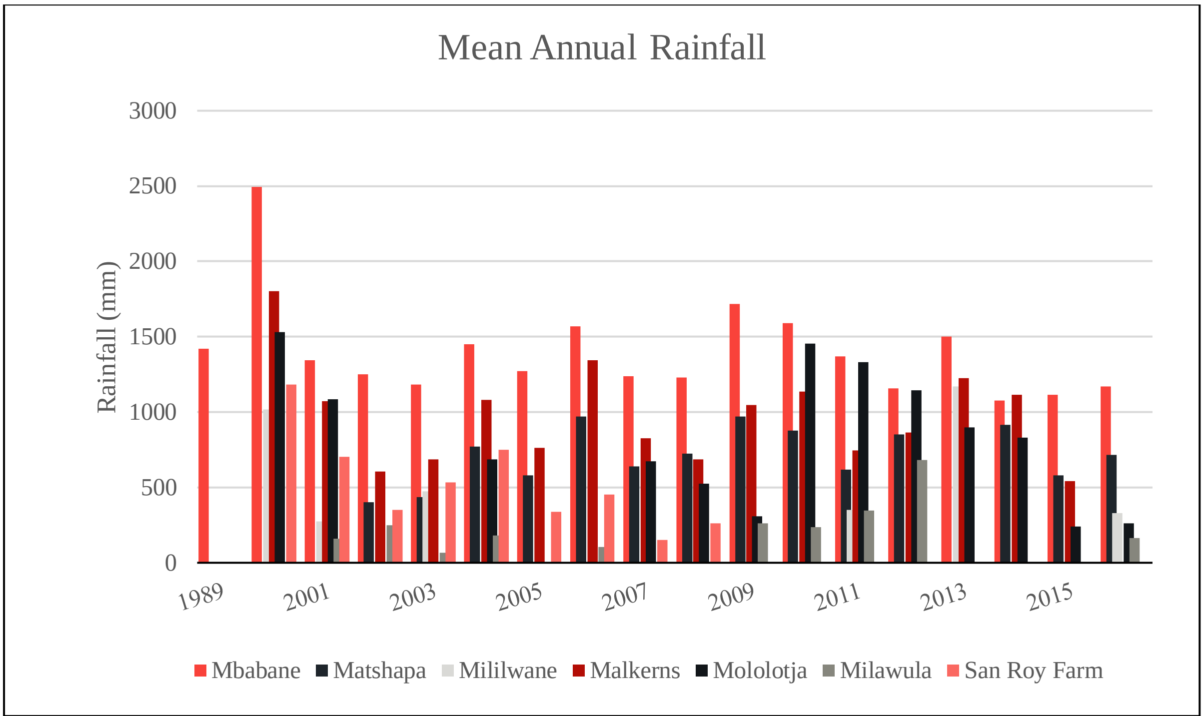


Figure 3: Mean Annual Rainfall at Selected Meteorological Stations (Source: Studio Pietrangeli, 2018)

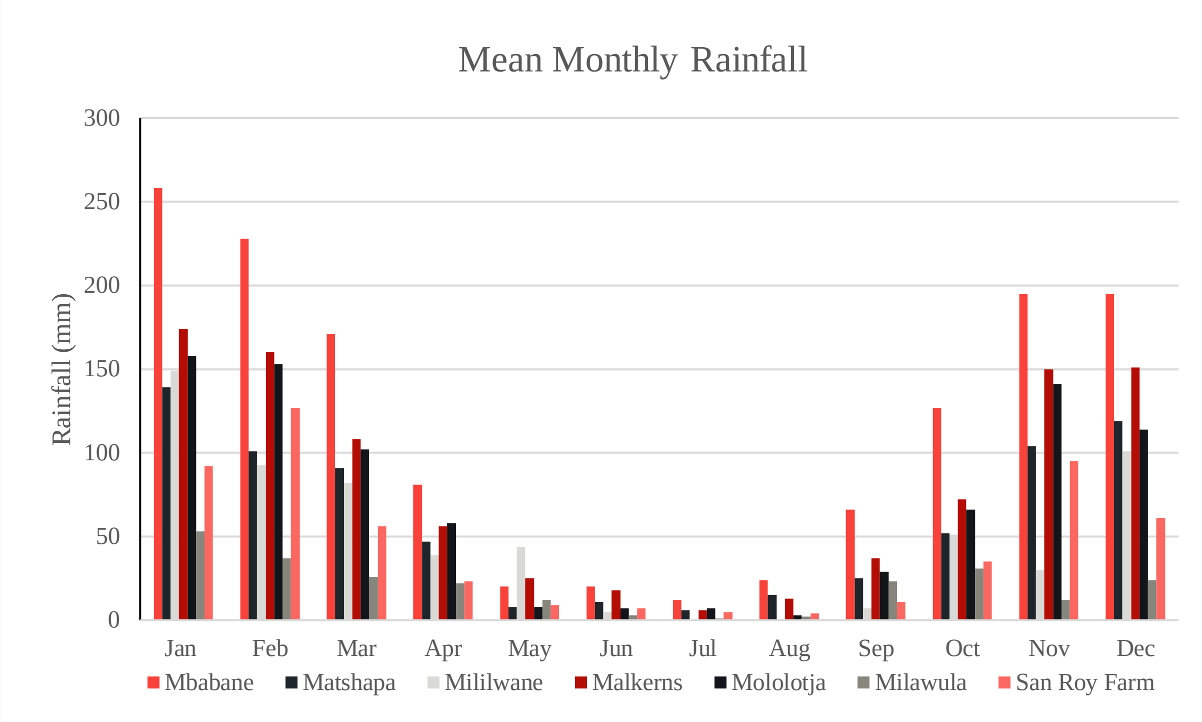


Figure 4: Mean Monthly Rainfall at Selected Meteorological Stations (Source: Studio Pietrangeli, 2018)

5.3 DRAINAGE AND HYDROLOGY

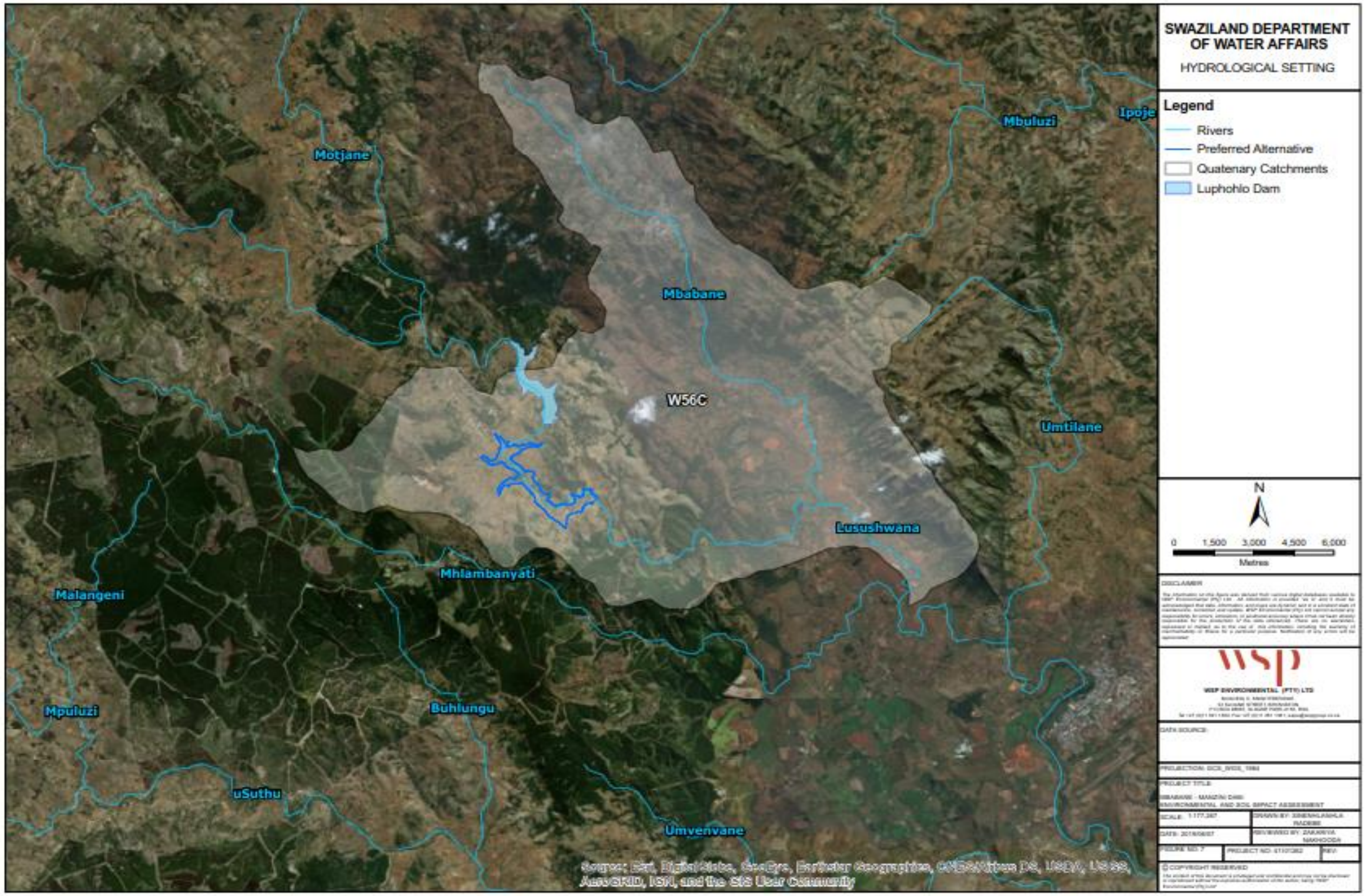
The proposed project area falls within the Joint Maputo River Basin. The project area is located within the Pongola-Mtamvuma Water Management Area (WMA), formerly known as the Usutu to Mhlatuze WMA and within the W56C Quaternary Catchment, of the Lusushwana sub-catchment (**Figure 1**). The specific reach considered for this study is 34 km in extent and is delineated by the W56C-1514 Sub Quaternary Reach (SQR). The Lusushwana and Mbabane Rivers mainly drain quaternary Catchment W56C, within which the proposed dam falls.

The Lusushwana River is 28.75 km long and it originates from within South Africa and enters Eswatini in the north-western part of the country. The river flows from its upper reaches, through the Ezulwini Valley towards the middle reaches along Lobamba, through the Matsapha industrial area until it joins the Usuthu River in Sidvokodvo (**Figure 5).**

The proposed Nondvo Dam will be situated downstream of the existing Luphohlo Dam and will extend along the Lusushwana River (**Figure 5**). The Lusushwana River is a tributary of the Great Usutu River, above its confluence with the Pongola River. The Lusushwana River originates on the interior plateau of South Africa and drains an area of approximately 1 190 km^2 (~4% of the Maputo River contributing catchment).

Several gauging stations, recording daily flow, are located within the contributing catchment of the proposed Nondvo Dam. Two gauging stations were identified for the estimates of the water balance of the river. The first being located just upstream of the Luphohlo Dam (GS015) and the second is located upstream of Matsapha and Lake Mkinkomo (GS002). Based on data from these two gauging stations the highest monthly average flow (i.e. runoff trend) occurs in February, following which the river flows decrease slowly to reach minimum flow levels in August and September (**Figure 6**). The mean annual flow is 11.5 m^3/s (363 Mm^3/year) and 3.5 m^3/s (120 Mm^3/year) respectively at GS002 and GS015.

Figure 5: Hydrological Setting



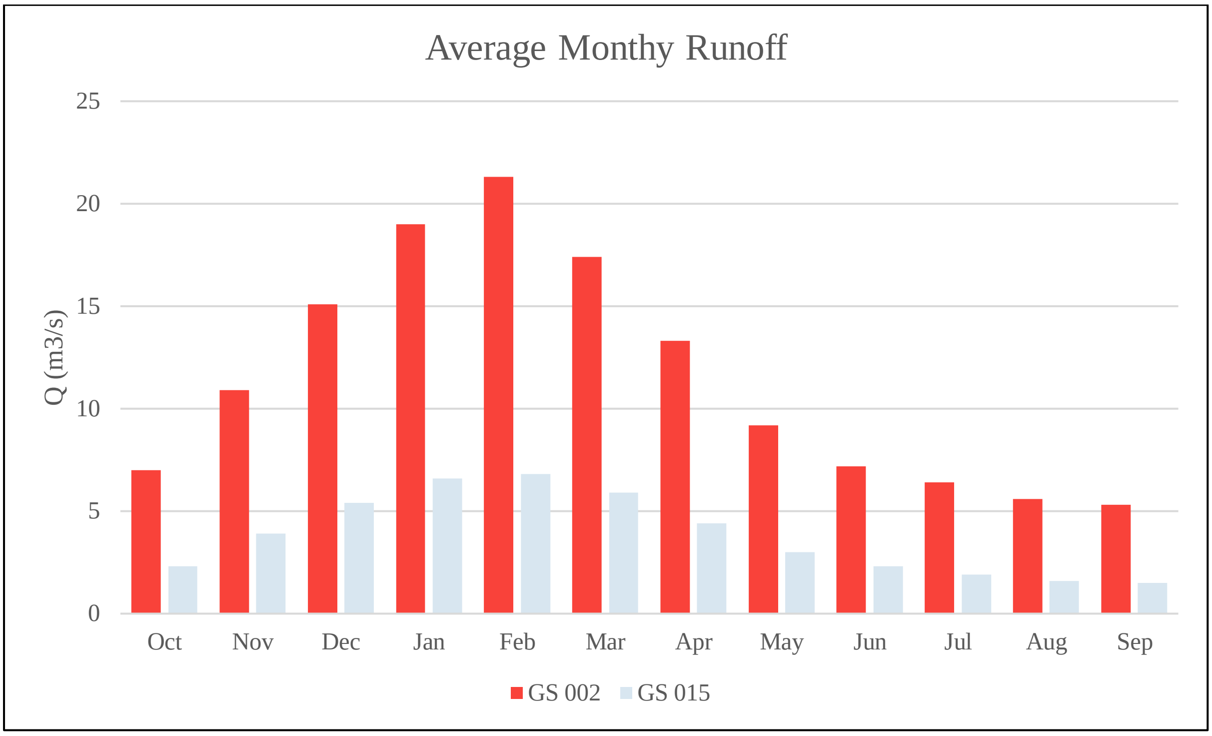


Figure 6: Mean Monthly Runoff Trend (Studio Pietrangeli, 2018)

5.4 GEOLOGY AND SOILS

The Nondvo Dam is located within a granite basement. The granite basement has been intruded by northwest-southeast trending dolerite dykes, with smaller-scale intrusions trending northeast-southwest. There are gneiss outcrops along the riverbanks and river beds, which are intruded by pegmatite veins. The higher slopes are characterised by sub-outcropping rock in some areas, while at higher elevations the gneiss-rounded outcrops are well visible.

The soils of the Maputo River Basin are unusually varied in terms of type, depth and texture. This can be attributed to the combination of steep temperature and rainfall gradients (influencing weathering processes) across the basin, the complex geology of the region (determining chemical composition and resistance to weathering), and varied relief. Soil formation in the basin is dominated by chemical processes, rather than physical (wind, water, ice, etc.) or biological processes. The degree of chemical weathering is influenced by temperature and rainfall, with hot, humid regions being most susceptible.

In the Escarpment Region, in which the project area is located, chemical weathering is reportedly moderate to high. Within the Lusushwana catchment, Regosols are identified to prevail with Leptosols and Ferralsols also present. These are weakly developed mineral soils in unconsolidated materials. Texture, chemical and mineral compositions vary widely across the region.

5.5 TOPOGRAPHY

An extensive topographical study of the project area was carried out as part of the feasibility assessment (Studio Pietrangeli, 2018). The project area extends along the Lusushwana River at an altitude ranging from 930 to 980 masl. The site is situated along a valley on hilly terrain with the Luphohlo Mountain Range rising steeply to a summit of 1 404 masl at a distance of 4 km to the north-east and another summit of 1 459 masl at a distance of 3 km to the east. Between 0.5 km and 1.5 km to the west, the terrain rises to summits ranging from 1 100 and 1 172 masl. The area is also characterised by rocky outcrops and seasonal streams with steep, rocky banks.

5.6 LAND USE

The Lusushwana River and the middle and lower reaches of the other Usuthu tributaries cascade down the escarpment through North-eastern Mountain Grassland. Much of this grassland has been replaced by extensive commercial eucalypt and pine plantations. Large areas along the middle reaches of the Ngwempisi and Lusushwana Rivers are used for dryland, subsistence farming. The urban areas of Mbabane, Matsapha and Manzini are located in the lower Lusushwana catchment, and surrounded by scattered rural settlements (Beuster & Clarke, 2008).

The Lusushwana River has multiple uses; it supplies the Matsapha Industrial Complex, Manzini City and surrounding areas with water. Other uses include fishing, recreation, irrigation and the river being a sink of urban and industrial waste for the biggest industrial area in Eswatini, the Matshapa Industrial Complex (Singwane & Magagula, 2014).

The project site is within the Mantabeni and Siphocosini communities, which are densely populated with residential homesteads. The communities have peri-urban characteristics in that they are situated on the fringe of the Mbabane and Ezulwini urban areas and, although separated from these urban areas by a mountain range, the landscape is a transition between urban and rural.

The primary localised land use to the proposed dam comprises dense clusters of residential homesteads, most of which have arable land used for subsistence agriculture, except along the banks of the Lusushwana River, which is characterised by riparian vegetation. Social amenities such as public schools, clinics, shops, churches and the two *Imiphakatsi* (Royal Kraals) of Siphocosini and Mantabeni are interspersed among the homesteads, predominantly in close proximity to the tarred main road (MR19).

To the north of the project site is the Luphohlo Dam, which is a multipurpose dam whose primary use is hydropower generation. The dam was established in 1984 with a dam wall height of 45 m and a capacity of 23.6 million m^3 (SoE Eswatini, 2001). Secondary uses from the dam include recreation and potable water supply. To the west is the Luphohlo mountain range, on which the Mlilwane Wildlife Sanctuary is situated and extends 10 km southward. A private commercial forestry plantation, in which the private company village of Mhlambanyatsi is situated, is located 4 km to the southwest.

5.7 WATER RESOURCE

5.7.1 WATER USE

Water from the Lusushwana River is used for all the applicable land uses in Eswatini due to the fact that the system runs through the major cities (i.e. Mbabane and Matsapha), forestry and agricultural zones. Additionally, the Usuthu Basin, which includes the Lusushwana River, is also used for tourism associated with its hot springs, and for sport and recreation. According to records from the DWA, a total of 90 water permit holders have access to the Lusushwana and Usuthu River Basin. A total of 79% of the permit holders use the resource for agricultural purposes, 9% use it for industrial purposes, 7% use it for Tourism purposes and the remaining 5% is used for hydropower generation at the Ezulwini and Edwaleni power stations (**Figure 1**).

5.7.2 WATER QUALITY

The water quality status for each of the sub-catchments within the Maputo River Basin has been assessed as part of the Joint Maputo River Basin Water Resources Study (JMRBWRS) (Rossouw, 2008). The focus of this section is on the component of the Rossouw (2008) study that focuses on the Lusushwana sub-catchment as the Nondvo dam is located within this catchment.

As part of this study, an assessment of the water quality within the catchment was suitable for irrigation and domestic water users (after treatment) (Rossouw, 2008). Salinity within the catchment increased downstream as a result of agricultural impacts and urban runoff, with a noticeable increase observed in the Matsapha area. A significant increase in alkalinity, hardness, calcium, ortho-phosphate and suspended sediment were also observed around the Matsapha area. These increases were attributed to land use practices within the Matsapha industrial complex, including runoff and effluent discharges (Singwane & Magagula, 2014).

5.7.3 POLLUTION SOURCES

Wastewater treatment works or industrial plants usually discharge their effluents to streams or rivers through conduits such as outfall pipes, ditches or canals (point sources). The quality of the waste discharges must conform to standards prescribed in licences, permits or other forms of authorisations (Rossouw, 2008). Within the Lusushwana sub-catchment, there are seven (7) known wastewater treatment works that potentially contribute to the deterioration of surface water within the basin (Rossouw, 2008).

Non-point source or diffuse pollution is largely caused by rainfall and the associated surface runoff that mobilises contaminants from the surface of the catchment. Non-point sources can originate from a widespread area, such as storm wash-off from urbanised or agricultural land uses. Salinity from irrigation return flows appears to be one of the main water quality influences in the basin.

The water quality assessment was undertaken by (Singwane & Magagula, 2014) using the World Health Organisation Objectives, The Eswatini Water Quality Objectives and the South African Water Quality Guidelines for Ecosystems. The outcomes are summarised as follows:

- Faecal Coliforms were above the acceptable range;
- pH was within the acceptable range;
- Dissolved Oxygen were within the acceptable range;
- Specific Conductivity was within the acceptable range;
- Turbidity was above the acceptable range;
- Nitrates were within the acceptable range; and
- Phosphates were above the acceptable range.

According to (Singwane & Magagula, 2014), threats to the Lusushwana River occur from:

- The Matsapha Industrial Complex and the associated activities, including:
  - Petroleum storage; and,
  - Improper treatment and disposal of domestic and industrial wastewater.
- Sand Mining along the banks of the River; and,
- Agricultural activities along the River banks.

For the Lusushwana sub-catchment a monitoring strategy is recommended for salinity, immediate management action is recommended in urban and industrial areas for organic, dye and hydrocarbon pollution, a nutrient management strategy should be developed to contain nutrient enrichment, and land-care programmes should be implemented to contain erosion and sediment wash-off (Rossouw, 2008).

6 METHODOLOGY

6.1 SITE WALKOVER

A site walkover was undertaken by WSP between the 13th and 14th of February 2019 to determine the soil characteristics and water quality across the catchment (i.e. quaternary catchment W56C). A photographic log highlighting the main features of the site visit is provided in **Appendix A** at each sampling point. It is worthwhile noting that significant rainfall had occurred in the catchment and runoff within the watercourse was elevated at the time of the site walkover.

6.2 SOIL ANALYSIS

Soil samples were assessed in accordance with the World Reference Base for Soil Resources (WRB, 2006). The World Reference Base for Soil Resources (WRB, 2006) is the international standard taxonomic soil classification system endorsed by the International Union of Soil Sciences (IUSS). It was developed by an international collaboration coordinated by the International Soil Reference and Information Centre (ISRIC) and sponsored by the IUSS and the FAO via its Land & Water Development division. It replaces the previous FAO soil classification.

The WRB borrows heavily from modern soil classification concepts, including USDA soil taxonomy, the legend for the FAO Soil Map of the World 1988, the Référentiel Pédologique and Russian concepts. The classification is based mainly on soil morphology as an expression of pedogenesis. A major characteristic of the USDA soil taxonomy system is that climate is not part of the system, except insofar as climate influences soil profile characteristics.

6.3 WATER QUALITY ANALYSIS

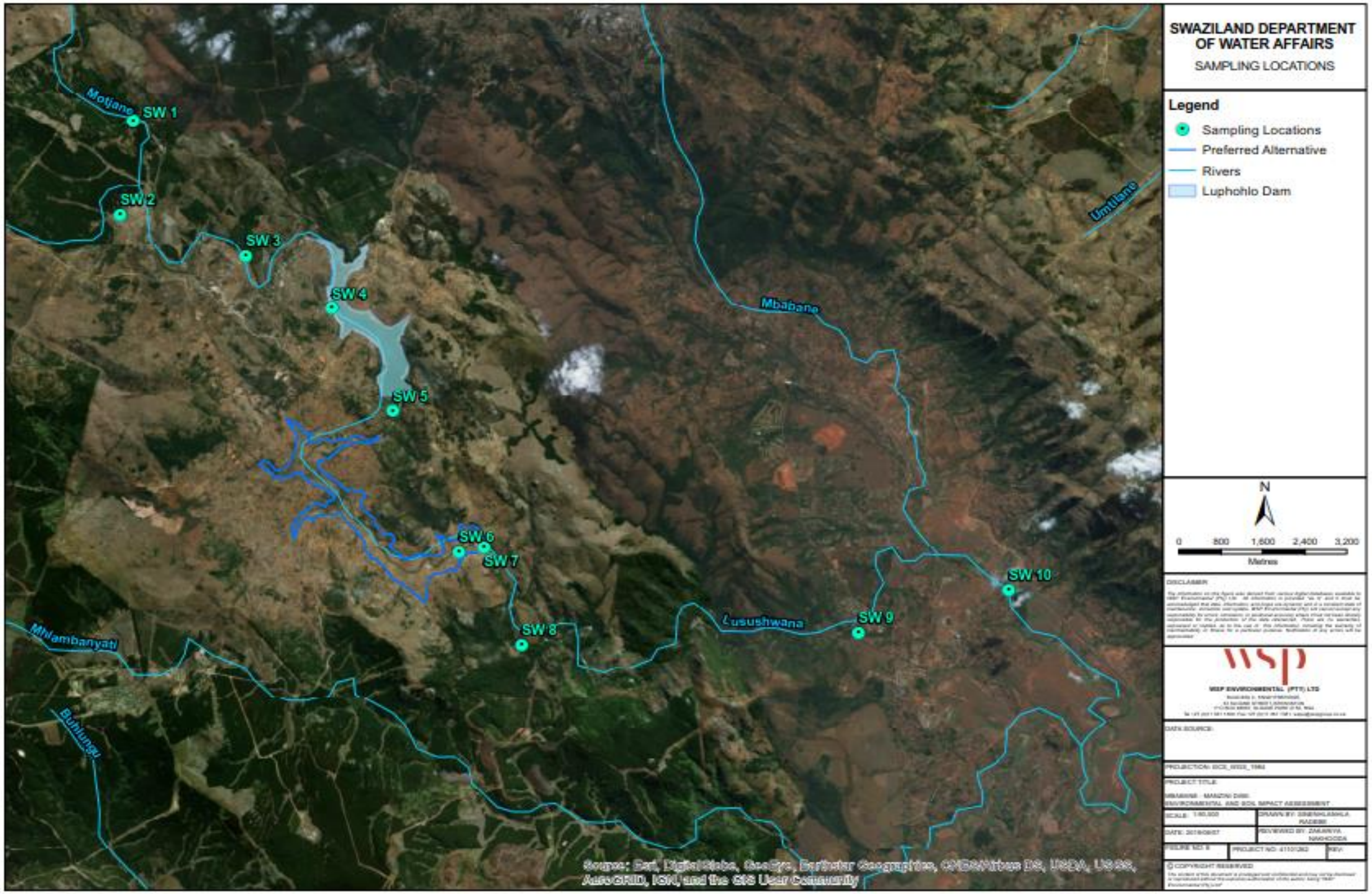
6.3.1 SAMPLING LOCATION

A total of ten (10) water samples were collected from surface water bodies upstream and downstream of the proposed Nondvo Dam (**Figure 7**) with images of the sampling locations in **Appendix A** (**Plates 1** through **10**). These points were selected in order to ascertain baseline conditions prior to the proposed Dam being constructed in order to understand the basin influences and potential impacts of the proposed Dam (**Table 2**).

Table 2: Surface Water Sampling Locations

Sampling Points	Latitude	Longitude	Description
SW1	-26.348292°	31.051386°	Upstream of the proposed Dam on the Motjane River
SW2	-26.365588°	31.048567°	Upstream of the proposed Dam on the Lusushwana River
SW3	-26.373418°	31.072420°	Upstream of the proposed Dam, after the confluence of the Motjane and Lusushwana Rivers
SW4	-26.383422°	31.088720°	Located within the Luphohlo Dam
SW5	-26.402516°	31.100093°	Immediately downstream of the Luphohlo Dam, upstream of the Nondvo River.
SW6	-26.428645°	31.112305°	Upstream of the proposed Dam, but downstream of the Nondvo River
SW7	-26.427960°	31.117073°	At the proposed Dam wall site
SW8	-26.446018°	31.124005°	Downstream of the proposed Dam along the Lusushwana River
SW9	-26.444662°	31.188412°	Downstream of the proposed Dam along the Lusushwana River, after the Mantega Nature Reserve, before the Mbabane River confluence
SW10	-26.437139°	31.217285°	Downstream of the proposed Dam along the Lusushwana River, in a semi-urban setting, after the Mbabane River confluence.

Figure 7: Sampling Locations



6.3.2 SAMPLING METHODOLOGY

The water quality samples were collected directly into laboratory-supplied sample containers. The samples were obtained from at least 10cm below the water surface where possible, with the bottle opening facing upstream. On each sample bottle, the following was recorded to ensure proper identification:

— Site Name;
— Sample Location and Sample Type; and
— Sample Date and Time.

Post sampling, all the samples were stored in a temperature-controlled cooler box (below 4ºC), which was kept sealed and dust-free, until the samples were dispatched to Jones Environmental (PTY) Ltd which is a SANAS accredited laboratory located in South Africa for analysis. The analytical suite is presented in **Table 3**.

Table 3: Laboratory Analytical Suite

Analyte	Units	Analyte	Units
Aluminium	mg/l	**Uranium**	ug/l
Antimony	ug/l	**Zinc**	ug/l
Arsenic	ug/l	**Fluoride**	mg/l
Barium	ug/l	**Chloride**	mg/l
Boron	ug/l	**Nitrite as NO^2**	mg/l
Cadmium	mg/l	**Nitrate as NO^3**	mg/l
Chromium	ug/l	**Sulphate**	mg/l
Copper	ug/l	**Cyanide**	mg/l
Iron	mg/l	**EC @25˚C**	uS/cm
Sodium	mg/l	**Chlorine**	mg/l
Lead	ug/l	**Ammonia as N**	mg/l
Manganese	mg/l	**pH***	pH units
Mercury	mg/l	**TDS**	mg/l
Nickel	ug/l	**Turbidity**	NTU
Selenium	ug/l	**-**	-

6.3.3 WATER QUALITY SCREENING

Water quality guidelines were attained from the Eswatini DWA. These were assessed to establish if they were suitable to assess the water quality based on the most sensitive uses (MSU). This was not possible as there were gaps in the guidelines, hence WSP sourced information from other guidelines to determine the relevant values for MSU.

— Eswatini Water Quality Objectives (Eswatini Water Pollution Control Regulations, 1999);
— Eswatini Effluent Standards (Eswatini Water Pollution Control Regulations, 1999);
— South African Aquatic Ecosystems Standards (DWS, South African Water Quality Guidelines, 1996);
— South African Irrigation Standards (DWS, South African Water Quality Guidelines, 1996)
— South African Livestock Watering Standards (DWS, South African Water Quality Guidelines, 1996) and
— WHO drinking water quality (WHO, 2008).

The Eswatini water quality objectives superseded all the other guidelines where constituents are present, as they are specific to the region.

Table 4 provides the MSU analysis against which the water quality results have been compared. It should be noted that many of the MSU values identified are related to the WHO drinking water guidelines. These guidelines are quite stringent and consideration should be given to the guideline limits as the surface water will not be utilised for direct consumption and will be treated prior to potable use.

6.4 IMPACT ASSESSMENT

6.4.1 METHODOLOGY

The ESIA will utilise a methodological framework developed by WSP to meet the combined requirements of international best practice and the relevant EIA Regulations. The determination and assessment of impacts will be based on the following criteria:

— Nature of the Impact;
— Significance of the Impact;
— Consequence of the Impact;
— Extent of the impact;
— Duration of the Impact;
— Probability if the impact;
— Degree to which the impact:
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be avoided, managed or mitigated.

Following international best practices, additional criteria have been included to determine the significant effects. These include the consideration of the following:

— Magnitude: to what extent environmental resources are going to be affected;
— Sensitivity of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), the rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor); and
— Severity of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering inter alia magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

Table 4: Identified MSU Water Quality Guidelines

Analyte	Units	Eswatini Water Quality Objectives	Irrigation	Livestock Watering	Aquatic Ecosystems	WHO	MSU
Aluminium	mg/l	**0.2**	5	5	5	0.100	**0.2**
Antimony	ug/l	-	-	-	-	20	**20**
Arsenic	ug/l	-	100	1000	10	10	**10**
Barium	ug/l	-	-	-	-	700	**700**
Boron	ug/l	-	-	-	-	500	**500**
Cadmium	mg/l	**0.003**	-	-	0.15	0.003	**0.003**
Chromium	ug/l	-	-	-	12	50	**12**
Copper	ug/l	-	200	50	0.3	2 000	**0.3**
Iron	mg/l	**1**	5	1	-	-	**1**
Sodium	mg/l	-	70	2000	-	40	**40**
Lead	ug/l	-	200	100	0.2	10	**0.2**
Manganese	mg/l	**0.5**	20	10	0.18	0.4	**0.5***
Mercury	mg/l	**1**	-	1	0.04	0.006	**1***
Nickel	ug/l	-	20	100	-	70	**20**
Selenium	ug/l	-	-	-	-	10	**10**
Uranium	ug/l	-	-	-	-	15	**15**
Zinc	ug/l	-	-	-	-	3	**3**
Fluoride	mg/l	**1**	2	2	≤0.75	1.5	**1***
Chloride	mg/l	-	-	1 500	-	-	**1 500**
Nitrite as NO^2	mg/l	**0.3**	-	-	-	3	**0.3**
Nitrate as NO^3	mg/l	**10**	-	-	-	50	**10**

Analyte	Units	Eswatini Water Quality Objectives	Irrigation	Livestock Watering	Aquatic Ecosystems	WHO	MSU
Sulphate	mg/l	-	-	1 000	-	-	**1 000**
Cyanide	mg/l	-	-	-	-	0.07	**0.07**
EC @25˚C	uS/cm	**1 800**	400	1 540	-	-	**1 800***
Chlorine	mg/l	-	-	-	-	5	**0.1**
Ammonia as N	mg/l	**0.6**	-	-	-	1.5	**0.6**
pH	pH units	**6.5-8.5**	-	-	-	6.5-8.5	**6.5-8.5***
TDS	mg/l	-	-	1 000	-	-	**500**
Turbidity	NTU	**5**	-	-	-	-	**5**

It should be noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance will be assessed with and without mitigation measures in place. Impacts are assessed in terms of the following criteria:

a) The **nature**; a description of what causes the effect, what will be affected and how it will be affected.

Table 5: Nature or Type of Impact

Nature or Type of Impact	Definition
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of the Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).
Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

b) The **physical extent**.

Table 6: Physical Extent Rating of Impact

Score	Description
1	the impact will be limited to the site;
2	the impact will be limited to the local area;
3	the impact will be limited to the region;
4	the impact will be national; or
5	the impact will be international;

c) The **duration**, wherein it is indicated whether the lifetime of the impact will be:

Table 7: Duration Rating of Impact

Score	Description
1	of a very short duration (0 to 1 year)
2	of a short duration (2 to 5 years)
3	Medium-term (5–15 years)
4	long term (> 15 years)
5	permanent

d) **Reversibility:** An impact is either reversible or irreversible. The level of reversibility is the ability of an environmental receptor to rehabilitate or restore itself after the activity has caused environmental change (i.e. how long before impacts on receptors cease to be evident).

Table 8: Reversibility of an Impact

Score	Description
1	The impact is immediately reversible.
3	The impact is reversible within 2 years after the cause of stress is removed; or
5	The activity will lead to an impact that is in all practical terms permanent.

e) The **magnitude** of impact on ecological processes, quantified on a scale from 0-10, where a score is assigned.

Table 9: Magnitude Rating of Impact

Score	Description
0	small and will have no effect on the environment.
1	minor and will not result in an impact on processes.
2	low and will cause a slight impact on processes.
3	moderate and will result in processes continuing but in a modified way.
4	high (processes are altered to the extent that they temporarily cease).
5	very high and results in complete destruction of patterns and permanent cessation of processes.

f) The **probability** of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:

Table 10: Probability Rating of Impact

Score	Description
1	very improbable (probably will not happen.
2	improbable (some possibility, but low likelihood).
3	probable (distinct possibility).
4	highly probable (most likely).
5	definite (impact will occur regardless of any prevention measures).

g) The **significance**, which is determined through a synthesis of the characteristics described above (refer to the formula below) and can be assessed as low, medium or high;

h) The status, which is described as either positive, negative or neutral;

i) The degree to which the impact can be reversed;

j) The degree to which the impact may cause irreplaceable loss of resources; and

k) The degree to which the impact can be mitigated.

The significance is determined by combining the above criteria in the following formula:

$$Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$$

$$[S = (E + D + R + M) \times P]$$

Where:

S – Significance Weighting	R – Reversibility
E – Extent	M – Magnitude
D – Duration	P – Probability

The significance score can therefore range from 3 (minimum) to 100 (Maximum). The significance weightings are defined as Low, Medium and High, as such the scoring system has been allocated accordingly to define the significance weighting, as identified in **Table 11**.

Table 11: Significance Weightings of an Impact

Overall Score	Significance Rating (Negative)	Significance Rating (Positive)	Description
4 - 29 points	**Low**	**Low**	where this impact would not have a direct influence on the decision to develop in the area
30 - 60 points	**Medium**	**Medium**	where the impact could influence the decision to develop in the area unless it is effectively mitigated
61 - 100 points	**High**	**High**	where the impact must have an influence on the decision process to develop in the area

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of the impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in the ESIA.

7 RESULTS AND DISCUSSION

7.1 SOIL ANALYSIS

According to the WRB system, the general Nondvo Dam study area is dominated by Ferralsols, Regosols and Leptosols. A Ferralsol is a red and/or yellow weathered soil whose colours result from an accumulation of metal oxides, particularly iron and aluminium. They are formed on geologically old parent materials in humid tropical climates, with rainforest vegetation growing in the natural state. These soils are typically well-drained and have a low erosion hazard. A Regosol is very weakly developed mineral soil in unconsolidated materials. Regosols are extensive in eroding lands, in particular in arid and semi-arid areas and in mountain regions. A Leptosol is a very shallow soil over hard rock or highly calcareous material or a deeper soil that is extremely gravelly and/or stony.

While the area surrounding the Nondvo Dam site appeared to be dominated by Ferralsols, evidence of Regosols and Leptosols was also found (**Appendix A, Plates 11** to **13**).

7.2 WATER QUALITY

The water quality results are summarised in **Table 12** and the full report along with laboratory certificates are provided in **Appendix B**. The following exceedances were highlighted:

— Aluminium

Aluminium exceeded the Eswatini Water Quality Objective guideline value at sampling point SW1, along the Motjane River upstream of the proposed Dam. The exceedance is marginal and could be attributed to the leaching of natural soils within the Motjane River catchment.

— Zinc

Zinc exceeded the MSU at all sampling points, with the exception of SW1 and SW7. The exceedances are marginal. Zinc can be introduced into water naturally by the erosion of minerals from rocks and soil, however since zinc ores are only slightly soluble in water. Zinc is only dissolved at relatively low concentrations. Levels of Zinc observed may also be related to agricultural practices within the catchment (i.e. fertigation).

— Turbidity

Turbidity was exceeded at all sampling points with the exception of SW4. The exceedances are likely as a result of heavy rainfall experienced prior to sampling, thereby increased runoff and sediment entering the watercourse. Sampling point SW4 was located within the Luphohlo Dam, therefore sediment had settled, resulting in a lower Turbidity.

Based on the laboratory analysis, the water quality within the Lusushwana River, proximal to the proposed dam site is of relatively good quality, however this needs to be contextualised as the high runoff during the site assessment would result in dilution of potential contaminants that may have otherwise been evident. It is therefore recommended that a formal monitoring programme be implemented to ascertain medium to long terms water quality trends.

Table 12: Water Quality Results

Analyte	Guidelines	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
Aluminium	**0.2 mg/l**	**0.244**	0.034	0.144	0.091	0.047	0.062	<0.02	<0.02	0.166	0.179
Antimony	**20 ug/l**	<2	<2	3	<2	<2	<2	<2	<2	<2	<2
Arsenic	**10 ug/l**	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Barium	**700 ug/l**	10	9	10	9	11	9	8	7	7	12
Boron	**500 ug/l**	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Cadmium	**0.003 mg/l**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	**12 ug/l**	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Copper	**0.3 ug/l**	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7
Iron	**1 mg/l**	0.254	0.193	0.384	0.288	0.198	0.287	0.134	0.156	0.387	0.233
Lead	**0.2 ug/l**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Manganese	**0.5 mg/l**	0.008	<0.002	0.01	0.002	0.176	0.034	0.029	0.023	0.019	0.015
Mercury	**0.001 mg/l**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	**20 ug/l**	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Selenium	**10 ug/l**	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Sodium	**40 mg/l**	4.2	4.7	4.9	4.6	5.2	4.0	4.2	3.9	4.0	4.7
Uranium	**15 ug/l**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Zinc	**3 ug/l**	3	**5**	**15**	**4**	**7**	**5**	<3	**4**	**5**	**4**
Fluoride	**1 mg/l**	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chloride	**1 500 mg/l**	3.3	2.9	3.2	3.2	3.7	3.3	3.4	3.3	3.4	3.9
Sulphate	**1 000 mg/l**	2.5	2.4	2.3	2.7	2.7	1.9	1.9	1.8	2.0	2.7

Analyte	Guidelines	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
Nitrite as N	**0.3 mg/l**	0.037	0.037	0.040	0.040	0.040	<0.006	0.037	<0.006	<0.006	0.043
Nitrate as N	**10 mg/l**	0.41	0.34	0.43	0.41	0.36	0.27	0.29	0.29	0.25	0.52
Free Cyanide	**70 mg/l**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Electrical Conductivity	**1 800 uS/cm**	71	61	70	62	70	65	67	56	47	60
Free Chlorine	**0.1 mg/l**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Free Ammonia as N	**0.6 mg/l**	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
pH	**6.5-8.5**	7.66	7.64	7.71	7.64	7.66	7.29	7.69	7.59	7.43	7.29
Total Dissolved Solids	**500 mg/l**	110	108	81	82	91	106	78	67	69	96
Turbidity	**5 NTU**	**84.8**	**49.7**	**24.5**	3.9	**13.3**	**21.8**	**7.1**	**6.4**	**26.5**	**81.0**

8 IMPACT ASSESSMENT

The following chapters present the anticipated impacts associated with overall basin protection associated with the Lusushwana River. These include those related to the upstream land use, water users and their impact on water quality, water quantity, soils and downstream users.

8.1 IDENTIFIED LAND USE/WATER USE AND IMPACTS TO THE LUSUSHWANA RIVER BASIN

The identified water uses within the basin and their associated impacts are presented in **Table 13**.

Table 13: Identified Water Uses and Associated Impacts

Water Uses	Activities	Associated Impacts
Urbanisation	— Urban expansion as a result of an influx of people resulting in increased abstractions from the resource. — Incorrect treatment or disposal of untreated water to the resource.	**Water Quality:** Deterioration of the quality of the resource and Sedimentation. **Water Quantity:** Reduction of available water within the basin. **Soils:** Erosion.
Agriculture (including subsistence farming)	— Irrigation. — Use of fertilisers and pesticides. — Incorrect agricultural practices and livestock grazing resulting in erosion.	**Water Quality:** Sedimentation and Eutrophication. **Water Quantity:** Reduction of available water within the basin. **Soils**: Erosion
Industry	— Disposal of wastewater into the resource. — Dirty water runoff from the industrial areas to the surface water resource. — Leaching of dirty surface water to the groundwater resource.	**Water Quality:** Deterioration of the quality of the resource. **Water Quantity:** Reduction of available water within the basin.
Forestry	— Afforestation.	**Water Quantity:** Reduction of available water within the basin.
Hydro-electricity	— Power Generation.	**Water Quality:** Changes in water temperature. **Water Quantity:** Reduction of available water within the basin.
New Developments	— Increased abstractions. — Increased effluent disposal. — Alterations to the river flow regime. — Potential increase of untreated water discharges.	**Water Quality:** Sedimentation **Water Quantity:** Reduction of available water within the basin. Alteration to natural flows. Changes to the hydrological cycle. **Soils: Erosion**

8.2 IMPACT ASSESSMENT: NONDVO DAM

The following chapters present the activities associated with the proposed Nondvo Dam which may impact the Lusushwana Basin. These impacts are associated with the construction, operational and decommissioning phases of the proposed Nondvo Dam (**Table 13**). A risk assessment for the Nondvo Dam is provided in **Table 14**, with cumulative risks for each of the phases provided in **Table 15**. Management and mitigative measures for the Nondvo Dam are presented in **Chapter 9**.

8.2.1 CONSTRUCTION PHASE

During the construction phase of the Nondvo Dam, the following activities are anticipated:

- Creation of roads and construction base camp;
- Construction of the Dam wall; and
- Water abstractions.

The impacts associated with these activities are elaborated on in the chapters below.

CREATION OF ROADS AND CONSTRUCTION BASE CAMP

The development of roads and construction camps would result in the clearing of the natural vegetation, exposing the underlying soils, thereby increasing the potential for sediments to be washed down into the Lusushwana River. The removal of vegetation can also result in a loss of surface roughness, resulting in decreased infiltration and increased surface water runoff causing increased surface water flows to the Lusushwana River.

At the construction base camp, an influx of workers is anticipated. There exists the possibility of inadequate handling of waste and wastewater at the temporary on-site disposal and sanitation facilities. As a result, there is a risk of pathways to the Lusushwana River being exposed and transporting these wastes downstream.

CONSTRUCTION OF THE DAM WALL

Excavations and blasting are anticipated in order to create suitable foundations for the dam wall. Owing to the disturbances within the watercourse and its banks, increased sediments are anticipated to enter the Lusushwana River which would increase turbidity, therefore negatively impact the quality of water within the river. Vehicle or equipment leaks (hydrocarbons) may occur whilst they are operating on site. Equipment such as cranes, excavators, concrete tankers will also be present on site. The hydrocarbons could be transported to the river via natural pathways, impacting on the water quality.

Materials used for the construction works may comprise hazardous materials, such as chemicals and lubricants. Accidental spillages of the materials could be transported to the river via natural pathways impacting on the water quality.

WATER ABSTRACTION

Water is an anticipated requirement for construction. If water is abstracted from the Lusushwana River, this could decrease the natural volume of water within the River.

SUMMARISED IMPACTS

The impacts identified as a result of the aforementioned activities are listed below:

- Water quality; and
- Water quantity.

8.2.2 OPERATIONAL PHASE

During the operational phase of the dam, the following activities are anticipated:

— Dam infilling;
— Flow attenuation;
— Care and maintenance; and
— Dam failure.

DAM INFILLING

During the inundation process the initial filling of the reservoir will increase in concentrations of nutrients and organic matter because of the decomposition of inundated vegetation and possible mobilisation of nutrients from agricultural activities taking place within the project area. This is likely to alter trophic conditions and biodiversity in the river downstream during the first few years (i.e. the period of maturation). There is an increased likelihood of changes to downstream oxygen levels and the potential of algae blooms within the dam. As the dam fills to its anticipated capacity, existing households and associated infrastructure would be inundated. This includes existing septic tanks, which would have a negative impact on the water quality.

The water quality impacts associated with the dam infilling are anticipated to be similar for downstream users as they will be receiving water from the dam via controlled releases.

FLOW ATTENUATION

Dam construction alters the amount of sediment production, retention and transportation in the system. Water released from a dam is likely to be clear because of the settling of suspended load within the dam (White, 2000). The operation of the proposed dam may result in the following impacts:

— Decrease in nutrients to downstream users as a result of sediment settling within the Dam; and,
— Water released from the dam is likely to be clear because of the settling of suspended load within the reservoir. Clear water has the potential capacity to carry more sediment than turbid water.

The dam would change the time, size and frequency of flow events in the river. Changes in velocity and volumes of flow would influence erosion thereby changing the natural shape of the watercourses.

Seepage from the dam wall may occur depending on the design. This would possibly result in baseline flows during the dry season being larger than the naturally occurring baseline flow. The inundation of the dam would increase the surface area of the water bodies within the basin. Evaporation will increase as a result of the larger surface area of the dam compared to the River. Groundwater recharge may increase as a result of water storage increasing infiltration.

There would be higher demand placed on the resource as a result of containment, thereby reducing flows within the catchment.

CARE AND MAINTENACE

During care and maintenance, disturbances within the watercourse and its banks are anticipated. These disturbances would contribute to increased sediments entering the Dam or the Lusushwana River which would increase turbidity, therefore negatively impact the quality of water within the river. Vehicle or equipment leaks (hydrocarbons) may occur whilst they are operating on site. Equipment such as cranes, excavators, concrete tankers will also be present on site. The hydrocarbons could be transported to the Dam or river via natural pathways, impacting on the water quality.

Materials used for the care and maintenance works may comprise hazardous materials, such as chemicals and lubricants. Accidental spillages of the materials could be transported to the river via natural pathways impacting on the water quality.

DAM FAILURE

Although considered unlikely, the failure of the Nondvo Dam is a possibility. This would result in a significant change to the morphology and habitat within and downstream of the dam. Although the water quantity would increase, downstream users would be highly impacted as the volume and velocity of water could cause houses and farms located along the banks of the river to be flooded resulting in significant negative social impacts within the basin.

SUMMARISED IMPACTS

- Water quality;
- Changes to the hydrological cycle;
- Alteration to the natural flow regime (Water quantity); and,
- Flood risk.

8.2.3 DECOMMISSIONING PHASE

During the decommissioning phase of the dam, the following activities are anticipated:

- Creation of a base camp; and
- Removal of the dam wall.

CREATION OF A BASE CAMP

The development of a construction camp would result in the clearing of the natural vegetation, exposing the underlying soils, thereby increasing the potential for sediments to be washed down into the Lusushwana River. The removal of vegetation can also result in a loss of surface roughness, resulting in decreased infiltration and increased surface water runoff causing increased surface water flows to the Lusushwana River.

At the construction base camp, an influx of workers is anticipated. There exists the possibility of inadequate handling of waste and wastewater at the temporary on-site disposal and sanitation facilities. As a result, there is a risk of pathways to the Lusushwana River being exposed and transporting these wastes downstream.

REMOVAL OF THE DAM WALL

Blasting and the removal of rubble are anticipated in order to decommission the Dam wall. Owing to the disturbances within the watercourse and its banks, increased sediments are anticipated to enter the Lusushwana River which would increase turbidity, therefore negatively impact the quality of water within the river. Vehicle or equipment leaks (hydrocarbons) may occur whilst they are operating on site. Equipment such as cranes, excavators, concrete tankers will also be present on site. The hydrocarbons could be transported to the river via natural pathways, impacting on the water quality.

Materials used for the construction works may comprise hazardous materials, such as chemicals and lubricants. Accidental spillages of the materials stored could be transported to the river via natural pathways impacting on the water quality. The removal of the dam wall would result in changes to the flow regime of the Lusushwana River. The volume of available water for downstream uses would increase as there would be no water abstractions for potable supply or irrigation.

IDENTIFIED IMPACTS

- Water quality;
- Changes to the hydrological cycle; and,
- Alteration to the natural flow regime.

9 MANAGEMENT AND MITIGATION MEASURES

The proposed mitigation measures for the Nondvo Dam construction, operational and decommissioning phases are presented in **Table 16**. The mitigation measures have been grouped according to the impacts posed to the Lusushwana River and the downstream users.

Table 14: Surface Water Impact Assessment

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
CONSTRUCTION																			
Impact 1:	Lusushwana Basin	**Water Quality**	Construction	Negative	Medium	4	3	3	3	4	**52**	**N2**	3	2	3	2	3	**30**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						
Impact 2:	Lusushwana Basin	**Alteration to the Flow Regime (Water Quantity)**	Construction	Negative	Medium	3	3	3	3	4	**36**	**N2**	3	3	3	2	2	**22**	**N1**
					Significance	**N2 - Medium**							**N1 - Low**						
OPERATIONAL																			
Impact 1:	Lusushwana Basin	**Water Quality**	Operational	Negative	Medium	4	3	3	4	4	**56**	**N2**	2	3	3	4	3	**36**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						
Impact 2:	Lusushwana Basin	**Alteration to the Flow Regime (Water Quantity)**	Operational	Negative	Medium	4	3	5	4	4	**64**	**N3**	4	3	5	4	3	**48**	**N2**
					Significance	**N3 - High**							**N2 - Medium**						
Impact 3:	Lusushwana Basin	**Changes to the Hydrological Cycle**	Operational	Negative	Medium	3	3	3	4	3	**39**	**N2**	2	3	3	4	3	**36**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						
Impact 4:	Lusushwana Basin	**Flood Risk**	Operational	Negative	Low	5	3	5	1	2	**24**	**N1**	3	3	5	1	2	**28**	**N1**
					Significance	**N1 - Low**							**N1 - Low**						
DECOMISSIONING																			
Impact 1:	Lusushwana Basin	**Water Quality**	Decommissioning	Negative	Medium	4	3	3	2	4	**48**	**N2**	3	2	3	2	4	**40**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						
Impact 2:	Lusushwana Basin	**Alterations to the Flow Regime (Water Quantity)**	Decommissioning	Negative	Medium	4	3	4	4	4	**45**	**N2**	4	3	4	4	3	**30**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						
Impact 3:	Lusushwana Basin	**Changes to the Hydrological Cycle**	Decommissioning	Negative	Medium	3	3	3	3	3	**36**	**N2**	2	3	3	3	3	**33**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						

Table 15: Cumulative Risk Assessment

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1	Lusushwana Basin	**Water Quality**	— Construction — Operational — Decommissioning	Negative	Medium	4	3	3	3	4	**52**	**N2**	3	2	3	3	3	**33**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						
Impact 2	Lusushwana Basin	**Alteration to the Flow Regime (Water Quantity)**	— Construction — Operational — Decommissioning	Negative	Medium	4	3	4	4	4	**60**	**N2**	4	3	4	3	3	**42**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						
Impact 3	Lusushwana Basin	**Changes to the Hydrological Cycle**	— Operational — Decommissioning	Negative	Medium	3	3	3	4	3	**39**	**N2**	2	3	3	4	3	**36**	**N2**
					Significance	**N2 - Medium**							**N2 - Medium**						
Impact 4	Lusushwana Basin	**Flood Risk**	— Operational	Negative	Medium	5	3	5	1	2	**28**	**N1**	3	3	5	1	2	**24**	**N1**
					Significance	**N1 - Low**							**N1 - Low**						

Table 16: Management and Mitigation Measures

Mitigation Action	Impact Reference	Frequency	Responsible Person	Phase of Project	Associated Cost (Euro (€))	Applicable Safeguards
Sedimentation: — Employ soil erosion control measures, such as protection berms or gabions, where necessary. The use of silt traps must be undertaken. Develop and implement a Storm Water Management Plan (SWMP). — Compile and implement an environmental management and restoration plan to ensure the rehabilitation of areas disturbed during construction that are not within the inundation area as soon as practically possible — Disturbed soils must be stabilised immediately through grass cover as a first step to soil stabilisation. Gabions or the use of geotextile fabric and landscaping, must be used to rehabilitate existing erosion areas. — Undertake the rehabilitation of disturbed areas and revegetate with indigenous plants — Develop a management plan for the Dam which includes a Sediment Management Plan.	**Impact 1: Water Quality**	Stormwater Management and Sediment Management Plans (SWMP & SMP) must be developed prior to any works been undertaken. These plans may be revised as and when the need arises. The additional erosion preventative measures and rehabilitation must occur during the construction phase.	Appointed Contractor Eswatini DWA Maintenance and Operations division	— Construction — Operational — Decommissioning	~ € 10 000	None
Establishment of Roads, Base Camps and Laydown Area: — The use of existing roads must be prioritised. New roads must be constructed as a last resort. Design and construct river crossings for vehicles in a way that does not alter the flow of water in the river. Vehicles are only allowed to cross the river at designated crossings to avoid disturbance of the watercourse. Sufficiently compact new access roads and the base camp to minimise erosion. — The use of sediment and oil traps must be implemented. Regular maintenance of these must be undertaken to prevent unnecessary dirty run-off to the River. — Develop the basecamp/laydown areas in areas which have been previously disturbed. — Toolbox talks. These must include the use of spill kits, handling of hazardous materials and occupational health and safety talks. — Keep spill kits or absorbent materials on hand to clean up spills. Once used, treat this material as hazardous waste and dispose of it accordingly. Clean up spills immediately.		The Water Quality Monitoring Programme (WQMP) as developed below must be implemented during the construction, operational and decommissioning phases of the project. This plan may be revised as and when the need arises. The remaining mitigative actions, where applicable, should be ongoing throughout the project lifespan.	Appointed Contractor Eswatini DWA Maintenance and Operations division	— Construction — Operational — Decommissioning	~ € 9 000	None

Mitigation Action	Impact Reference	Frequency	Responsible Person	Phase of Project	Associated Cost (Euro (€))	Applicable Safeguards
— Provide adequate ablution facilities and waste skips for site workers. Do not place any sanitary facilities within 100 m of a watercourse. Remove refuse and solid waste at regular intervals to prevent littering. — Store all hazardous materials in a hazardous store with an impermeable floor surface and which is fenced, roofed, secured, bunded and regularly cleaned. Store Material Safety Data sheets (MSDS) on site. Store, transport, use and dispose of chemicals as per the manual / MSDS. Undertake Construction activities during the dry season. — Water Quality Programme: The Water Quality Monitoring Programme must be implemented during construction of the proposed dam. This programme must be updated to accommodate the different phases of the project and extend into the operational phase. The monitoring programme must be a living document and updated in accordance to different project phases.						
Dam Wall Construction: — Develop Work Method Statements and an Environmental Management Programme. — Avoid activities in and on the banks of the river as far as possible. — Ensure that vehicles and equipment are kept in good working order and oil or fuel leaks are repaired immediately upon detection. No vehicle repairs are allowed in riparian areas. — Do not mix concrete directly on the ground. Use plastic liners and mixing trays at all times. Remove waste concrete and sediment sludge to an appropriately designated storage area in order to prevent contamination during rainfall. Contain cement contaminated water within the process water system / dirty water system. — Undertake construction activities during the dry season. — Water Quality Programme: A water quality monitoring programme must be implemented during construction of the proposed dam. This programme must be updated to accommodate the different phases of the project and extend into the operational phase. The monitoring programme must be a living document and updated in accordance to different project phases.		Work Method Statements and an Environmental Management Programme must be developed prior to undertaking any works on site. The Water Quality Monitoring Programme as developed below must be implemented during the construction, operational and decommissioning phases of the project. This plan may be revised as and when the need arises. The remaining mitigative actions, where applicable, should be ongoing throughout the project lifespan.	Appointed Contractor Eswatini DWA Maintenance and Operations division	— Construction — Operational	~ € 10 000	None
— Water used during the construction phase may only be abstracted from the Lusushwana River if authorisation by the Eswatini DWA has been granted. — Develop an abstraction plan for water stored with the dam. The plan must factor in abstraction for domestic water supply, hydro-power and maintaining the ecological flows for the River. The plan must factor in the downstream water users. — Maintain Natural flows through a controlled release plan and controlled releases of water for Domestic use.	**Impact 2: Alteration to the Flow Regime (Water Quantity)**	The water abstraction plan/programme must be developed prior to the construction of the Dam.	Eswatini DWA Maintenance and Operations division	— Construction — Operational	~ € 15 000	None
— Appropriate lining materials for the dam must be utilised. — The lining of the dam must be structurally sound, therefore reducing the infiltration to groundwater.	**Impact 3: Changes to the Hydrological Regime**	Once off during construction. Monitoring post-construction	Appointed Contractor Eswatini DWA Maintenance and Operations division	— Construction	~ € 50 000	None
— Conduct regular maintenances checks on the Dam wall. — Develop an early warning system. — Develop an evacuation plan for people located downstream of the Dam.	**Impact 4: Flood Risk**	An early warning system and evacuation plan must be developed prior to construction been undertaken. Monthly inspection of the Dam wall during operations must be undertaken.	Eswatini DWA Maintenance and Operations division	— Operational	~ € 10 000	None

10 WATER MONITORING PROGRAMME

The sample locations and collection frequency for the construction and operational phases of the proposed dam is outlined in the chapters below. The objective of the monitoring programme is to ascertain the impacts of the proposed dam on the receiving water environment. Should upstream impacts be identified the monitoring programme may need to be expanded on to qualify potential source zones within the broader basin.

10.1 SAMPLING LOCATIONS AND FREQUENCY

Sampling must be undertaken upstream and downstream of the proposed dam along the Lusushwana River. The locations are elaborated on in **Table 17** and illustrated in **Figure 8**. This would enable a comparison to be undertaken in order to determine impacts to the River.

Table 17: Proposed Sampling Location and Frequency

Point	Latitude	Longitude	Frequency	Rationale
SW5	-26.4025°	31.1003°	**Construction Phase:** Weekly **Operational Phase:** Monthly	This is upstream of the proposed dam inundation area, and also downstream of the existing Lupholo Dam along the Lusushwana River. The effects of the Lupholo Dam would be included in the results.
SW7	-26.4286°	31.1123°	**Construction Phase:** Weekly **Operational Phase:** Monthly	This point is after the confluence of the Nondvo and Lusushwana Rivers. Sampling at this location would factor in the effects of the Nondvo River.
SW8	-26.4279°	31.1170°	**Construction Phase:** Weekly **Operational Phase:** Monthly	This point is located immediately downstream of the proposed dam wall. A sample here would provide an indication of the impacts that the proposed dam would have on the Lusushwana River.
SW9	-26.4460°	31.1241°	**Construction Phase:** Weekly **Operational Phase:** Monthly	This point is located approximately 2.4km downstream of the proposed dam wall, along the Lusushwana River. A sample here would provide an indication as to how the environment would react to the proposed dam.
SW10	-26.4446°	31.1881°	**Construction Phase:** Weekly **Operational Phase:** Monthly	This point is located approximately 9.75km downstream of the proposed dam wall, along the Lusushwana River. A sample here would provide an indication as to how the environment would react to the proposed dam, prior to the river passing through a semi-urban area.

10.2 SAMPLING METHODOLOGY

The water quality samples must be collected directly into laboratory-supplied sample containers. Water samples must be obtained from at least 10cm below the water surface wherever possible, with the bottle opening facing upstream. Sample containers must be kept closed and in a clean condition up to the point of sampling.

Monitoring must be undertaken according to WHO Guidelines for Drinking-Water Quality, ensuring that the potential for cross-contamination is minimised.

For each sampling point, the temperature, pH and electrical conductivity must be measured *in-situ* using a calibrated multi-parameter probe, and recorded. This information, as well as the physical and environmental information of each sampling point (e.g. visual, olfactory observations and flow conditions) must be recorded on designated field data sheets.

On each sample, the following must be recorded to ensure proper identification:

- Site Name;
- Sample Location and Sample Type; and
- Sample Date and Time.

Post sampling, all samples must be stored in a temperature-controlled cooler box (below 4°C), which is kept sealed and dust-free, until samples are dispatched to a suitably accredited laboratory for analysis.

10.2.1 ANALYTICAL PROGRAMME

The Kingdom of Eswatini has developed Water Pollution Control Regulations (1999), which are currently operational. The regulated guidelines are presented in **Table 8** (**Chapter 6.2**) for water quality. It is recommended that the analytical suite follow the schedule outlined in **Table 18**. The consolidated monitoring and measuring plan is outlined in **Table 19**.

Table 18: Eswatini Water Quality Guidelines

Physic-chemical parameters	Standard/Objective
Dissolved oxygen	minimum of 4 mg/l (surface water only)
pH	minimum 6.5 and maximum 8.5
EC	1800 µS/cm maximum
Turbidity	5 Nephelometric units (NTU) maximum
Hardness	1000 mg/l maximum (as calcium carbonate)
Chemical oxygen demand	10 mg oxygen/l maximum
Biological oxygen demand	5 mg oxygen/l maximum
Nitrate	10 mg N/l (as nitrogen) maximum
Nitrite	0.2-3 mg N/l (as nitrogen) maximum
Ammonia	0.6 mg N/l maximum
Fluoride	1.0 mg/l maximum
Iron	1 mg/l maximum
Manganese	0.5 mg/l maximum
Mercury	0.001 mg/l maximum
Cadmium	0.003 mg/l maximum
Aluminium	0.2 mg/l maximum
Total Coliforms	1 - 10 per 100 ml maximum
Faecal Coliforms	1 - 10 per 100 ml maximum
Zinc*	3 ug/l maximum
Phosphates*	0.1 mg/l maximum
***Added in based on land uses within the Lusushwana River Basin**	

10.2.2 DATA REPORTING

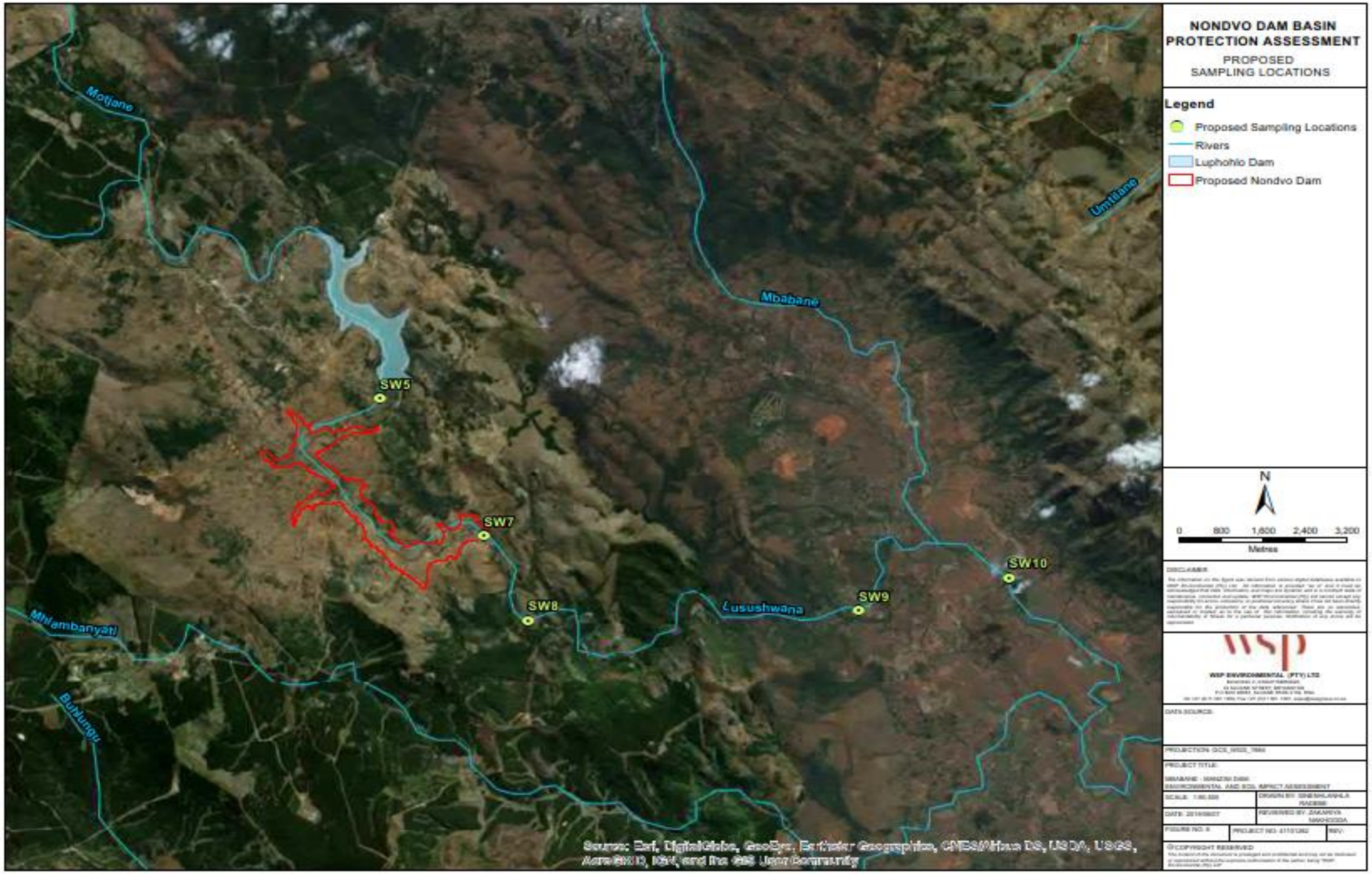
A factual and interpretive report should be drafted in accordance with the monitoring reporting requirements stipulated in the Water Pollution Control Regulations (1999). The report should include a description of the methodologies followed, the analytical results obtained and associated interpretation in line with the defined water quality guidelines. A database of the result should be developed in order to gain an understanding of the impacts during the construction and operation phases through a trend analysis.

The precision of the sampling and analysis must be assessed through a comparison of the original and duplicate sample analytical results. This must be done through a quality assurance/quality control programme (i.e. obtain the percentage variance of the duplicated sample).

Table 19: Water Quality Monitoring and Measuring Plan

Sample ID	Parameter Being Monitored	Method	Location		Frequency	Responsible Person	Associated Cost	Applicable Safeguards
			Latitude	Longitude				
SW5	As outlined in **Table 18.**	As outlined in **Chapter 10.2**	-26.4025°	31.1003°	**Construction Phase:** Weekly **Operational Phase:** Monthly	Eswatini DWA Maintenance and Operations division	**Construction Phase:** ~ € 150 per week **Operational Phase:** ~ € 150 per month	N/A
SW7	As outlined in **Table 18.**	As outlined in **Chapter 10.2**	-26.4286°	31.1123°	**Construction Phase:** Weekly **Operational Phase:** Monthly	Eswatini DWA Maintenance and Operations division	**Construction Phase:** ~ € 150 per week **Operational Phase:** ~ € 150 per month	N/A
SW8	As outlined in **Table 18.**	As outlined in **Chapter 10.2**	-26.4279°	31.1170°	**Construction Phase:** Weekly **Operational Phase:** Monthly	Eswatini DWA Maintenance and Operations division	**Construction Phase:** ~ € 150 per week **Operational Phase:** ~ € 150 per month	N/A
SW9	As outlined in **Table 18.**	As outlined in **Chapter 10.2**	-26.4460°	31.1241°	**Construction Phase:** Weekly **Operational Phase:** Monthly	Eswatini DWA Maintenance and Operations division	**Construction Phase:** ~ € 150 per week **Operational Phase:** ~ € 150 per month	N/A
SW10	As outlined in **Table 18.**	As outlined in **Chapter 10.2**	-26.4446°	31.1881°	**Construction Phase:** Weekly **Operational Phase:** Monthly	Eswatini DWA Maintenance and Operations division	**Construction Phase:** ~ € 150 per week **Operational Phase:** ~ € 150 per month	N/A

Figure 8: Proposed Sampling Locations



11 CONCLUSIONS

The main purpose of the proposed Nondvo Dam project is for the storage of water for the supply of potable water to Mbabane and Manzini. Three alternatives were assessed by Studio Pietrangeli (2017), with Alternative 1, having a Full Supply Level of 960 masl and a supplied volume with an assured yield of 95% is 9.8 Mm^3/year been selected.

A total of ten baseline samples were taken and analysed against Eswatini Water Quality Legislation; The Water Quality Objectives (Water Pollution Control Regulations, 2010) and Environmental Management Act (No 5 of 2002) – Water Pollution Control Regulations. The samples were collected from both up-and downstream of the proposed dam **-** as a basis of a recommended monitoring plan. The analysis indicated that the water quality within the Lusushwana River is good, with minor exceedances noted.

The effects of water use and land use practices within the Nondvo Dam contributing catchment, namely agriculture, urban, forestry and industrial uses need to be qualified in terms of water resource quantity and quality. This will become apparent as additional monitoring data comes to light. The need for adaptation within the monitoring programme is therefore recommended (i.e. change in the number of sampling locations and analytical suite).

The impacts associated with the Nondvo Dam were rated Low with mitigation, whilst the operational and decommissioning risks were rated as medium. Construction risks were largely related to pollution associated with the setting up of a basecamp and the machinery and equipment utilised in construction of the dam.

The risks associated with the operational phase factored in changes to the downstream flow regime of the Lusushwana River and the resultant alterations to the water quality and hydrological cycle, which were viewed as the pertinent impacts. Dam failure, although highly unlikely was also factored in during the operational phase. The pre-and post-mitigation risks were rated as medium. The cumulative impacts during the construction, operational and decommissioning phases presented in **Table 20**.

Table 20: Summarised Risk Assessment

Impact	Receptor	Pre-Mitigation	Post-Mitigation
Impact 1: Water Quality	Lusushwana River	**N2 - Medium**	**N2 - Medium**
Impact 2: Alteration to the Flow Regime (Water Quantity)	Lusushwana River	**N2 - Medium**	**N2 - Medium**
Impact 3: Changes to the Hydrological Cycle	Lusushwana River	**N2 - Medium**	**N2 - Medium**
Impact 4: Flood Risk	Lusushwana River	**N1 - Low**	**N1 - Low**

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- Studio Pietrangeli, 2017. Nondvo Mpp Mbabane-Manzini Corridor DAM,.Final Scoping Study
- Studio Pietrangeli, 2018. Nondvo Mpp Mbabane-Manzini Corridor DAM Feasibility Study. Hydrological Study (203 GEN R SP001A)
- Studio Pietrangeli, 2018. Nondvo Mpp Mbabane-Manzini Corridor DAM Feasibility Study. Topographical Study (201 GEN R SP001A)

APPENDIX

A SITE IMAGES

APPENDIX

Plate 1: Sampling Point SW1

Plate 2: Sampling Point SW2

Plate 3: Sampling Point SW3

APPENDIX

Plate 4: Sampling Point SW4

Plate 5: Sampling Point SW5

Plate 6: Sampling Point SW6

APPENDIX

Plate 7: Sampling Point SW7

Plate 8: Sampling Point SW8

Plate 9: Sampling Point SW9

APPENDIX

Plate 10: Sampling Point SW10

Plate 11: Evidence of Ferrasols found at the Nondvo Dam Site

APPENDIX

Plate 12: Evidence of Regosols Found at the Nondvo Dam Site

Plate 13 :Evidence of Leptosols Found at the Nondvo Dam Site

APPENDIX

B LABORATORY ANALYTICAL CERTIFICATES

Exova Jones Environmental South Africa

Unit D2/5
9 Quantum Road
Firgrove Business Park
Somerset West
7130
South Africa

WSP - South Africa
Building C, Knightsbridge
33 Sloane Street
Bryanston
Johanessburg
Gauteng
South Africa
2191

Attention :	Hassen Khan
Date :	4th March, 2019
Your reference :	41101262
Our reference :	Test Report 19/109 Batch 1
Location :	Swaziland Mbabane
Date samples received :	19th February, 2019
Status :	Final report
Issue :	1

Ten samples were received for analysis on 19th February, 2019 of which ten were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Analysis was undertaken at either Exova Jones Environmental (UK), which is ISO 17025 accredited under UKAS (4225) or Exova Jones Environmental (SA) which is ISO 17025 accredited under SANAS (T0729) or a subcontract laboratory where specified.

NOTE: Under International Laboratory Accreditation Cooperation (ILAC), ISO 17025 (UKAS) accreditation is recognised as equivalent to SANAS (South Africa) accreditation.

Compiled By:

Aatifah Latief

Inorganics Laboratory:

Musa Tiki
Technical Signatory (Inorganics)

Exova Jones Environmental

Client Name:	WSP - South Africa
Reference:	41101262
Location:	Swaziland Mbabane
Contact:	Hassen Khan
JE Job No.:	19/109

Report : **Liquid**

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-8	9-15	16-23	24-31	32-39	40-47	58-59,61-63,88-89	66-67,69-71,90-91	74-75,77-79,92-93	82-83,85-87,94-95			
Sample ID	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10			
Depth													
COC No / misc													
Containers	V H HN HCL N P G	V HN HCL N P G	V H HN HCL N P G	V H HN HCL N P G	V H HN HCL N P G	V H HN HCL N P G	H HN N P G V	H HN N P G V	H HN N P G V	H HN N P G V			
Sample Date	14/02/2019	14/02/2019	14/02/2019	14/02/2019	14/02/2019	14/02/2019	14/02/2019	14/02/2019	14/02/2019	14/02/2019			
Sample Type	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019			
Dissolved Aluminium*	244	34	144	91	47	<20	<20	166	179	62	<20	ug/l	UK_TM30/UK_PM14
Dissolved Antimony*	<2	<2	3	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	UK_TM30/UK_PM14
Dissolved Arsenic*	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ug/l	UK_TM30/UK_PM14
Dissolved Barium*	10	9	10	9	11	8	7	7	12	9	<3	ug/l	UK_TM30/UK_PM14
Dissolved Boron*	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	ug/l	UK_TM30/UK_PM14
Dissolved Cadmium*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	UK_TM30/UK_PM14
Total Dissolved Chromium*	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	ug/l	UK_TM30/UK_PM14
Dissolved Copper*	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	ug/l	UK_TM30/UK_PM14
Total Dissolved Iron*	254	193	384	288	198	134	156	387	233	287	<20	ug/l	UK_TM30/UK_PM14
Dissolved Lead*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/l	UK_TM30/UK_PM14
Dissolved Manganese*	8	<2	10	2	176	29	23	19	15	34	<2	ug/l	UK_TM30/UK_PM14
Dissolved Mercury*	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	UK_TM30/UK_PM14
Dissolved Nickel*	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	UK_TM30/UK_PM14
Dissolved Selenium*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	UK_TM30/UK_PM14
Dissolved Sodium*	4.2	4.7	4.9	4.6	5.2	4.2	3.9	4.0	4.7	4.0	<0.1	mg/l	UK_TM30/UK_PM14
Dissolved Uranium*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/l	UK_TM30/UK_PM14
Dissolved Zinc*	3	5	15	4	7	<3	4	5	4	5	<3	ug/l	UK_TM30/UK_PM14
Fluoride [SA]	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	ug/l	SA_TM27/SA_PM0
Chloride [SA]	3.3	2.9	3.2	3.2	3.7	3.4	3.3	3.4	3.9	3.3	<0.3	mg/l	SA_TM27/SA_PM0
Sulphate [SA]	2.5	2.4	2.3	2.7	2.7	1.9	1.8	2.0	2.7	1.9	<0.5	mg/l	SA_TM27/SA_PM0
Nitrite as N [SA]	0.037	0.037	0.040	0.040	0.040	0.037	<0.006	<0.006	0.043	<0.006	<0.006	mg/l	SA_TM27/SA_PM0
Nitrate as N [SA]	0.41	0.34	0.43	0.41	0.36	0.29	0.29	0.25	0.52	0.27	<0.05	mg/l	SA_TM27/SA_PM0
Free Cyanide*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	UK_TM89/UK_PM0
Electrical Conductivity @25C [SA]	71	61	70	62	70	67	56	47	60	65	<2	uS/cm	SA_TM28/SA_PM0
Free Chlorine	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/l	SA_TM66/SA_PM0
Free Ammonia as N*	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	mg/l	UK_TM176/UK_PM0
pH [SA]	7.66	7.64	7.71	7.64	7.66	7.69	7.59	7.43	7.29	7.29	<2.00	pH units	SA_TM19/SA_PM0
Total Dissolved Solids [SA]	110	108	81	82	91	78	67	69	96	106	<35	mg/l	SA_TM20/SA_PM31
Turbidity	84.8	49.7	24.5	3.9	13.3	7.1	6.4	26.5	81.0	21.8	<0.1	NTU	SA_TM34/SA_PM0

Exova Jones Environmental **Notification of Deviating Samples**

Client Name: WSP - South Africa
Reference: 41101262
Location: Swaziland Mbabane
Contact: Hassen Khan

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
No deviating sample report results for job 19/109						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 19/109

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 19/109

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
SA_TM19	Determination of pH by bench pH meter	SA_PM0	No preparation is required.	Yes			
SA_TM20	Modified BS 1377-3: 1990 Gravimetric determination of Total Dissolved Solids	SA_PM31	Sample is filtered	Yes			
SA_TM27	Major ions by Ion Chromatography	SA_PM0	No preparation is required.	Yes			
SA_TM28	Determination of Electrical Conductivity with hand held manual conductivity probe.	SA_PM0	No preparation is required.	Yes			
SA_TM34	Turbidity by TL2300 Turbidity Meter	SA_PM0	No preparation is required.				
SA_TM66	Determination of Free Chlorine which reacts with DPD (N,N-diethyl-p-phenylenediamine) reagent and measured spectrophotometrically.	SA_PM0	No preparation is required.				
UK_TM176	Free ammonia based on the pH and temperature dependent equilibrium calculated in accordance with NRA Water Quality Objectives 1994 using the ammoniacal nitrogen result.	UK_PM0	No preparation is required.				
UK_TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	UK_PM14	Analysis of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for dissolved metals and acidified if required.				
UK_TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	UK_PM0	No preparation is required.				

APPENDIX

C-3 SOCIO-ECONOMIC IMPACT ASSESSMENT

MBABANE – MANZINI CORRIDOR DAM (NONDVO DAM)

SOCIO-ECONOMIC IMPACT ASSESSMENT

CONTRACT NUMBER: MNRE/DWA/002/2017-18

BETWEEN

GOVERNMENT OF THE KINGDOM OF ESWATINI MINISTRY OF NATURAL RESOURCES & ENERGY, DEPARTMENT OF WATER AFFAIRS (DWA)

AND

WSP ENVIRONMENTAL (Pty) Ltd. (SOUTH AFRICA / CANADA) AND SI-FUTURES (LESOTHO)

SOCIAL IMPACT ASSESSMENT REPORT

22 NOVEMBER 2019

(updated March 2021)

EXECUTIVE SUMMARY

INTRODUCTION

In the past few years Eswatini like many other Southern African Countries experienced drought and the reality of being a water scarce region. However, the cities of Mbabane and Manzini bore the brunt of water shortages for a very long period. In response, the government of the Kingdom of Eswatini requested financing from African Development Bank (AfDB) to undertake the feasibility study to provide potable water to Mbabane and Manzini and surrounding areas, as well as irrigation agricultural land in the region.

PROJECT DESCRIPTION

Following the completion of the technical feasibility study, undertaken by Studio Pietrangeli (Studio Pietrangeli, 2019) it was determined that the Project would comprise 38.6 m high gravity Roller Compacted Concrete (RCC) Dam and small hydropower plant (HPP) of less than 1 MW. The dam will harvest flows along the Lusushwana River, regulated by the upstream Luphohlo Dam, and associated tributary, the Nondvo River, resulting in a storage reservoir with a total storage capacity of approximately 22 Mm^3, delivering an assured yield of 9.8 Mm^3 per year. The reservoir will cover a surface area of approximately 2.4 km^2 (240 ha) across two Royal Kraal areas, namely the Siphocosini and Mantabeni.

The dam will provide water to Mbabane, Manzini and the areas between (i.e. Mbabane and Manzini corridor) to meet water demands up to 2050, for the following uses:

- Potable, industrial and tourist use;
- Irrigation of approximately 800 ha; and
- Energy production.

PROJECT LOCATION

The proposed project site is situated approximately 12 km south of Mbabane and 26 km north-west of Manzini, along the south-eastern boundary of the Hhohho Region, Eswatini. The proposed Nondvo Dam is to be situated on the Lusushwana River, at the following coordinates 26°25'39.04"S and 31°7'0.98"E (UTM, WGS84: 312220E; 7075564S), approximately 7 km downriver of the existing Luphohlo Dam.

PURPOSE OF THE REPORT

The purpose of the report is to provide a detailed socio-economic baseline and assess the potential socio-economic impacts that may result due to the implementation of the Project for inclusion in the Environmental and Social Impact Assessment (ESIA). The report also identifies required mitigation measures to minimise negative impacts and enhance positive impacts.

The resettlement process required to facilitate the development of the Project, has potential significant social implications for the Project in terms of loss of housing, land, assets, and social facilities. The extent and impacts associated with the resettlement process have been detailed within a separate Resettlement Action Plan (RAP), along with the required measures to ensure effective implementation thereof to minimise negative impacts and enhance positive impacts.

METHODOLOGY

The social impact assessment was undertaken using both qualitative and quantitative methods, which complement each other in providing the baseline conditions of the social environment in the Nondvo dam area. The following instruments were used:

- Desk based data review;
- Site visits;

- Community engagement (including focus group discussions, key informant interviews and public meetings); and
- Detailed socioeconomic survey.

SUMMARY OF PREDICTED SIGNIFICANT IMPACTS

Based on the discussion presented in the previous sections, it can be concluded that majority of the negative socio-economic impacts of the proposed Nondvo Dam Project will occur during the Construction Phase (including inundation), with majority of the impacts in the Operation Phase being positive. Potential significant negative impacts during planning / construction phase are associated with physical and economic displacement of project affected peoples, disruption to family and community structures, as well as exacerbation of anti-social behaviour due to in migration and associated increased pressure on social infrastructure and services.

Positive impacts during Construction phase will include temporary creation of employment opportunities as well as associated economic benefits. Significant Negative impacts include the physical and economic displacement of PAPs, loss of plant resources used by the community (ecosystem services) as well as potential exacerbation of anti-social behaviour due to in migration (influx of job seekers). With the implementation of recommended mitigation measures, these impacts can be reduced to Medium or Low negative significance.

The most significant Positive impact of the project will be experienced during the Operation Phase. This relates to the ease of shortage of water supply in Manzini and Mbabane and surrounding areas as well as the irrigation of approximately 800 ha of agricultural land, promoting social and economic growth in these areas.

The significant negative impact likely to occur during the operational phase of the proposed project is the continuation of anti-social behaviour and spread of STIs and HIV/AIDS. With the implementation of recommended mitigation measures the impact can be reduced to a Medium negative significance.

CONCLUSION AND RECOMMENDATIONS

It is recommended that the mitigation and maximisation measures included in this report be implemented to decrease the effect of negative impacts on communities and maximise the effect of positive impacts.

In conclusion the proposed Nondvo Dam project poses a number of potential positive and negative social impacts of which majority of the negative impacts are associated with the construction phase and positive impacts with the operation phase.

With appropriate measures, the negative impacts can be reduced to acceptable levels while the positive impacts can be maximised to provide significant benefits to the region.

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LIST OF ACRONYMS

ADF	African Development Fund
AfDB	African Development Bank
ARVs	Anti-retrovirals
CAL	Community Area Leaders
CEDAW	Convention on Elimination of Discrimination against Women
CSOs	Civil Society Organizations
CRR	Comment and Response Register
DFIs	Development Finance Institutions
DNRE	Department of Natural Resources and Environment
DWA	Department of Water Affairs
EAARR	Environmental Audit, Assessment and Review Regulations (2000)
EAP	Environmental Action Plan
EEA	Eswatini Environment Authority
EEC	Eswatini Electricity Company
EHG	Eswatini Housing Board
EIA	Environmental Impact Assessment
ENTC	Eswatini National Trust Commission
EPC	Engineering, procurement, and construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
EPs	Equator Principles
EWSC	Eswatini Water Services Corporation
FDI	Foreign Development Investment
FGDs	Focus Group Discussions
GDP	Gross Domestic Product
GBV	Gender Based B=Violence
ha	Hectare
HHs	Households
HPP	Hydropower plant
IFC	International Finance Corporation
JMRBWRS	Joint Maputo River Basin Water Resources Study
KIIs	Key Informant Interviews
km	Kilometre
km^2	Square kilometre
LRP	Livelihood Restoration Plan
m	Metre

masl	Metres above sea level
MDG	Millennium Development Goals
MHUD	Ministry of Housing and Urban Development
MMA	Maphanga Mitchell Associates
Mm^3	Cubic megameters
MW	MegaWatt
NDS	National Development Strategy
NGOs	Non-Governmental Organisations
OHS	Occupational Health and Safety
PAP	Project Affected People
PAH	Project Affected Household
PSs	Performance Standards
QAQC	Quality Assurance and Quality Control
RAP	Resettlement Action Plan
RCC	Roller-Compacted Concrete Dam
RMCs	Regional Member Country's
RoW	Right of Way
RPF	Resettlement Policy Framework
PRSPs	Poverty Reduction Support Programmes
SADC	Southern African Development Community
SEP	Stakeholder Engagement Plan
TDL	Title Deed Land
ToR	Terms of Reference
UN	United Nations
UNDP	United Nations Development Programme
UTM	Universal Transverse Mercator
WB	World Bank
WID	Women in Development
WSP	WSP Environmental (Pty) Ltd
WSS	Water supply and sanitation

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1 INTRODUCTION AND PROJECT BACKGROUND

The Kingdom of Eswatini (abbreviated in this document as Eswatini, and previously known as Swaziland) is a small landlocked country in Southern Africa, bordering Mozambique and South Africa. It covers an area of 17,360 km^2 and has a population of 1.39 million (mid 2012). The country is largely mountainous with 75.8% of the population living in rural areas with livelihoods predominantly dependent on subsistence agriculture. Eswatini has relatively well-developed infrastructure in comparison to other Sub-Saharan African countries, but there are a number of critical areas that require further improvement.

The nature of the hydrological network of Eswatini, comprising rivers shared between several states upstream and downstream, coupled with highly seasonal patterns with relatively long periods of drought makes the management of the country's surface water resources very difficult and vulnerable to climatic change. Economic and demographic growth of the country as well as changes in the water usage patterns have resulted in a significant increase in the demand for water resources. It has been identified that the size of existing infrastructure and the capacity of equipment will soon be inadequate to satisfy the water demand. Furthermore, in Eswatini, all 'normal flow' in the rivers, most of them being of transboundary type, has been allocated under the arrangements of the international treaties. 'Normal flow' is water that has been calculated as being available 80% of the time during the driest months of the year. Therefore, the only water that can be made available for allocation is surplus flow (during floods and rainy season) through harnessing this flow in large storage reservoirs. This means that currently no water allocation can be made to any new developments as the water demand far exceeds the 'normal flow'. This is a major challenge limiting further social and economic development in the country.

As a response to these constraints the Government of Eswatini, Ministry of Natural Resources and Energy, Department of Water Affairs (DWA) intends to better exploit surface water resources within the Mbabane – Manzini Corridor, by storing surplus water made available during flooding periods, above the allocated abstraction limits established by the Tripartite Agreement signed with South Africa and Mozambique. The stored water is then intended to be released as required for the various downstream usages. A Joint Maputo River Basin Water Resources Study (JMRBWRS) was jointly undertaken by the Kingdom of Eswatini, the Republic of South Africa and the Republic of Mozambique (Skoy Plancenter Ltd, 2008). During this study, a multi-criteria selection process was developed and applied to a number of proposed water supply projects in order to identify the most promising options for further investigation.

The DWA appointed Studio Pietrangeli Consulting Engineers (Studio Pietrangeli) to undertake the relevant scoping and feasibility studies for the multipurpose project to "identify and design a project that meets competing water demands up to the Horizon 2050 through optimizing its dimensions and costs and minimizing socio-environmental impacts". Several project options were studied during the feasibility-scoping phase to meet the short- and long-term demands. Based on the results of the feasibility-scoping study the DWA selected the following options, as identified in **Table 1-1**, to be subjected to a detailed feasibility assessment (Studio Pietrangeli, 2019).

Table 1-1: Projects subjected to detailed feasibility assessment

SOLUTION PERIOD	PROJECT
Short Term Solutions (up to 2025)	– Hawane Dam (Raising of the by 3.5m) – Luphohlo Dam (Raising of the by 5m)
Long Term Solutions (up to 2050)	– Nondvo Dam (construction of new dam)

The ESIA, and as such the SIA, only deals with the Nondvo Dam project. Although the Luphohlo Dam raising is not being assessed as part of the ESIA the dimensioning of Nondvo Dam, as defined within the final feasibility study undertaken by Studio Pietrangeli, takes into account the benefit of the presence of the raised Luphohlo Dam.

The main purpose of Nondvo Dam is the storage of water for the supply of potable water to Mbabane and Manzini, which are currently suffering from intermittent water shortages, and where the anticipated future water demand is deemed to be highest. The additional water supply is also anticipated to facilitate the growth of the population alongside the “Corridor” area connecting these two cities. Possible secondary benefits of the proposed dam are the potential for utilising the Nondvo Dam head for small-scale hydropower generation, improving the output of run-of-river hydropower plants situated further downstream, as well as utilising the stored water for irrigation of approximately 800 Hectares (ha) of agricultural land in the surrounding region.

Two terms have been utilised in identification of the proposed dam, namely the ‘Mbabane – Manzini Corridor Dam’ and the ‘Nondvo Dam’. The Mbabane – Manzini Corridor Dam is reference to the geographical area that will be served by the dam, whilst the term “Nondvo Dam” is the official shortened version of the project title in reference to the dam’s location whereupon it will harvest surface flows along the Lusushwana River and its tributary, the Nondvo River. The terms “Mbabane – Manzini Corridor Dam” and “Nondvo Dam” are therefore used interchangeably throughout the project’s study documentation.

2 PROJECT DESCRIPTION AND LOCATION

Following the completion of the technical feasibility study, undertaken by Studio Pietrangeli (Studio Pietrangeli, 2019) it was determined that the Project would comprise 38.6 m high gravity Roller Compacted Concrete (RCC) Dam and small hydropower plant (HPP) of less than 1 MW. The dam will harvest flows along the Lusushwana River, regulated by the upstream Luphohlo Dam, and associated tributary, the Nondvo River, resulting in a storage reservoir with a total storage capacity of approximately 22 Mm^3, delivering an assured yield of 9.8 Mm^3 per year. The reservoir will cover a surface area of approximately 2.4 km^2 (240 ha) across two Royal Kraal areas, namely the Siphocosini and Mantabeni.

The dam will provide water to Mbabane, Manzini and the areas between (i.e. Mbabane and Manzini corridor) to meet water demands up to 2050, for the following uses:

- Potable, industrial and tourist use;
- Irrigation of approximately 800 ha; and
- Energy production.

The proposed project site is situated approximately 12 km south of Mbabane and 26 km north-west of Manzini, along the south-eastern boundary of the Hhohho Region, Eswatini (**Figure 2-1**). The proposed Nondvo Dam is to be situated on the Lusushwana River, at the following coordinates 26°25'39.04"S and 31°7'0.98"E (UTM, WGS84: 312220E; 7075564S), approximately 7 km downriver of the existing Luphohlo Dam.

Figure 2-2 indicates the proposed locality of the Nondvo Dam and extent of the inundation area.

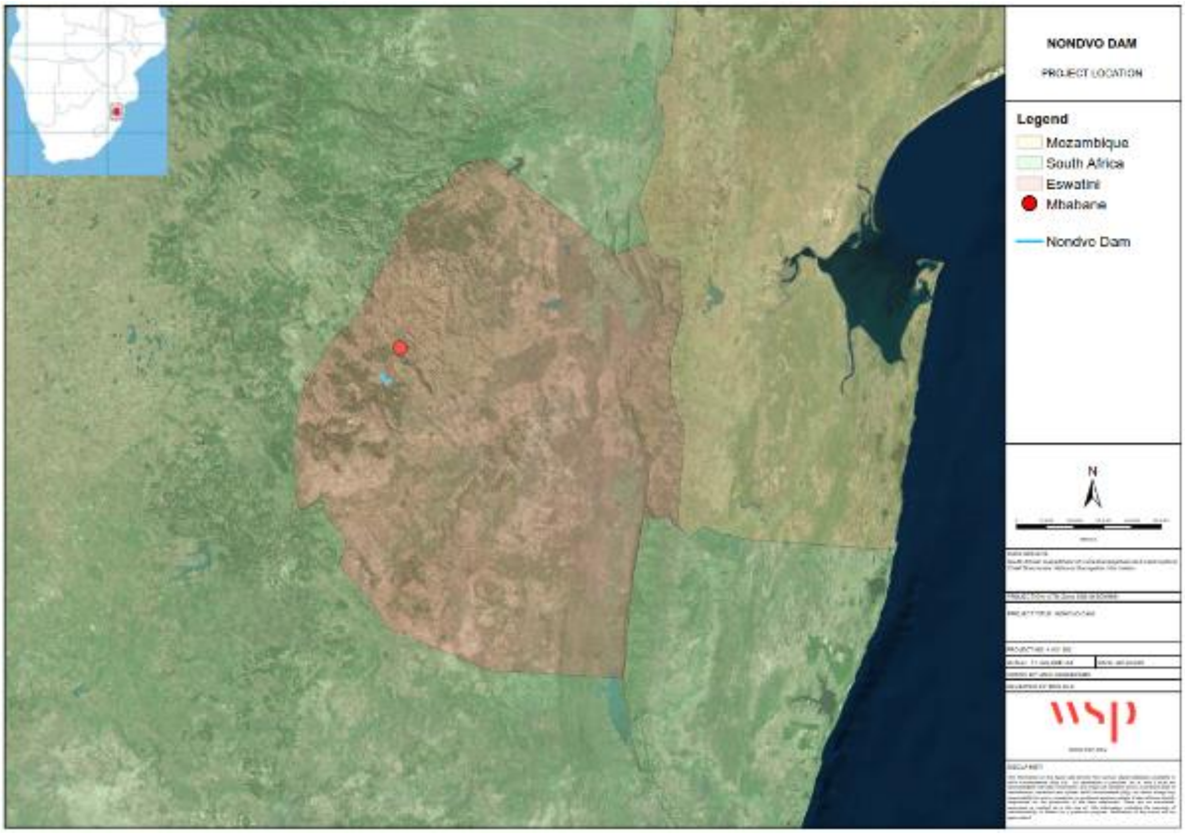

Figure 2-1: Layout Indicating the Project Location

Figure 2-2: Layout indicating the location and extent of the proposed Nondvo Dam

In order to ensure effective construction and operation of the dam relevant temporary and permanent associated infrastructure is required, including river diversion works, access roads, site establishment (i.e. site camps and offices), quarry and more. Furthermore, certain existing infrastructure will be affected by the dam reservoir that will require realignment/ relocation. These include the main road (MR19) and smaller informal roads, railway line, electricity / communications lines, as well as private structures (i.e. dwellings, small businesses and religious and education facilities).

The Project therefore comprises the following elements as assessed within the ESIA:

- River diversion works;
- Nondvo Dam and auxiliary works;
    - Dam wall;
    - Spillway;
    - Intake;
    - Powerhouse (i.e. hydro power plant); and
    - Bottom outlet.
- Temporary access roads;
- Quarry;
- Site camps and offices;
- Electrical distribution system, connection to the existing low voltage electricity distribution scheme; and
- Railway line realignment.

These are illustrated in **Figure 2-3** to **Figure 2-6** below.

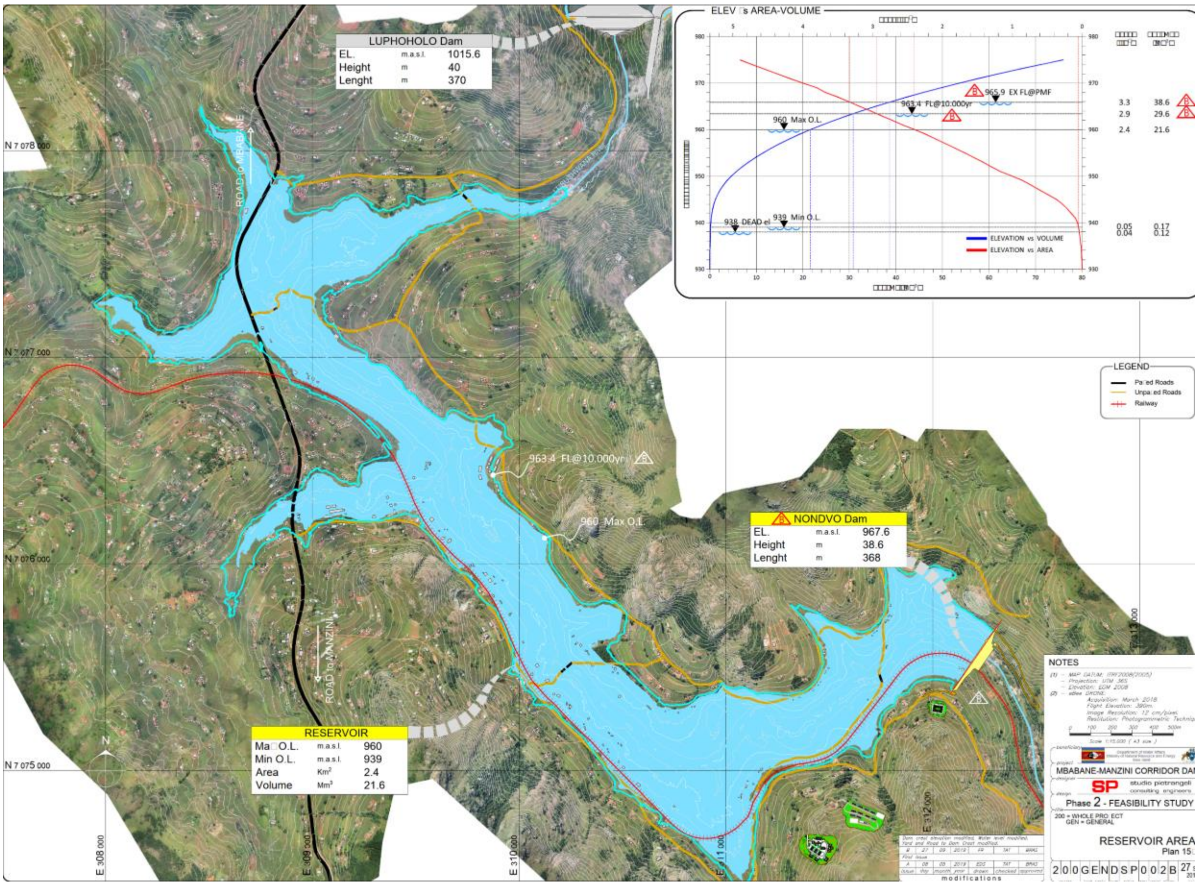

Figure 2-3: Layout showing the dam wall and reservoir area along with associated infrastructure

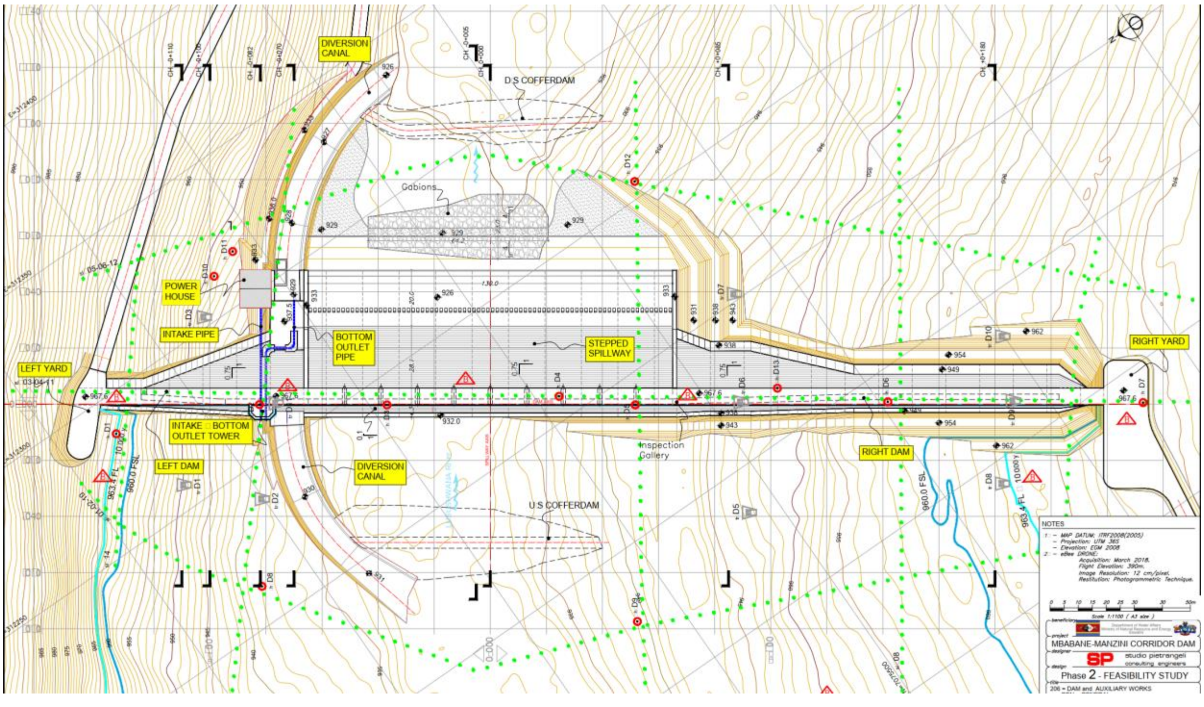

Figure 2-4: Plan of the dam wall and auxiliary works

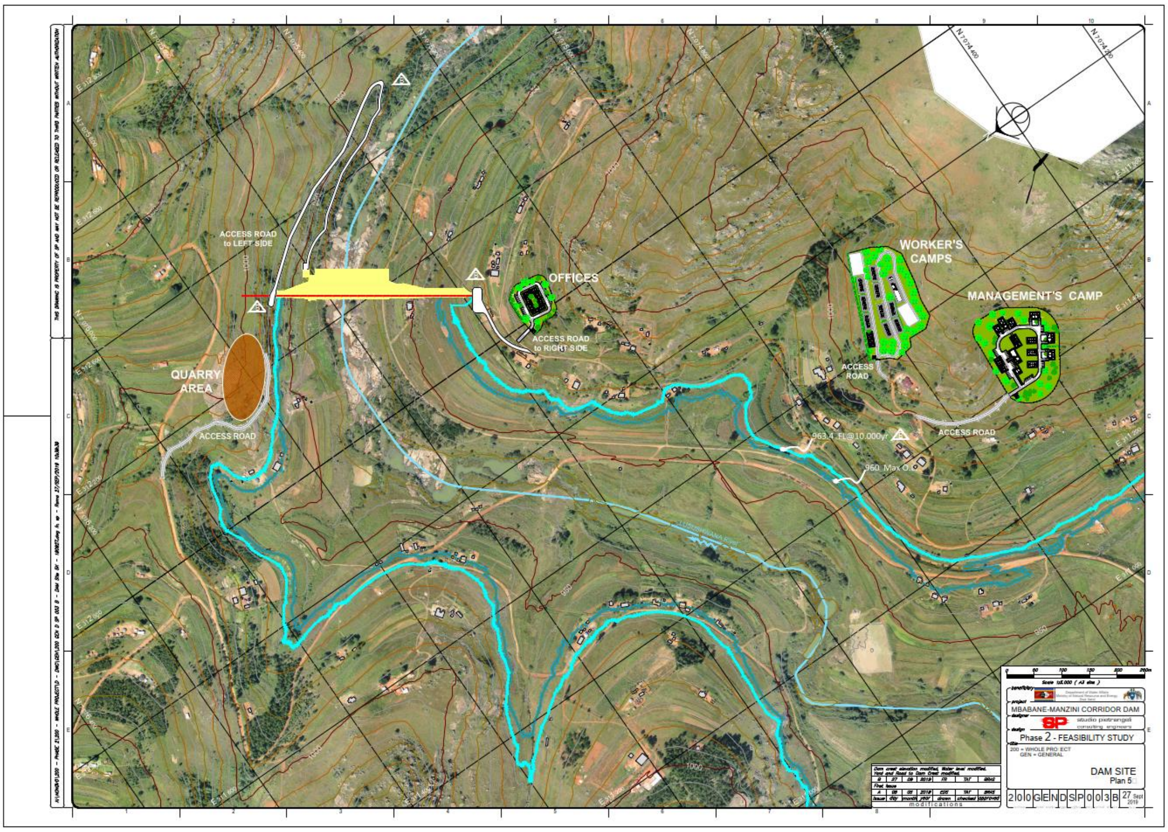

Figure 2-5: Layout showing the location and extent of the dam wall and associated infrastructure (quarry, site camps and offices, access roads)

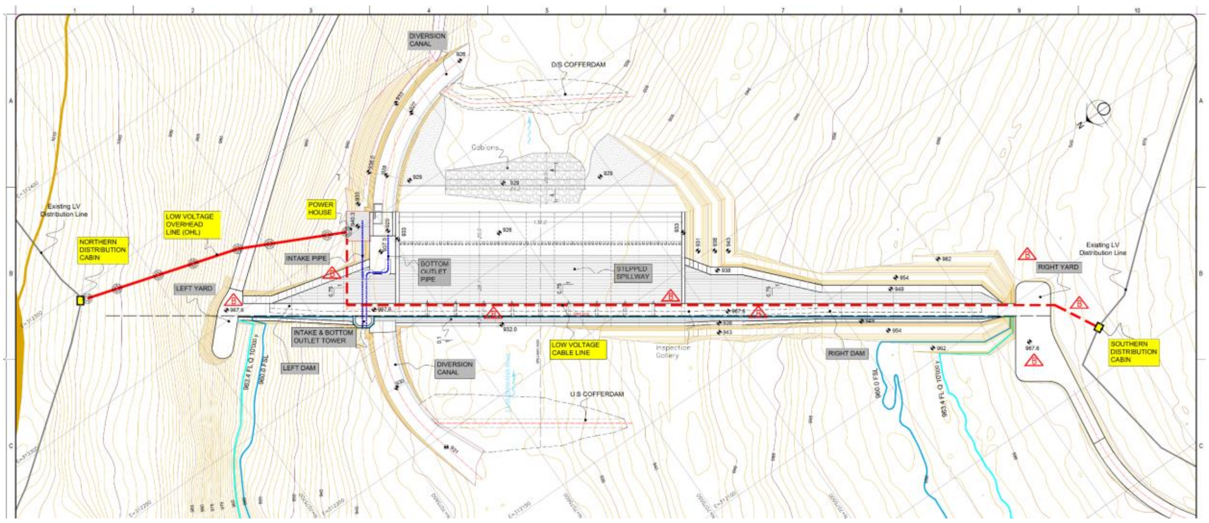

Figure 2-6: Low voltage distribution power lines

The resettlement process required to facilitate the development of the Project, which has implications for the ESIA in terms of loss of housing, land, assets and social facilities, has been assessed and detailed within a Resettlement Action Plan (RAP), however, it is also noted that certain aspects associated with the proposed dam were not identified or assessed within the technical feasibility study (Studio Pietrangeli, 2019), as such these have been excluded from the terms of reference for assessment within the ESIA. These include:

- Water distribution infrastructure (i.e. pipeline network connecting dam to end users);
- Realignment of the inundated internal access roads; and
- Host community impacts has only been included at a high-level.

At the time of writing the SIA (this report), the details for the excluded components had not been identified or assessed within the feasibility studies (Studio Pietrangeli, 2019). A detailed assessment of such would have to be undertaken prior to Project being implemented.

Additionally, based on the feasibility design requirement for maintaining the current ecological flow of the river, downstream communities / water users were not anticipated to be impacted upon by implementation of the Proposed Project.

3 PURPOSE OF THE REPORT

The purpose of the report is to provide a detailed socio-economic baseline and social impact assessment of the Project for ESIA purposes as well as baseline data for the Resettlement Action Plan (RAP).

The resettlement process required to facilitate the development of the Project, has potential significant social implications for the Project in terms of loss of housing, land, assets, and social facilities. The extent and impacts associated with the resettlement process have been detailed within the RAP, a separate document from this report, along with the required measures to ensure effective implementation thereof to minimise negative impacts and enhance positive impacts.

4 ASSUMPTIONS AND LIMITATIONS

4.1 ASSUMPTIONS

In undertaking this assessment, the following assumptions are applicable:

- All the relevant stakeholders had been consulted extensively regarding the selection of the project site for implementation of the Nondvo Dam;
- Initial railway line and MR19 road re-alignments were included in the scope of work (however alternative routes may be proposed) as such the route and associated impacts may change.

4.2 LIMITATION OF PROPOSED NONDVO DAM CONSTRUCTION

The following limitations were encountered during the assessment:

- The lack of detail regarding potential employment opportunities (i.e. number of permanent / temporary; skilled / unskilled; local / external) during the project construction and operation phases places a limitation on determining the level of potential impact resulting from the project implementation. Furthermore, it reduces the ability to ascertain the potential level of influx to the area by work seekers.
- The socio-economic study was completed in a very short period. This resulted in constraints relating to desktop studies, gathering of data and data verification.
- Lack of infrastructure designs disadvantaged the consultant in ensuring that all those who will be potentially affected physically and economically are identified in the current study.
- Expected number of Community Area Leaders (CALs) to guide the enumerators was reduced dramatically, which had a knock-on effect on households that could be reached per day; and
- Lack of engagement, open and transparent communication between DWA, other related departments and Inner Councils is key to the success of this project. To ensure a smooth transition, DWA and any other designated Departments must facilitate meetings of the Inner Councils of both Royal Kraals.

5 LEGAL POLICY FRAMEWORK

A series of measures will be implemented in accordance with the national government and the AfDB Guidelines on Involuntary Resettlement with a view to ensure that adequate mitigation measures are put in place by the project proponent to deal with any negative impacts on the project affected persons.

Relevant policies and legislation include:

- The National Trust Commission Act 1972
- Human Settlements Authority Act, 1988
- Acquisition of Property Act, 1961
- Conveyance and Burial of Dead Bodies Act, 1970
- Land Survey Act, 1961
- Deeds Registry Act, 1968
- The Definition of Swazi Areas Act, 1917
- Land Speculation Control Act and the Land Speculation Control Regulations, 1972
- The Building and Housing Act, 1988
- National Housing Board Act, 1988
- The Eswatini Posts and Telecommunications Corporations Act 1980
- Ministry of Housing and Urban Development (MHUD) Resettlement Policy & Guidelines 1994
- The Railway Act 1962
- Eswatini Occupational Safety and Health Act 2001
- Eswatini Electricity Company- Labour Management Act 2019
- Eswatini Employment Act 1980
- Eswatini Public Health Act 1969
- The Environmental Management Act 2002
- Eswatini Electricity Act 2018

Discussion of key legislation and policy relevant to the study are discussed further in the sections below.

5.1 THE CONSTITUTION OF THE KINGDOM OF ESWATINI 2005

Chapter 13 of the new constitution requires the establishment within five years of a single countrywide system of local government, to allow people at sub-national and local level to progressively take control of their own affairs. Local governments shall be organised and administered through democratic means. The introduction of the new constitution corresponds with the government's decentralisation policy and implementation strategy. The new constitution specifically pronounces its position on property and compensation in Section 19 (1) states that "*a person has the right to own property alone or in association with others.*". Likewise, in 19 (2b) the constitution states that no one should be deprived of property ownership and in cases of public interest or safety owners shall be duly compensated.

In terms of Section 211 subsection 1, all land in Eswatini including any existing concessions, save for privately held title deed land, shall vest in Ingwenyama in Trust of the Swazi Nation. Subsection 3 provides that a person shall not be deprived of land without due process of law. Where that person has been deprived of such land he shall be compensated for any improvements on that land or loss consequent upon the deprivation unless otherwise provided by law.

5.1.1 RIGHTS AND FREEDOMS OF WOMEN

- Women have the right to equal treatment with men and that right shall include equal opportunities in political, economic, and social activities.
- Subject to the availability of resources, the Government shall provide facilities and opportunities necessary to enhance the welfare of women to enable them to realise their full potential and advancement.
- A woman shall not be compelled to undergo or uphold any custom to which she is in conscience opposed.

5.1.2 RIGHTS OF PERSONS WITH DISABILITIES

- Persons with disabilities have a right to respect and human dignity and the Government and society shall take appropriate measures to ensure that those persons realise their full mental and physical potential.
- Parliament shall enact laws for the protection of persons with disabilities to enable those persons to enjoy productive and fulfilling lives.

5.1.3 RIGHTS OF WORKERS

- A person has the right to practise a profession and to carry on any lawful occupation, trade, or business.
- A worker has a right to –
  - (a) Freely form, join or not to join a trade union for the promotion and protection of the economic interests of that worker; and
  - (b) Collective bargaining and representation.
- The employer of a female worker shall accord that worker protection before and after childbirth in accordance with law.

5.2 THE NATIONAL TRUST COMMISSION ACT 1972

This Act provides for the operation of cultural institutions and the proclamation of national parks, monuments and matters incidental thereto. The Act provides further, at Section 21, that the owner or occupier of private land falling within the boundary of a reserve shall not without the prior consent of the Commission sell or lease such land or permit any portion of such land to be occupied without having given a prior option to the Commission to purchase, lease or otherwise occupy such land on the same terms. The person may not construct a building, roads, dams, or bridges without such consent. No excavation or material alteration of the natural configuration of such land can be made. The National Trust Commission should, in terms of this Act, have first preference in the purchase or lease of the property.

5.3 HUMAN SETTLEMENTS AUTHORITY ACT, 1988

The act established the Human Settlements Authority and its objects and functions. It provides policy support to Government and the orderly development of human settlements by allowing for and outlining procedures for the establishment of Human Settlements. It also makes provision for the establishment of human settlement development plans, the revocation or modification of development plans and finance mechanisms for the supply and maintenance of improved shelter and infrastructure. The act also provides procedure for township establishment for any person wishing to sub- divide property into five or more plots.

5.4 ACQUISITION OF PROPERTY ACT, 1961

This Act provides for the authorisation of the acquisition of property for public and other purposes and for settling the amount of any compensation to be paid or any matter in difference. In terms of Section 2 of the Act, public purposes include, but are not limited to the construction of any railway authorised by legislation or for the maintenance or working or any existing railway. Section 3 of the

Act provides that the Minister responsible for Natural Resources may acquire any real property needed for public purposes, whether present or future, paying such consideration or compensation as may be agreed upon or determined under the provisions of this Act. The section also authorises the Minister to purchase the property or any part thereof as he thinks proper at a price agreed upon or determined under this Act. In terms of Section 5 of the Act once the Minister is satisfied that certain property is required for a public purpose, he shall give notice to the owner or any person claiming title thereof to sell and convey or lease the said property for the execution of the public purpose. Section 10 of the Act provides for the establishment of the Board of Assessment and any dispute emanating from this Act ought to be resolved by this Board. Section 15 of the Act stipulates matters that need to be considered in determining compensation.

5.5 CONVEYANCE AND BURIAL OF DEAD BODIES ACT, 1970

This Act deals with the conveyance of dead bodies, their burial and incidental or connected matters which include but not limited to the exhumation in reburial of the said dead bodies. The Act provides that no person shall cause a body, or remains of a body, to be exhumed without a permit issued by the Minister or without an order of the High Court. This is stipulated in Section 14 of the Act. Subsection (2) of the Act provides that the body or remains of a person who died from an infectious disease shall only be exhumed after the lapse of four (4) years since his death. It further provides that in all other cases the exhumation of a body or the remains of a body shall be permitted after the lapse of two (2) years. However, in special circumstances the Minister may waive the provisions of the paragraph relating to the exhumation of a body of a person who did not die from an infectious disease. Consequently, the Minister may waive the two (2) year period in the circumstances wherein there is a construction of a railway line. The Minister referred to herein is the Minister of Tinkhundla Administration and Development.

5.6 LAND SURVEY ACT, 1961

The act provides for the survey of land and matters incidental thereto. It deals with interpretation including the definition of diagram, general plan, lot, owner, registration, and township. It deals with matters relating to the Surveyor-General and Surveyors, surveys and resurveys, beacons, and boundaries.

5.7 DEEDS REGISTRY ACT, 1968

This act consolidates and amends the laws in force in Eswatini relating to the Registration of Deeds. It establishes the Deeds Registry, appointment, duties, and powers of the Registrar. It deals with the registration of land including transfers, substituted title deeds and endorsements and covers; change of title by endorsement; townships including requirements in case of sub-divisions of land into lots, transfer of township, extension of boundaries of an existing township. It further deals with bonds including execution, cession, transfer and registration of notarial bonds, the rights in immovable property and ante nuptial contract. A discussion concerning the township establishment process, in which this legislation plays an important part, is contained in relationship to the Human Settlements Authority Act.

5.8 THE DEFINITION OF SWAZI AREAS ACT, 1917

This Act describes areas set apart under the Concessions' Partition Act and it also declares and determines the conditions and restrictions subject to which the Swazi people are entitled to the sole and exclusive use and occupation of such areas. This Act defines the various Swazi Nation Land within the various districts and it also confers certain rights on Swazi nationals on the use of such land.

5.9 LAND SPECULATION CONTROL ACT AND THE LAND SPECULATION CONTROL REGULATIONS, 1972

The act provides for the control of speculative land transactions involving persons who are not citizens of Eswatini and matters incidental thereto. The Regulations prescribe exemptions, form of consent, conduct of proceedings, and registration of landowners who are non-citizens of Eswatini through the Land Control Board and the form of appeal.

5.10 THE BUILDING AND HOUSING ACT, 1988

The act provides for the control and the safety of buildings and for incidental or connected matters. It deals with the classes of buildings, locations, design, and construction and building regulations, including codes of practice.

The procedure required by the Act is that all applicants must submit five copies of the following documents to the Local Authority, together with an application fee: Application form; Working drawings; Site plan showing access to the public road, existing buildings, and plot boundaries; A location map; and all sewerage, drainage and water plans. Plans are forwarded to several government departments and public utilities for comment. The Principal Secretary of the Ministry of Housing and Urban Development (MHUD) makes the final decision, except in Mbabane and Manzini, where it is made by the City Council.

5.11 NATIONAL HOUSING BOARD ACT, 1988

The act deals with the establishment of the Eswatini Housing Board (EHB) and includes provisions to purchase or by other means acquire and by sale, mortgage, or lease, dispose of any movable or immovable property. It details the objects and functions of the Board which subject to the provisions of the Human Settlements Authority Act are to provide affordable housing generally in Eswatini and to take over such housing schemes as the government may determine. The EHB make loans for acquisition of property and construction of housing or housing schemes.

5.12 THE ESWATINI POSTS AND TELECOMMUNICATIONS CORPORATIONS ACT 1980

This Act provides for the establishment of the Eswatini Posts and Telecommunications Corporate and, albeit not substantively, provides for the procedure to be followed in the event there is a necessity to remove telephone lines or alter such lines positions. Section 17(2) of the Act provides that where a telephone line or pole has been constructed, under the provisions of the Act, on property that does not fall under the management of a local authority, any person entitled to do so, may require the Corporation to remove or alter the position of the line if he wishes to construct a building on the said property. The costs of the alteration and / or removal will be borne by the Corporation provided the line was not constructed for the sole use of the person making the requisition.

The Act also provides that if such person wishes to deal with the property in such a manner other than by erecting a building, then he may require the Corporation to remove the line and / or alter its position and the Corporation may either comply to do so and bear the costs. The Corporation may also comply on condition that the person making the request bears the costs. The Corporation may also refuse to comply with the said requirements in which case the person concerned may make application to the Minister whose decision will be final.

5.13 MINISTRY OF HOUSING AND URBAN DEVELOPMENT (MHUD) RESETTLEMENT POLICY AND GUIDELINES 1994

The MHUD resettlement policy and guidelines lay a foundation through which resettlement can be carried out regarding MHUD projects but should be considered as guideline for this project to limit adverse effects of resettlement.

5.14 GENDER EQUITY

Since 2000, a series of significant legislation relating to gender equity in Eswatini has come into being including the new constitution. The situation may be summarized as follows: The Constitution of the Kingdom of Eswatini (2005), as well as protecting fundamental rights of all citizens (Section 14), specifically enshrines the rights of women (Section 28) to equal treatment, political, economic, and social opportunities and commits the Government to enhancing their welfare and provides for equal access to land irrespective of gender (Section 211). Furthermore, according to Section 28 (3) women may not be compelled to undergo or uphold any custom "to which she is in conscience opposed.

The Gender Unit in the Ministry of Home Affairs has identified Constitutionalism and Law Reform as a priority, and they have drafted a Program of Action with the assistance of United Nations Development Programme (UNDP). Currently the Constitution has two provisions explicitly stating the protection from gender discrimination and inequality before the law based on gender. Sections 14 and 28 enshrine gender equality reforms and redress previous legislation such as the Marriage Act of 1964, the Deeds Registry Act of 1938 and the Intestate Succession Act of 1953 and other inheritance laws.

5.15 THE RAILWAY ACT 1962

The Act provides for the construction and operation of the Eswatini Railway and for finances of the said Railway. S13 of the Act makes provision for the powers of the Eswatini Railway one of which is to acquire land. This power is also buttressed in S 28, 29 and 33 of the Act. The Act exempts Eswatini Railway from paying transfer duty. The provisions of the Sub-division of Land Act 1957 do not apply to any land required to be sub divided for the railway reserve not to any subdivision of land resulting from the deduction of any land required for the railway reserve. This is provided for in S36 of the Act.

5.16 THE ENVIRONMENTAL MANAGEMENT ACT 2002

The Act provides for the promotion and enhancement, protection and conservation of the environment and matters that are incidental thereto. In consideration of the magnitude of the work that will be done in the construction of the railway line, in terms of this Ac, it is necessary to conduct an Environmental Impact Assessment. If it appears that the impact on the environment is grave, the land or that environmental aspect will not be interfered with. However, in the event the Director authorises the continuation of the project and it transpired that there is an impact on the environment, in terms of S64 of the Act, the Eswatini Railway may be served with a protection order in terms of which Eswatini Railway may be directed to stop the activity that is causing the adverse effect, control the activity and to assess the actual or anticipated extent of the adverse effect.

This Act also governs the other Environmental Acts which include but not limited to The Forest Preservation Act of 1910, The Private Forest Act 1951, The Water Act of 2003 and the Flora Protection Act of 2001.

5.17 DECLARATION OF LAND, MINERALS AND WATER AS NATIONAL RESOURCE.

- Subject to the provisions of this Constitution or any other law, land, minerals and water are national resources.
- In the interests of the present and future generations, the State shall protect and make rational use of its land, mineral and water resources as well as its fauna and flora, and shall take appropriate measures to conserve and improve the environment. Land 211.
- From the date of commencement of this Constitution, all land (including any existing concessions) in Eswatini, save privately held title-deed land, shall continue to vest in iNgwenyama in trust for the Swazi Nation as it vested on 12 April 1973.
- Save as may be required by the exigencies of any situation, a citizen of Eswatini, without regard to gender, shall have equal access to land for normal domestic purposes.
- A person shall not be deprived of land without due process of law and where a person is deprived, that person shall be entitled to prompt and adequate compensation for any improvement on that land or loss consequent upon that deprivation unless otherwise provided by law.

5.18 AFRICAN DEVELOPMENT BANK'S SAFEGUARD POLICY AND GUIDELINES

5.18.1 INVOLUNTARY RESETTLEMENT POLICY, 2003.

The overall goal of the Bank's Policy on Involuntary Resettlement is to ensure that when people must be displaced, they are treated equitably, and that they share in the benefits of the project that involve their resettlement. The Policy has the following key objectives:

- To avoid involuntary resettlement where feasible, or minimize resettlement impacts where population displacement is unavoidable, exploring all viable project designs. Particular attention must be given to socio-culture consideration such as culture or religious significance of land, the vulnerability of affected population, or the availability of in-kind replacement for assets, especially when they have important intangible implication. When a large number of people or a significant portion of the affected population would be subject to relocate or would suffer from the impacts that are difficult to quantify and to compensate, the alternative of not going ahead with the project should be give serious consideration;
- To ensure that the displaced people receive resettlement assistance, preferably under the project, so that their standards of living, income earning capacity, and production levels are improved;
- To provide explicit guidance to Bank staff and to the borrowers on the conditions that need to be met regarding involuntary resettlement issues in Bank operations in order to mitigate the negative impacts of displacement and resettlement and establish sustainable economy and society; and
- To set up a mechanism for monitoring the performance of involuntary resettlement programs in Bank operations and remedying problems as they arise to safeguard against ill-prepared and poorly implemented resettlement plans.

In order to achieve the goals of this Policy that involve Involuntary Resettlement, the Plan shall be prepared and evaluated according to the following guiding principles:

- The borrower should develop a resettlement plan where physical displacement and loss of economic assets are unavoidable. The plan should ensure that displacement is minimized, and that the displaced persons are provided with assistance prior to, during and following physical relocation. The aim of the relocation and of the resettlement plan is to improve displaced persons former living standards, income earning capacity, and production levels. The resettlement plan should be conceived and executed as part of development program, with displaced persons provided with sufficient resources and opportunities to share in the project benefits. Project planners should work to ensure that the affected communities give their demonstrable acceptance to the resettlement plan and the development program, and that necessary displacement is done in the context of negotiated settlement with affected community.
- Additionally, displaced persons and host community should be meaning-fully consulted early in the planning process and encourage participation in the planning and implementation of the resettlement program. The displaced persons should be informed about their options and right pertaining to resettlement. They should be given genuine choices among technically and economically feasible resettlement alternatives. In this regard, particular attention should be paid to the location and scheduling of activities. For consultations to be meaningful, information about the proposed project and the plans regarding resettlement and rehabilitation must be made available to local people and national civil society organizations in a timely manner and in a form and manner that is appropriate and understandable to the local people. As well, careful attention should be given in the organization of meetings. The feasibility of holding separate women's meetings and fair representation of female heads of households, in addition to mixed meetings should be explored. Also, the way in which information is disseminated should be cautiously planned as levels of literacy and networking may differ along gender liners;
- Particular attention should be paid to the need of disadvantaged groups among those displaced, especially those below the poverty line, the land less, the elderly, women and children, and ethnic, religious, and linguistic minorities, including those without legal title to asset, female head of households. Appropriate assistance must be provided to assist the disadvantaged groups cope with the dislocation and to improve status. Provision of health care services, particularly for pregnant women, and infants, may be important during and after

relocation to prevent increases in morbidity and mortality due to malnutrition, the psychological stress of being uprooted, and increased risk of diseases;

- Resettlees should be integrated socially and economically into host communities so that any adverse impact on host communities are minimized. Any payment due to the hosts for land or other assets provided to resettles should promptly render. Conflicts between hosts and new arrivals may develop as increased demands are placed on land, water, forests, services, etc. or if the new arrivals are provided services and housing superior to those of the host. These impacts must be carefully considered when assessing the feasibility and cost of any proposed project involving displacement, and adequate resources must be reflected in the budget for the mitigation of those additional environmental and social impact.
- Displaced persons should be compensated for losses at "replacement cost" prior to their physical displacement or before taking-over of the land and related assets or commencement of project activities, whichever occurs first; and
- The total cost of the project as a result should be included in the full cost of all resettlement activities, factoring in the loss of livelihood, and earning potential among affected peoples. This attempt to calculate the "total economic cost" should also factor the social, health, environmental and psychological impacts of the project and displacement, which may disrupt productivity and social integration. The resettlement cost should be treated against economic benefits of the project and any other net benefits to new arrivals should be added to the benefit stream of the project.

The policy defines the affected population in a resettlement program, describes the modes of identifying their loss of assets/income resources or access to assets, eligibility, and entitlements within the context of a resettlement plan.

5.18.2 AFDB GENDER POLICY

The policy is based on the premise that Africa has pronounced, region-specific gender characteristics that are of direct relevance to its economic and social development. It takes into account the international agenda, which calls for transformation, aimed at achieving full and equal partnership between men and women. Gender has become an issue for development intervention. First, inequalities continue to exist between women and men despite significant improvement in the absolute status of women and gender equality in most African countries. The following guiding principles form the basis of Bank's assistance in the area of gender/women empowerment.

5.18.3 GENDER ANALYSIS WILL BE AN INTEGRAL PART OF ALL BANKS' POLICIES, PROGRAMMES AND PROJECTS.

Gender analysis will be conducted for all Bank intervention to design intervention that respond to the needs and priorities of both men and women. Experience has shown that women and men differ in the way they respond to and/or benefit from development and in the absence of specific attention to differences between women and men, planning for "the people" can result in the exclusion of women or men as participant or beneficiaries of planned change.

5.18.4 ATTENTION WILL BE PAID TO THE CO-OPERATIVE RELATION BETWEEN WOMEN AND MEN

The concept of gender implicitly embodies a culture that entails cooperation and interdependence between men and women rather than separation. It is oriented towards an equitable and sustainable development with women and men as equal partners in decision making. Focus on women without taking into account their relations with men can undermine the objective of reducing disparities. Women do not live in isolation and by addressing them as such, development practitioners risk alienating must strive to empower both men and women to transform relations between them by taking into account the needs and interests of both genders and ensuring that all benefit equally from development.

5.18.5 WOMEN'S ECONOMIC EMPOWERMENT WILL BE CONSIDERED AS KEY TO SUSTAINABLE DEVELOPMENT

Women in Africa are active in a variety of economic areas. Moreover, they often shoulder the primary responsibility for the well-being of the family. However, due to legal and customary barriers women lack access to credit and this impedes their effective economic participation. Experience has shown that providing credit services to women enhances productivity and promotes efficient lab our allocation. In addition, relative to men, women who possess economic means, invest more in education and health of their children. Measures will therefore be taken to support Regional Member Country (RMC) initiatives that target women entrepreneurs and producers in both formal and informal sectors and which adopt innovative lending policies and practices.

5.18.6 WOMEN WILL NOT BE CONSIDERED TO BE HOMOGENEOUS GROUP.

Although they may face some common difficulty due to the way a particular society defines gender, other important factors such as class, race, ethnicity, and religion also contribute to their position in the society. Thus, activities targeting an in differentiated category "women" may provide opportunities to some women and at the same time leave other groups disadvantaged.

5.18.7 PROGRAM AND PROJECT WILL TAKE ACCOUNT OF DIFFERENCE BETWEEN WOMEN; AND A STRATEGIC CHOICE WILL BE MADE ON THE USE OF THE MAINSTREAMING STRATEGY / TARGET INPUT

Targeted projects for women or men and gender mainstreaming are not incompatible responses. The question is one of strategic and operational choice depending on a particular situation. Targeted intervention may be required to address the disadvantages and limitations experiences by women because of the way the gender concept is conducted in a specific context. Thus, projects should be designed to address gender disparities, or, to target issues which specifically affect women such as ownership of land, access to credit or legal literacy. Similarly, activities could target the special gender division of lab our and male responsibility in reproductive health issues.

This policy codifies the Banks' formal commitment to the gender mainstreaming approach. It seeks to define a more systematic approach to planning of development interventions so that they can address the priorities of women as well as men for greater efficiency, effectiveness, and sustainability unlike the former Women in Development (WID) policy. The focus of this policy is gender relations, which shape outcome for both men and women. With introduction of the gender analytical framework, the fundamentally social nature and gender differences that result in inequalities between women and men gains greater visibility. The policy adopts the concept of "gender mainstreaming" as a key strategy for overcoming women's exclusion from decision making and from access to any control over development resources and benefits.

5.19 WORLD BANK GROUP POLICY ON POVERTY REDUCTION

The goal of the Bank's poverty policy is to ensure that poverty in Africa is reduced. This involves development of strategies that facilitate national ownership, participation, and an orientation towards improvements in the welfare of the poor, especially in the achievement of Millennium Development Goals (MDGs).

The objectives of the policy are to bring poverty reduction to the forefront of the Bank's lending and non-lending activities and to support its Regional Member Country's (RMCs) in their efforts towards poverty reduction. Support for country-owned Poverty Reduction Support Programmes (PRSPs) plays an important role in this respect. The following are the policy Guiding principles:

- **Poverty Focus.** Poverty reduction has become the overarching goal of the Bank for the last four years. The realization of this goal requires a more focused analysis of the incidence, depth and causes of poverty in Africa. Such focus on poverty reduction instance, it is necessary to go beyond a general support for agricultural, human resource and private sector development by designing and implementing pro-poor policies within these broad areas.

- **National ownership, participation, and outcome orientation**. The principles of the new strategic framework form the basis for the policies discussed in this chapter. A number of policy measures such as support for national capacity building, promotion of the participatory approach development of new forms of partnerships and establishment of poverty monitoring systems relate directly to these principles.
- **Internal policy coherence.** The importance of the priority areas and the crosscutting issues has been discussed in the Banks sector specified policies. The purpose of the poverty policy is to strengthen existing sector policy prescriptions and to fill gaps on specific areas from standpoint of poverty reduction.
- **Country-led partnership.** The policy also underscores the importance of a coordinated donor response to the demand from RMCs for supporting their PRSPs. A strong partnership ensures the consistency between the Bank's poverty policy and the poverty reduction strategies of its RMCs as articulated in the PRSPs for African Development Fund (ADF) countries and similar planning documents for African Development Bank (AfDB) member countries.
- **Enriched conceptual framework.** The policy takes into account the new conceptual framework which expands the concept of poverty beyond income measures and its causes. It also addresses the economic and non-economic causes of poverty.

In many African countries, problem of poverty is exacerbated by episodes of frequent drought, crop failure and natural disaster like floods, political conflict, and epidemics. For instance, in many African countries, the number of internally and externally displaced people due to political conflict is quite high.

The Bank recognizes that the success of safety-net programs depends on several factors including fiscal affordability, the availability of adequate information on the potential beneficiaries and the administrative capacity to reach targeted groups. To this effect, the Bank will support provision of the following social protection related activities:

- Public program works that create employment for the able-bodied poor, particularly in rural areas;
- Re-training of public employees that are retrenched as a result of adjustment programs;
- Child feeding programs, especially for HIV/AIDs related orphans; and
- Provide emergency relief including food aid in time of natural disasters.

5.20 POLICY GUIDELINES ON CO-OPERATION WITH CIVIL SOCIETY ORGANIZATIONS (CSOs)

The policy reflects the Banks' newly defined Vision and its commitment to:

- Stakeholder participation as a key strategy to achieve its objectives of poverty reduction and good governance.
- Improved governance – a task area in which the Bank intends to play an active leadership role;
- Expanding the range of civil society organization which the Bank may work, corresponding to the broader objectives, and overcoming limitations only on "NGOs";
- Improved effectiveness on the ground by learning more about how its regional member countries (RMCs) can better work with civil society organizations.

Through public statements, consultative practices and lending decisions, the Bank has made clear its intention to engage the NGOs, and other organizations from the Civil Society. It has committed itself to Client – focused gender- sensitive and participatory approaches involving a broad range of stakeholders.

The Banks' principal mandate is to lend to governments for development purposes in RMCs. The pursuit of improved co-operation with CSOs does not imply a shift in emphasis to by-pass the former in favour of the latter. The Bank acknowledges that governments' role and function in promoting development for its people is irreplaceable and it cannot be substituted by the involvement of the CSOs but can only be enhanced.

One set of criteria cannot cover all circumstances, as performance requirements will vary depending on the nature of task to be performed. Specific selection criteria will need to be applied for specific cases. Nevertheless, for operational purposes, the following criteria may serve as a starting point by which to select an appropriate CSOs:

- Credibility and legitimate: Acceptability of the organization to relevant stakeholders;
- Competence: Relevant demonstrated skills and proven track record;
- Capacity for making judgment informed by lesions from experience (based on working with different types of CBOs, government branches or aid institutions);
- Legal status: Formal recognition or registration in the RMCs, in instances where the risk of opportunism is high, the CSO should be able to show proof that it has existed for at least one year prior to the onset of project identification;
- Appropriate organization capacity: Operating structure, scale, and material resources;
- Representative and responsiveness: To local people; accountability to members/beneficiaries, gender sensitivity;
- Internal governance, social management including accounting systems and transparency about them, a readiness to undergo audits, transparent leadership and decision making.

Where CSOs are selected as implementing partners of the Bank and RMC, the existence of sound and verifiable finance management and reporting systems will be applied as additional criteria.

5.21 DISCLOSURE AND ACCESS TO INFORMATION

This revised policy supersedes the AfDB Policy on disclosure of information dated October 2005.The Policy provides the Bank group with an improved framework within which to disclose information on policies and strategies and key decision made during project development and implementation.

Maximum disclosure and access to information will increase public support for the Bank Groups Mission and enhance the effectiveness of its operations. The policy contains the following new elements:

- A strengthened presumption of disclosure, eliminating the positive list and emphasizing a limited negative list;
- Introduction of an appeals mechanism;
- Provision of simultaneous disclosure; and
- Increased access to the broad range of stakeholders.

The policy aims to:

- Maximize disclosure of information within the Banks Groups possession and limit the list of expectations to reflect the Banks willingness to disclose information;
- Facilitate access to and share information on the Bank group's operations with a broad range of stakeholders;
- Promote good governance, transparency and accountability to provide leadership in this area to RMCs;
- Improve on implementation effectiveness and better co-ordinate the information disclosure processes;
- Give more visibility to the Bank Group's mission, strategies and activities to stakeholders;

- Support the Bank Group’s consultative process in its activities and stakeholders participation in the implementation of the Bank Group financed projects;
- Ensure harmonization with other Development Finance Institutions (DFIs) on disclosure of information.

5.22 HANDBOOK ON STAKEHOLDERS CONSULTATIONS AND PARTICIPATION ON AFDB FUNDED PROJECTS

Participation in development can be defined as the process through which people with an interest (stakeholders) influence and share control over development issues that affect them. Measures must be taken to identify the relevant stakeholders and involve them in the process of formulating the project. This entails sharing with them the objective of the project and seeking their views for integration in the project design before decisions are concluded. It might be necessary to take the stakeholders through a process of training and thus empowering them not only to meaningfully to contribute to the project design but also for their future participation in the sustainability of the project.

According to the Handbook, many methods and technique have been developed to promote participation by stakeholders in development. Some of the methods and techniques used include:

- Participatory stakeholders analysis;
- Participatory meetings and workshops;
- Participatory research/data collection;
- Participatory planning.

In some instances, it might be necessary to combine the above techniques depending on the nature of the project at hand and the complexity of the stakeholders involved.

6 SOCIO-ECONOMIC ASSESSMENT METHODOLOGY

The social impact assessment was undertaken using both qualitative and quantitative methods, which complement each other in providing the baseline conditions of the social environment in the Nondvo dam area. The following instruments were used:

6.1 DESK BASED DATA REVIEW

Relevant secondary data was collected and reviewed, including an assessment of studies undertaken for the Project to date. These included:

- Technical Feasibility Study undertaken by Studio Pietrangeli (Scoping & Final);
- AfDB guidelines (applicable to the project);
- Relevant legislation.

Project Maps and engineering drawings were also reviewed and studied prior to undertaking fieldwork. In addition to this, more information was sourced from printed and electronic reports and documents, including relevant websites. Demographic Surveys and Census reports were also reviewed, among others.

6.2 SITE VISITS

Site visits, as a reconnaissance to the project area, were undertaken on 29 May 2019 to collect information related to various aspects of the project. The visit enabled the consultants to comprehend and visualise the project area, the extent of the reservoirs; and determine which communities will be affected/benefit from the project.

6.3 COMMUNITY ENGAGEMENT

Community engagement was undertaken through the holding of community meetings, Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) in the affected communities. These were done concurrently with the household surveys. Unstructured interviews containing open-ended questions were used. The FGDs were designed to give an opportunity to the various target groups to express their views, feelings, aspirations, and expectations of the project (including both positive and negative attributes of the project) under a free and relaxed atmosphere without feeling intimidated. These were held with men and women of different age groups, as well as older persons and people with disability. KIIs were held with the chiefs, councillors, teachers, priests, retired civil servants and a local member of parliament.

FGDs and KIIs were aimed at obtaining information from the members of the community about the proposed project as well as to ask them questions in relation to their views about the project. The information gathered from the above community engagement activities has been incorporated into the report.

Engagement and surveys were undertaken in both Royal Kraals of Mantabeni and Siphocosini from 29 July to 17 August 2019. Further detail on the community engagement methodologies is presented below.

The objective of engaging Community Area Leaders (CALs) was for two reasons, namely (i) to identify Mantabeni and Siphocosini households, and (ii) introduce the enumerators to the household to conduct interviews especially because the two Royal Kraals and the communities are side by side and there are no clear boundaries demarcating them. The CALs participation became valuable also because they know all the members of the households, their whereabouts including those who work outside their community. Furthermore, they could identify fields and properties belonging to various households and bear witness to the ownership of such property.

6.4 SOCIO-ECONOMIC SURVEYS (SES)

The socio-economic impacts, as well as compensation and relocation needs (detailed in the Resettlement Action Plan (RAP[1])) are based on a detailed socioeconomic survey and census of community members and Project Affected People (PAPs) within the affected communities.

The aim of the survey is to establish a portrait of the socio-economic conditions of the households and communities and to evaluate the nature and extent of the impacted elements (cultivated and other lands, structures, etc.). These formed the basis for performing cost estimations for compensation and relocation. The main structures and houses of the impacted households and community structures (school, churches, etc.) was located using GPS technology. All census and survey data were gathered with tablets and on-line data compilation application (SnapSurvey) to insure secure and efficient data gathering. Three teams of investigators worked under the supervision of the Socio-economic Survey Supervisor to conduct a detailed socioeconomic survey.

- Primary Area – affected by dam inundation;
- Secondary Area – affected by linear realignments and developments.

The main tool used for this study is the survey form (questionnaire), directly supplemented on electronic tablets using a computerized data collection software (SNAP Survey) which allows quality control of the information collected. The questionnaire was adapted to the database that include all the information gathered during the census, the inventory, and the detailed socio-economic survey. A pre-test was conducted to ensure its suitability for situations encountered in the field, to the correct understanding of the respondents and of the enumerators and to its proper use. The survey quality was checked and corrected daily through SnapSurvey compilation.

Eight enumerators covered the two communities of Mantabeni and Siphocosini. The local Stakeholder Engagement Advisor (Eswatini) was present at the training to share socio-economic knowledge on the affected Royal Kraals and other areas. These enumerators attended a two-day training session to familiarise themselves with the questionnaire, interview procedures and requirements (and use of Tablets for data capture and GPS). Consultations with local authorities were held concomitantly with these investigations.

The SES targeted individual households to gather information regarding the households' standard of living/socio-economic status. Furthermore, the questionnaires included queries on the following:

- household income sources, and expenditure patterns
- number of household members,
- gender and age,
- education and employment status,
- means of livelihood,
- information on private and communal property
- moveable assets, fixed assets,
- services provision,
- HIV/AIDS and gender related issues, homestead details, (tenure, description of structures, length of stay at residential site)
- economic activities,
- ownership and usage of cultivation of agricultural fields, ownership of livestock,
- work experience / skills acquired,
- travelling patterns, mode of transport, and
- ecosystem services (biodiversity etc.).

[1] The RAP forms a standalone report detailing the resettlement and compensation process required for the Project.

The Households survey questionnaire was administered to 187 or the total 1320 HHs making up the two Royal Kraals. This represents approximately 14% of the affected communities. In majority of the cases the survey was administered to household heads however in certain instances the household heads were not available as such the survey was conducted with a member of the household. The households surveyed were identified as those falling within Project area.

A control sample of 10% (commonly referred to as the control group be surveyed of people not affected by the project) was proposed to be undertaken, however this process was ultimately not undertaken due to limitations of available CALs to guide the enumerators which reduced the effective number of households that could be reached within the survey timelines. The public meetings were therefore utilised to register the larger community’s opinions and expectations and responses regarding the Project.

The household survey information was shared information with the RAP Survey team to ensure that there is alignment by documenting the following aspects: sources and distribution of income, distribution of expenditure, means of subsistence, food security, health situation, education, vulnerability factors, concerns and expectations raised by the project.

7 SOCIO ECONOMIC BASELINE AND PROFILE OF THE PEOPLE IN THE PROJECT AREA

7.1 STUDY AREA

The socio-economic impacts, compensation and relocation needs is based on a detailed census and socioeconomic survey of Project Affected People (PAP) and affected communities. The aim of the survey is to establish a portrait of the socio-economic conditions of the households and communities and to evaluate the nature and extent of the impacted elements (cultivated and other lands, structures, etc.). These will form the basis for performing cost estimations for compensation and relocation. The main structures and houses of the impacted households and community structures (school, churches, etc.) were located using GPS technology.

7.1.1 ROYAL KRAALS OF MANTABENI AND SIPHOCOSINI

This section describes the study area of the Royal Kraals of Mantabeni and Siphocosini and presents the holistic view of the area currently before any development associated with the Nondvo Dam Project.

Eswatini has a total area of approximately 17.363 km² and in terms of land boundaries and it borders with Mozambique for 105 kilometres, and South Africa for 430 km, giving a total land boundary length of 535 km. The topography mainly comprises of mountains and hills with various temperately sloping plains. The Great Usutu River is the lowest point at 21 m and Emlembe is the highest point at 1,862 m in the country (Wikipedia, 2017).

The Nondvo Dam Project Area is made up of the Royal Kraals of Mantabeni and Siphocosini with 12 communities namely: Mhlane (Siphocosini), Spete, Ncabaneni, Sithobela, Masibekela, Mhothoza, Mahlatsini, Ndlolotsini, Majadvula, Ndlelalula, Nkhube and Mhlane (Mantabeni). The Royal Kraals of Mantabeni and Siphocosini are situated in the Hhohho administrative District, under the Motjane (Tinkundla) constituency in Eswatini. It is located about 17.5 km from the capital city of Mbabane.

Table 7-1 below identifies the communities within each of the Mantabeni and Siphocosini Royal Kraals, which are graphically illustrated in **Figure 7-1**.

Table 7-1: Communities Inundated by the Nondvo Dam related socio-economic survey

ROYAL KRAAL	COMMUNITY
Mantabeni	Majadvula
	Mhlane
	Ndlelalula
	Masibekela
	Mhothoza
	Ndlolotsini
	Mahlatsini
	Nkhube
Siphocosini	Mhlane
	Ncabaneni
	Sithobela
	Spete

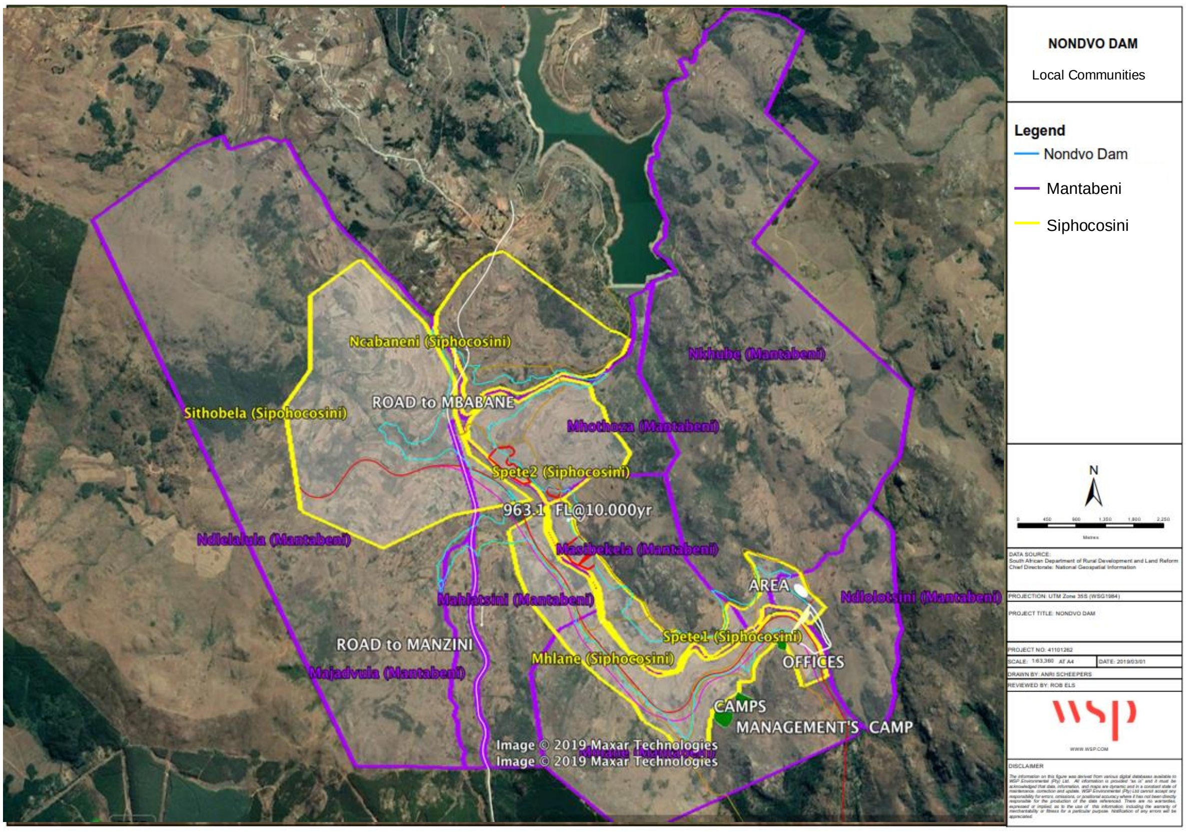

Figure 7-1: Layout showing the extent of the Siphocosini (yellow) and Mantabeni (purple) Communities in relation and extent of the proposed dam reservoir.

7.1.2 PROJECT FOOTPRINT AND SOCIAL INFRASTRUCTURE

The Nondvo dam reservoir will cover an area of between 0.05 and 2.4 km^2 during normal operations (i.e. Minimum operating level of 939.0 masl and Maximum operating level at 960.0 masl respectively). While during flood events (i.e. flood level @10,000 years of 963.4 masl) this area can increase to 2.9 km^2, as indicated in **Figure 7-2**.

The following social infrastructure is located within the reservoir inundation area:

- 3 low level crossing for vehicles;
- 2 footbridges for pedestrians; and
- 2 schools (one high school and one primary school).

The locations of the low-level crossings, footbridges and schools are indicated in **Figure 7-2**. While **Figure 7-3** provides a closer view of the two schools and the footbridge located between them, crossing the Lusushwana River.

Inundation of the reservoir will result in the loss of the above identified infrastructure and social facilities. The loss of the southernmost low-level crossing will effectively be replaced by the bridge to be constructed across the dam wall, at the southern end of the reservoir. While a new vehicular and pedestrian crossing is to be established at the northern end of the reservoir, replacing the northernmost low-level crossing. However, due to the distance from one bank to the other it has been determined that replacing the infrastructure located in the main sections of the reservoir (i.e. two footbridges and single low level crossing) cannot be replaced. Alternative access routes will be provided for pedestrian and vehicular traffic at both the northern and southern ends of the reservoir. This will facilitate movement around the dam as part of ensuring that life of the PAPs in the communities of the Mantabeni and Siphocosini Royal Kraals returns to normalcy as far as possible, as per the prescripts of the AfDB Safety Policy and Guidelines and GIIP.

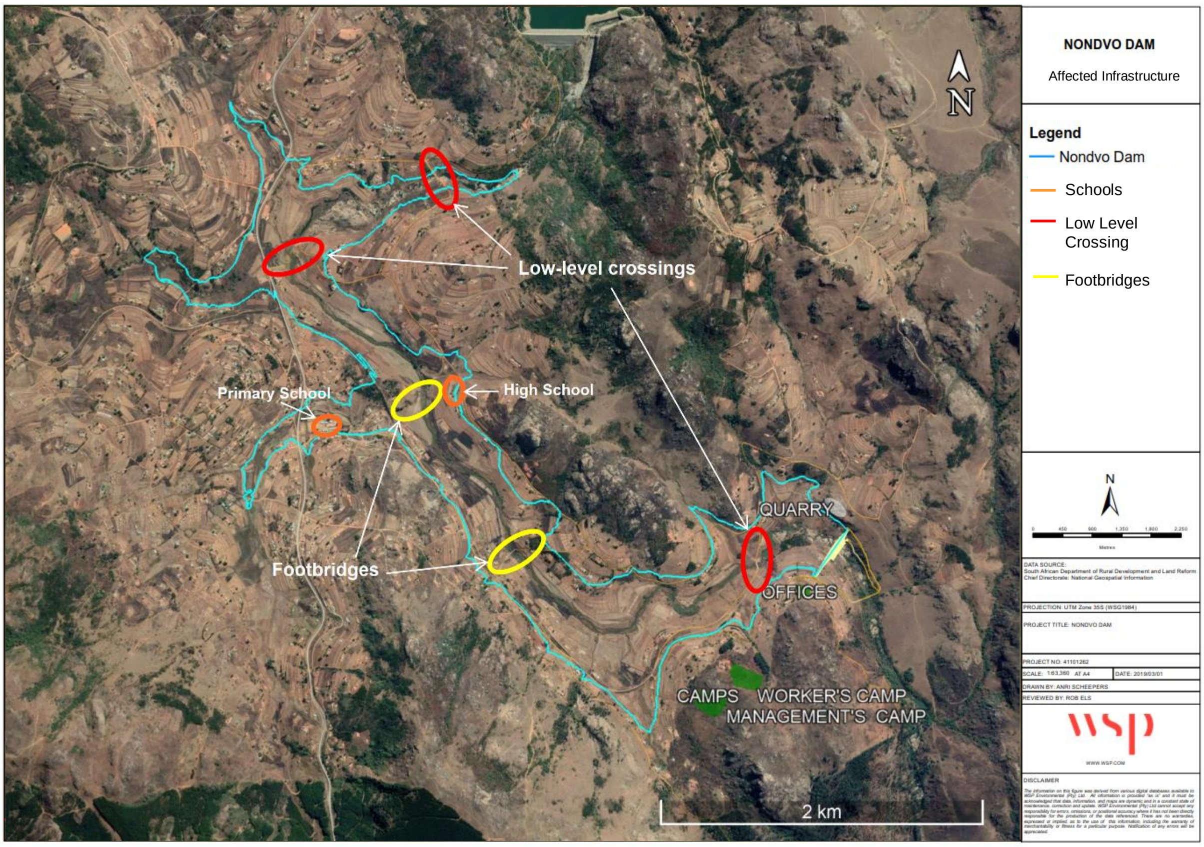

Figure 7-2: Layout showing the Project footprint including reservoir at flood level of 963.4 masl (blue line) and location of affected social infrastructure.

Figure 7-3: Layout showing the two schools and footbridge crossing the Lusushwana River

As both schools are located within the inundation area, these will have to be relocated prior to inundation of the reservoir taking place. Considerable planning will have to be undertaken prior to selecting appropriate relocation sites for both schools which will have to take into consideration that the footbridges connecting the two banks will no longer be accessible. As such school children based on the opposite bank of the new school will could end up having to travel more than 8 km to reach school, whereas previously they would have been able to walk a few hundred meters.

7.2 NATIONAL LAND TENURE SYSTEM

The land tenure system in Eswatini is divided into two basic categories namely Title Deed Land (TDL) and Swazi Nation Land (SNL). According to the Government of Eswatini (1989) TDL tenure, currently accounts for 37% of the country and have exclusive rights of access to a defined piece of land with titles held by individuals or corporate bodies. Owners of land titles can sell or use the land as collateral. The State can withdraw title in land required for national development only after making appropriate compensation.

SNL means land held by the King in trust for the nation and is allocated by chiefs to homestead heads, who under Swazi law and custom are men. Swazis living in SNL do not have title deeds and can never use their land as collateral for application for loans with the banks. However, in the past land was allocated to women through male proxies even though many women are de facto heads of homestead, a practice still being practiced in some Royal Kraals. However, Committee on Elimination on Discrimination against Women (CEDAW) Report (2012) notes that in some instance's chiefs have relaxed this restriction. In this regard the Royal Kraals of Mantabeni and Siphocosini fall into this category that adheres to Section 211 of the Eswatini Constitution which provides for equal access to land for men and women for normal domestic use.

SNL includes land bought from TDL landowners by a reigning monarchy in trust for the Swazi Nation. Such land has been leased to private companies to attract private capital and expertise to SNL. The use of this land does not reflect the traditional and political relations between chiefs and people as provided for under Swazi law and custom.

The Royal Kraals of Mantabeni and Siphocosini are part of SNL and guided by its prescripts (i.e. none of the affected properties are TDL).

7.3 NATIONAL ECONOMY

According to the Trading economics (2018) the economy of Eswatini is diversified. Agriculture, forestry, and mining account for approximately 13% of Eswatini GDP while manufacturing sector textile and sugar related processing represent 37%. Services with government services leads the pack by contributing 50% towards the country's GDP. The World Bank 2018 states that Eswatini's GDP in 2018 was worth 4.70 billion US dollars in 2018. The GDP value of Eswatini represents 0.01 percent of the world economy. GDP in Eswatini averaged 1.52 USD Billion from 1960 until 2018, reaching an all-time high of 4.82 USD Billion in 2011 and a record low of 0.04 USD Billion in 1961.

The economic growth of Eswatini is said to have lagged behind that of its neighbours. Real GDP growth since 2001 has averaged 2.8% nearly 2% points lower than growth in other Southern African Customs Union (SACU).

7.4 POPULATION AND DEMOGRAPHICS

According to the Census 2017 and the World Population Review (2019), the population of Eswatini's is 1,093 238 Million people and that of Mantabeni and Siphocosini Royal Kraals is 7 482 consisting of approximately 1320 households in 12 communities.

7.4.1 PROJECT AFFECTED PEOPLE

As stated earlier, PAPs identification was made possible due to the demarcation of the inundation area with buffer zone to define the maximum water level and a safe zone to allow residents to occupy. It was necessary to estimate the number of community representatives of the PAPs per community to identify the amount of work and costs for carrying out the Resettlement Planning at the implementation stage as well as the potential impacts. Firstly, we secured the Google maps with gazette road width overlaid to enable identification of potentially affected households and their assets. This approach was applied to ensure that both socio economic study and RAP are as accurate as possible in their identification of PAP and their assets. The use of google map proved to be valuable in providing the number of households which are precariously situated both in terms of the assets inside the FSL as well as within the buffer zone. This approach together with the RAP will assist in providing diagnosis in how each household would be further impacted and the extent thereof in line with the AfDB Statements on Involuntary Resettlement as stipulated in the Bank's document entitled "Guidelines on Involuntary Displacement and Resettlement in Development Projects" (2003). The guidelines stipulate that when people must be displaced; it is to be ensured that they are treated equitably and share in the benefits of the project that involves their displacement. Efforts should be made to minimise disruptions to their livelihoods, ensure that the displaced persons receive resettlement assistance to improve their living standards. Furthermore, close attention should be paid on the displacement of disadvantaged groups such as female headed households, child headed households, elderly people, the poor and the marginalised communities. The borrower should set up mechanism to monitor the performance of the RAP. The guidelines recognise that the borrowing country has laws and regulations dealing with various issues pertaining to displacement and compensation for loss of assets and rights that need not be violated. The borrower should be encouraged to take a long-term view of the inadequate provisions to improve on the inherent gaps to achieve equity.

7.4.2 SAMPLED HHS

A detailed SES of the 187 representatives of the community identified to fall within the Project affected area was conducted as a basis for SES baseline and planning the eventuality of resettlement. The 187 household represent approximately 14% of the total community households. The 187 community representatives include both physically affected and economically affected.

Figure 7-4 clearly depicts the proportion of sampled HHs in both Royal Kraals, 55.61% of Mantabeni households and 42.25% of Siphocosini. It is noted that 4 HHs (i.e. 2.14%) did not identify with either community.

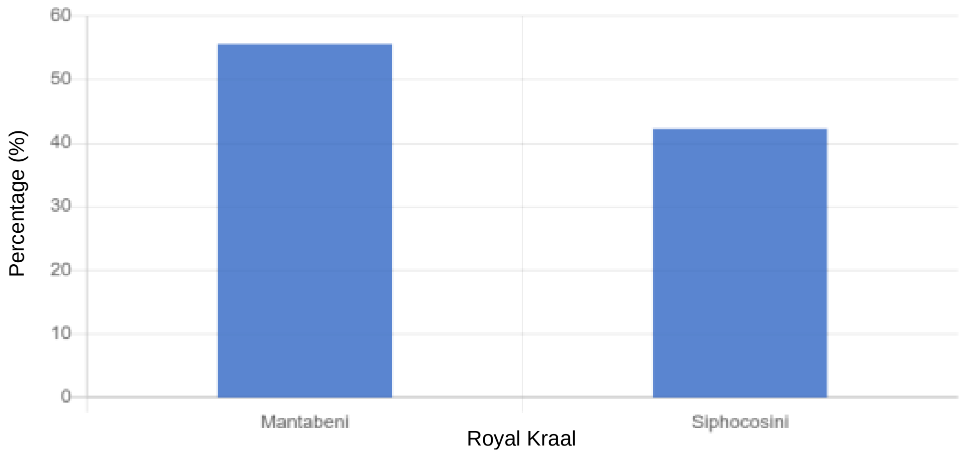

Figure 7-4: Percentage of surveys conducted per Royal Kraal.

Table 7-2 shows the number of households surveyed per community in Siphocosini and the percentage thereof which is graphically shown in **Figure 7-5**.

Table 7-2: Households surveyed per Community in Siphocosini

ZONE	NUMBER OF SURVEYS	PERCENTAGE
Spete 1	40	21.39
Sthobela	13	6.95

ZONE	NUMBER OF SURVEYS	PERCENTAGE
Ncabaneni	12	6.42
Mhlane	9	4.81
Spete 2	11	1.07
Total	**85**	**40.63**

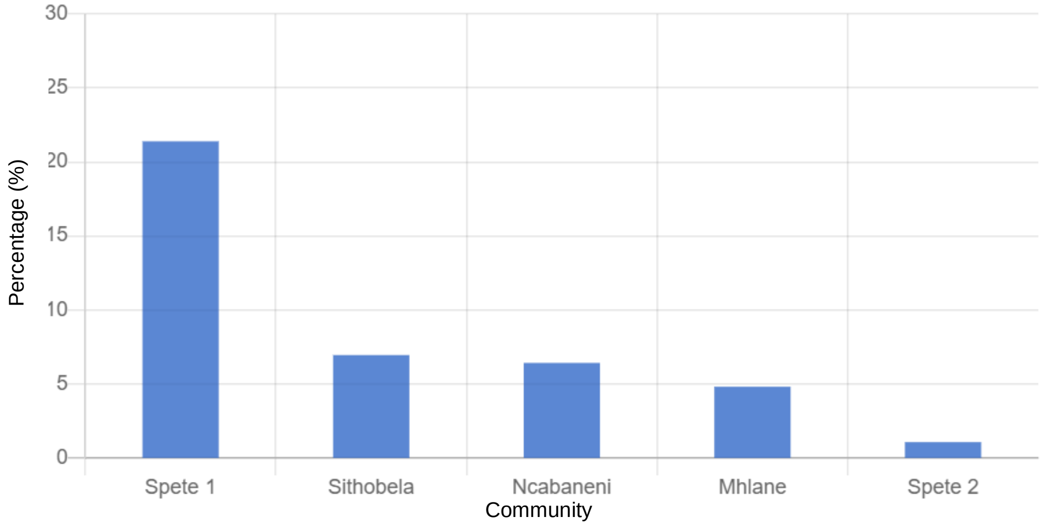

Figure 7-5: Percentage of surveys undertaken per community in Siphocosini

Table 7-3 shows the number of HH per community in Mantabeni and the percentage thereof which is graphically shown in **Figure 7-6**.

Table 7-3: Households surveyed per Community in Mantabeni

ZONE	FREQUENCY	PERCENTAGE
Mhlane	77	41.18
Majadvula	13	6.96
Ndlelalula	3	1,6
Mahothoza	3	1,6
Masibekela	2	1.07
Mahlatsini	2	1.07
Nkhube	1	0.53
Total	**101**	**51.01**

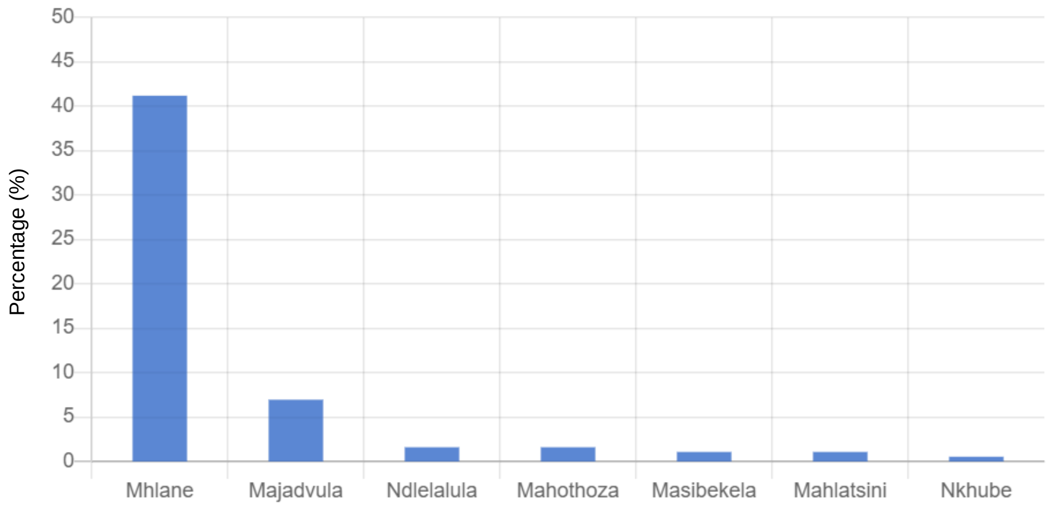

Figure 7-6: Percentage of surveys undertaken per community in Mantabeni

From the above it is evident that the communities of Mhlane (Mantabeni) and Spete 1 (Siphocosini) are the most prevalent in the area and therefore likely to be the most impacted communities of the two communities.

7.5 AGES OF HEADS OF HOUSEHOLD

Table 7-4 indicates the age of heads of households surveyed. Of the household respondents: 43.32 % were people between 56 years and older 27.81 between ages 46 and 55, 17.65% between ages 36 and 45, 8.02% between 26 and 35 and 1.07% were between 15 and 25 years, as indicated in **Figure 7-7**.

In some households where parents were unavailable because they worked out of town, children responded on their behalf while others clearly were households headed by children.

Table 7-4: Head of Households surveyed per age

AGE	FREQUENCY	PERCENTAGE
56 & Older	81	43.32
46-35	52	27.81
36-45	33	17.65
26-35	15	8.02
15-25	2	1.07
Total	183	97.87

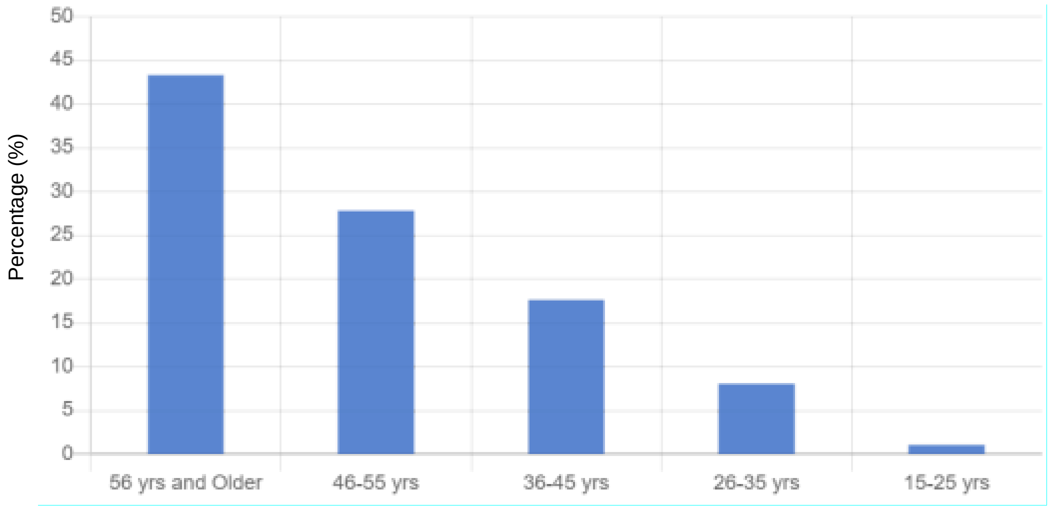

Figure 7-7: Percentage of Households per age

7.6 AVERAGE HOUSEHOLD SIZE

From the socio-economic data gathered from the 187 surveyed households, the average household size consists of 7.1 persons (**Table 7-5**). In majority of the cases the households included elders, resulting in the average of 4 adults and 3 children per household.

Table 7-5: Average size of household

	ADULTS	CHILDREN
Total from the 187 surveyed household	712	616
Average person's / household	4	3
Total Number of Household Occupants	1328	
Average size of household	7.1	

During the socio-economic survey and census, it was identified that approximately 210 households could potentially be directly affected by the proposed Project, either falling within the inundation footprint or associated infrastructure. As such it is anticipated that approximately 1491 persons may be directly impacted upon requiring either physical or economic displacement.

7.7 GENDER EQUALITY AND PARTICIPATION OF WOMEN IN COMMUNITY ACTIVITIES

In view of social and cultural norms, gender equality is always given special attention in resettlement studies to ensure that women are not adversely impacted by the implementation of any large infrastructure project and disadvantaged should economic or social opportunities be availed. The question on how the household owners were divided in terms of gender was critical to record participation of women in comparison to certain rural areas which are often dominated by patriarchal tendencies. In the case of Mantabeni and Siphocosini there are 33 single women and make up 17.65% of the population of 187 respondents. The level of separation and divorce in the community was recorded at 2.14%. These single women who came from outside the Royal Kraals had followed the process of ukuKhonta - the application process to live in the community from the Chief or Inner Council. Membership in a local community is the condition for the right to receive or to be allocated land and is granted through a process of UkuKhonta. Sometimes applicants or new residents are required to pay a stipulated amount or cows to the Inner Council towards the upliftment of the community.

Most single women who live in the community are new residents (having lived in the area for less than 10 years) and majority are employed by government as public servants. Additionally, there are two categories of women whose properties were bequeathed to them as the only survivors in their families while others are widowed.

Specific questions on awareness of gender equality were raised and how that information was acquired. Out of 187 respondents 9 did not respond only 178 responded. Out of 178 respondents 137 stated that they understand what gender equality entails, 41 had no conception thereof. On how they acquired the information 82 abstained and only 105 responded out of 187. Six indicated that radio programmes influenced them, 42 learned through discussions with other members, 38 learnt from public gatherings, 11 from pamphlets and 8 from other sources. On the question whether women and men should be afforded the same opportunities and position in everything, 7 did not respond to the question only 180 responded, 128 agreed while 42 disagreed and 10 were uncertain. This response was interesting especially because the government of Eswatini has ensured through the Constitution of Eswatini that gender equality is espoused throughout the Kingdom.

In addition to delineation of the gender roles sitting arrangements in community meeting was conspicuous because of the separation thereof. In Siphocosini women did not actively participate in the community meetings they only asked questions after the meeting was concluded. However, in Mantabeni women asked questions during the general meeting and participated fully throughout the proceedings. Even though the sitting arrangements were supposed to be separate, lines of demarcation were blurred.

7.8 PREVALENCE OF GENDER BASED VIOLENCE (GBV)

Violence against women and girls is one of the most systematic and widespread human rights violations globally. According to a 2013 global review of available data, 35% UN Women Report of women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence. Eswatini has also experienced the scourge of gender-based violence in its all forms including sexual assault, domestic violence, and sexual harassment. According to Eswatini Action Group Against Abuse (SWAGAA) 9 in 10 children will experience some form of physical or psychological abuse in their lifetime. Hence Section 18 of the Constitution of Eswatini as well as the Sexual Offences and Domestic Violence Act 2018 is a step in the right direction in curbing the scourge of GBV. This Act prohibits violence in all spheres, strengthen, and consolidate common law and statutory provisions to adequately provide for dealing successfully with sexual offences and domestic violence.

Out of 175 respondents, 109 were not certain of the existence of gender-based violence in the community. This is no surprise since often victims of GBV often do not report it due to fear of stigma or sometimes in the case of sexual assault victims often tend to blame themselves. Only 50 respondents affirmed its prevalence and 18 disagreed that there was any gender-based violence. However, out of 167 respondents 120 indicated that women are mostly affected by gender-based violence, 32 are children, 6 are men, 2 stated that elderly are often victims while only 1 person stated that people living with a disability also victims. The high School Principal indicated that there was a prevalence of gender-based violence in the community to an extent where the school has often involved intervention of police in such cases. It is, however, not surprising that a lot of people did not respond well in this question. This could be attributed to socio-cultural factors such as fear of social stigma, attitudes, and social pressures, prevent victims of violence from reporting cases of violence, particularly to institutional structures (such as police and health services), which are inherently patriarchal (Lowe Morna et al, 2017).

7.9 PERCEPTION ABOUT WOMEN PARTICIPATING IN THE WORKFORCE

Out of 172 respondents 166 said men should be part of the workforce while 6 agreed that women should form part of the workforce. Those that responded that no women should be part of the workforce their responses varied, including:

- Women do not have the required strength,
- Men are bread winners,

– Women cannot work deep in the forest because it is dangerous.

From these responses above clearly their point of reference is the fact that a high percentage of males in the community are employed in the Timber Forests in the surrounding areas.

7.10 POSITION AND ROLE OF WOMEN IN THE COMMUNITY

Since women fall under the vulnerable category a detailed analysis was conducted to determine their position in the project area and assess how they would be affected by the project. The survey results were consistent with the roles and relations between the men and women in semi-rural urban communities based on cultural norms. When a few single women were asked why they chose to settle in this community, the following were the responses:

– *"This area is not culturally oppressive";*
– *"Single women like me are able to Khonta and aren't discriminated in any way";*
– *"I was given support in the community when I first came to settle";*
– *"The fact that I am a teacher in the local school worked in my favour".*

No overt evidence of discrimination of marginalisation of women was recorded throughout the survey. For instance, women of Mantabeni and Siphocosini are actively engaged in social and economic activities, be it formal or informal in their communities, like their male counterparts. This practice is consistent with the gender policies of the country.

7.11 DURATION OF ESTABLISHMENT OF HOMESTEADS IN MANTABENI AND SIPHOCOSINI

The analysis of data revealed that most of the households that were established between 1-10 years 31.55% belong to the category of homeowners between the ages of 35-55 and as compared to 60.97% of those who have lived in the community between 11-40 years (**Table 7-6**).

Table 7-6: Period for which surveyed households have lived in the Community

YEARS LIVED IN COMMUNITY	NO. OF PEOPLE	PERCENTAGE
>40	50	26.74
21-40	37	19.79
11-20	27	14.44
6-10	26	13.9
1-5	37	16.58
1	2	1.07
No Information	8	4.28
Total	187	

Construction of homestead -Older homesteads have more established homes often built from brick and mortar or mud, toilets, kraals, sheds, traditional grain sheds, fields, forests, and boreholes. Similarly sheds and kraals are invariably made from wood. The older homesteads are located throughout the community not necessarily on the periphery like those of the new residents who are often located in the outskirts of the community closer to the main roads. Another striking feature about these new homesteads owners is the fact that they do not often possess a lot of property such as fields, forests, kraals and sheds and their homes are modern and often have toilets and bathrooms in their homes as well as outside. Yet mostly older homesteads invariably have their toilets and showers outside.

7.12 LEVEL OF EDUCATION

According to the Convention on the Elimination of All forms of Discrimination of Women (CEDAW) 2012 literacy levels in Eswatini were high amongst both male and female (above 90%). It was further noted that teenage pregnancies may affect young women's ability to stay in school and later go on to find employment (CEDAW, 2012). Despite this, Eswatini has reached equality in secondary education (GenderLinks, 2015).

The results of the SES identified that 21.39% of respondents have tertiary and vocational education, 39.58% have high school education, 31.02% have primary education and 3.07% are illiterate (**Figure 7-8**). Showing the area has a high level of education. This analysis is consistent with the national statistics of Eswatini.

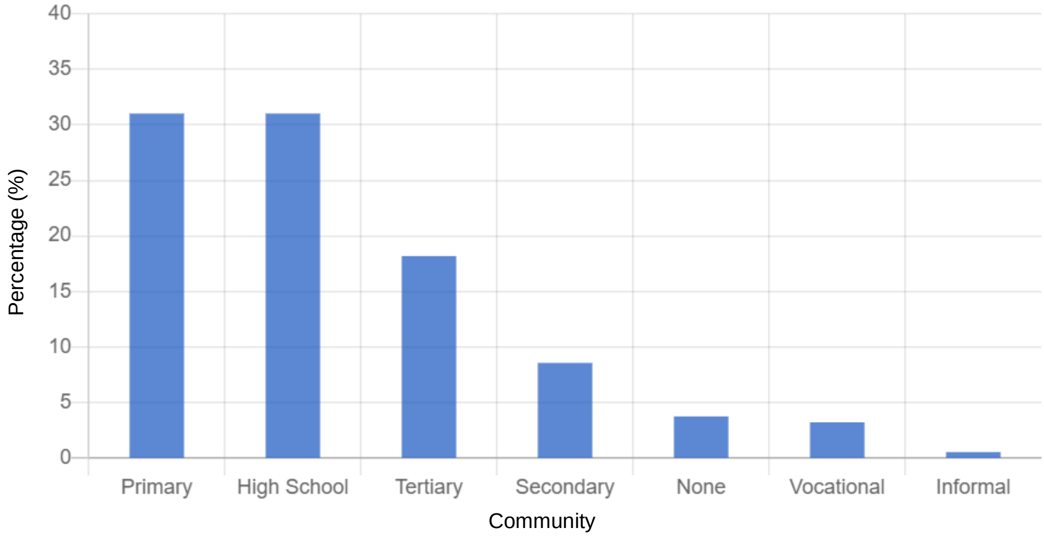

Figure 7-8: Level of education of respondents

7.13 OCCUPATION OF THE PEOPLE OF MANTABENI AND SIPHOCOSINI

Table 7-7 below outlines the type of employment of the head of household for each household surveyed.

Table 7-7: Occupation of the community members of Mantabeni and Siphocosini

TYPE OF EMPLOYMENT	ACTUAL NUMBERS	PERCENTAGES
Formal employment	70	37.43
Self Employed	22	19.25
On Farm Production (Animal and Farm Production	13	6.96
Informal Employment	8	4.28
Piece Work	10	5.35
Not in Labour Market	36	19.25
Unemployed not seeking work	18	9.63
Unemployed Seeking work in the past 3 Months	5	2.67
No response	5	2.67

It is essential to note that among the people who reside in these two communities there is a spread of careers that people are involved in. There are two members of parliament, teachers who teach in both the local primary and high school, two soldiers, Policemen, Engineers, Public Servants, Farmers and Shop Owners. It was identified during the survey that a number of persons are employed in Mbabane however moved out of the city due to the higher cost of living within the city. Choosing to reside in the more rural area where cost of living is much less.

7.14 EMPLOYMENT AND SKILLSETS

The survey results show that of the respondents between ages 18-55 comprise 65% of the respondents, of which the portion of respondents who are currently unemployed and seeking work in the past three months is 12.50%. General statistics indicate that Eswatini has a 22% unemployment rate, as such the project area is better off than the national status; however, the level of unemployment is still high.

Furthermore, 56.68% of the households indicated that no-persons within the household had any level of construction related skill set, while 34.22% indicated they were skilled and 5.88 were uncertain of this question. **Table 7-8** indicates the various skillsets, and number of persons with these skillsets within the households surveyed.

Table 7-8: Skills Available in Mantabeni and Siphocosini

SKILLS	NUMBER OF INDIVIDUALS	PERCENTAGE (%)
Bricklaying	34	18.18
Brickmaking	22	11.76
Roofing	20	10.70
Driving	14	7.49
Carpentry	11	5.88
Welding/Metal Work	9	3.74
Electrical	7	3.74
Plumbing	7	3.21
Tiling	6	2.14
Cabinet Making	4	0.53
Thatching	1	0.5
Iron Mongering	1	0.53
No skill set	51	27.3

When large infrastructure projects are about to be implemented in various places there are always high expectations from local communities regarding employment opportunities. A question was posed whether the community believe that locals would be the first to be considered for employment during the Nondvo Dam Construction, the responses varied. Out of 187 respondents 72 strongly agreed 40 somehow agreed, 23 somehow disagreed and 14 disagreed with this assertion.

The follow-up question intended to establish the possession of related skills to this proposed infrastructure project (i.e. large scale water infrastructure).

Table 7-9 below shows the various skills indicated related to water projects by members of surveyed households. Of the 187 HHs survey, a total of 19 individuals were identified to have experience in terms of water supply projects. Therefore approximately 10% of HHs potentially have requisite skills for employment with the scope of the proposed Project. Considering the total number households within the two Royal Kraals is approximately 1320, there are potentially 132 persons in the community with applicable skills to be employed. This number will certainly make a difference in terms of public perception should such a high number of local community members be employed on the project. This move would be a step in the right direction since unemployed rate amongst the youth in Eswatini in 2017 was 43.04%.

Table 7-9: Skills Related to Water Infrastructure Projects

TYPE OF SKILL	NO. OF SKILLED PEOPLE
Maintenance	6
Electrical	4
Fitting and Turning	2
Operating	1
Mechanical	1
Instrumentation	1
Driving	2
Miscellaneous	2
TOTAL	19

7.15 MONTHLY EXPENDITURE OF FAMILIES

From the data collected in the community, 6 main sources of livelihoods were identified from the household responses. The dominant income generating activities in the community ranged from business and wage employment both in the formal and informal sectors. Various descriptions of what the people in the community do for a living were identified and fell into eight categories as shown in **Table 7-7** above.

Often when people are requested to discuss or disclose their income, they either underreport or opt for non-disclosure. In this case SI-Futures decided to use broad ranges to ensure that people are not forced to disclose exact figures but are within a range. This question was often preceded by an explanation regarding the necessity of the information. Of the 187 HH, 178 responded indicating that 14 lived below E1000, 109 below E3000 while 55 stated that their monthly expenditure was more than E3000 and beyond.

One hundred and fifteen (115) respondents stated that they did not have any reliable income, on further probing it was established that some are self-employed while others are farmers engaged in agriculture and livestock farming. The fact that there are variable incomes reported could be explained by the impacts of drought in crop failure due to insufficient and scantily spread rainfall (FAO, 2013).

7.16 PROVIDERS FOR THE FAMILY UPKEEP

Often some household heads work outside the community in Mbabane, Manzini or even in South Africa in some instances. It was further established that often families are taken care of by family members working outside the community. 40 out of 175 Households respondents (i.e. 39%) indicated that certain family members provide remittance from outside their community for upkeep. Out of those who provided remittance - sons constituted 8.56%, daughters 4.81%, fathers 4.28%, mothers 3.74% and 6.95% other.

This data is consistent with the statistics provided by the Eswatini Household Income and Expenditure Survey of 2016/17 which indicated that 11.39% received money from outside the country while 42.99% received from inside the country.

7.17 MEANS OF LIVELIHOOD

Subsistence farming is the main source of staple food production and is the livelihood foundation of the rural people in Africa (Boko et al., 2007). Each of the 187 households visited during the survey had either a garden and or fields which are in operation. All 187 respondents had fruit trees such as guava, avocado pears, peaches, bananas, mulberry and other in their homesteads. Livestock the households raised included poultry, goats, sheep, pigs, and cattle.

According to the Food and Agriculture Organisation (FAO, 2015) subsistence farming in Eswatini constitutes 74% of the arable land and accounts for almost three quarters of the total employment in the kingdom with more than 70% of Eswatini’s population dependant on subsistence farming. However, agricultural activities have been deteriorating over the last two decades due to a series of droughts.

Local livelihoods are heavily dependent on crop production for household subsistence and economic survival. Crops are grown for multiple purposes, primarily household consumption (average 75%) followed by sale, and payment to others for services rendered. Some households in Mantabeni and Siphocosini communities do not engage in crop production. However, as indicated below, in majority of cases a member of these households is involved in agriculture as a worker (generally as casual labour or via a sharecropping arrangement).

Livestock production is also an important livelihood source for local households. In Eswatini smallholder farmers make up 70 percent of the population that is over 1 million people relying on subsistence farming (FAO, 2016). As such, access to, and availability of, grazing land is essential.

Majority of respondents indicated that their gardens and fields are their primary source of livelihood, as is evident in **Table 7-10**, which shows the various means of livelihood in the community. This was also supported by the fact that most of the gardens in the homesteads had signs that they were being cultivated. From the table it is evident that a significant portion of the community depend on farming activities (i.e. rely on the land) as part of their livelihood. The construction of the dam will impact negatively on the agricultural fields since most will be inundated.

Table 7-10: Means of Livelihood

TYPE OF MEANS OF LIVELIHOOD	NUMBER OF HOUSEHOLDS	PERCENTAGE (%)
Farmer	93	49.73
Vegetables and Fruit Sales	58	31.02
Formally Employed	51	27.27
Livestock Sales	31	16.58
Casual Labour	20	10.70
Pension	11	5.88
World Food Programme AID (WFP)	5	2.67
Artisan	1	0.53
Other	43	22.99

Only 5 households indicated that they are dependent on World Food Programme Aid (WFP) for livelihood support, however during the survey it was noted that there were other families that lived below the poverty line. This is not unexpected in that according to the Youth and Public Policy, 2015, 63% of the Eswatini population live on less than $1 per day. These families may be more susceptible to project associated impacts.

7.18 ECOSYSTEM SERVICES

Natural resources are collected by all households living in the area. These are used for household consumption. These resources are collected across various locations within the broader Project Area including riverbanks, grazing areas, and mountainous areas. The most important natural resources in the Project Area include wood, brush, water, sand, wild plants, reeds, useful grasses, fruits, and medicinal plants used to cure various illnesses for both humans and livestock. Some of these wild vegetables and medicinal plants only grow along the riverine areas. Wood and brush are collected and used as sources of fuel for cooking and heating in the households. Wild plants and fruit are collected for household consumption and sale to supplement household food reserves and income.

7.19 MAIN RESOURCE FOR COOKING AND LIGHTING

According to the Eswatini Household Income and Expenditure Survey 2016/17, 63.67% of households have access to electricity and 64.38% use it for lighting and 32.50% for cooking.

As indicated in **Table 7-11**, a significant portion of the households are connected to the national power grid with 78.67% of the households utilising electricity for lighting and only 11.23 % utilise candles. Notable a smaller portion of the households 44.39% use electricity for cooking while 48.66% use firewood.

Table 7-11: Source of Cooking and Lighting

RESOURCE	COOKING		LIGHTING	
	No. of HHs	%	No. of HHs	%
Firewood	91	48.66%	4	2.14%
Electricity	83	44.39%	146	78.67%
Gas	7	3.4%	2	1.07%
Solar	1	0,53%	2	1.07%
Other	1	0,53%	2	1.07%
Candles	0	0	21	11.23%

7.20 INCOME DERIVED FROM PROPERTY DEPENDED ON AVAILABILITY OF WATER

One hundred and thirteen (113) household owners stated that their vegetable gardens require water, 68 needed water for their livestock, 68 for fruit trees and 51 did not specify. One hundred and fifteen (115) respondents indicated that income from these properties vary and is unreliable. Sixteen percent (16%) indicted that annually they derived E2000 and above, and those earning between E1000-1500 were 2%, 1% earn between E500-1000. The rest of the respondents did not provide data.

7.21 SOURCE OF FRESHWATER IN THE COMMUNITIES

There are various sources of freshwater in both Mantabeni and Siphocosini. Out of 179 respondents 63 indicated that they have connection taps, 35 use public standpipes, 24 stream or river, 22 from the well, 19 hand pumped borehole, 5 traditional Hand Dug Well, 4 from Spring, 4 from Electric Pump Borehole, 2 from rainwater tanks and 2 from other sources.

Figure 7-9 below graphically indicates the percentage of fresh water sources utilised by the respondents.

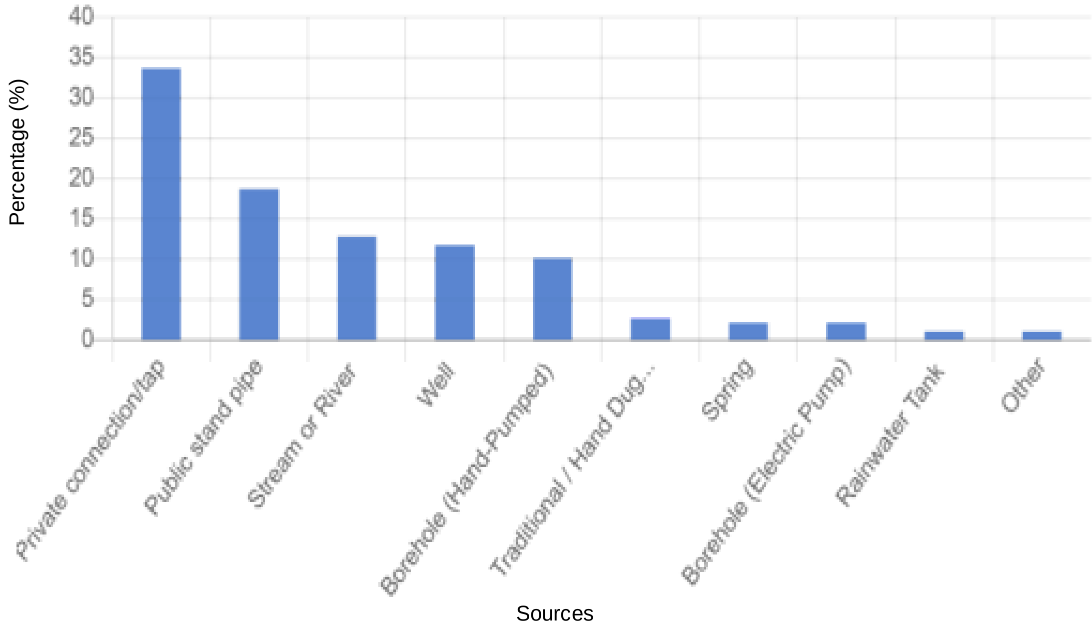

Figure 7-9: Sources of fresh water in Mantabeni and Siphocosini

Regarding the condition of water, 106 respondents were very positive stating that the water was clean even though during the winter months of June and July the volume decreased. The positive aspect of the community water is the fact that it is free, very clean and reliable. Negative aspects to the community water are that it is prone to drought and inconsistent during winter months, and lack of maintenance plan is a challenge. Water from the Lusushwana River is mainly used for irrigation and other sources are used for household activities.

The distance from the water source varies from 1-5 km with 5 km being the furthest a person would travel to get water. However, the 5 km distance is excessive, and lack of accuracy could be attributed to lack of sense of distance especially for rural people. Out of 177 respondents, 156 obtained water within 0-1 km, 8 travelled further assumption was that this often occurred during winter months (see **Table 7-12**). From the table below it is clear that in the communities of Mantabeni and Siphocosini majority of the water points are close by (i.e. within 1 km from households).

Table 7-12: Distance from the water source

DISTANCE	0-1 km	1-2 km	2-3 km	3-4 km	>5 km
Number	156	8	3	2	8

Many women still walk long distances to reach the nearest water points. Men often do not participate in the activity water collection because they are at work or involved with other activities. Unfortunately, women are often alone collecting water or wood which makes them more susceptible to danger and gender-based violence. Accessibility to water points will also benefit the other vulnerable people more for instance, people with disability, children from child-headed households as well as the elderly.

Literature has shown that in African countries where the majority of the people still live in rural areas and are still enduring the challenges related to inadequate supply of water and poor sanitation, the job of providing water and ensuring proper and hygienic sanitation still lies with women (UN Commission on Sustainable Development). Women tend to be users, providers, and managers of water (World Bank, 2002) and in Eswatini like many other countries, it is the cultural practice for women and girls to fetch water used for household purposes. This is well reflected in the SES responses. Although the respondents' argument was that this is the case because women are the ones who use more water than other family members, this is more of an engendered responsibility.

7.22 VULNERABLE GROUPS

Vulnerable groups are distinct categories of social and economically distressed people who might suffer disproportionately from the effects of displacement. These may be ethnic minority, women and child-headed households, impoverished youth, the poorest (based on the poverty line), the disabled and elderly.

When projects of this magnitude are proposed or implemented, extra vigilance is always taken in ensuring that vulnerable groups comprising people with disabilities, elderly, orphans, and people living with mental illness, female headed households and the youth are not also excluded in the survey and their rights are not jeopardised. Hence in this survey it was essential that information was gathered about the vulnerable groups and who might suffer disproportionately from the effects of displacement by the various phases of construction of Nondvo Dam.

Out of a total 182 respondents, for this particular question, 26 were reported to have disabilities. Of the 36 people with disabilities, 18 were noted to suffer from impaired mobility, 2 from blindness, 2 are mute and 4 were unspecified.

During the KIIs it was identified that the impacts of HIV/AIDS has had devastating effects in the area with several children being orphaned under the care of their aging grandparents or relatives and in some instances becoming the head of the household. The Principal of Masibekela High School also shared the negative impacts of HIV/AIDS in the community and how the school is coping with child headed households to mitigate against poverty these children are living under. Out of 469 reported orphans, 170 are high school students at Masibekela. The School Principal indicated that the school provides food care packages as well as vegetables from the school fields and gardens. 85 of these high school pupils are reportedly heads of households. 85 child-headed in a community of approximately 1320 households (approximately 6%) is a high number that will require extra vigilance and special programme that will provide mitigation measures from the overall impact of the dam. The issue of teenage pregnancy was also flagged as part of a challenge faced by grandparents raising these orphaned children.

As per the information obtained during KII the **Table 7-13** below indicates the high number of reported vulnerable persons in Mantabeni and Siphocosini communities.

Table 7-13: Vulnerable Groups within the Siphocosini and Mantabeni Royal Kraals

GROUP	ELDERLY 70YRS AND OVER	ORPHANS	CHILD HEADED HOUSEHOLDS	MENTAL HEALTH
Number	49	469	85	10

7.23 HEALTH ISSUES AND AVAILABILITY OF HEALTH FACILITIES

There is only one clinic/health facility that serves the Royal Kraals of Mantabeni and Siphocosini, which is located in Siphocosini. Respondents indicated having visited the clinic occasionally for various sicknesses. Some respondents further indicated that they have been referred to hospital in Mbabane for serious illnesses by the health facility.

The distance people travel between the community and the clinic in Siphocosini and public hospital in both Mbabane and Manzini varies (see **Table 7-14**). Respondents reported that the distance travelled was between 1 km and 20 km. It is essential to note that in Mantabeni and Siphocosini all roads are gravel and are not always maintained with no signage indicating distances. The phenomenon of stating inaccurate distances is prevalent among rural non drivers. It is therefore anticipated that those indicating distances of above 10 km to the clinic have overstated the distance as the surveyed area is located less than 10 km from the clinic. Additionally, as Mbabane is approximately 20 km from the site this misconception of distance is highlighted.

Table 7-14 Distance from Home to the Health Facility

DISTANCE	1-5 km	6 – 10 km	11- 15 km	16 – 20 km	21- 25 km
Respondents	29	26	7	17	1

7.24 HIV/AIDS AWARENESS

Eswatini like so many other Southern African Countries has also not been spared the effects of HIV/AIDS epidemic. Despite being the country with the smallest population of 1 336 933, Eswatini remains the highest with HIV prevalence in the world with devastating impacts. Twenty-six percent of adults aged 15 to 49 years are reputedly HIV-positive, with women representing 59% of those infected. Eswatini is ranked as a lower middle-income country; however, 40% of the wealth is controlled by only 10% of the population, and 69% of the population lives below the poverty line (United Nations Country Team 2009). However, over the past decade there has been great efforts to reverse the impacts through improved access to health facilities and other related HIV testing facilities and provision of free ARVs.

Conversations with the community also indicated that both the Royal Kraals of Mantabeni and Siphocosini have also suffered the devastating effects of HIV/AIDS over the years (refer to **Section 7.22** above). For instance, the high level of orphaned children left to be raised by their grandparents is testimony to the aftereffects of HIV/AIDS throughout the country.

Out of 179 respondents to the question of being aware of HIV, 172 responded positively while 7 stated that were not aware thereof. From the analysis of the survey, it was clear that extensive awareness campaigns in the community have been conducted using mediums such as radio, clinic, public gatherings, schools, pamphlets and posters, workplace, and churches. A lot of respondents acknowledged benefiting from the campaigns regarding how to avoid getting infected, knowledge about the disease, how to live with the disease and where to get ARVs.

One hundred and forty-nine (149) respondents acknowledged having tested for HIV/AIDS while 32 indicated that they had not. The question of frequency was also raised with the respondents, with 69 indicating that they had been tested in the past three months, 26 in the past 6 months, 30 in the past year and 22 in the past 2 years.

On the question of awareness of the existence of the HIV/AIDS support group, out of 180 respondents only 63 were aware (less than half). Out of 63 respondents 60 stated that they were satisfied with the services offered by the support groups. In general, a conclusion can be drawn that the Government of Eswatini has fared well in their efforts to curb new infections and destigmatising HIV/AIDS.

7.25 COMMUNITY EXPECTATIONS RELATING TO THE DAM CONSTRUCTION

The residents expressed varying expectations regarding the proposed Nondvo Dam Construction. The responses fell into the following categories:

- Water quality improvement;
- Piped water to each Household in the community;
- Easy Access as roads, bridges and foot bridges will be built by the Project;
- Job Creation and employment;
- Improved Transportation; and
- Drilled Boreholes for Agriculture.

Views and expectations of the community varied significantly. 116 People responded to this question, 34 people expected nothing from the dam construction, 25 expected more jobs would be realised, 19 hoped they would get clean reliable water, 15 expected development and 8 were disillusioned. These disillusioned residents stated that they have first-hand information of what happened to PAPs of Luphohlo Dam regarding non-payment of compensation and lack of development in the area.

There were categorical in stating that their wish was that the Nondvo Dam project would not succeed because they believe it would impoverish and disadvantage people of Mantabeni and Siphocosini.

During discussions where these aspects were raised, the consultants attempted to raise expectations in detailing the scope of the project and that the water obtained from the dam is to be distributed to the Mbabane and Manzini area. Additionally, that the project was still at the feasibility stage and that at this stage there can be no guarantee that the project will go ahead.

7.26 NEGATIVE LEGACY ASSOCIATED WITH THE LUPHOHLO DAM CONSTRUCTION

As indicated above during the SES several people expressed their displeasure about the proposed Nondvo Dam construction. They indicated that when Luphohlo Dam was built, displaced people were never compensated and the promised infrastructure in terms of the roads and replacement housing were never implemented.

It is therefore essential that lessons learned from the Luphohlo Dam construction are heeded to mitigate against this negative legacy spilling into the Nondvo Dam project.

The following are some of the interventions that are to be considered and implemented by the project implementer:

- Adhere to the prescripts of national legislation as well as AfDB requirements.
- Transparency in communication with all PAPs and other stakeholders.
- Resettlement and compensation process to be undertaken effectively, by competent specialists, and the valuation and compensation process is to be based on market related rates.
- A clear communication strategy to be developed for Nondvo Dam Project. Any negative perception must be addressed timeously to avoid reputational risk.

8 PHYSICALLY AND ECONOMICALLY DISPLACED HOUSEHOLDS

A total of 175 PAPs[2] have been identified within the project area that will require either physical or economic displacement, or a combination thereof, because of the Nondvo Dam and reservoir. **Table 8-1** indicates the number of PAPs by community, number of households, and assets recorded in the detailed census undertaken as part of the RAP process. Of the 175 PAPs, 51 are located within Siphocosini with a total of 138 assets recorded, and 122 are in Mantabeni with a total of 808 assets recorded. Included in the 175 PAPs are two schools with a total of 45 identified assets.

Table 8-1: PAPs Compensation entitlement per affected communities

ROYAL KRAAL	COMMUNITY	NUMBER OF HH	NUMBER OF ASSETS
Mantabeni	Mahlatsini	6	49
	Mahothoza	1	19
	Majadvule	27	144
	Masibekela	3	4
	Mhlane	83	562
	Nkhube	1	17
	Spete	1	13
	Subtotal	**122**	**808**
Siphocosini	Mhlane	4	18
	Ncabaneni	18	33
	Sithobela	4	13
	Spete	25	74
	Subtotal	**51**	**138**
Schools	All	2	45
Total		**175**	**991**

Furthermore, based on desktop survey, the provisional railway realignment will affect approximately 21 PAPs with 125 assets; and the provisional MR19 road realignment is anticipated, to affect approximately 39 PAPs and 163 identified assets. With an average household size of 7.1 persons the Nondvo Dam and reservoir is anticipated to impact approximately 1240 residents and the road and railway realignments works an additional 426 residents, due to either physical or economic displacement or a combination thereof.

Further details regarding the resettlement and compensation process are provided in the RAP, issued as a separate standalone report, detailing the actions required to facilitate effective compensation and livelihood restoration as defined with a Livelihood Restoration Plan (LPR).

[2] PAPs refers to households with dwellings, households with assets, businesses as well as schools located within the project footprint that will require resettlement or compensation because of the project.

9 ASSESSMENT OF IMPACTS

9.1 IMPACT ASSESSMENT METHODOLOGY

The ESIA utilises a methodological framework developed by WSP to meet the combined requirements of international best practice and the relevant EIA Regulations. The determination and assessment of impacts is based on the following criteria:

- Nature of the Impact;
- Significance of the Impact;
- Consequence of the Impact;
- Extent of the impact;
- Duration of the Impact;
- Probability if the impact;
- Degree to which the impact:
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be avoided, managed, or mitigated.

Following international best practice, additional criteria have been included to determine the significant effects. These include the consideration of the following:

- Magnitude: to what extent environmental resources are going to be affected;
- Sensitivity of the resource or receptor (rated as high, medium, and low) by considering the importance of the receiving environment (international, national, regional, district and local), rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor); and
- Severity of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering inter alia magnitude, duration, intensity, likelihood, frequency, and reversibility of the change.

It is noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance will be assessed with and without mitigation measures in place. Impacts are assessed in terms of the following criteria:

a) The **nature**; a description of what causes the effect, what will be affected and how it will be affected (see **Table 9-1**).

Table 9-1: Nature or Type of Impact

NATURE OR TYPE OF IMPACT	DEFINITION
Beneficial / Positive (+)	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative (-)	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of Project).

NATURE OR TYPE OF IMPACT	DEFINITION
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).
Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

b) The physical extent (see **Table 9-2**).

Table 9-2: Physical Extent Rating of Impact

SCORE	DESCRIPTION
1	the impact will be limited to the site;
2	the impact will be limited to the local area;
3	the impact will be limited to the region;
4	the impact will be national; or
5	the impact will be international;

c) The duration **(see Table 9-3)**, wherein it is indicated whether the lifetime of the impact will be:

Table 9-3: Duration Rating of Impact

SCORE	DESCRIPTION
1	of a very short duration (0 to 1 years)
2	of a short duration (2 to 5 years)
3	medium term (5–15 years)
4	long term (> 15 years)
5	Permanent

d) Reversibility: An impact is either reversible or irreversible. The level of reversibility is the ability of an environmental receptor to rehabilitate or restore itself after the activity has caused environmental change (i.e. how long before impacts on receptors cease to be evident) (see **Table 9-4**).

Table 9-4: Reversibility of an Impact

SCORE	DESCRIPTION
1	The impact is immediately reversible.
3	The impact is reversible within 2 years after the cause or stress is removed; or
5	The activity will lead to an impact that is in all practical terms permanent.

e) The magnitude of impact on ecological processes, quantified on a scale from 0-5, where a score is assigned (see **Table 9-5**).

Table 9-5: Magnitude Rating of Impact

SCORE	DESCRIPTION
0	small and will have no effect on the environment.
1	minor and will not result in an impact on processes.
2	low and will cause a slight impact on processes.
3	moderate and will result in processes continuing but in a modified way.
4	high (processes are altered to the extent that they temporarily cease).
5	very high and results in complete destruction of patterns and permanent cessation of processes.

f) The probability of occurrence, which describes the likelihood of the impact actually occurring (see **Table 9-6**). Probability is estimated on a scale where:

Table 9-6: Probability Rating of Impact

SCORE	DESCRIPTION
1	very improbable (probably will not happen).
2	improbable (some possibility, but low likelihood).
3	probable (distinct possibility).
4	highly probable (most likely).
5	definite (impact will occur regardless of any prevention measures).

g) The significance, which is determined through a synthesis of the characteristics described above (refer formula below) can be assessed as low, medium or high;

h) The status, which is described as either positive, negative or neutral;

i) The degree to which the impact can be reversed;

j) The degree to which the impact may cause irreplaceable loss of resources; and

k) The degree to which the impact can be mitigated.

The significance is determined by combining the above criteria in the following formula:

$$Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$$

$$[S = (E + D + R + M) \times P]$$

Where the symbols are as follows:

SYMBOL	CRITERIA	DESCRIPTION
S	Significance Weighting	Refer to Table 9-7: Significance Weightings of an Impact
E	Extent	Refer to Table 9-2: Physical Extent Rating of Impact
D	Duration	Refer to Table 9-3: Duration Rating of Impact
R	Reversibility	Refer to Table 9-4: Reversibility of an Impact
M	Magnitude	Refer to Table 9-5: Magnitude Rating of Impact
P	Probability	Refer to Table 9-6: Probability Rating of Impact

The significance score can therefore range from 3 (minimum) to 100 (Maximum). The significance weightings are defined as Low, Medium, and High, as such the scoring system has been allocated accordingly to define the significance weighting, as identified in **Table 9-7**.

Table 9-7: Significance Weightings of an Impact

OVERALL SCORE	SIGNIFICANCE RATING (NEGATIVE)	SIGNIFICANCE RATING (POSITIVE)	DESCRIPTION
≤ 30 points	Low	Low	where this impact would not have a direct influence on the decision to develop in the area
31 - 60 points	Medium	Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated
≥ 61 points	High	High	where the impact must have an influence on the decision process to develop in the area

The impact significance without mitigation measures have been assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact, and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures, and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in the ESIA.

9.2 CONSTRUCTION AND INUNDATION PHASE IMPACTS

9.2.1 IMPACT OF PHYSICAL DISPLACEMENT AND RESETTLEMENT

9.2.1.1 *Description of Impact*

Physical displacement is generally defined as the relocation or loss of shelter and other household structures, and/ or restrictions on land use. Based on the feasibility designs of the Project, at least 175[3] PAPs fall within the project footprint and will therefore require relocation of compensation (i.e. physical or economic displacement). The properties fall either within the construction footprint of the dam, or associated infrastructure, or within the inundation area of the reservoir.

Of the affected PAPs at total of 102 require a combination of physical and economic displacement. These comprise 99 households (including dwellings, outbuildings, agricultural fields, and other assets), 1 church, 2 schools, 1 formal business (shop) and 4 informal shops (Spaza shops).

9.2.1.2 *Sensitivity of Receptors*

The communities in the area are heavily dependent on agriculture, namely farming of livestock and crop production, as a source of livelihood. There are vulnerable people in the local communities who by virtue of their gender, age, physical or mental disability, economic disadvantage or social status would be more adversely affected by the Project. Furthermore, they may be limited in their ability to take advantage of the Project's development benefits and deal with the negative consequences. Vulnerable people require special attention and consultation, these include HIV/AIDS affected people and households; people co-infected by HIV/AIDS and tuberculosis (TB); child-headed households; people with mental health illnesses; people with physical disabilities; elderly; children and orphans.

[3] Details regarding the number of PAPs and associated assets, locations and budget costs, are defined within the RAP.

Based on the above, households affected by physical displacement are considered to have High sensitivity to this impact.

9.2.1.3 *Assessment of Impact*

The impact of physical displacement of households will be direct, negative and localised in nature and will be permanent, including where the Site Camps and Offices will be located as these are to be handed over to the community once they are no longer required by the project proponents. The magnitude of the unmitigated impact will be *Large* given the high number of affected households, the extent of the disruption, and likely stress to the affected families in the long-term. The fact that currently no host families have been identified adds to the stress and anxiety families experience regarding lack of information. As indicated in **Table 9-8**, the significance of this impact (pre-mitigation) is therefore anticipated to be a **High (negative)**.

Table 9-8: Impact of Physical Displacement of Households (Pre-Mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Physical Displacement and Resettlement of Affected Households	The Project will result in physical displacement and relocation of approximately 175 households and the loss of over 991 assets in Mantabeni and Siphocosini.	5	4	5	5	5	**95**
		N3 - High					

9.2.1.4 *Mitigation Measures*

In accordance with the mitigation hierarchy, the Project planning has aimed to minimise displacement as far as possible, in the knowledge that resettlement is a highly significant social impact for affected families (as well as the potential of delaying implementation of the Project and increasing costs).

Apart from replacing houses and compensating for other assets affected by the Nondvo Dam Project, it is recommended that affected households must be included in the development and implementation of alternative livelihood strategies in accordance with World Bank Safeguard policy and International Best Practice Standards.

DWA (and the DNRE) will ensure that:

- **Resettlement Planning and Implementation** that will form part of a separate contract is compliant with all provisions of the AfDB and Good International Industry Practice (GIIP).
- **Socio-economic Census** of affected persons, assets and other entities to establish an accurate socio-economic profile that can be used as the basis for future monitoring.
- **Mitigation for other community impacts:** Implement the recommendations/ measures that will be proposed in the RAP and LRP to ensure that households retain access to social services, community infrastructure and resources where the Nondvo Dam Project results in severed access.
- **Resettlement Implementation** (to be done by DWA with support of a specialist RAP consultant), shall include:
  - Signing of compensation agreements with affected communities;
  - Payment of compensation; and
  - Implementation and management of the resettlement programme including preparation of relocation sites; construction of replacement housing and amenities/services; physical relocation of households and their belongings; and relocation of graves and other social mitigation.

Additional aspects that shall be considered as part of the RAP contract include:

- The socio-economic census shall outline multiple providers of income and include a gender analysis as a basis for facilitating different opportunities for employment of women;
- Criteria set for the socio-economic census for determining vulnerability of households shall ensure that vulnerable groups (poor, elderly, disabled) are included;
- Compensation and other necessary assistance shall be provided before impacts of the Project occur;
- Arrangements and resources for resettlement shall be adequate and assigned;
- The resettlement timetable shall be linked to the phasing of Project implementation;
- Physical and economic assistance to households will be provided during relocation;
- Households requiring relocation shall be properly briefed on the advantages and disadvantages of different housing types to make informed decisions;
- Replacement housing structures shall be built to Eswatini's building and safety standards;
- Grievance procedures shall be prepared and implemented; and
- A Monitoring and Evaluation Plan for resettlement shall be prepared and implemented, and mid-term and long-term Monitoring and Evaluation audits conducted.

9.2.1.5 *Residual Impact*

Implementation of the RAP as stipulated under the mitigation measures above is predicted to reduce the magnitude to *Medium* and probability. Over time, as households adapt to the new location, the residual impact significance should reduce to one of **Medium (negative)** significance, and possibly even lower in some cases (see **Table 9-9**). This is difficult to predict given that relocation terms and details are still to be defined and agreed, these will differ by household and each household will respond differently to the final relocation. As such, monitoring must extend for a suitable period into operation to ensure that the quality of life of displaced persons is equal to or better than prior to displacement.

Table 9-9: Impact of Physical Displacement of Households (Post-Mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Physical Displacement and Resettlement of Affected Households	The Project will result in physical displacement and relocation of approximately 175 households and the loss of over 991 assets in Mantabeni and Siphocosini.	3	4	3	5	4	**60**
		N2 - Medium					

** Note: The residual rating is based on a precautionary judgement that considers the disruption and stress caused to affected households who have to relocate and the uncertainty as to how different households will respond to this. Households will have differing residual rating depending on their final resettlement terms. Some households may respond positively while others may adapt with difficulty.

9.2.2 ECONOMIC DISPLACEMENT

9.2.2.1 *Description of Impact*

Economic displacement refers to the loss of assets or access to assets that leads to loss of income sources or other means of livelihood. In this case, the construction and inundation of the Nondvo Dam will result in the loss of access to agricultural land, grazing land and natural resources.

Of the 175 identified PAPs a total of 73 PAPs have been identified[4] that will require compensation for the direct loss of assets (i.e. economic displacement). Land users engaged in crop cultivation and livestock farming will experience economic displacement, affecting their ability to produce food and cash crops/ produce. Given the shortage of arable land in the area, it is expected that this loss of land will have a significant impact on food security, household income and livelihoods for the affected families. This will be further aggravated for those who face displacement relating to loss of, or loss of access to, natural resources (e.g. medicinal plants, grasses, tress providing ecosystem services such as traditional medicines and sources of fuel), impacting subsistence livelihoods and traditional household structures.

This impact will be experienced directly as a result of a combination of: i) lost access to these land-based livelihoods and resources from which the majority of the population in the Nondvo Dam Project area derive an income; ii) increased competition for land by displaced people and migrants moving into the area (e.g. work-seekers); iii) lack of alternatives; and iv) increased time and cost due to extended traveling distances to and from areas where resources are still available as well as impeded access.

The main economic activities that will be affected by the Nondvo Dam Project are discussed below.

- Loss of Access to Agricultural Land

  A large portion of the productive agricultural land in the area is located in the proposed inundation area, as these fall within the existing floodplain. Given the existing scarcity of arable land within Mantabeni and Siphocosini and Eswatini at large, there is a high likelihood that affected people may not be provided with land for the loss of their fields.
- Loss of Access to Grazing Land

  The Nondvo Dam Project will result in a loss of access to grazing areas, specifically resulting from inundation. All directly affected grazing will be permanently lost and affected people will be expected to find alternate grazing, thus placing an additional strain on existing grazing resources beyond the Nondvo Dam Project footprint.
- Loss of Access to Natural Resources

  Project activities which will impact access to natural resources include:
  - Vegetation clearance during construction;
  - Establishment of temporary and permanent infrastructure
  - Inundation;
  - Establishment of new settlements, grazing and agricultural fields; and
  - Increased population due to in-migration of work and business-seekers.

  The loss of access to natural resources may be exacerbated by the generally degraded vegetation in the Nondvo Dam Project Area and increased competition for the remaining natural resources by both local people and in-migrants.

9.2.2.2 *Sensitivity of Receptors*

The Mantabeni and Siphocosini communities are highly reliant on agricultural activities (i.e. crop production and livestock) for their livelihoods. The affected households are classed as having *High* sensitivity to economic displacement from land take requirements for the Project. The receptors that will be most sensitive to the impact include the direct owners of affected agricultural fields, livestock owners, those that practice sharecropping, agricultural labourers, and the affected households with vulnerable persons. Users of natural resources will also be sensitive

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[4] The RAP will identify the exact impacts, the individual households and customary areas (and users) that will be affected.

to the loss of resources; however, many of these resources will be available elsewhere, albeit slightly further away and perhaps at a cost to them for transportation.

9.2.2.3 *Assessment of Impact*

The impact of economic displacement will be direct and negative in nature. The impact will be localised and experienced by the PAPs who will lose access to agricultural land (cultivated and grazing), and natural resources. Economic displacement impacts will occur during the construction and inundation phases of the project and in most instances will be permanent in nature. The impact magnitude will be *Large* owing to the significant reliance of the affected people on these livelihood activities, lack of skills and experience to undertake alternate employment, and a lack of alternate work opportunities. As indicated in **Table 9-10** the impact is therefore anticipated to be of a **High (negative)** significance pre-mitigation.

Table 9-10: Impact of Economic Displacement (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Economic Displacement of Affected Households	Loss of access to agricultural land for crop cultivation and livestock grazing, as well as natural resources will affect people's ability to produce food and cash crops/ produce.	4	3	3	4	5	**70**
		N3 - High					

9.2.2.4 *Mitigation Measures*

As per mitigation measures specified above (refer to 9.2.1.4).

Additional mitigation measures include:

- A separate Livelihood Restoration Plan (LRP) must be developed to address economic displacement.
- DWA will collaborate with relevant authorities and organisations to initiate and develop projects that aim to enhance agricultural production amongst the population of the Nondvo Dam Project Area. These must address the application of more effective farming methods, approaches to increase crop yields, introduction of drought resistance crops and mechanisms to assist farmers in selling their produce at the highest possible prices.

9.2.2.5 *Residual Impact*

Implementation of the measures described above is predicted to result in a reduction of the magnitude of the impact to *Medium* and the probability therefore. The impact significance could potentially be reduced to a **Medium (negative)** significance (see **Table 9-11**). The impact could further reduce over time once the affected households have adapted to the changes that will be brought on by the Project and the various livelihood restoration projects are underway.

Table 9-11: Impact of Economic Displacement (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Economic Displacement of Affected Households	Loss of access to agricultural land for crop cultivation and livestock grazing, as well as natural resources will affect people's ability to produce food and cash crops/ produce.	3	2	3	4	4	**48**
		N2 - Medium					

It is difficult to assess the residual rating given that the details of compensation are not known and the ability to replace livelihoods is dependent on many variable factors, including the willingness/ interest/ ability of the affected people to adopt new livelihood strategies.

9.2.3 HOST COMMUNITY IMPACTS

9.2.3.1 *Description of Impact*

Several potential impacts may result from the resettlement of PAPs within identified host communities, these include:

- Increased pressure on infrastructure / social services;
- Increased competition for land;
- increases demand for goods and services; and
- Conflict between resettled PAPs and host community members;

The appearance of resettled people into the community increases demand for goods and services. While this generally increases the trade of small business operators (which is usually positive), it also increases demand on public services, which may not be able to cope with the additional demand. This may result in increased congestion or delays in being able to access services. There may even be shortages of key requirements, water, electricity, fuel etc. The increased demand in the economy may potentially lead to local inflation.

Additionally, there may be resentment between the host community and the resettled households, especially if the host community feels that the resettled people are being given special treatment, like modern houses, preferential access to jobs or other benefits that are not available to them. In some cases, this resentment may result in a degree of unpleasantness displayed towards the resettled people, with the relocated people being made to feel that they are not welcome. In severe cases there can be hostility or violence between the host community and resettled people.

9.2.3.2 *Sensitivity of Receptors*

The host communities are located within the existing Royal Kraal or in the immediately surrounding areas, thereby retaining a close connection to the existing communities. Sensitivity is considered to be Medium.

9.2.3.3 *Assessment of Impact*

Increased pressure on land, goods and services and infrastructure will result in direct negative impacts on the community. The impact is anticipated to be of a moderate magnitude and long term. Combined with a low possibility results in an impact of **Medium** (negative) significance (**Table 9-12**).

Table 9-12: Host community Impacts (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Host community impacts	Introduction of the relocated PAPs into the host community will result in increased pressure on land, infrastructure, goods, and services. In severe cases these may result in conflict.	3	2	3	4	4	**48**
		N2 - Medium					

9.2.3.4 *Mitigation Measures*

- Engagement with host communities to be undertaken early in the resettlement planning process.
- Preliminary engagement with host communities should be undertaken with caution so as not to raise expectations or unfounded concerns about possible settlement of newcomers.
- Share information transparently and regularly with the host communities throughout the land-acquisition planning and implementation process.
- Facilitate coordination and interaction between host communities and resettles to determine how and when newcomers will be incorporated in to local social and organisational structures.

– The Project should consider the provision of infrastructure and facilities to serve the resettled and the host community so that the host community will also benefit. Implementation of a community development project that would benefit both displaced households and the host community is good practice that will help to build and maintain a sustainable social licence to operate.

9.2.3.5 *Residual Impact*

Implementation of the above mitigation measures will serve to reduce the probability, resulting in a residual impact of **Low** (negative) significance (Table 9-13).

Table 9-13: Host community impacts (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased safety risks to people and animals	Introduction of the relocated PAPs into the host community will result in increased pressure on land, infrastructure, goods, and services. In severe cases these may result in conflict.	3	2	3	4	2	**24**
		N1 - Low					

9.2.4 IMPACT OF SITE CLEARANCE / INUNDATION OF PLANTS USED BY COMMUNITIES (ECOSYSTEM SERVICES)

9.2.4.1 *Description of Impact*

This impact will involve the clearance of vegetation and topsoil in the dam wall and auxiliary works infrastructure footprint, quarry, and site camps / offices. Combined these areas effectively form a small portion of the project area. However, the inundation of the Nondvo Dam will result in the flooding of and area approximately 2.4 km^2 in extent. This will be a direct impact that will result in a loss of grassland and rocky outcrop habitats containing important plant resources that are used by the communities.

9.2.4.2 *Sensitivity of Receptors*

Majority of the plant species used by local communities for food, medicinal or spiritual purposes are located within the rocky outcrop / grassland mosaic habitats that are prevalent throughout the Project Area. While this vegetation mosaic has been heavily overgrazed within the development footprint and has moderate to low biodiversity value, a number of useful plant species were identified within the general vicinity of the infrastructure footprints. Given the high reliance of local communities on a wide range of useful plants, although they appear to be widespread and common within the Project Area, their sensitivity to site clearance is assigned as *Medium*.

9.2.4.3 *Assessment of Impact*

The impact of site clearance on important plant resources will be a direct, negative, long term to permanent impact that will definitely take place. However, the extent of the impact will be relatively small (limited to the impact footprint), and the vegetation type is ecologically degraded, resulting in an impact magnitude of *Medium*. As indicated in **Table 9-14**, prior to the implementation of any mitigation measures, the significance of this impact on important plant resources is anticipated to be of a **High (negative)** significance.

Table 9-14: Impact of Site Clearance on Plants used by Surrounding Communities (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Loss of plant resources used by the community	Loss of vegetation will result from site clearance in the infrastructure footprint during construction as well as due to flooding during inundation of reservoir area.	3	3	5	5	4	**64**
		N3 - High					

9.2.4.4 *Mitigation Measures*

The following measures are recommended as mitigation for the impact of site clearance / inundation of important plant resources:

- Populations of plants considered to be important to local communities are to be identified within the construction and inundation areas through discussions with traditional medicinal practitioners;
- Local traditional medicine practitioners and members of local communities are to be allowed and encouraged to harvest plant resources within the infrastructure footprint prior to site clearance;
- Local communities are to be given support to harvest and stockpile firewood and other plant resources from the entire inundation zone prior to inundation;
- Local communities are to be supported to start plant nurseries/ community gardens to propagate and grow useful plant resources especially medicinal plants; and

9.2.4.5 *Residual Impact*

Implementation of the measures described above and, in the Construction EMP, will reduce the magnitude of the impact to *Small* and the impact significance to **Low** (see **Table 9-15)**.

Table 9-15: Impact of Site Clearance on Plants used by Surrounding Communities (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Loss of plant resources used by the community	Loss of vegetation will result from site clearance in the infrastructure footprint during construction as well as due to flooding during inundation of reservoir area.	2	2	3	3	2	**20**
		N1 - Low					

9.2.5 CREATION OF EMPLOYMENT, PROCUREMENT AND LOCAL BUSINESS OPPORTUNITIES

9.2.5.1 *Description of Impact*

Employment (formal and informal) and other income generation opportunities in the Nondvo Dam Project Area and the surrounding area are very scarce, specifically for those with no or low levels of education. The majority of the local population are involved in subsistence agricultural activities (i.e. crop and livestock production) as their primary livelihood strategy. There are some small enterprises providing basic services throughout the Project Area, these include selling fresh and processed foods, basic groceries, alcohol, etc. These businesses are predominantly located along the Mhlambanyatsi Road (MR19).

As indicated in the results of the SES, there is a potential that 10% of the community (approximately 130 people) may have the requisite skill sets for employment on the project (i.e. large scale water infrastructure). This excludes the potential for unskilled employment, of which there is a larger labour pool within the community that could fulfil these roles.

In addition to direct employment opportunities, many indirect and induced employment opportunities will potentially be created within the supply chain (indirect), to meet the needs of the migrant work-seekers and the Project workers who will have increased levels of disposable income.

In terms of procurement of goods and services the Project Area has limited established businesses. Majority of the local businesses are micro- and small-scale enterprises that deliver goods and services required by the local population.

9.2.5.2 *Sensitivity of Receptors*

The sensitivity of the communities in the Project area is considered Medium, given the fact that the construction activities will require specialised goods and services, on a large scale, which does not exist within the community. Given the lack of established businesses it is unlikely that members of the community / surrounding area will not be able to secure procurement contracts. However, despite low levels of disposable income, people have already demonstrated that they can and will respond to the increased demand for goods and services; this will result in the formation of small and micro-enterprises.

9.2.5.3 *Assessment of Impact*

Employment will be experienced as a direct, indirect, and induced *positive* impact as it relates to the Project, the associated supply chain, and the potential increased size of the population due to in-migration. The impact will be short-term as the construction phase is proposed to be undertaken over a 36 month period. However, the workers, and businesses, may obtain requisite skills/ experience for the long-term.

The magnitude of the impact as it relates to all employment and procurement opportunities is expected to be *Medium* for local people who will be able to secure jobs with the Project and establish small businesses to cater for the needs of project workers or smaller service requirements. Therefore, as shown in **Table 9-16**, the significance of the impact in all phases is rated as **Medium (positive)**.

Table 9-16: Impact of Related to Creation of Employment, Procurement and Local Business Opportunities (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Creation of Employment, Procurement and Local Business Opportunities	Generation of employment (formal and informal) and other income generation opportunities in the Nondvo Dam Project area and the surrounding area.	3	3	3	2	3	**33**
		P2 - Medium					

9.2.5.4 *Mitigation / Enhanced measures*

- Appropriate training and capacity building opportunities must be provided to all workers. Opportunities for rehiring into more skilled positions is to be considered and applied where feasible;
- Recruitment for new positions to be undertaken through liaison with local community structures to identify local labour pool.
- Skills audits are to be undertaken well before the construction begins to assist labour recruitment in the area. Where possible training is to be provided to upskill local youth where there are skills shortages.
- Local labour must be used as much as possible.

Recommended mitigation measures include:

- DWA, Inner Council and EPC Contractor could form a Nondvo Dam Labour Recruitment Committee. This committee would be responsible to establish the criteria for employment of both locals and outside work seekers. These criteria will be guided by the laws of the lands to ensure fairness and transparency.
- A database of work seekers is to be developed and shared with the contractors.
- The contractor must also discuss with the Nondvo Dam Labour Recruitment Committee other jobs for which in house training could be provided. This strategy will ensure that a large pool of people are afforded opportunities to participate in the employment sector.

9.2.5.5 *Residual Impact*

Implementation of the above-mentioned enhancement measures will increase the probability of the impact however the residual impact will remain **Medium** positive significance for the population of the local area (see **Table 9-17**).

Table 9-17: Impact of Related to Creation of Employment, Procurement and Local Business Opportunities (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Creation of Employment, Procurement and Local Business Opportunities	Generation of employment (formal and informal) and other income generation opportunities in the Nondvo Dam Project area and the surrounding area.	4	3	3	2	4	**48**
		P2 - Medium					

9.2.6 INCREASED COST OF LIVING AND DEBT GENERATION

9.2.6.1 *Description of Impact*

Most people living in the Project Area are self-employed. They mostly rely on remittances from family members, government grants and *ad hoc* income earned from selling of agricultural produce and harvesting of natural resources. Increased demand for goods and services is likely to result in increased prices.

Households living in the area currently do not pay for their land or housing other than where maintenance or expansions are required. Even then, locally available materials are largely used for construction purposes. The prices of food and basic household goods are most likely to increase and have the most prominent negative effect on the cost of living for residents. Additionally, increased travelling distance around the reservoir will increase the cost of travel to reach important public services such as clinics, trading posts, schools, and places of worship.

Simultaneously, however, local people will be able to sell their goods / services at higher prices, thus potentially generating more income. Some business people in the area are concerned that during the construction phase, customers will want to purchase goods on credit and may then leave without settling their debt to the service providers.

9.2.6.2 *Sensitivity of Receptors*

Levels of income are low, and the economy is largely subsistence based. As such, local people will be sensitive to price increases, especially if they are not able to increase their income simultaneously. However, the majority of people already rely on their subsistence crops for most of the year. Since many community members indicated they are positive about the potential new opportunities to sell goods and services and claim to be aware of the potentially negative consequences of the Project on the local economy, the sensitivity of the majority of households to price increases is therefore rated *Medium*. Households who are able to respond to demands for goods and services, and benefit through increased income generation, will be far less sensitive (*Low*) to this impact. People living in the most isolated communities are likely to be the most sensitive as access to the area increases resulting in increased demand and rising costs.

9.2.6.3 *Assessment of the Impact*

This impact will be indirect and negative for most people, primarily for the residents in the most isolated locations. The Project's need for goods and services and the related demand from work-seekers will have an indirect effect on supply and demand, and prices of goods and services. The extent will be local, and the duration will be short-term as related to the construction phase. As Project workers leave the area, incomes reduce and migrants begin moving away, prices may decrease slightly. However, the area will be more accessible and is likely to attract visitors and business people, thus prices will likely remain elevated (levels are not known and difficult to predict).

Based on the large scale of the Project and the potential for in-migration (workers and work-seekers), the magnitude of this impact is expected to be *High*. The impact significance is assessed to be of **Medium** significance for most households (**Table 9-18**).

Table 9-18: Increased Cost of Living and Debt Generation (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased Cost of Living and Debt Generation	Increased demand for goods and services is likely to result in increased prices. Simultaneously, however, local people will be able to sell their goods / services at higher prices, thus potentially generating more income. Increased travelling distance around the reservoir will increase the cost of travel around the dam to reach important public services such as clinics, trading posts, schools and places of worship.	4	3	5	3	4	**60**
		N2 - Medium					

The response to the impact will vary, thus the significance of the impact will be variable.

9.2.6.4 *Mitigation Measures*

The following measures are recommended as mitigation for the impact:

- Identify and implement social development projects as a means of delivering socio-economic benefits to assist in combatting some of the challenge's households may experience.
- Individuals employed on the project are to be encouraged to market newly acquired skills from the construction phase to be applied in similar water construction projects.
- Local retailers are to be encouraged to provide necessary construction materials and other services.
- Women and youth are to be encouraged to form cooperatives that will take advantage of the construction period in supplying needed services during and after construction.
- Provision of vehicular bridge / crossing on the northern extent of the dam and use of the dam wall to serve as public crossing.

9.2.6.5 *Residual Impact*

Implementation of the above-mentioned measures would serve to reduce the magnitude and probability of negative impacts, lowering the anticipated impact to a **Low (**negative) significance (**Table 9-19**).

Table 9-19: Increased Cost of Living and Debt Generation (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased Cost of Living and Debt Generation	Increased demand for goods and services is likely to result in increased prices. Simultaneously, however, local people will be able to sell their goods / services at higher prices, thus potentially generating more income. Increased travelling distance around the reservoir will increase the cost of travel around the dam to reach important public services such as clinics, trading posts, schools and places of worship.	2	2	1	2	3	**21**
		N1 - Low					

9.2.7 DISTURBANCE FROM INCREASED NUISANCE FACTORS (NOISE, DUST, VIBRATION)

9.2.7.1 *Description of Impact*

Mantabeni and Siphocosini are familiar with traffic, especially those that reside along the main roads in the communities and the MR19. People still walk distances to catch taxis or buses when going to the town major centres such as Mbabane. However, majority of the Project Area remains quiet and peaceful due to the lack of vehicle ownership within the community and rural nature of the area.

The air quality in the area is generally good with the main pollutants arising from localised (community-level) combustion of solid fuels (shrubs for cooking and heating, and burning of crop residue and household waste, as well as a low level of dust generated from traffic on unpaved roads and vehicle emissions. Wind-blown dust and some smoke from burning grassland occurs in the drier months.

Construction activities will generate uncharacteristic disturbances resulting in a range of nuisance factors (notably increased levels of noise and decreased air quality). Air, noise and vibration disturbances will occur on commencement of Project advance works with site clearing, blasting in quarry area, access road construction, establishment of site camps and offices, and stockpiling of rock.

These nuisance factors will continue to varying levels and across the Project Area for the duration of the construction phase (estimated at 36 months). The advance works will predominantly affect Mhlane community due to its proximity to the site establishment areas. Construction of the dam and ongoing activities at the camps, works areas and quarry, will create disturbances that will largely affect Mhlane and Spete1, due to their proximity to these activities. Disturbances related to traffic noise and dust generation will affect the communities located along the transport routes. The extent of these disturbances is anticipated to vary substantially on a daily basis, depending on the type and schedule of activities and the prevailing weather.

The number of construction contractors and staffing for each contract is not yet known. Construction activities will be undertaken during normal working ours, however in exceptional circumstances, such as during concrete pouring which cannot be stopped once commenced, work outside of these hours will be required. Where construction activities are required to take place outside of normal working, the Contractor is to provide sufficient notification (at least 48 hours) to the community of such works.

The potential activities that will generate the disturbances in the Project Area are:

- Travel and operation of construction vehicles and heavy machinery of different types (mainly diesel powered);
- Use of mobile diesel generators;
- The presence of construction workers and work-seekers;
- Blasting at the quarry sites and at various locations, as required;
- Bulldozing and exposure of disturbed bare ground and soil / rock dumps;
- Lights during night work (if required).

Construction vehicles (including transport of large volumes of rock / aggregate from quarries and crushing plants), and machinery will be used on an almost ongoing basis throughout construction and will be the sources of most noise and dust disturbance (along with intermittent blasting). Diesel powered generators will likely be used throughout the project. Under exceptional circumstances, when night work is required, the noise levels will be most significant given the very low prevailing ambient noise levels at night. These sounds will disturb sleep patterns and could result in a lack of productivity and focus during daytime tasks, and general irritation of local residents. Night work is therefore only permitted under exceptional circumstances.

It is expected that construction workers will either be housed in the designated, access-controlled construction camps, or they will be employed from the local communities and therefore reside in their own homes. During work hours, the presence of the workers can result in elevated noise levels linked to actual work activities, as well as loud conversations between the workers.

Blasting will be required at the quarry site and at various locations where hard ground needs levelling or rock needs to be removed. Blasting will result in intermittent loud noise and dust generation. In addition, it is likely that there may be fly-rock associated with each blast, depending on the manner in which blasting is managed.

Dust will largely be generated by the clearance of topsoil and exposure of loose sand or soil as the construction contractor clear the footprint for the Project infrastructure and begin blasting and removing rock from the construction footprint and quarry site. The exposed soil may be blown across the area during dry periods and as a result of the passage of construction vehicles back and forth, especially during the dry winter periods between May and October. Increased levels of dust can be a nuisance in that it could dirty houses and the clean washing hung out to dry; it may aggravate those with existing respiratory conditions; and it could impact crops.

Physically, these nuisance factors will lead to noise, dust and potentially (for some people) an unwanted visual change in the landscape character. Some people may experience emotional and psychological distress as a result of the ongoing disturbances; this is most likely to be the case near schools and healthcare facilities where learning and healing could be affected, and in the closest communities. The majority of the construction-related disturbances will occur at a local level and will affect households, infrastructure, communities and road users in the immediate vicinity of the dam wall and quarry area.

9.2.7.2 *Sensitivity of Receptors*

Local residents are accustomed to living in an environment free from the disturbances that can be expected from construction-related nuisance factors. As such, all residents will be affected; however, it is expected that most will adapt to/ accept the disturbances, which are short-term in nature.

Mhlane and Spete1 communities are located closest to the dam wall footprint and quarry site, while numerous other communities are located along the main transport routes. These communities will be the most impacted given their proximity to the construction sites. Mhlane and Spete1 communities are going to be directly affected by the advance works, the dam construction, as well as by activities resulting from other Project components.

Besides the most directly affected communities, other receptors that may be more sensitive than others to these nuisance factors include:

- Residents located near to the construction sites where work is undertaken at night, as noise levels are elevated at night due to the lower ambient noise;
- Students at nearby schools who are likely to find it difficult to concentrate on their classes when noise levels are elevated. In addition, the activities are going to be new and exciting and will captivate the attention of many students, thus distracting them and diverting their attention away from their lessons;
- People with respiratory conditions could experience an exacerbation of the condition as a result of increased levels of dust in their environment;
- People who have livelihood activities located closest to the directly affected footprint (e.g. crops, grazing) may incur damages to their produce resulting from the fly-rock and dust; and
- Sites of religious/ traditional and cultural significance could be disturbed.

How each individual experiences these disturbance factors is highly subjective; for instance, some will welcome the sounds as an indication of development and anticipation of a better life; while others will place higher value on the silence associated with a rural environment. The sensitivity of the majority of receptors is likely to be Medium; while sensitivity is considered High for the most affected receptors.

9.2.7.3 *Assessment of Impacts*

The disturbances arising as a result of the construction phase nuisance factors will be negative and direct in nature (as related to Project activities). The impact will be experienced locally, largely at a site level (around the Project footprint and along transport routes). The direct construction-related disturbances are highly likely to occur and will persist for the duration of the construction phase (short-term); Mhlane and Spete1 will be most affected given their close proximity to all activities. The magnitude of this impact is anticipated to be Medium. For the most sensitive receptors, the impact is assessed as a **Medium** (negative) significance (**Table 9-20**).

Table 9-20: Disturbance from Increased Nuisance Factors (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Disturbance from increased nuisance factors (Noise, Dust, Vibrations)	Construction activities will generate uncharacteristic disturbances resulting in a range of nuisance factors (notably increased levels of noise, decreased air quality and vibrations). Damage to households' structures from heavy traffic and rock fall from the blasting operations.	4	2	1	2	5	**45**
		N2 - Medium					

9.2.7.4 *Mitigation Measures*

- Workforce Management
    - All construction staff will agree to a Code of Conduct (CoC) that outlines protocols and standards for working in the Project Area as part of their contract. The CoC must address the following:
        - Respect for local residents, including being considerate about noise levels, privacy, and local customs;
        - Respect for existing livelihood activities and the environment;
        - Respect for community water supplies (to prevent pollution and overuse);
        - No hunting, snaring or unauthorised taking of any property belonging to someone else, including removal of natural resources;
        - Zero tolerance of illegal activities by construction personnel including: illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting;
        - Disciplinary measures for not adhering to the CoC. Theft or purposeful damage to property and similar crimes conducted by contractor staff shall be managed as dismissible offences.
- Ongoing engagement and grievance management
    - DWA will present the schedule and approach to construction to the district authorities and community leadership structures to enable their understanding of the Project roll out;
    - DWA will regularly review and update the Community Participation Strategy; this strategy is to be agreed upon by local community structures through the appointed CALs; and
    - The contractor shall appoint appropriately trained and experienced staff to implement stakeholder engagement during the course of work and shall assign adequate resources.
    - Households within the vicinity of the construction of the dam and quarry area must be resettled before construction activity begins in order to avoid any accidents and damage to property from the blast area, rock falls, and noise from the construction site.
- Engineering and Operational Practices
    - All diesel-powered construction, earth moving, and equipment must be kept at a high level of maintenance. This must include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment must serve as trigger for withdrawing it for maintenance.
    - All appointed contractors to include noise management provisions as part of onsite work inductions.
- Generic Construction Phase Management Measures

  - Traffic Management
    - Contractors will compile a traffic management plan / method statement relevant to their activities, which shall include a protocol for handling accidents involving other vehicles, pedestrians, animals or property;
    - DWA / Contractor will undertake traffic safety awareness sessions at schools and in communities during construction and early operation (until completion of dam construction). This is to be done in collaboration with the Roads Directorate and Ministry of Education, as appropriate;
    - The appointed contractor/s will have the necessary insurance / contingency budget in place for costs incurred with accidents involving other vehicles, people, animals, agricultural land, or infrastructure; and
    - The contractor will be required to compensate any affected community member for injured animals in terms of agreed protocols.
- Dust Suppression and Emissions Management
  - Site clearance is to be minimised as far as possible to reduce the potential for dust, and other impacts;
  - Dust suppression measures are to be implemented as specified in the ESMP, which shall include wetting of roads during windy conditions and covering of stockpiles of loose material, such as soils / sand;
  - Install an onsite weather station to monitor general weather conditions. When wind speeds above 20 km/hr are expected, this is to trigger implementation of measures to minimise dust emissions;
  - Ensure an adequate water supply on site for effective dust/particulate matter suppression, using non-potable water where possible;
  - Ensure equipment is readily available on site to clean any dry spillages;
  - Ensure fine-powdered materials are delivered in enclosed tankers and stored in areas suitable for emission control systems to prevent escape of material and overfilling during delivery;
  - For smaller supplies of fine-powder materials, ensure bags are sealed after use and stored in contained buildings to prevent dust;
  - Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site;
  - Ensure vehicles carrying materials or spoil entering and leaving sites are covered to prevent escape of materials during transport;
  - Where reasonable and feasible, haul roads will be maintained with water carts and graders, and the condition of the roads will be monitored especially in high risk areas and/or during high risk periods;
  - Contractors must ensure all construction vehicles comply with their relevant emission standards. Furthermore, contractors must provide confirmation that all off road diesel equipment would meet best available diesel emissions standards or be fitted with a diesel exhaust treatment device where possible;
  - Contractors must, where possible and available, use low-Sulphur diesel in vehicles to minimise harmful emissions.
- Noise Management
  - Workers are to be considerate regarding noise levels and associated disruption to local people; this is to be outlined in the CoC; and
  - Noisy activities (e.g. blasting) are not to be scheduled at critical times (e.g. school exams, religious services/ celebrations), where located in close proximity. DWA / Contractor will consult local leaders, school principals, healthcare workers and

religious leaders regarding important events or occasions that may be negatively affected by construction noise in order to try to schedule these activities at different times.
        - Noise generating construction activities are to only be undertaken outside normal working hours under exceptional circumstances.
        - Where noise generating construction activities are required to take place outside of normal working hours, the Contractor is to provide sufficient notification (at least 48 hours) to the community of such works.
    - Blasting and Vibration
        - DWA and its contractor(s) shall develop blast designs and procedures that will keep noise and blasting to a minimum without compromising blast requirements. Blast plans are to be compiled as method statements to be approved by the Resident Engineer;
        - All blasting activities will be undertaken following a planned schedule and the local communities informed of this in advance;
        - All safety measures related to blasting are to be implemented as specified in the ESMP; and
        - DWA and its contractor(s) shall ensure that no blasting activities occur at night.
    - Waste Management and Water Source Management
        - Waste management measures are to be implemented as specified in the ESMP. This is to include the use of portable toilets and rubbish bins (to avoid littering); and
        - Water management measures shall include controls on use of community water supply points by construction workers who may not be familiar with protocols of keeping supplies clean and uncontaminated.
    - Earthworks and Stockpiling
        - Stockpiles shall be located away from sensitive receptors and, where necessary, covered with anchored fabrics, or seeded with sterile grass;
        - Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable; and
        - Where practical, only remove any cover for exposed areas in small areas during work and not all at once.

9.2.7.5 *Residual Impact*

Post-mitigation, it is expected that the magnitude of the disturbance resulting from increased nuisance factors resulting from construction activities could be reduced to Small, resulting in a decreased impact significance of **Low (negative)** significance (**Table 9-21**).

Table 9-21: Disturbance from Increased Nuisance Factors (pre-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Disturbance from increased nuisance factors (Noise, Dust, Vibrations)	Construction activities will generate uncharacteristic disturbances resulting in a range of nuisance factors (notably increased levels of noise, decreased air quality and vibrations). Damage to households' structures from heavy traffic and rock fall from the blasting operations.	3	2	1	2	2	**16**
		N1 - Low					

9.2.8 ANTI-SOCIAL BEHAVIOUR AND INCREASED PREVALENCE OF SEXUALLY TRANSMITTED INFECTIONS (STIS) AND HIV/AIDS DUE TO IN-MIGRATION

9.2.8.1 *Description of Impact*

The process of Ukukhonta (i.e. the application process to live in the community from the Chief or Inner Council) is credited to regulating the influx of migration into new communities. However, with the proposed dam construction it could be tricky to control the entry of people because of heightened construction activities. In this instance these job seekers are only there temporarily with no intentions of permanent relocation. Eswatini has experienced high rate of HIV/AIDS infections and deaths. However, with the concerted effort on enhancement of health awareness campaigns and distribution of anti-retrovirals, new HIV infections have reportedly declined. It is essential to note that anti-social behaviour is influenced by many factors. There is a high probability that relationships will be formed which may lead to resurgence of STIs and STDs including HIV infections. Currently the level of crime in the communities of Mantabeni and Siphocosini is insignificant.

Some of the anti-social behaviour likely to occur are described below.

- Increase in crime levels given that many of the migrants to the area will not have income or access to land to generate a livelihood.
- An increase in disposable income within the Project Area (among workers) could result in an increase in alcohol and drug abuse, increased incidences of prostitution and casual sexual relations. These activities could lead to an increased incidence of STIs and HIV, and increased numbers of teenage and unwanted pregnancies. The increased prevalence of diseases would affect contractors, employees, local residents and the families/ sexual partners of anyone becoming infected in the Project Area.
- Young girls are likely to enter into relationships with migrant workers (and work-seekers) in the hope that they will be able to leave the area and secure a 'better' lifestyle. However, they are likely to end up dropping out of school with unwanted pregnancies, STIs and HIV.
- General unrest may arise as a result of increased pressure for resources, resentment towards those who secure employment and procurement opportunities as well as benefits from other Projects (specifically if the beneficiaries are from outside the area).

9.2.8.2 *Sensitivity of Receptors*

The population of the Project Area is going to be susceptible to the inevitable increase in anti-social behaviour as described above given the prevailing high levels of poverty and low levels of economic opportunity and is therefore assessed as having *High* sensitivity to this impact.

9.2.8.3 *Assessment of the Impact*

This negative impact will arise as a direct result of construction workers, and indirectly via migrant work-seekers to the area. The impact will be experienced at a local level; however, the impact duration will likely be long-term as improved access and the attraction to the area will facilitate ongoing migration in and out of the Project Area. This impact will affect the individuals and families that engage in such activities, while crime could affect anyone. The magnitude of the impact is rated *High*. The pre-mitigation impact is therefore anticipated to be of a **High (negative)** significance (**Table 9-22**).

Table 9-22: Anti-Social Behaviour and Increased Prevalence of Sexually Transmitted Infections (STIs) and HIV/AIDs due to in-migration (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Exacerbation of Anti-Social Behaviour due to in	Expectations regarding possible employment opportunities may result in the area surrounding the site experiencing an influx of job seekers. Migrants will bring with them differing cultures, religious beliefs, norms and values; they influence	4	3	5	5	4	**68**

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
migration (influx of job seekers)	young people to change in a manner that may not be accepted by the more conservative/ traditional sector of the population. Resulting increased prevalence of Sexually Transmitted Infections (STIs) and HIV/AIDS as well as crime.						
		N3 - High					

9.2.8.4 *Mitigation Measure*

– Workforce Management measures as specified in Section 9.2.6.4

Additional mitigation measures include:

– Ongoing engagement and grievance management
  - o DWA / construction Contractor to appointment Community Liaison Officer (CLO) and implement a grievance resolution procedure; and
  - o As part of induction, the appointed contractor will develop a brochure containing basic socio-cultural information, to be distributed to all new employees on the Project Site.

9.2.8.5 *Residual Impact*

Implementation of the measures described above is predicted to result in a reduction of the magnitude of the impact to Medium as well as the probability, the residual impact is anticipated to be of a **Medium** (negative) significance (**Table 9-23**).

Table 9-23: Anti-Social Behaviour and Increased Prevalence of Sexually Transmitted Infections (STIs) and HIV/AIDs due to in-migration (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Exacerbation of Anti-Social Behaviour due to in migration (influx of job seekers)	Expectations regarding possible employment opportunities may result in the area surrounding the site experiencing an influx of job seekers. Migrants will bring with them differing cultures, religious beliefs, norms and values; they influence young people to change in a manner that may not be accepted by the more conservative/ traditional sector of the population. Resulting increased prevalence of Sexually Transmitted Infections (STIs) and HIV/AIDS as well as crime.	3	3	3	4	3	39
		N2 - Medium					

9.2.9 INCREASED PRESSURE ON SOCIAL INFRASTRUCTURE AND SERVICES

9.2.9.1 *Description of Impact*

The Nondvo Dam Project Area has one clinic, primary school and high school and is regarded as semi-rural. However, the possible influx of work seekers and additional contractor's workforce may add more stress on the existing resources. It is however anticipated that in view of the high unemployment rate in the country, most of the work seekers will be both single and married men. It is very highly unlikely that they would bring their families. Thus, less impact on schools and more demand for land, healthcare, water and sanitation and waste management is anticipated. The technical team has already identified both the management and contractors' office and workers camp site in Mhlane, separating them from the community.

Besides Project workers, the anticipation of employment, other income generation opportunities, and benefits linked to improved local infrastructure and services, will likely result in significant influx to the area. Current lack of well-maintained infrastructure in the form of roads, bridges and foot bridges would certainly collapse under the strain of the influx of large trucks and other construction equipment. As for public transportation, shops and lounging areas are almost non-existent, especially in the communities of Mhlane and Spete1. It would be commendable for locals if they could seize the opportunity rather than rely on employment from the Nondvo Dam Project and start their own business and supply the services required since there will be a high demand for them. It is essential to note that the influx of job seekers, whether short or long term is immaterial because the pressure will still be exerted on the resources in their current form.

9.2.9.2 *Sensitivity of the Resource*

Given the already strained social infrastructure and services in the Project Area, additional pressure from outsiders would further overload the existing services, such as clinics, water and sanitation, and land. There is limited land to allocate to newcomers for farming, natural resources additionally water and sanitation and waste management services are inadequate. Hence the existing infrastructure and services are of *High* sensitivity to additional pressure, as well as the local population who require access to them.

9.2.9.3 *Assessment of the Impact*

The influx of workers and work-seekers for the Project construction phase would have a direct (workers) impact on infrastructure and services. The impact will be experienced at the local level during the construction phase (short-term). The magnitude of the impact related to influx resulting in increased pressure on social infrastructure and services during construction is expected to be *Medium*. Which combined with the *High* sensitivity would result in an impact of **High** (negative) significance (**Table 9-24**).

Table 9-24: Increased Pressure on Social Infrastructure and Services (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased pressure on social infrastructure and services	The Project area has one clinic, primary school and high school and is regarded as semi-rural. The possible influx of job seekers and additional contractor's workforce may add more stress on the existing resources.	3	3	5	4	4	**60**
		N2 - Medium					

9.2.9.4 *Required Mitigation Measures*

– Workforce Management measures as specified in Section 9.2.6.4

Additional mitigation measures include:

– Ensure communities in the Nondvo Project Area are fully informed of the preferential labour policy for recruiting workers from local communities and how they are required to register for work well in advance of construction in order that sourcing of local labour is maximised.
– Education System
    - Construction of replacement schools is to be implemented well in advance of the construction of the dam to minimize disruptions on education of the local communities.
– Social development (Recommended mitigation measure)
    - DWA in partnership with Inner Councils and relevant organisations (e.g. donors, civil society and NGOs), where available and appropriate, assist in planning for anticipated increased demands on public infrastructure and services in communities that are significantly affected by in- migration due to Project activities; and

9.2.9.5 *Residual Impact*

Even with the implementation of mitigation measures it is anticipated that the impact will remain of a **Medium** (negative) significance (**Table 9-25**).

Table 9-25: Increased Pressure on Social Infrastructure and Services (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased pressure on social infrastructure and services	The Project area has one clinic, primary school and high school and is regarded as semi-rural. The possible influx of job seekers and additional contractor's workforce may add more stress on the existing resources.	3	3	3	3	4	**48**
		N2 - Medium					

9.2.10 DISRUPTION TO FAMILY AND COMMUNITY STRUCTURES

9.2.10.1 *Description of Impact*

The proposal of the Nondvo Dam Project provides new prospects and expectation of employment opportunities. Employment opportunities (albeit relatively limited in duration) offered by the Project contractors will provide income that is likely to be far beyond what is generated by agricultural work. Those who are employed will learn new skills that may enable them to secure construction work in the future. There are also high expectations that the employment opportunities will lead to an improved standard of living.

It is probable that those employed during the construction phase would aim to secure further work in the construction sector with their newly acquired skills and experience, leading to a longer-term disruption to social and economic networks. It is also possible that once young men and women have experienced paid work with their acquired skills in the construction field may opt to go find work elsewhere. Similarly, it is anticipated that these new acquired skills may inadvertently cause a shortage of available farming skills and family support networks during the construction phase, and beyond. However, since these young people will have enough money that they would send home (as it is the norm with African families) to get hired help in agriculture.

Like with many other large infrastructure projects such as the Lesotho Highlands Water Project (LHWP), and Maguga Dam Project, it is expected that people will be forced return to their farming and household responsibilities after construction is completed, if they are unable to secure further paid employment elsewhere. When the LHWP I was built, some people with new acquired skills and the training they received proceeded to seek work in the South African mines. This training and exposure to other possibilities afforded a lot of people opportunities never available to them before. This assertion, however, recognizes the existence of the unintended consequence of disruption in the social and cultural fabric of the families and greater community, namely where people became more interested in other fields other than agriculture and livestock. For instance, with the improved infrastructure access the outside world became achievable. Consequently, new opportunities were seized with some people becoming transport operators while others provided services such as trading shops, businesses that had never existed prior to the LHWP. Similarly, in Mantabeni and Siphocosini the improved infrastructure and availability of disposable income could allow people to explore other opportunities outside of agriculture activities (which has also been plagued by drought and seen yields decreasing annually).

9.2.10.2 *Sensitivity of Receptors*

Given the size and capabilities of the population, there are likely to be many people who do not secure construction phase employment and who will be in a position to support households with home-based and agricultural tasks in the absence of those who pursue Project employment opportunities. Hiring of local labour will provide work opportunities that a people have been looking for since the agricultural sector has not been performing so well in the past few years. Sensitivity is considered to be *Low*.

9.2.10.3 *Assessment of the Impact*

While the number of employment opportunities and job requirements are not yet known, it is expected that these opportunities will be relatively small in comparison to the size of the eligible population; despite the fair number of employment opportunities that are likely to be available. Following construction, it is conceivable that while some people will attempt to secure further paid employment outside the agricultural sector, most are likely to be forced to return to existing livelihood activities and household responsibilities. It is unlikely that the Project would result in a permanent loss of household support or farming expertise. Given the short-term nature of the impact, the magnitude is considered to be *Medium*. The impact significance is rated as **Medium** (negative) significance (**Table 9-26**).

Table 9-26: Disruption to Family and Community Structures (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Disruption to Family and Community Structures	Employment opportunities may inadvertently cause a shortage of available farming skills and family support networks during the construction phase. Additionally, people employed in the construction work may aim to secure further work in the construction sector elsewhere, with their newly acquired skills and experience may be required, leading to a long term absence from family and disruption to family setting and social structures and improved economic networks.	3	3	5	4	4	60
		N2 - Medium					

9.2.10.4 *Required Mitigation Measures*

- Implement the Labour Recruitment Guidelines and allocate maximum number of unskilled and semi-skilled jobs to local residents;
- In order to avoid any school dropouts, measures are to be defined together with relevant authorities, also applying the Eswatini Employment Act 1980 section dealing with Child Labour stipulating that Contractor will be prohibited to employ anyone under the age of 18 years.
- DWA and Inner Council to define criteria that prevent youth from leaving school in favour of short-term employment. These may include:
  - Minimum education qualifications for people below the age of 20;
  - Letter from school or area community leader stating that applicant did not drop-out of school specifically as a result of the Project; or
  - Employment of people from as many households as possible to distribute income across households.
- Share types of job opportunities, including capacity and qualification requirements long in advance of recruitment to provide people with motivation to complete schooling to the required level, thus discouraging school dropouts; and
- Implement a skills development and capacity building programme well in advance of recruitment to ensure that a suitable number of people attain the necessary skills.

Recommended Mitigation Measures

- DWA to collaborate with relevant authorities and organisations to develop programmes that aim to enhance agricultural production and new technologies to improve yields amongst the Nondvo Dam Project Area population. These are to address the application of more effective farming methods, approaches to increase crop yields, and mechanisms to assist farmers in selling their produce at the highest possible prices.

9.2.10.5 *Residual Impact*

It is expected that through the implementation of the above measures, the duration of this impact would reduce however the significance rating would remain **Medium** (negative) significance post-mitigation (**Table 9-27**).

Table 9-27: Disruption to Family and Community Structures (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Disruption to Family and Community Structures	Employment opportunities may inadvertently cause a shortage of available farming skills and family support networks during the construction phase. Additionally, people employed in the construction work may aim to secure further work in the construction sector elsewhere, with their newly acquired skills and experience may be required, leading to a long term absence from family and disruption to family setting and social structures and improved economic networks.	3	3	3	3	4	48
		N2 - Medium					

9.2.11 INCREASED DEMAND ON LOCAL UTILITIES – ENERGY AND WATER SUPPLY

9.2.11.1 *Description of Impact*

Additional power requirements for construction purposes and services or facilities in the various housing, camp and work areas is likely to place additional pressure on existing electricity supply in the Project area which may result in overloading and possible blackouts (i.e. periods without electricity to the area).

Additional water usage required for construction purposes and services or facilities in the various housing, camp and work areas is likely to place additional pressure on existing water supply in the Project area which may result in periods of water shortage in the piped infrastructure.

9.2.11.2 *Sensitivity of Receptors*

As indicated in the SES results almost 66% of the respondents have electricity connections to their houses, which they rely on for source of lighting and cooking. However, it is noted that alternative sources of fuel are also utilised within the community, especially within winter months.

As indicated in the SES results almost 50% of the respondents obtain water from private connections or standpipes. However, it is noted that alternative sources of water are also utilised within the community. During the winter months the water supply is noted to be inconsistent.

9.2.11.3 *Assessment of Impact*

Loss of electricity and / or piped water for periods would result in negative impacts on the social functioning of the households. More significantly public service facilities such as clinics, schools as well as shops (i.e. businesses) within the Project would not function properly without electricity / water. The impact is anticipated to be of a large magnitude however of local extent and short duration. Combined with a low possibility results in an impact of **Low** (negative) significance (**Table 9-28**).

Table 9-28: Demand on local utilities –Energy and Water Supply (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Demand on local utilities - Energy and Water Supply	Additional power requirements for construction purposes and services or facilities in the various housing, camp and work areas is likely to place additional pressure on existing electricity supply. Additional water requirements for construction purposes and services or facilities in the various housing, camps and work areas is likely to place additional pressure on existing water supply	4	2	1	2	3	**27**
		N1 - Low					

9.2.11.4 *Mitigation Measures*

- DWA, in partnership with local authorities and relevant agencies / organisation, where available and appropriate, assist in planning for anticipated increased demands on public infrastructure and services in communities.
- The Contractor shall provide a standby power generator to augment any power needs and shall ensure that there is enough electricity in the area to meet all demands before construction.
- DWA, and the Project implementing agency shall ensure that provision of portable water to the local community in improved and is reliable by providing communities with water based on the international standards for rural water supply.

9.2.11.5 *Residual Impact*

Implementation of the above mitigation measures will serve to reduce the magnitude and possibility however the residual impact significance will remain **Low** (negative) (**Table 9-29**).

Table 9-29: Demand on local utilities –Energy and Water Supply (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Demand on local utilities - Energy and Water Supply	Additional power requirements for construction purposes and services or facilities in the various housing, camp and work areas is likely to place additional pressure on existing electricity supply. Additional water requirements for construction purposes and services or facilities in the various housing, camps and work areas is likely to place additional pressure on existing water supply	3	2	1	2	2	16
		N1 - Low					

9.2.12 INCREASED SAFETY RISKS TO PEOPLE AND ANIMALS

9.2.12.1 *Description of Impact*

A number of potential hazards threaten the public safety and security during the construction phase, these include:

- Short-term dust is primarily a nuisance factor to nearby receptors (e.g. onsite workers, roadside kiosks and residents) but may cause acute health issues (e.g. eye irritation, breathing problems) if acceptable standards are exceeded.
- Improper chemical storage and handling may expose the communities to hazardous chemicals, which may affect their health.
- People and livestock falling into open trenches leading to injuries and in some cases, fatality.
- Movement of construction machinery and vehicles resulting in increased potential for road accidents leading to injury to pedestrian and other motorists and in some cases, fatality.
- Blasting at sites could result in fly rock during the blasting activities.
- Large, exposed water body during inundation phase.

With the exception of road connecting Mbabane and Mhlambanyatsi (MR19), roads in the Project area are unsealed and in relatively poor condition, particularly over the rainy season. Apart from a bus service, there is little to no public transport offered on the road network in and around the communities. During the construction phase there will be an increase in vehicular movement, including abnormal loads, along the roadways in the Project area.

The local population and animals will likely be more at risk during the initial phases of the construction process, given that they will not be used to the risks that will arise during construction. Children, in particular, are going to be the most sensitive given that they are likely to want to investigate and explore the construction sites, equipment and materials.

9.2.12.2 *Sensitivity of Receptors*

The construction activities will generate a range of safety risks that the population of the Project Area may not have been exposed to, to date. Sensitivity is considered to be Medium.

9.2.12.3 *Assessment of Impact*

Increased safety risks will result in direct negative impacts on the community. The impact is anticipated to be of a large magnitude and permanent as there is the potential for loss of life. Combined with a low possibility results in an impact of **Medium** (negative) significance (**Table 9-30**).

Table 9-30: Increased safety risks to people and animals (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased safety risks to people and animals	A number of hazards threaten the public safety and security during the construction phase, including increased traffic movement, handling of hazardous chemicals, rock blasting during quarry mining.	5	2	5	5	3	**51**
		N2 - Medium					

9.2.12.4 *Mitigation Measures*

- ESMP and associated management plans to be implemented adequately.
- Adequate traffic signage must be utilised for all project stakeholders.
- Existing roads running through the project area are to be kept open as far as possible. Access routes may need to be temporarily diverted or closed for short periods when construction activities pose a potential safety risk.
- Resettlement of households to be concluded within the construction area in advance of construction of the Dam.

9.2.12.5 *Residual Impact*

Implementation of the above mitigation measures will serve to reduce the magnitude and duration, resulting in a residual impact of **Low** (negative) significance (**Table 9-31**).

Table 9-31: Increased safety risks to people and animals (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased safety risks to people and animals	A number of hazards threaten the public safety and security during the construction phase, including increased traffic movement, handling of hazardous chemicals, rock blasting during quarry mining.	3	2	1	2	3	**24**
		N1 - Low					

9.3 OPERATION PHASE

9.3.1 EASE OF SHORTAGE OF WATER IN MANZINI, MBABANE, IRRIGATION OF AGRICULTURAL LAND AND PROMOTION OF SOCIAL AND ECONOMIC GROWTH

9.3.1.1 *Description of Impact*

The completion of the Nondvo Dam Project water infrastructure will ensure reliable water supply in Manzini, Mbabane and surrounding areas as well as water supply for irrigation of 800 ha of agricultural land in the project area.

Well managed and maintained infrastructure has a potential to enhance development, attract investors, and foreign direct investment (FDI). Once there are investors and FDI is realised this would assist in improving the country's economic outlook, GDP and employment. However, on the regional note the SADC Regional Water Supply and Sanitation Programme's overarching aim is to facilitate SADC Member States to effectively improve and fast-track the provision of safe water supply and sanitation (WSS) contributing to socio-economic growth, poverty reduction, promote good public health, regional integration, and poverty alleviation. Infrastructure assets, such as roads, electricity, water, and telecommunications services are essential inputs for both the private and public sectors. The availability of reliable infrastructure assets can increase returns and levels of investment and therefore accelerate economic growth. Furthermore, infrastructure assets assist in linking disparate parts of a country which helps businesses access new customers and develop new markets, driving both productivity and economic growth.

9.3.1.2 *Sensitivity of Receptors*

Given the general lack of economic diversity; the high reliance on outside markets; the country's economic status and high poverty levels, the sensitivity is considered to be *High*.

9.3.1.3 *Assessment of Impact*

The positive impact of increased Government revenue will be a direct impact as it relates to revenue generated by the Nondvo Dam Project and indirect positive as it relates to Government spending in the country. The Nondvo Dam Project has the potential to induce associated growth and development in areas where spending occurs. This benefit will continue throughout the operational life of the Nondvo Dam Project; therefore, the impact will be long-term. The predicted increase in revenue that the Government will receive from water sales, as well as the improved productive of 800 ha of agricultural land, is of considered a *Large* magnitude. The significance of this impact will be of a **Major (positive)** throughout the operational life of the Project (**Table 9-32**).

Table 9-32. Impact of secure water supply, irrigation, and promotion of social and economic growth (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Ease of Shortage of Water in Manzini and Mbabane, Irrigation of agricultural land and Promotion of Social and Economic Growth	The completion of the Nondvo Dam Project water infrastructure will ensure reliable water supply in Manzini, Mbabane and surrounding areas as well as water supply for irrigation of 800 ha of agricultural land in the project area. The availability of reliable infrastructure assets can increase returns and levels of investment and therefore accelerate economic growth.	4	4	5	5	5	**90**
		P3 - High					

9.3.1.4 *Enhancement Measures*

No enhancement measures are required, however; good governance and financial management practices are essential; open and transparent practices will assist in building relationships of trust with stakeholders, especially with potential critics and Project observers.

9.3.1.5 *Residual Impact*

The residual impact significance will remain **Major** (positive).

9.3.2 ECONOMIC OPPORTUNITIES AND DIVERSIFICATION

9.3.2.1 *Description of Impact*

A large portion of The Mantabeni and Siphocosini population is currently dependent on agricultural activities and livestock, which limits economic opportunities beyond subsistence-based agriculture. During the operational phase, the number of direct Project employees[5] and

[5] Project employment figures were not available at the time of the assessment.

Project procurement requirements will be dramatically reduced in comparison to the construction phase. As such, a limited number of locally-based businesses will be able to service the operational needs – which will include fuel supply, food, and office materials.

However, as a result of the Project, the area will be more accessible and the reservoir will potentially be seen as an attraction, resulting in an increase in the number of tourists visiting the area. It is also likely that following the long construction phase, some of the workers and migrant work-seekers will remain; thus, the population is likely to increase as compared to the current baseline. With an increase in visitors, a likely increase in the resident population, and increased exposure to a more active economy, local entrepreneurs will continue to provide businesses that meet the ongoing needs and demands.

Additionally, the economy, which is almost exclusively focused on agriculture, is likely to become more diversified through an influx of people with a greater variety of skills and offerings. Agriculture is likely to remain the foundation of the economy for most households. However, the need to offer alternate goods and services (e.g. accommodation, meals, fresh produce, cleaning, entertainment/ recreation, curios) to the operational workers, newcomers, and local people should result in diversification of the economy of Mantabeni and Siphocosini. In the future, post-construction, many people are likely to have an improved opportunity to generate income from other activities beyond agriculture.

While economic opportunities and the possibility for economic diversification will arise as a result of increased demand from operational workers, work-seekers and visitors; the onus will remain on individuals to start-up/ enhance businesses to benefit from the increase in demand. It is likely that these opportunities could be taken by outsiders with the means to respond quickly to the demand. Locals may find it more difficult to set-up competitive businesses due to a lack of skill and financial resources. The aesthetic nature of the environment of the area and the presence of the nearby Nature Reserve may also enhance the degree to which diversification of the economy is achieved post-dam construction.

9.3.2.2 *Sensitivity of Receptors*

It is expected that the influx of migrants (potentially with more expertise and resources) will result in increased competition for local jobs, procurement contracts and to establish required businesses. The communities in the Project Area can be considered to have Medium sensitivity in that the economic opportunities will be available, but the majority of the population are unlikely to have the skills or capital to access/ optimise the opportunities. Many households/ individuals are likely to be able to set-up small initiatives that will increase their ability to earn additional income – at the very least, the market for their surplus agricultural produce and curios will increase.

9.3.2.3 *Assessment of Impact*

The benefits to the local economy would be experienced as a positive impact that would deliver direct, indirect and induced opportunities. Direct Project opportunities will be more limited in the local economy; these are more likely to generate national and regional and international benefits. The impact will be experienced at the local level as a result of localised demand for goods and services through increased spending by workers, residents, commuters and visitors/tourists. The operational phase will be long- term to permanent. The magnitude of this impact is expected to be *Low-Medium*, which in the context of the *Medium* sensitivity of the receptors results in an impact predicted to be of **Medium (positive)** significance (**Table 9-33**).

Table 9-33: Economic Opportunities and Diversification (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Economic Opportunities	The Project area will be more accessible, and the reservoir will potentially be seen as an attraction resulting in increased number of tourists visiting the area. With increased employment	3	3	3	4	4	**52**

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
and Diversification	opportunities, there will be increased informal traders with diverse business types to take advantage of the workers in the area. The economy, which is almost exclusively focused on agriculture, is likely to become more diversified through an influx of informal traders and people with a greater variety of skills and offerings.						
		P2 - Medium					

9.3.2.4 *Enhancement Measures*

- Continue implementation of livelihood restoration and social development projects with directly affected households and communities until it can be demonstrated that local residents directly affected by the project are self-sufficient and able to sustain their livelihoods.
- Youth with Entrepreneurial skill to be developed further through collaboration with service providers such as Vocational Colleges namely Gwamile Vocational and Commercial Training Institute, which is to include all affected parts of the extended Project Area, as part of DWA's commitment to social development.

9.3.2.5 *Residual Impact*

Through sustained implementation of the enhancement measures, the duration of this impact could increase however the residual significance rating would remain **Moderate** (positive) significance (**Table 9-34**).

Table 9-34: Economic Opportunities and Diversification (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Economic Opportunities and Diversification	The Project area will be more accessible, and the reservoir will potentially be seen as an attraction resulting in increased number of tourists visiting the area. With increased employment opportunities, there will be increased informal traders with diverse business types to take advantage of the workers in the area. The economy, which is almost exclusively focused on agriculture, is likely to become more diversified through an influx of informal traders and people with a greater variety of skills and offerings.	3	3	3	5	4	**56**
		P2 - Medium					

9.3.3 INCREASED COST OF LIVING

9.3.3.1 *Description of Impact*

The cost of goods and services is likely to increase gradually throughout the construction phase and remain elevated throughout the operational phase. It is likely that the prices of goods and services may readjust to meet market demand, reaching a more stable/ normalised level. Given that the population of the area is likely to remain somewhat elevated, and economic diversification is probable, prices will stabilise, albeit at a higher relative level than they are currently.

In addition to the increased costs of items, goods and services that were previously not offered for purchase may become available. The area will be more accessible and attractive to visitors and new residents, they are likely to bring new merchants that sell an increased diversity of goods, and thus tempting people to purchase goods that ordinarily would not have been available to them. Currently, there is limited public transport with few taxis operating in the area; and away from the Mhlambanyatsi Road (MR19) most people walk or hire private cars to larger items. With potential improved road networks there is likely to be an expansion of transport options available representing an increased cost of living.

Post construction and the completion of the associated job opportunities, the general standard of living could deteriorate over time as a result of decreased levels of affordability (linked to decreased income compared to the more prosperous construction Phase) although it is still expected to remain better than before construction. The standard of living could be counterbalanced by improved economic opportunities and improved accessibility to markets and critical social infrastructure and other service.

9.3.3.2 *Sensitivity of the Receptors*

The sensitivity of the population will vary. Some people will be able to increase and maintain their increased levels of income generation, while others (specifically the elderly and more traditional people) will continue their lifestyles in a manner similar to current levels. Everyone will be affected by an increase in the cost of living; some people will be able to accommodate the increase and given the expectation and potential for new market opportunities, the overall sensitivity of the population is rated as *Medium*. The people who cannot increase their income will be more sensitive to the impact, but many people will have begun to adjust to the increased cost of living during the proposed 36 month construction phase.

9.3.3.3 *Assessment of the Impact*

This impact is considered negative and will continue as an indirect consequence of the changed nature of the area. The impact will be experienced at the local level and will be permanent, it is likely to affect most people. The magnitude will be *Medium* and will gradually decrease over time as the market adjusts to demand. People are likely to adjust to the cost of living over time, albeit with difficulty. The significance is likely to be one of **Moderate** (negative) significance (**Table 9-35**).

Table 9-35: Increased Cost of Living (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased cost of living	The cost of goods and services is likely to increase gradually throughout the construction phase and remain elevated throughout the operational phase. In addition to the increased costs of items, goods and services that were previously not offered for purchase may become available.	4	2	3	5	4	**56**
		N2 - Medium					

9.3.3.4 *Required Mitigation Measures*

- Identify and implement social development projects, such as training for management of household finances, skills development, agricultural training, and technical assistance, that can be provided by Government Organizations, Non-Governmental Organizations (NGOs) and Civil Society Organizations (CSOs) as a means of delivering socio-economic benefits to assist in combatting some of the challenge's households may experience.
- Individuals are to be encouraged to market the newly acquired skills from the construction phase to be applied in similar water construction projects.

9.3.3.5 *Residual Impact*

There is little that can be done to significantly reduce the cost of living. Also, it is uncertain the extent to which the recommended interventions will be effective in providing additional livelihood support to the local population that could help to moderate the increased cost of living that is expected. As such, it is anticipated that the magnitude will reduce slightly; however, the impact is anticipated to remain of a **Medium** (negative) significance (**Table 9-36**). It is likely that as the market adjusts, the sensitivity of many households will decrease, and the impact will normalise.

Table 9-36: Increased Cost of Living (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Increased cost of living	The cost of goods and services is likely to increase gradually throughout the construction phase and remain elevated throughout the operational phase. In addition to the increased costs of items, goods and services that were previously not offered for purchase may become available.	3	3	3	5	4	**56**
		N2 - Medium					

9.3.4 GROWTH IN LOCAL TOURISM SECTOR

9.3.4.1 *Description of Impact*

Establishment of the Nondvo Dam is anticipated to result in an aesthetic benefit to the area, potentially attracting tourists. Should recreational actives be permitted on the dam the potential for tourism attraction would increase. Eswatini has well developed tourism sector and well known for its excellent hospitality hence it would not be difficult to build on the back of such foundation.

The growth of the tourism sector will also facilitate creation of induced employment for local people, especially the youth. There will be opportunities for people to start a range of small businesses, including hospitality services (e.g. accommodation, meals, transport), tour guiding services (e.g. hiking trails, botanical/ avian/ ecological trails), amongst others. However, it is anticipated that it will take a considerable length of time for tourism to increase, even after the 36 month construction phase is completed; establishing tourism facilities and activities will require investment of funding and support to local entrepreneurs.

9.3.4.2 *Sensitivity of Receptors*

The growth and increased number of tourists in the Project Area is likely to stimulate a change in the livelihoods of the locals who become involved in the sector. However, there exist barriers for locals fully partaking in the sector, including limited skills and resources to maximise the opportunities presented, as well as competition from in-migrants who may have more experience in the sector. Therefore, the sensitivity of the receptors is regarded as *Medium*.

9.3.4.3 *Assessment of Impact*

Growth and development of the tourism sector will be experienced as an indirect and induced positive impact. The impact will be localised but with the potential to extend to other areas of interest within Hhohho District. The magnitude of the impact will be *Small-Medium* depending on the uptake of the opportunities associated with growth of the tourism sector. Overall, the impact is rated as one of **Low (positive)** significance (**Table 9-37**).

Table 9-37: Growth in the Tourism Sector (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Growth in the local tourism sector	Establishment of the Nondvo Dam would likely attract visitors who would value the aesthetic presence of the reservoir and who enjoy water-based recreational activities that may be permitted at the site. This would increase the footprint of tourist and contribute to the income generation of the local area. Construction of tourism facilities by local entrepreneurial and partnerships in the area may increase. Growth of the tourism sector will also facilitate creation of induced employment for local people, especially the youth.	3	2	3	5	2	**26**
		P1 - Low					

9.3.4.4 *Recommended Enhancement Measures*

- DWA to engage with Ministry of Tourism and Environmental Affairs, promoting collaboration with other stakeholders both in government and private industry relating to tourism to develop a tourism plan from the Region, including other tourist attractions such as the Luphohlo Dam and Mantenga Nature Reserve.
- DWA to engage with the Department of Finance and Commerce, Industry and Trade to facilitate provision of:
  - Conduct training and development to start-up and small businesses; as well as to facilitate provision for micro-loans for tourism related entities.
  - Conduct capacity building and training sessions to support locals in setting up and operation small businesses, or to improve their offerings, and to comply with the strict health, safety, and quality standards.

9.3.4.5 *Residual Impact*

The implementation of the mitigation measures has the potential to increase the extent and possibility; hence the impact could become one of **Moderate** (positive) significance (**Table 9-38**).

Table 9-38: Growth in the Tourism Sector (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Growth in the local tourism sector	Establishment of the Nondvo Dam would likely attract visitors who would value the aesthetic presence of the reservoir and who enjoy water-based recreational activities that may be permitted at the site. This would increase the footprint of tourist and contribute to the income generation of the local area. Construction of tourism facilities by local entrepreneurial and partnerships in the area may increase. Growth of the tourism sector will also facilitate creation of induced employment for local people, especially the youth.	3	3	3	5	3	**42**
		P2 - Medium					

9.3.5 CONTINUATION OF ANTI-SOCIAL BEHAVIOUR AND SPREAD OF STIS AND HIV/AIDS

9.3.5.1 *Description of Impact*

Anti-social behaviour, as described in Section 9.2.8, is expected to continue into the operational life of the Project. There will no longer be Project workers and many migrant work-seekers will likely leave the area in search of opportunities elsewhere. As a result of increased accessibility and an inevitable flow of ‘outsiders’ through the area, norms, values and customs will continue to change; people will continue to be exposed to different views and ways of life. Migration in and out of the area will likely be driven more by economic / market reasons, as well as travel to schools and other social facilities that may be of a higher standard than those present in the Nondvo Project area.

As with the construction phase impact, HIV and STIs, casual sexual relationships, prostitution, unwanted pregnancies, an increase in drug and alcohol abuse, and crime are likely to persist to some degree. Long distance truck drivers and migrants in search of work opportunities are likely to be the most significant contributors to the spread of HIV and STIs; and may increase a demand for prostitution and attract local women to enter into relationships with them.

9.3.5.2 *Sensitivity of Receptors*

Following the proposed 36 month construction phase, people would already have experienced an increase in the anti-social behaviour. While an increase in anti-social behaviour is not desirable, people will have adapted to the increased risks and exposure especially where economic matters are concerned. Hence their levels of sensitivity will have reduced to *Medium*.

9.3.5.3 *Assessment of the Impact*

While the level of confidence in this impact is low, the negative impact of ongoing anti-social behaviour and spread of HIV/AIDS is expected to continue into the operational phase as a result of the inevitable changes that the years of construction phase will precipitate, and as an indirect result of 'outsiders' visiting and travelling through the area.

The impact will be experienced at a local level; however, STI and HIV infections will spread into the areas where the road users and work-seekers originate and migrate to, potentially national / international depending on logistics. The duration will be long-term to permanent, specifically as related to diseases such as HIV/AIDS which, for those affected, will have permanent impacts on them and their families. This impact could affect individuals and families in different ways and to varying degrees. The magnitude of the impact is rated *Medium* compared to the Large magnitude during dam construction. When combined with the *Medium* sensitivity of the receptors, the impact is assessed as being **High** (negative) significance (**Table 9-39**).

Table 9-39: Continuation of Anti-Social Behaviour and Spread of STIs and HIV/AIDS (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Continuation of Anti-Social Behaviour and Spread of STIs and HIV/AIDS	As a result of increased accessibility and an inevitable flow of 'outsiders' through the area, norms, values and customs will continue to change; people will continue to be exposed to different views and new ways of life. Migration in and out of the area will likely be driven more by economic / market reasons, as well as other social facilities that may be of a higher standard than those present in the Nondvo Project Area.	3	4	5	4	4	64
		N3 - High					

9.3.5.4 *Recommended Mitigation Measures*

- During the operational phase there are limited interventions that can be implemented directly by DWA. However, DWA can continue to collaborate with the various stakeholders such as the Ministry of Health, Education and Training, Commerce, Industry and Trade, and Agriculture to support the community in a holistic way ranging from health and welfare, economic and entrepreneurial endeavours by identify potential projects and interventions that could result in improvements to anti-social behaviour. These are likely to include improved education and training, recreational facilities and activities, crime awareness and management interventions, improved health awareness campaigns (specifically linked to sexual health and well-being).

9.3.5.5 *Residual Impact*

Given that DWA cannot do much to mitigate this indirect impact, and that mitigation is largely the responsibility of the government of Eswatini through its relevant ministries, the residual significance rating will remain **Medium** (**Table 9-40)**. Over time, the significance is likely to reduce as the population adapts.

Table 9-40: Continuation of Anti-Social Behaviour and Spread of STIs and HIV/AIDS (post-mitigation)

Aspect	Impact Summary	Post-Mitigation					
		(M+	E+	R+	D)x	P=	S
Continuation of Anti-Social Behaviour and Spread of STIs and HIV/AIDS	As a result of increased accessibility and an inevitable flow of 'outsiders' through the area, norms, values and customs will continue to change; people will continue to be exposed to different views and new ways of life. Migration in and out of the area will likely be driven more by economic / market reasons, as well as travel to schools and other social facilities that may be of a higher standard than those present in the Nondvo Project Area.	3	4	3	5	4	**60**
		N2 - Medium					

9.3.6 PROVISION OF LOCAL UTILITIES – ENERGY

9.3.6.1 *Description of Impact*

The Nondvo Dam includes a small hydropower plant with a rated power generation of less than 1MW. The energy generated by the project is to be utilised for operational purposes of the dam as well as distribution of electricity to the local communities, by connecting into existing electrical distribution infrastructure, thereby potentially increasing their quality of life.

It is anticipated that the distribution of electricity generated, as well as the operation, management, and maintenance of the hydropower plant, will be taken over by the EEC.

9.3.6.2 *Sensitivity of Receptors*

As indicated in the SES results almost 66% of the respondents have electricity connections to their houses, which they rely on for source of lighting and cooking. The sensitivity of connected households is low however unconnected household is considered high.

9.3.6.3 *Assessment of Impact*

The additional source of electricity would result in positive impacts on the quality of life of the households not already connected to the national grid. The power source may also result in improved stability of the power supply to the community. The impact is anticipated to be of a large magnitude of a permanent nature, however of local extent. The impact is therefore anticipated to be of a **Medium** (positive) significance (**Table 9-41**).

Table 9-41: Provision of local utilities - Energy (pre-mitigation)

Aspect	Impact Summary	Pre-Mitigation					
		(M+	E+	R+	D)x	P=	S
Demand on local utilities - Energy	The energy generated by the project is to be utilised for operational purposes of the dam as well as distribution of electricity to the local population near the reservoir and thus thereby increasing their quality of life.	3	2	5	5	4	**60**
		P2 - Medium					

9.3.6.4 *Mitigation Measures*

– None required.

9.3.6.5 *Residual Impact*

The residual impact significance will remain **Medium** (positive).

10 SUMMARY OF PREDICTED IMPACTS

Based on the discussion presented in the previous sections, it can be concluded that majority of the negative socio-economic impacts of the proposed Nondvo Dam Project will occur during the Construction Phase (including inundation), with majority of the impacts in the Operation Phase being positive.

Positive impacts during Construction phase will include temporary creation of *employment opportunities* as well as associated economic benefits. Significant *Negative impacts* include the physical and economic displacement of PAPs, loss of plant resources used by the community (ecosystem services) as well as potential exacerbation of anti-social behaviour due to in migration (influx of job seekers). With the implementation of recommended mitigation measures, these impacts can be reduced to Medium or Low negative significance.

The most significant Positive impact of the project will be experienced during the Operation Phase. This relates to the ease of shortage of water supply in Manzini and Mbabane and surrounding areas as well as the irrigation of approximately 800 ha of agricultural land, promoting social and economic growth in these areas.

The significant *negative* impact likely to occur during the operational phase of the proposed project is the continuation of anti-social behaviour and spread of STIs and HIV/AIDS. With the implementation of recommended mitigation measures the impact can be reduced to a Medium negative significance.

Table 10-1 and **Table 10-2** summarise the potential socio-economic impacts that may occur during the construction and Operation Phase, respectively.

Table 10-1: Summary of construction phase impacts

Aspect	Impact Summary	Pre-Mitigation	Post-Mitigation
Physical Displacement and Resettlement of Affected Households	The Project will result in physical displacement and relocation of approximately 175 households in Mantabeni and Siphocosini.	N3 - High	N2 - Medium
Economic Displacement of Affected Households	Loss of access to agricultural land for crop cultivation and livestock grazing, as well as natural resources will affect people's ability to produce food and cash crops/ produce.	N3 - High	N2 - Medium
Host Communities	Introduction of the relocated PAPs into the host community will result in increased pressure on land, infrastructure, goods, and services. In severe cases these may result in conflict.	N2 - Medium	N1 - Low
Loss of plant resources used by the community (ecosystem services)	Loss of vegetation will result from site clearance in the infrastructure footprint during construction as well as due to flooding during inundation of reservoir area.	N3 - High	N1 - Low
Creation of Employment, Procurement and Local Business Opportunities	Generation of employment (formal and informal) and other income generation opportunities in the Nondvo Dam Project area and the surrounding area.	P2 - Medium	P2 - Medium
Increased Cost of Living and Debt Generation	Increased demand for goods and services is likely to result in increased prices. Simultaneously, however, local people will be able to sell their goods / services at higher prices, thus potentially generating more income. Increased travelling distance around the reservoir will increase the cost of travel around the dam to reach important public services such as clinics, trading posts, schools and places of worship.	N2 - Medium	N1 - Low
Disturbance from increased nuisance factors (Noise, Dust, Vibrations)	Construction activities will generate uncharacteristic disturbances resulting in a range of nuisance factors (notably increased levels of noise, decreased air quality and vibrations).Damage to households' structures from heavy traffic and rock fall from the blasting operations.	N2 - Medium	N1 - Low
Exacerbation of Anti-Social Behaviour due	Expectations regarding possible employment opportunities may result in the area surrounding the site experiencing an influx of job seekers. Migrants will bring with them differing cultures, religious beliefs,	N3 - High	N2 - Medium

Aspect	Impact Summary	Pre-Mitigation	Post-Mitigation
to in migration (influx of job seekers)	norms and values; they influence young people to change in a manner that may not be accepted by the more conservative/ traditional sector of the population. Resulting increased prevalence of Sexually Transmitted Infections (STIs) and HIV/AIDS as well as crime.		
Increased pressure on social infrastructure and services	The Project area has one clinic, primary school and high school and is regarded as semi-rural. The possible influx of job seekers and additional contractor's workforce may add more stress on the existing resources.	**N2 - Medium**	**N2 - Medium**
Disruption to Family and Community Structures	Employment opportunities may inadvertently cause a shortage of available farming skills and family support networks during the construction phase. Additionally, people employed in the construction work may aim to secure further work in the construction sector elsewhere, with their newly acquired skills and experience may be required, leading to a long term absence from family and disruption to family setting and social structures and improved economic networks.	**N2 - Medium**	**N2 - Medium**
Demand on local utilities - Energy and Water Supply	Additional power requirements for construction purposes and services or facilities in the various housing, camp and work areas is likely to place additional pressure on existing electricity supply. Additional water requirements for construction purposes and services or facilities in the various housing, camps and work areas is likely to place additional pressure on existing water supply	**N1 - Low**	**N1 - Low**
Increased safety risks to people and animals	A number of hazards threaten the public safety and security during the construction phase, including increased traffic movement, handling of hazardous chemicals, rock blasting during quarry mining.	**N2 - Medium**	**N1 - Low**

Table 10-2: Summary of operation phase impacts

Aspect	Impact Summary	Pre-Mitigation	Post-Mitigation
Ease of Shortage of Water in Manzini and Mbabane, Irrigation of agricultural land and Promotion of Social and Economic Growth	The completion of the Nondvo Dam Project water infrastructure will ensure reliable water supply in Manzini, Mbabane and surrounding areas as well as water supply for irrigation of 800 ha of agricultural land in the project area. The availability of reliable infrastructure assets can increase returns and levels of investment and therefore accelerate economic growth.	**P3 - High**	**-**
Economic Opportunities and Diversification	The Project area will be more accessible, and the reservoir will potentially be seen as an attraction resulting in increased number of tourists visiting the area. With increased employment opportunities, there will be increased informal traders with diverse business types to take advantage of the workers in the area. The economy, which is almost exclusively focused on agriculture, is likely to become more diversified through an influx of informal traders and people with a greater variety of skills and offerings.	**P2 - Medium**	**P2 - Medium**
Increased cost of living	The cost of goods and services is likely to increase gradually throughout the construction phase and remain elevated throughout the operational phase. In addition to the increased costs of items, goods and services that were previously not offered for purchase may become available.	**N2 - Medium**	**N2 - Medium**
Growth in the local tourism sector	Establishment of the Nondvo Dam would likely attract visitors who would value the aesthetic presence of the reservoir and who enjoy water-based recreational activities that may be permitted at the site. This would increase the footprint of tourist and contribute to the income generation of the local area. Construction of tourism facilities by local entrepreneurial and partnerships in the area may increase. Growth of the tourism sector will also facilitate creation of induced employment for local people, especially the youth.	**P1 - Low**	**P2 - Medium**
Continuation of Anti-Social Behaviour and Spread of STIs and HIV/AIDS	As a result of increased accessibility and an inevitable flow of 'outsiders' through the area, norms, values and customs will continue to change; people will continue to be exposed to different views and new ways of life. Migration in and out of the area will likely be driven more by economic / market reasons, as well as travel to schools and other social facilities that may be of a higher standard than those present in the Nondvo Project Area.	**N3 - High**	**N2 - Medium**

Aspect	Impact Summary	Pre-Mitigation	Post-Mitigation
Demand on local utilities - Energy	The energy generated by the project is to be utilised for operational purposes of the dam as well as distribution of electricity to the local population near the reservoir and thus thereby increasing their quality of life.	**P2 - Medium**	**P2 - Medium**

11 RECOMMENDATIONS AND CONCLUSIONS

It is recommended that the mitigation and maximisation measures included in this report be implemented to decrease the effect of negative impacts on communities and maximise the effect of positive impacts.

In conclusion the proposed Nondvo Dam project poses a number of potential positive and negative social impacts of which majority of the negative impacts are associated with the construction phase and positive impacts with the operation phase.

With appropriate measures, the negative impacts can be reduced to acceptable levels while the positive impacts can be maximised to provide significant benefits to the region.

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ANNEXURE 1: ATTENDANCE REGISTERS OF PUBLIC MEETINGS AT SIPHOCOSINI & MANTABENI

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy
Mbabane - Manzini Corridor Dam (Nondvo Dam)
Environmental & Social Impact Assessment (ESIA)
Public Participation Meeting Attendance Register

SIPHOCOSINI COMMUNITY MEETING
Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: SIPHOCOSINI
Date/ Lusuku: 3 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
MBUSO KINGSLEY	WSP/ MMA	LOCAL ENVIRONMENTAL SUPPORT	7653 0306	mbuso@mapmitch.org	[signature]
Daniel Mamba	Ncabaneni (Siphocosini)	RESIDENT	76474869	Box 511 Mbabane	[signature]
T M Simelane	Ncabaneni	RESIDENT	76997814	–	TM
SABELO MOTALING	"	N/A RESIDENT	79327120	–	[signature]
Mark Payne	Ncabaneni	N/A RESIDENT	76781811	mpayneafrica@gmail.com	[signature]
LEONARD CAMP	SITHOBELA	N/A RESIDENT	76432302		[signature]
Jamison Matsebula	Sipete	N/A RESIDENT	76022701 78676363	okumhlophemesimaifs@gmail.com	[signature]
ENOS NKAMBULE	Sipete	BANDLANCANE	78028157 76341753	P.O. Box 70 Nhlambeng	[signature]
KENNETH DLAMINI	NCABANENI	INNER COUNCIL	76971540	BOX 9874 MBABANE	[signature]
Patrick Zulu	Sithobela	Induna Yembali	76084392	–	[signature]
APENIKO MBUYISA	Ncabaneni	Mgijimi	76605740	–	[signature]

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy

Mbabane - Manzini Corridor Dam (Nondvo Dam)
Environmental & Social Impact Assessment (ESIA)
Public Participation Meeting Attendance Register

SIPHOCOSINI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: SIPHOCOSINI
Date/ Lusuku: 03 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
David Ndwandwe	Ncabaneni	RESIDENT	76532752	–	[signature]
PATRICK MAWYA	NYAMA	"	76079184	–	[signature]
SIPHO LANGWENYA	EMBO	"	76031191	–	[signature]
Ishmael Dlamini	Ncabaneni	"	76035440	–	[signature]
MAURICE LITTLER	NCABANENI	"	76048295	–	[signature]
DLAMINI MANANZI	NCABANENI	"	76346167	–	[signature]
SIMELANE ROBERT	"	"	78035968	–	[signature]
Fine Dlamini	NCABANENI	"	76499256	–	[signature]
Sihlongonyane Vivian	KANYAMA	"	76923671	–	[signature]
VILAKATI ANDREW	KANYAMA	"	76496668	–	[signature]
Austin Dlamini	Kanyama	"	76240811	–	[signature]

SIPHOCOSINI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: SIPHOCOSINI

Date/ Lusuku: 03 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Moses Maseko	Sibetsa	RESIDENT	78217571	–	[signature]
Sibusiso Simelane	Ncabaneni	RESIDENT	76456550	–	[signature]
Vusie Sibisi	Sithobela	N/A RESIDENT	7651 1586	–	[signature]
M. Vilakati	Ncabaneni	N/A RESIDENT	76034268	–	[signature]
BONGANI DUBE	KANIAMA	N/A RESIDENT	76328818	–	[signature]
ABEL MOTSA	EMBO	N/A RESIDENT	7623 4526	–	[signature]
VINCENT SANDLENI	SPHOCOSINI NO II	" "	78635060	–	[signature]
NDZABEDA	EMBO	" "	76279055	–	[signature]
Solomon Vilakati	Embo	" RESIDENT	7659 7835	–	[signature]
Orela mariya	Embo	RESIDENT	7819287	–	–
David Dlamini	Embo	RESIDENT	78146430	–	[signature]

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Venue/ Indzawo: SIPHOCOSINI
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Hudu Dlamini	Ncabaneni	Prince	-	-	[signature]
Dumisani Dlamini Maphikam	Embo	"	76362289	-	[signature]
Samson M Msibi	Embo	Bandlancame	76088126	-	[signature]
NGabi Dlamini	Ncabaneni	Prince	-	-	[signature]
Moses Nhlabatsi	Spete	Umeluleki	-	-	[signature]
Mchele Gule	Embo	Umeluleki	76217973	-	[signature]
Shedrak Maphosa	KaNyama	Umeluleki	76859894	ssmaphosa@yahoo	[signature]
Mlandomolle Dlamini	Embo	RESIDENT	78029771	mlandomolle@gmail.com	[signature]
Lungisisa S Vilakati Dladla	Mantabeni/Siphocosini	RESIDENT	78399469	lungisisa34@gmail.com	[signature]
Tmulasizwe T.Z Mdluli	Ncabaneni	Community member	76286230	tmulasmdluli011@gmail.com	[signature]
Lucky M Dube	Spete	RESIDENT	76327966	-	[signature]

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Jeremiah Nhlabatsi	Siphocosini II	Mphatsi ukhulugo	76543734	-	J.N.Nhlabatsi
Sifiso Motsa	Siphocosini II	Secretary	7605 7097	-	[illegible]
Mduduzi Nguenya	Siphocosini II	Ngcini mafa	76054679	-	M.Ng
Sipho Dlamini	~~Siphocosini~~ Ncabaneni	Ncabaneni	76458984	-	[illegible]
Alfred Nhlabatsi	Siphocosini II	Bandlancane (Endunkhulu)	76349219	-	A.N.Bot
Mathendele Dlamini	S'thobela	Kings Son	7624 9837	-	SD
Sbusiso Dlamini	Sthobela	King's Son	76172242	dlaminimbazo@mail.com	SD
NELSON DLAMINI	NCAbaneni	Kings Son	76321278	-	[illegible]
Senzo Dlamini	Embo	PRINCE	76295959	-	[illegible]
Soniboy Dlamini	EMBO	PRINCE	76980415	-	[illegible]
LOT DLAMINI	NCABANENI	PRINCE		-	Lot Dlamini

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Mxolisi Dlamini	Sipete	RESIDENT	76882868	Sinazodlamini@gmail.com	[signature]
Nkosinathi Nkambule	Sipete	RESIDENT	76776155	N/A	[signature]
Sibusiso Masi	Ncabaneni	RESIDENT	78023487	mnisisg@sgo.org.sz	[signature]
Mxolisi Masi	Ncabaneni	RESIDENT	78637864	-	[signature]
Timothy Kunene	KANYAMA	RESIDENT	76224230	-	[signature]
Armstrong Dlamini	Embo	Inner Council	76024040	asd@asd.co.sz	[signature]
Nsizwa Khoza	Embo	RESIDENT	76032708	Jethmoman15@gmail.com	[signature]
Sandile Ngozo	Mcabaneni	RESIDENT	76675743	-	[signature]
HAPPYGOD MATSEBULA	SITFOBELA	RESIDENT	76267842	-	[signature]
Luke Mthwanazi	Ambo Kuntsetse	RESIDENT	76251773	-	[signature]
Mfanizile Dlamini	Embo-Kuntsetse	RESIDENT	76650582	-	[signature]

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Hlophe Nduduzo S	Sipete	RESIDENT	7650 9553	–	[signature]
Sibiya Comfort	Sipete	"	76283374	–	[signature]
Dlamini Christopher	Ncabaneni	"	7607 2641	–	[signature]
Michel Mavimbela	Ncabaneni	Mphetsi sikhungo (ZONE LEADER)	76118733	–	[signature]
Sfiso Mamba	Embo	RESIDENT	76080478	–	[signature]
Dumisani Dlamini	Spebe	"	76406393	–	[signature]
Mxolisi Simelane	Sihobela	"	76440745	–	[signature]
Alfred Shongwe	Sihobela	"	7618 3213	–	[signature]
Sicelo Dlamini	Spete	"	7672 3472	–	[signature]
Phumlani Hlophe	Spete	"	7651 2071	–	[signature]
Bongu Hlophe	"	"	76077640	–	[signature]

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Philani Tfwala	Spete	RESIDENT	76170323	-	[signature]
Gorge Simelane	Sthobela	"	76035045	-	[signature]
Mxolisi Matsebula	Embo	"	76236300	-	[signature]
Majaha Hlophe	Spete	"	76351661	-	[signature]
Sibusiso Ngwenya	Spete	"	76134520	-	[signature]
Lomsanetfo Ngwenya	Spete	"	76134560	-	[signature]
Bongani Dube	[illegible]	"	7617617	-	[signature]
Bongani Langwenya	Sitfobela	"	76117497	-	[signature]
Milton Ngwenya	Ncabaneni	"	78637750	-	[signature]
Shadrak Nhlabatsi	Spete	"	78206037	-	[signature]
Nozwandile Mnethwa	Sithobela	"	78058009	-	[signature]

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Boy Nkambule	Spete	RESIDENT	76325895	–	[signature]
Gudeni Simelane	Embo	"	76535332	–	[signature]
Elson Maseko	Sthobela	"	76522801	–	E.M.
MUSA Dlamini	Sithobela	"	76268677	–	[signature]
David Samson Nyoni	Sthobela	"	–	–	D.N
Samuel Mavuso	Ncabaneni	"	7611 8754	–	[signature]
Philani Dlamini	Sthobela	"	76072988	–	[signature]
May Thwala	Sthobela	"	76370409	–	[signature]
Sanelisiwe	Kuncene	"	7663624	–	[signature]
Daniel Nhlabatsi	SPETE	"	76520821	–	[signature]
MBUSO Dlamini	Sithobela	"	76646381	–	[signature]

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Grace Hlophe	Sipete	– RESIDENT	78348349	–	G. Hlophe
Jema Dlamini	Ncabaneni	– "	76576854	–	J. Dlamini
Eldah Dlamini	Sithobela	– "	76772161	–	E. Dlamini
Mavis Hlophe	Sipete	– "	76576079	–	M. Hlophe
Nompumelelo Nxumalo	Ncabaneni	– "	76067111	–	N. Nxumalo
Agnes Silindza	Sipete	– "	–	–	A. Silindza
Babili T. Mabuza	Ncabaneni	– "	76768065	–	Mabuza
Thulani Mangabsi	Ncabaneni	– "	76048219	–	[illegible]
Wandile Gulwe	Sipete	– "	76140194	–	[illegible]
~~Hloph~~ Mhlophe Nkambule	Embo	– "	76130528	–	N Nkambule
Ndumiso Dlamini	Sipete	– "	76149941	–	Dlamini

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Bugile Dlamini	EMBO	community member	76070441	bujilesibany@gmail.	BD
Futhi Zwane	Ncabaneni	community member	76703936	–	[signature]
Louisa Thandazo Dlamini	Ncabaneni	community member	76411074	–	[signature]
Make Lindiwe Mnisi	Ncabaneni	" "	76143241	–	[signature]
Make Elcoe Zwane	Embo	" "	76188772	–	E Z
Make LILIA Dlamini	" "	" "	76273074	–	[signature]
NOMSA DLAMINI	" "	" "	76150293	–	N Dlamini
Rejoyce Mabuza	NCabaneni	"	7619773	–	[signature]
Lindiwe Zitala	Ncabaneni.	COM: RESIDENT	76703203	–	Zitala
Make PHILILE Shhonga	Sipece	COM, "	7614467	–	Philile
MRS Shongwa Khumalo	Spete	Comunity "	76574876	–	TKSHongwe

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Zanele Kunene	Sthobela	community	76290651	//	Kunene
Agnes Magagula	Sthobela	community member	76711890 ~~7618140~~	//	M. Magagula
Norah Shabangu	Ncabaneni	community	76755140	//	N. Shabangu
Sholiphi Dlamini	Ncabaneni	Community	78291399	//	S Dlamini
Sarafina Dlamini	Sipho Sipete	community	76285429	//	S. Dlamini
Sanny Simelane	NCABANENI	COMMUNITY	76924403	//	S. Simelane
Lungile Manana	KANYAMA	COMMUNITY	76050941	oxtailpot@gmail.com	[signature]
Spholeshle Sacolo	SIPHOCOSINI	- RESIDENT	76215391	Khekza@gmail.com	[signature]
HRH Thokoza Dlamini	SIPHOCOSINI	- RESIDENT	76059422	-	[signature]
Mrs Faye Miller	Ncabaneni	COMMUNITY Member	76122298	fpayne@Swazi.net	efmiller
Mousa M Gwe	Ncabaneni	COMMUNITY member	76661434	-	[signature]

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Sibongile Mhlanga	Ncabaneni	COMMUNITY member	7641 3264	–	SMhlanga
Mary Simelane	Ncabeneni	community MEMBER	–	–	M.Simelane
Zanele Dlamini	Embo	community "	76439040	–	Z.Dlamini
Sebenzile Zubuko	Sipete	community "	78146495	–	[illegible]
Bhelina Dlamini	Ncabeneni	community "	76216158	–	BDlamini
Isabel Maseko	Sipete	community "	76346353	–	Isabel
Martha Nkhatshwa	Sithobela	Community "	76573753	–	Mkhatshwa.
Sonto Simelane	Embo	community "	76225565	–	SonTO
Gladys Manana	Sithobela	community "	78145441	–	Gladys
Maria Matsebula	Sithobela	community "	76584326	–	MT
Nompumelelo Giyane	Embo	community "	7627733[illegible]	–	NGiyane

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Gabisile Gule	Sipete	community MEMBER	76340478	—	Gule
Tholakele Khumalo	Embo	community "	78074545	—	Tholakele
Gugu Matsebula	Sithobela	community "	76083325	—	G.Matsebula
Thoko Gule	Ncabaneni	community "	76383404	—	T.Gule
Nosbile Dlamini	Embo	community "	76112310	—	[illegible]
Jabulile Simelane	Embo	community "	76543588	—	J.Simelane
Welile kunene	Embo	community "	76704526	—	WKunene
Itfombile Simelane	~~Em~~ Ncabaneni	community "	76721189	—	T. Simelane
Gcina Mavimbela	Ncabaneni	community "	76525025	—	G Maambela
Auto Simelane	Ncabaneni	community "	76554700	—	A.Simelane
Nokuthula Mahlalela	Ncabaneni	community "	76340406	—	N Mahlalela

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Thulani Msibi	Sithobela	community MEMBER	76516511	–	T.Msibi
Lindiwe Dlamini	Embo	community "	76683969 ~~76683446~~	–	[signature]
Ntombi Mavuso	Sipete	community "	76629598	–	[signature]
Elizabeth Sihlongonyane	Sithobela	community "	78723389	–	ES
Maggi Mamba	Sithabela	community "	76970624	–	M.Mamba.
Khanyisile Dlamini	Sithobela	community "	76933757	–	K.Dlamini
Xolile Shongwe	Ncabaneni	community "	76377926	–	X.X.SHONGWE
Zodwa Matse	Ncabaneni	community "	76458100	–	[signature]
Zanele Msimango	Ncabaneni	community "	76076754	–	Z.Dlamini
Virginia Ndzinisa	~~Ncabab~~ Ncabaneni	community "	76424702	–	V. Ndzinisa
Sebenele Simelane	Ncabaneni	community "	76052510	–	S.Simelane

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Dumsile Mavuso	Ncabaneni	community MEMBER	76935357	–	[signature]
Ellene Manyatsi	Ncabaneni	community "	76553906	–	E. Manyatsi
Leta Mnisi	Sithobela	community "	76643523	–	L. Mnisi
Sitfoliwe Gwebu	Embo	community "	78481174	–	S. Gwebu
Alice K. Dlamini	Embo	community "	76636355	–	A. Dlamini
Anna Itfwala	Sithobela	community "	–	–	[signature]
Miriathe Malaza	Sipete	community "	–	–	M. Malaza
Thandi Maseko	Sithobela	community "	76744717	–	T. maseko
Phumzile Itfwala	Sithobela	community "	76537413	–	[signature]
Thembi Sukati	Sithobela	community "	76328872	–	[signature]
Zanele Ndzima	Sithobela	community "	76591077	–	[signature]

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Selina Sikhondze	Sithobela	community MEMBER	76279408	—	S Sikhondze
Katherin Dlamini	Sithobela	community "	76798383	—	Dlamini
Afra Mabuza	Ncabaneni	community "	76340169	—	Afra
Thulisile Mabuza	Ncabaneni	community "	76143695	—	T Mabuza
Sizakele Mamba	Ncabaneni	community "	76242517	—	Mamba
Dumsile Ngubeni	Embo	community "	76870477	—	[illegible]
Xolile Magagula	Sithobela	community "	76267729	—	Magagula
Thembi Ndzimandze	Sipete	community "	78636154	—	T Ndzimandze
Beauty Lukhele	Embo	community "	76357512	—	[illegible]
DUDU DUPONT	NCABANENI	" "	76071913	—	D Dupont
CEBILE DLAMINI	NGABANENI	" "	78136633	—	Dlamini

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SIPHOCOSINI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: SIPHOCOSINI
Date/ Lusuku: 03 AUG 2019.

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Khangezile Dube	Ncabaneni	community MEMBER	78117696	—	[signature]
Zodwa Dlamini	Sithobela	community "	76571318	—	[signature]
Busile Msibi	Embo	COMMUNITY "	76364560	busile81@gmail.com	Busibi
THOBILE THWALA	EMBO	COMMUNITY "	78079517	—	T.Thwala
Simangele Mlangeni	EMBO	COMMUNITY "	76416031	—	[signature]
Nonhlanhla Ngcamphalala	Mahlanya	community "	78046675	—	[signature]
Susan Dlamini	Sipete	community "	78225539	—	S.Dlamini
Zandile Dlamini	Embo	community "	76050359	—	Z.Dlamini
Nomsa Ttfwala	Embo	community "	78344731	—	[signature]
Sibongile Dlamini	KaNyama (Siphocosini)	community "	76744553	—	S.Dlamini
Nonhlanhla Mchobokazi	Sitobela	COMMUNITY "	76330454	—	Mchobokazi

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SIPHOCOSINI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: SIPHOCOSINI
Date/ Lusuku: 03 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Simelane Hildah	Ncabaneni	community MEMBER	76356106	—	[signature]
Josephina Hlophe	~~Ncabaneni~~ Sipete	community "	—	—	[signature]
Nothando Dlamini	Ncabaneni	community "	76661523	—	[signature]
Nontsikelelo Simelane	Ncabaneni	community "	78449655	—	[signature]
Lombuso Nkambule	Sipete	~~com~~ " "	78191398	—	L.Nka
Queen Mabuza	Ncabaneni	" "	76354702	—	Q Mabuza
Elizabeth Sithole	Ncabaneni	" "	76335670	—	[signature]
Tryphina Simelane	Ncabaneni	" "	76712906	—	[signature]
Gcebile Mthethwa	Sithobela	" "	76733084	—	G.M
Mchobokazi Nomsa	Sithobela	" "	76511220	—	[signature]
Xolile Motsa	Ncabaneni	" "	76086826	—	[signature]

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy
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SIPHOCOSINI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: ~~MNCITABENI~~ SIPHOCOSINI
Date/ Lusuku: 03 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Justice Mamba	Ncabaneni	Community Police	76264389	–	J.M
MPENDULO DLAMINI	EMBO	MELULEKI	76518690	–	MGD
THULANI VILAKATI	Ncabaneni	LIJAHA LELIKUBA TINTFOMBI	78144218	–	Thu.
SBUSISO MALAZA	SPETE		76622306	–	Sm
OBED LANGWENYA	EMBO	MPHATSI SIKHUNGO	76070294	–	[illegible]
ZODWA DLAMINI	Si FUTURES	CONSULTANT	–	zodwad@icloud.com	[illegible]
Phakisa Mokhesi	Sifutures	CONSULTANT	76426284	phakisa-mokhesi@sifutures.co.ls	[illegible]
R Ramodeti	Si FUTURES	CONSULTANT	76426266	ramoerich@gmail.com	[illegible]

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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17/08/2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Vusi Mahlambi	Mhlane	Community Police	76301127	—	Samull
Thembsile Nhlabatsi	Mahothoza	Community Police	76658035	—	TN
Tengetile Mlangeni	Mahothoza	Community Police	76047434	—	TMlangeni
Freda Nkumane	Mahlangeunu	Umsicamphe	76540615	—	Nkumane
Ciniso Mlangeni	Mahothoza	- RESIDENT	76666430	—	Mlangeni
Martha Dlamini	Mahlangeunu	Badlaueane	76510583	—	[illegible]
Nhlabatsi Monica	Mantabeni	Bandlancane	76548277	—	MN
Celani Hlophe	Mahlalangcunu	treasure	76785189	—	Hlophe
Edgar Du Pont	EZULWINI Counsilor	Consulor	76118485	—	[illegible]
ERIC NXUMALO	//	Bandlancane	76122583	—	[illegible]
MBONENI XABA	//	MBONENI	76085121	—	[illegible]

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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Mzwanga Mbebe	Mantabeni	Bucopho	76276835	Box 74 Mbabane	[signature]
Mandla Cindz.	mantabeni	Vise Chairperson	76176784	Box 6803 Mbabane	[signature]
JOHANES HLOPHE	mantabeni	Chairperson	76143027	—	[signature]
Ndlavela Mavimbela	Zulwini	Indvuna	7645 3017	—	Ndlavela
Elias Mdlovu	Zulwini	Chairperson	7603 6869	—	Mdlovu
Lenchie Lapidos	Mantabeni	Bandla Ncane	76267266	—	Lapidos
Thabitha Mndzebele Mazuje	Mantabeni	- RESIDENT	76329807	-	Mndzebele
Telesitha Nkambule	Mantabeni	RESIDENT	78053597	Box 4054 Mbabane	[signature]
Thubelihle Mabaso	Mantabeni	RESIDENT	76377003	—	T. Mabaso
Lihle Sibandze	Mantabeni	RESIDENT	76798572	—	L. Sibandze
Sikhulile Motsa	Mantabeni	RESIDENT	76796162	—	S. Motsa

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Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Tengetile Nhlabatsi	mantabeni	- RESIDENT	76424906	-	T.Nhlabatsi
Mbali Lokotfwako	Mantabeni	RESIDENT	76395050	—	M.Lokotfwako
Senamile Mamba	Mantabeni	- RESIDENT	78109270	-	[illegible]
Jolanda Lokotfwako	mantabeni	RESIDENT	76471505	-	Lokotfwako
Dephile Sihlongonyane	Mantabeni	- RESIDENT	76767955	-	Sihlongonyane
Nondabo Sibiya	Mantabeni	- RESIDENT	76331823	-	Sibiya
Nkosingiphile Tfwala	Mantabeni	- RESIDENT	76369541	-	Tfwala
Silindile Shongwe	Shongwe Mantabeni	- RESIDENT	7618 1874	—	Shongwe
Beketele Simelane		- RESIDENT	76264419	-	Simelane
Siyabonga Motsa	Mantabeni	- RESIDENT	76455462	-	S.Motsa
Sbonelo Khumalo	Mantabeni	- RESIDENT	76048565	-	S.Khumalo

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Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Sakhile Maseko	Mantabeni	- RESIDENT	78144360	-	S. Maseko
Nonsikelelo Macina	Mantabeni	- RESIDENT	76310490	-	N. Macina
Rebecca Kubheka	Mantabeni	- RESIDENT	78056500	-	R Kubheka
Precious Mngometulu	Mantabeni	- RESIDENT	76245520	-	Mngometulu
Nkosingiphile Sibandze	Mantabeni	- RESIDENT	76520193	-	[illegible]
Nkosinathi mbetse	mantabeni	- RESIDENT	76264006	-	[illegible]
Gcebile Dlamini	Mantabeni	- RESIDENT	76174822	-	Dlamini
Richard Mnisi	Mantabeni	- RESIDENT	76378685	-	[illegible]
Millicent Nkambule	Mantabeni	- RESIDENT	76654268	-	Nkambule
Graham Mgwenya	Mantabeni	- RESIDENT	76185714	-	Mgwenya
Xolile Gundzi	Mantabeni	- RESIDENT	76119810	-	[illegible]

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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Dande Dikalala	Mhlane	RESIDENT	76313575	—	Dikalala
Nosipho Mbhamali	Ndlelaluhlei	RESIDENT	76327299	—	Nmbhamali
Thandie Lokotfwako	Mhlane	RESIDENT	76613496	—	T. Lokotfwako
Nontobeko Mthethwa	Mhlane	RESIDENT	76572736	—	Ntseefwa
Nokuthula Zwane	Mhlane	RESIDENT	78151221	—	N.ZWANE
Lindiwe Mabuza	"	RESIDENT	76062018	—	[illegible]
Phumzile Mavimbela	"	RESIDENT	76159810	—	P.Mavimbela
Lomthandazo Mazubuko	MANTABENI	RESIDENT	76231352	—	L.M.
Lettar Mnisi	MHLANE	RESIDENT	76893703	—	Lettar
Bongi Moyane	Mhlane	— RESIDENT	76137152	bogama.@gmail	[illegible]
Rose Simelane	Scakayu	— RESIDENT	76147575	—	RSimelane

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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Dumisani Simelane	Mhlane	RESIDENT	76477002	—	[signature]
Alfred Cindzi	Mhlane	RESIDENT	76724416	—	[signature]
Clement Motsa	Mbabane	RESIDENT	76172235 ~~76171722~~	—	[signature]
Ephraim Motsa	Mhlane	RESIDENT	76383859	—	[signature]
Mfanfikile Shabangu	Mhlane	RESIDENT	76072506	—	[signature]
Luke Dlamini	Mantabeni	RESIDENT	76673720	—	[signature]
Albert Dlamini	Mantabeni	RESIDENT	76324069	—	[signature]
Dumisani Khoza	Mantabeni	RESIDENT	76339881	—	[signature]
Johannes Mbetse	Mantabeni	RESIDENT	76244087	—	[signature]
Nhlanhla Mamba	Mantabeni	RESIDENT	76445608	—	[signature]
Mncedisi Dlamini	Mantabeni	RESIDENT	78020406	—	[signature]

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy
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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Mgao Dlamini	Nkhube	RESIDENT	7641 5058	—	[signature]
Mandla Mdluli	Mantabeni	RESIDENT	76040089	—	[signature]
ISAAC ZAMBANE	Mamini (Mhlane)	RESIDENT	76073370	—	[signature]
David Vilakati	Nkhube	RESIDENT	78059371	—	D Vilakati
Simon Mbetse	Mhlane	RESIDENT	76177011	—	[signature]
JOSEPH HLOPHE	MHLANE	— RESIDENT	76078359	—	[signature]
Mdwidwi Mbetse	Mhlane	RESIDENT	76688741	—	[signature]
Samuel Mbetse	Mhlane	RESIDENT	78269737 ~~78269397~~	—	[signature]
Prince Sicelo	Masibekela	RESIDENT	—	—	[signature]
Sabelo Motsa	Mantabeni	RESIDENT	7612 6468	—	[signature]
Jabusibili Ndzingane	Mhlane	RESIDENT	76047240	—	JDS

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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019.

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Isaiah Nkambule	Mhlane	RESIDENT	7890612	I Nkambule	J. Nkambule
Nkosinathi Simelane	Mhlane	RESIDENT	78623627	-	[signature]
Mavisha Shongwe	Mantabeni	RESIDENT	76304611	-	[signature]
Nkosinathi Shongwe	Mantabeni	RESIDENT	76083093	-	[signature]
Sifiso Sibandze	Nkhube	RESIDENT	76321843	-	S. Sibandze
Mvikeli Nhlabatsi	Mantabeni	RESIDENT	78144511	-	Nhlabatsi
Isaac Dlamini	Nkhube	RESIDENT	76276400	-	[signature]
Duma Mamba	Nkhube	RESIDENT	76224672	-	[signature]
Nkosingiphile Lokotfwako	Nkhube	RESIDENT	76834480	-	Nlokotfwako
~~Dui~~ Maswazi Lokotfwako	Nkhube	RESIDENT	79796686	-	[signature]
Mbhekeni Mahlambi		RESIDENT	78359693	-	[signature]

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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 07 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Daniel M Mamba	Mantabeni	RESIDENT	78043284	—	[signature]
Vusi Motsa	Mantabeni	RESIDENT	76041598	—	[signature]
LUNGELWA KHUMALO	MANTABENI	RESIDENT	78230251	—	[signature]
Bonginkhosi Ngwenya	Mantabeni	RESIDENT	76322411	—	BNGWENYA
Themba Mabuza	Mhlane	RESIDENT	76264784	—	[signature]
Ndumiso L Mkhonta	Mantabeni	RESIDENT	76517470	—	[signature]
Vusi Sangweni	Mhlane	RESIDENT	76856671	—	[signature]
Phinda Mndvoti	Mhlane	RESIDENT	76807198	—	[signature]
PHILEMON MDJANE	MHLANE	RESIDENT	76083146	—	[signature]
DUMISANI SHONGWE	MHLANE	RESIDENT	76517074	—	[signature]
PETER SIMELANE	MHLANE	RESIDENT	7612 9387	—	[signature]

MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Dumisani Khumalo	Mhlane	RESIDENT	76933809	–	[signature]
Mangowu Mnisi	Mhlane	RESIDENT	76496185	–	[signature]
Mathew Dlamini	Mhlane	RESIDENT	78467143	–	[signature]
Douglas Mamba	Mhlane	RESIDENT	760 79355	–	[signature]
Petros Gama	Nkhube.	RESIDENT	76310190	–	[signature]
Mawandile Dlamini	Nkhube	RESIDENT	76365345	–	[signature]
Anthony Mloba	Nkhube	RESIDENT	76697095	–	A. Mloba
Nkambule. Nusie Mfanawenkosi	Mhlarre	RESIDENT	76528101	–	[signature]
Daniel Cindzi	MHLANE	RESIDENT	76211643	–	[signature]
Sipho Manana	Mantabeni	RESIDENT	76070338	–	[signature]
Moses Dlamini	Nkhube	RESIDENT	76872651	–	[signature]

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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Flora Cindzi	Mhlane	RESIDENT	76675129	-	F. Cindzi
Dumisani Gama	Nkhube	RESIDENT	78491493	-	D.Gama
Phumzile Vilakati	Mhlane	RESIDENT	76078912	-	Vilakazi
Jabu Kunene	Mahlalangeni	RESIDENT	76517071	-	J. Kunene
Tryphina Mndzebele	Mhlane	RESIDENT	76755076	-	T. Mdzebele
Khombisile Motsa	Mhlane	RESIDENT	76569819	-	K. Motsa
Lindiwe Bhembe	Mahlatsini	RESIDENT	76260146	-	L. Bhembe
Gemma Zwane	Mhlane	RESIDENT	76287097	-	G. Zwane
Fikelephi Mahlambi	Mhlane	RESIDENT	76940121	-	F. Mahlambi
Neli M. Dlamini	Mhlane	RESIDENT	-	-	N. Dlamini
Thembi Nhlabatsi	Mhlane	RESIDENT	76760283	-	T. Nhlabatsi

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MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
NTOMBIKAYISE DLAMINI	MHLANE	— RESIDENT	76281431	—	[signature]
GRACE Maseko	MHLANE	— RESIDENT	78185018	—	[signature]
JeremiyaSimelane	Mantabeni	— RESIDENT	—	—	J M
Cecilia Dlamini	Mhlane	~ RESIDENT	76046014		[signature]
SIKELELA VILAKATI	Mantaben.	— RESIDENT	76116251	~~Box 6120 Mbabane~~	[signature]
Nhleko Vus B.	MANTABENI	— RESIDENT	78143881	~~Mxo2iTi~~	[signature]
Sibongile Msibi	~~Mahlabsini~~ Mantabeni	— RESIDENT	76156829	—	[signature]
Fikile N. Dlamini	Mantabeni	— RESIDENT	76388694	—	F. N. Dlamini
Sibusiso Mbetse	Mhlane	— RESIDENT	76485808	—	Sibetso
Sibongile Mahlambi	Mhlane	— RESIDENT	76762968	—	S.M
Jabulile Malaza	Mantaboni	| RESIDENT	78459240	—	[signature]

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy
Mbabane - Manzini Corridor Dam (Nondvo Dam)
Environmental & Social Impact Assessment (ESIA)
Public Participation Meeting Attendance Register

MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Nhlanhla Masuku	Mantabeni	– RESIDENT	7637169[illegible]	nhlanhla masuku [illegible]	[signature]
M[illegible] M[illegible]ba	Mantabeni	– RESIDENT	76130464	–	[signature]
Meludzi Dlamini	Mhlambanyatsi	– RESIDENT	78605993	–	[signature]
Lucky Shongwe	Mantabeni	– RESIDENT	76277534	–	[signature]
Mahlubi Dlamini	Mantabeni	– RESIDENT	7641805	–	[signature]
Walter Nkambule	Mantabeni	– RESIDENT	76276597	–	[signature]
Thuleni Baartsiee	Mantabeni	– RESIDENT	76182795	–	[signature]
Makhosazana Mvubu	Mantaben	– RESIDENT	76599396	–	[signature]
Mbetse Nonhlanhla	Mantabeni	– RESIDENT	76600172	–	[signature]
Dories Gama	Mhlane	– RESIDENT	78076216	–	[signature]
Wendile Dlamini	Mantabeni	– RESIDENT	76318693	jnddlamini@gmail.com	[signature]

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy
Mbabane - Manzini Corridor Dam (Nondvo Dam)
Environmental & Social Impact Assessment (ESIA)
Public Participation Meeting Attendance Register

MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Selby.Z.Nkambule	Nkube	Zone Vice Chairman	76218929	–	[signature]
Mr Wilson Kunene	Mantabeni	Inner Council	7631 8049	–	[signature]
Nichole [illegible]	Mantabeni	[illegible]	76[illegible] 5[illegible]	–	[signature]
Jacob Mathobala	Mantabeni	Inter Council	7865213	–	J. Mathobela
Bhekiy Matsebula	MANTABENI	Bhekile Mkhulu	76883019	–	[signature]
Veli Sifundza	Mantabeni	– RESIDENT	~~780~~ 78348461	–	[signature]
Jabulani Khoza	Mantabeni	– RESIDENT	76404878	–	[signature]
Vusi Shongwe	Scakavu	RESIDENT	76743702	–	[signature]
FANA MAGAGULA	SCAKAVU	– RESIDENT	78342479	–	[signature]
Maseko Qiniso	Mantabeni	– RESIDENT	76089985	–	Q.Maseko
Bafana Mkhonta	Mantabeni	– RESIDENT	–	–	B. Mkhonta

WSP Project No.: 41101262MMA file reference: C:\Shared\jobs$\Jobs 16\SD1631 Mbabane-Manzini Corridor Dam (Nondvo Dam)\Meetings\SD1631 Public Participation Meeting Attendance Register.xlsx

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy
Mbabane - Manzini Corridor Dam (Nondvo Dam)
Environmental & Social Impact Assessment (ESIA)
Public Participation Meeting Attendance Register

MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Mavimbela Nel'siwe	Scakavu	- RESIDENT	78374096	-	[illegible]
Koloni Mamba	Mahlalangcunu	- RESIDENT	-	-	K. M
Joyce Bhembe Miya	Emaphepheni Ebhekephi	- RESIDENT	76454609	-	J Bhembe
Khumbuzile Thwala	eNkobe	- RESIDENT	78360931	-	[illegible]
Lungile Mkhatshwa	Mngcozini	- RESIDENT	76690884	-	L. m
Sandile Magagula	Mhlane	- RESIDENT	76421467	-	Magagula
Sithembile Hlatjwayo	MANTABENI	- RESIDENT	76888156	-	S.Hlatjwayo
Joanah Methe	Mantabeni	- RESIDENT	76128308	-	Methe
Gugu Manana	Mhlane	- RESIDENT	78451085	-	G Manana
Rose Dlamini	Mhlane	- RESIDENT	76364885	-	[illegible]
Nozizwe Dlamini	Mhlane	- RESIDENT	76199542	-	N. Dlamini

MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Ndzelaphi mbetse	Mhlane	— RESIDENT		—	
Jabu Zwane	Mhlane	— RESIDENT	76445722	—	J. Zwane
NCamsile Dludlu	mantabeni	— RESIDENT	76472295	—	NCD
ndambayi Sibiya	mantabeni	— RESIDENT	78522904	—	NS
Siphiwe Cindzi	Mhlane	— RESIDENT	78253854	—	S Cindzi
Busi Mndebele	Mantabeni	— RESIDENT	76086566	—	Busi
Harriet Nkambule	Mantabeni	— RESIDENT	76477496	—	HK
Phillile Mthembu	Mhlane	— RESIDENT	76318851	—	PM
Sibongile Nkambule	Mkhwebane	— RESIDENT	-	—	Sibongile
Sibusiswe Mbhetse	Macozini	— RESIDENT	76405201	—	SMbets
Makhosi Dlamini	Mkhwebane	— RESIDENT	76057987	—	Dlamini

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy

Mbabane - Manzini Corridor Dam (Nondvo Dam)

Environmental & Social Impact Assessment (ESIA)

Public Participation Meeting Attendance Register

MANTABENI COMMUNITY MEETING

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: MANTABENI

Date/ Lusuku: 17 AUG 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
Sonto Dlamini	Mkhwebane	– RESIDENT	76174586	–	[signature]
Rondon, Stanford	Mantabeni	– RESIDENT	76522057	–	R.StanforD.
Thabitha Mamba	Mantabeni	– RESIDENT	–	–	T.M
Florence Magagula	Mantabeni	– RESIDENT	–	–	F.M
Busisiwe Gadlela	Mantabeni	– RESIDENT	–	–	B. G
Eldah Dlamini	Mantabeni	– RESIDENT	–	–	E.D
Fikelephi Dlamini	Mantabeni	– RESIDENT	76412576	–	F.D
Phumzile Dlamini	Nkhube	– RESIDENT	76148375	–	P.D.
Sibongile Zwane	Mncozini	– RESIDENT	76378487	–	[signature]
Sibongile Simelane	Machalangeni	– RESIDENT	76999648	–	[signature]
Lydia N. Mbetse	Mhlane	– RESIDENT	76777035	–	L N Mbetse

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy
Mbabane - Manzini Corridor Dam (Nondvo Dam)
Environmental & Social Impact Assessment (ESIA)
Public Participation Meeting Attendance Register

MANTABENI COMMUNITY MEETING

Venue/ Indzawo: MANTABENI
Date/ Lusuku: 17 AUG 2019

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
NTOMBIFUTHI BHEMBE	MHLANE	– RESIDENT	76241366	–	BHEMBE
NTOKOZO BHEMBE	MHLANE	– RESIDENT	76060228	–	N.B
Mary Nxumalo	Mahlalangwenu	RESIDENT	76534104	–	–
Busisiwe Mofokeng	Mhlane	– RESIDENT	76655138	–	B.M
Sibongile Vilakati	Mhlane	RESIDENT	76030318	–	–
Ntombikayise Siyaya	Mahlalangwenu	– RESIDENT	76640574	–	–
Siphiwe Maseko	Mahlalangwenu	– RESIDENT	76316577	–	–
Makhosazane Shongwe	Majadvule	– RESIDENT	76282133	–	–
Thulsile Gwinindza	Majadvule	– RESIDENT	76124045	–	–
Mhlabatsi Tlondwuzo	Nkhube	– RESIDENT	76548277	–	H. Mhlabatsi
Mabaso Thokwane	Nkhube	– RESIDENT	76250317	–	Mabaso

ANNEXURE 2: MINUTES OF COMMUNITY MEETING AT SIPHOCOSINI

MBABANE – MANZINI CORRIDOR (NONDVO) DAM ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA)

RECORD OF MEETING WITH SIPHOCOSINI COMMUNITY

<table>
<tr><td>Project Number:</td><td colspan="4">41101262</td></tr>
<tr><td>Grant Number:</td><td colspan="4">P-SZ-EAZ-001 /002 and P-SZ-EAO-002</td></tr>
<tr><td>Contract Number:</td><td colspan="4">MNRE/ DWA/ 002/ 2017-18</td></tr>
<tr><td>Client:</td><td colspan="4">Government of the Kingdom of Eswatini
Ministry of Natural Resources & Energy
Department of Water Affairs (DWA)</td></tr>
<tr><td>Project Title:</td><td colspan="4">Mbabane-Manzini Corridor (Nondvo) Dam
Feasibility Study
Environmental & Social Impact Assessment</td></tr>
<tr><td>Consultant:</td><td colspan="4">WSP Environmental (Pty) Ltd</td></tr>
<tr><td>Meeting organized by:</td><td colspan="4">WSP Environmental (Pty) Ltd</td></tr>
<tr><td>Date:</td><td colspan="4">03rd August 2019</td></tr>
<tr><td>Time:</td><td>Start :</td><td>11:00hrs</td><td>End:</td><td>13:30hrs</td></tr>
<tr><td>Venue:</td><td colspan="4">Siphocosini</td></tr>
<tr><td>Objectives:</td><td colspan="4">Introducing the Socio-economic and Resettlement Action Plan Survey Team to Siphocosini Community.
Presenting the Socio-economic and Resettlement Action Plan Survey process to Siphocosini Community.</td></tr>
</table>

ATTENDANCE:

	NAME	ORGANIZATION
1.	Chief Jabhane Dlamini	Chief
2.	Mduduzi Matsebula	Right Honourable Member of Parliament
3.	Sikakadza Nicholas Matsebula	Indvuna (Headman) of Siphocosini
4.	Nelson Dlamini	Inner Council Member (Royal Household Representative)
5.	Lot Dlamini	Inner Council Member (Royal Household Representative)
6.	Mathendele Dlamini	Inner Council Member (Royal Household Representative)
7.	Sibusiso Dlamini	Inner Council Member (Royal Household Representative)
8.	Senzo Dlamini	Inner Council Member (Royal Household Representative)
9.	Sonnyboy Dlamini	Inner Council Member (Royal Household Representative)
10.	Sipho Mavimbela	Inner Council Member (Secretary)
11.	Paul Kunene	Inner Council Member (*Umsumphe*/ Land Allocation and Boundary Committee)
12.	Samson Msibi	Inner Council Member
13.	Alfred Nhlabatsi	Inner Council Member
14.	Kenneth Dlamini	Inner Council Member
15.	Moses Nhlabatsi	Inner Council Member
16.	Mchele Gule	Inner Council Member

17.	Isaya Tfwala	Inner Council Member
18.	Jabulani Lukhele	Inner Council Member
19.	Jeremiah Nhlabatsi	Inner Council Member
20.	Jabulani Makhanya	Inner Council Member
21.	Mathokoza Malinga	Inner Council Member
22.	Simson Dlamini	Inner Council Member
23.	Andreas Mamba	Inner Council Member
24.	Enock Ngwenya	Inner Council Member
25.	Dudu Mamba	Inner Council Member
26.	Sebezile Maseko	Inner Council Member
27.	Ellen Manyatsi	Inner Council Member
28.	F. Nhlabatsi	Inner Council Member
29.	Abednigo Mbuyisa	Inner Council Member
30.	Obed Langwenya	Inner Council Member
31.	Sikelela Mavimbela	Inner Council Member
32.	Ndumiso Dlamini	Inner Council Member
33.	Jeffery Dlamini	Inner Council Member
34.	Mduduzi Dlamini	Inner Council Member
35.	Gcina Mdluli	Inner Council Member
36.	Mancoba Mhlanga	Inner Council Member
37.	Micah Mkhonta	Inner Council Member
38.	Obed Masuku	Inner Council Member
39.	Lindiwe Zikalala	Inner Council Member
40.	Dudu Dlamini	Inner Council Member
41.	Eunice Mkhonta	Inner Council Member
42.	Gcebile Shiba	Inner Council Member
43.	Thandi Mkhwanazi	Inner Council Member
44.	Sanele Shongwe	Inner Council Member
45.	Daniel Mamba	Community Member
46.	TM Simelane	Community Member
47.	Sabelo Motaung	Community Member
48.	Mark Payne	Community Member
49.	Leonard Camp	Community Member
50.	Jameson Matsebula	Community Member
51.	Enos Nkambule	Community Member
52.	David Ndwandwe	Community Member
53.	Patrick Maziya	Community Member
54.	Sipho Langwenya	Community Member
55.	Ishmael Dlamini	Community Member
56.	Maurice Littler	Community Member
57.	Mduduzi Dlamini	Community Member
58.	Robert Simelane	Community Member
59.	Fine Dlamini	Community Member
60.	Vivian Sihlongonyane	Community Member
61.	Andrew Vilakati	Community Member
62.	Austin Dlamini	Community Member
63.	Moses Msibi	Community Member
64.	Sibusiso Simelane	Community Member
65.	Vusi Sibisi	Community Member
66.	M. Vilakati	Community Member
67.	Bongani Dube	Community Member
68.	Abel Motsa	Community Member
69.	Vincent Sangweni	Community Member
70.	K. Mkhabela	Community Member
71.	Solomon Vilakati	Community Member
72.	Orela Maziya	Community Member
73.	David Dlamini	Community Member
74.	Hudu Dlamini	Community Member
75.	Dumisani Dlamini	Community Member
76.	Ngabi Dlamini	Community Member
77.	Shedrack Maphosa	Community Member
78.	Mfanalomuhle Dlamini	Community Member
79.	Fungisisa Vilakati-Dladla	Community Member
80.	Thulasizwe Mdluli	Community Member
81.	Lucky M. Dube	Community Member
82.	Sifiso Motsa	Community Member
83.	Mduduzi Ngwenya	Community Member
84.	Sipho Dlamini	Community Member
85.	Mxolisi Dlamini	Community Member

86.	Ndumiso Nkambule	Community Member
87.	Sibusiso Mnisi	Community Member
88.	Mxolisi Mnisi	Community Member
89.	Timothy Kunene	Community Member
90.	Armstrong Dlamini	Community Member
91.	Oscar Khaba	Community Member
92.	Sandile Ngozo	Community Member
93.	Happyguy Matsebula	Community Member
94.	Luke Mkhwanazi	Community Member
95.	Mfanzile Dlamini	Community Member
96.	Comfort Sibiya	Community Member
97.	Christopher Dlamini	Community Member
98.	Michael Mavimbela	Community Member
99.	Sifiso Mamba	Community Member
100.	Dumisani Dlamini	Community Member
101.	Mxolisi Simelane	Community Member
102.	Alfred Sihlongonyane	Community Member
103.	Sicelo Dlamini	Community Member
104.	Phumlani Hlophe	Community Member
105.	Bongani Hlophe	Community Member
106.	Philani Tfwala	Community Member
107.	George Simelane	Community Member
108.	Mxolisi Matsebula	Community Member
109.	Majaha Hlophe	Community Member
110.	Sibusiso Ngwenya	Community Member
111.	Lomasontfo Ngwenya	Community Member
112.	Bongani Dube	Community Member
113.	Milton Ngwenya	Community Member
114.	Shedrack Nhlabatsi	Community Member
115.	Mzwandile Mthethwa	Community Member
116.	Gudeni Simelane	Community Member
117.	Elson Maseko	Community Member
118.	Musa Dlamini	Community Member
119.	David Nyoni	Community Member
120.	Samuel Msweli	Community Member
121.	Philani Dlamini	Community Member
122.	May Thwala	Community Member
123.	Saneliso Kunene	Community Member
124.	Daniel Nhlabatsi	Community Member
125.	Mbuso Dlamini	Community Member
126.	Grace Hlophe	Community Member
127.	Jema Dlamini	Community Member
128.	Eldah Dlamini	Community Member
129.	Mavis Hlophe	Community Member
130.	Nompumelelo Nxumalo	Community Member
131.	Agnes Silindza	Community Member
132.	Babili Mabuza	Community Member
133.	Thulani Manyatsi	Community Member
134.	Wandile Guliwe	Community Member
135.	Mhlophe Nkambule	Community Member
136.	Ndumiso Dlamini	Community Member
137.	Buyile Dlamini	Community Member
138.	Futhi Zwane	Community Member
139.	Louisa Dlamini	Community Member
140.	Lindiwe Mnisi	Community Member
141.	Elise Zwane	Community Member
142.	Lillian Dlamini	Community Member
143.	Nomsa Dlamini	Community Member
144.	Rejoyce Mabuza	Community Member
145.	Lindiwe Zikalala	Community Member
146.	Philile Sikhondze	Community Member
147.	T.K. Shongwe-Khumalo	Community Member
148.	Zandile Kunene	Community Member
149.	Agnes Magagula	Community Member
150.	Norah Shabangu	Community Member
151.	Sholiphi Dlamini	Community Member
152.	Sarafina Dlamini	Community Member
153.	Sunny simelane	Community Member
154.	Lungile Manana	Community Member

155.	Sipholesihle Sacolo	Community Member
156.	Thokoza Dlamini	Community Member
157.	Faye Miller	Community Member
158.	Monisa Gule	Community Member
159.	Sibongile Mhlanga	Community Member
160.	Mary Simelane	Community Member
161.	Zanele Dlamini	Community Member
162.	Sebenzile Zubuko	Community Member
163.	Bhelina Dlamini	Community Member
164.	Isabel Maseko	Community Member
165.	Martha Mkhatshwa	Community Member
166.	Sonto Simelane	Community Member
167.	Gladys Manana	Community Member
168.	Maria Matsebula	Community Member
169.	Nompumelelo Giyane	Community Member
170.	Gabsile Gule	Community Member
171.	Tholakele Khumalo	Community Member
172.	Gugu Matsebula	Community Member
173.	Thoko Gule	Community Member
174.	Ncobile Dlamini	Community Member
175.	Jabulile Simelane	Community Member
176.	Welile Kunene	Community Member
177.	Tfombile Simelane	Community Member
178.	Gcina Mavimbela	Community Member
179.	A. Simelane	Community Member
180.	Nokuthula Mahlalela	Community Member
181.	Thulani Msibi	Community Member
182.	Lindiwe Dlamini	Community Member
183.	Ntombi Mavuso	Community Member
184.	Elizabeth Sihlongonyane	Community Member
185.	Maggi Mamba	Community Member
186.	Khanyisile Dlamini	Community Member
187.	Xolile Shongwe	Community Member
188.	Zodwa Matse	Community Member
189.	Zanele Msimango	Community Member
190.	Virginia Ndzinisa	Community Member
191.	Sebenele Simelane	Community Member
192.	Dumsile Mavuso	Community Member
193.	Ellene Manyatsi	Community Member
194.	Leta Mnisi	Community Member
195.	Sitfoliwe Gwebu	Community Member
196.	Alice Dlamini	Community Member
197.	Anna Tfwala	Community Member
198.	Miriathe Malaza	Community Member
199.	Thandi Maseko	Community Member
200.	Phumzile Tfwala	Community Member
201.	Thembi Sukati	Community Member
202.	Zanele Nzima	Community Member
203.	Selinah Sikhondze	Community Member
204.	Catherine Dlamini	Community Member
205.	Afra Mabuza	Community Member
206.	Thulisile Mabuza	Community Member
207.	Sizakele Mamba	Community Member
208.	Dumsile Ngubeni	Community Member
209.	Xolile Magagula	Community Member
210.	Beauty Lukhele	Community Member
211.	Dudu Du Pont	Community Member
212.	Cebile Dlamini	Community Member
213.	Khangezile Dube	Community Member
214.	Zodwa Dlamini	Community Member
215.	Busile Msibi	Community Member
216.	Thobile Thwala	Community Member
217.	Simangele Mlangeni	Community Member
218.	Nonhlanhla Ngcamphalala	Community Member
219.	Susan Dlamini	Community Member
220.	Zandile Dlamini	Community Member
221.	Nomsa Tfwala	Community Member
222.	Sibongile Dlamini	Community Member
223.	Nonhlanhla Mchobokazi	Community Member

224.	Hildah Simelane	Community Member
225.	Josephina Hlophe	Community Member
226.	Nothando Dlamini	Community Member
227.	Nontsikelelo Simelane	Community Member
228.	Lombuso Nkambule	Community Member
229.	Queen Mabuza	Community Member
230.	Elizabeth Sithole	Community Member
231.	Tryphina Simelane	Community Member
232.	Gcebile Mthethwa	Community Member
233.	Nomsa Mchobokazi	Community Member
234.	Xolile Motsa	Community Member
235.	Justice Mamba	Community Member
236.	Mpendulo Dlamini	Community Member
237.	Thulani Vilakati	Community Member
238.	Sibusiso Malaza	Community Member
239.	Themba Dlamini	Community Member
240.	Hezekiah Hlophe	Community Member
241.	Boy Thwala	Community Member
242.	Jabulani Dlamini	Community Member
243.	Walter Dlamini	Community Member
244.	Moses Seyama	Community Member
245.	Mbongwa Seyama	Community Member
246.	Hambaphi Simelane	Community Member
247.	Thembela Simelane	Community Member
248.	Mthunzi Mkhonta	Community Member
249.	Ndumiso Hlophe	Resident/ Community Representative
250.	Richard Ramoeletsi	Si Futures – Resettlement Action Plan Specialist
251.	Phakisa Mokhesi	Si Futures – Data Specialist
252.	Dr Zodwa Dlamini	Si Futures – Environmental & Social Impact Assessment Specialist
253.	Hlasoa Matsoso	Si Futures – Surveyor
254.	Mamahlolonolo Mokhobo	Si Futures – Surveyor
255.	Keketso Mosebi	Si Futures – Surveyor
256.	Zaba Mdlovu	Si Futures – Enumerator
257.	Blessing Masuku	Si Futures – Enumerator
258.	Siphesihle Tsabedze	Si Futures – Enumerator
259.	Babili Magagula	Si Futures – Enumerator
260.	Mcebo Mabaso	Si Futures – Enumerator
261.	Tebenguni Simelane	Si Futures – Enumerator
262.	Welile Maphalala	Si Futures – Enumerator
263.	Charity Lapidos	Si Futures – Enumerator
264.	Sandziso Mthupha	Si Futures – Enumerator
265.	Sambulo Zwane	Si Futures – Enumerator
266.	Mbuso Kingsley	WSP – Local Environmental Support
267.	Temusa Zwane	WSP – Local Environmental Support

AGENDA

AGENDA ITEM	RESPONSIBILITY
1. Welcome and Introductions	Inner Council/ WSP
2. Socio-economic and RAP Survey Process 2.1 Description of RAP Survey 2.2 Description of Socio-economic Survey	Si Futures
3. Discussion 3.1 Queries, comments, suggestions, concerns	Community Members
4. Closing 4.1 Words of appreciation to Community 4.2 Royal Kraal's closing remarks	Si Futures Royal Kraal

1. Welcome and introductions

The *Indvuna* announced that the Socio-economic and Resettlement Action Plan (RAP) Survey Team had been invited to present the survey process to the community of Siphocosini. He introduced Mr Ndumiso Hlophe, a community member, appointed by the Inner Council to be the Community Representative who will accompany and assist the Survey Team with local knowledge pertaining to the community.

Mbuso Kingsley introduced the Survey Team and described the respective roles of the Survey Team members:

- Mr Richard Ramoeletsi, Resettlement Action Plan Specialist and Team Leader;
- Dr Zodwa Dlamini, Environmental & Social Impact Assessment Specialist, Scio-economic Survey Team Leader;
- Mr Phakisa Mokhesi, Data Specialist, Fixed Assets Data Collection and Land Survey Team Leader
- Fixed Assets Data Collection and Land Survey Team comprising:
  a) Hlasoa Matsoso;
  b) Mamahlolonolo Mokhobo;
  c) Keketso Mosebi.
- A total of 11 enumerators, identifiable by high visibility yellow vests with name tags, who will be divided into two groups:
  i) Socio-economic Survey Team;
  ii) Resettlement Action Plan (RAP) Team.

2. Socio-economic and RAP Survey Process

2.1 Description of RAP Survey

Mr Ramoeletsi explained that the purpose of the survey is to work with the community in identifying the properties that will be affected by the proposed dam. The properties are those that are along and below the buffer contour line. This therefore includes those properties within the buffer zone and the inundation area.

2.1.1 Identification of fixed assets

The Survey Team will work with respective property owners in identifying and recording:

a) Houses;
b) Structures;
c) Fields;
d) Trees;
e) Kraals;
f) Chicken coops;
g) Any and all other fixed assets belonging to each respective homestead.

It is anticipated that in some cases certain fixed assets within the homestead will be above the buffer contour and other fixed assets will be below the buffer contour. For example, the houses may be above the buffer while the fields are below the buffer contour. In such cases only the affected fields and other affected non residential fixed assets will be identified, measured and recorded. Such identification, measurement and recording will be undertaken in the presence of the homestead head or authorised representative/s.

Similarly, the fixed assets of community facilities and amenities, such as schools, churches, clinics, shops, recreational areas, communal fields, are likely to be affected, therefore the representatives of such facilities will need to be present during identification, measuring and recording of their respective affected fixed assets.

2.1.2 Identification of cemeteries and graves

Where there are cemeteries, those homesteads which will be affected, i.e. those below the buffer contour, will be required to identify each respective grave which belongs to the homestead and is located within the cemetery, even if the cemetery is above the buffer contour. This will enable each respective grave to be exhumed, relocated and re-buried in accordance with cultural practices, thereby ensuring that the homestead's graves are not left behind during the resettlement process.

Where graves are not in a cemetery, but are in isolated locations below the buffer contour, it will be necessary for family members to point out or, if uncertain, consult with family elders to assist the family members in pointing out the locations of such graves so that they are not inadvertently inundated. It will otherwise be impractical to exhume graves which are remembered after they have been inundated.

The identification of graves includes stillborns, who due to particular cultural burial practices, may not have marked graves and are not buried at the cemetery, but at a designated location within the homestead. Family members will be required to point out or, if uncertain, consult with family elders to assist the family members in pointing out the locations of the graves of stillborns. This is to enable the graves of stillborns to also be relocated.

2.1.3 Identification of communal grazing areas

It will be necessary to identify, measure and record communal grazing areas.

2.1.4 Request for support from traditional authorities

Mr Ramoeletsi kindly requested the support of the Chief, *Indvuna* and Inner Council in being sensitive towards the affected homesteads since they will be affected not only materially by having to resettle, but also emotionally and psychologically by the anxiety of knowing that resettlement is imminent. The traditional authorities are therefore kindly requested to assist the Project Team by pleading for the cooperation of the affected homesteads throughout the data collection of the Socio-economic and RAP Survey.

2.1.5 Data collection process

The Surveyors together with a team of Enumerators will visit each affected homestead. The homestead representative will identify each fixed asset. The Surveyors and Enumerators will measure and record each fixed asset. Recording will include taking a photograph of the fixed asset with the homestead head or authorised representative standing beside the asset. For each homestead, the photographs of the fixed assets and a map of the measured assets will be printed onto a form containing the details of the homestead head and spouse.

For each community facility, the photographs of the fixed assets and a map of the measured assets will be printed onto a form containing the details of the authorised custodian.

2.1.6 Data verification

The printed form will be presented to the homestead head for verification of the captured assets. The homestead head may designate the spouse, or other representative authorised by the homestead head to verify the contents of the printed form. Where the homestead head or authorised representative is satisfied that the data on the form has been captured correctly, then the homestead head or authorised representative will sign acknowledgement that the data was captured correctly as at the date of the survey. The form will then be signed by the Royal Kraal (*Umphakatsi*) witnessing that the homestead head or authorised representative is satisfied with the correctness of the data. On behalf of the Consultant, the RAP Specialist will then sign as witness that the affected homestead head and *Umphakatsi* have acknowledged the correctness of the data. Finally, the Department of Water Affairs (DWA) will sign on behalf of the Ministry of Natural Resources & Energy, acknowledging that all the aforementioned persons are satisfied with the correctness of the data. The signature of DWA will also serve as acknowledgement on behalf of the Government that the affected homestead qualifies for compensation and inclusion in the Resettlement process.

Where the homestead head identifies discrepancies or incorrectly captured data, the homestead head will instruct the Survey Team to correct such data prior to signing acceptance of the data captured on the form. Thereafter the amended form, signed by the homestead head, will proceed up the levels of authority for counter signature.

2.1.7 Map of project site

A map will be issued to the Inner Council by the Survey Team, indicating the buffer contour and the inundation area. The map will be made available to the community to identify which of their fixed assets will be affected.

2.2 Description of Socio-economic Survey

The Socio-economic Survey will identify the baseline social and economic characteristics of the affected homesteads and community. The overall objective is to determine the existing social and economic condition of the affected homesteads and community in order to ensure that changes arising from project activities, including resettlement and relocation, do not leave the affected homesteads and community worse off.

2.2.1 Community facilities and amenities

The availability and accessibility of community facilities such as schools, health care centres, water sources, public roads, will be recorded through interviewing affected homesteads and any other relevant stakeholders within the community.

The availability and accessibility of community facilities in the receiving community, to which affected homesteads will be resettled, will also be taken into consideration to ensure that the demand placed upon such resources is not exceeded to the detriment of the wellbeing of the both the receiving community and the resettled families.

2.2.2 Identification of employment opportunities likely to arise during project implementation

Data will be collected through interviews to determine existing skills that are available within the affected community in order to determine the prioritisation of appropriate employment opportunities for members of the community. For example, some members of the community may have qualifications and training in certain vocations, such as construction, catering, driving and many others which are likely to be required during project implementation.

The role of the Social Impact Assessment report is to present facts and recommendations upon which the Government will need to make decisions. The Government will implement the compensation and resettlement process in accordance with international best practice guidelines and principles of the African Development Bank as well as national laws and regulations.

3. Discussion

The community members were provided the platform to submit queries, comments, suggestions and concerns to the Socio-economic and RAP Survey Team.

3.1 Affected zones

3.1.1 Extent of affected zones

The *Indvuna* explained that the three zones that will be affected are:

a) Spete;
b) Ncabaneni;
c) Sithobela.

Of note is that Masibekela High School and Bhekephi Primary School will be affected.

3.2 Flora and fauna

3.2.1 Natural resources of cultural and economic value

A query was raised as to how natural resources, particularly those of cultural and economic value will be compensated, especially since they do not belong to individuals, but the community as a whole. An example of plants of medicinal value was cited.

Response: natural resources of cultural and economic value such as various species of grasses which grow on communal land and are harvested for making mats, hats, constructing structures within homesteads etc, will be identified measured and recorded. This will support the description and determination of existing sources of cultural and economic livelihood within the affected community.

Communal fixed assets such as communal grazing areas, and grasses of cultural and economic value will be measured and compensation will be based on the affected area measurement. Compensation will be made to the designated custodian, such as the Chief or the Royal Kraal, whichever the case may be.

3.3 Realignment of railway line and main road

3.3.1 Potential resettlements arising from realignment of railway line and main road

A suggestion was proposed that the survey should include resettlements that will be caused by the realignment of the railway line and main road. This will avoid having to survey the community several times, prolonging the anxiety amongst community members.

Response: a separate technical consultant will determine suitable realignment routes for the railways line and main road, respectively. When those feasibility study reports of each realignment have been made available to the Government, the associated resettlement surveys of such realignments will be undertaken. Presently the Survey Team is focusing on the dam.

3.3.2 Accessibility within affected community

A query was raised on whether or not the project will provide access routes across the dam, since presently there are low level crossings for vehicles and footbridges for pedestrians.

Response: impacts on vehicular and pedestrian access will be taken into consideration and appropriate mitigations and enhancements will be developed. In line with the principle of ensuring that the affected *community is not left worse off as a result of a development project, some of the feeder roads within the community will need to be upgraded to prevent sections of the community being isolated by the dam.*

3.4 Identification of graves of stillborns

3.4.1 Identification of graves of stillborns

A query was raised on how the deal with cases where the locally resident family members do not know of any stillborns within the homestead whereas the only person who knows may be the mother who has long since left the homestead to settle elsewhere. One day she may return only to find the homestead inundated.

Response: prior to allowing the RAP Specialist to respond, the Indvuna asserted that if there is no way of any locally resident family member or any other person reasonably knowing that there is a grave of a stillborn, then unfortunately no claim can be initiated since it was not reasonably practical to expect such locally resident persons to have known. Mr Ramoeletsi responded that where remaining family members are uncertain of specific locations of graves of stillborns, then depending on the specific local customs, a portion of the soil from the homestead will be taken in lieu of the grave of the stillborn for reburial.

3.5 Source of funds

3.5.1 Source of funds for resettlement and compensation

A query was raised that in view of current reports in the media that the Government has limited financial resources for various activities, where will the funds come from for resettling and compensating all the affected homesteads?

Response: the project will be funded by the African Development Bank (AfDB), subject to terms and conditions of funding agreement with the Government of the Kingdom of Eswatini.

3.6 Relocation of schools

3.6.1 Relocation of affected schools

A query was raised as to whether or not relocation sites have been identified for Masibekela High School and Bhekephi Primary School.

Response: schools will need to be relocated, i.e. shifted such that they remain within the community since they serve the whole community rather than just the affected homesteads. It was clarified that relocation means shifting the position of a homestead or facility, whereas resettlement means moving to a new location. The community in conjunction with the Government will need to identify suitable relocation sites. The same applies to clinics.

3.7 Planned cultivation and home improvements

3.7.1 Status of current plans for cultivation and home improvements

A query was raised as to whether or not affected homesteads should continue with their cultivation plans and home improvements, since they will be resettled. Furthermore, how will homesteads be compensated for crops and home improvements that are established after the survey?

Response: cultivation plans and home improvements shall proceed as normal until such time that the Government issues an instruction to affected homesteads to stop cultivation or home improvement beyond a date to be appointed. When the appointed cut-off date has been announced by the Government, the affected homesteads will be surveyed again to update the data for each homestead.

3.8 Proximity of Luphohlo Dam and Nondvo Dam

3.8.1 Living in close proximity to two dams

A concern was raised that for those homesteads that will not be resettled, living in close proximity to two dams will affect the local climate such that winters will be colder, resulting in an increase in respiratory illnesses. There will also be the psychological stress of proximity to two large water bodies. Therefore it is suggested that indirect social impacts be taken into consideration so that indirectly affected homesteads are also accommodated by the survey.

Response: both direct and indirect impacts and mitigations will be taken into consideration.

3.9 Project Corporate Social Investment

3.9.1 Community facilities

A suggestion was submitted that the project provide tangible technical and/ or financial assistance to the affected community through the construction of facilities to meet the social amenity needs of the community. Examples of community water supply infrastructure and construction of a community hall were cited.

Response: suggestion was noted and will be included in recommendations of Social Impact Assessment report.

4. Closing

4.1 Words of appreciation to the Inner Council

The Socio-economic and RAP Survey Team expressed gratitude to the community for the opportunity of presenting the survey process and looked forward to working in close cooperation with the community during the survey.

4.2 Royal Kraal's closing remarks

The *Indvuna* expressed appreciation to the community for attending the meeting and acknowledged that due to time constraints of the meeting it may not have been possible for all queries and concerns to have been exhausted, therefore community members are requested to feel free to bring forward additional queries and concerns to their respective Zone Leaders who in turn will channel them through to the Inner Council, who will forward them to the Consultant. The *Indvuna* requested that the issues of the railway line and main road be addressed urgently by the Government since additional homesteads will be relocated by the possible realignment of the railway line and main road, which will have been triggered by the dam.

The Honourable Member of Parliament urged the community to welcome the proposed dam as part of the overall development of the community and urged all parties to treat each other respect and dignity throughout the various stages of the project. He also urged the community and the consultants to involve the Inkhundla throughout the consultation process.

The Chief expressed appreciation for the presentation from the Socio-economic and RAP Survey Team and urged the community to cooperate throughout the survey since it is being undertaken on behalf of His Majesty King Mswati III, the Government of the Kingdom of Eswatini and the Swazi Nation.

Record of meeting proceedings prepared by:

Mbuso Kingsley

ANNEXURE 3: MINUTES OF COMMUNITY MEETING AT MANTABENI

MBABANE – MANZINI CORRIDOR (NONDVO) DAM ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA)

RECORD OF MEETING WITH MANTABENI COMMUNITY

Project Number:	41101262		
Grant Number:	**P-SZ-EAZ-001 /002** and **P-SZ-EAO-002**		
Contract Number:	MNRE/ DWA/ 002/ 2017-18		
Client:	Government of the Kingdom of Eswatini Ministry of Natural Resources & Energy Department of Water Affairs (DWA)		
Project Title:	Mbabane-Manzini Corridor (Nondvo) Dam Feasibility Study Environmental & Social Impact Assessment		
Consultant:	WSP Environmental (Pty) Ltd		
Meeting organized by:	WSP Environmental (Pty) Ltd		
Date:	17th August 2019		
Time:	**Start :** 10:50hrs	**End:**	13:50hrs
Venue:	Mantabeni		
Objectives:	• Introducing the Socio-economic and Resettlement Action Plan Survey Team to Mantabeni Community. • Presenting the Socio-economic and Resettlement Action Plan Survey process to Mantabeni Community.		

ATTENDANCE:

	NAME	ORGANIZATION/ DESIGNATION
1.	Ndlavela Mavimbela	Indvuna (Headman) of Mantabeni
2.	Sifiso Mdlovu	Chairperson
3.	Mandla Cindzi	Vice Chairperson
4.	Malanga Mbetse	*Bucpho*/ Development Committee Chairperson
5.	Freda Nkumane	*Umsumphe*/ Land Allocation and Boundary Committee
6.	Finchie Lapidos	Inner Council Member
7.	Thabitha Mndzebele-Maziya	Inner Council Member
8.	Celani Hlophe	Inner Council Member
9.	Martha Dlamini	Inner Council Member
10.	Tengetile Mlangeni	Inner Council Member
11.	Thembisile Nhlabatsi	Inner Council Member
12.	Edgar Du Pont	Inner Council Member
13.	Vusi Mahlambi	Inner Council Member
14.	Daniel Saulus	Inner Council Member
15.	Eric Nxumalo	Inner Council Member
16.	Mboneleli Xaba	Inner Council Member

17.	Ciniso Mlangeni	Inner Council Member
18.	Monica Nhlabatsi	Inner Council Member
19.	Vusi Mahlambi	Inner Council Member
20.	Johannes Hlophe	Inner Council Member
21.	Tebesutfu Nkambule	Community Member
22.	Thubelihle Mabaso	Community Member
23.	Lihle Sibandze	Community Member
24.	Sikhulile Motsa	Community Member
25.	Mbali Lokotfwako	Community Member
26.	Senamile Mamba	Community Member
27.	Yolanda Lokotfwako	Community Member
28.	Phephile Sihlongonyane	Community Member
29.	N. Sibiya	Community Member
30.	Nkosing'phile Tfwala	Community Member
31.	Silindile Shongwe	Community Member
32.	Beketele Simelane	Community Member
33.	Siyabonga Motsa	Community Member
34.	Sibonelo Khumalo	Community Member
35.	Sakhile Maseko	Community Member
36.	Nonsikelelo Maziya	Community Member
37.	Rebecca Kubheka	Community Member
38.	Precious Mngometulu	Community Member
39.	Nkosing'phile Sibandze	Community Member
40.	Nkosinathi Mbetse	Community Member
41.	Gcebile Dlamini	Community Member
42.	Richard Mnisi	Community Member
43.	Millicent Ndzimandze	Community Member
44.	Graham Ngwenya	Community Member
45.	Xolile Cindzi	Community Member
46.	Zanele Zikalala	Community Member
47.	Nosipho Mbhamali	Community Member
48.	Nontobeko Mthethwa	Community Member
49.	Nokuthula Zwane	Community Member
50.	Lindiwe Mabuza	Community Member
51.	Phumzile Mavimbela	Community Member
52.	Lomthandzo Mazibuko	Community Member
53.	Lettah Mnisi	Community Member
54.	Bongi Moyane	Community Member
55.	Rose Simelane	Community Member
56.	Dumisani Simelane	Community Member
57.	Alfred Cindzi	Community Member
58.	Clement Motsa	Community Member
59.	Ephraim Motsa	Community Member
60.	Mfanufikile Shabangu	Community Member
61.	Luke Dlamini	Community Member
62.	Albert Dlamini	Community Member
63.	Dumisani Khoza	Community Member
64.	Johannes Mbetse	Community Member
65.	Nhlanhla Mamba	Community Member
66.	Mncedisi Dlamini	Community Member
67.	Mgaco Dlamini	Community Member
68.	Mandla Mdluli	Community Member
69.	Isaac Zambane	Community Member
70.	David Vilakati	Community Member
71.	Simon Mbetse	Community Member
72.	Joseph Hlophe	Community Member
73.	Mdwidwi Mbetse	Community Member
74.	Samuel Mbetse	Community Member
75.	Prince Sicelo	Community Member
76.	Sabelo Motsa	Community Member
77.	Jahasibili Ndzingane	Community Member
78.	Isaiah Nkambule	Community Member
79.	Nkosinathi Simelane	Community Member
80.	Mavisha Shongwe	Community Member
81.	Nkosinathi Shongwe	Community Member
82.	Sifiso Sibandze	Community Member
83.	Mvikeli Nhlabatsi	Community Member
84.	Isaac Dlamini	Community Member
85.	Duma Mamba	Community Member

86.	Nkosingiphile Lokotfwako	Community Member
87.	Maswazi Lokotfwako	Community Member
88.	Mbhekeni Mahlambi	Community Member
89.	Daniel Mamba	Community Member
90.	Vusi Motsa	Community Member
91.	Lungelwa Khumalo	Community Member
92.	Bonginkhosi Ngwenya	Community Member
93.	Themba Mabuza	Community Member
94.	Ndumiso Mkhonta	Community Member
95.	Vusi Sangweni	Community Member
96.	Phinda Mndvoti	Community Member
97.	Philemon Moyane	Community Member
98.	Dumisani Shongwe	Community Member
99.	Peter Simelane	Community Member
100.	Dumisani Khumalo	Community Member
101.	Manyovu Mnisi	Community Member
102.	Mathew Dlamini	Community Member
103.	Douglas Mamba	Community Member
104.	Petros Gama	Community Member
105.	Mzwandile Dlamini	Community Member
106.	Anthony Mlotsa	Community Member
107.	Vusi Nkambule	Community Member
108.	Daniel Cindzi	Community Member
109.	Sipho Manana	Community Member
110.	Moses Dlamini	Community Member
111.	Flora Cindzi	Community Member
112.	Dumisani Gama	Community Member
113.	Phumzile Vilakati	Community Member
114.	Jabu Kunene	Community Member
115.	Typhina Mndzebele	Community Member
116.	Khombisile Motsa	Community Member
117.	Lindiwe Bhembe	Community Member
118.	Gemma Zwane	Community Member
119.	Fikelephi Mahlambi	Community Member
120.	Neli Dlamini	Community Member
121.	Themba Nhlabatsi	Community Member
122.	Ntombikayise Dlamini	Community Member
123.	Grace Maseko	Community Member
124.	Jeremiah Simelane	Community Member
125.	Cecilia Dlamini	Community Member
126.	Sikelela Vilakati	Community Member
127.	Vusi Nhleko	Community Member
128.	Sibongile Msibi	Community Member
129.	Fikile Dlamini	Community Member
130.	Sibusiso Mbetse	Community Member
131.	Sibongile Mahlambi	Community Member
132.	Jabulile Malaza	Community Member
133.	Nhlanhla Masuku	Community Member
134.	Mandla Mvubu	Community Member
135.	Mduduzi Dlamini	Community Member
136.	Lucky Shongwe	Community Member
137.	Mahlubi Dlamini	Community Member
138.	Walter Nkambule	Community Member
139.	Thulani Baartjies	Community Member
140.	Makhosazana Mvubu	Community Member
141.	Nonhlanhla Mbetse	Community Member
142.	Doris Gama	Community Member
143.	Wandile Dlamini	Community Member
144.	Selby Nkambule	Community Member
145.	Wilson Kunene	Community Member
146.	Jacob Mathabela	Community Member
147.	Bheki Matsenjwa	Community Member
148.	Veli Sifundza	Community Member
149.	Jabulani Khoza	Community Member
150.	Vusi Shongwe	Community Member
151.	Fana Magagula	Community Member
152.	Qiniso Maseko	Community Member
153.	Bafana Mkhonta	Community Member
154.	Nelisiwe Mavimbela	Community Member

155.	Koloni Mamba	Community Member
156.	Joyce Bhembe	Community Member
157.	Khumbuzile Tfwala	Community Member
158.	Lungile Mkhatshwa	Community Member
159.	Sandile Magagula	Community Member
160.	Sithembile Hlatjwayo	Community Member
161.	Joanah Mbetse	Community Member
162.	Gugu Manana	Community Member
163.	Rose Dlamini	Community Member
164.	Nozizwe Dlamini	Community Member
165.	Ndzelaphi Mbetse	Community Member
166.	Jabu Zwane	Community Member
167.	Ncamsile Dludlu	Community Member
168.	Ndambayi Shiba	Community Member
169.	Siphiwe Cindzi	Community Member
170.	Busi Mndzebele	Community Member
171.	Harriet N.	Community Member
172.	Philile Mthembu	Community Member
173.	Sibongile Nkambule	Community Member
174.	Sibusisiwe Mbetse	Community Member
175.	Makhosi Dlamini	Community Member
176.	Sonto Dlamini	Community Member
177.	Roydon Stanford	Community Member
178.	Thabitha Mamba	Community Member
179.	Florence Magagula	Community Member
180.	Busisiwe Gadlela	Community Member
181.	Eldah Dlamini	Community Member
182.	Fikelephi Dlamini	Community Member
183.	Phumzile Dlamini	Community Member
184.	Sibongile Zwane	Community Member
185.	Sibongile Simelane	Community Member
186.	Lydia Mbetse	Community Member
187.	Ntombifuthi Bhembe	Community Member
188.	Ntokozo Bhembe	Community Member
189.	Mary Ndzimandze	Community Member
190.	Busisiwe Mofokeng	Community Member
191.	Sibongile Vilakati	Community Member
192.	Ntombikayise Siyaya	Community Member
193.	Siphiwe Maseko	Community Member
194.	Makhosazana Shongwe	Community Member
195.	Thulisile Ginindza	Community Member
196.	Nonduduzo Nhlabatsi	Community Member
197.	Nokwanda Mabaso	Community Member
198.	Samuel Ncongwane	Inner Council/ Project Community Representative
199.	Nicholas Zwane	Inner Council/ Project Community Representative
200.	Richard Ramoeletsi	Si Futures – Resettlement Action Plan Specialist
201.	Dr Zodwa Dlamini	Si Futures – Environmental & Social Impact Assessment Specialist
202.	Mcebo Mabaso	Si Futures – Enumerator
203.	Charity Lapidos	Si Futures – Enumerator
204.	Sandziso Mthupha	Si Futures – Enumerator
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4. Closing 4.1 Words of appreciation to Community 4.2 Royal Kraal's closing remarks	Si Futures Royal Kraal

1. Welcome and introductions

The Vice Chairperson of the Inner Council, on behalf of the Indvuna, announced that the Socio-economic and Resettlement Action Plan (RAP) Survey Team had been invited to present the survey process to the community of Mantabeni. As this was a regular community meeting, community agenda items were first addressed prior to the special presentation on Nondvo Dam, which commenced 1hr 40mins after the meeting had commenced. The *Indvuna* joined the meeting during as the Nondvo Dam agenda item commenced.

Mbuso Kingsley introduced the Survey Team and described the respective roles of the Survey Team members:

- Mr Richard Ramoeletsi, Resettlement Action Plan Specialist and Team Leader;
- Dr Zodwa Dlamini, Environmental & Social Impact Assessment Specialist, Scio-economic Survey Team Leader;
- Mr Phakisa Mokhesi, Data Specialist, Fixed Assets Data Collection and Land Survey Team Leader
- Fixed Assets Data Collection and Land Survey Team comprising:
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- A total of 11 enumerators, identifiable by high visibility yellow vests with name tags, who will be divided into two groups:
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    ii) Resettlement Action Plan (RAP) Team.

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2.1 Description of RAP Survey

It was explained to the meeting participants that the purpose of the survey is to work with the community in identifying the properties that will be affected by the proposed dam. The properties are those that are along and below the buffer contour line. This therefore includes those properties within the buffer zone and the inundation area.

2.1.1 Identification of fixed assets

The Survey Team will work with respective property owners in identifying and recording:

a) Houses;
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c) Fields;
d) Trees;
e) Kraals;
f) Chicken coops;
g) Any and all other fixed assets belonging to each respective homestead.

It is anticipated that in some cases certain fixed assets within the homestead will be above the buffer contour and other fixed assets will be below the buffer contour. For example, the houses may be above the buffer while the fields are below the buffer contour. In such cases only the affected fields and other affected non residential fixed assets will be identified, measured and recorded. Such identification, measurement and recording will be undertaken in the presence of the homestead head or authorised representative/s.

Similarly, the fixed assets of community facilities and amenities, such as schools, churches, clinics, shops, recreational areas, communal fields, are likely to be affected, therefore the representatives of such facilities will need to be present during identification, measuring and recording of their respective affected fixed assets.

2.1.2 Identification of cemeteries and graves

Where there are cemeteries, those homesteads which will be affected, i.e. those below the buffer contour, will be required to identify each respective grave which belongs to the homestead and is located within the cemetery, even if the cemetery is above the buffer contour. This will enable each respective grave to be exhumed, relocated and re-buried in accordance with cultural practices, thereby ensuring that the homestead's graves are not left behind during the resettlement process.

Where graves are not in a cemetery, but are in isolated locations below the buffer contour, it will be necessary for family members to point out or, if uncertain, consult with family elders to assist the family members in pointing out the locations of such graves so that they are not inadvertently inundated. It will otherwise be impractical to exhume graves which are remembered after they have been inundated.

The identification of graves includes stillborns, who due to particular cultural burial practices, may not have marked graves and are not buried at the cemetery, but at a designated location within the homestead. Family members will be required to point out or, if uncertain, consult with family elders to assist the family members in pointing out the locations of the graves of stillborns. This is to enable the graves of stillborns to also be relocated.

2.1.3 Identification of communal grazing areas

It will be necessary to identify, measure and record communal grazing areas.

2.1.4 Potential resettlement site/s

It was emphasized that while no potential resettlement sites/s had yet been identified, it would be ideal to indentify sites within the community. Based on previous experience with similar projects elsewhere in Southern Africa, the RAP Specialist cautioned heads of affected homesteads not to be too eager to seize the opportunity to move to urban areas as the cost of living may exceed their financial resources in the long term.

2.1.5 Data collection process

The Surveyors together with a team of Enumerators will visit each affected homestead. The homestead representative will identify each fixed asset. The Surveyors and Enumerators will measure and record each fixed asset. Recording will include taking a photograph of the fixed asset with the homestead head or authorised representative standing beside the asset. For each homestead, the photographs of the fixed assets and a map of the measured assets will be printed onto a form containing the details of the homestead head and spouse.

For each community facility, the photographs of the fixed assets and a map of the measured assets will be printed onto a form containing the details of the authorised custodian.

2.1.6 Data verification

The printed form will be presented to the homestead head for verification of the captured assets. The homestead head may designate the spouse, or other representative authorised by the homestead head to verify the contents of the printed form. Where the homestead head or authorised representative is satisfied that the data on the form has been captured correctly, then the homestead head or authorised representative will sign acknowledgement that the data was captured correctly as at the date of the survey. The form will then be signed by the Royal Kraal (*Umphakatsi*) witnessing that the homestead head or authorised representative is satisfied with the correctness of the data. On behalf of the Consultant, the RAP Specialist will then sign as witness that the affected homestead head and *Umphakatsi* have acknowledged the correctness of the data. Finally, the Department of Water Affairs (DWA) will sign on behalf of the Ministry of Natural Resources & Energy, acknowledging that all the aforementioned persons are satisfied with the correctness of the data. The signature of DWA will also serve as acknowledgement on behalf of the Government that the affected homestead qualifies for compensation and inclusion in the Resettlement process.

Where the homestead head identifies discrepancies or incorrectly captured data, the homestead head will instruct the Survey Team to correct such data prior to signing acceptance of the data captured on the form. Thereafter the amended form, signed by the homestead head, will proceed up the levels of authority for counter signature.

2.1.7 Map of project site

A map will be issued to the Inner Council by the Survey Team, indicating the buffer contour and the inundation area. The map will be made available to the community to identify which of their fixed assets will be affected.

2.2 Description of Socio-economic Survey

The Socio-economic Survey will identify the baseline social and economic characteristics of the affected homesteads and community. The overall objective is to determine the existing social and economic condition of the affected homesteads and community in order to ensure that changes arising from project activities, including resettlement and relocation, do not leave the affected homesteads and community worse off.

2.2.1 Community facilities and amenities

The availability and accessibility of community facilities such as schools, health care centres, water sources, public roads, will be recorded through interviewing affected homesteads and any other relevant stakeholders within the community.

The availability and accessibility of community facilities in the receiving community, to which affected homesteads will be resettled, will also be taken into consideration to ensure that the demand placed upon such resources is not exceeded to the detriment of the wellbeing of the both the receiving community and the resettled families.

2.2.2 Identification of employment opportunities likely to arise during project implementation

Data will be collected through interviews to determine existing skills that are available within the affected community in order to determine the prioritisation of appropriate employment opportunities for members of the community. For example, some members of the community may have qualifications and training in certain vocations, such as construction, catering, driving and many others which are likely to be required during project implementation.

The role of the Social Impact Assessment report is to present facts and recommendations upon which the Government will need to make decisions. The Government will implement the compensation and resettlement process in accordance with international best practice guidelines and principles of the African Development Bank as well as national laws and regulations.

3. Discussion

The community members were provided the platform to submit queries, comments, suggestions and concerns to the Socio-economic and RAP Survey Team.

3.1 Data verification

3.1.1 Presentation of completed forms to homesteads

A concern was raised that when the Community Representatives visit the homesteads to present the completed forms for verification and signing by the homestead heads, they tend to rush through the forms and request the homesteads heads to sign the forms. This presents the risk of pressurising the homestead head, who will thus be unable to fully satisfy himself or herself that all the captured data is indeed correct.

Response: the concern was noted and Community Representatives were instructed, after the initial homesteads during the verification visits in days preceding the community meeting, to leave forms with affected homestead heads at least overnight to fully satisfy themselves of the accuracy of the data captured.

3.2 Invitation of Member of Parliament

3.2.1 Invitation of Member of Parliament to Community Meetings

A suggestion was submitted that the Member of Parliament (MP) be invited to community meetings when discussing development projects of this size and nature. The reason is that the community members may wish to ask the MP how the decision to propose the construction of

Nonvdo Dam, or any other infrastructure project of similar size, was arrived at by the Government and/ or Parliament.

Response: the Indvuna clarified that the project was first introduced during the term of the former and late Prime Minister and previous Parliament, therefore the identification of the proposed site was arrived at through extensive consultations between the Government of the Kingdom of Eswatini and neighbouring states of South Africa and Mozambique.

3.3 Planned cultivation, home improvements and community development programmes

3.3.1 Status of current plans for cultivation and home improvements

A query was raised as to whether or not affected homesteads should continue with their cultivation plans and home improvements, since they will be resettled. Furthermore, how will homesteads be compensated for crops and home improvements that are established after the survey?

Response: cultivation plans and home improvements shall proceed as normal until such time that the Government issues an instruction to affected homesteads to stop cultivation or home improvement beyond a date to be appointed. When the appointed cut-off date has been announced by the Government, the affected homesteads will be surveyed again to update the data for each homestead.

3.3.2 Status of existing and planned development programmes

A query was raised as to whether or not some community development programmes, such as rural water supply and rural electrification programmes (electricity schemes) should continue since they will be affected by the dam.

Response: as with cultivation plans and home improvements, the community development programmes shall proceed as normal until such time that the Government proclaims the cut-off date. The reason is that in the event that the current designs of the dam are altered or if the decision is reached that the dam is environmentally and socially not feasible, existing community development programmes will have been unnecessarily interrupted.

3.3.3 Control of opportunistic development

A query was raised as to how opportunistic development, through the establishment of new homesteads and/ or implementation of home improvements, will be controlled. Failure to control such development, without defining a cut-off date urgently, will escalate any initial budget for resettlement and relocation particularly due to people being tempted to take advantage of the time lapse between the sensitization of the community and the announcement of the cut-off date.

Response: it is acknowledged that opportunistic developments are highly likely, therefore it is necessary to proceed with studies in as timely a manner as is reasonable, while being cognizant of the sensitivities of the subject of resettlement and relocation. An effective method of controlling opportunistic development will be the Government's proclamation of the cut-off date after all studies have been concluded.

3.4 Potential resettlement and alternative project sites

3.4.1 Potential resettlement site/s

A query was raised on whether or not potential resettlement sites have been identified.

Response: it was reiterated that while no potential resettlement sites/s had yet been identified, it would be ideal to indentify sites within the community or sites of similar characteristics as the present location since various homesteads will have been attracted to the area by particular characteristics, such as availability of rainfall, relative proximity to urban area, proximity to next of kin, etc. Therefore resettlement to a site of similar characteristics will mitigate various forms of anxiety, which no amount of compensation will be able to replace.

3.4.2 Alternative project sites

A suggestion was submitted that alternative project sites be explored as a means of mitigating the distress and cost of resettling the densely distributed homesteads from the proposed project site. It was suggested that a site such as the nearby commercial forestry plantation to the south west of Mantabeni be considered for the dam since there are no homesteads there.

Response: it was clarified that the project in its entirety comprises other options of raising Luphohlo Dam and Hawane Dam respectively. Therefore Nondvo Dam is one of three options, all of which may be feasible, or only two of which may be feasible, or only one of which may be feasible. When all options have been evaluated, a decision will be made on the best option or combination of options.

A member of the audience further supported the response by enlightening meeting participants that it is necessary for them as a community to take into consideration the fact that the present scarcity of water may be exacerbated in the distant future due to climate change. Therefore, he urged fellow participants to appreciate the need for taking interventions to ensure water security for the future, even if it means having to make the sacrifice of resettling some homesteads for the greater good of all.

3.5 Realignment of railway line and main road

3.5.1 Potential resettlements arising from realignment of railway line and main road

A request for clarification was raised on what will happen those homesteads which have encroached into the railway line since Eswatini Railway recently informed the community that they will have to relocate since they should not have been allocated land within an existing railway reserve. Therefore with the possibility of the dam being implemented, will those homesteads now be safe to remain within the railway reserve? A further query was raised on whether or not the main road will cause additional resettlement of homesteads.

Response: a separate technical consultant will determine suitable realignment routes for the railways line and main road, respectively. When those feasibility study reports of each realignment have been made available to the Government, the associated resettlement surveys of such realignments will be undertaken. The dam will indeed trigger realignments of the railway line and main road and this will in turn necessitate the realignment of access roads within the community. Therefore the resettlement and relocation of homesteads will affect *more than just those within the dam's inundation area. Presently the Survey Team is focusing on the dam.*

3.5.2 Accessibility within affected community

A query was raised on whether or not the project will provide access routes across the dam, since presently there are low level crossings for vehicles and footbridges for pedestrians.

Response: impacts on vehicular and pedestrian access will be taken into consideration and appropriate mitigations and enhancements will be developed. In line with the principle of ensuring that the affected community is not left worse off as a result of a development project, some of the feeder roads within the community will need to be upgraded to prevent sections of the community being isolated by the dam.

3.6 Relocation of schools

3.6.1 Relocation of affected schools

A query was raised as to what will happen to the schools, Masibekela High School and Bhekephi Primary School if they are affected by the dam, particularly since they serve the community as a whole and not just the affected homesteads.

Response: schools will need to be relocated, i.e. shifted such that they remain within the community since they serve the whole community rather than just the affected homesteads. It was clarified that relocation means shifting the position of a homestead or facility, whereas resettlement means moving to a new location. The community in *conjunction with the Government will need to identify suitable relocation sites. The same applies to clinics.*

3.7 Proximity of Luphohlo Dam and Nondvo Dam

3.7.1 Living in close proximity to two dams

A concern was raised that the proximity of two dams to each other will increase the intensity of localised weather conditions such as strong winds and rainfall intensity during thunderstorms. This will therefore exacerbate storm damage to homesteads and other property as well as increase anxiety amongst community members.

Response: both direct and indirect impacts and mitigations will be taken into consideration. The ESIA will take impacts on climate change into consideration.

4. Closing

4.1 Words of appreciation to Community

The Socio-economic and RAP Survey Team expressed gratitude to the community for the opportunity of presenting the survey process and looked forward to working in close cooperation with the community during the survey.

4.2 Royal Kraal's closing remarks

The *Indvuna* expressed appreciation to the community for attending the meeting. He emphasised that it is acknowledged that resettlement and relocation will cause much anxiety both those who are directly affected and those who are indirectly affected. He however pleaded with the community to understand that the proposed dam seeks to improve water security and one of the objectives is to ensure that affected parties are not left worse off. Therefore the community is urged to cooperate throughout the survey in ensuring that the proposed project is a success.

Record of meeting proceedings prepared by:

Mbuso Kingsley

ANNEXURE 4: PHOTOS OF COMMUNITY MEETINGS

PHOTOS MANTABENI COMMUNITY MEETING


17/08/2019 13:52


17/08/2019 13:53

PHOTOS OF COMMUNITY MEETINGS AT SIPHOCOSINI

ANNEXURE 5: MINUTES OF INNER COUNCIL MEETING AT SIPHOCOSINI

MBABANE – MANZINI CORRIDOR (NONDVO) DAM ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA)

RECORD OF MEETING WITH SIPHOCOSINI INNER COUNCIL

Project Number:	41101262			
Grant Number:	**P-SZ-EAZ-001 /002** and **P-SZ-EAO-002**			
Contract Number:	MNRE/ DWA/ 002/ 2017-18			
Client:	Government of the Kingdom of Eswatini Ministry of Natural Resources & Energy Department of Water Affairs (DWA)			
Project Title:	Mbabane-Manzini Corridor (Nondvo) Dam Feasibility Study Environmental & Social Impact Assessment			
Consultant:	WSP Environmental (Pty) Ltd			
Meeting organized by:	WSP Environmental (Pty) Ltd			
Date:	31st July 2019			
Time:	**Start :**	10:25hrs	**End:**	11:25hrs
Venue:	Siphocosini			
Objectives:	• Introducing the Socio-economic and Resettlement Action Plan Survey Team to Siphocosini *Bandlancane* (Inner Council). • Presenting the Socio-economic and Resettlement Action Plan Survey process to Siphocosini Inner Council.			

ATTENDANCE:

	NAME	ORGANIZATION
1.	Sikakadza Nicholas Matsebula	Indvuna (Headman) of Siphocosini
2.	Nelson Dlamini	Inner Council Member (Royal Household Representative)
3.	Lot Dlamini	Inner Council Member (Royal Household Representative)
4.	Sipho Mavimbela	Inner Council Member (Secretary)
5.	Paul Kunene	Inner Council Member (*Umsumphe*/ Land Allocation and Boundary Committee)
6.	Samson Msibi	Inner Council Member
7.	Alfred Nhlabatsi	Inner Council Member
8.	Kenneth Dlamini	Inner Council Member
9.	Moses Nhlabatsi	Inner Council Member
10.	Mchele Gule	Inner Council Member
11.	Isaya Tfwala	Inner Council Member
12.	Jabulani Lukhele	Inner Council Member
13.	Jeremiah Nhlabatsi	Inner Council Member
14.	Jabulani Makhanya	Inner Council Member
15.	Mathokoza Malinga	Inner Council Member

16.	Simson Dlamini	Inner Council Member
17.	Andreas Mamba	Inner Council Member
18.	Enock Ngwenya	Inner Council Member
19.	Dudu Mamba	Inner Council Member
20.	Sebezile Maseko	Inner Council Member
21.	Ellen Manyatsi	Inner Council Member
22.	F. Nhlabatsi	Inner Council Member
23.	Abednigo Mbuyisa	Inner Council Member
24.	Obed Langwenya	Inner Council Member
25.	Sikelela Mavimbela	Inner Council Member
26.	Ndumiso Dlamini	Inner Council Member
27.	Jeffery Dlamini	Inner Council Member
28.	Mduduzi Dlamini	Inner Council Member
29.	Gcina Mdluli	Inner Council Member
30.	Mancoba Mhlanga	Inner Council Member
31.	Micah Mkhonta	Inner Council Member
32.	Obed Masuku	Inner Council Member
33.	Lindiwe Zikalala	Inner Council Member
34.	Dudu Dlamini	Inner Council Member
35.	Eunice Mkhonta	Inner Council Member
36.	Gcebile Shiba	Inner Council Member
37.	Thandi Mkhwanazi	Inner Council Member
38.	Sanele Shongwe	Inner Council Member
39.	Ndumiso Hlophe	Resident/ Community Representative
40.	Richard Ramoeletsi	Si Futures – Resettlement Action Plan Specialist
41.	Phakisa Mokhesi	Si Futures – Data Specialist
42.	Dr Zodwa Dlamini	Si Futures – Environmental & Social Impact Assessment Specialist
43.	Hlasoa Matsoso	Si Futures – Surveyor
44.	Mamahlolonolo Mokhobo	Si Futures – Surveyor
45.	Keketso Mosebi	Si Futures – Surveyor
46.	Zaba Mdlovu	Si Futures – Enumerator
47.	Nokwanda Shongwe	Si Futures – Enumerator
48.	Blessing Masuku	Si Futures – Enumerator
49.	Siphesihle Tsabedze	Si Futures – Enumerator
50.	Babili Magagula	Si Futures – Enumerator
51.	Mcebo Mabaso	Si Futures – Enumerator
52.	Tebenguni Simelane	Si Futures – Enumerator
53.	Welile Maphalala	Si Futures – Enumerator
54.	Charity Lapidos	Si Futures – Enumerator
55.	Sandziso Mthupha	Si Futures – Enumerator
56.	Sambulo Zwane	Si Futures – Enumerator
57.	Mbuso Kingsley	WSP – Local Environmental Support
58.	Temusa Zwane	WSP – Local Environmental Support

AGENDA

AGENDA ITEM	RESPONSIBILITY
1. Welcome and Introductions	Inner Council/ WSP
2. Socio-economic and RAP Survey Process 2.1 Description of RAP Survey 2.2 Description of Socio-economic Survey	Si Futures
3. Closing 3.1 Words of appreciation to Inner Council 3.2 Inner Council’s closing remarks	 Si Futures Inner Council

1. Welcome and introductions

WSP Environmental (Pty) Ltd (WSP) had requested a meeting for introducing the Socio-economic and Resettlement Action Plan (RAP) Survey Team to Siphocosini *Bandlancane* (Inner Council). The Inner Council welcomed the Survey Team to Siphocosini.

The *Indvuna* introduced Mr Ndumiso Hlophe, a community member, appointed by the Inner Council to be the Community Representative who will accompany and assist the Survey Team with local knowledge pertaining to the community.

Mr Hlophe introduced the Survey Team and thereafter Mbuso Kingsley described the respective roles of the Survey Team members:

- Mr Richard Ramoeletsi, Resettlement Action Plan Specialist and Team Leader;
- Dr Zodwa Dlamini, Environmental & Social Impact Assessment Specialist, Scio-economic Survey Team Leader;
- Mr Phakisa Mokhesi, Data Specialist, Fixed Assets Data Collection and Land Survey Team Leader
- Fixed Assets Data Collection and Land Survey Team comprising:
    a) Hlasoa Matsoso;
    b) Mamahlolonolo Mokhobo;
    c) Keketso Mosebi.
- A total of 11 enumerators, identifiable by high visibility yellow vests with name tags, who will be divided into two groups:
    i) Socio-economic Survey Team;
    ii) Resettlement Action Plan (RAP) Team.

2. Socio-economic and RAP Survey Process

2.1 Description of RAP Survey

Mr Ramoeletsi explained that the purpose of the survey is to work with the community in identifying the properties that will be affected by the proposed dam. The properties are those that are along and below the buffer contour line. This therefore includes those properties within the buffer zone and the inundation area.

2.1.1 Identification of fixed assets

The Survey Team will work with respective property owners in identifying and recording:

a) Houses;
b) Structures;
c) Fields;
d) Trees;
e) Kraals;
f) Chicken coops;
g) Any and all other fixed assets belonging to each respective homestead.

It is anticipated that in some cases certain fixed assets within the homestead will be above the buffer contour and other fixed assets will be below the buffer contour. For example, the houses may be above the buffer while the fields are below the buffer contour. In such cases only the affected fields and other affected non residential fixed assets will be identified, measured and recorded. Such identification, measurement and recording will be undertaken in the presence of the homestead head or authorised representative/s.

Similarly, the fixed assets of community facilities and amenities, such as schools, churches, clinics, shops, recreational areas, communal fields, are likely to be affected, therefore the representatives of such facilities will need to be present during identification, measuring and recording of their respective affected fixed assets.

2.1.2 Identification of cemeteries and graves

Where there are cemeteries, those homesteads which will be affected, i.e. those below the buffer contour, will be required to identify each respective grave which belongs to the homestead and is located within the cemetery, even if the cemetery is above the buffer contour. This will enable each respective grave to be exhumed, relocated and re-buried in accordance with cultural practices, thereby ensuring that the homestead's graves are not left behind during the resettlement process.

Where graves are not in a cemetery, but are in isolated locations below the buffer contour, it will be necessary for family members to point out or, if uncertain, consult with family elders to assist the family members in pointing out the locations of such graves so that they are not inadvertently inundated. It will otherwise be impractical to exhume graves which are remembered after they have been inundated.

The identification of graves includes stillborns, who due to particular cultural burial practices, may not have marked graves and are not buried at the cemetery, but at a designated location within the homestead. Family members will be required to point out or, if uncertain, consult with family elders to assist the family members in pointing out the locations of the graves of stillborns. This is to enable the graves of stillborns to also be relocated.

2.1.3 Identification of communal grazing areas

It will be necessary to identify, measure and record communal grazing areas.

2.1.4 Request for support from traditional authorities

Mr Ramoeletsi kindly requested the support of the Chief, *Indvuna* and Inner Council in being sensitive towards the affected homesteads since they will be affected not only materially by having to resettle, but also emotionally and psychologically by the anxiety of knowing that resettlement is imminent. The traditional authorities are therefore kindly requested to assist the Project Team by pleading for the cooperation of the affected homesteads throughout the data collection of the Socio-economic and RAP Survey.

2.1.5 Data collection process

The Surveyors together with a team of Enumerators will visit each affected homestead. The homestead representative will identify each fixed asset. The Surveyors and Enumerators will measure and record each fixed asset. Recording will include taking a photograph of the fixed asset with the homestead head or authorised representative standing beside the asset. For each homestead, the photographs of the fixed assets and a map of the measured assets will be printed onto a form containing the details of the homestead head and spouse.

For each community facility, the photographs of the fixed assets and a map of the measured assets will be printed onto a form containing the details of the authorised custodian.

2.1.6 Data verification

The printed form will be presented to the homestead head for verification of the captured assets. The homestead head may designate the spouse, or other representative authorised by the homestead head to verify the contents of the printed form. Where the homestead head or authorised representative is satisfied that the data on the form has been captured correctly, then the homestead head or authorised representative will sign acknowledgement that the data was captured correctly as at the date of the survey. The form will then be signed by the Royal Kraal (*Umphakatsi*) witnessing that the homestead head or authorised representative is satisfied with the correctness of the data. On behalf of the Consultant, the RAP Specialist will then sign as witness that the affected homestead head and *Umphakatsi* have acknowledged the correctness of the data. Finally, the Department of Water Affairs (DWA) will sign on behalf of the Ministry of Natural Resources & Energy, acknowledging that all the aforementioned persons are satisfied with the correctness of the data. The signature of DWA will also serve as acknowledgement on behalf of the Government that the affected homestead qualifies for compensation and inclusion in the Resettlement process.

Where the homestead head identifies discrepancies or incorrectly captured data, the homestead head will instruct the Survey Team to correct such data prior to signing acceptance of the data captured on the form. Thereafter the amended form, signed by the homestead head, will proceed up the levels of authority for counter signature.

2.2 Description of Socio-economic Survey

The Socio-economic Survey will identify the baseline social and economic characteristics of the affected homesteads and community. The overall objective is to determine the existing social and economic condition of the affected homesteads and community in order to ensure that changes arising from project activities, including resettlement and relocation, do not leave the affected homesteads and community worse off.

2.2.1 Community facilities and amenities

The availability and accessibility of community facilities such as schools, health care centres, water sources, public roads, will be recorded through interviewing affected homesteads and any other relevant stakeholders within the community.

The availability and accessibility of community facilities in the receiving community, to which affected homesteads will be resettled, will also be taken into consideration to ensure that the demand placed upon such resources is not exceeded to the detriment of the wellbeing of the both the receiving community and the resettled families.

2.2.2 Identification of employment opportunities likely to arise during project implementation

Data will be collected through interviews to determine existing skills that are available within the affected community in order to determine the prioritisation of appropriate employment opportunities for members of the community. For example, some members of the community may have qualifications and training in certain vocations, such as construction, catering, driving and many others which are likely to be required during project implementation.

3. Discussion

The members of the Inner Council were provided the platform to submit comments, suggestions and queries to the Socio-economic and RAP Survey Team.

3.1 Project Corporate Social Investment

3.1.1 Community facilities

The *Indvuna* submitted a suggestion that, where possible, the project provide technical and/ or financial assistance to the affected community through the construction of facilities to meet the social amenity needs of the community. An example of construction of a community hall for community meetings was cited. He further pointed out that one of the recommendations which arose from the Feasibility Study Report was that the structures that will be built for the project site office and workers' camp may be repurposed for community facilities upon completion of the construction of the dam.

3.2 Accessibility to social amenities

3.2.1 Accessibility at receiving communities

A query was raised as to whether or not a homestead's access to social amenities at the place of resettlement will be taken into consideration. For example, some amenities such as communal grazing are presently a short walk from an affected homestead, however at the place of resettlement, the resettled family members may have to walk longer distances than they presently do to access those amenities.

Response: accessibility to social facilities and amenities by resettled homesteads will be taken into consideration in the planning of the resettlement of homesteads.

3.2.2 Accessibility within affected community

A query was raised on whether or not the project will provide access routes across the dam, since presently there are low level crossings for vehicles and footbridges for pedestrians.

Response: impacts on vehicular and pedestrian access will be taken into consideration and appropriate mitigations and enhancements will be developed.

3.2.3 Replacement of affected schools

A query was raised as to whether or not Masibekela High School, which is a relatively new school will be replaced.

Response: schools will need to be relocated, i.e. shifted such that they remain within the community since they serve the whole community rather than just the affected homesteads. It was clarified that relocation means shifting the position of a homestead or facility, whereas resettlement means moving to a new location.

3.3 Availability of land for resettlement and relocation

3.3.1 Scarcity of land

The *Indvuna* pointed out that land for resettlement and relocation is scarce, citing the example of the difficulty that was experienced when identifying suitable land for constructing Masibekela High School. One of the contributing factors to scarcity of land is the rapid rate of development within the community.

Response: it was reiterated that schools will need to be relocated, preferably close to their existing sites.

The *Indvuna* then pointed out that the Consultant’s response implies, therefore that where facilities, such as schools are relocated, it means that homesteads will have to be resettled or relocated to provide land for the relocated facilities. Therefore, in addition to those homesteads directly affected by the dam, there will be additional homesteads whose resettlement or relocation is incidental to the dam.

3.4 Homesteads where construction has not yet commenced

3.4.1 Homesteads which have been allocated land, but have not yet been developed

The *Indvuna* highlighted that some community members, including those wishing to settle in the community, have been allocated land through Swazi law and custom (*kukhonta*) by *Umphakatsi* to construct their homesteads, but they have not yet commenced construction. In all cases those allocated land have paid the application fee and all costs associated with the application process. Therefore it is imperative for the Zone Leaders to bring to the Survey Team’s attention the locations of all designated homesteads allocated land, but have not yet commenced construction so that those homesteads are included in the resettlement and/ or compensation process. The *Indvuna* cautioned Zone Leaders to be vigilant of potential false claims that may arise where people claim they were allocated land when in actual fact they were not allocated land by *Umphakatsi*.

4. Closing

4.1 Words of appreciation to the Inner Council

The Socio-economic and RAP Survey Team expressed gratitude to the Inner Council for the opportunity of presenting the survey process and granting permission to proceed with the survey.

4.2 Inner Council's closing remarks

The *Indvuna* expressed appreciation for the introductory meeting with the Socio-economic and RAP Survey Team. The *Indvuna* reiterated that several meetings had already been held with the Inner Council and the community where the project was introduced. He reiterated that the Environmental and Social Impact Assessment had now reached the critical stage of interacting with the directly affected homesteads. He therefore proposed that the question and answer session be deferred to the Community Meeting scheduled for 03rd August 2019. That is where the interested and affected parties will be provided the platform to submit further comments, suggestions, queries and concerns. The *Indvuna* pledged that the role of the Inner Council will be to continue promoting awareness of the project to the community members and to promote the community's cooperation with the Survey Team during the course of the survey. In the meantime the Survey Team is granted permission to commence surveying the affected homesteads prior to the Community Meeting.

Record of meeting proceedings prepared by:

Mbuso Kingsley

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy

Mbabane - Manzini Corridor Dam (Nondvo Dam)

Environmental & Social Impact Assessment (ESIA)

Public Participation Meeting Attendance Register

MMA

INTRODUCTION TO SIPHOCOSINI INNER COUNCIL

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: SIPHOCOSINI

Date/ Lusuku: 31 JULY 2019

NAME/ LIBITO	ORGANIZATION/ COMMUNITY INHLANGANO/ SIFUNDZA/ SIGODZI	DESIGNATION/ SIKHUNDLA/ SIGABA EMMANGWENI	CONTACT NUMBER/ INOMBOLO YELUCINGO	EMAIL/ LIKHELI LEKUCHUMANA NGA NGCONDVOMSHINI	SIGNATURE/ SAYINA LAPHA
MBUSO KINGSLEY	MMA	ENVIRONMENTAL CONSULTANT	2404 3044/ 7653 0306	mbuso@mapritch.org	[signature]
NICHOLAS MATSEBULA	SIPHOCOSINI	INDVUNA (HEADMAN)	7618 2950	—	[signature]
NELSON DLAMINI	"	INNER COUNCIL	—	—	[signature]
SAMSON MSIBI	"	"	—	—	[signature]
SIPHO MAVIMBELA	"	"	—	—	[signature]
KENNETH DLAMINI	"	"	—	—	[signature]
MOSES NHLABATSI	"	"	—	—	[signature]
CHELE GULE	"	"	—	—	[signature]
PAUL KUNENE	"	"	—	—	[signature]
ALFRED NHLABATSI	"	"	—	—	[signature]
ISAYA TFWALA	"	"	—	—	[signature]

Government of the Kingdom of Eswatini, Ministry of Natural Resources and Energy
Mbabane - Manzini Corridor Dam (Nondvo Dam)
Environmental & Social Impact Assessment (ESIA)
Public Participation Meeting Attendance Register

INTRODUCTION TO SIPHOCOSINI INNER · COUNCIL

Luhla lwalabo lebebakhona emhlanganweni welucwaningo lwemvelo nenhlalakahle

Venue/ Indzawo: SIPHOCOSINI
Date/ Lusuku: 31 JULY 2019

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SABULANI LUKHELE	SIPHOCOSINI	INNER COUNCIL	–	–	[signature]
JEREMIAH NHLABATSI	"	"	–	–	JUNHLABA
SABULANI MAKHANYA	"	"	–	–	[signature]
MATHOKOZA MAKINGA	"	"	–	–	[signature]
SIMSON DLAMINI	"	"	–	–	[signature]
ANDREAS MAMBA	"	"	–	–	A MAMBA
LOTHI DLAMINI	"	"	–	–	T Dlamini
ENOCK NGWENYA	"	"	–	–	[signature]
DUDU MAMBA	"	"	–	–	[signature]
SEBENZILE MASEKO	"	"	–	–	SMaseko
ELLEN MANYABI	"	"	–	–	E. Manyabi

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FANIZA MHLABA	SIPHOCOSINI	INNER COUNCIL	-	-	[signature]
ABEDNIGO MBUTISA	"	UMGIJIMI (Chief's Runner)	-	-	[signature]
OBED LANGWENYA	"	INNER COUNCIL	-	-	[signature]
SIKELELA MAVIMBELA	"	"	-	-	[signature]
NDUMISO DLAMINI	"	"	-	-	[signature]
JEFERY DLAMINI	"	"	-	-	[signature]
MDUDUZI DLAMINI	"	"	-	-	[signature]
GCINA MDLULI	"	"	-	-	[signature]
MANCOBA MHLANGA	"	"	-	-	[signature]
MICAH MKHONTA	"	"	-	-	[signature]
OBED MASUKU	"	"	-	-	[signature]

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LINDIWE ZIKALALA	SIPHOCOSINI	INNER COUNCIL MEMBER	-	-	[signature]
DUMSI DLAMINI	"	"	-		[signature]
EUNICE MKHONTA	"	"	-		[signature]
Gcebile Shiba	"	"	76614115		[signature]
THANDI MKHWANAZI	"	"	-		[signature]
SANELE SHONGWE	"	"	-		[signature]
NOMVISO HLOPHE	"	"	76613390		[signature]
ZODWA DLAMINI	SI FUTURES	CONSULTANT	-		[signature]
R. Ramoeletsi	SI FUTURES	CONSULTANT	7642 6266	ramoerich@gmail.com	[signature]
P. Mokhesi	SI FUTURES	CONSULTANT	7642 6254	Phakisa.mokhesi@sifutures.co.ls	[signature]

ANNEXURE 6: MINUTES OF INNER COUNCIL MEETING AT MANTABENI

MBABANE – MANZINI CORRIDOR (NONDVO) DAM ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA)

RECORD OF MEETING WITH MANTABENI INNER COUNCIL

Project Number:	41101262			
Grant Number:	**P-SZ-EAZ-001 /002** and **P-SZ-EAO-002**			
Contract Number:	MNRE/ DWA/ 002/ 2017-18			
Client:	Government of the Kingdom of Eswatini Ministry of Natural Resources & Energy Department of Water Affairs (DWA)			
Project Title:	Mbabane-Manzini Corridor (Nondvo) Dam Feasibility Study Environmental & Social Impact Assessment			
Consultant:	WSP Environmental (Pty) Ltd			
Meeting organized by:	WSP Environmental (Pty) Ltd			
Date:	31st July 2019			
Time:	**Start :**	12:00hrs	**End:**	13:17hrs
Venue:	Mantabeni Royal Kraal (*Umphakatsi*)			
Objectives:	• Introducing the Socio-economic and Resettlement Action Plan Survey Team to Mantabeni *Bandlancane* (Inner Council). • Presenting the Socio-economic and Resettlement Action Plan Survey process to Mantabeni Inner Council.			

ATTENDANCE:

	NAME	ORGANIZATION
1.	Ndlavela Mavimbela	Indvuna (Headman) of Mantabeni
2.	Sifiso Mdlovu	Chairperson
3.	Mandla Cindzi	Vice Chairperson
4.	Malanga Mbetse	*Bucpho*/ Development Committee Chairperson
5.	Khetsemabala Nsingwane	*Umsumphe*/ Land Allocation and Boundary Committee
6.	Freda Nkumane	*Umsumphe*/ Land Allocation and Boundary Committee
7.	Finchie Lapidos	Inner Council Member
8.	Enock Shiba	Inner Council Member
9.	Muzi Khumalo	Inner Council Member
10.	Nelisiwe Motsa	Inner Council Member
11.	Thabitha Mndzebele-Maziya	Inner Council Member
12.	Celani Hlophe	Inner Council Member
13.	Mathew Dlamini	Inner Council Member
14.	Martha Dlamini	Inner Council Member
15.	Tengetile Mlangeni	Inner Council Member
16.	Thembisile Nhlabatsi	Inner Council Member

17.	Edgar Du Pont	Inner Council Member
18.	Vusi Mahlambi	Inner Council Member
19.	Daniel Saulus	Inner Council Member
20.	Samuel Ncongwane	Inner Council Member/ Project Community Representative
21.	Richard Ramoeletsi	Si Futures – Resettlement Action Plan Specialist
22.	Phakisa Mokhesi	Si Futures – Data Specialist
23.	Dr Zodwa Dlamini	Si Futures – Environmental & Social Impact Assessment Specialist
24.	Hlasoa Matsoso	Si Futures – Surveyor
25.	Mamahlolonolo Mokhobo	Si Futures – Surveyor
26.	Keketso Mosebi	Si Futures – Surveyor
27.	Zaba Mdlovu	Si Futures – Enumerator
28.	Nokwanda Shongwe	Si Futures – Enumerator
29.	Blessing Masuku	Si Futures – Enumerator
30.	Siphesihle Tsabedze	Si Futures – Enumerator
31.	Babili Magagula	Si Futures – Enumerator
32.	Mcebo Mabaso	Si Futures – Enumerator
33.	Tebenguni Simelane	Si Futures – Enumerator
34.	Welile Maphalala	Si Futures – Enumerator
35.	Charity Lapidos	Si Futures – Enumerator
36.	Sandziso Mthupha	Si Futures – Enumerator
37.	Sambulo Zwane	Si Futures – Enumerator
38.	Mbuso Kingsley	WSP – Local Environmental Support
39.	Temusa Zwane	WSP – Local Environmental Support

AGENDA

AGENDA ITEM	RESPONSIBILITY
1. Welcome and Introductions	Inner Council/ WSP
2. Socio-economic and RAP Survey Process 2.1 Description of RAP Survey 2.2 Description of Socio-economic Survey	Si Futures
3. Closing 3.1 Words of appreciation to Inner Council 3.2 Inner Council's closing remarks	 Si Futures Inner Council

1. Welcome and introductions

WSP Environmental (Pty) Ltd (WSP) had requested a meeting for introducing the Socio-economic and Resettlement Action Plan (RAP) Survey Team to Mantabeni *Bandlancane* (Inner Council). The Inner Council welcomed the Survey Team to Mantabeni.

Mr Samuel Ncongwane, a member of the community and Inner Council, was presented as having been appointed by the Inner Council to be the Community Representative who will accompany and assist the Survey Team with local knowledge pertaining to the community.

Mbuso Kingsley introduced the Survey Team and described their respective roles:

- Mr Richard Ramoeletsi, Resettlement Action Plan Specialist and Team Leader;
- Dr Zodwa Dlamini, Environmental & Social Impact Assessment Specialist, Scio-economic Survey Team Leader;
- Mr Phakisa Mokhesi, Data Specialist, Fixed Assets Data Collection and Land Survey Team Leader
- Fixed Assets Data Collection and Land Survey Team comprising:
    a) Hlasoa Matsoso;
    b) Mamahlolonolo Mokhobo;
    c) Keketso Mosebi.
- A total of 11 enumerators, identifiable by high visibility yellow vests with name tags, who will be divided into two groups:
    i) Socio-economic Survey Team;
    ii) Resettlement Action Plan (RAP) Team.

The Inner Council requested the Enumerators to introduce themselves individually.

2. Socio-economic and RAP Survey Process

2.1 Description of RAP Survey

Mr Ramoeletsi explained that the purpose of the survey is to work with the community in identifying the properties that will be affected by the proposed dam. The properties are those that are along and below the buffer contour line. This therefore includes those properties within the buffer zone and the inundation area.

2.1.1 Identification of fixed assets

The Survey Team will work with respective property owners in identifying and recording:

a) Houses;
b) Structures;
c) Fields;
d) Trees;
e) Kraals;
f) Chicken coops;
g) Any and all other fixed assets belonging to each respective homestead.

It is anticipated that in some cases certain fixed assets within the homestead will be above the buffer contour and other fixed assets will be below the buffer contour. For example, the houses may be above the buffer while the fields are below the buffer contour. In such cases only the affected fields and other affected non residential fixed assets will be identified, measured and recorded. Such identification, measurement and recording will be undertaken in the presence of the homestead head or authorised representative/s.

Similarly, the fixed assets of community facilities and amenities, such as schools, churches, clinics, shops, recreational areas, communal fields, are likely to be affected, therefore the representatives of such facilities will need to be present during identification, measuring and recording of their respective affected fixed assets.

2.1.2 Identification of cemeteries and graves

Where there are cemeteries, those homesteads which will be affected, i.e. those below the buffer contour, will be required to identify each respective grave which belongs to the homestead and is located within the cemetery, even if the cemetery is above the buffer contour. This will enable each respective grave to be exhumed, relocated and re-buried in accordance with cultural practices, thereby ensuring that the homestead's graves are not left behind during the resettlement process.

Where graves are not in a cemetery, but are in isolated locations below the buffer contour, it will be necessary for family members to point out or, if uncertain, consult with family elders to assist the family members in pointing out the locations of such graves so that they are not inadvertently inundated. It will otherwise be impractical to exhume graves which are remembered after they have been inundated.

The identification of graves includes stillborns, who due to particular cultural burial practices, may not have marked graves and are not buried at the cemetery, but at a designated location within the homestead. Family members will be required to point out or, if uncertain, consult with family elders to assist the family members in pointing out the locations of the graves of stillborns. This is to enable the graves of stillborns to also be relocated.

2.1.3 Identification of communal grazing areas

It will be necessary to identify, measure and record communal grazing areas.

2.1.4 Request for support from traditional authorities

Mr Ramoeletsi kindly requested the support of the Chief, *Indvuna* and Inner Council in being sensitive towards the affected homesteads since they will be affected not only materially by having to resettle, but also emotionally and psychologically by the anxiety of knowing that resettlement is imminent. The traditional authorities are therefore kindly requested to assist the Project Team by pleading for the cooperation of the affected homesteads throughout the data collection of the Socio-economic and RAP Survey.

The Inner Council was further requested to refrain from using the survey as an opportunity to victimise affected homesteads who may have committed transgressions against the traditional authorities in the past. An example of victimisation was cited as deliberately and/ or maliciously causing an affected homestead to be excluded from the survey such that the homestead is denied compensation that is rightfully deserved.

2.1.5 Data collection process

The Surveyors together with a team of Enumerators will visit each affected homestead. The homestead representative will identify each fixed asset. The Surveyors and Enumerators will measure and record each fixed asset. Recording will include taking a photograph of the fixed asset with the homestead head or authorised representative standing beside the asset. For each homestead, the photographs of the fixed assets and a map of the measured assets will be printed onto a form containing the details of the homestead head and spouse. For each community facility, the photographs of the fixed assets and a map of the measured assets will be printed onto a form containing the details of the authorised custodian.

Each homestead will be required to produce the Identity (I.D.) card of the homestead head when data of the homestead is collected. Where either spouse at the homestead is deceased, then a death certificate will be required. Where a homestead has been allocated land to settle in the community, but no construction has commenced, then *Umphakatsi* through the Project Community Representative will be required to bring such a homestead to the attention of the Survey Team.

2.1.6 Data verification

The printed form will be presented to the homestead head for verification of the captured assets. The homestead head may designate the spouse, or other representative authorised by the homestead head to verify the contents of the printed form. Where the homestead head or authorised representative is satisfied that the data on the form has been captured correctly, then the homestead head or authorised representative will sign acknowledgement that the data was captured correctly as at the date of the survey. The form will then be signed by the Royal Kraal (*Umphakatsi*) witnessing that the homestead head or authorised representative is satisfied with the correctness of the data. On behalf of the Consultant, the RAP Specialist will then sign as witness that the affected homestead head and *Umphakatsi* have acknowledged the correctness of the data. Finally, the Department of Water Affairs (DWA) will sign on behalf of the Ministry of Natural Resources & Energy, acknowledging that all the aforementioned persons are satisfied with the correctness of the data. The signature of DWA will also serve as acknowledgement on behalf of the Government that the affected homestead qualifies for compensation and inclusion in the Resettlement process.

Where the homestead head identifies discrepancies or incorrectly captured data, the homestead head will instruct the Survey Team to correct such data prior to signing acceptance of the data captured on the form. Thereafter the amended form, signed by the homestead head, will proceed up the levels of authority for counter signature.

2.2 Description of Socio-economic Survey

The Socio-economic Survey will identify the baseline social and economic characteristics of the affected homesteads and community. The overall objective is to determine the existing social and economic condition of the affected homesteads and community in order to ensure that changes arising from project activities, including resettlement and relocation, do not leave the affected homesteads and community worse off.

2.2.1 Community facilities and amenities

The availability and accessibility of community facilities such as schools, health care centres, water sources, public roads, will be recorded through interviewing affected homesteads and any other relevant stakeholders within the community.

The availability and accessibility of community facilities in the receiving community, to which affected homesteads will be resettled, will also be taken into consideration to ensure that the demand placed upon such resources is not exceeded to the detriment of the wellbeing of the both the receiving community and the resettled families.

2.2.2 Identification of employment opportunities likely to arise during project implementation

Data will be collected through interviews to determine existing skills that are available within the affected community in order to determine the prioritisation of appropriate employment opportunities for members of the community. For example, some members of the community may have qualifications and training in certain vocations, such as construction, catering, driving and many others which are likely to be required during project implementation.

2.2.3 Natural resources of cultural and economic value

Natural resources of cultural and economic value such as various species of grasses which grow on communal land and are harvested for making mats, hats, constructing structures within homesteads etc, will be identified measured and recorded. This will support the description and determination of existing sources of cultural and economic livelihood within the affected community.

3. Discussion

The members of the Inner Council were provided the platform to submit comments, suggestions and queries to the Socio-economic and RAP Survey Team.

3.1 Extended families

3.1.1 Absent and deceased homestead heads

A query was raised on how homesteads with absent or deceased homestead heads as well as child headed homesteads will be surveyed, i.e. who will be recognised as the homestead head in such cases?

Response: the designated living homestead head, whether designated by extended family elders or other form of documented proof, will be recorded as the homestead head. Additional written confirmation by Umphakatsi will be required certifying the designated person, who is the next of kin to the deceased, as the homestead head.

3.1.2 Multiple homesteads per individual

A query was raised as to how multiple homesteads headed by an individual will be dealt with. For example, where a homestead head has one homestead which is affected and another homestead within the same community which is not affected, will the homestead head be compensated for the affected homestead or required to move to the unaffected homestead, and thereby be deemed as not qualifying for compensation?

Response: the specific affected fixed asset, whether it be on or more fields or a homestead, will be compensated, irrespective of how many *other homesteads in the community headed by an individual are not affected.*

3.2 Annual cultivation programmes

3.2.1 Annual cultivation programmes of affected homesteads

A query was raised as to whether or not affected homesteads should continue with their annual cultivation programmes at the being of the rainy season, since they will be resettled.

Response: annual cultivation programmes shall proceed as normal until such time that the Government issues an instruction to affected homesteads to stop cultivation beyond a date to be appointed. The same shall apply to establishment of new homesteads and construction of structures within existing homesteads.

3.3 Benefit of project to the affected community

3.3.1 Socio-economic benefits of proposed dam to affected community

A query was raised as to whether or not the affected community, i.e. the host community of the dam will benefit from the project during the operation phase. The query was raised in light of the adjacent existing Luphohlo Dam not having directly benefitted the host community, yet homesteads were relocated to provide space for the dam.

Response: while the purpose of the proposed dam is to meet the future water needs along the Mbabane-Manzini corridor, the water needs of the host community will also be taken into consideration, therefore the directly affected community will benefit.

3.4 Proposed dam site

3.4.1 Detailed map of proposed dam

A detailed map of the final proposed dam site was requested in order to provide clarity to the community on the respective locations of the directly affected homesteads.

Response: a map will be issued to the Inner Council by the Survey Team, indicating the buffer contour and the inundation area. During the meeting, several map slides were presented.

3.5 Impacts of sourcing of construction material on agriculture

3.5.1 Impacts of construction activities on subsistence agriculture

A concern was raised that while it is acknowledged that community residents are permitted to continue with their respective annual cultivation programmes until a cut-off date is announced, the real impacts on agriculture emerge during construction. This is when construction material such as gravel and sand are sourced from nearby sites which at times may require borrowing material from arable land, resulting in food insecurity amongst the remaining homesteads. Therefore, even if borrow sites are identified in advance, the actual yields are sometimes lower than initially estimated, resulting in resorting to borrowing material from arable land.

Response: the social impact assessment report will include recommendations for mitigating potential adverse impacts on subsistence agriculture. This will include recommendations on timely compensation to those who will be affected by loss of arable land.

4. Closing

4.1 Words of appreciation to the Inner Council

The Socio-economic and RAP Survey Team expressed gratitude to the Inner Council for the opportunity of presenting the survey process and granting permission to proceed with the survey.

4.2 Inner Council's closing remarks

The *Indvuna* expressed appreciation for the introductory meeting with the Socio-economic and RAP Survey Team. The *Indvuna* emphasized that through the survey the Environmental and Social Impact Assessment commenced in earnest since the social impacts are the most sensitive aspect of the project. He further highlighted that some aspects of resettlement and compensation may present challenges to the Government, however that is beyond the scope of the consultants whose role is to present facts and recommendations upon which the Government will need to make decisions.

The Survey Team was invited to present the survey process to the Community Meeting which is scheduled for 17th August 2019. In the meantime the survey is permitted to proceed amongst the affected homesteads and the Inner Council will support the Survey Team through promoting the community's cooperation with the survey.

Record of meeting proceedings prepared by:

Mbuso Kingsley

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MBUSO KINGSLEY	MMA	ENVIRONMENTAL CONSULTANT	2404 3044/ 7653 0306	mbuso@mapmitch.org	[signature]
Malanga Mbetse	MANTABENI	Bucopho (INNER COUNCIL)	76276835	—	[signature]
Enock Shiba	"	LIBANDLA "	76185532	—	[signature]
Muzi Khamalo	MANTABENI	LIBANDLA "	76048585	—	[signature]
Samuel Ncongwane	MANTABENI	Libandla "	76171042	—	[signature]
Nelisiwe P. Motsa	MANTABENI	Libandla "	76278916	—	[signature]
Thabitha Mndzebele Magagula	MANTABENI	libandla "	76329807	—	Mndzebele
Freda S. Nkumane	MANTABENI	Umsumphe "	76540615	—	[signature]
Celani Hlophe	Mantabeni	Libandla "	76785189	—	[signature]
Mathew Dlamini	Mhlane (MANTABENI)	INNER COUNCIL	78447143	—	[signature]
Martha Dlamini	Mahlalangcuna (MANTABENI)	bandlancane (INNER COUNCIL)	76510583	—	[signature]

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Tengetile Mlangeni	Mahlothoza (MANTABENI)	Community Police	76047434	—	TMlangeni
Thembisile Nhlabatsi	Mahlothoza (MANTABENI)	Community Police	76658035	—	TNhlabatsi
Khetsemabala Nsingwane	Zulwini	Umsumpe	76635457	—	[illegible]
Sifiso Mdluli	Zulwini	Chairperson	76036869	—	[illegible]
Babe Mavimbela	Zulwini	Induna	76453017	—	Mavimbela
Mandla Ginindza	mantabeni	Vice Chairperson	76176784	—	[illegible]
Edgar . du Pont	Zulwini	Council member	76118485	—	[illegible]
Vusi Mahlambi	Mantabeni	Umphatsi weMaphoyisa Emangwaneni ~~Samuel Mahlambi~~	76301127	—	Samuel
D.P. Saulus	eZulwini	Member	76211371	—	DSaulus
Juchie Lapidos	Mantabeni	Lubandla	76267266	—	[illegible]
Thembisile Nhlabatsi	mantabeni	Libandla	76658035	—	TN

WSP Project No.: 41101262 MMA file reference: Z:\jobs$\Jobs 16\SD1631 Mbabane-Manzini Corridor Dam (Nondvo Dam)\Meetings\SD1631 Public Participation Meeting Attendance Register.xlsx

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ZODWA DLAMINI	SI-FUTURES	CONSULTANT	-	zodwad@icloud.com	[signature]
R Ramoelcti	"	"	7642 6266	ramoerich@gmail.com	[signature]
Phakisa Mokhesi	"	"	7642 6284	phakisa.mokhesi@sifutures.co.ls	[signature]

ANNEXURE 7: SOCIO-ECONOMIC HOUSEHOLD SURVEY QUESTIONNAIRE

NONDVO DAM PROJECT ESWATINI

HOUSEHOLD QUESTIONNAIRE

Form A

1) Interview Status (Tick only one):

Fully Completed ____ - 1

Partially Completed ____ - 2

2) Total number of visits: _________

3) Enumerator Self Check (field), print first name: ________________________________

Date: ________________________________

4) Supervisor Check (field), print surname: ________________________________

Date: ________________________________

Questionnaire Entry Completed: ________________________________

Date: ________________________________

Questionnaire Validation Completed: ________________________________

Date: ________________________________

Introductory note by Research Assistants/Enumerators

Step 1:

My name is...............................I am working for FI FUTURES Consult…………………….The purpose of my visit to you is to inform you and request your participation in social and environmental impact assessment study of a project called Nondvo Dam. The government of Eswatini through the Ministry of Water Affairs and African Development Bank have proposed this project in order to improve access to clean and safe drinking water for Manzini and Mbabane. Therefore, FI-FUTURES, as an ESIA practitioner, has been engaged by WSP (main consultant) to undertake a social impact study. The aim of the study is to plan for resettlement for households that will be impacted by the construction and inundation of Nondvo Dam. Your responses will be used to correctly identify and measure your physical fixed property such as homes in the homestead, kraals, garden, fruit trees, family graves, and fields so that proper and fair compensation will be prepared for reimbursement and development on behalf of the entire community of Siphocosini and Mantabeni. For ethical purposes, your information will not be discussed with any of the members of the community except the inner Council for the sake of verification and authentification of property and land. Confidentiality and anonymity will be maintained at all times in this project.

If you agree to participate and /or give consent, would you please sign the form attached.

Step 2:
Do you agree to participate?
1. Yes/Yebo €
2. No/Cha €

Step 3:
For the purposes of my survey I would like you to answer the following questions as honestly as possible. Your views are very important to us and we will ensure that they are accurately captured.

SECTION A: BACKGROUND INFORMATION

Name of village:______________________________________
Name of the Zone: ____
Name of District: ____
Research Assistant: ____
Supervisor Name:____
Date:____
Time Begin:_________________________Time Completed______________

SECTION ONE: DEMOGRAPHIC INFORMATION

1. **Names of HH Member____**

2. **Oldest > Youngest____**

3. **Age of Household Head**
   1= 15-25 yrs. 2= 26-35 yrs. 3= 36-45 yrs 4= 46-55 yrs. 5= 56 yrs & Older

4. **Age of respondent (Iminyaka yomuntu ophendula imibuto)**
   1= 15-25 yrs. 2= 26-35 yrs. 3= 36-45 yrs. 4= 46-55 yrs. 5= 56 yrs & Older

5. **Sex of the Household Head**
   1=Male 2=Female

6. **Sex of the respondent**
   Male Female

7. **Relation of respondent to household head**
   1= HH Head) 2= Spouse 3=Child) 3= = Relative 5= Sibling 6= Non-relative

8. **Marital Status**

1= Single 2= Married 3= Widowed
4= Separated

9. Education Level of Household Head
1=Primary Level (3. High School Level 2=Secondary Level 4. Tertiary 5. None 6. Informal/ Long distance 7. Vocational).

10. **[If 6-17] Still in School?** [If aged 6-17] Is [name] still in school? 1 = yes 2 = no

11. **Total number of people living in this household (male and females)** 1=Adults (Abadala) (over 18 years) ____
2=Children (under 18 years)) ____

12. How many children are still going to school
1=Girls:_________________________ 2=Boys_______________________________

13. People with Disabilities and vulnerable individuals
Are there people who live with disabilitien in this household?

1	2	3	More

14. What type of Disabilities

/Blind	Difficult Mobility	Learning Diasability	Mute	Any Other

15. How many vulnerable people live in this household (old people over the

Older than 70-100	Child Headed household	Orphaned children	Living with Mental Health Issues

16. Occupation of household head
Is [name] generating income through the following: 1 = formal emp (job) 2 = formal emp (self) 3 = informal emp 4 = piecework 5 = on-farm production for sale (animal, crop) 6 = unemployed & seeking work in past 3 months 7 = unemployed & not seeking work in past 3 months 8 = not in labour market

17. Of all household members, can any member comfortably read and understand spoken English to a level that they could comprehend a full presentation in English or read a detailed booklet or newspaper that is in English?
[Enum: Confirm, as this is often overstated]1= yes 2=no 3=do not know/cannot say

18. [If yes to the question above] How many household members or any age can do so?

19. What is the main language spoken at home between family members? 1=Siswati 2=English
[Enum: Circle ONLY ONE]

20. What other languages, if any, are spoken at home between family members?

[Circle up to 3 responses] [Enum: ensure that these are different languages than noted above]

21. How long has this household been established in this area?1= < 1 year 2=1-5 yrs 3=6-10 yrs 4=10-20 yrs
    5=21-40 yrs 6=> 40yrs 7=do not know
22. Had any of your relatives/friends lived here before you came? 1= yes 2=no 3=do not know/cannot say

23. Did they help you with your settlement? 1= yes 2=no 3=do not know/cannot say

24. Was it easy to settle here or did you experience any difficulties when you came? 1= yes 2=no 3=do not know/cannot say
25. If yes, Please explain____

26. Do you have relative that live in any farm/settlement/village near the project site that you frequently visit? 1= yes 2=no 3=do not know/cannot say

27. How frequent do you visit these places?

SECTION TWO: MEANS OF LIVELIHOOD/INCOME

28. **Means of livelihood**
    1= Farmer2= Vegetable and Fruit Sales) 3= Formally Employed 4= Livestock sales) 5= Artisan 6= Casual Labour 6= Beer brewing 7= Pension8. WFP Aid 9= Other Specify
    ____
29. **Does the household receive any remittance** from persons living outside this household on a regular basis? By regular, we mean at least four times over the past year.**? (**1=Yes 2=No

30. **If yes where does the remittance come from** 1=Inside Eswatini
    2=Outside Eswatini

31. **Who provides the remittance**
    1=Son
    2=Daughter
    3=Mother
    4=Father
    5=Children
    6= Other _________________________

32. **On a monthly basis how much does your family spend?** 1=No reliable income 2=less than E1000.00 3=less than E2000.00 4=Less than E3000.00 5. More than E3000.00).

33. What is the main source of lighting for this household? Electricity (generator) 1.Electricity (solar) 2.Electricity (battery) 3.Gas 4. Paraffin 5.Candles 6.Firewood 7.Other (specify): ______________________

34. What is the main source of fuel for cooking in this household?) 1.electricity (solar) 2.electricity (battery) 3.gas 4. Paraffin 5..firewood 7. dung 8. other (specify): ______________________

35. How many days, if any, in the past month did any household member eat food that was given freely by someone else (incl. government programmes) specifically due to lack of food? ________________[Enum: 0 is a valid value][If do not know exactly, get estimate]
36. How many days, if any, in the past month did any household member eat food that was borrowed from another household because there was no food in the household? ________________[Enum: 0 is a valid value][If do not know exactly, get estimate]
37. How many days, if any, in the past WEEK did any household member go to sleep without eating that day because there was no food in the house for them to eat? ________________[Enum: 0 is a valid value][If do not know exactly, get estimate][Enum: must be values 0-7

SECTION THREE: MOVABLE ASSETS

	Cattle Ownership	Sheep Ownership	Goat Ownership	Donkey Ownership	Horse/ Pony Ownership	Chicken Ownership	Pig Ownership	Other Ownership (specify)	Other Ownership (specify)
Indicate total number of assets for the household overall									

	Radio Ownership	TV Ownership	Cell Phone Ownership	Refrigera-tor Ownership	Bed Ownership	Car Ownership	Scotch Cart Ownership	Computer Ownership	Bicycle Ownership
Indicate total number of assets for the household overall									

SECTION FOUR: FIXED ASSETS

	Fields	House	Toilet	Kraal	Shed	Fencing	Trees	Wells	Boreholes
Mark the fixed assets associated with each category (# only)									
Land board measurements of each:									

SECTION FIVE: SKILLS/ EXPERIENCE QUESTIONS

Questions and Enumerator Instructions	Responses	Codes	GO TO	Sup.
Does any household member have any experience in a construction-related job where some skills are required?	yes no do not know/cannot say	1 2 3		
[If yes to above] What was the specific nature of this experience for SKILLED jobs? [Circle up to 3 responses]	iron mongering carpentry welding/metalwork driving plumbing electrical bricklaying masonry roofing thatching cabinet making tiling	1 2 3 4 5 6 7 8 9 10 11 12		

Questions and Enumerator Instructions	Responses	Codes	GO TO	Sup.
	brickmaking other (specify): ________________________	13 ##		
Does any household member have any training in any construction-related sector?	yes no do not know/cannot say	1 2 3		
[If yes to above] What was the field/what were the fields of training offered? [Circle as many as appropriate]	iron mongering carpentry welding/metalwork driving plumbing electrical bricklaying masonry roofing thatching cabinet making tiling brickmaking other (specify): ________________________	1 2 3 4 5 6 7 8 9 10 11 12 13 ##		

Does any household member have any experience in working in the water sector where some skills are required?	yes no do not know/cannot say	1 2 3		
[If yes to above] What was the specific nature of this experience? [Circle as many as appropriate]	heavy machinery maintenance fitting & turning boiler making electrical instrumentation driving operating explosives mechanical safety control metallurgy mining geology other (specify): ________________________	1 2 3 4 5 6 7 8 9 10 11 12 13 14 ##		
Does any household member have any training in any water-related sector?	yes no do not know/cannot say	1 2 3		

[If yes to 304] What was the field/what were the fields of training offered? [Circle as many as appropriate]	heavy machinery maintenance fitting & turning boiler making electrical instrumentation driving operating explosives mechanical safety control metallurgy mining geology other (specify): ________________________	1 2 3 4 5 6 7 8 9 10 11 12 13 14 ##		

SECTION SIX: PROJECT RELATED IMPACT ISSUES

Questions and Enumerator Instructions	**Responses**	**Codes**	**GO TO**	**Sup.**
Have you heard anything about a project that is proposed in this area?	yes no do not know/cannot say	1 2 3		
[If yes to above] What have you heard? [Circle up to 3 responses]	do not know specifics, just heard that a water project will be opened up [circle by itself] possibility of water pipes installed in the area possibility of a road to the site unskilled people will be employed skilled people will be employed that people will be forced to move that the project will bring benefits for locals other (specify): ____________	1 2 3 4 5 6 7 8 ##		

[If yes to above] What do you think might be the main benefits, if any, of such a project for people in this immediate area? [Circle up to 3 responses]	none [circle by itself] jobs more economic activity improved access to water other investment opportunities better municipal services improved education improved water services skills training opportunities other (specify): ____________	1 2 3 4 5 6 7 8 9 ##		
[If yes to above] What do you think might be the main problems, if any, of such a project for people in this immediate area? [Circle up to 5 responses]	none [circle by itself] may be forced to relocate increase in crime increase in transactional/commercial sex work spread of HIV/AIDS increase in poaching informal settlements will develop we will be dislocated disturbance of ancestral sites loss of access to natural resources for gathering conflict between ethnic groups discrimination against minority groups increase in alcohol abuse increased fighting and violence increased domestic violence increase in number of shebeens other (specify): ____________	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 ##		
We will now present you with a number of attitudinal statements, which we would like you to indicate whether you agree or disagree with the statement, and how strongly you agree or disagree. Please use the following scale: 'strongly agree', 'somewhat agree', 'somewhat disagree', 'strongly disagree', or 'do not know'.				
If word gets out that dam construction project is going to be constructed in this area, too many job seekers will come to the area and take the jobs away from locals	strongly agree somewhat agree somewhat disagree strongly disagree do not know	1 2 3 4 5		
Few to no local people in this area will get jobs during dam construction	strongly agree somewhat agree somewhat disagree strongly disagree do not know	1 2 3 4 5		

Few to no local people in this area will get jobs during operation of the project	strongly agree somewhat agree somewhat disagree strongly disagree do not know	1 2 3 4 5		
Archaeological and social significance sites/artefact				
Prior to the farming operations, has the site been used by indigenous people				
In your knowledge, is there a possibility of the project footprint having some interesting insights, graves and other historic features or abandoned artefacts, such as old borehole pumps?	Discipline			

Section 2 Cont

INFORMATION ON PRIVATE PROPERTY OWNERSHIP THAT REQUIRE WATER USAGE

38. **Which property/assets require water usage to bring you income?** 1=Fruit trees 2=Vegetable Garden) 3= Live stock 4= fields 5= Other Specify _____________

39. **Considering the number of years you have used this property, how much income in average do you get from this property? (**1= no reliable income 2= < E500/ year 3= E500 – E1 000/ year 4= E1 000 – E1 500 5= E2 000 and above 6= Other specify ____

SECTION SEVEN: SERVICE PROVISION

40. **Do the following services exist in this village? For each give number** 1=Rural Water 2=VIP latrines 3=Day Care Centre 5=Primary School 6=Clinic 7=High School 8=Church
 9=Shops 10=Postal Agency 11=Police station*)* 12= Council office 13=Other Specify
 ____

41. **What are your views and expectations about the proposed dam construction in your area?**
 ____

42. **What benefits do you foresee if there is dam construction in your community?** 1= Improved health services
 2= Improved and healthy environment in schools
 3= Improved and healthy environment in service areas
 4= Others specify____

SECTION EIGHT: HEALTH ISSUES AND HIV/AIDS

43. **Are you aware of HIV& AIDS**
    1= Yes 2= No

44. **Has there been any awareness campaign on HIV & AIDS in your village?** 1= Yes 2= No

45. **What did you gain from the campaign?**
    1= knowledge of the disease 3= How to avoid getting infected
    2= How to live with HIV/AIDS 4= Where to get ARVs (
    5= Other (specify) ____

46. **Was the campaign helpful?**
    1= Yes 2=No

47. If No why? Explain ___________________

48. **How was information disseminated to you?**

1= Verbally 2=Clinic 3= Radio/TV 4= School children) 5= Pamphlets / posters
6= workplace) 7= Public gatherings 8= Other specify ____

49. **How do you get regular and up-to-date information about HIV & AIDS**1= Verbally 2=Clinic 3= Radio/TV
    4= School children 5= Pamphlets / posters)

6= workplace 7= Public gatherings
8= Other specify (Tse ling, Hlalosa)____

50. **What methods would you suggest for getting regular updates and information about HIV & AIDS?**

1= Verbally 2=Clinic 3= Radio/TV 4= School 5= Pamphlets / posters 6= Workplace 7= Public gatherings
8= Other specify____

51. **Do you have people in your household or community living with HIV/AIDS**
    1= Yes2= No

52. **Have you tested**
    1= Yes 2=No

53. **If yes how long ago was it?**
    1= Year ago
    2= 6 months ago
    3= 3 months ago
    4= Others specify____

54. **Do you have HIV/AIDS support group in your Community?**
    1= yes 2= No

55. **If yes, are you satisfied by the services from the support group?**
    1= Yes 2- No

56. **If no, why and what would you like to see happening?**

____

57. **Where do you get HIV & AIDS services?**

58. **How far is the service point from your village?**

SECTION NINE: GENDER RELATED ISSUES

59. **Do you understand gender equality?**

    1=Yes 2=No

60. **What influenced your understanding?**

1= Radio/TV
2=Panthlets
3=Through discussions with other community members
4=Public gatherings
5=Other (specify)_______________________________

61. **Should women and men be given same opportunities and positions in everything?**

    1=Agree
    2=Disagree
    3=Not sure

62. **How prevalent is Gender Based Violence in your community?**

1= Low
2= High
3=Not sure

63. **Who are the most affected?**

    1=Women
    2=Men
    3=Children (boys and girls)
    4=People with disabilities
    5=Older Persons

64. **Looking at other projects implemented in your community, who are the most employed and why? (**

    1= Men
    2=Women

65. **Explain your answer**

____
____

SECTION 6: WATER CONSUMPTION/ USAGE PATTERNS

Q68. Where does your household obtain water for drinking and washing today? (Tick one option)**.**

Water Source	Option
1 = Rainwater Tank	
2 = Well (Deep	
3 = Traditional / Hand Dug Well	
4 = Borehole (Hand-Pumped)	
5 = Spring	
6 = Stream or River	
8 = Swamp	
9 = Other	
10=Public stand pipe	
11=Private connection/tap	

Q69. For the water source ticked above, were there any months each year where water was scarce or of poor quality, please tick below?

Month	Scarce	Poor Quality
January		
February(		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December(		

Q70. Why do you use this source of water?

1=Its cheaper/affordable 2=There are no other sources

3=Other)____

Q71. Are you satisfied with your current water system?

1= Yes
2=No

a) If Yes detail the positive aspects/attributes

b) If No detail the negative aspects/attributes

Q72. How is the quality of water from your water source?

a) Good
b) Dirty/Sandy/Muddy
c) Poor taste/Smell
d) Worms/Other contamination

Q73. What options are there for improvement? If any:

a) By the community

b) By the government

Q74. How much distance do you travel to fetch water?

1=0-1 km, 2=1-2km, 3=2-3km, 4=3-4km, 5=other (specify)

Q75. How long do you normally travel to get to your water source?

Q76.Who draws water more often?

1=Men 2=Women 3=Boys 4=Girls

5=Other***)***____

Q77. Why the one mentioned?

____

Q78. What do you use water for other than drinking and washing?

a) Gardening, crops/trees
b) Brewing
c) Poultry
d) Livestock
e) Bricklaying
f) Other

Q79. In the last month did you have enough water for all your needs?

a) Yes
b) No
c) If No, why, please explain

Q80. What are your views and expectations about the proposed dam construction in your area?

____

Q81. What benefits do you foresee if there is dam construction in your community? (1= Improved health services 2= Improved and healthy environment in schools

3= Improved and healthy environment in service areas

5= Others specify)____

Q82. Are you willing or able to pay for improved water services

a) If Yes, explain
b) If No, explain
c) If No, What do you think should be the options of water supply services for the very poor, the poor and non-poor

SECTION 7: BIODIVERSITY

Q84a) Are there medicinal plants in your village close to dam area?

Yes		No	

Q84b) If your answer is yes, please name them and their medicinal purpose

Plant name	**Medicinal purpose?**

Q85. Are there other plants of important use in your village?

Use	**Plant(s) name**
Wild vegetables	
Wild fruits	
Roofing	
Making brooms, hats and ropes	
Plants for sale (e.g rosehip)	
Firewood	
Other(specify) ______________________________	

Q86. Are there any wild animals in this area?

Yes		No	

____

Thank you for your cooperation. Do you have any questions/opinion?
____
____
____

END OF INTERVIEW

PLEASE RECORD THE FINISH TIME: __________________ [Enum: Please transfer finish time to page 1 and calculate total time]

Enumerator to circle level of co-operation below.

Level of co-operation

____ - 1 high

____ - 2 medium

____ - 3 low

Sign____**Date**_________________________

Thank You

ANNEX 2

INTERVIEW GUIDE FOR FOCUS GROUP DISCUSSIONS
(For different target groups)

Form B

Introductory note by data collectors

Step 1:

Step 1:
My name is............. I am working for...... The purpose of my visit to you is to inform you and request your participation in social impact assessment study of a project called Nondvo Dam with the assistance of WSP and SI-FUTURES and Ministry of Water Affairs proposed this project in order to augment water supply for Manzini and Mbabane. ThereforeSI-FUTURES, as an ESIA practitioner, has been engaged by WSP (main consultant) to undertake an environmental and social impact study. For ethical purposes, you will not be required to mention your name and contacts. Confidentiality and anonymity will be maintained in this project.

If you agree to participate and /or give consent for your child to also participate in the study, would you please sign the Form attached.

Step 2:
Do you agree to participate?
1. Yes €
2. No €

Step 3:
For the purposes of my survey I would like you to answer the following questions as honestly as possible. Your views are very important to us and we will ensure that they are accurately captured.

Section A
Village: ____
Council: ____
District: ____

Section B: Demographic Information
Q1. Gender
a) Male
b) Female

Q2. Marital Status (
a) Single
b) Married

c) Divorced
d) Widowed
e) Separated

Q3. Education Level
a) Tertiary
b) High School
c) Primary
d) None

Q4. Occupation
a) Employed
b) Unemployed
c) Self-employed
d) Student

SECTION C: MEANS OF LIVELIHOOD/INCOME

Q5. Which means of livelihoods do you survive with?

Q6. How long have you survived with this means of livelihood?
Q7. Is this livelihood able to finance all your needs? (

Q8. Are there any selling points along the site where the dam will be constructed?

Q9. Are majority of these selling points owned by women or men?

SECTION D: INFORMATION ON PRIVATE OR COMMUNITY PROPERTY OWNERSHIP

Q10. What assets or property does the household own near the dam site?
Q11. Which property/assets bring you income?
Q12. Is this property the sole means of income for you?
Q13. For how long has the property been used?
Q14.Is the area proposed for dam construction being used by the community?
Q15. If yes, what is it being used for? 1=grazing land, 2= firewood collection, 3=medicinal plants collection, 4=other (specify).
Q16. In your view, will the dam construction limit the access to this area for the community?
Q17. If yes, explain.

SECTION E: SERVICES PROVISION

Q18. Which services exist in your community?
Q19. What are the challenges faced by your community due to water shortage? (
Q20. What are your views and expectations concerning the proposed water connection in your area?
Q21. What benefits do you foresee if there is proper water connection in your community?

SECTION FIVE: HEALTH ISSUES AND HIV/AIDS (

Q18. Are you aware of HIV & AIDS?
Q19. Has there been any awareness campaign on HIV & AIDS in your village?
Q20. What did you gain from the campaign?
Q21. Was the campaign helpful?
Q22. How was information disseminated to you?
Q23. How do you get regular and up-to-date information about HIV & AIDS?
Q24. What methods would you suggest for getting regular updates and information about HIV & AIDS?
Q25. Do you have people in your household or community living with HIV/AIDS?
Q26. Have you been counselled and tested for HIV/AIDS?
Q27. If yes how long ago was it?
Q28. Do you have HIV/AIDS support group in your Community?
Q29. If yes, are you satisfied by the services from the support group?
Q30. If no, why and what would you like to see happening?
Q31. Where do you get HIV & AIDS services?
Q32. How far is the service point from your village?
Q33. How is their performance in helping the community?

SECTION SIX: GENDER RELATED ISSUES

Q34. Do you understand gender equality?
Q35. If Yes, What influenced your understanding? If No (enumerator will explain the concept).
Q36. Do you believe women and men should be given same opportunities and positions in everything?
Q37. How prevalent is Gender Based Violence in your community?
Q38. Who are the most affected and why?
Q39. Looking at other projects implemented in your community, who are the most employed and why?

SECTION SEVEN: WATER CONSUMPTION/ USAGE PATTERNS

Q40. Where does your household currently obtain water for drinking, cooking, bathing and washing? (Tick one option)**.**

Water Source	Option
1 = Rainwater Tank	
2 = Well (Deep)	
3 = Traditional / Hand Dug Well	
4 = Borehole (Hand-Pumped)	
5 = Spring	
6 = Stream or River	
8 = Swamp	
9= in-house plumbing (own)	
10=tap in yard (own	
11= in-house plumbing (other household)	
12=tap in yard (other household)	
13= public tap/standpipe	

14=vendor (purchase)	
9 = Other	

Q41. For the water source ticked above, were there any months each year where water was scarce or of poor quality, please tick below?

Month	Scarce	Poor Quality
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

Q42. Why do you use this source of water?
1=Its cheaper/affordable
2=There are no other sources
3=Other ____

Q43. What challenges do you encounter when using this water source? ____________
____

Q44. How long is the distance to your water source?

1= 0-1 km 2=1-2km 3=2-3km 4= Other specify
*(A*____

Q45. How long do you normally travel to get to your water source
1=Less than an hour
2=Less than 2 hours
3=Less than 3 hours
4=More than 3 hours

Q46. Who draws water more often?
1=Men 2=Women (3=Boys 4=Girls 5=Other*)*____

Q47. Why the one mentioned above

____

CLOSE QUESTIONS

What is your perception about the proposed project?

Do you have any final comments to make before we close this interview?

END OF INTERVIEW

PLEASE RECORD THE FINISH TIME: ___________________ [Enum: Please transfer finish time to page 1 and calculate total time]

Enumerator to circle level of co-operation below.

Level of co-operation

____ - 1 high

____ - 2 medium

____ - 3 low

Thank you for your cooperation. Do you have any questions/opinion

____
____
____

Sign____**Date**__________________________

Thank You

ANNEX 3

BASELINE INFORMATION ON COMMUNITY LEADERS/CHIEFS AND COMMUNITY COUNCILORS AND OTHER KEY INFORMANTS

FORM C

Introductory note by Research Assistants/Enumarators

Step 1:

My name is............. I am working for Seed Consult….The purpose of my visit to you is to inform you and request your participation in social and environmental impact assessment study of a project called Nondvo Dam Construction initiated by the Ministry of Water Affairs with the assistance of WSP have proposed this project in order to augment water supply for Manzini and Mbabane. Therefore, SI-FUTURES, as an ESIA practitioner, has been engaged by WSP (main consultant) to undertake an environmental and social impact study. The aim of the study is to identify individual and communal properties that may be directly or indirectly affected by the construction of the dam and inundation thereof. Your responses will be used for the Ministry of Water Affairs to prepare compensation and resettlement plan for the affected communities and individuals. For ethical purposes, you will not be required to mention your name and contacts. Confidentiality and anonymity will be maintained in this project.

If you agree to participate and /or give consent for your child to also participate in the study, would you please sign the Form attached.

If you agree to participate and /or give consent to participate in the study, would you please sign the Form attached.

Step 2:

Do you agree to participate?

1. Yes €
2. No €

Step 3:

For the purposes of my survey I would like you to answer the following questions as honestly as possible. Your views are very important to us and we will ensure that they are accurately captured.

1. Respondent No____
2. Sex __________________________Age ___________________________
3. Official Name of the Village ___________________
4. Your title ____
5. **Besides your official position what do you do for a living**?

   ____
6. **How do people in the village make a living?**

   ____

   ____

7. **After giving you the description of the project, what are your views and expectations about the proposed dam construction? _______________________________**

8. **Do the following services exist in this village?**
a) Piped Water Supply b) electricity c) Primary School
c) Sewer line d) Day Care Centre e) Church
f) High School g) Postal Agency h) Health Clinic/Hospital
i) Shops j) telephones lines k) Other (specify)

9. How do you think the proposed dam construction project will benefit the community? Positive benefits
____
____
Negative benefits _____________________________
____
10. Are there any individual and community properties that are likely to be affected by the dam construction in this area?
11. 11 .Is the area proposed for dam construction being used by the community?

12 .IF yes, what is it being used for? 1=grazing land, 2= firewood collection, 3=medicinal plants collection, 4=other (specify).
13. In your view, will the dam construction limit access to this area for the community?
14 .If yes, explain.

____

15. Are there medicinal plants and other important plants in your village close to the proposed dam site?
16. If your answer is yes, please name them and their purpose

Plant name	**Medicinal & other purposes**

17. Are there any selling points along the site where the dam will be constructed?

18. Are majority of these selling points owned by women or men, and why?
19. Do you have the confidence that people in this community understand issues of HIV and AIDs)____

20. How are gender relations in this community? ____
21. Are there any issues of gender based violence in this community? ______________

22. Looking at other developmental projects implemented in your community, who are the most employed and why?

23. Are you aware of HIV & AIDS
24. Has there been any awareness campaign on HIV & AIDS in your village
25. What did you gain from the campaign?

26. How was information disseminated to youz?
27. How do you get regular and up-to-date information about HIV & AIDS?
28. What methods would you suggest for getting regular updates and information about HIV & AIDS?
29. Do you have people in your household or community living with HIV/AIDS?
30**.** Do you have community health workers and or HIV/AIDS support group in your Community?
31. If yes, are you satisfied by the services from these support structures? (
32. If no, why and what would you like to see happening?

____

Thank you for your cooperation. Do you have any questions/opinion?

____
____
____

Sign____**Date**______________________

Sign ______________________________________Date______________________________

Thank you - end

APPENDIX

C-4 BIODIVERSITY ASSESSMENT

Biodiversity Baseline & Impact Assessment for the proposed Nondvo Dam Project

Mhlambanyatsi, Eswatini

March 2021

CLIENT

Prepared by:

The Biodiversity Company

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Report Name	**Biodiversity Baseline Assessment for the proposed Nondvo Dam Project**
Client	**Eswatini**
Submitted to	wsp
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science.

DETAILS OF KEY SPECIALISTS

Specialist	Botany / Mammals
Contact Person	Martinus Erasmus
Contact Number	0824481667
Contact email	martinus@thebiodiversitycompany.com
Postal address	777 Peridor Street, Jukskei Park, 2153
Expertise of the Specialist	Martinus Erasmus obtained his B-Tech degree in Nature Conservation in 2016 at the Tshwane University of Technology. Martinus has over 5 years consulting experience, with working experience in southern Africa.
Specialist	Herpetofauna / Mammals
Contact Person	Michael Adams
Contact Number	0836807619
Contact email	mike@thebiodiversitycompany.com
Postal address	777 Peridor Street, Jukskei Park, 2153
Expertise of the Specialist	Michael Adams is Cert Sci Nat registered (118544) and is an experienced natural scientist with a specialisation in herpetofauna. He has over 10 years of experience working with reptiles and amphibians as a consultant and through various conservation initiatives.
Specialist	Avifauna
Contact Person	Tyron Clark / Phil Patton
Contact Number	0836229224
Contact email	tyon@thebiodiversitycompany.com
Postal address	777 Peridor Street, Jukskei Park, 2153
Expertise of the Specialist	Tyron has 9 years of experience conducting biodiversity and wetland assessments in a number of African countries afforded him good experience in wide variety of development types. He attained his MSC in Zoological science from the University of the Witwatersrand. His research interests centre on biogeography and ecological niche modelling.
Specialist	Aquatic Ecology
Contact Person	Russell Tate
Contact Number	0824549019
Contact email	russell@thebiodiversitycompany.com
Postal address	777 Peridor Street, Jukskei Park, 2153
Expertise of the Specialist	Russell is a published, registered Professional Scientist (Pr. Sci. Nat Aquatic Health: 400089/15) with an MSc in aquatic eco-toxicology. Russell has more than 5 years working experience as a consultant, including working expereince in southern Africa.
Specialist	Ecosystem Services
Contact Person	Ivan Baker
Contact Number	0798984056
Contact email	ivan@thebiodiversitycompany.com
Postal address	777 Peridor Street, Jukskei Park, 2153
Expertise of the Specialist	Ivan Baker is Cand. Sci Nat registered (119315) in environmental science and geological science. Ivan is a wetland and ecosystem service specialist, a hydropedologist and pedologist that has completed numerous specialist studies ranging from basic assessments to EIAs. Ivan has carried out various international studies following FC standards. Ivan completed training in Tools for Wetland Assessments with a certificate of competence and completed his MSc in environmental science and hydropedology at the North-West University of Potchefstroom.

ACRONYMS

ACRONYM	DESCRIPTION
AIP	Alien and/or Invasive plant
ASPT	Average Score Per Taxon
AZE	Alliance for Zero Extinction
CapClwO	Cape Clawless Otter
CH	Critical Habitat
CR	Critically Endangered
CHA	Critical Habitat Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPAITC	Commercial Plantations and Alien Invasive Tree Clumps
CPUE)	Catch per unit effort
DCA	Detrended Correspondence Analysis
DMU	Discrete Management Unit
EBA	Endemic Bird Areas
EMA	Environmental Management Act
EN	Endangered
ENBSAC	Eswatini National Biodiversity Strategy and Action Plan
ENTC	Eswatini National Trust Commission
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ES	Ecosystem Services
ESIA	Environmental and Social Impact Assessment
EWT	Endangered Wildlife Trust
FROC	Frequency of Occurrence
FPA	Flora Protection Act
GA	Game Act
GN	Guidance Note
GPS	Global Positioning System
HigGolM	Highveld Golden Mole
IBA	Important Bird and Biodiversity Areas
IFC	International Finance Corporation
IHIA	Intermediate Habitat Integrity Assessment
IUCN	International Union for Conservation of Nature
JMRBWRS	Joint Maputo River Basin Water Resources Study
LC	Least Concern
NE	Near-Endemic
NMDS	Non-metric Multidimensional Scaling

NPAES	National Protected Areas Expansion Strategy
NatRedDu	Natal Red Duiker
NatRedRc	Natal Red Rock Rabbit
NT	Near Threatened
NWA	Noxious Weeds Act
PCA	Plant Control Act
PS	Performance Standard
TAITC	Transformed Alien Invasive Tree Clumps
TBC	The Biodiversity Company
TCP	Transformed Commercial Plantations
ToR	Terms of Reference
SABAP	Southern African Bird Atlas Project
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SCI	Stream condition index
SASS5	South African Scoring System version 5
SQR	Sub Quaternary Reach
SemRocGr	Semi-natural Rocky Grasslands
STHFE	Southern Temperate Highveld Freshwater Ecoregion
UNEPWCMC	UN Environment Programme World Conservation Monitoring Centre
WatrMong	Water Mongoose
WBPA	Wild Bird Protection Act
WHO	World Health Organization
WSP	WSP Environmental (Pty) Ltd
ZLFE	Zambezian Lowveld Freshwater Ecoregion

NON-TECHNICAL SUMMARY

The Biodiversity Company (TBC) was commissioned for the undertaking of terrestrial and aquatic ecological surveys, and compilation of a biodiversity baseline and impact report in support of the environmental and social impact assessment report required for the proposed Nondvo Dam Project. This report presents the results of the wet season (or high flow) (4th to 10th March 2019) and dry season (or low flow) (21st to 24th / 27th to 30th May 2019) surveys.

The proposed Nondvo Dam is located between the towns of Mhlambanyatsi, Lobamba and Mbabane, in Eswatini. The proposed dam will be situated approximately 7.5km downstream of the foot of the existing Luphohlo Dam on the Lusushwana River, upstream of the Mantenga Falls (see Figure 10 in the main report).

Seven preliminary habitat types were delineated within the defined Discrete Management Unit (DMU). These habitats have been infringed upon and utilised by the local community and the associated livestock. Anthropogenic impacts have had the largest impact on habitats within the DMU.

The Rocky Grassland habitat was one of the largest and most sensitive areas within the DMU and was characterised by areas with a high density of rocks, boulders and more grassland areas in-between. One listed Endangered plant species was observed within this habitat, namely *Alepidea amatymbica*, thus resulting in the Rocky Grassland being identified under Tier 1 of the Critical Habitat Assessment (CHA) as per the International Finance Corporation (IFC6). Several other species of conservation concern and protected plant species were found within the Rocky Grassland. Faunal diversity was highest within this habitat due to the more natural state and distance from the anthropogenic environment. The Lanner Falcon (*Falco biarmicus*) and Southern Bald Ibis (*Geronticus calvus*) both being Vulnerable species, were observed during the assessments and will most likely nest within the cliffs in the Rocky Grassland habitat. The Rocky Grassland also provided the most suitable habitat for several reptile and amphibian species. This habitat is regarded the most sensitive within the DMU, rated with a high sensitivity.

Semi-natural Indigenous Tree Clumps are characterised by tall dense clumps of trees that occur in the drainage lines or areas with large quantities of water. The Riverine (or riparian) habitat includes flowing, open water habitats with exposed protruding bedrock and low riverine fringe vegetation, wetlands and small episodic streams. These habitats are important as a movement corridor for several faunal species, especially birds and mammals, a sensitive habitat for amphibian species and plays a vital role as a water resource, not only for the biodiversity but also the local human community. These two habitats are considered to be moderate to highly sensitive.

Transformed Commercial Plantations (TCP) and Transformed Alien Invasive Tree Clumps (TAITC) are areas infested with alien invasive trees with little natural vegetation. The transformed habitats are characterised by areas cleared of natural vegetation used for homesteads and subsistence farming and have several anthropogenic impacts. Both of these habitats are considered to have a low sensitivity; however the plantations are considered as a moderately sensitive habitat due to their role as refuge and forage areas for certain avifaunal species.

The results of two riverine ecology surveys indicated that the reach of the Lusushwana River, within the specified DMU, was classified as modified habitat. Based on the assessed water quality parameters, the water quality was derived to be natural, with low conductivity, neutral pH levels and fair clarity. Instream habitats were found to be modified as a result of the existing Luphohlo Dam, whereby flow and channel morphology had been impacted. The riparian habitat was determined to be modified as an effect of the Luphohlo dam, compounded by the presence of extensive stands of alien vegetation. Aquatic macroinvertebrate assemblages were found to be diverse but composed of largely tolerant invertebrate communities. A reflection of the high diversity of aquatic macroinvertebrates was corroborated through the direct observation of 42 Odonata taxa.

The fish community of the Lusushwana River reaches assessed during this study was found to be dominated by Cichlidae. Indicating the dominance of slow-flowing habitats across the project area and confirming impacted conditions established in the habitat assessments. The Mantenga Waterfall was found to be a migratory barrier to non-anguillid taxa and a limiting factor for the distribution of fish species in the watercourse. Flow and habitat transformation sensitive and listed taxa, including *Chiloglanis emarginatus,* were observed during the assessment indicating that the fish community will be sensitive to changes in flow.

The results of the impact assessment indicated significant impacts to the riverine habitats within the inundation zone. In addition, high rated impacts to downstream riverine ecology can be anticipated from the outset of the proposed project. Should several anticipated developments proceed with the Nondvo Dam project cumulative impacts anticipated include increased salinity of the Lusushwana River in proximity to Manzini as a result of reduced flows. In addition, should the development of impoundments in the Usuthu/Maputo Rivers proceed, it is likely that there will be an impact to floodplains within the lower reaches of the Usuthu watercourse. This will likely result in the further alteration of hydrology, sediment loads and local ecology in the Pongola River floodplains and Makatini Flats in proximity to the Ndumo Game Reserve in South Africa.

The results of the impact assessment for the terrestrial ecology indicated significant impacts to the inundation zone. This is mainly due to the destruction of habitat in order to construct infrastructure, especially around the proposed dam wall area. The inundation zone is also a contributing factor to the high sensitivity rating of the Rocky Grassland habitats and the associated fauna which overlaps with the proposed infrastructure. Significant impacts to the habitats outside of the inundation zone are high due to the construction of the proposed camps within the Rocky Grassland habitat. The flooding of the proposed inundation zone will not directly have an impact on any of the sensitive habitats, and the wetlands, river & riparian habitats will be replaced and expanded after being flooded. The indirect impact of the expected movement of the human community and the associated impacts into the surrounding habitat, especially the rocky grassland can be considered as highly detrimental to the biodiversity in the area. Thus, the mitigation and planning regarding the movement and resettlement of the community can be regarded as the most important factor to consider.

Despite the high rated risks anticipated impacts, mitigation actions, such as the implementation of the ecological flow releases, and potentially moving the proposed locations of the dam wall and camps, can reduce impacts to local riverine conditions as well as the terrestrial ecology. Overall, given the classification of the associated riverine habitat as modified habitat, no significant fatal flaws for the proposed project could be identified.

The results of the CHA indicated that the considered DMU did not exceed any thresholds for the classification, and therefore the riverine habitat within the DMU of this assessment would not constitute CH. However, given the locality of the Mantenga Nature Reserve immediately downstream of the project area, the proposed activities must adhere to the mitigation hierarchy and commit to avoid, mitigate and minimise the indirect impacts that can be anticipated.

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Tables

Figures

1. Introduction

The Biodiversity Company (TBC) was commissioned by WSP Environmental (Pty) Ltd (WSP) for the undertaking of terrestrial and aquatic ecological surveys, and compilation of a biodiversity baseline and impact assessment report in support of the environmental and social impact assessment (ESIA) report required for the proposed Nondvo Dam Project.

This report presents the results of the terrestrial and aquatic ecological baseline, critical habitat and impact assessment based on the results of the literature review, as well as the results of the wet season (or high flow) (4th to 10th March 2019) and dry season (or low flow) (21st to 24th / 27th to 30th May 2019) surveys.

1.1 Scope & Purpose of the Report

The project area is situated between Manzini and Mbabane in Eswatini. The specific scope of the proposed project includes the construction of a dam with a total surface area of 630 ha. The objective of the dam is to store water in order to provide potable water to the two cities of Mbabane and Manzini, which are currently suffering intermittent water shortages. In the meantime, the stored water could also be used for irrigation and for improving the output of run-of–the-river hydropower plants situated further downstream.

Several tasks were listed in the Terms of Reference (ToR) for this assessment, these include the following:

- Desktop description of the project area;
- Terrestrial and aquatic ecology baseline description of the project area;
- Determination of the potential impacts of the proposed project; and
- Formulation of mitigation measures.

2. Legal Framework

2.1 The National Regulatory Framework

The following legislation is applicable:

- Noxious Weeds Act (NWA)No 19 of 1929;
- Plant Control Act (PCA) No 8 of 1981: Restriction on the movement and trade of flora species;
- The Flora Protection Act (FPA), 2000 No 10: Protection of endemic flora with special mention to the protection of protected species;
- Wild Birds Protection Act (WBPA) 1914: Protection of wild birds from any commercial gain from them;
- Game Act (GA), 1991: Preservation of game species including mammals and birds; and
- Environmental Management Act (EMA), 2002: Include factors such as pollution control, waste management and guideline for environmental assessments.

2.2 Eswatini National Biodiversity Strategy and Action Plan (ENBSAP)

The principal objectives of the Eswatini National Biodiversity Strategy and Action Plan (ENBSAC) (2001) have been adopted from the Convention on Biological Diversity, these are:

1. To conserve the biodiversity of Eswatini;

2. To encourage the sustainable use of biodiversity in Eswatini; and
3. To ensure that benefits accrued from the utilisation of Eswatini's biodiversity are shared equitably.

2.3 Lender's Requirements

The International Finance Corporation (IFC) Environmental and Social PS (2012) will be considered for this project. The PS relevant to the project is:

- PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

2.4 International Legislation and Policy

The following are applicable:

- Convention on Biological Diversity (Rio de Janeiro, 1992);
- The United Nations Convention to Combat Desertification;
- United Nations Framework Convention on Climate Change;
- The Ramsar Convention (on wetlands of international importance);
- African Convention on the Conservation of Nature and Natural Resources;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is an international agreement between governments. It aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival; and
- The IUCN (World Conservation Union). The IUCN's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

3. Project Area

3.1 Project Locality

The proposed Nondvo Dam is located between the towns of Mhlambanyatsi, Lobamba and Mbabane, in Eswatini. The proposed dam will be situated at the foot of the existing Luphohlo Dam and will extend along the Lusushwana River. The Lusushwana River is a tributary of the Great Usutu River, above its confluence with the Phongolo River. The watercourse, potentially affected by the proposal, is located within the Pongola-Mtamvuma Water Management Area within the W56C quaternary catchment. The specific reach considered for this assessment was a 34 km reach as delineated by the W56C-1514 Sub Quaternary Reach (SQR).

The project area consists of some natural areas as well as plantations and agricultural areas. Furthermore, some rural developments are found with subsistence farming practices which include crop production and livestock grazing. The topography within the project area is predominantly steep slopes with deep narrow valleys. The location of the project area in relation to the local setting is presented in Figure 1.

Figure 2 presents a Google Earth time series for the project area, and immediately surrounding areas. It is evident from the series that the project area has been inhabited since 2003, with extensive agricultural activities undertaken. The density of the households and agricultural fields has gradually increased to date. This time series does indicate a level of disturbance to the general area, including the project area.

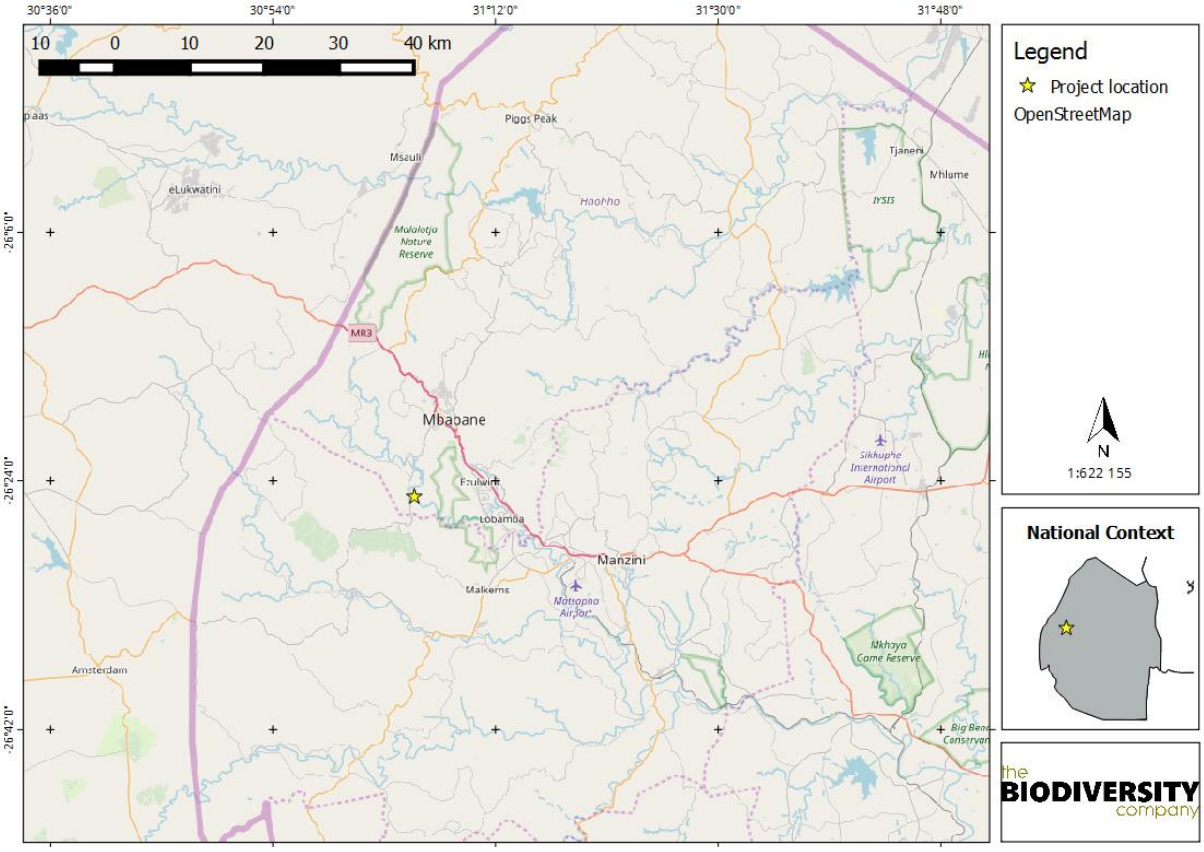


Figure 1: Locality map of the project area in relation to the local setting

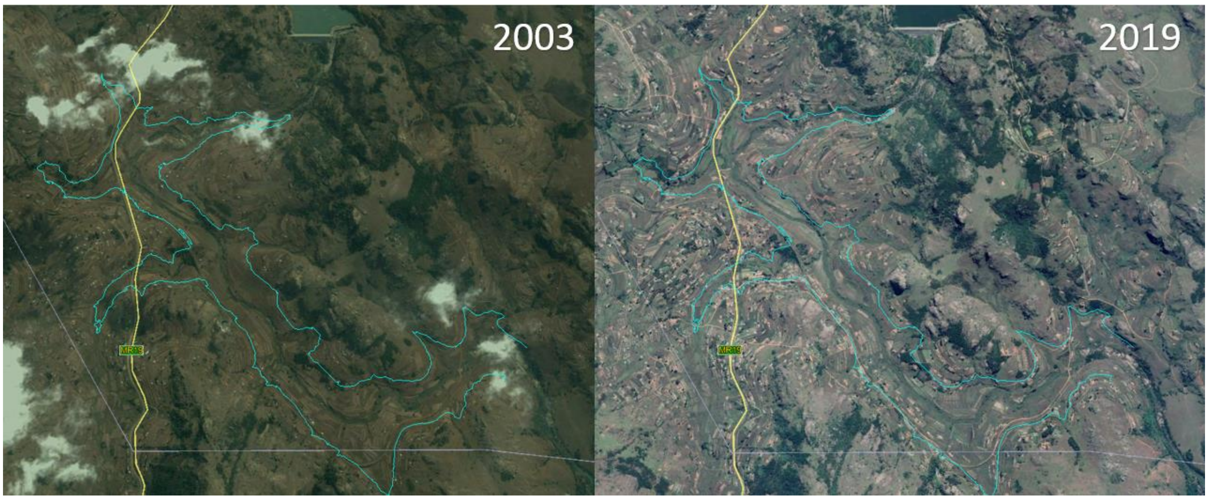


Figure 2: A Google Earth time series for the project area

3.2 Climate

Eswatini is characterised by two distinct seasons, namely summer and winter seasons. Hot temperatures and wet weather conditions characterize the summer season, with the period extending from October to March. The winter season extends from April to September and is characterized by cool temperatures to cold dry weather conditions.

The climate in the project area is temperate, with rainfall amounting to 1,000 / 2,000 mm per year. The average rainfall in the project area measures on average 1,350 mm per year, with a maximum in summer (from November to February) and a minimum in winter, when the rains are rare (Figure 3).

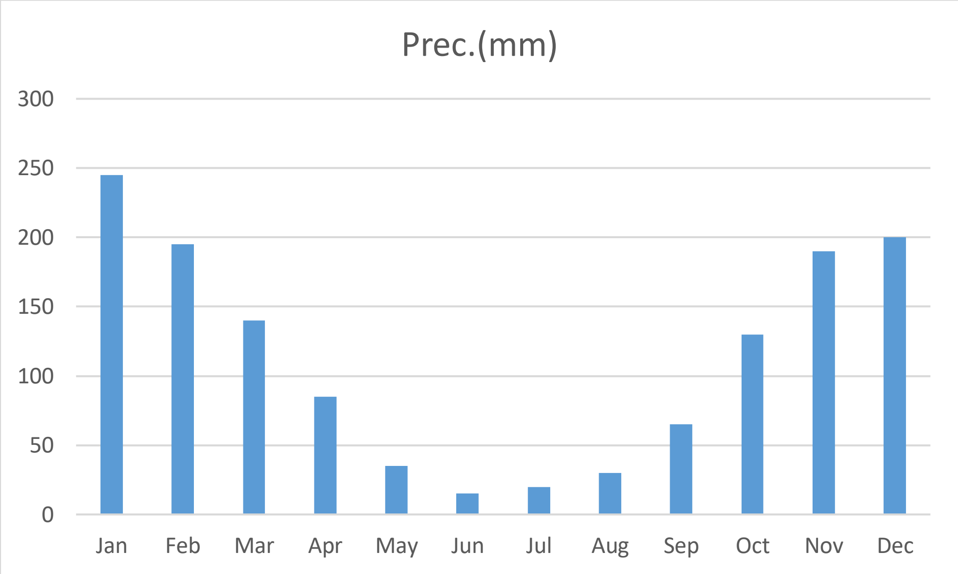


Figure 3: Shows the average monthly precipitation (Prec.) for the project area (source, www.climatestotravel.com)

3.3 Biodiversity & Conservation

A variety of datasets have been considered and reviewed in order to provide a suitable description of the project area, whilst also considering the surrounding areas. Table 1 presents an overview of datasets that were considered for this assessment, with some aspects not further presented due to limited relevance. A comment has been provided for each dataset to describe the data and the relevance in the context of the project.

Table 1: Datasets considered for the description of the project area and corresponding comments

Dataset	Comment
Global Critical Habitat Screening Layer (UNEP-WCMC (2017))	This screening layer presents the global spatial distribution of likely or potential Critical Habitat (CH), as defined by the IFC PS6 criteria. Based on this Likely CH is associated with the Mantenga Nature Reserve and the Mlilwane Wildlife Sanctuary, located within 2km east and 5km south-east respectively of the proposed inundation area.
Protected Areas (IUCN and UNEP-WCMC (2016))	This dataset displays areas that are legally protected according to various designations and managed to achieve conservation objectives. The World Database on Protected Areas does not indicate the presence of any protected areas within Eswatini. The nearest area is the Licuati Forest Reserve approximately 140km east of the project area, in Mozambique. The Mantenga Nature Reserve is located east of the proposed inundation area, within 2km of the project area. The Mlilwane Wildlife Sanctuary is located south-east and adjoining to the Mantenga Nature Reserve. The Mlilwane Wildlife Sanctuary is a conservation area, and not a formally protected area.
RAMSAR (IUCN and UNEP-WCMC (2016))	There are no RAMSAR sites or systems within the country.
Biosphere Reserve (IUCN and UNEP-WCMC (2016))	The Lubombo Biosphere Reserve lies in the Lubombo Mountain Range, which forms the eastern border of Eswatini with Mozambique and South Africa. It is part of the Maputoland-Phondoland-Albany Biodiversity Hotspot.
Biodiversity Hotspots	A biodiversity hotspot is a biogeographic region that is both a significant reservoir of biodiversity and is threatened with destruction. The nearest hotspot is the Maputaland-Pondoland-Albany hotspot approximately 20km from the project area. This hotspot stretches along the east coast of southern Africa below the Great Escarpment and is an important centre of plant endemism.

Dataset	Comment
Alliance for Zero Extinction (AZE) sites (2010)	This dataset displays critical sites for conservation that contain endangered species with limited ranges and populations found nowhere else on the planet. There are no AZE sites located in the country.
Important Bird and Biodiversity Areas (IBA, 2015).	IBAs are a subset of Key Biodiversity Areas (KBAs). These sites are needed to ensure the survival of viable populations of most of the world's bird species. The nearest IBA is Songimvelo Nature Reserve approximately 50km north of the project area.
Endemic Bird Areas (EBA) (Stattersfield *et al.,* 1998)	This dataset displays areas where the geographic range of two or more endemic bird species overlaps. The nearest EBA is located on the border of South Africa (in South Africa) approximately 30km west of the project area.
Biodiversity intactness (UNEP-WCMC and Natural History Museum)	This dataset displays the impacts of forest change on local biodiversity intactness. The intactness of the area is predominantly low.
Biodiversity significance (IUCN, BirdLife International, and UNEP-WCMC (2016))	This dataset displays the relative importance of each pixel in terms of its aggregate contribution to the distribution of forest-dependent species of mammals, birds, amphibians, and conifers. The significance of the project area is classified as low.

3.4 Ecological Descriptions

3.4.1 Tree Cover

To define the status of the land use and identify areas of vegetation (natural and also plantations) or disturbance, tree cover is considered. According to Hansen *et al*. (2013) "tree cover" is defined as all vegetation taller than 5 meters (m) in height. "Tree cover" is the biophysical presence of trees and which can take the form of natural forests or plantations existing over a range of canopy densities. Figure 4 depicts the low tree cover in the project area, especially when compared with the more dense cover associated with the forestry plantations south of the project area.

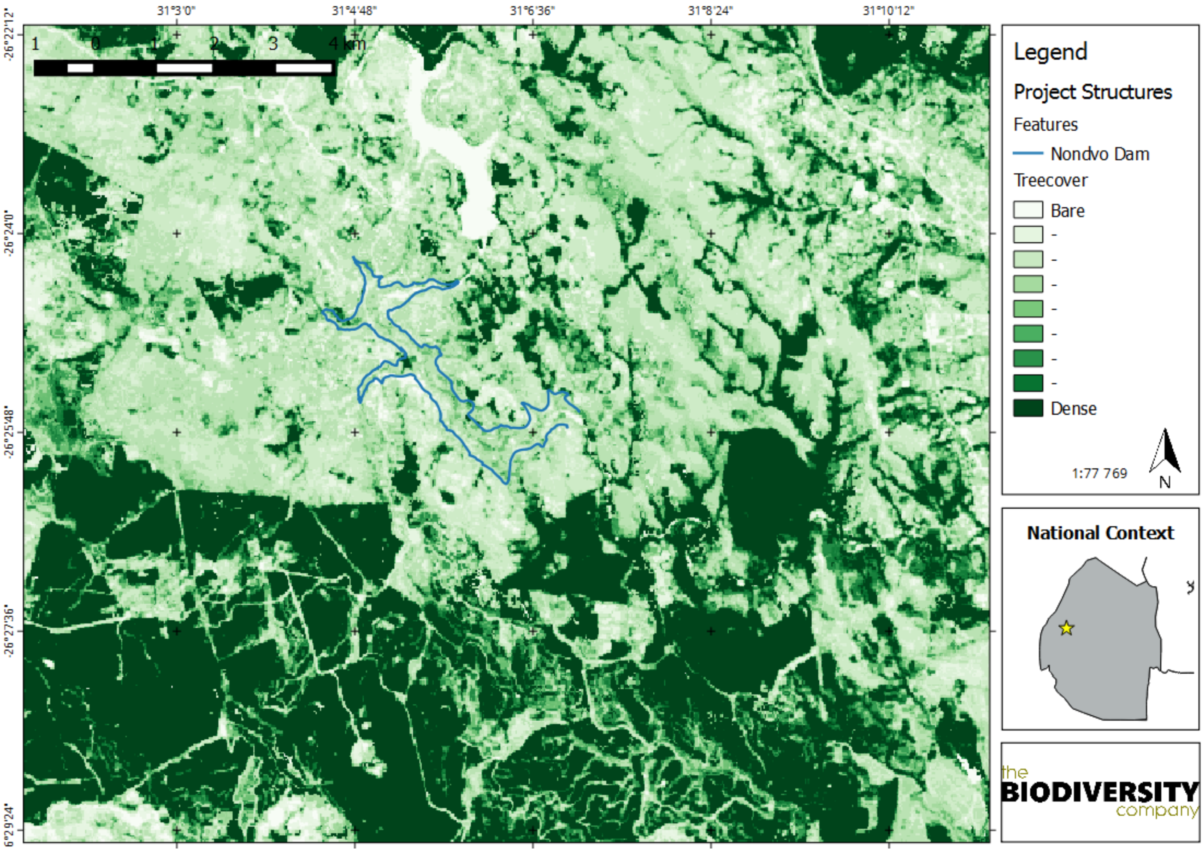


Figure 4: The tree cover for the region (Hansen et al. 2013)

3.4.2 Land Cover

To define land-use in the project area, the ESA (2017) land cover dataset (version 2.07) was considered as a global land cover spatial representation for the project area. The dataset provides a total of 22 global land cover classes, which have been summarised for the requirements of this assessment. The land cover classes include agriculture, forest, grassland, wetland, settlement, shrubland, sparse vegetation, bare area, water and permanent ice (and snow). The land cover associated with the project area is presented in Figure 5. The dominant land cover classes associated with the project area include cropland and shrubland. The notable "bare area" north of the inundation area is the Luphohlo Dam.

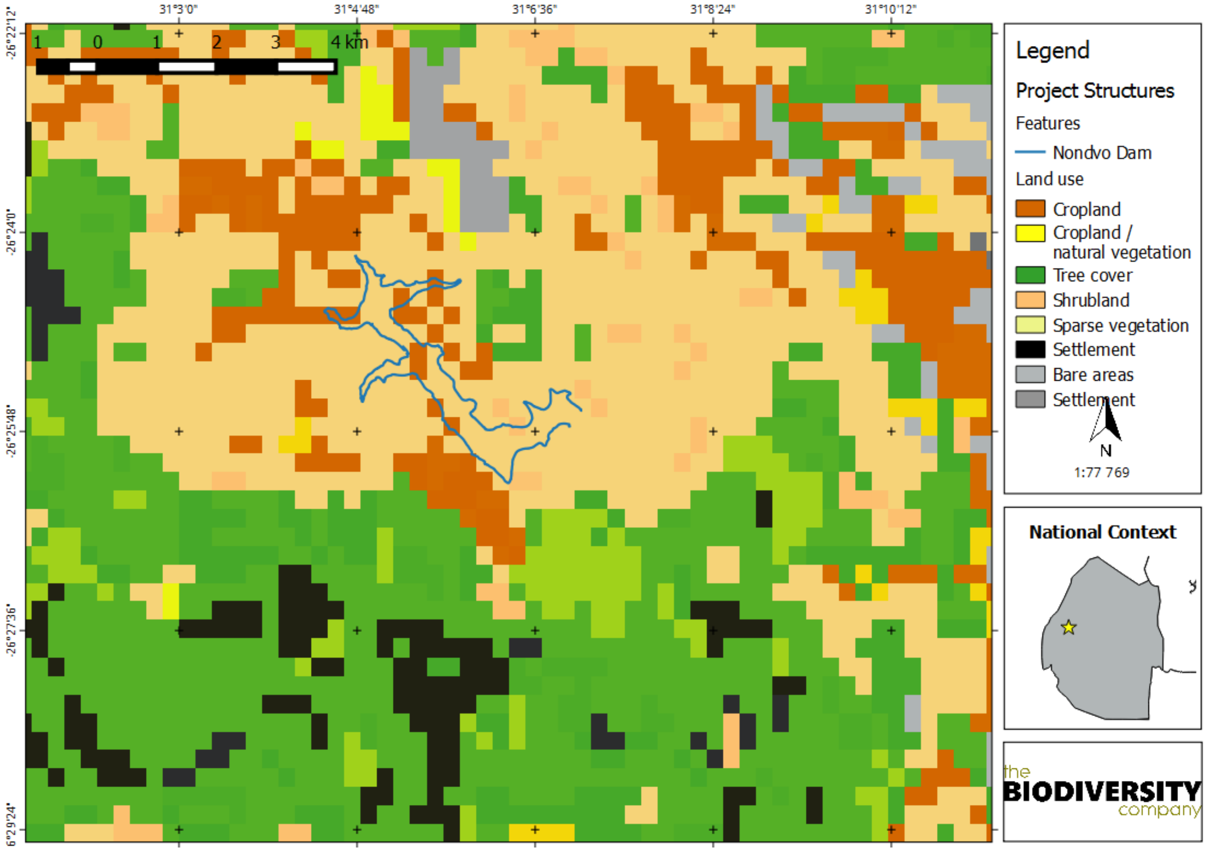


Figure 5: Land cover classes (broad level) associated with the project area (ESA, 2017)

3.4.3 Threatened Fauna of Eswatini

According to the Eswatini National Trust Commission (ENTC), on an international level, as at August 2017, the IUCN Red List of Threatened Species lists 819 species of fauna. The breakdown of numbers of listed fauna for Eswatini is given in Table 2.

Table 2: Listed fauna species for Eswatini

Invertebrates	
Molluscs	
Least Concern	13 species
Arthropods	
Data Deficient	2 species
Least Concern	79 species
Vertebrates	
Fishes	
Endangered	2 species
Near Threatened	4 species
Vulnerable	1 species

Data Deficient	4 species
Least Concern	39 species
Amphibians	
Least Concern	44 species
Reptiles	
Near Threatened	*Afroedura major* (Swazi Flat Gecko)
	Chamaesaura aenea (Coppery Grass Lizard)
	Chamaesaura macrolepis (Large-scaled Grass Lizard)
	Homoroselaps dorsalis (Striped Harlequin Snake)
	Leptotyphlops telloi (Tello's Thread Snake)
Lower Risk	*Crocodylus niloticus* (Nile Crocodile)
	Kinixys natalensis (KwaZulu-Natal Hinged-back Tortoise)
Least Concern	45 species
Birds	
Critically Endangered	*Necrosyrtes monachus* (Hooded Vulture)
	Gyps africanus (White-backed Vulture)
Endangered	*Aquila nipalensis* (Steppe Eagle)
	Gyps coprotheres (Cape Vulture)
	Torgos tracheliotos (Lappet-faced Vulture)
Near Threatened	*Ardeotis kori* (Kori Bustard)
	Calidris ferruginea (Curlew Sandpiper)
	Neotis denhami (Denham's Bustard)
	Stephanoaetus coronatus (Crowned Eagle)
	Sylvia nigricapillus (Bush Blackcap)
	Terathopius ecaudatus (Bateleur)
Vulnerable	*Polemaetus bellicosus* (Martial Eagle)
	Bugeranus carunculatus (Wattled Crane)
	Sagittarius serpentarius (Secretarybird)
	Bucorvus leadbeateri (Southern Ground-hornbill)
	Geronticus calvus (Southern Bald Ibis)
	Hirundo atrocaerulea (Blue Swallow)
Least Concern	444 species
Mammals	
Critically Endangered	*Diceros bicornis* (Black Rhinoceros)
Endangered	*Lycaon pictus* (African Wild Dog)
Near Threatened	*Aonyx capensis* (African Clawless Otter)
	Ceratotherium simum (White Rhinoceros)
	Eidolon helvum (African Straw-coloured Fruit-bat)
	Equus quagga (Plains Zebra)
Vulnerable	*Loxodonta africana* (African Elephant)
	Panthera leo (Lion)
	Acinonyx jubatus (Cheetah)
	Panthera pardus (Leopard)
	Hippopotamus amphibius (Hippopotamus)
	Smutsia temminckii (Temminck's Ground Pangolin)
Least Concern	104 species

3.4.4 Protected Areas

Figure 6 shows the location of protected areas in relation to the project area. Formally protected areas refer to areas protected by national legislation.

Based on the SANBI (2005) Protected Areas Map and the National Protected Areas Expansion Strategy (NPAES) the project area does not overlap with any formally or informally protected area (Figure 6) but does occur in very close (<1 km) proximity to the Mlilwane Wildlife Sanctuary. This protected area is further divided into Mantenga Nature Reserve[1] in the northern section and Mlilwane Wildlife Sanctuary in the southern section.

The Mantenga Nature Reserve, proclaimed in 1994, is a protected area of 725ha in a secluded corner of the Ezulwini Valley, just 2 km from a major road. It contains not only the Mantenga Waterfalls, but also the cultural village, Ligugu Lemaswati ("pride of the Swazi people"). This nature reserve is home to vervet monkeys, baboons, warthogs, nyalas and duikers as well as the Endangered Bald Ibis.

The Mlilwane Wildlife Sanctuary is Eswatini's pioneer conservation area. Mlilwane was proclaimed in 1961. The name 'Mlilwane' ('Little Fire' in siSwati) was derived from the numerous fires started by lightning strikes on the Mlilwane Hill but now holds significance as the little fire that ignited the conservation movement in Eswatini. Mlilwane's diverse habitats support an extensive species list (including Suni antelopes and the Blue Crane) on its 4560ha property.

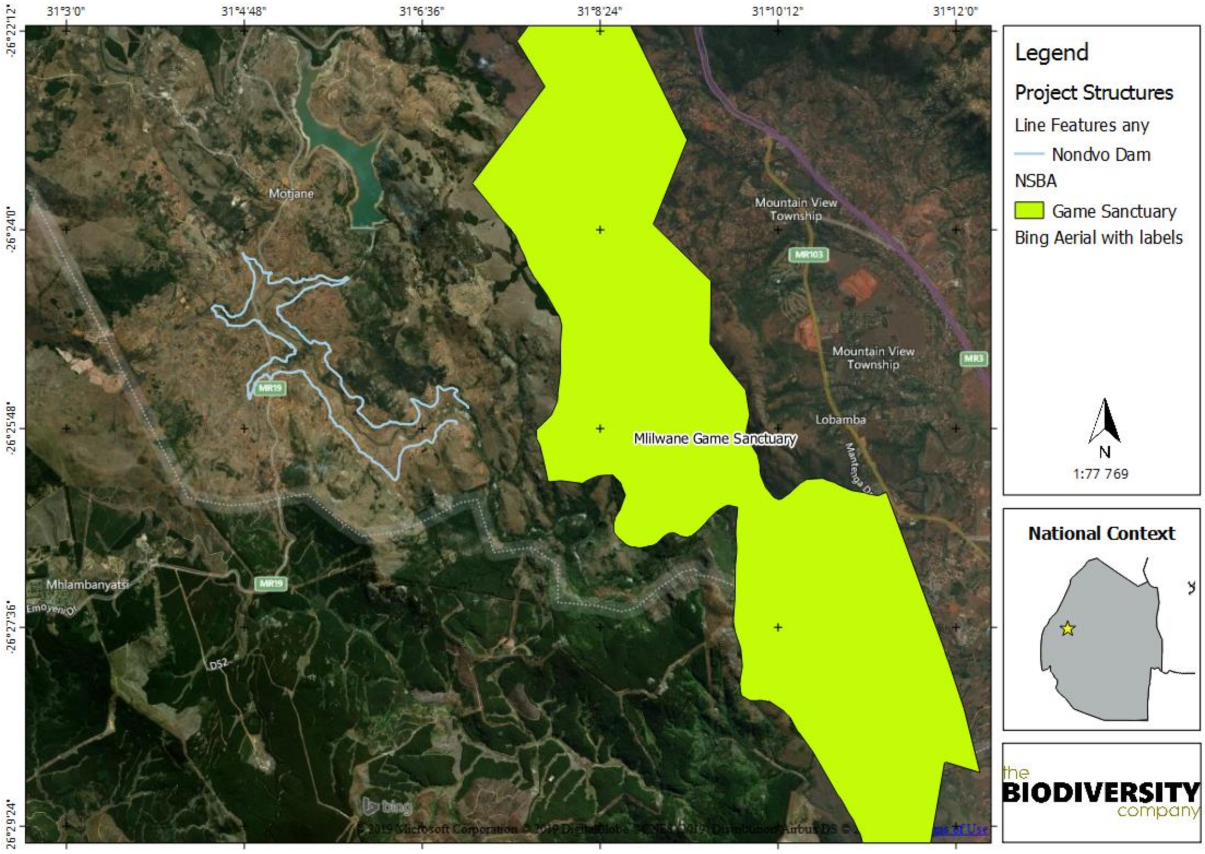


Figure 6: Formally protected areas adjacent to the project area (source, http://www.thekingdomofeswatini.com/central-eswatini/mantenga-reserve-village-falls/)

[1] Updated shapefiles and delineations were not available. For mapping purposes, the SANBI (2005) dataset was considered.

3.4.5 Hydrological Setting

The proposed Nondvo Dam is located between the towns of Mhlambanyatsi, Lobamba and Mbabane, in Eswatini (Figure 1). The proposed dam wall structure will be situated approximately 7.5 km downstream of the foot of the existing Luphohlo Dam (Figure 7) wall structure (Figure 8) on the Lusushwana River (Figure 9), 8 km upstream of the Mantenga Falls (Figure 10).

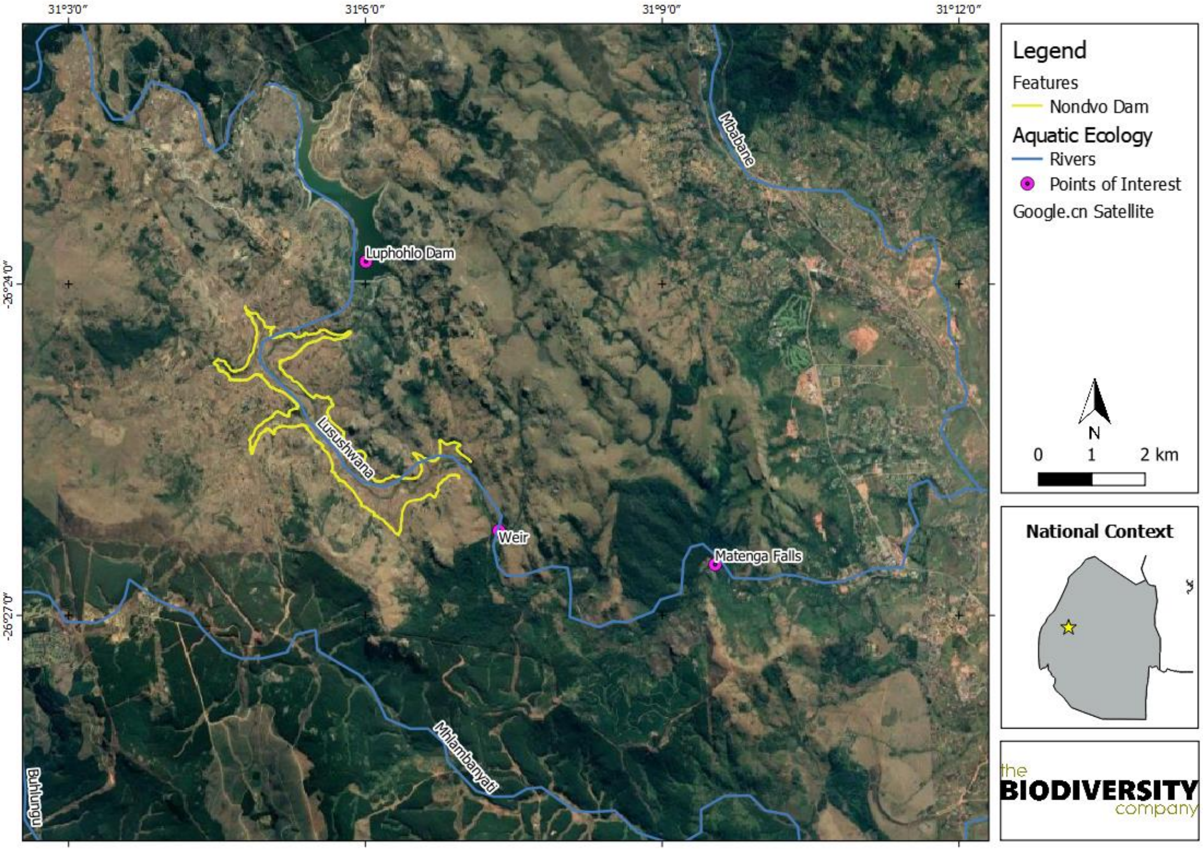


Figure 7: Locality of the proposed project

Figure 8: The Luphohlo Dam on the Lusushwana River upstream of the proposed impoundment (March 2019)

Figure 9: The Lusushwana River downstream of the proposed impoundment (March 2019)

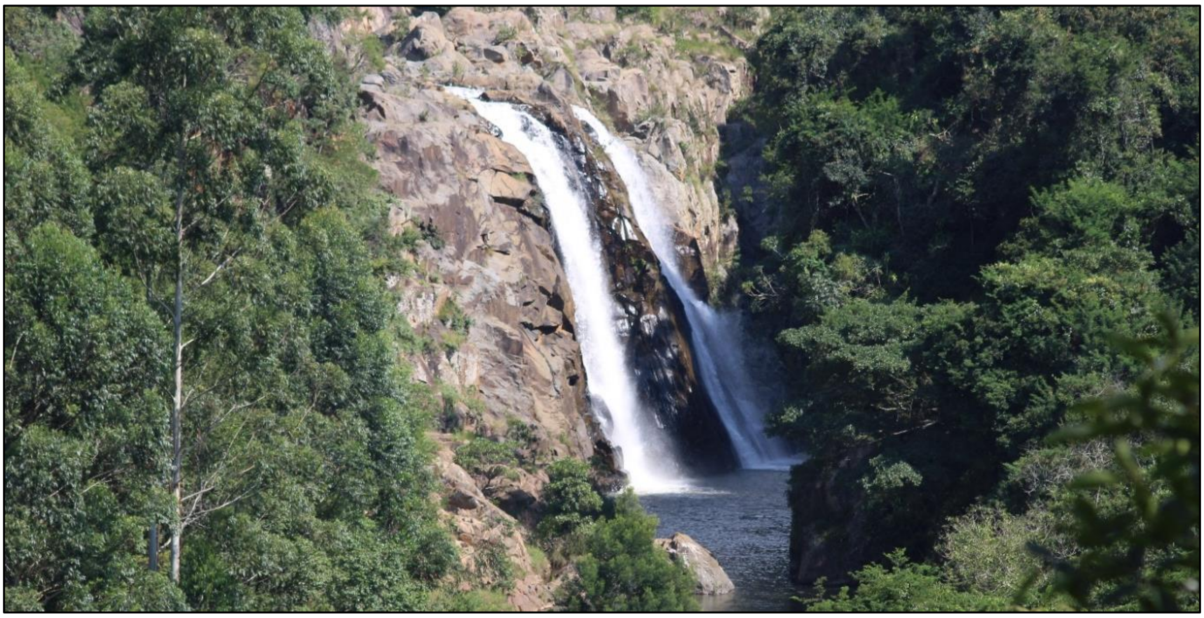


Figure 10: The Mantenga Falls on the Lusushwana River downstream of the proposed impoundment (March 2019)

The watercourse considered in this assessment is located in the Southern Temperate Highveld Freshwater Ecoregion (STHFE). This ecoregion spans the interior of South Africa, with the western boundary formed by the Magaliesberg, Pilansberg and Waterberg ranges, the northern boundary the Soutpansberg, and the eastern boundary formed by the Drakensburg mountain range.

The topography of the freshwater ecoregion is dominated by rolling hills with grassy plateaus and extensive source zone wetlands. The climate of the region is temperate with rainfall that varies from 1400 mm in the east to 400 mm in the west. High-intensity rainfall events are known to frequent the area, with the highest frequency of hailstorms in Southern Africa. The flood regime of the watercourses in this freshwater ecoregion is largely unimodal, with floods occurring in the months between October and March on an annual basis (Figure 11).

Figure 11: Unimodal flooding regime observations in the Lusushwana River (S8 March 2019 left, May 2019 right)

3.5 Geomorphological Setting

The Lusushwana River rises 25 km upstream of the current project area, within proximity to the South Africa-Eswatini border (i.e. approximately 5 km south of the Oshoek border post). The Lusushwana River in its upper reaches was a characteristic upland watercourse, with steep gradients, moderate widths (±3 m) and cobbled substrates (Rountree *et al*., 2000; Figure 12). Downstream of the Luphohlo Dam, flows and gradients in the watercourse become gentle and present lowland river gradients as represented by a class E geo-class (Rountree *et al*., 2000). As a resultant effect of the Luphohlo Dam, which has reduced flood peaks and overall discharge, over and above the geomorphological effects of the reduced gradient, the instream channel of the Lusushwana River forms deep slow-flowing pools that are densely vegetated, as presented in Figure 13.

Figure 12: The Lusushwana River upstream of the Luphohlo Dam illustrating typical upland river geomorphic features (O2; May 2019)

Figure 13: The Lusushwana River downstream of the Luphohlo Dam illustrating typical lowland river geomorphic features (S4; March 2019). Note this area will be within the inundation zone of the proposed Nondbo Dam.

Within the lower reaches of the proposed inundation zone, and in proximity of the proposed dam wall, the gradients of the Lusushwana River increase to a class C geoclass representing a rejuvenated lower foothill zonation (Rountree *et al*., 2000). The effect of the increased gradient has created bedrock cascades with intermittent pools and shallow runs (Figure 14). In addition, large instream boulders and bedrock complexes create diverse habitats of cascades, pools and rapids. The zone of rejuvenation continues until downstream of the Mantenga Falls, whereafter lowland geomorphic watercourses were observed (Figure 15). Downstream of the Mantenga Falls, and following the confluence with the Mbabane River, the Lusushwana River has typical lowland characteristics as indicated by the increased width and sandy substrates of the watercourse (Figure 16).

Figure 14: The Lusushwana River downstream of the Luphohlo Dam illustrating typical rejuvenated bedrock cascade geomorphic features (S6; March 2019)

Figure 15: The Lusushwana River downstream of the Luphohlo Dam illustrating typical rejuvenated reaches with bedrock boulders and pools dominating the river profile geomorphic features (S9; May 2019)

Figure 16: The lower Lusushwana River in the W56C-1600 (March 2019)

4. Assumption & Limitations

This report is based on the following assumptions and limitations:

- It is assumed that all third-party information obtained (e.g. spatial data) and discussed is correct at the time of writing this report;
- No instream flow requirements were considered for this assessment;
- No hydrological assessment was completed as part of this assessment;
- No ecological reserve determination was completed for this assessment;
- No species flow characteristics were investigated;
- The aquatic assessment was based on the results of bi-annual surveys, temporal trends are likely to fluctuate in the long term;
- Aquatic macroinvertebrates were identified to family level only;
- The delineation of the riparian area was largely based on the definition of the macro-channel contours. The entire river reach was not directly surveyed. It is noted that there is an

approximate error rating of 5 m in the available contour data and therefore the accuracy of the assessment is limited to a degree, this was however not considered to be significant, but must be noted;

- Ecosystem services provided by the project area play an important role in the socio-economic climate of the area. The socio-economic impacts and assumptions outlined within this document are however limited to the authors' current understanding of the ecology and biodiversity of the project area and are limited to the information available at the time of writing this report;
- Crop fields, areas covered in alien vegetation and built-up areas provide difficulties in detecting exterior signs of wetness, i.e. vegetation and soil patterns. This phenomenon could cause inaccuracies regarding the identification and delineation of wetland areas;
- An ecological flow assessment was not conducted for this project. A high-level discussion document has been provided as an appendix to this report;
- The re-alignment of the railway and also the construction of a road across the bridge were provided post-submission of the report and have not been included in the impact assessment; and
- The loss of crop fields has been determined on a qualitative and quantitative basis, of which the latter includes the hectares of crop fields expected to be lost rather than the financial value thereof. The financial considerations are assumed to be a component of the social assessment.

5. Baseline Environment Description

5.1 Discrete Management Unit

In order to manage risks associated with the project, the IFC's PS6 is crucial for the identification of Critical Habitat (CH), which in turn requires the definition of one or more Discrete Management Units. DMUs are areas with a definable boundary within which the character of biological communities and/or management issues have more in common with each other than they do with those in adjacent areas. DMUs can be defined by both ecological (such as a particular forest block) and administrative considerations (for example the limits of a protected area).

The DMU concept is intended to ensure that CH assessment is conducted at an ecologically relevant scale, which is often much larger than the project's direct footprint. It should be noted that the term "Management Unit" in the phrase DMU refers to "global management unit for the biodiversity feature in question" and does not imply that the project has any management responsibility at the scale of the DMU.

For each species qualifying for consideration under PS6 Criteria 1-3, the relevant DMUs are first identified. It is likely that DMUs will be similar for many species, but if appropriate, different DMUs can be defined for each candidate species. The selection of DMUs to include CH assessment should be informed by an understanding of the scale of a project's potential impacts (so as not to waste effort studying areas outside the project's influence) but the DMUs should be defined solely by ecological or administrative criteria.

The whole of a DMU containing CH-qualifying biodiversity features is considered to be CH for those features, even if the qualifying features are found only in a portion of the DMU. However, the assessment of impacts and mitigation actions that will determine if a project can align with PS6 will focus only on the portions of the DMU where the Critical Habitat-qualifying features can be found. A description and justification for the delineation of the terrestrial and aquatic DMUs are provided in the subsequent sections.

5.1.1 Terrestrial Ecology DMU

For the project area, when considering the proposed inundation zone, biological communities within a local extent were determined via satellite images, in correlation with the landscape data[2], as well as the amount of vegetation types and their extent according to Mucina & Rutherford (2006). The expected species (fauna and flora) data and the habitats associated with these specific species were also used in order to determine the DMU, thus considering all of the biodiversity features of concern and the ecological processes which drive them.

The existence of a protected area, according to the SANBI (2005) Protected Areas Map and the National Protected Areas Expansion Strategy (NPAES) in close proximity to the project was also considered. The Mlilwane Wildlife Sanctuary occurs within 2 km of the proposed inundation zone, thus a 2 km DMU ensured that the protected area was incorporated into the assessment.

The local communities residing in the inundation zone were considered in the impacts. Two communities are expected to be affected by the flooding of the inundation zone, it was assumed they will also be relocated to areas within the 2km DMU.

The terrestrial (DMU) defined for the project is shown in Figure 17, based on a 2km radius from the proposed inundation zone.

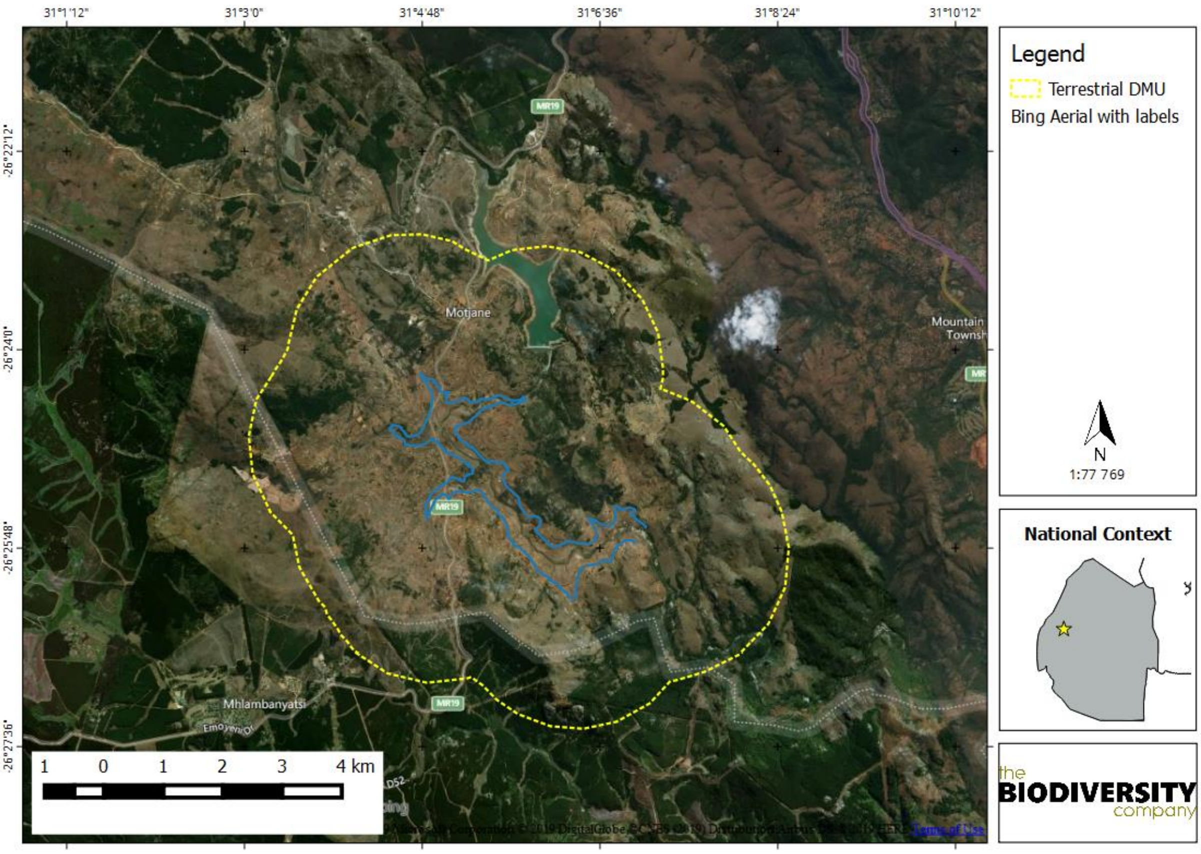


Figure 17: Extent of the Terrestrial DMU defined for this assessment

[2] Eswatini Sentinel2 Land Use Land Cover 2016 was considered for the delineation and classification of land cover types for the project area,

5.1.2 Aquatic Ecology DMU

The selection of a riverine DMU is a critical component of the risk assessment process and considered to be crucial for this project. The DMU selection criteria utilised in this assessment were selected based on the following factors:

- Geomorphological characters;
- Migration Barriers; and
- Anticipated impacts.

The geomorphological characters of the considered watercourse were briefly illustrated in the section above (Geomorphological Setting). The geomorphological characteristers of the directly affected reach of the watercourse differed from the upstream and downstream reaches. The directly affected area consisted of a channelled floodplain lowland watercourse in the upper reaches (i.e. above the proposed dam wall) and a rejuvenated reach downstream of the proposed dam wall to the Mantenga Falls. Further downstream of the Mantenga Falls, the watercourse has lowland characteristics as detailed in the habitat assessment. Considering the variation of the geomorphological features, this criterion did not present a suitable means to delineate the management unit. As such, the migration barrier and anticipated impacts criteria were thus utilised for the DMU selection.

The instream migration barriers presented by the Luphohlo Dam upstream of the inundation zone, and the Mantenga Falls, downstream of the proposed dam wall, presented adequate features for the selection of the management unit. The upstream point selected for the DMU is thus the Luphohlo Dam.

The third criteria utilised for the delineation of the DMU was the anticipated impacts of the proposed impoundment, whereby it is likely impacts can be expected downstream of the impoundment until a confluence with a suitably sized watercourse occurs. Thus, the downstream limit of the DMU was the confluence between the Lusushwana River (W56C-1514), with the W56C-1478 SQR of the Mbabane River where the river increases significantly in width and forms the W56C-1600 SQR of the Lusushwana River.

The aquatic DMU defined for the project is shown in Figure 18.

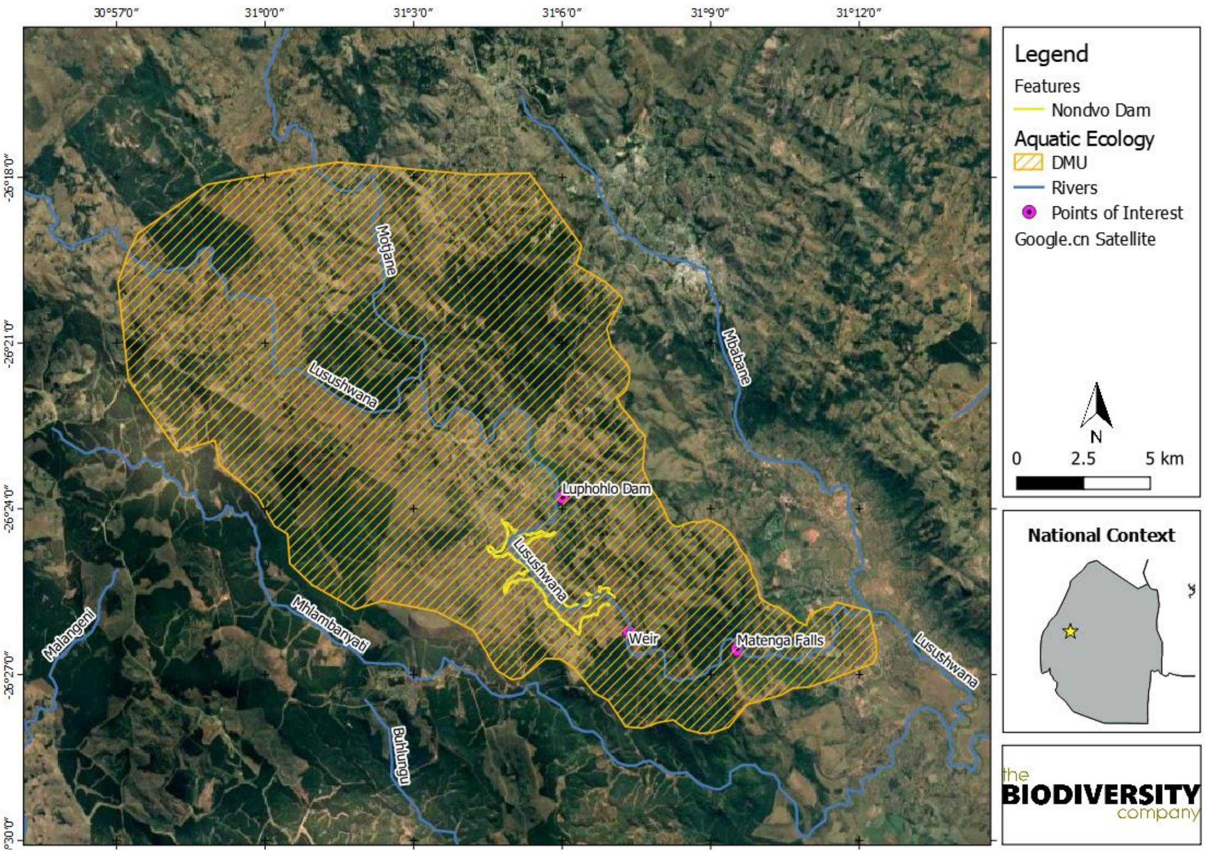


Figure 18: Extent of the Aquatic Discrete Management Unit defined for this assessment

5.2 Site Coverage

The dual season project area coverage by the specialists and sample locations, as evaluated from some of their GPS tracks, are presented below. Figure 19 presents some of the specialist tracks and sampling means and locations for the terrestrial ecology component. Figure 20 presents the locations of the sampling and observation sites considered for the aquatic ecology component.

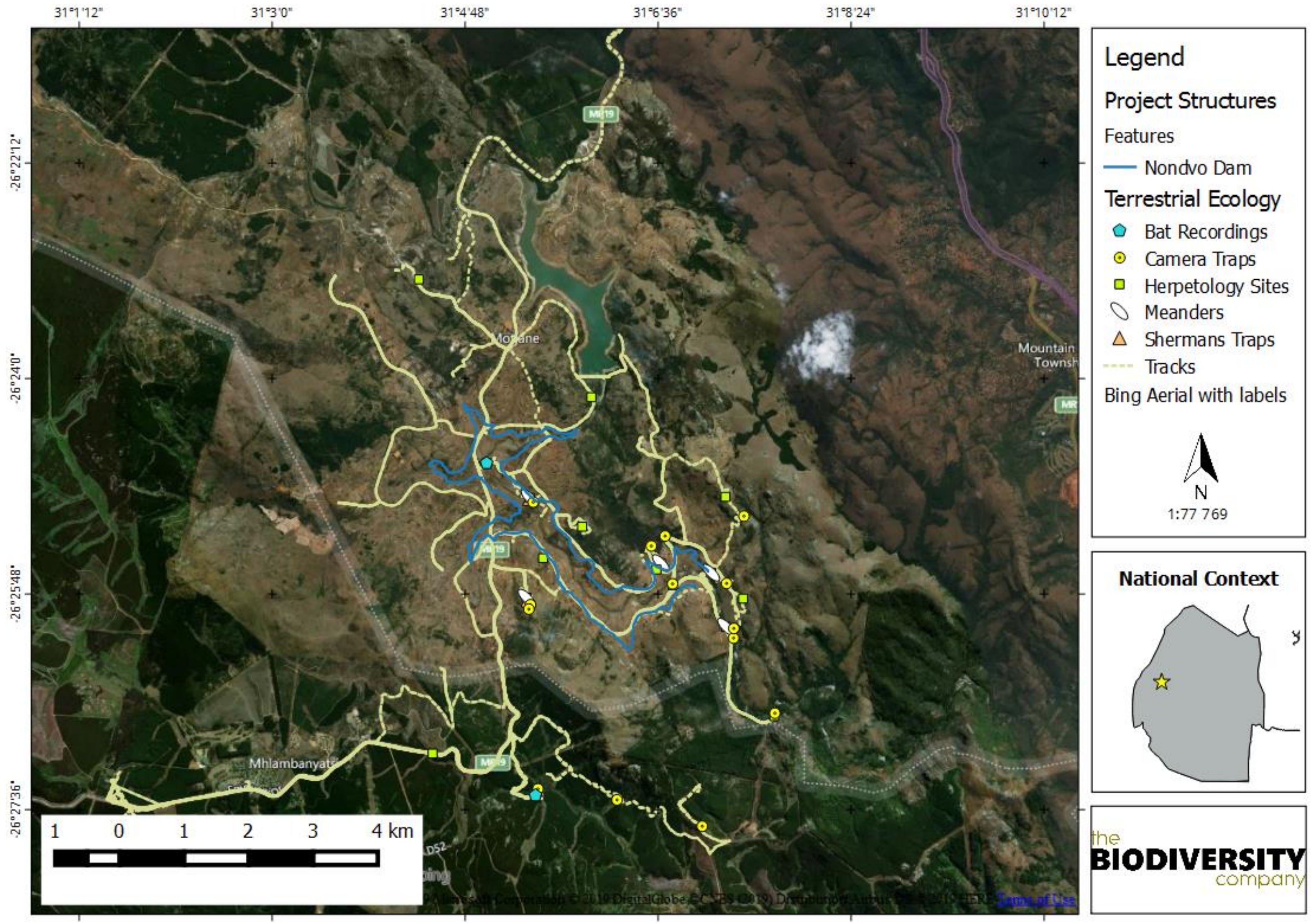


Figure 19: The specialist site coverage for the terrestrial ecology assessment

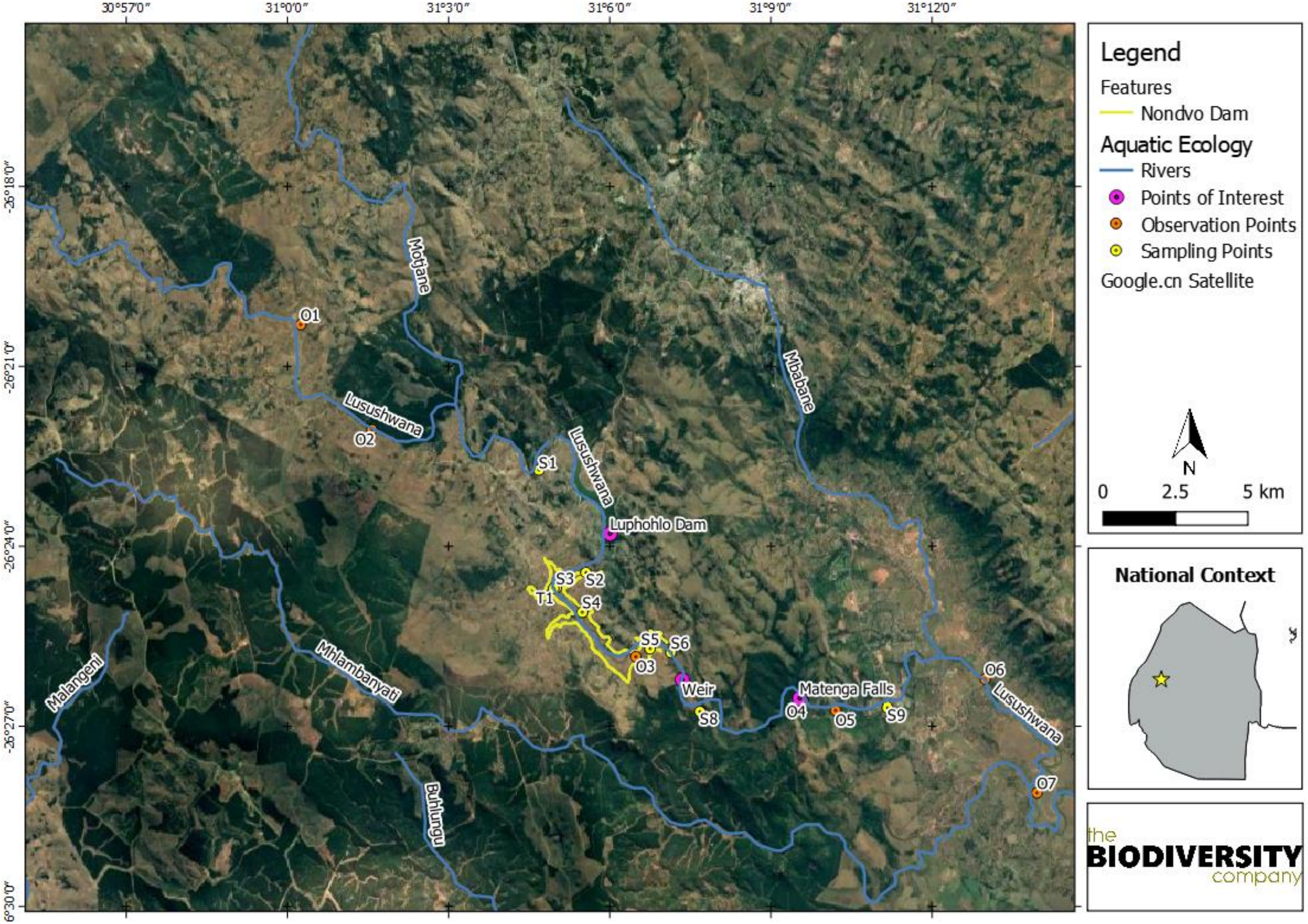


Figure 20: The specialist site coverage for the aquatic ecology assessment

5.3 Habitats and Floristic Analysis

5.3.1 Habitat Types

Seven preliminary habitat types were delineated for the project footprint area and the associated DMU. The approximate area that each habitat covers within the respective area is presented in Table 3. The extent of the habitats are shown in Figure 21, with the corresponding sensitivities presented in Figure 22. Representative photos of each habitat type are shown in Figure 23 to Figure 26, and are briefly discussed below.

As evident fromTable 3 the Transformed: Homesteads and Subsistence Farming dominate (77,95%) the extent of the project footprint area. Whereas the extent of the DMU is collectively dominated by the Rocky Grassland (37,67%) and Homestead and Subsistence Farming (37,35%). The Transformed: Commercial Plantations and Alien Invasive Tree Clumps (CPAITC) comprises approximately a third (21,81%) of the extent of the DMU.

Table 3: Preliminary habitat types and their areas within the project area

Habitat	DMU		Footprint Area	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Semi-Natural: Rocky Grassland	2016,62	37,67	1.82	0,62
Semi-Natural: Indigenous Tree Clumps	5,26	0,09	0,0	0,0
Transformed: Commercial Plantations	576,60	10,56	0,0	0,0
Transformed: Alien Invasive Tree Clumps	601,79	11,25	2,23	0,75
Transformed: Homesteads and Subsistence Farming	2054,04	37,35	229,95	77,95
Riverine (Wetlands, River & Riparian Habitat)	76,3	1,33	61,0	20,68
Luphohlo dam	100,39	1,75	-	-
Total	5341,0	**100**	**295**	**100**

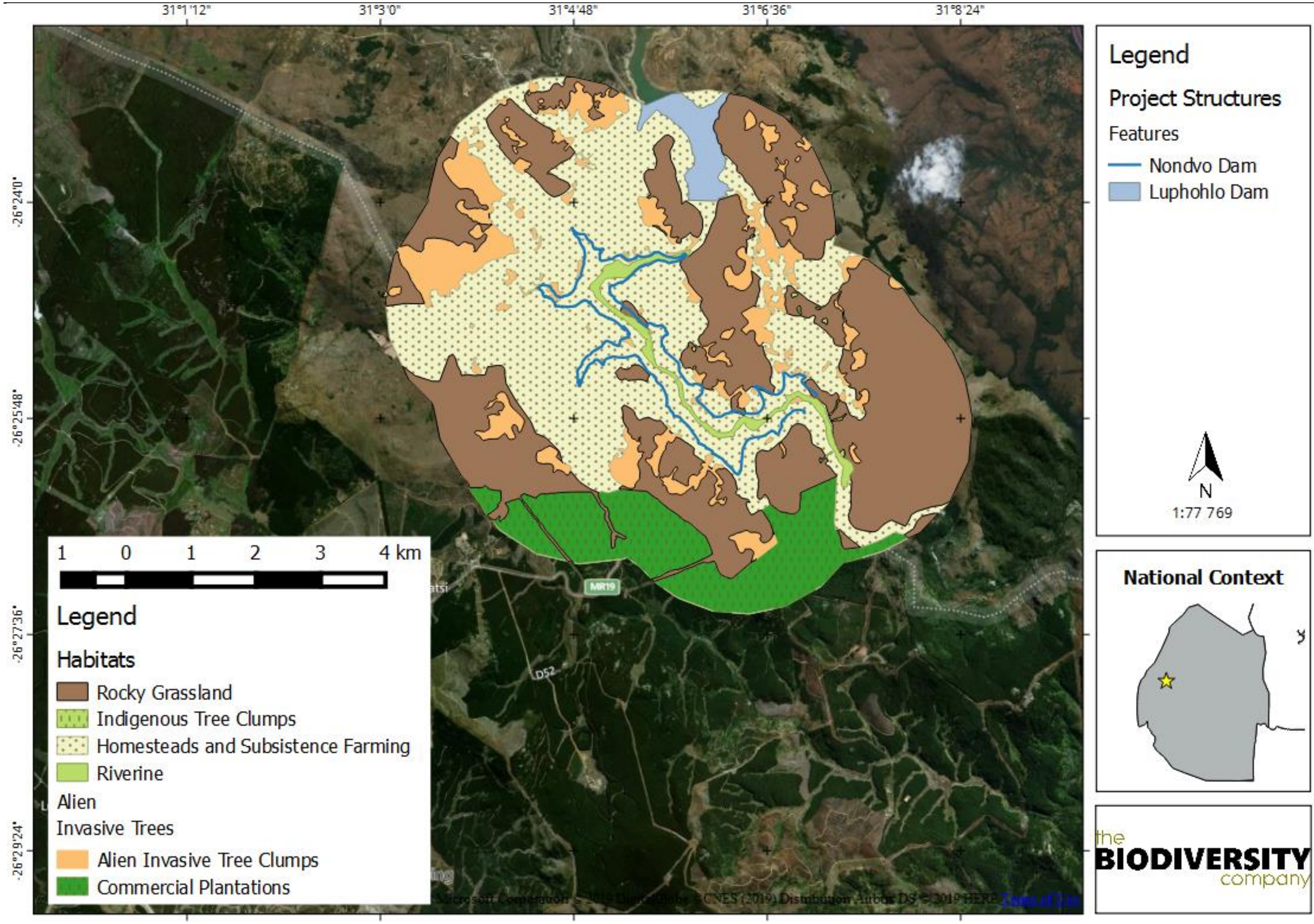


Figure 21: Habitats delineated for the project area

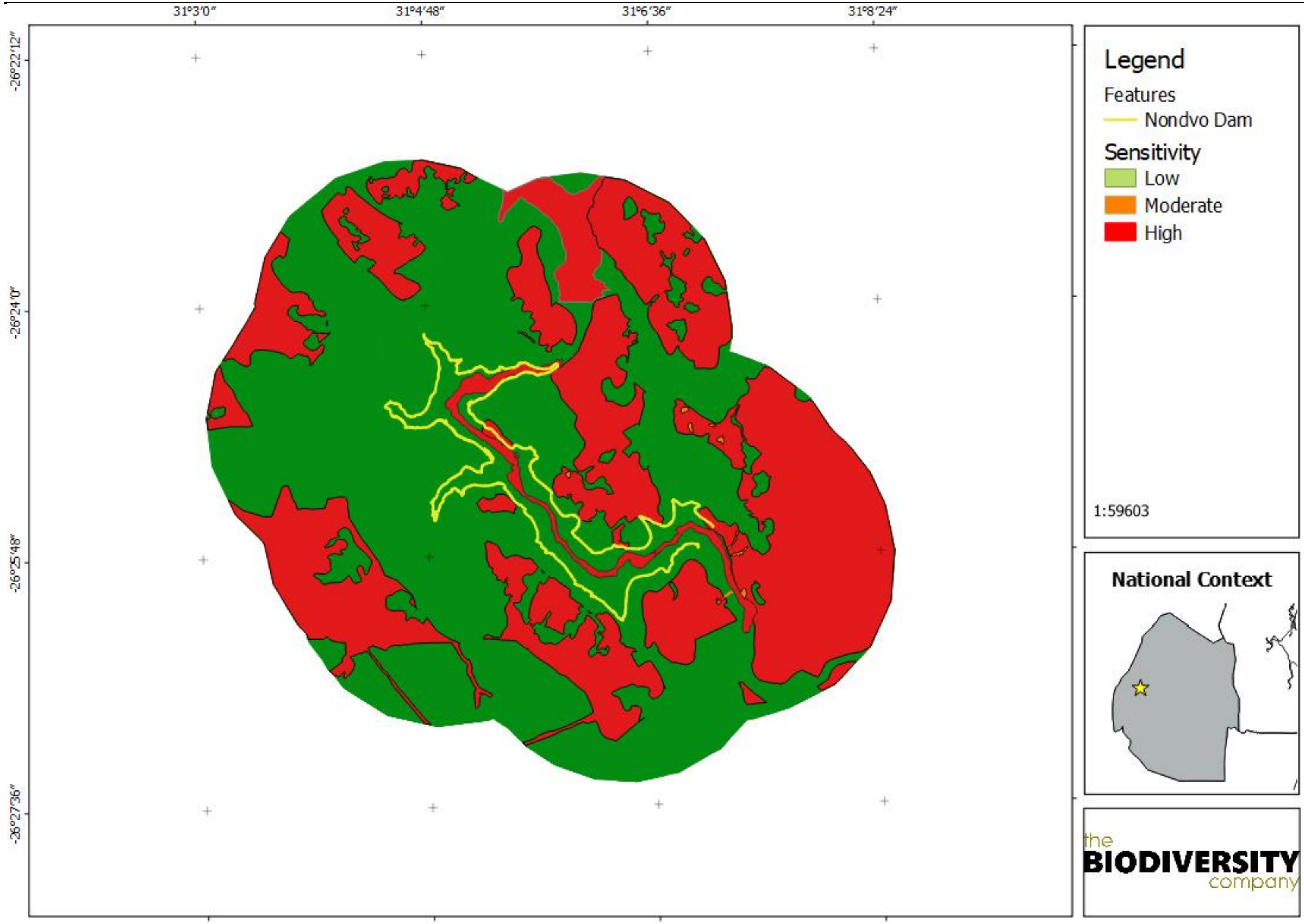


Figure 22: Habitats sensitivity for the project area

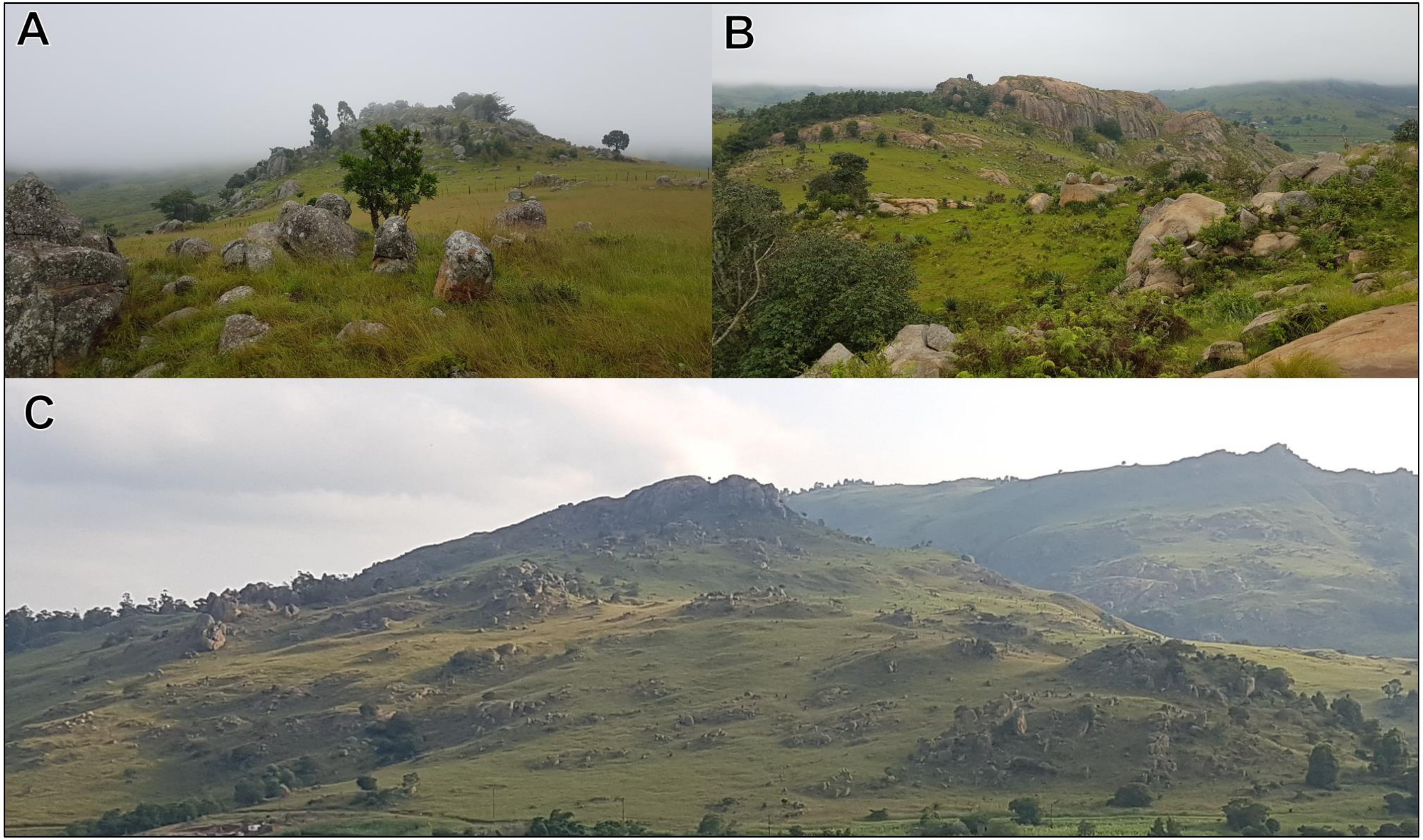


Figure 23: Representative photos for the preliminary habitats delineated during survey; A, B & C) Semi-Natural: Rocky Grassland

Figure 24: Representative photos for the preliminary habitats delineated during survey; D) Semi-Natural: Indigenous Tree Clumps; E) Transformed: Plantations/Alien Tree clumps

Figure 25: Representative photos for the preliminary habitats delineated during survey; F, G & H) Transformed: Homesteads and Subsistence Farming

Figure 26: Representative photos for the preliminary habitats delineated during survey; I, J & K) Wetlands, River & Riparian Habitat

5.3.1.1 Semi-Natural: Rocky Grassland

The Semi Natural Rocky Grassland habitat was the most expansive habitat within the DMU. The habitat consisted of areas with a high density of rocks and boulders and grassland areas in between. The habitat has been infringed upon by the local community and the associated livestock, which has had the largest impact on this habitat. Portions of the habitat that were more treacherous and had a high density of boulders and rocks were noted to be less impacted by infringement (i.e. in a more natural, pristine condition). This habitat type has undergone impacts associated with human activity such as the removal of trees and herbaceous material, which is most likely used by the local community for firewood and/or medicine.

Typical tree species associated with these outcrops were limited due to the amount of rocks and a lack of deep soils but included *Protea caffra, Psychotria capensis, Dalbergia armata.* Most of the Aloe species, including the listed *Aloe ecklonis,* occurred in large densities within this habitat. Herbaceous and graminoid plants occurred in-between many of the rocks but occurred in higher densities within the grassland areas.

The Rocky Grassland forms part of a unique habitat within the region that plays a role within the faunal species makeup within the area by providing refugia, food and a more natural environment in comparison to the vast plantations that surround the area.

One IUCN Red-listed Data plant species was recorded within this habitat, *Alepidea amatymbica*, which is listed as EN. According to the Eswatini Red Data plant list (Eswatini National Trust Commission, 2017c), one Red Data plant species, *Aloe ecklonis* (VU), was recorded within this habitat in small colonies. Additionally, several of the protected plant species according to the Flora Protection Act 2002 were identified within this habitat.

This habitat unit can be regarded as highly important, not only within the local landscape, but also regionally. The habitat sensitivity is considered high-critical, due to the plant species recorded and the role of this habitat to biodiversity.

5.3.1.2 Semi-Natural: Indigenous Tree Clumps

This habitat within the project area is characterised by tall dense clumps of trees that occur in the drainage lines, or areas with large quantities of water available, where the tree roots could establish. The vegetation is mainly comprised of several tree species including *Syzygium gerrardii, Faurea rochetiana, Dombeya rotundifolia, Cussonia sphaerocephala*, *Erythrina latissima, Diospyros lycioides, Diospyros whyteana* as well as *Pterocarpus angolensis.*

No IUCN Red-listed or Eswatini Red Data Plants species were recorded within this habitat. *Berchemia zeyheri, Dombeya rotundifolia, Pterocarpus angolensis* and *Cyathea dregei* are plants listed in the Flora Protection Act of 2002 that were recorded within this unit.

Due to the fact that this habitat is connected to, and functions with the Rocky Grassland, it can be regarded as moderate-highly important within the landscape. The sensitivity of this habitat is therefore moderate-high.

5.3.1.3 Transformed: Commercial Plantations and Alien Invasive Tree Clumps

Collectively, the transformed habitat, associated with commercial plantations and invasive tree clumps, is the third most expansive habitat within the DMU. This habitat is characterised by areas severely dominated by alien invasive tree species, especially *Pinus pinaster* and *Acacia mearnsii* but also *Eucalyptus* sp. These areas have little to no natural vegetation that can survive and compete with the alien species.

No IUCN or Eswatini Red Data Plants species were recorded within this habitat unit. This habitat is assigned a low sensitivity.

5.3.1.4 Transformed: Homesteads and Subsistence Farming

The Homesteads and Subsistence Farming habitat is one of the largest habitats within the DMU. This habitat is characterised by areas cleared of natural vegetation mainly for subsistence agriculture, as well as roads, housing and business infrastructure. Vegetation structure ranges from low sparse herbland to tall closed shrubland consisting of non-native crops and weeds. These crops (mainly maize and sorghum) are used for essential sources of food and income for the local community and drives the large-scale disturbance of the natural environment. Most of the alien and/or invasive plant species occurred within this habitat due to the continued impact and the fact that many species are species that are used for agriculture. Small patches of natural vegetation do exist within the habitat, but due to the adjacent anthropogenic activities are either fragmented or severely degraded due to edge effects. A large portion of the alien invasive plant species occurring in this habitat type were planted for aesthetic reasons.

No IUCN or Eswatini Red Data Plants species were recorded within this habitat unit. This habitat is assigned a low sensitivity.

5.3.1.5 Riverine (Wetlands, River & Riparian Habitat)

Riverine habitats are found within the lower-lying areas of the project area and include flowing open water habitats with exposed protruding bedrock and low riverine fringe vegetation, wetlands and small episodic streams.

The vegetation is characterised by some tall trees that still exist in small patches to more open areas with water constituent herbs and grasses in several areas. Plant species associated with this habitat unit include *Breonadia salicina, Combretum erythrophyllum, Syzygium cordatum, Miscanthus junceus, Buddleja salviifolia* as well as *Leersia hexandra. Typha capensis* and *Phragmites mauritianus* were plant species being more hydrophytic. *Crinum bulbispermum* occurred inconspicuously in areas that haven't been degraded too much. Some alien and/or invasive plant species, such as *Sesbania punicea, Ricinus communis* and *Senna didymobotrya* occurred along and within the habitat due to the dispersal of seeds via water, however the infringement of these species was less severe than in other normal conditions.

Due to the role that this habitat plays as a water source for the local community, this area has been infringed upon, and utilized extensively. Washing of clothes, sand mining and bathing occurs on a daily basis leaving the habitat in a constant state of disturbance. This habitat, even though degraded, is still important as a movement corridor for several faunal species, especially birds and mammals, and plays a vital role as a water resource not only for the biodiversity but also the local community.

No IUCN Red-listed or Eswatini Red Data Plants species were recorded within this habitat. *Breonadia salicina*, *Pterocarpus angolensis, Schizostylis coccinea, Crinum bulbispermum* and *Cyathea dregei* are plants listed in the Flora Protection Act of 2002 that were recorded within this unit.

Due to the role that this habitat plays it can be regarded as moderate-highly important within the local landscape. The sensitivity of this habitat is therefore moderate-high.

5.3.2 Floristic Analysis

5.3.2.1 Overview

A total of 201 plant species, across 67 families, were recorded during the survey. Table 4 indicates the number of species recorded per growth form. Whereas Table 5 presents details pertaining to the trees, shrubs and herb recorded for the assessment.

Of the species recorded the dominant growth forms within the project area consist of herbs (26.87%) and Graminoid (15.92%) followed by shrubs (16,67%) (Figure 27). The Poaceae family represented 15,92 % of the recorded plant species, followed by Asteraceae (11,94 %), Fabaceae (7,46 %), Rubiaceae (4,98 %), with a large majority of the rest being 0.50% (refer to Table 4 and Figure 28 for further detail).

The timed meander method is a highly efficient method for conducting floristic analysis specifically in detecting plant SCC and maximising floristic coverage. Meanders were focused onthe Rocky Grassland habitats as these appeared to have the highest potential to contain SCC (desktop habitat assessment and the judgment of the ecologists). In addition to the targeted timed meander searches, random meanders were conducted across the project area and spot observations of plant species not recorded during the targeted timed meanders were recorded *ad hoc* (for more details on the methods and materials refer to Appendix A).

The list of plant species recorded to date is therefore by no means comprehensive, and repeated surveys during phenological periods not covered, may likely yield up to 40% additional flora species for the project area (a full list of species expected can be seen in Appendix B). However, floristic analysis conducted to date is however regarded as a sound representation of the local flora for the project area.

<u>NOTE: Many areas within the project area were trampled and grazed at the time of fieldwork, which complicated representative sampling within this habitat. Although not accurately portrayed throughout the species effort curves, the habitat type represents a fairly high number of species and species diversity for the project area.</u>

Table 4: Dominant growth forms of the recorded plant species within the project area

Growth form	# of Species	%
Carnivore	1	0,50
Climber	5	2,49
Creeper	1	0,50
Dwarf Shrub	6	2,99
Geophyte	9	4,48
Graminoid	32	15,92
Herb	54	26,87
Hydrophyte	2	1,00
Hyperhydate	1	0,50
Lithophyte	4	1,99
Shrub	30	14,93
Succulent	21	10,45
Suffrutex	2	1,00
Tree	33	16,42
Grand Total	201	100

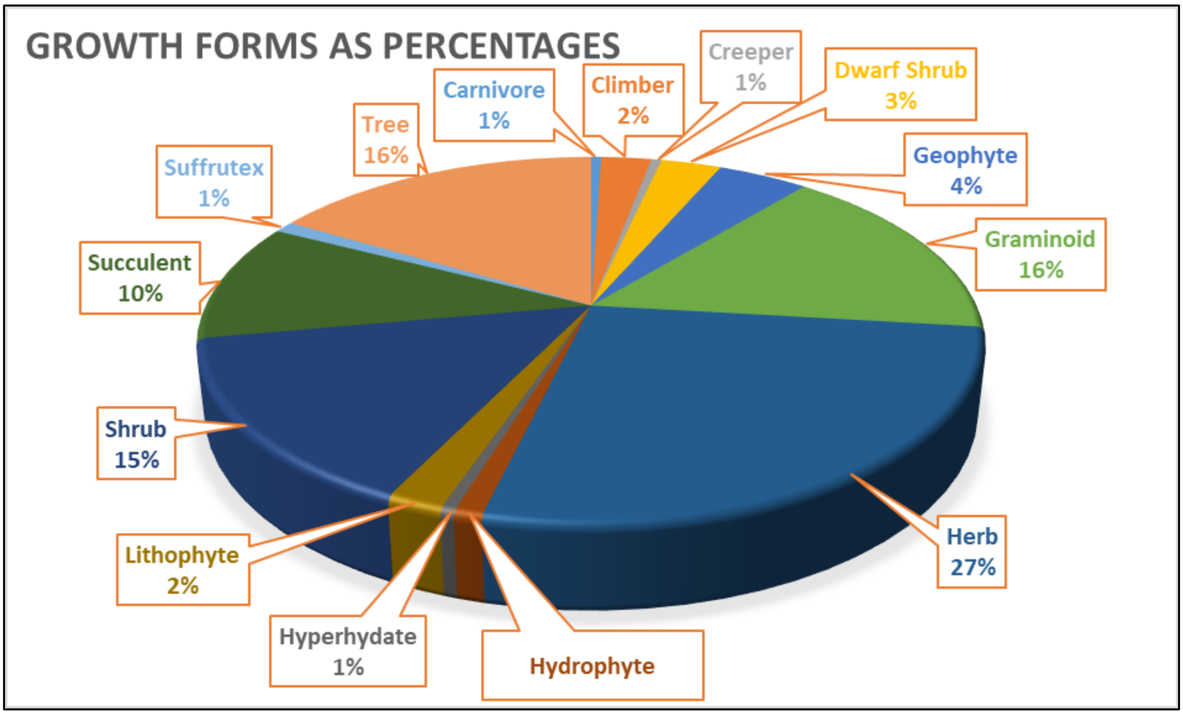


Figure 27: Percentage growth forms of the recorded flora species

Table 5: Trees, shrubs, and herbs recorded at the proposed project area.

Family	Taxon	IUCN/Red list	Eswatini Red List	Flora Protection Act 2002	Uses	Medicine	Food	Alien
Acanthaceae	*Crabbea hirsuta Harv.*	LC						
	Thunbergia dregeana Nees	LC			Traditional medicine	X		
Agapanthaceae	*Agapanthus inapertus P.Beauv. subsp. inapertus*	LC			Ornamental			
Agavaceae	*Agave americana L. subsp. americana var. americana*	LC			Ornamental, Hedge			X
	Agave sisalana Perrine	LC			Ornamental, Hedge			X
Amaranthaceae	*Achyranthes aspera L. var. aspera*	LC			Traditional Medicine	X		X
	Amaranthus hybridus L. subsp. hybridus var. hybridus	LC						X
Amaryllidaceae	*Brunsvigia grandiflora Lindl.*	LC						
	Crinum bulbispermum (Burm.f.) Milne-Redh. & Schweick.	LC		Schedule B: Protected-VU	Traditional medicine, Ornamental	X		
	Hymenocallis littoralis (Jacq.) Salisb.	LC						
	Boophone disticha (L.f.) Herb.	LC		Schedule A: Protected-EN	Medicinal	X		
	Haemanthus humilis Jacq. subsp. hirsutus (Baker) Snijman	LC						
Apiaceae	*Alepidea amatymbica Eckl. & Zeyh.*	**EN**		Schedule B: Protected-VU	Traditional Medicine	X		
Apocynaceae	*Carissa bispinosa (L.) Desf. ex Brenan*	LC			Traditional Medicine	X		
Araceae	*Monstera deliciosa Liebm.*	NE						X
	Zantedeschia albomaculata (Hook.) Baill.	LC			Ornamental			
Araliaceae	*Cussonia sphaerocephala Strey*	LC			Traditional medicine	X		
Asphodelaceae	*Aloe ecklonis Salm-Dyck*	LC	**VU B1B2cD2**		Traditional medicine; Inflorescence eaten	X	X	
	Aloe arborescens Mill.	LC			Ornamental			
	Aloe cooperi Baker	LC			Ornamental			
	Aloe marlothii A.Berger	LC			Ornamental			
	Kniphofia linearifolia Baker	LC		Schedule B: Protected-VU				
Asteraceae	*Bidens pilosa L.*	NE			Traditional medicine	X		X
	Ageratum houstonianum Mill.	LC						X
	Berkheya echinacea (Harv.) O.Hoffm. ex Burtt Davy	LC						
	Brachylaena discolor DC.	LC						
	Campuloclinium macrocephalum (Less.) DC.	NE			Ornamental			X
	Conyza bonariensis (L.) Cronquist var. microcephala (Cabrera) Cabrera	NE						
	Crepis hypochaeridea (DC.) Thell.	NE						X

Family	Taxon	IUCN/Red list	Eswatini Red List	Flora Protection Act 2002	Uses	Medicine	Food	Alien
	Dicoma anomala Sond. subsp. anomala	LC						
	Cirsium vulgare (Savi) Ten.	NE						X
	Euryops laxus (Harv.) Burtt Davy	LC						
	Felicia muricata (Thunb.) Nees subsp. muricata	LC						
	Geigeria burkei Harv. subsp. diffusa (Harv.) Merxm.	LC						
	Cosmos bipinnatus Cav.	NE			Traditional Medicine	X		X
	Helichrysum argyrolepis MacOwan	LC						
	Helichrysum cerastioides DC.	LC						
	Helichrysum cooperi Harv.	LC			Love Charm			
	Kleinia galpinii Hook.f.	LC						
	Lopholaena disticha (N.E.Br.) S. Moore	LC						
	Xanthium spinosum L.	LC						X
	Helichrysum cephaloideum DC.	LC						
	Hypochaeris radicata L.	LC						X
	Schistostephium crataegifolium (DC.) Fenzl ex Harv.	LC						
	Sonchus wilmsii R.E.Fr.	LC						
	Tagetes minuta L.	NE			Traditional medicine, Insect Repellent	X		X
Balsaminaceae	*Impatiens hochstetteri Warb. subsp. hochstetteri*	LC						
Bignoniaceae	*Jacaranda mimosifolia D. Don*	NE			Ornamental			X
	Tecoma capensis (Thunb.) Lindl.	LC			Traditional medicine, Ornamental	X		
	Tecoma stans (L.) Juss. ex Kunth var. stans	NE						X
Cactaceae	*Cereus jamacaru DC.*	NE			Hedge, Ornamental			X
	Opuntia ficus-indica (L.) Mill.	NE			Hedge		X	X
Campanulaceae	*Wahlenbergia krebsii Cham. subsp. krebsii*	LC						
Cannaceae	*Canna indica L.*	NE			Ornamental			X
Caricaceae	*Carica papaya*	NE					X	X
Caryophyllaceae	*Silene burchellii Otth subsp. modesta J.C. Manning & Goldblatt*	LC						
Chrysobalanaceae	*Parinari capensis Harv. subsp. capensis*	LC						
Combretaceae	*Combretum apiculatum Sond.*	LC			Firewood			
	Combretum collinum Fresen.	LC						
	Combretum erythrophyllum (Burch.) Sond.	LC						
Commelinaceae	*Commelina africana L. var. krebsiana (Kunth) C.B.Clarke*	LC				X	X	

Family	Taxon	IUCN/Red list	Eswatini Red List	Flora Protection Act 2002	Uses	Medicine	Food	Alien
	Commelina erecta L.	LC						
Convolvulaceae	*Ipomoea crassipes Hook.*	NE						
Crassulaceae	*Crassula alba Forssk. var. alba*	LC	Endemic					
	Crassula sarcocaulis Eckl. & Zeyh.	LC			Traditional Medicine	X		
	Crassula vaginata Eckl. & Zeyh. subsp. vaginata	LC	Near-Endemic		Traditional Medicine	X		
Cyatheaceae	*Cyathea dregei Kunze*	LC		Schedule B: Protected-VU				
Dennstaedtiaceae	*Pteridium aquilinum (L.) Kuhn*	LC						
Dipsacaceae	*Cephalaria pungens Szabó*	LC						
Droseraceae	*Drosera burkeana Planch.*	LC						
Ebenaceae	*Diospyros lycioides Desf. subsp. guerkei (Kuntze) De Winter*	LC						
	Diospyros whyteana (Hiern) F. White	LC						
	Euclea undulata Thunb.	LC						
Euphorbiaceae	*Euphorbia ingens E. Mey. ex Boiss.*	LC			Traditional medicine. Fish poison	X		
	Ricinus communis L.	NE			Ornamental, Castor-oil			X
Fabaceae	*Acacia mearnsii De Wild.*	NE			Tanbark, Firewood			X
	Burkea africana Hook.	LC			Traditional Medicine, Tanning	X		
	Chamaecrista comosa E. Mey.	LC						
	Dalbergia armata E. Mey.	LC						
	Desmodium setigerum (E. Mey.) Benth. ex Harv.	LC						
	Dichrostachys cinerea (L.) Wight & Arn.	LC			Firewood, Fence Poles, Traditional medicine	X		
	Erythrina humeana Spreng.	LC						
	Erythrina latissima E .Mey.	LC						
	Indigofera schimperi Jaub. & Spach var. schimperi	LC						
	Pseudarthria hookeri Wight & Arn. var. hookeri	LC			Ornamental			
	Pterocarpus angolensis DC.	LC		Schedule A: Protected-EN	Furniture, Ornamental, Traditional medicine	X		
	Rhynchosia nitens Benth. ex Harv.	LC						

Family	Taxon	IUCN/Red list	Eswatini Red List	Flora Protection Act 2002	Uses	Medicine	Food	Alien
	Senegalia caffra (Thunb.) P.J.H. Hurter & Mabb.	LC						
	Senna didymobotrya (Fresen.) H.S.Irwin & Barneby	NE			Ornamental			X
	Sesbania punicea (Cav.) Benth.	NE						X
Gesneriaceae	*Streptocarpus cooksonii B.L .Burtt*	LC						
Heteropyxidaceae	*Heteropyxis natalensis Harv.*	LC						
Iridaceae	*Aristea angolensis Baker*	LC		Schedule B: Protected-VU				
	Dietes grandiflora N.E.Br.	LC			Ornamental			
	Gladiolus crassifolius Baker	LC			Traditional medicine	X		
	Gladiolus sp.							
	Schizostylis coccinea Backh. & Harv.	LC		Schedule B: Protected-VU				
	Watsonia watsonioides (Baker) Oberm.	LC	Near-Endemic	Schedule B: Protected-VU	Traditional Medicine	X		
Lamiaceae	*Aeollanthus parvifolius Benth.*	LC						
	Ocimum obovatum E. Mey. ex Benth.	NE						
	Plectranthus petiolaris E. Mey. ex Benth.	LC						
	Stachys natalensis Hochst.	LC						
	Stachys nigricans Benth.	LC			Traditional Medicine	X		
	Tetradenia galpinii (N.E.Br.) Phillipson & C.F. Steyn	LC						
Lauraceae	*Persea americana Mil.*	LC					X	X
Maesaceae	*Maesa lanceolata Forssk.*	LC						
Malvaceae	*Corchorus confusus Wild*	LC						
	Dombeya rotundifolia (Hochst.) Planch. var. rotundifolia	LC		Schedule C: Protected-Rare				
Melastomataceae	*Dissotis princeps (Kunth) Triana*	LC			Traditional Medicine	X		
Meliaceae	*Melia azedarach L.*	NE			Ornamental			X
Moraceae	*Ficus ingens (Miq.) Miq.*	LC						
	Morus alba L.	NE					X	X
Musaceae	*Musa sp (Banana)*	NE					X	X
Myrtaceae	*Eucalyptus camaldulensis Dehnh.*	NE			Timber, Firewood, Ornamental			X
	Psidium guajava L.	NE					X	X
	Syzygium cordatum Hochst. ex C.Krauss subsp. cordatum	LC			Traditional Medicine	X		
	Syzygium gerrardii (Harv. ex Hook.f.) Burtt Davy	LC						

Family	Taxon	IUCN/Red list	Eswatini Red List	Flora Protection Act 2002	Uses	Medicine	Food	Alien
Nyctaginaceae	*Bougainvillea glabra Choisy*	NE			Ornamental			X
	Mirabilis jalapa L.	NE						X
Ochnaceae	*Ochna serrulata (Hochst.) Walp.*	LC						
Onagraceae	*Oenothera stricta Ledeb. ex Link subsp. stricta*	NE						X
Orchidaceae	*Eulophia angolensis (Rchb.f.) Summerh.*	LC			Love Charm			
	Stenoglottis longifolia Hook.f.	LC						
Oxalidaceae	*Oxalis obliquifolia Steud. ex A.Rich.*	LC						
Papaveraceae	*Argemone ochroleuca Sweet subsp. ochroleuca*	NE			Traditional medicine	X		X
Pedaliaceae	*Ceratotheca triloba (Bernh.) Hook.f.*	LC			Traditional Medicine	X		
Phytolaccaceae	*Phytolacca octandra L.*	NE						X
Pinaceae	*Pinus pinaster Aiton*	NE			Timber			X
Poaceae	*Aristida adscensionis L.*	LC						
	Hyparrhenia hirta (L.) Stapf	LC			Thatching			
	Imperata cylindrica (L.) Raeusch.	LC						
	Melinis repens (Willd.) Zizka subsp. repens	LC						
	Miscanthus junceus (Stapf) Pilg.	LC						
	Andropogon eucomus Nees	LC						
	Andropogon gayanus Kunth var. polycladus (Hack.) Clayton	LC						
	Aristida junciformis Trin. & Rupr. subsp. junciformis	LC						
	Paspalum dilatatum Poir.	NE						X
	Cortaderia selloana (Schult.) Asch. & Graebn.	NE			Ornamental, Dune Stabilisation			X
	Cymbopogon caesius (Hook. & Arn.) Stapf	LC						
	Cymbopogon nardus (L.) Rendle	LC			Thatching			
	Eragrostis curvula (Schrad.) Nees	LC						
	Hyperthelia dissoluta (Nees ex Steud.) Clayton	LC						
	Leersia hexandra Sw.	LC						
	Loudetia flavida (Stapf) C.E. Hubb.	LC						
	Loudetia simplex (Nees) C.E. Hubb.	LC						
	Monocymbium ceresiiforme (Nees) Stapf	LC						
	Panicum maximum Jacq.	LC						
	Paspalum urvillei Steud.	NE						X
	Perotis patens Gand.	LC						
	Phragmites mauritianus Kunth	LC						
	Schizachyrium sanguineum (Retz.) Alston	LC						

Family	Taxon	IUCN/Red list	Eswatini Red List	Flora Protection Act 2002	Uses	Medicine	Food	Alien
	Setaria megaphylla (Steud.) T. Durand & Schinz	LC						
	Setaria sphacelata (Schumach.) Stapf & C.E. Hubb. ex M.B.Moss var. sphacelata	LC						
	Setaria sphacelata (Schumach.) Stapf & C.E. Hubb. ex M.B. Moss var. sericea (Stapf) Clayton	LC						
	Sporobolus africanus (Poir.) Robyns & Tournay	LC						
	Sporobolus pyramidalis P. Beauv.	LC						
	Urelytrum agropyroides (Hack.) Hack.	LC						
	Themeda triandra Forssk.	LC						
	Zea mays	NE					X	X
	Saccharum officinarum L.	NE					X	X
Polygonaceae	*Persicaria serrulata (Lag.) Webb & Moq.*	NE						
Proteaceae	*Faurea rochetiana (A. Rich.) Chiov. ex Pic.Serm.*	LC						
	Grevillea robusta A. Cunn. ex R.Br.	NE			Ornamental, Timber			X
	Protea caffra Meisn. subsp. falcata (Beard) Lötter	LC		Schedule B: Protected-VU	Traditional medicine			
Pteridaceae	*Cheilanthes hirta Sw.*	LC						
	Cheilanthes viridis (Forssk.) Sw. var. viridis	LC						
Rhamnaceae	*Berchemia zeyheri (Sond.) Grubov*	LC		Schedule B: Protected-VU	Traditional Medicine, Furniture, Ornaments	X		
	Ziziphus mucronata Willd.	LC						
Rosaceae	*Prunus persica (L.) Batsch var. persica*	NE					X	X
	Pyracantha angustifolia (Franch.) C.K. Schneid.	NE			Ornamental, Hedge			X
	Rubus proteus C.H. Stirt.	NE					X	X
Rubiaceae	*Oldenlandia herbacea (L.) Roxb. var. herbacea*	LC						
	Pentanisia angustifolia (Hochst.) Hochst.	LC						
	Richardia brasiliensis Gomes	NE						X
	Breonadia salicina (Vahl) Hepper & J.R.I. Wood	LC		Schedule B: Protected-VU	Furniture, Boats, Floors			
	Burchellia bubalina (L.f.) Sims	LC						
	Conostomium natalense (Hochst.) Bremek.	LC						
	Keetia gueinzii (Sond.) Bridson	LC						
	Psychotria capensis (Eckl.) Vatke subsp. capensis var. pubescens (Sond.) E.M.A. Petit	NE						
	Vangueria infausta Burch.	LC			Traditional medicine	X		
	Tapiphyllum parvifolium (Sond.) Robyns	LC						

Family	Taxon	IUCN/Red list	Eswatini Red List	Flora Protection Act 2002	Uses	Medicine	Food	Alien
Salicaceae	*Populus alba L. var. alba*	NE			Timber, Shelter, Ornamental			X
Sapotaceae	*Englerophytum magalismontanum (Sond.) T.D.Penn.*	LC			Traditional Medicine, Fruit for wine, syrup and jam	X	X	
Scrophulariaceae	*Buddleja salviifolia (L.) Lam.*	LC			Fishing rods, Assegaai, Traditional Medicine	X		
	Tetraselago natalensis (Rolfe) Junell	LC						
	Zaluzianskya elongata Hilliard & B.L. Burtt	LC						
Solanaceae	*Datura ferox L.*	NE						X
	Solanum mauritianum Scop.	NE			Ornament			X
	Solanum sisymbriifolium Lam.	NE						X
Thymelaeaceae	*Gnidia burchellii (Meisn.) Gilg*	LC						
	Gnidia splendens Meisn.	LC						
	Gnidia triplinervis Meisn.	LC						
	Passerina montivaga Bredenk. & A.E.van Wyk	LC						
Typhaceae	*Typha capensis (Rohrb.) N.E.Br.*	LC						
Ulmaceae	*Trema orientalis (L.) Blume*	LC					X	
Velloziaceae	*Xerophyta retinervis Baker var. retinervis*	LC						
Verbenaceae	*Verbena bonariensis L.*	NE			Ornamental			X
	Lantana camara L.	NE			Ornament, Hedge			X
	Lippia javanica (Burm.f.) Spreng.	LC			Traditional Medicine	X		
Vitaceae	*Cyphostemma natalitium (Szyszyl.) J.J.M.van der Merwe*	LC						
	Rhoicissus tridentata (L.f.) Wild & R.B. Drumm. subsp. cuneifolia (Eckl. & Zeyh.) Urton	LC						

IUCN =EN-Endangered; VU – Vulnerable; LC-Least Concern; NE-Not Evaluated

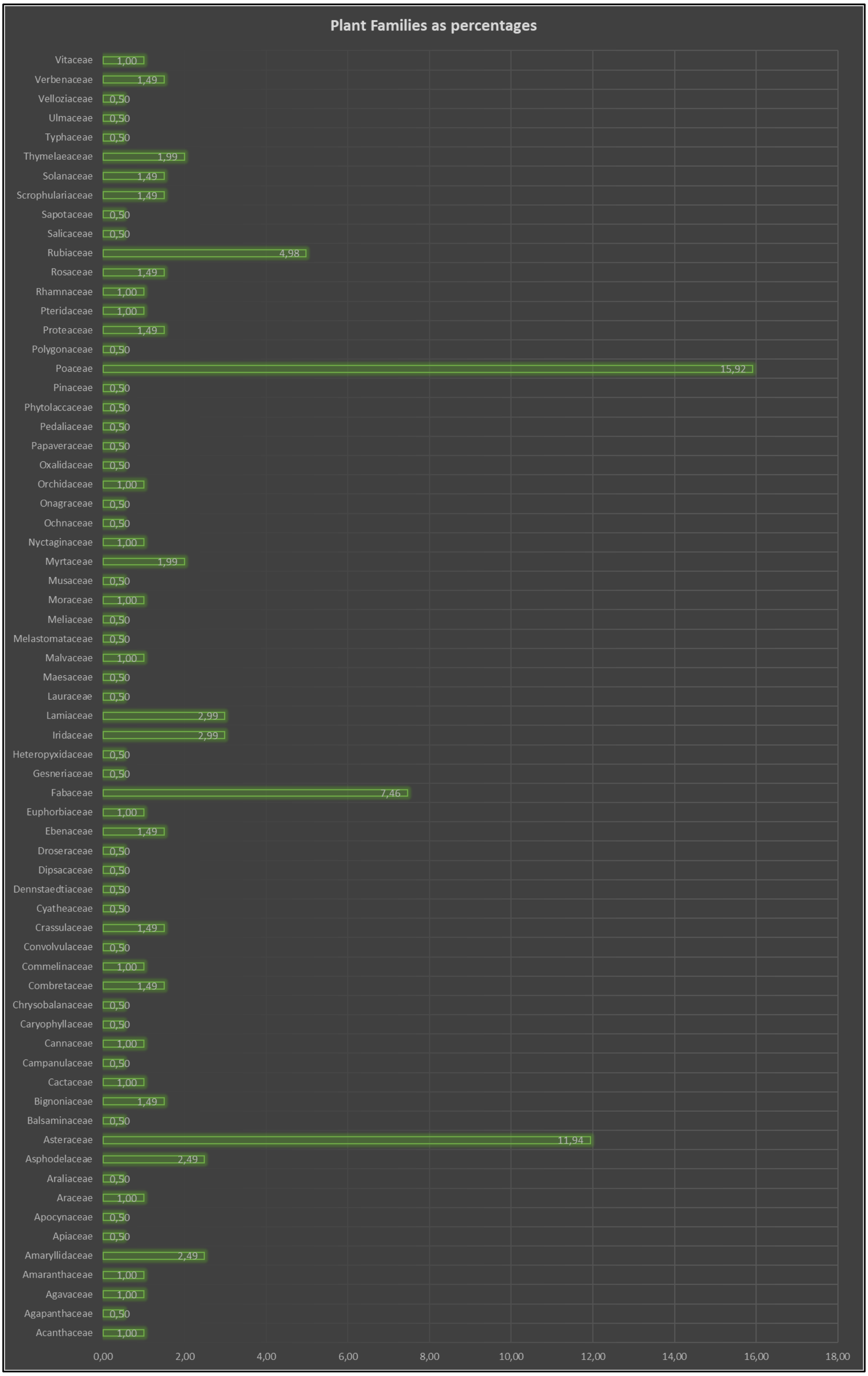


Figure 28: Number of flora families within the species recorded

5.3.2.2 Alien and/or invasive plant species

A total of 52 (25.87%) alien and/or invasive plant (AIP) species were recorded within the project area. The majority of these were recorded within the transformed, modified and riparian habitat types. A list of all the AIP's recorded within the project area is given in Table 6. Many of these species are cultivated food plants or used as ornamental garden plants.

Table 6: AIP's recorded within the project area

Family	Taxon	Uses	Medicine	Food
Agavaceae	*Agave americana L. subsp. americana var. americana*	Ornamental, Hedge		
	Agave sisalana Perrine	Ornamental, Hedge		
Amaranthaceae	*Achyranthes aspera L. var. aspera*	Traditional Medicine	X	
	Amaranthus hybridus L. subsp. hybridus var. hybridus			
Araceae	*Monstera deliciosa Liebm.*			
Asteraceae	*Bidens pilosa L.*	Traditional medicine	X	
	Ageratum houstonianum Mill.			
	Campuloclinium macrocephalum (Less.) DC.	Ornamental		
	Crepis hypochaeridea (DC.) Thell.			
	Cirsium vulgare (Savi) Ten.			
	Cosmos bipinnatus Cav.	Traditional Medicine	X	
	Xanthium spinosum L.			
	Hypochaeris radicata L.			
	Tagetes minuta L.	Traditional medicine, Insect Repellent	X	
Bignoniaceae	*Jacaranda mimosifolia D. Don*	Ornamental		
	Tecoma stans (L.) Juss. ex Kunth var. stans			
Cactaceae	*Cereus jamacaru DC.*	Hedge, Ornamental		
	Opuntia ficus-indica (L.) Mill.	Hedge		X
Cannaceae	*Canna indica L.*	Ornamental		
Caricaceae	*Carica papaya*			X
Euphorbiaceae	*Ricinus communis L.*	Ornamental, Castor-oil		
Fabaceae	*Acacia mearnsii De Wild.*	Tanbark, Firewood		
	Senna didymobotrya (Fresen.) H.S. Irwin & Barneby	Ornamental		
	Sesbania punicea (Cav.) Benth.			
Lauraceae	*Persea americana Mil.*			X
Meliaceae	*Melia azedarach L.*	Ornamental		
Moraceae	*Morus alba L.*			X
Musaceae	*Musa sp (Banana)*			X
Myrtaceae	*Eucalyptus camaldulensis Dehnh.*	Timber, Firewood, Ornament		
	Psidium guajava L.			X

Family	Taxon	Uses	Medicine	Food
Nyctaginaceae	*Bougainvillea glabra Choisy*	Ornamental		
	Mirabilis jalapa L.			
Onagraceae	*Oenothera stricta Ledeb. ex Link subsp. stricta*			
Papaveraceae	*Argemone ochroleuca Sweet subsp. ochroleuca*	Traditional medicine	X	
Phytolaccaceae	*Phytolacca octandra L.*			
Pinaceae	*Pinus pinaster Aiton*	Timber		
Poaceae	*Paspalum dilatatum Poir.*			
	Cortaderia selloana (Schult.) Asch. & Graebn.	Ornamental, Dune Stabilisation		
	Paspalum urvillei Steud.			
	Zea mays (Maize)			X
	Saccharum officinarum L.			X
Proteaceae	*Grevillea robusta A. Cunn. ex R.Br.*	Ornamental, Timber		
Rosaceae	*Prunus persica (L.) Batsch var. persica*			X
	Pyracantha angustifolia (Franch.) C.K. Schneid.	Ornamental, Hedge		
	Rubus proteus C.H. Stirt.			X
Rubiaceae	*Richardia brasiliensis Gomes*			
Salicaceae	*Populus alba L. var. alba*	Timber, Shelter, Ornamental		
Solanaceae	*Datura ferox L.*			
	Solanum mauritianum Scop.	Ornament		
	Solanum sisymbriifolium Lam.			
Verbenaceae	*Verbena bonariensis L.*	Ornamental		
	Lantana camara L.	Ornament, Hedge		

5.3.2.3 Socio-economically important plants

At least 76 species (37.81%) of the total plant species recorded are regarded as important with regards to providing at least 1 (one) important known secondary ecosystem service (Table 7). Of the 37 species, the majority (14 species) are species that are cultivated as a food source, whereas 28 of the plant species have some documented medicinal properties associated with them.

Table 7: Selection of significant plant species recorded within the project area

Family	Taxon	Uses
Acanthaceae	*Thunbergia dregeana Nees*	Traditional medicine
Agapanthaceae	*Agapanthus inapertus P. Beauv. subsp. inapertus*	Ornamental
Agavaceae	*Agave americana L. subsp. americana var. americana*	Ornamental, Hedge
	Agave sisalana Perrine	Ornamental, Hedge
Amaranthaceae	*Achyranthes aspera L. var. aspera*	Traditional Medicine
Amaryllidaceae	*Crinum bulbispermum (Burm.f.) Milne-Redh. & Schweick.*	Traditional medicine, Ornamental
	Boophone disticha (L.f.) Herb.	Traditional Medicine
Apiaceae	Alepidea amatymbica	Traditional Medicine
Apocynaceae	*Carissa bispinosa (L.) Desf. ex Brenan*	Traditional Medicine
Araceae	*Zantedeschia albomaculata (Hook.) Baill.*	Ornamental

Family	Taxon	Uses
Araliaceae	*Cussonia sphaerocephala Strey*	Traditional medicine
Asphodelaceae	*Aloe ecklonis Salm-Dyck*	Traditional medicine; Inflorescence eaten
	Aloe arborescens Mill.	Ornamental
	Aloe cooperi Baker	Ornamental
	Aloe marlothii A. Berger	Ornamental
Asteraceae	*Bidens pilosa L.*	Traditional medicine
	Cosmos bipinnatus Cav.	Traditional Medicine
	Tagetes minuta L.	Traditional medicine, Insect Repellent
	Campuloclinium macrocephalum (Less.) DC.	Ornamental
	Helichrysum cooperi Harv.	Love Charm
Bignoniaceae	*Tecoma capensis (Thunb.) Lindl.*	Traditional medicine, Ornamental
	Jacaranda mimosifolia D. Don	Ornamental
Cactaceae	*Cereus jamacaru DC.*	Hedge, Ornamental
	Opuntia ficus-indica (L.) Mill.	Hedge
Cannaceae	*Canna indica L.*	Ornamental
Caricaceae	*Carica papaya*	Fruit Eaten
Combretaceae	*Combretum apiculatum Sond.*	Firewood
Commelinaceae	*Commelina africana L. var. krebsiana (Kunth) C.B. Clarke*	Traditional Medicine
Crassulaceae	*Crassula sarcocaulis Eckl. & Zeyh.*	Traditional Medicine
	Crassula vaginata Eckl. & Zeyh. subsp. vaginata	Traditional Medicine
Euphorbiaceae	*Euphorbia ingens E. Mey. ex Boiss.*	Traditional medicine, Fish poison
	Ricinus communis L.	Ornamental, Castor-oil
Fabaceae	*Burkea africana Hook.*	Traditional Medicine, Tanning
	Dichrostachys cinerea (L.) Wight & Arn.	Firewood, Fence Poles, Traditional medicine
	Pterocarpus angolensis DC.	Furniture, Ornaments, Traditional medicine
	Acacia mearnsii De Wild.	Tanbark, Firewood
	Pseudarthria hookeri Wight & Arn. var. hookeri	Ornamental
	Senna didymobotrya (Fresen.) H.S. Irwin & Barneby	Ornamental
Iridaceae	*Gladiolus crassifolius Baker*	Traditional Medicine
	Watsonia watsonioides (Baker) Oberm.	Traditional Medicine
	Dietes grandiflora N.E.Br.	Ornamental
Lamiaceae	*Stachys nigricans Benth.*	Traditional Medicine
Lauraceae	*Persea americana Mil.*	Fruit Eaten
Melastomataceae	*Dissotis princeps (Kunth) Triana*	Traditional Medicine
Meliaceae	*Melia azedarach L.*	Ornamental
Moraceae	*Morus alba L.*	Fruit Eaten
Musaceae	*Musa sp (Banana*	Fruit Eaten
Myrtaceae	*Syzygium cordatum Hochst. ex C. Krauss subsp. cordatum*	Traditional Medicine
	Eucalyptus camaldulensis Dehnh.	Timber, Firewood, Ornament
	Psidium guajava L.	Fruit Eaten
Nyctaginaceae	*Bougainvillea glabra Choisy*	Ornamental
Orchidaceae	*Eulophia angolensis (Rchb.f.) Summerh.*	Love Charm
Papaveraceae	*Argemone ochroleuca Sweet subsp. ochroleuca*	Traditional Medicine

Family	Taxon	Uses
Pedaliaceae	*Ceratotheca triloba (Bernh.) Hook.f.*	Traditional Medicine
Pinaceae	*Pinus pinaster Aiton*	Timber
Poaceae	*Hyparrhenia hirta (L.) Stapf*	Thatching
	Cortaderia selloana (Schult.) Asch. & Graebn.	Ornamental, Dune Stabilisation
	Cymbopogon nardus (L.) Rendle	Thatching
	Zea Mays (Maize)	Fruit Eaten
	Saccharum officinarum L.	Fruit Eaten
Proteaceae	*Grevillea robusta A. Cunn. ex R.Br.*	Ornamental, Timber
	Protea caffra Meisn. subsp. falcata (Beard) Lötter	Traditional medicine
Rhamnaceae	*Berchemia zeyheri (Sond.) Grubov*	Traditional Medicine, Furniture, Ornaments
Rosaceae	*Pyracantha angustifolia (Franch.) C.K. Schneid.*	Ornamental, Hedge
	Prunus persica (L.) Batsch var. persica	Fruit Eaten
	Rubus proteus C.H. Stirt.	Fruit Eaten
Rubiaceae	*Breonadia salicina (Vahl) Hepper & J.R.I. Wood*	Furniture, Boats, Floors
	Vangueria infausta Burch.	Traditional medicine
Salicaceae	*Populus alba L. var. alba*	Timber, Shelter, Ornamental
Sapotaceae	*Englerophytum magalismontanum (Sond.) T.D.Penn.*	Traditional Medicine, Fruit for wine, Syrup and Jam
Scrophulariaceae	*Buddleja salviifolia (L.) Lam.*	Fishing rods, Assegaai, Traditional Medicine
Solanaceae	*Solanum mauritianum Scop.*	Ornamental
Ulmaceae	*Trema orientalis (L.) Blume*	Fruit Eaten
Verbenaceae	*Lippia javanica (Burm.f.) Spreng.*	Traditional Medicine
	Verbena bonariensis L.	Ornamental
	Lantana camara L.	Ornamental, Hedge

5.3.2.4 Ecology of plants

At least 68.16% (137 species) of the total plant species recorded are regarded indigenous to southern Africa (SANBI. (2019) (see Table 5). Nine (9) plants were regarded as endemic. The ecology of the recorded plants and the percentage of indigenous plants versus non-indigenous plants is presented in Figure 29 and Figure 30 respectively. Figure 31 presents some photographs of plant species recorded for this assessment.

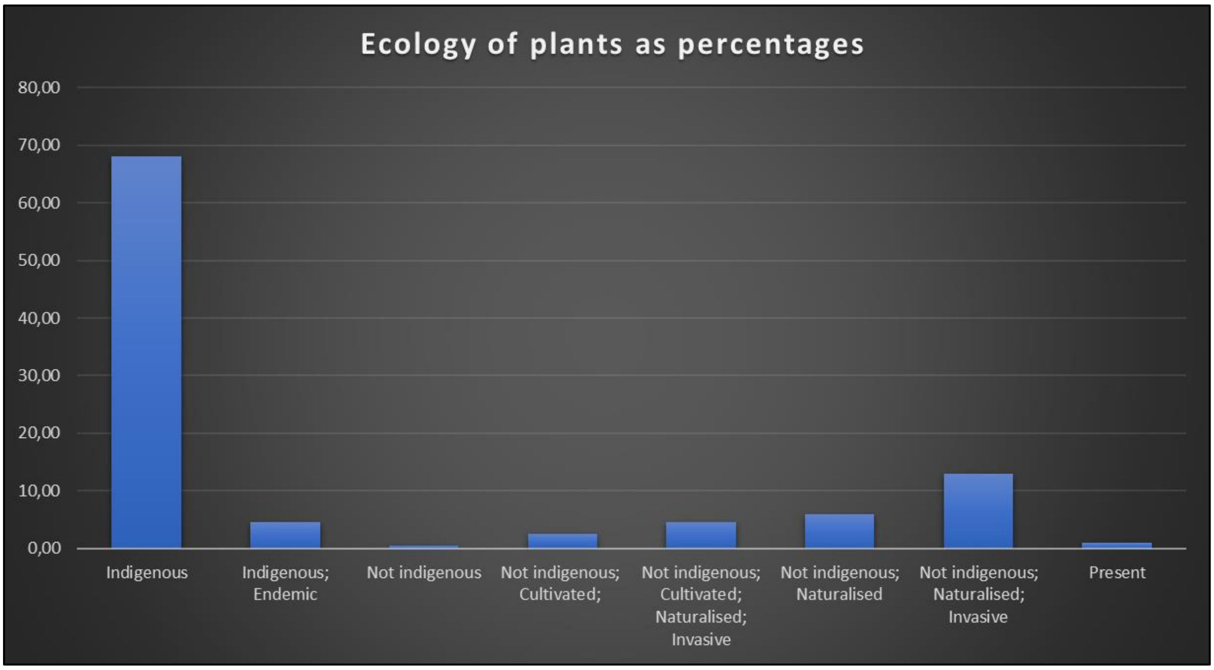


Figure 29: Ecology of the recorded plants.

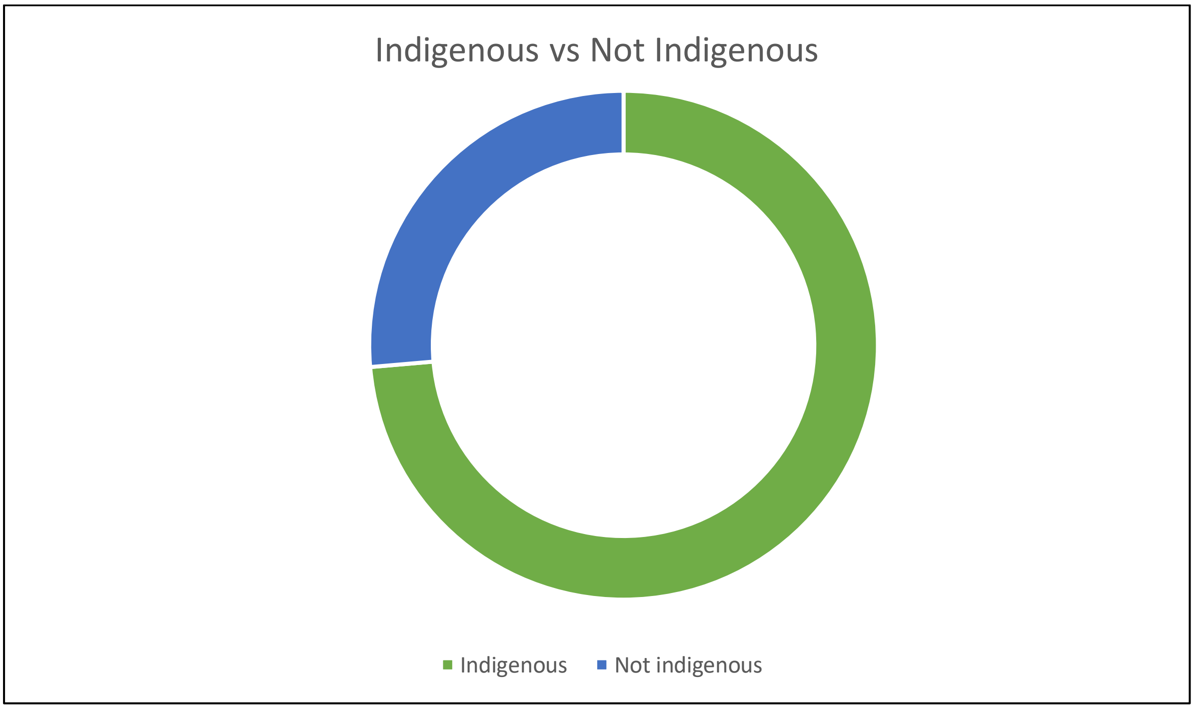


Figure 30: Percentage indigenous vs not indigenous plants

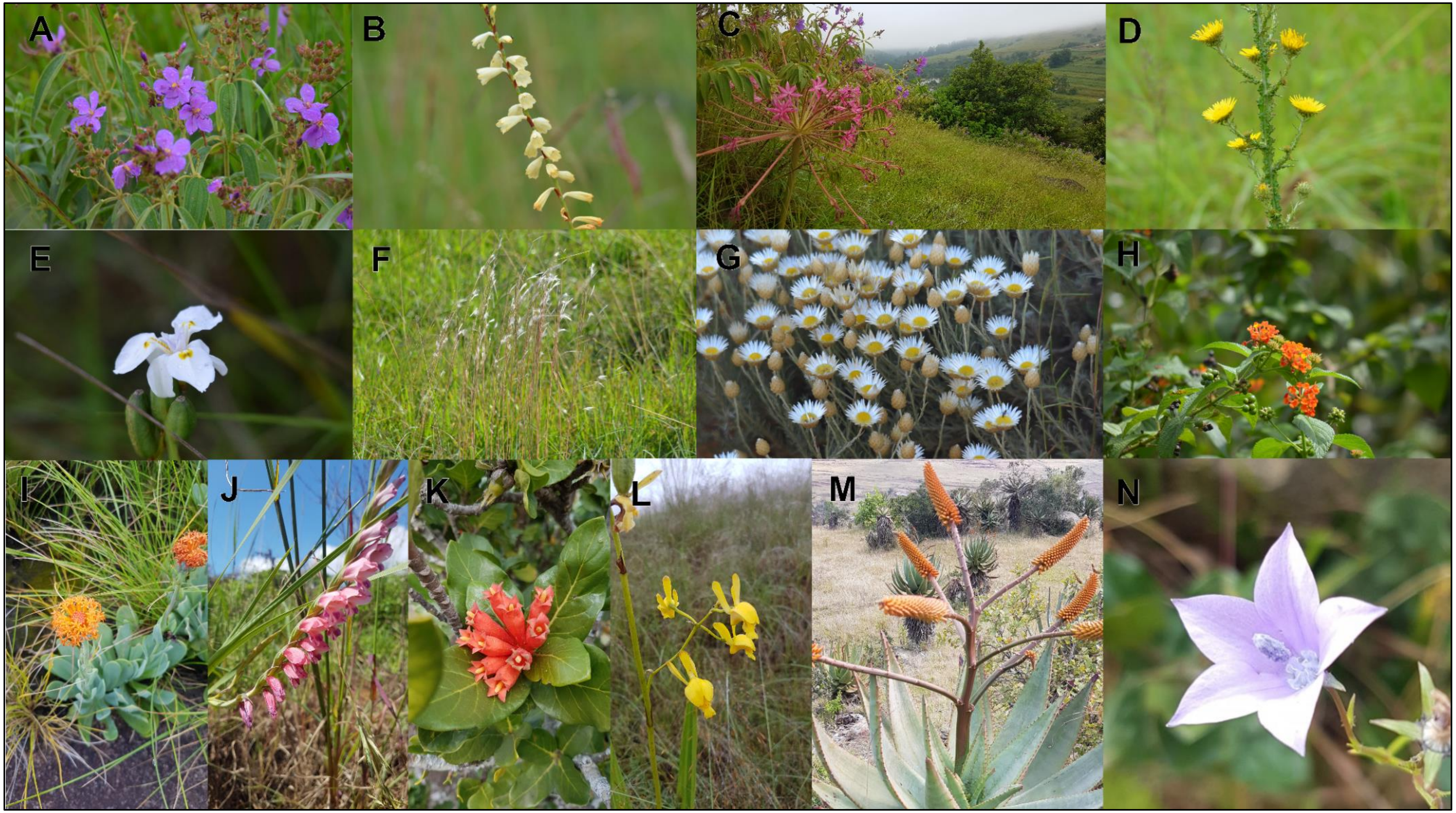


Figure 31: A selection of plant species observed within the proposed project area during the dual season survey; A) Dissotis princeps; B) Watsonia watsonioides ; C) Brunsvigia grandiflora; D) Berkheya echinacea; E) Dietes grandiflora; F) Andropogon eucomus; G) Helichrysum argyrolepis; H) Lantana camara I) Kleinia galpinii; J) Gladiolus crassifolius; K) Breonadia salicina; L) Eulophia angolensis; M) Aloe marlothii; N) Wahlenbergia krebsii

5.3.2.5 Species of conservation concern

Sixteen (16) plant SCC were observed within the project area during the dual season survey. The majority of the species were recorded in the *Rocky Grassland* habitat as well as some in the *Riparian* habitat.

The primary threat to *Alepidea amatymbica* (EN) which is protected both internationally and nationally is over-exploitation for the traditional medicine trade. Some of these species with their Red-listing status are presented in Table 8 and presented in Figure 32.

Table 8: Plant SCC recorded during the dual season survey

Family	Taxon	IUCN/Red list	Eswatini Red List	Flora Protection Act 2002	Growth form	Habitats
Amaryllidaceae	*Crinum bulbispermum (Burm.f.) Milne-Redh. & Schweick.*	LC		Schedule B: Protected-VU	Hydrophyte; geophyte;	Riparian
	Boophone disticha (L.f.) Herb.	LC		Schedule A: Protected-EN	Succulent; geophyte;	Rocky Grassland, Riparian
Apiaceae	*Alepidea amatymbica Eckl. & Zeyh.*	**EN**		Schedule B: Protected-VU	Herb	Rocky Grassland
Asphodelaceae	*Kniphofia linearifolia Baker*	LC		Schedule B: Protected-VU	Herb	Riparian, Indigenous Tree Clumps, Rocky Grassland
	Aloe ecklonis Salm-Dyck	LC	VU B1B2cD2		Succulent; Herb	Rocky Grassland
Crassulaceae	*Crassula alba Forssk. var. alba*	LC	Endemic		Succulent; Herb	Rocky Grassland
	Crassula vaginata Eckl. & Zeyh. subsp. vaginata	LC	Near-Endemic		Succulent; Herb	Rocky Grassland
Cyatheaceae	*Cyathea dregei Kunze*	LC		Schedule B: Protected-VU	Tree	Riparian, Indigenous Tree Clumps, Rocky Grassland, Homesteads and Subsistence Farming
Fabaceae	*Pterocarpus angolensis DC.*	LC		Schedule A: Protected-EN	Tree	Riparian, Indigenous Tree Clumps, Rocky Grassland, Homesteads and subsistence Farming
Iridaceae	*Aristea angolensis Baker*	LC		Schedule B: Protected-VU	Herb	Rocky Grassland
	Schizostylis coccinea Backh. & Harv.	LC		Schedule B: Protected-VU	Herb	Riparian
	Watsonia watsonioides (Baker) Oberm.	LC	Near-Endemic	Schedule B: Protected-VU	Geophyte; herb;	Rocky Grassland
Malvaceae	*Dombeya rotundifolia (Hochst.) Planch. var. rotundifolia*	LC		Schedule C: Protected-Rare	Tree	Indigenous Tree Clumps, Rocky Grassland

Proteaceae	*Protea caffra Meisn. subsp. falcata (Beard) Lötter*	LC		Schedule B: Protected-VU	Tree; shrub	Rocky Grassland, Indigenous Tree Clumps
Rhamnaceae	*Berchemia zeyheri (Sond.) Grubov*	LC		Schedule B: Protected-VU	Tree; shrub	Riparian, Indigenous Tree Clumps
Rubiaceae	*Breonadia salicina (Vahl) Hepper & J.R.I. Wood*	LC		Schedule B: Protected-VU	Tree	Riparian

The Eswatini Red Data Plants list, as well as the Flora Protection Act 2002 can be obtained from the website cited as Eswatini National Trust Commission, 2017. The Flora Protection Act 2002 may be outdated but was included none the less.

Figure 32: SCC recorded during the field survey: A) Alepidea amatymbica; B) Crassula vaginata; C) Aristea angolensis; D) Aloe ecklonis; E) Boophone disticha; F) Breonadia salicina; G) Kniphofia linearifolia; H) Pterocarpus angolensis

5.4 Herpetofauna

Overall, herpetofaunal diversity was noticeably high within the project area, especially considering the increased levels of anthropogenic disturbances on site. During the wet season survey nineteen (19) reptiles and nine (9) amphibians were recorded while in the dry season five (5) reptile species and three (3) amphibians were recorded. The complete list of expected species is provided in Appendices D and E for reptiles and amphibians, respectively.

5.4.1 Wet Season Survey

Analysis of data captured in the field, a total of nineteen (19) reptile species were observed during the wet season survey, representing 19% of the expected 102 species. For amphibians, nine (9) species were observed representing 21% of the expected 43 species. Given the relatively short survey duration, these results indicate remarkable success. Table 9 lists all the herpetofaunal species recorded during the wet season survey within the project area.

Three endemic and one near-endemic species were recorded (Table 9). A selection of photographs taken during the wet season survey of amphibians and reptiles is provided in Figure 33, Figure 34 and Figure 35.

The herpetofauna sampling effort was comprehensive within the accessible area and comprised twelve (12) diurnal and five (5) nocturnal active sampling sites as well as three diurnal meander samples during the wet season survey.

The endemic *Hyperolius semidiscus* (Yellow-striped Reed Frog) was recorded during the wet season survey and is listed as Regionally Extinct according to the Eswatini Fauna Red List which is based on the "Threatened Vertebrates of Eswatini" (Monadjem *et al*., 2003).

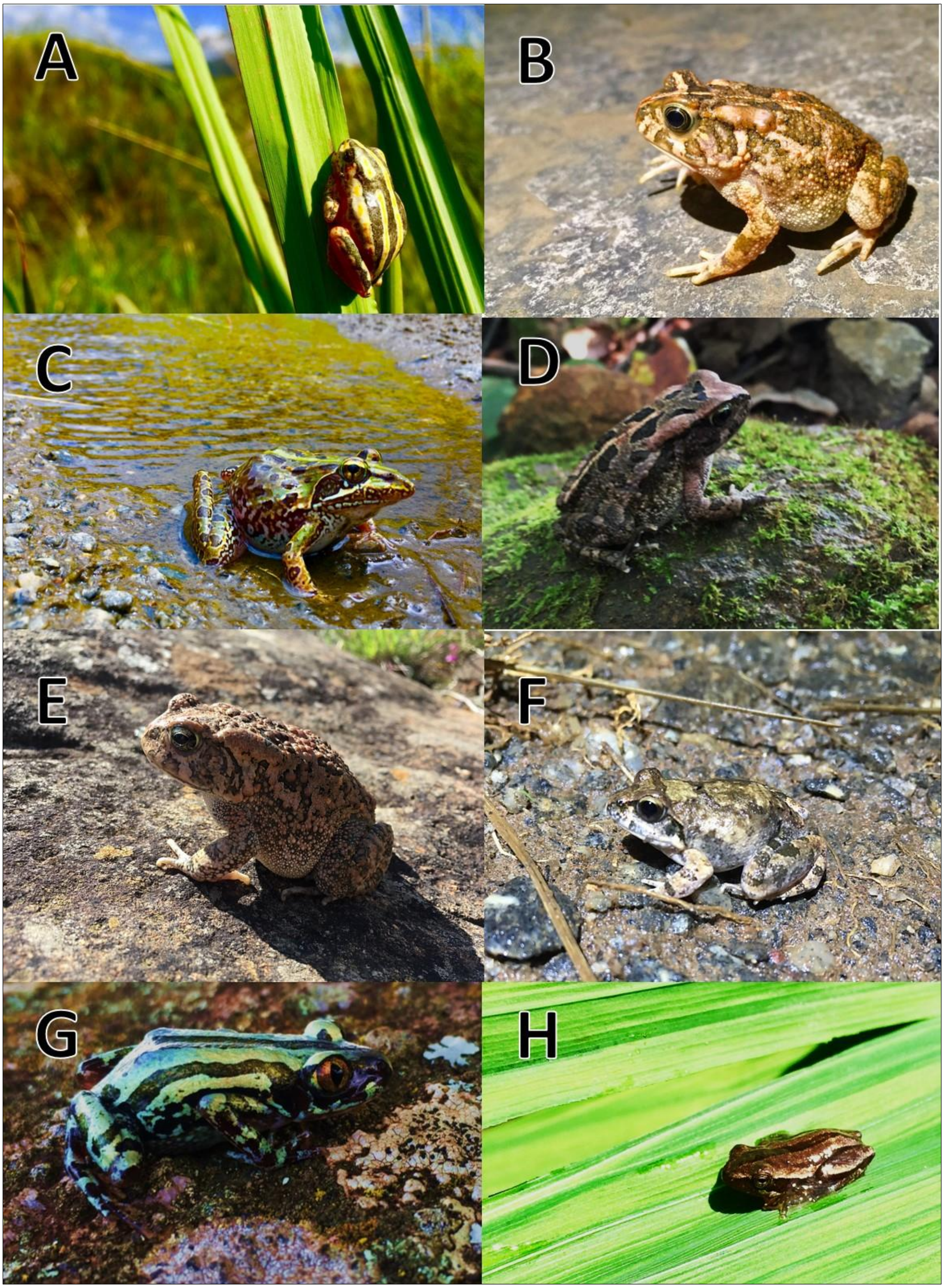


Figure 33: Some of the amphibian species recorded within the project area during the May 2019 survey: A) Painted Reed Frog (Hyperolius marmoratus), B) & E) Guttural Toad (Sclerophrys gutturalis), C) Delalande's River Frog (Amietia delalandii), D) Raucous Toad (Sclerophrys capensis), F) Natal Sand Frog (Tomopterna natalensis), G) Bubbling Kassina (Kassina senegalensis) and H) Yellow-striped Reed Frog (Hyperolius semidiscus)

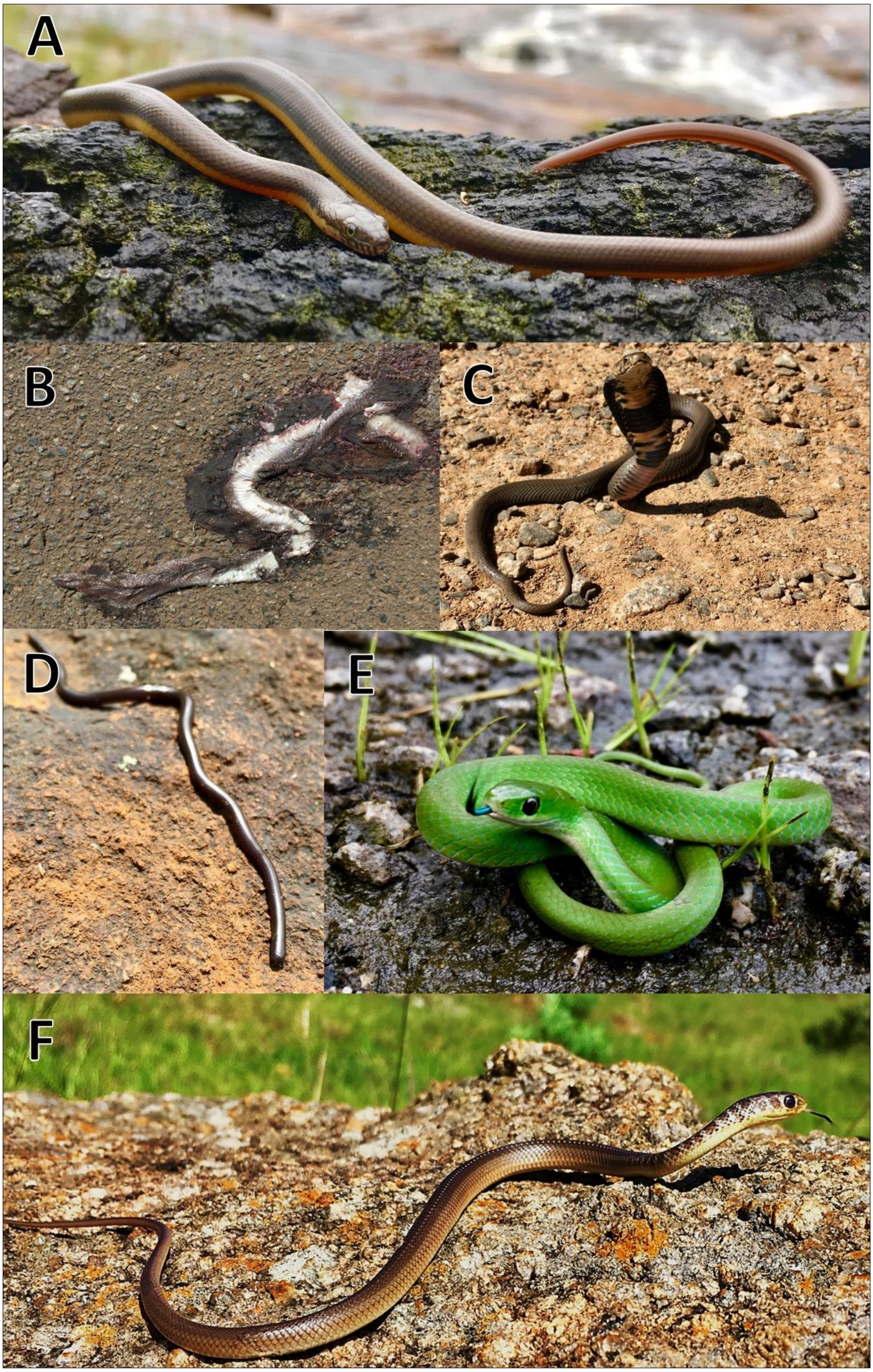


Figure 34: Some of the reptile species recorded in the project area during the March 2019 survey: A) Dusky-bellied Water Snake (Lycodonomorphus laevissimus), B) Brown House Snake (Boaedon capensis), C) Mozambique Spitting Cobra (Naja mossambica), D) Thread Snake (Leptotyphlops sp.), E) South Eastern Green Snake (Philothamnus hoplogaster), and F) Short-snouted Grass Snake (Psammophis brevirostris)

Figure 35: Some of the recorded lizard species from the project area: A) Rainbow Skink (Trachylepis margaritifer), B) & C) Common Girdled Lizard (Cordylus vittifer), D) Wahlberg's Velvet Gecko (Homopholis wahlbergii), E) Montane Dwarf Burrowing Skink (Scelotes mirus), and F) Eastern Ground Agama (Agama aculeata distanti)

Table 9: List of all herpetofauna recorded within the project area during the wet season survey

Species	Common Name	Conservation Status		Endemic
		Eswatini Regional Listing	IUCN (2017)	
Reptiles				
Acanthocercus atricollis	Southern Tree Agama	LC	LC	No
Agama aculeata distanti	Eastern Ground Agama	LC	LC	No
Boaedon capensis	Brown House Snake	LC	LC	No
Chondrodactylus turneri	Turner's Gecko	LC	Unlisted	No
Cordylus vittifer	Common Girdled Lizard	LC	LC	**Near-endemic**
Dendroaspis polylepis	Black Mamba	LC	LC	No
Hemidactylus mabouia	Common Tropical House Gecko	LC	Unlisted	No
Homopholis wahlbergii	Wahlberg's Velvet Gecko	LC	LC	No
Leptotyphlops sp.	Thread Snake	LC	Unlisted	No

Species	Common Name	Conservation Status		Endemic
		Eswatini Regional Listing	IUCN (2017)	
Lycodonomorphus laevissimus	Dusky-bellied Water Snake	LC	LC	**Endemic**
Lygodactylus capensis	Common Dwarf Gecko	LC	Unlisted	No
Naja mossambica	Mozambique Spitting Cobra	LC	Unlisted	No
Panaspis wahlbergii	Wahlberg's Snake-eyed Skink	LC	Unlisted	No
Philothamnus hoplogaster	South Eastern Green Snake	LC	Unlisted	No
Psammophis brevirostris	Short-snouted Grass Snake	LC	Unlisted	No
Scelotes mirus	Montane Dwarf Burrowing Skink	LC	LC	**Endemic**
Trachylepis margaritifer	Rainbow Skink	LC	LC	No
Trachylepis striata	Striped Skink	LC	Unlisted	No
Trachylepis varia	Variable Skink	LC	LC	No
Amphibians				
Amietia delalandii	Delalande's River Frog	LC	Unlisted	No
Cacosternum boettgeri	Common Caco	LC	LC	No
Hyperolius marmoratus	Painted Reed Frog	LC	LC	No
Hyperolius semidiscus	Yellow-striped Reed Frog	LC	LC	**Endemic**
Kassina senegalensis	Bubbling Kassina	LC	LC	No
Phrynobatrachus mababiensis	Dwarf Puddle Frog	LC	LC	No
Sclerophrys capensis	Raucous Toad	LC	LC	No
Sclerophrys gutturalis	Guttural Toad	LC	LC	No
Tomopterna natalensis	Tremelo Sand Frog	LC	LC	No

5.4.2 Dry Season Survey

A selection of photographs taken during the dry season survey of amphibians and reptiles are provided in Figure 36 and Figure 37. A list of all the herpetofauna species recorded during the dry season survey is provided in Table 10.

Three species that were not recorded in the wet season survey, increases the total number of observed reptiles (to 21) and amphibians (to 11). One endemic gecko species was recorded, the Spotted Dwarf Gecko (*Lygodactylus ocellatus ocellatus*).

Figure 36: Reptile species recorded in the dry season; A) Southern Rock Agama (Agama atra), B) Wahlberg's Snake-eyed Skink (Panaspis wahlbergii), C) Rainbow Skink (Trachylepis margaritifer), and D) Spotted Dwarf Gecko (Lygodactylus ocellatus ocellatus)

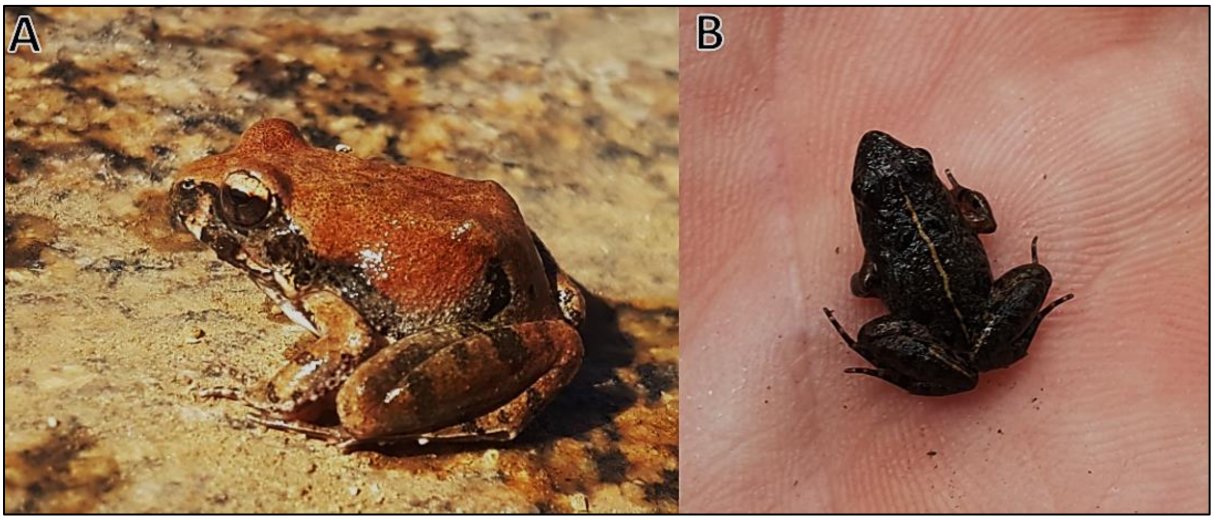


Figure 37: Some of the amphibian species recorded in the dry season; A) Natal Sand Frog (Tomopterna natalensis), and B) Dwarf Puddle Frog (Phrynobatrachus mababiensis)

Table 10: List of all herpetofauna recorded within the project area during the dry season survey

Species	Common Name	Conservation Status		Endemic
		Eswatini Regional Listings	IUCN (2019)	
Reptiles				
Agama atra	Southern Rock Agama	LC	LC	No
Lygodactylus ocellatus ocellatus	Spotted Dwarf Gecko*	LC	LC	**Endemic**
Panaspis wahlbergii	Wahlberg's Snake-eyed Skink	LC	Unlisted	No
Psammophis mossambicus	Olive Grass Snake*	LC	Unlisted	No
Trachylepis margaritifer	Rainbow Skink	LC	LC	No
Amphibians				
Phrynobatrachus mababiensis	Dwarf Puddle Frog*	LC	LC	No
Ptychadena oxyrhynchus	Sharp-nosed Grass Frog*	LC	LC	No
Tomopterna natalensis	Natal Sand Frog	LC	LC	No

(*) denotes species that were not recorded during the wet season survey

5.4.3 Herpetofauna Habitat Associations

5.4.3.1 Semi-Natural: Rocky Grassland

The Common Girdled Lizard (*Cordylus vittifer*), Wahlberg's Velvet Gecko (*Homopholis wahlbergii*), Rainbow Skink (*Trachylepis margaritifer*) and Variable Skink *(Trachylepis varia*) were the four most common reptiles found on the rocky slopes of these grassland habitats. Figure 38 shows an example of this habitat from within the project area. Although not recorded during surveys, the Near Threatened and endemic Swazi Flat Gecko (*Afroedura major*) is expected to occur in this habitat. During the dry season survey, an endemic species of gecko (*Lygodactylus ocellatus ocellatus* – Spotted Dwarf Gecko) was recorded in this habitat type.

These, predominantly sloped, areas provide habitat for some of the amphibian species that are not associated with fast-flowing or permanent water (e.g. Raucous Toad (*Sclerophrys capensis*)). Small streams and drainage lines intersected various portions of this habitat. These, more permanently wet, areas provide suitable habitat for the Common River Frog (*Amietia delalandii*), Common Caco (*Cacosternum boettgeri*) and some of the Reed Frog (*Hyperolius*) species.

Although not recorded during surveys, the two near threatened and endemic Grass Lizard species (*Chamaesaura aenea* and *Chamaesaura macrolepis*) are expected to occur in the grassland areas of this habitat. This habitat type is considered important reptile habitat (especially for rupicolus species) and due to the limited amount of this habitat type in the region, and its relatively pristine condition, it is considered to be of a high sensitivity.

Figure 38: An example of the Semi-Natural: Rocky Grassland habitat within the project area

5.4.3.2 Semi-Natural: Indigenous Tree Clumps

The areas directly adjacent to, and below, the proposed dam wall are representative of this habitat type. This area is considered semi-forested and although impacted by the presence of alien plant species, is considered to be in a fairly pristine condition. Wahlberg's Snake-eyed Skink (*Panaspis wahlbergii*) and Southern Tree Agama (*Acanthocercus atricollis*) were commonly recorded in this habitat.

Due to its proximity to the river and riparian habitat, a number of amphibian species were recorded in this habitat type. Dwarf Puddle Frog (*Phrynobatrachus mababiensis*), Raucous Toad (*Sclerophrys capensis*) and both recorded Hyperolius sp. were observed in this habitat. Due to the limited amount of this habitat type in the region, it is considered to be of a moderate to high sensitivity.

5.4.3.3 Transformed: Commercial Plantations

This habitat type includes all of the major commercial tree plantations in the project area and within the DMU, as defined. These monocultures (predominantly Pine and *Eucalyptus* sp.) do not support even moderate species diversity. This habitat is considered extremely transformed and only two generalist reptile species were recorded (Common Dwarf Gecko (*Lygodactylus capensis*) and Variable Skink (*Trachylepis varia*)). This habitat type is considered to be of low sensitivity.

5.4.3.4 Transformed: Alien Invasive Tree Clumps

As with the commercial plantations, these stands are predominantly monocultures of alien invasive plant species. Although often interspersed with some indigenous species, this habitat is considered to be heavily transformed and only generalist reptile species, and no amphibian species, were recorded. This habitat type is considered to be of low sensitivity.

5.4.3.5 Transformed: Homesteads and Subsistence Farming

Several synanthropic reptile species are able to colonise and exploit homesteads and cropland areas. Eastern Ground Agama (*Agama aculeata distanti*), Common Dwarf Gecko (*Lygodactylus capensis*) and Variable Skink (*Trachylepis varia*) were all observed in this modified habitat. The Guttural Toad

(*Sclerophrys gutturalis*) in particular, is able to exploit disturbed habitats and is usually the only amphibian characteristic of these modified habitats. This degraded habitat has a low sensitivity.

5.4.3.6 Wetlands, River & Riparian Habitat

Only aquatic or semi-aquatic species are expected in the rivers themselves, but numerous other species are found on the shores of the river. Nile Crocodile (*Crocodylus niloticus*) was not observed in any of the rivers in the project area, however this species has been recorded downstream (in the Mlilwane Nature Reserve) and as such, it is likely to occur in the area. No Water Monitor Lizards (*Varanus niloticus*) were observed within the river itself during the field surveys but this species is expected to occur, as there is plentiful habitat present. The endemic Dusky-bellied Water Snake (*Lycodonomorphus laevissimus*) was recorded within this habitat type.

Amphibian species such as the Yellow-striped Reed Frog (*Hyperolius semidiscus*), Painted Reed Frog (*Hyperolius marmoratus*) and Delalande's River Frog (*Amietia delalandii*) breed in the temporary vegetated pools that form on the sandy shores of the river. In general, rivers are highly sensitive ecological features and the possible presence of a threatened species (Nile Crocodile) and the confirmation of an endemic species (Dusky-bellied Water Snake) within this habitat elevates its sensitivity to high.

5.5 Mammals

Eswatini is home to 106 species of mammals, of which one is critically endangered, two are endangered, five are vulnerable, and four are near threatened (IUCN, 2018) (for the full list see Appendix C). No endemic mammal species are found in Eswatini. Up to 1996, no published information existed on Eswatini's mammals. An intensive 5-year survey resulted in the publication of a checklist (Monadjem, 1997) and a book on the mammals of Eswatini (Monadjem, 1998). Regional red list data is based on information compiled by the Endangered Wildlife Trust (EWT) and the South African National Biodiversity Institute (SANBI) for Eswatini, South Africa and Lesotho.

5.5.1 Observed Mammal Species Richness

A total of 21 mammal species were either directly observed or deduced to be present in the project area based on visual cues (sightings, tracks, scat, etc.). During the wet season surveys, 16 mammal species were recorded (Table 11), while during the dry season 12 mammal species were recorded (Table 12). This represents 19.81% of the 106 species expected (IUCN, 2019).

In general, the observed diversity and density for mammal species were low and very few signs of mammals were observed (such as spoor, diggings, etc). This contrasts starkly with the expected mammal species richness of the area, which was considered to be high. The high expected richness was attributed to the extensive size of the project area coupled with the ecological complexity of the area.

Subsistence hunting (especially with large packs of hunting dogs) and habitat destruction have caused a massive loss of large and medium-sized mammal species and population densities in the area. Consequently, the larger mammal species such as elephants, rhino and buffalo are now almost exclusively confined to conservation areas. Large and medium-sized mammals were noticeably absent from the project area. However, certain areas within the proposed project area are characterized by rocky grasslands which provide sufficient habitat and refugia to many smaller mammal species such as rodents, bats, genets and mongooses amongst others.

Sherman trapping was carried out at three sites with 11 traps (per site) for a period of four days per season, resulting in a total of 88 trap nights. Ten motion-activated camera traps were deployed for five days (per season) while a further four cameras were put out for a period that extended over three months. The long-term monitoring done by these four cameras was to ensure that the sampling is as robust as possible and that the likelihood of human disturbances in the form of mainly human scent does not decrease the chance of detecting shy animals. This also increased the chance of detecting any SCCs that could have been present.

Figure 39: Specialists deploying a motion-activated camera trap and checking a Sherman trap in the project area

During the wet and dry season surveys diurnal and nocturnal surveys were also undertaken and the presence of any mammal species/signs of mammals (scat, markings, footprints) were recorded. Bat detection was done with an Echo meter Touch 2 Pro (wildlifeacoustics.com) during the evenings (Figure 40). Nocturnal surveys were also conducted using spotlights while driving slowly through the project area.

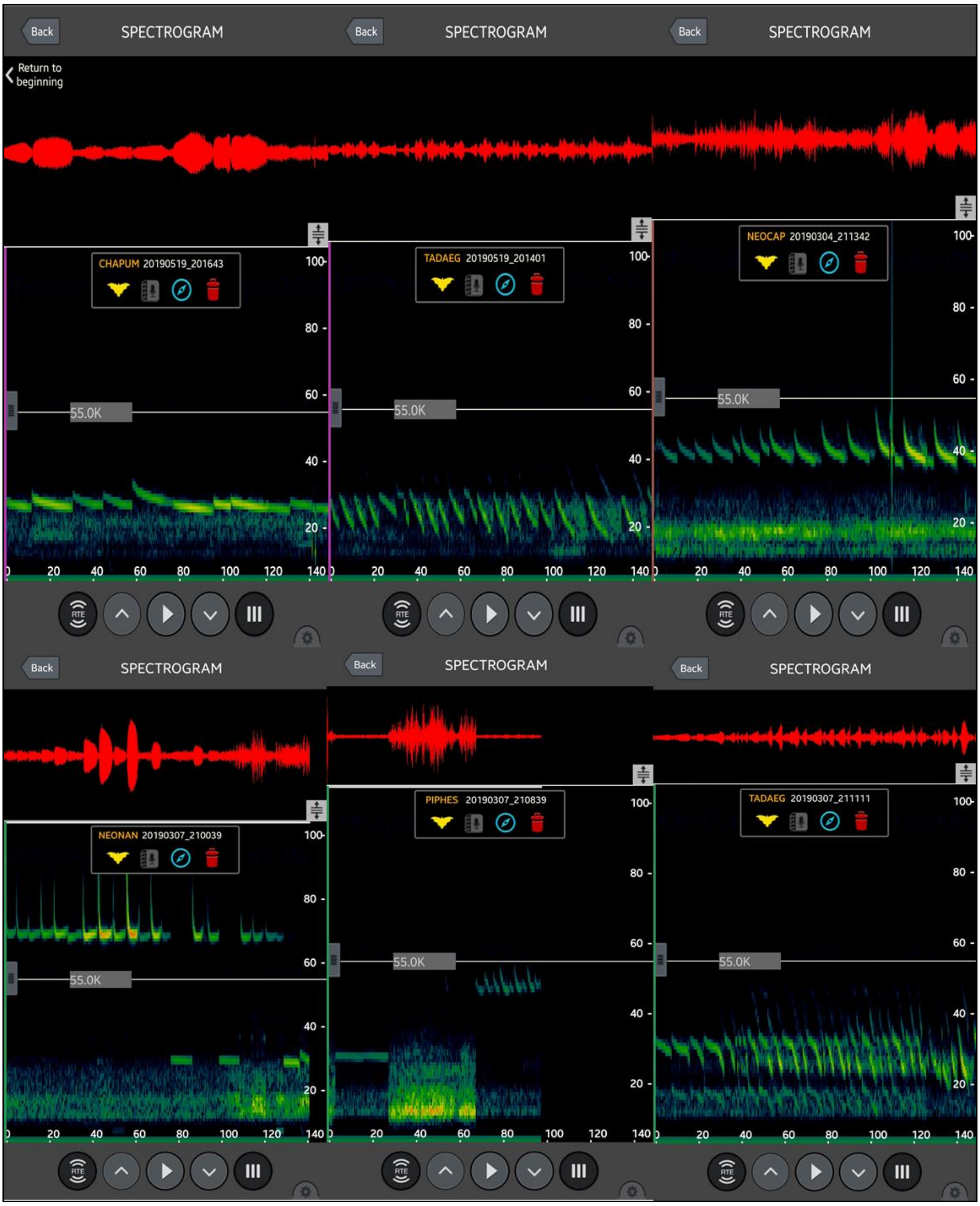


Figure 40: Screenshots of bat recordings by Echo meter Touch 2 pro

5.5.2 Wet Season Survey

A selection of photographs of mammal species observed during the wet season survey is provided in Figure 41, Figure 42 and Figure 43. The full list of observed species is shown in Table 11.

Table 11: Mammal species observed, or deduced to be present in the project area based on visual signs (tracks, scats etc.) within the proposed project area during the wet season survey

Species	Common Name	Conservation Status		Endemic
		Eswatini Regional Listing	IUCN (2019)	

Aethomys ineptus (cf)	Tete Veld Rat	LC	LC	No
Amblysomus septentrionalis	Highveld Golden Mole	NT	NT	No
Aonyx capensis	Cape (African) Clawless Otter	NT	NT	No
Atilax paludinosus	Water Mongoose	LC	LC	No
Chaerephon pumilus	Little Free-tailed Bat	LC	LC	No
Chlorocebus pygerythrus	Vervet Monkey	LC	LC	No
Genetta maculata (cf)	Rusty-spotted Genet	LC	LC	No
Herpestes sanguineus	Slender Mongoose	LC	LC	No
Ichneumia albicauda	White-tailed Mongoose	LC	LC	No
Neoromicia capensis	Cape Serotine Bat	LC	LC	No
Neoromicia nana	Banana Bat	LC	LC	No
Pipistrellus hesperidus	African Pipistrelle	LC	LC	No
Procavia capensis	Rock Hyrax	LC	LC	No
Rattus novegicus	Brown Rat	Exotic		No
Sylvicapra grimmia	Common Duiker	LC	LC	No
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	LC	No

(Red text) denotes listed species, conservation status

Figure 41: A selection of mammal species observed within the proposed project area during the wet season survey: A) Water Mongoose (Atilax paludinosus) footprint, B) Rusty-spotted Genet (Genetta maculata cf) footprint, C) Vervet Monkey (Chlorocebus pygerythrus), D) Highveld Golden Mole (Amblysomus septentrionalis), E) Rock Hyrax (Procavia capensis), and F) Tete Veld Rat (Aethomys ineptus cf)

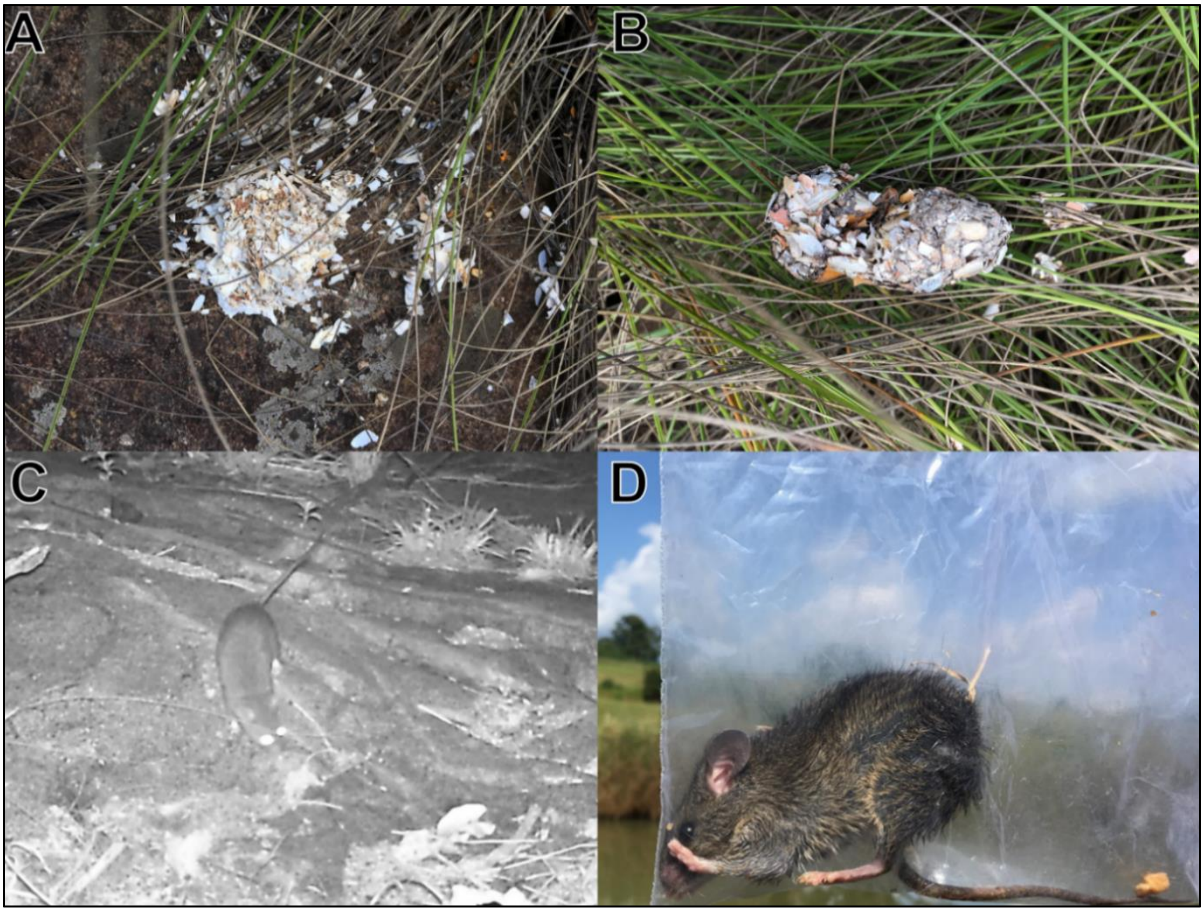


Figure 42: A selection of images of mammals observed during the wet season survey: A & B) Cape Clawless Otter (Aonyx capensis) droppings, C and D) Brown Rat (Rattus novegicus)

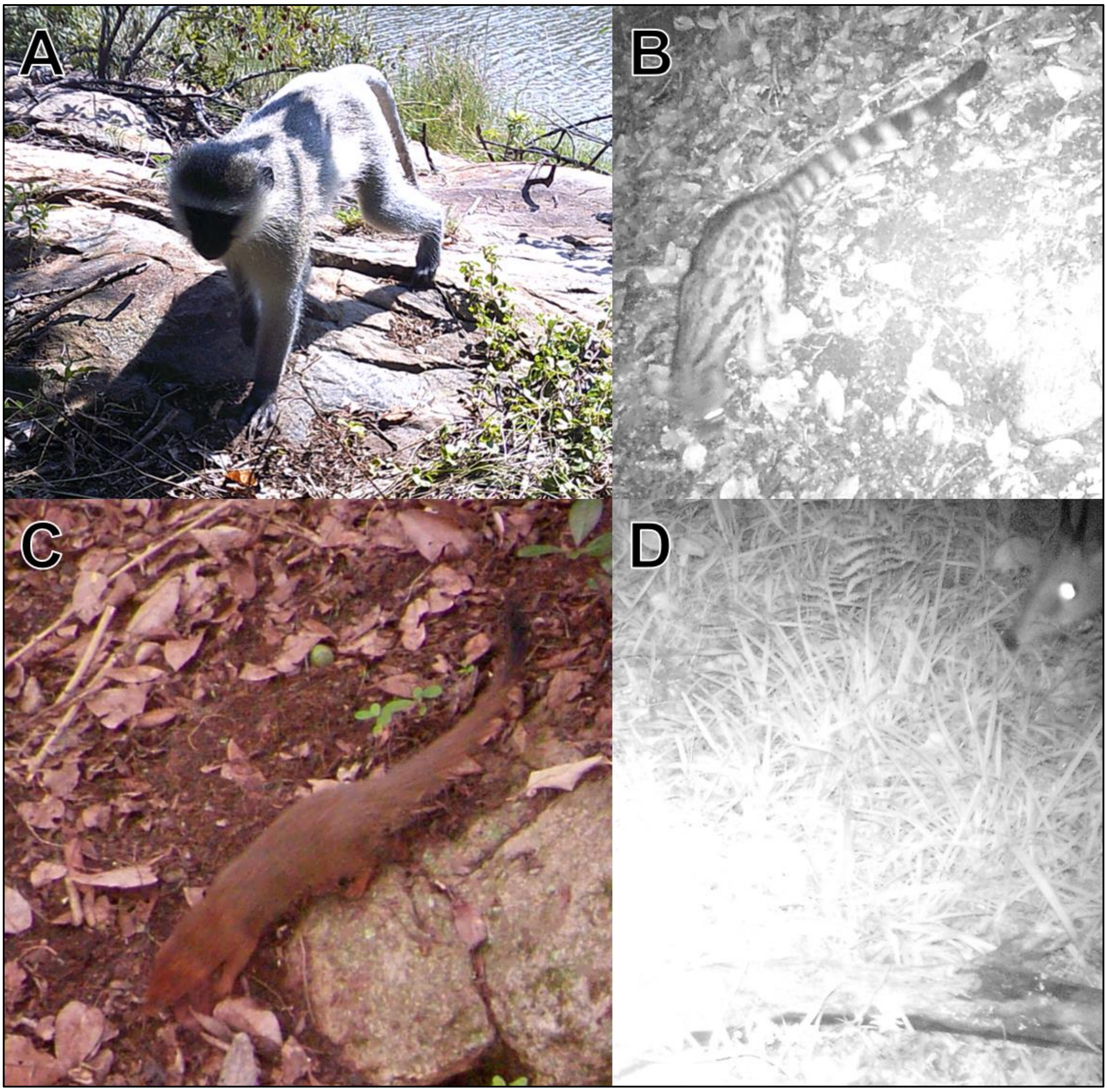


Figure 43: Some of the mammal species recorded on camera traps: A) Vervet Monkey (Chlorocebus pygerythrus), B) Rusty-spotted Genet (Genetta maculata), C) Slender Mongoose (Herpestes sanguineus) and D) Common Duiker (Sylvicapra grimmia)

5.5.3 Dry season survey

A selection of photographs of mammal species observed during the dry season survey is provided in Figure 44 and Figure 45, while the full list of species recorded are shown in Table 12.

Table 12: Mammal species observed, or deduced to be present in the project area based on visual signs (tracks, scats, etc.) within the proposed project area during the dry season survey

Species	Common Name	Conservation Status		Endemism
		Eswatini Regional Listing	IUCN (2019)	
Aethomys ineptus	Tete Veld Rat	LC	LC	No
Atilax paludinosus	Water Mongoose	LC	LC	No
Cephalophus natalensis	Natal Red Duiker*	NT	LC	No
Chlorocebus pygerythrus	Vervet Monkey	LC	LC	No
Genetta maculata	Rusty-spotted Genet	LC	LC	No

Species	Common Name	Conservation Status		Endemism
		Eswatini Regional Listing	IUCN (2019)	
Herpestes sanguineus	Slender Mongoose	LC	LC	No
Hystrix africaeaustralis	Cape Porcupine	LC	LC	No
Ichneumia albicauda	White-tailed Mongoose	LC	LC	No
Lepus saxatilis	Scrub Hare	LC	LC	No
Mastomys natalensis	Natal Multimammate Mouse	LC	LC	No
Procavia capensis	Rock Hyrax	LC	LC	No
Pronolagus crassicaudatus	Natal Red Rock Rabbit*	LC	LC	No

(Red text) denotes listed species, conservation status / (*) denote species not observed in the wet season

Figure 44: Some of the mammal species recorded in the dry season; A) Natal Multimammate Mouse (Mastomys natalensis), B) Rock Hyrax (Procavia capensis), C) White-tailed Mongoose (Ichneumia albicauda), D Slender Mongoose (Herpestes sanguineus), E) Vervet Monkey (Chlorocebus pygerythrus) and F) Scrub Hare (Lepus saxatilis) droppings

Figure 45: Some of the mammal species recorded by camera trap in the dry season; A) Rusty-spotted Genet (Genetta maculata), B) Water Mongoose (Atilax paludinosus), C) Natal Red Duiker (Cephalophus natalensis). and D) Natal Red Rock Rabbit (Pronolagus crassicaudatus)

5.5.4 Species of Conservation Concern

A total of seventeen (17) SCCs are expected in the area, three (3) of these species were recorded. They are the Cape Clawless Otter (*Aonyx capensis*), Highveld Golden Mole (*Amblysomus septentrionalis*) and Natal Red Duiker (*Cephalophus natalensis*).

Cape Clawless Otter (*Aonyx capensis*) (NT) populations are thought to be decreasing throughout most of their distributional range, mainly as a result of the declining state of freshwater ecosystems. Their habitat has either drastically changed or has been lost following bush clearing, deforestation, overgrazing, draining of wetlands or water extraction amongst others. Otters are predominantly aquatic and often use rivers and perennial streams as corridors for migration or local movement. The extensive drainage systems and the large perennial rivers within the project area offer excellent habitat and migration corridors to this species and therefore there is a high probability of this species occurring within the project area (Skinner & Chimimba, 2005; Jacques *et al*., 2015). African Clawless Otters also appear in Appendix II of CITES. The construction of the dam will have a direct impact on the species in the form of habitat destruction.

Highveld Golden Mole (*Amblysomus septentrionalis*) (NT) range are being threatened by habitat degradation associated with the mining of shallow coal deposits. Their habitats range from marshes in grasslands to friable soils on mountainsides. The Highveld Golden Mole does not appear on CITES listings (CITES, 2019). This species was found in the greater DMU (i.e not within the inundation zone), it is however likely that other members of this species might be impacted by the filling of the dam.

Natal Red Duiker (*Cephalophus natalensis*) (NT) are thought to be threatened by hunting and trapping, as well as by the loss of suitable habitat. Their habitats are restricted to evergreen forests and riverine thickets (Rowe-Rowe, 1994). The Natal Red Duiker does not appear on CITES listings. This species was found outside the inundation zone, but inside the DMU. There is sufficient habitat for this species to relocate to new habitats should this be necessary. It must be noted however that the relocation of the local villagers into new areas might result in the hunting of the Natal Red Duiker within the relocation area.

5.5.5 Mammal Habitat Association

In order to determine the strength of the association of the observed mammal species with their habitat a Detrended Correspondence Analysis (DCA) was done. DCA is a multivariate statistical analysis, based on binary presence-absence data of the species with the different habitats. The species richness was divided into the habitat associations; this is shown in Figure 46. It can clearly be seen that the Cape Clawless Otter (CapClwO) and Water Mongoose (WatrMong) have a very high affinity for the wetland riverine area (Wetl/Ri), while the Highveld Golden Mole (HigGolM) and Natal Red Rock Rabbit (NatRedRc) can be found in the Semi-natural Rocky Grasslands (SemRocGr). The Banana Bat (BananBat) has a strong association with the transformed homesteads and subsistence farming (TraHomAn), this is due to the large numbers of Banana trees in the area that this insectivorous bat uses for roosting. The association of the Natal Red Duiker (NatRedDu) with the Semi Indigenous trees habitat is as a result of the forest and thicket habitats that these species are restricted to. The other species (Figure 46) are mostly generalist with no restriction to their habitat preference and are more likely to adapt to new habitats.

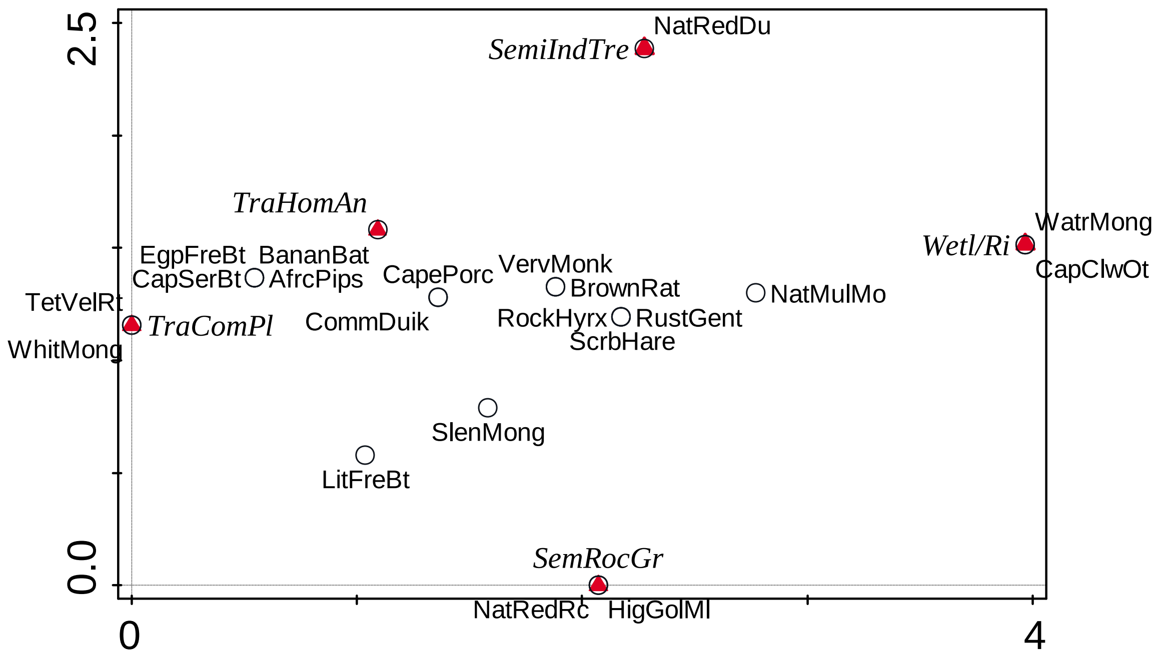


Figure 46: DCA plot of the mammal species found with their habitat associations.

Some of the species were found in more than one habitat. However, this does not mean that the species is a resident in the area but may still utilise the habitat for foraging. In total, the largest number of species were found in the Semi-natural: Rocky Grasslands (27%) followed by the transformed: Commercial Plantations/Transformed: alien invasive tree clumps that account for 22% of the species (Figure 47).

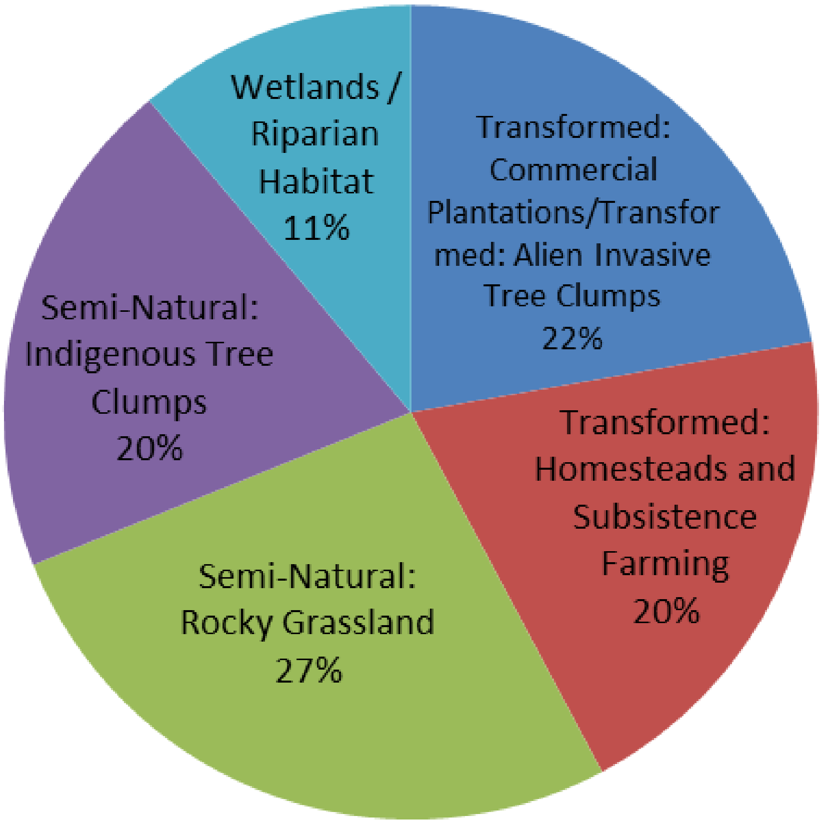


Figure 47: The percentage of mammal species found in each habitat type.

5.5.6 Habitat Sensitivity

The habitat sensitivity of the mammals is based on the number of species as well as SCCs found in each habitat type (Figure 48). Areas given a high sensitivity are important habitats for the species and in most cases are still in a natural condition. This was also given a high rating because of the importance of the areas as a water source for mammal species. One SCC found exclusively in the areas given a high sensitivity is the *Aonyx capensis* (*Aonyx capensis*). While the areas given a low sensitivity are mostly the areas surrounding the homesteads where the habitat has been altered extensively and does not support a large number of mammal species anymore. Moderate sensitivity was given to areas that mostly function as habitats for generalist species.

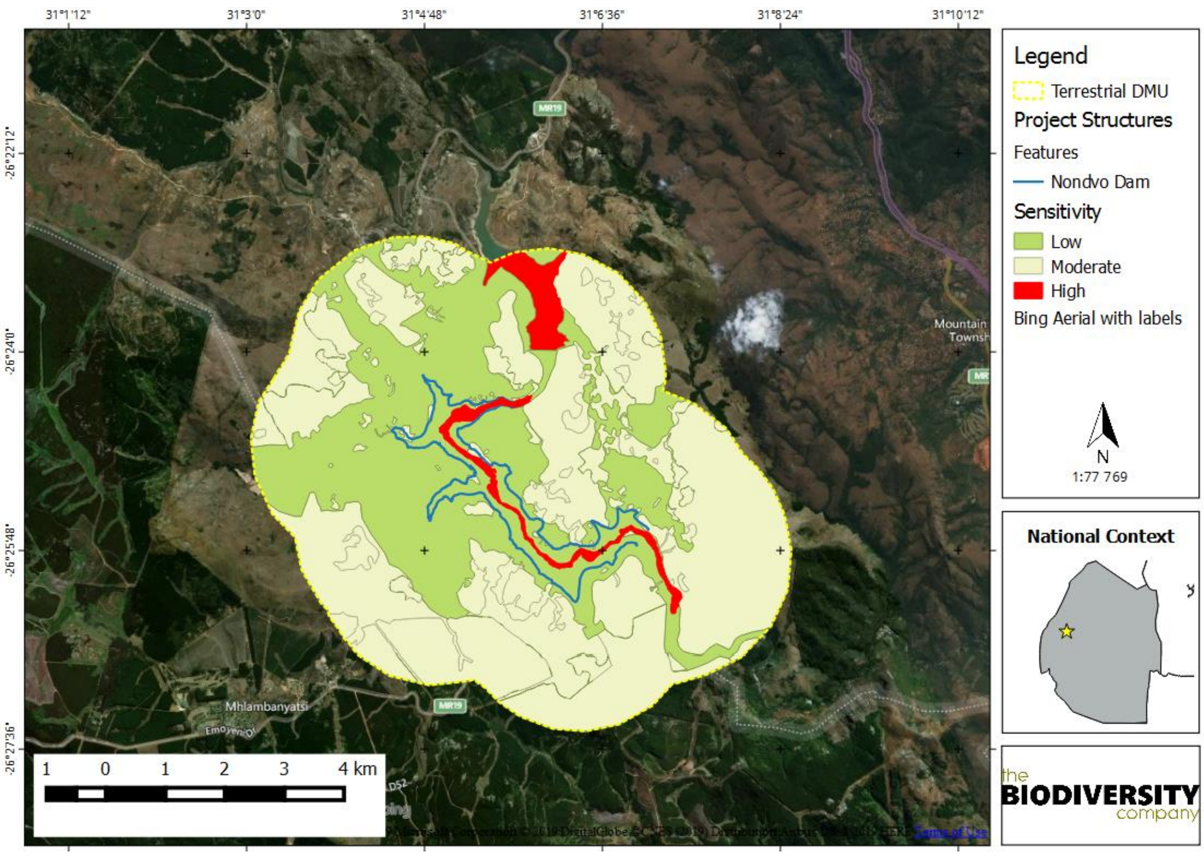


Figure 48: Habitat sensitivity of the mammal habitats.

5.6 Avifauna

5.6.1 National Context

Eswatini is home to 518 bird species, of which four are introduced species (Rock Dove, Indian Myna, House Sparrow (considered naturalised) and Rose-ringed Parakeet). Twenty threatened species occur in Eswatini globally (Lepage, 2009; Lepage, 2019). Of the 518 species found in the area, 52 are only rarely or accidentally seen, they are species such as Dark Chanting-Goshawk (*Melierax metabates*), Rufous-bellied Heron (*Ardeola rufiventris*) and Great White Pelican (*Pelecanus onocrotalus*). The diversity of birds is considered high despite the relatively small size of the country (17,364 km ^{2}). The spread of birds can be found across the country's six physiographic zones: Highveld, Upper Middleveld, Lower Middleveld, Western Lowveld, Eastern Lowveld and Lubombo Range (Remmelzvaal, 1993) or four ecosystems: montane grassland, savanna-woodland mosaic, forest, and aquatic systems. Eswatini does not have bird species that are endemic, however; 52 species can be found that are near-endemic and occur only in Eswatini and South Africa (CBD, 2009). Of the near-endemic birds, 50% occur in the grassland, 25% in the savanna-woodland, 23% in the forest, and 1% in the aquatic ecosystem (Monadjem *et al.,* 2003).

According to IUCN (2019), the country supports two critically endangered birds (*Necrosyrtes monachus* (Hooded Vulture) and *Gyps africanus* (White-backed Vulture)); three endangered birds, six near-threatened birds, and six vulnerable species.

5.6.2 Regional Context

Three IBAs can be found in Eswatini according to Birdlife International. These IBAs cover 580km^2, or 3.3%, of the area of the country. They are the Malolotja Nature Reserve IBA, Hlane and Mlawula Game Reserves IBA, and Mahamba Mountain IBA.

The closest IBA to the project area is the Malolotja Nature Reserve IBA, which is approximately 38 km from the site. This 1800 ha nature reserve is home to 280 bird species and one of the only places Blue Swallow (*Hirundo atrocaerulea*) can be seen regularly (Birdlife International, 2019). Other significant species found here include Denham's Bustard (*Neotis denhami*), Ground Woodpecker *(Geocolaptes olivaceus*), Striped Flufftail (*Sarothrura affinis*), Black-winged Lapwing (*Vanellus melanopterus),* Southern Bald Ibis (*Geronticus calvus*), Sentinel Rock-Thrush (*Monticola explorator),* Buff-streaked Chat (*Oenanthe bifasciata*), Broad-tailed Warbler (*Schoenicola brevirostris*), Eastern Long-billed Lark (*Certhilauda semitorquata*) and Gurney's Sugarbird (*Promerops gurneyi*) (Cohen *et al.,* 2006). The site is dominated by the rugged mountains of the Silotfwane, Mgwayiza and Ngwenya ranges. Steep valleys and gorges cut into this mountain escarpment, while deep river valleys and gentle rolling grassland plains dominate the adjacent landscape. Sour highland grassveld covers the gently undulating hills and slopes interspersed with narrow drainage lines (Birdlife International, 2019). The project area has similar habitat to the IBA and as such similar species can have been expected to occur in the area, should the area not have been disturbed by human presence.

5.6.3 Local Context

More than 300 species (Appendix F) have been recorded in the general area (Roberts multi-media database, 2015). The SSC include Blue Swallow *(Hirundo atrocaerulea),* Red-winged Francolin *(Scleroptila levaillantii),* Denham's Bustard *(Neotis denhami)* and White-bellied Korhaan *(Eupodotis senegalensis)* and are resident. Other grassland species of interest include Black-winged Lapwing *(Vanellus melanopterus)* and Broad-tailed Warbler *(Schoenicola brevirostris).* Buff-streaked Chat *(Campicoloides bifasciata)* is found on exposed Rocky Grassland slopes and Gurney's Sugarbird *(Promerops gurneyi)* is common (Birdlife South Africa, 2017).

The Riverine habitat associated with the Lusushwana River includes species such as African Finfoot *(Podica senegalensis)*, Half-collared Kingfisher *(Alcedo semitorquata),* and Mountain Wagtail *(Motacilla clara)*. The associated forests and exotic plantations can include Bat Hawk *(Macheiramphus alcinus)* and the "near-threatened" Crowned Eagle *(Stephanoaetus coronatus),* Forest Buzzard *(Buteo trizonatus),* African Cuckoo Hawk *(Aviceda cuculoides),* Tambourine Dove *(Turtur tympanistria),* Bush Blackcap *(Lioptilus nigricapillus),* Barratt's Warbler *(Bradypterus barratti),* Olive Bush-Shrike *(Chlorophoneus olivaceus),* Black-bellied Starling *(Notopholia corrusca),* Olive Sunbird *(Cyanomitra olivacea),* Swee Waxbill *(Coccopygia melanotis),* Green Twinspot *(Mandingoa nitidula)* and Forest Canary *(Crithagra scotops).*

5.6.4 Wet Season Survey

During the wet season survey, 93 species were recorded. In Appendix F a full list of the expected species found in quadrants based on SABAP2 can be found, with the observed species presented in Table 13. Some of the species observed in the wet season are shown in Figure 49 and Figure 50. Table 14 shows a statistical summary of the species recorded during the wet season.

Table 13: Avifauna species observed during the wet season

Species	Common Name	Conservation Status Regional (ESKOM, 2015)	IUCN (2019)
Accipiter tachiro	Goshawk, African	Unlisted	LC
Alcedo cristata	Kingfisher, Malachite	Unlisted	Unlisted
Alopochen aegyptiacus	Goose, Egyptian	Unlisted	LC
Anas sparsa	Duck, African Black	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Andropadus importunus	Greenbul, Sombre	Unlisted	LC

Species	Common Name	Conservation Status Regional (ESKOM, 2015)	IUCN (2019)
Anthus leucophrys	Pipit, Plain-backed	Unlisted	LC
Apalis thoracica	Apalis, Bar-throated	Unlisted	LC
Apus affinis	Swift, Little	Unlisted	LC
Ardea cinerea	Heron, Grey	Unlisted	LC
Batis capensis	Batis, Cape	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC
Buteo buteo	Buzzard, Steppe	Unlisted	LC
Buteo rufofuscus	Buzzard, Jackal	Unlisted	LC
Buteo trizonatus	Buzzard, Forest	Unlisted	NT
Butorides striata	Heron, Green-backed	Unlisted	LC
Camaroptera brachyura	Camaroptera, Green-backed	Unlisted	LC
Cecropis abyssinica	Swallow, Lesser Striped	Unlisted	LC
Centropus burchellii	Coucal, Burchell's	Unlisted	Unlisted
Cercomela familiaris	Chat, Familiar	Unlisted	LC
Ceryle rudis	Kingfisher, Pied	Unlisted	LC
Chalcomitra amethystina	Sunbird, Amethyst	Unlisted	LC
Chlidonias leucopterus	Tern, White-winged	Unlisted	LC
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC
Cinnyris afer	Sunbird, Greater Double-collared	Unlisted	LC
Cisticola aberrans	Cisticola, Lazy	Unlisted	LC
Cisticola fulvicapilla	Neddicky, Neddicky	Unlisted	LC
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC
Cisticola textrix	Cisticola, Cloud	Unlisted	LC
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC
Colius striatus	Mousebird, Speckled	Unlisted	LC
Columba livia	Dove, Rock	Unlisted	LC
Corvus albus	Crow, Pied	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Cossypha heuglini	Robin-Chat, White-browed	Unlisted	LC
Crithagra mozambicus	Canary, Yellow-fronted	Unlisted	LC
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Dryoscopus cubla	Puffback, Black-backed	Unlisted	LC
Emberiza flaviventris	Bunting, Golden-breasted	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Falco biarmicus	Falcon, Lanner	VU	LC
Gallirex porphyreolophus	Turaco, Purple-crested	Unlisted	LC
Geronticus calvus	Ibis, Southern Bald	VU	VU
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC
Hedydipna collaris	Sunbird, Collared	Unlisted	LC
Hirundo atrocaerulea	Swallow, Blue	CR	VU
Hirundo fuligula	Martin, Rock	Unlisted	Unlisted
Hirundo rustica	Swallow, Barn	Unlisted	LC

Species	Common Name	Conservation Status Regional (ESKOM, 2015)	IUCN (2019)
Indicator minor	Honeyguide, Lesser	Unlisted	LC
Laniarius ferrugineus	Boubou, Southern	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Lonchura cucullata	Mannikin, Bronze	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Macronyx croceus	Longclaw, Yellow-throated	Unlisted	LC
Merops apiaster	Bee-eater, European	Unlisted	LC
Milvus migrans	Kite, Black	Unlisted	LC
Mirafra africana	Lark, Rufous-naped	Unlisted	LC
Motacilla aguimp	Wagtail, African Pied	Unlisted	LC
Motacilla clara	Wagtail, Mountain	Unlisted	LC
Muscicapa caerulescens	Flycatcher, Ashy	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Onychognathus morio	Starling, Red-winged	Unlisted	LC
Oriolus larvatus	Oriole, Black-headed	Unlisted	LC
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Phylloscopus trochilus	Warbler, Willow	Unlisted	LC
Ploceus cucullatus	Weaver, Village	Unlisted	LC
Ploceus ocularis	Weaver, Spectacled	Unlisted	LC
Pogoniulus chrysoconus	Tinkerbird, Yellow-fronted	Unlisted	LC
Prinia subflava	Prinia, Tawny-flanked	Unlisted	LC
Promerops gurneyi	Sugarbird, Gurney’s	Unlisted	NT
Pternistis swainsonii	Spurfowl, Swainson's	Unlisted	LC
Pycnonotus tricolor	Bulbul, Dark-capped	Unlisted	Unlisted
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Sarothrura elegans	Flufftail, Buff-spotted	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Scopus umbretta	Hamerkop, Hamerkop	Unlisted	LC
Sphenoeacus afer	Grassbird, Cape	Unlisted	LC
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Strix woodfordii	Owl, African Wood	Unlisted	LC
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC
Tachymarptis melba	Swift, Alpine	Unlisted	LC
Terpsiphone viridis	Paradise-flycatcher, African	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Turdus olivaceus	Thrush, Olive	Unlisted	LC
Turtur chalcospilos	Wood-dove, Emerald-spotted	Unlisted	LC
Upupa africana	Hoopoe, African	Unlisted	LC
Uraeginthus angolensis	Waxbill, Blue	Unlisted	LC
Vanellus melanopterus	Lapwing, Black-winged	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC

Species	Common Name	Conservation Status Regional (ESKOM, 2015)	IUCN (2019)
Zosterops virens	White-eye, Cape	Unlisted	LC

(Red text) denotes listed species, conservation status

Table 14: Statistical summary of the total number of species, species of conservation concern and near-endemic species observed within the project area.

Parameter	Expected (% of Local estimate)	Observed (% of expected estimate)
Total number of species (SABAP2)	212 (42 %)	93 (44 %)
Number of globally threatened/near-threatened species (IUCN, 2017)	18 (64 %)	3 (16 %)
Number of near-endemic species (shared with 3 or less countries)	49 (84 %)	26 (53 %)

Figure 49: Some of the bird species observed in the wet season: A) Yellow-throated Longclaw (Macronyx croceus), B) Cattle Egret (Bubulcus ibis), C) African Paradise Flycatcher (Terpsiphone viridis), D) Dark capped Bulbul (Pycnonotus tricolor), E) Buff-streaked Chat (Oenanthe bifasciata) and F) Amethyst Sunbird (Chalcomitra amethystina)

Figure 50: Some of the bird species observed in the wet season: A) Red-collared Widowbird (Euplectes ardens), B) Pin-tailed Whydah (Vidua macroura), C) Burchell's Coucal (Centropus burchellii), D) African Wood Owl (Strix woodfordii), E) Steppe Buzzard (Buteo buteo), and F) Lesser Striped Swallow (Hirundo abyssinica)

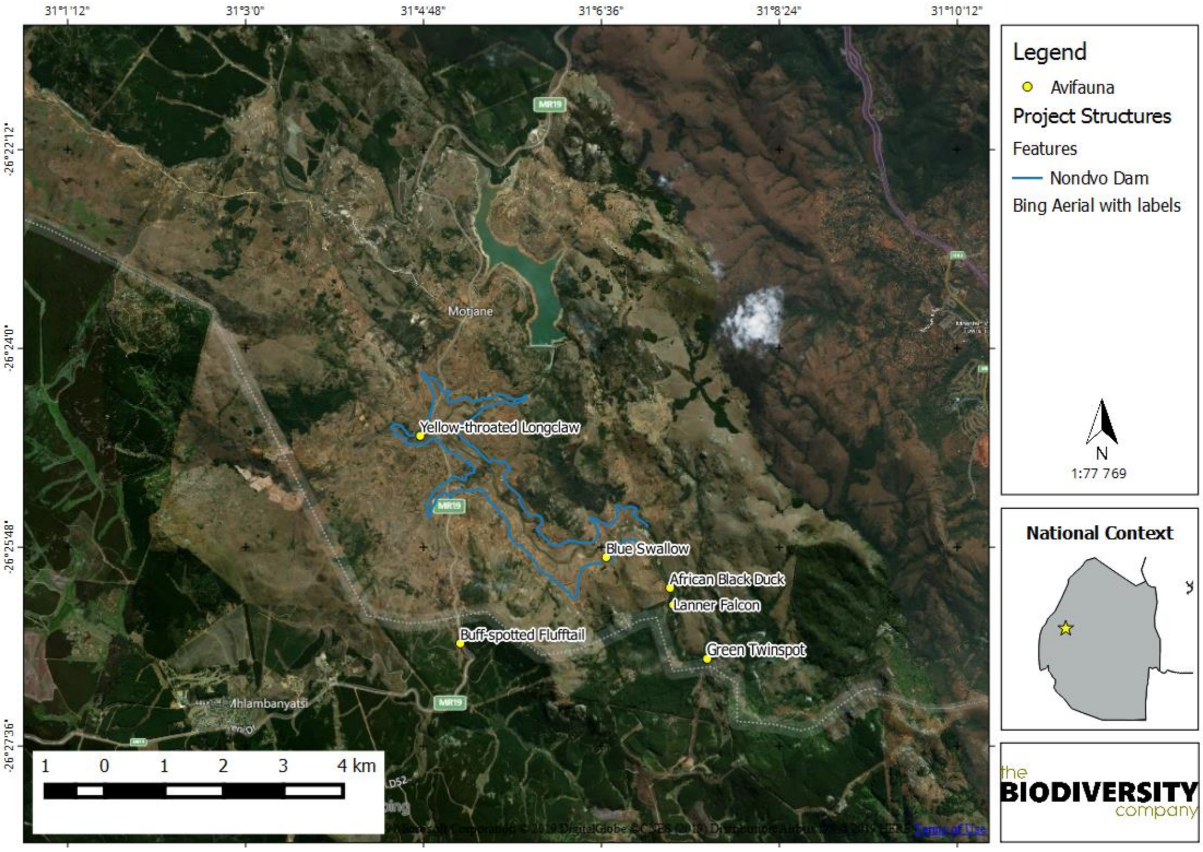


Figure 51: Location of some avifaunal species observed during the wet season

5.6.5 Dry Season Survey

During the dry season survey, 77 avifaunal species were observed, the full list of species found is shown in Table 15. Figure 52 and Figure 53 shows some of the species recorded in the project area during the dry season. One avifaunal SCC was recorded – the Lanner Falcon, which is listed as VU.

Table 15: Avifaunal species recorded in the project area during the dry season

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Accipiter melanoleucus	Sparrowhawk, Black	Unlisted	LC
Acridotheres tristis	Myna, Common	Unlisted	LC
Acrocephalus arundinaceus	Reed-warbler, Great	Unlisted	LC
Alcedo cristata	Kingfisher, Malachite	Unlisted	Unlisted
Amaurornis flavirostris	Crake, Black	Unlisted	LC
Anas sparsa	Duck, African Black	Unlisted	LC
Andropadus importunus	Greenbul, Sombre	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bradornis pallidus	Flycatcher, Pale	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Buteo rufofuscus	Buzzard, Jackal	Unlisted	LC
Centropus burchellii	Coucal, Burchell's	Unlisted	Unlisted
Cercotrichas leucophrys	Scrub-robin, White-browed	Unlisted	LC
Chalcomitra amethystina	Sunbird, Amethyst	Unlisted	LC
Cinnyris afer	Sunbird, Greater Double-collared	Unlisted	LC

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Cinnyris talatala	Sunbird, White-bellied	Unlisted	LC
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC
Colius striatus	Mousebird, Speckled	Unlisted	LC
Columba guinea	Pigeon, Speckled	Unlisted	LC
Corvus albus	Crow, Pied	Unlisted	LC
Corvus capensis	Crow, Cape	Unlisted	LC
Corythaixoides concolor	Go-away-bird, Grey	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Crithagra mozambicus	Canary, Yellow-fronted	Unlisted	LC
Crithagra sulphurata	Canary, Brimstone	Unlisted	Unlisted
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Dryoscopus cubla	Puffback, Black-backed	Unlisted	LC
Emberiza tahapisi	Bunting, Cinnamon-breasted	Unlisted	LC
Estrilda astrild	Waxbill, Common	Unlisted	LC
Falco biarmicus	Falcon, Lanner	VU	LC
Fulica cristata	Coot, Red-knobbed	Unlisted	LC
Gallirex porphyreolophus	Turaco, Purple-crested	Unlisted	LC
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC
Hirundo rustica	Swallow, Barn	Unlisted	LC
Hypargos margaritatus	Twinspot, Pink-throated	Unlisted	LC
Lagonosticta rubricata	Firefinch, African	Unlisted	LC
Laniarius ferrugineus	Boubou, Southern	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Lonchura cucullata	Mannikin, Bronze	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Macronyx capensis	Longclaw, Cape	Unlisted	LC
Macronyx croceus	Longclaw, Yellow-throated	Unlisted	LC
Megaceryle maximus	Kingfisher, Giant	Unlisted	Unlisted
Merops pusillus	Bee-eater, Little	Unlisted	LC
Monticola rupestris	Rock-thrush, Cape	Unlisted	LC
Motacilla aguimp	Wagtail, African Pied	Unlisted	LC
Motacilla capensis	Wagtail, Cape	Unlisted	LC
Muscicapa adusta	Flycatcher, African Dusky	Unlisted	LC
Oenanthe bifasciata	Chat, Buff-streaked	Unlisted	LC
Onychognathus morio	Starling, Red-winged	Unlisted	LC
Oriolus larvatus	Oriole, Black-headed	Unlisted	LC
Pandion haliaetus	Osprey	Unlisted	LC
Parisoma subcaeruleum	Tit-babbler, Chestnut-vented	Unlisted	Unlisted
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Passer melanurus	Sparrow, Cape	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC
Ploceus cucullatus	Weaver, Village	Unlisted	LC

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC
Prinia subflava	Prinia, Tawny-flanked	Unlisted	LC
Pternistis natalensis	Spurfowl, Natal	Unlisted	LC
Pycnonotus tricolor	Bulbul, Dark-capped	Unlisted	Unlisted
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Riparia paludicola	Martin, Brown-throated	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Thamnolaea cinnamomeiventris	Cliff-chat, Mocking	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Turdus olivaceus	Thrush, Olive	Unlisted	LC
Turdus smithi	Thrush, Karoo	Unlisted	LC
Upupa africana	Hoopoe, African	Unlisted	LC
Uraeginthus angolensis	Waxbill, Blue	Unlisted	LC
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC
Zosterops virens	White-eye, Cape	Unlisted	LC

Table 16: Statistical summary of the total number of species, species of conservation concern and near-endemic species observed within the project area.

Parameter	Expected (% of local estimate)	Observed (% of expected estimate)
Total number of species (SABAP2)	212 (42 %)	77 (36 %)
Number of globally threatened/near-threatened species (IUCN, 2017)	18 (64 %)	1 (0.05 %)
Number of near-endemic species (shared with 3 or less countries)	49 (84 %)	22 (44 %)

Figure 52: Some of the avifaunal species recorded in the dry season; A) Cape Wagtail (Motacilla capensis), B) Jackal Buzzard (Buteo rufofuscus), C) Little Bee-eaters (Merops pusillus), D) Olive Thrush (Turdus olivaceus), E) Southern Grey-headed Sparrow (Passer diffusus) and F) Common Fiscal (Lanius collaris)

Figure 53: Some of the avifaunal species recorded in the dry season; A) Buff Streaked Chat (Oenanthe bifasciata), B) Crested Barbet (Trachyphonus vaillantii), C) Brown Hooded Kingfisher (Halcyon albiventris), D) Cattle Egret (Bubulcus ibis), E) Giant Kingfisher (Megaceryle maximus), and F) Greater Double-collared Sunbird (Cinnyris afer)

5.6.6 Avifaunal Trophic Guilds

Overall, the project area supports a moderate to high density of small to medium-sized birds comprised mainly of seed and insect-eating species, but also includes some large raptors. Large raptors detected on-site included Lanner Falcon, Jackal Buzzard and Forest Buzzard. One larger raptor, namely the Osprey, was observed in the downstream area.

Analysis of the major avifaunal trophic guilds (Figure 54) reveals that the species composition within the project area is dominated by diurnal ground insectivores (IGD), granivores (IGD) and omnivores (OMD). This pattern is true for both the wet and the dry season. This guild pattern makes sense given the large portions of the Rocky Grassland habitats in the project area, which provides an abundance of high seed yielding grasses and weedy annuals. In contrast, nocturnal carnivores (CGN and CAN) were the least prevalent and occupied a lower representation than would be expected, based on the number of expected species of this class. This can be explained by the presence of rural development in the area and likely cultural beliefs that portray owls as omens of bad luck and death (for example), ultimately resulting in their persecution and death (EWT, 2015). The extensive impacts on the Riverine habitat and its disturbed nature might explain the lack of water-associated insectivores (IWD).

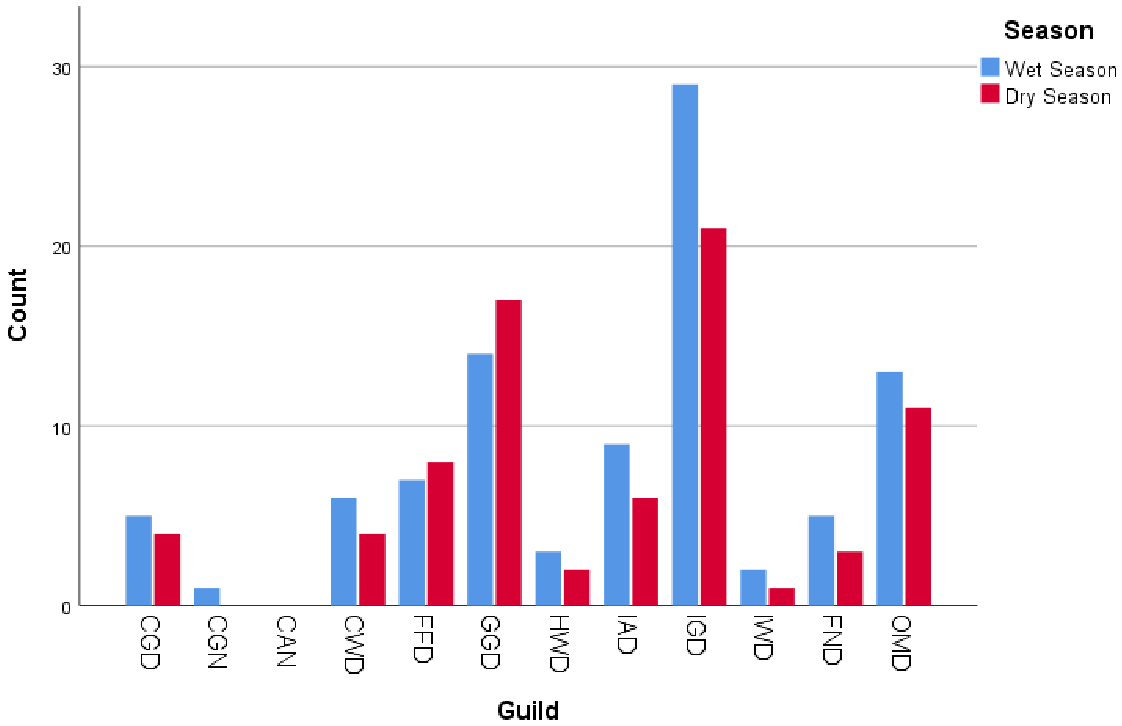


Figure 54: Avifaunal trophic guilds. CGD, carnivore ground diurnal; CGN, carnivore ground nocturnal, CAN, carnivore air nocturnal, CWD, carnivore water diurnal; FFD, frugivore foliage diurnal; GGD, granivore ground diurnal; HWD, herbivore water diurnal; IAD, insectivore air diurnal; IGD, insectivore ground diurnal; IWD, insectivore water diurnal; NFD, nectivore foliage diurnal; OMD, omnivore multiple diurnal.

5.6.7 Avifauna Habitat Association

Five avifaunal habitat types were identified within the project area, namely the Riverine (Riparian and Wetland) Habitat; Transformed: Commercial Plantations/Transformed: Alien Invasive Tree Clumps Habitat; Transformed: Homesteads and Subsistence Farming Habitat; Semi-Natural: Indigenous Tree Clumps Habitat and Semi-Natural: Rocky Grassland Habitat. Most species were recorded in the rocky grassland followed by the semi-natural tree clumps. The distribution of avifaunal species per habitat types is presented in Figure 55.

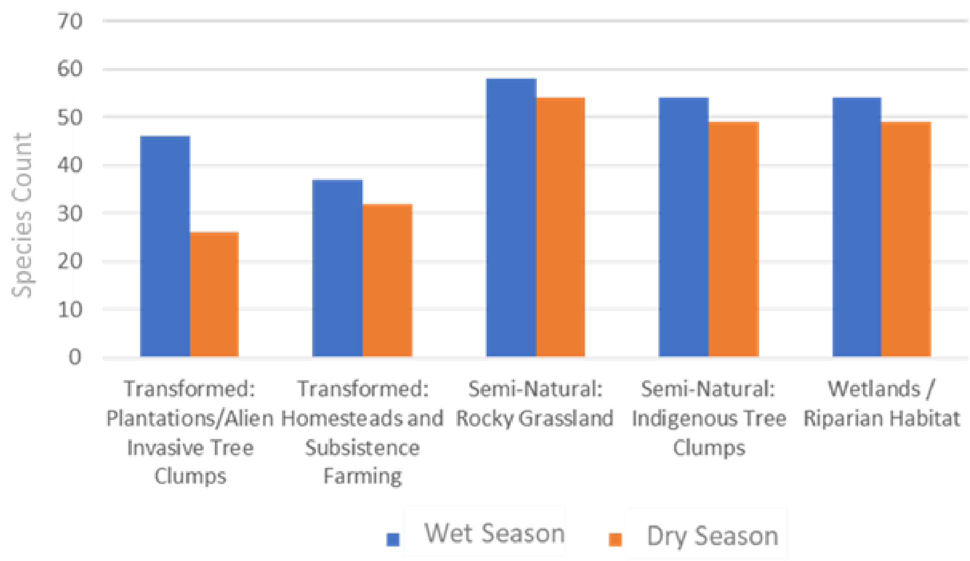


Figure 55: The species habitat distribution.

The non-metric multidimensional scaling (NMDS) ordination, shown in Figure 56, provides a visual representation of the difference / similarity in the species composition among the five habitat types. From the ordination plot it is evident that the Riverine and Rocky Grassland bird assemblage is largely distinct from the assemblages associated with the Homestead and Alien Vegetation (plantation) avifaunal species assemblages. Furthermore, Indigenous Tree Clumps avifaunal assemblages have a stronger association with those of the Rocky Grassland than those of the Riverine habitat.

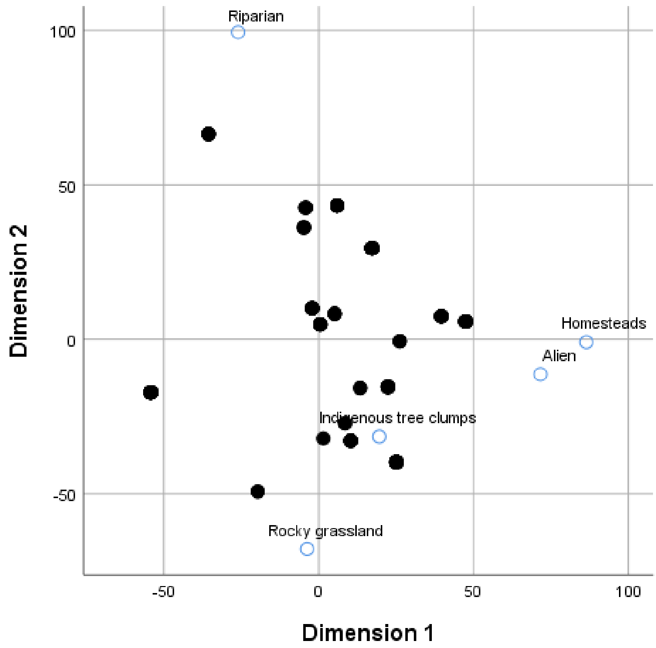


Figure 56: A non-metric multidimensional scaling ordination of the relative abundances of bird species based on Euclidean distance with a Kruskals stress of 0.32.

5.6.7.1 Riverine (Riparian and Wetland) Habitat

This habitat starts at the Luphohlo Dam and extends along the Lusushwana River. The riparian habitat provides important foraging habitat for darters, cormorants, ducks, geese and Kingfishers. Its steep banks provide nesting habitat for bee-eaters and kingfishers. However, significant mudflats and shallow shoreline habitats are largely lacking; limiting the number of wading bird species likely to occur. Nevertheless, densely vegetated backwaters provide suitable habitat for crakes, and moorhens. The riparian understory is characterised by an abundance of small estrildids. Noteworthy species typically associated with this habitat included Green-backed Heron, Black Crake, Burchel's Coucal, Pied Kingfisher, Brown-hooded Kingfisher, Giant Kingfisher, Malachite Kingfisher, White-browed Robin-Chat, Purple-crested Turaco, Great Reed-warbler, African Black Duck and Sombre Greenbul.

5.6.7.2 Transformed: Commercial Plantations/ Alien Invasive Tree Clumps

This habitat represents areas where Pine and *Eucalyptus* sp trees are commercially grown. These areas have been extensively altered and do not support a great number of species. A few insectivorous species can be found on the fringes of these plantations, one such species is the Common Fiscal. Alien vegetation was also prevalent in the project area, with a large number of clumps found. These plants often have fruits that attract species such as the Red-faced Mousebird, Speckled Mousebird, Grey go-away-bird, Black Collared - and Crested Barbets.

5.6.7.3 Transformed: Homesteads and Subsistence Farming

This habitat represents land that has been completely transformed through anthropogenic land-use practices (e.g. settlements, croplands, infrastructure and soccer fields). The avifaunal assemblage associated with it is characterised by common, adaptable and commensal species. Species that occurred in particularly high abundances within this habitat include Pied Crow, Dark-capped Bulbul, Bronze Mannikin and House Sparrow.

5.6.7.4 Semi-Natural: Indigenous Tree Clumps

This habitat is formed by tall indigenous trees and shrubs forming forest-bushveld areas. The under-canopy of this habitat is dominated by grasses and some ferns. Avifaunal species associated with this habitat include Forest Buzzard, Ashy Flycatcher, Cape White-eye, Greater Double-collared Sunbird and Buff-spotted Flufftail.

5.6.7.5 Semi-Natural: Rocky Grassland

This habitat covers the largest area of the DMU and as such supports the greatest number of species. It is made up of open grasslands with sections of rocky outcrops. This habitat supports a range of species including granivores, omnivores, insectivores and even carnivores. A number of prey species were observed in this area for predatory bird species such as the Jackal Buzzard. Smaller species include Yellow-throated Longclaw, Fork-tailed Drongo, Buff-streaked Chat, African Stone Chat, Mocking Cliff Chat and Natal Spurfowl.

Figure 57: Bird species associated with some of the habitats they occur in; A) Sombre Greenbul (Andropadus importunus) wetland/riparian and semi natural indigenous tree clumps, B) White-browed Robin-chat (Cossypha heuglini) riparian and wetland vegetation, C) Fan-tailed Widow (Euplectes axillaris) semi natural rocky grasslands, D) Greater double collared Sunbird (Cinnyris afer) semi natural indigenous tree clumps, E) Familiar Chat (Oenanthe familiaris) Rocky grasslands, F) Red-collared Widow (Euplectes ardens) riparian and wetland habitat, G) Pin-tailed Wydah (Vidua macroura) homesteads and subsistence farming areas, H) Lesser striped swallow (Cecropias abyssinica) fringes of the plantations and in the alien vegetation clumps and I) Yellow-throated Longclaw (Macronyx croceus) rocky grassland.

5.6.8 Species of Conservation Concern

The species below are the avifaunal SCC (Table 17) that were observed within the project area. A more in-depth description of their habitats is found below.

Table 17: Avifaunal SCCs recorded in the project area

Species	Common Name	Conservation Status	
		Regional (Eskom, 2015)	IUCN (2019)
Buteo trizonatus	Buzzard, Forest	Unlisted	NT
Falco biarmicus	Falcon, Lanner	VU	LC
Geronticus calvus	Ibis, Southern Bald	VU	VU
Hirundo atrocaerulea	Swallow, Blue	CR	VU

Forest Buzzard (*Buteo trizonatus*) was found on the forest fringes in the DMU, this species is listed as NT (IUCN, 2019). This species is commonly found in Afromontane forests and plantations, especially pine and eucalyptus plantations. Prey includes vlei rat, striped mouse, sombre greenbul, juvenile francolins, various snake and lizard species. This species breeds in trees, where the nest is made of a platform of sticks (Roberts, 2018). Seeing that the plantations will not form part of the inundation zone the likelihood of this species being negatively influenced by the development is low.

Lanner Falcon (*Falco biarmicus)* was observed in both the wet and dry season surveys indicating that this species is resident in the area. This VU bird (IUCN, 2019) is often found in open grassland or woodlands near cliffs or electric pylons. Their diet consists of 80% of birds, but also preys on mammals, reptiles and insects (Roberts, 2018). This species nests on cliffs. The cliffs they were noticed close to will not be directly in the inundation area. Although they might be disturbed by the water, sufficient cliffs are found in the area to which they will be able to move.

Southern Bald Ibis *(Geronticus calvus)* was mainly observed in the upper grasslands of the project area, but were also seen next to the river. This VU species' diet consists mainly of insects but does also feed on smaller mammals, amphibians and occasionally carrion (IUCN, 2019). These birds can be found in colonies where they breed on steep cliffs (Roberts, 2018). Due to the breeding habits of these species it is unlikely that they will be detrimentally impacted by the proposed dam.

Blue Swallows *(Hirundo atrocaerulea)* were observed in the valley portion of the project area. During the survey the inclement weather is thought to have pushed this species down below the mist belt, and a small number were observed flying in the centre of the project site. As soon as the weather cleared, they disappeared. This intra-African migratory species is threatened by the destruction and degradation of its grassland and wetland habitats on both its breeding grounds and its non-breeding grounds. The destruction of natural habitat has been found to have led to a rapid reduction of its already small population, which is projected to continue in the future unless immediate conservation action is taken across its entire distribution range. This VU (IUCN, 2019) species is associated with montane grasslands adjacent to streams, where it feeds mostly on aerial insects. They nest under overhangs of a hole in the earth such as potholes, donga, aardvark burrows or mine shafts (Roberts, 2018). Nests could not be identified within the project area; furthermore this species was also not seen perching in the habitat (which generally is near their nesting site (Roberts, 2018)). It can therefore be said that this species was using the area for foraging and is not a permanent resident.

5.6.9 Habitat Sensitivity

Results of this avifaunal survey highlight the Riparian and Rocky Grassland habitats as supporting a diverse and unique avifaunal assemblage and were given a high sensitivity. The Transformed: plantation and Alien vegetation as well as Indigenous tree clumps habitats support the second highest bird diversity. The indigenous tree clumps still remain in a largely intact state and as such are assigned a Moderate sensitivity. The birds found in the plantations and alien vegetation have adapted and this habitat has become an important part of the ecosystem and were given a moderate sensitivity. The Homesteads' habitats are considerably more impacted and support similar compliments of common and adaptable species and therefore are assigned a Low sensitivity from an avifaunal perspective. The avifaunal habitat sensitivity map is shown in Figure 58.

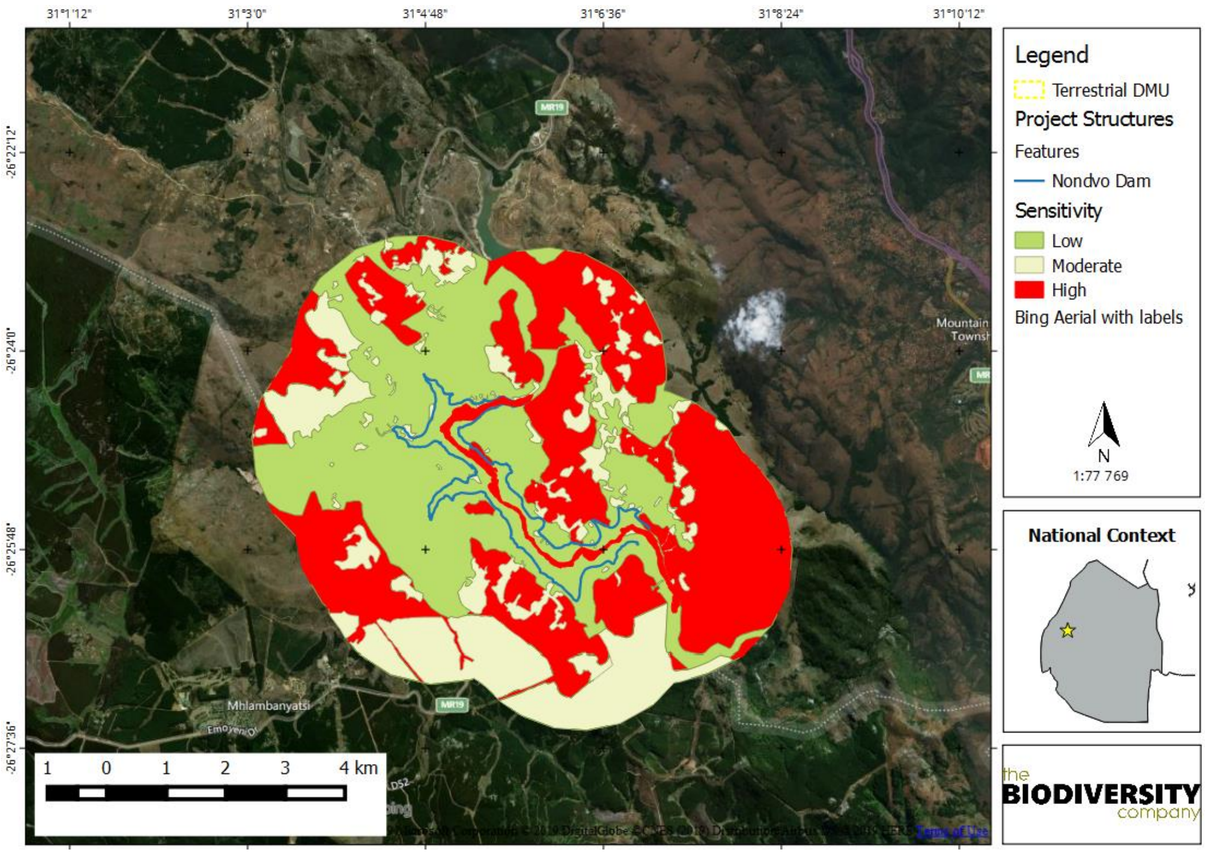


Figure 58: Avifaunal habitat sensitivity

5.7 Aquatic Ecology

5.7.1 Water Quality

In situ water quality analyses was conducted at upstream and downstream sites for the project area to characterise physical water quality parameters during the assessment. These results are important to assist in the interpretation of biological results due to the direct influence water quality has on aquatic life forms.

The results of the survey are presented in Table 18, Table 19 and Table 20. Water quality results were compared to Target Water Quality Ranges for South African Aquatic Ecosystems (DWAF, 1996), as conditions were comparable to those in South Africa.

Table 18: In situ water quality results for the March 2019 survey

Site	pH	Temperature (°C)	DO (mg/l)	Conductivity (µS/cm)	Turbidity (NTU)
TWQR*	6.5-9	5-30	<5.00	-	-
S1	6,5	24	6.5	62	52
S2	7.0	29	8.1	62	9.7
S4	7,1	24	5.5	71	5.8
S5	6.8	23	8.4	71	10
S6	6,9	23	6.4	64	8.9
S7	7,2	24	5.6	61	5.7
(*) denotes Target Water Quality Range for Aquatic Ecosystems in South Africa (DWAF, 1996)					

Table 19: In situ water quality results for the May 2019 survey

Site	pH	Temperature (°C)	DO (mg/l)	Conductivity (µS/cm)	Turbidity (NTU)
TWQR*	6.5-9	5-30	>5.00	-	-

S1	7.1	18	8.3	61	14
S2	7.1	19	8.5	61	2.4
S4	6.9	17	7.2	64	14
S5	7.1	16	5.1	62	7.5
S6	6.9	18	8.2	62	7.3
S7	7.1	18	7.9	48	4.2
S8	7.2	18	8.7	42	5.1
(*) denotes Target Water Quality Range for Aquatic Ecosystems in South Africa (DWAF, 1996)					

Table 20: Statistical analysis of the water quality results (March and May 2019)

Site	pH	Conductivity (µS/cm)	Temperature (°C)	Turbidity (NTU)
March 2019	6.9±0.1	65±1.8	24±1.0*	15±7.3
May 2019	7.0±0.1	57±3.2	17±0.4*	7.9±1.8
Total	7.0±0.1	60±2.1	20±1.0	11±3.5

(*) denotes significantly different (*p<0.05*)

The results of the *in situ* water quality assessment indicate no parameters which exceed the established water quality guideline values in DWAF (1996). The pH values obtained were found to be neutral at 7.0±0.1, and to be statistically similar (*p>0.05*) between the high and low flow periods, with a nominal variation between the sites or surveys. The water temperatures observed were found to range from 17±0.4°C in the low flow (May 2019) survey to a significantly increased (*p*<0.05) temperature of 24±1.0°C in the high flow (March 2019) confirming the seasonal water temperature range. The levels of dissolved oxygen were observed at values exceeding the recommended threshold effect concentration of 5.0 mg/l at all sites considered in this assessment.

The level of dissolved solids, as measured by conductivity, were found to be statistically similar between the surveys and sites at a mean and SEM of 60±2.1 µS/cm. This low dissolved solid result indicates a natural state of dissolved elements, similar to what can be expected for the zonation of the watercourse. Land-use activities in the catchment considered were thus determined to not significantly affected the levels of dissolved solids. The water clarity observed, as measured by turbidity, during the assessment was found to be higher in the low flow survey as would be expected (Figure 59). However, the difference in water turbidity was not significant between surveys and corroborates the conductivity results, in that water quality is largely natural. It is important to note, that suspended solid content would increase during rainfall events, as was observed at S1 in the March 2019 survey, which increased the turbidity readings to 50 NTU. The conditions whereby the instream slow-flowing and densely vegetated habitats compounded by the effect of the Luphohlo impoundment were determined to mitigate this impact at the downstream sites and further increased turbidity levels were not observed.

Overall, based on the assessed parameters the water quality observed in the Lusushwana River was derived to be natural, with low conductivity, neutral pH levels and fair clarity. The observed water quality would not have any impact on local riverine ecology.

Figure 59: Water clarity and stone biotopes in the Lusushwana River

5.7.2 Habitat Assessment

5.7.2.1 Intermediate Habitat Integrity Assessment

The results for the instream and riparian habitat integrity assessment for the Lusushwana River reach are presented in Table 21 (Kleynhans, 1996). The reaches include 10 km of the system assessed during the assessment.

Table 21: Results for the Lusushwana habitat integrity assessment

Instream	**Average**	**Weighted Score**
Water abstraction	10	5.6
Flow modification	16	8.6
Bed modification	16	8.6
Channel modification	15	7.8
Water quality	5.0	2.8
Inundation	10	4.0
Exotic macrophytes	0.0	0.0
Exotic fauna	10	3.2
Solid waste disposal	10	2.4
Total Instream		**56**
Category		**class D**
Riparian	**Average**	**Weighted Score**
Indigenous vegetation removal	16	8.6
Exotic vegetation encroachment	18	8.8
Bank erosion	3.0	1.8
Channel modification	16	8.0
Water abstraction	10	5.2
Inundation	11	5.1
Flow modification	18	8.8
Water quality	5.0	2.6
Total Riparian		**50**
Category		**class D**

According to the instream habitat index the instream ecological habitat is largely modified (class D). A large loss of natural habitat and biota was noted to have occurred in the assessed watercourse. The central causative factor for the high degree of modification can be attributed to the Luphohlo Dam, which has inundated a significant portion of the Lusushwana River reach above the Mantenga Falls. The effect of the inundation is further compounded by the presence of a weir, which was recorded in the lower reaches (Figure 60). In addition to the direct inundation impacts, flow modification downstream of the impoundment was determined to have an impact on the physical condition of the river channel and bed, whereby erosional forces and river velocity had reduced to form numerous slow-flowing pools with sand/mud substrates (Figure 61). It is noted that following the confluence of the watercourse rising in the flow volumes in the Lusushwana River increase, and the overall impact is reduced in the lower reaches of the Lusushwana River.

It is noted that the instream modification of the Lusushwana River has resulted in reduced flooding events, whereby the floodplains are sufficiently inundated. In addition, the sediment regime of the Lusushwana River has been altered by the presence of the Luphohlo Dam, reducing the volumes of sediment deposited on river bends, margins and floodplains. Adding a cumulative effect of the currently existing conditions to flow modification, sedimentation from the myriad of forestry activities in the catchment compounded by livestock and subsistence agriculture has likely added to the degree of fine sedimentation in the watercourse, and thus differs from natural reference conditions.

Water quality modification was determined to be low, with no significant source of poor water quality in the catchment. Land use in the catchment presents diffuse sources for contamination, with no industrial activities clearly observable in the immediate upstream areas. Subsistence agriculture, which has encroached into wetland areas would present diffuse agricultural runoff with a potential to contain herbicide and increased nutrient loads (Figure 62).

Figure 60: An impoundment located on the Lusushwana River (March 2019)

Figure 61: A vegetated pool in the Lusushwana River, formed as a resultant effect of flow modification (March 2019)

Figure 62: Agricultural activities encroaching into wetland areas feeding the Lusushwana River (March 2019)

The riparian habitat of the Lusushwana River was determined to be largely modified (class D). The central factors resulting in this impact could be attributed to exotic vegetation encroachment. Stands of invasive forestry-related vegetation were observed throughout the considered river reach assessed in this assessment. Dominant non-native vegetation included *Eucalyptus sp.* which was found to have encroached into the upper zone of the riparian areas (Figure 63). In addition to *Eucalyptus,* stands of *Pinus sp* and *Acacia mearnsii* were also observed throughout the project area (Figure 64).

In addition to alien vegetation, sand mining activities were noted in the historical floodplain areas where sufficient material had been deposited. These activities have a direct impact on the condition of the riparian zone (Figure 65). These areas, once abandoned, also serve as vector areas for the continued proliferation of alien vegetation. Further assessment of the riparian habitat is provided in the subsequent sections.

Figure 63: Eucalyptus sp. in the Lusushwana River riparian habitat (March 2019)

Figure 64: Invasive vegetation in the riparian zone of the Lusushwana River riparian habitat (May 2019)

Figure 65: Sand mining activities in the riparian zone of the Lusushwana River (March 2019)

5.7.2.2 Riparian Habitat

The extent of the marginal edge of the riparian zone was dependent on the extent of the instream conditions and geomorphological structures. In the slow-flowing waters that make up the majority of the inundation zone, the marginal, and to a degree the instream zone, consisted of dense stands of *Phragmites sp*. as indicated in Figure 66. With instream marginal stands observed in Figure 67. Within the pool systems where flow allowed for the accumulation of substrates, marginal vegetation consisted of a mix of vegetation including submerged grasses, *Cyperus*, sedges and *Phragmites* (Figure 68).

Figure 66: Phragmites sp. in the Lusushwana River

Figure 67: Submerged grass, Phragmites and a sedge in a pool of the Lusushwana River

The lower zone of the riparian vegetation consisted of a variety of sedges, Cyperus and *Persicaria sp.* as presented in Figure 68. The lower zone of the riparian habitat was typically confined to an area within approximately 0.5-1m from the instream river edge.

The upper zone native vegetation consisted of woody trees such as River Bush-willow (*Combretum erthrophyllum*), Waterberry (*Syzygium cordatum*) and Matumi (*Breonadia salicina*) (Figure 69). Additionally, the upper zone of the riparian habitat was heavily affected by non-native woody taxa as listed in the riparian Intermediate Habitat Integrity Assessment. The upper zone of the riparian habitat was largely defined by the macro channel as depicted in the aerial photo (Figure 70). It is noted that within the bedrock areas some riparian vegetation had rooted in isolated patches, this was noted to add to the extent of the riparian area.

The riparian zone of the Lusushwana River was noted to support numerous ecosystem services such as sand provision for the mining activities, as well as the provision of woody material utilised in forestry activities. The delineation of the riparian habitat is presented in Figure 71.

Figure 68: Lower riparian zone vegetation (Lusushwana River)

Figure 69: Typical native woody upper zone riparian vegetation (left: Waterberry, right: Matumi)

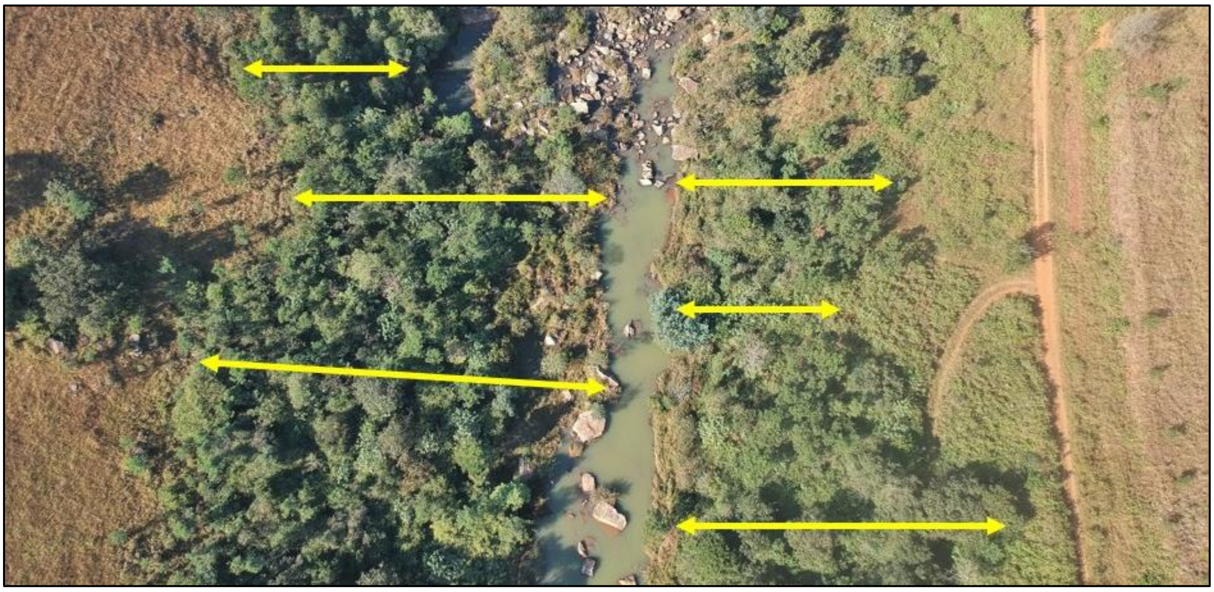


Figure 70: Extent of the riparian vegetation (depicted by arrows) at S5 on the Lusushwana River (May 2019)

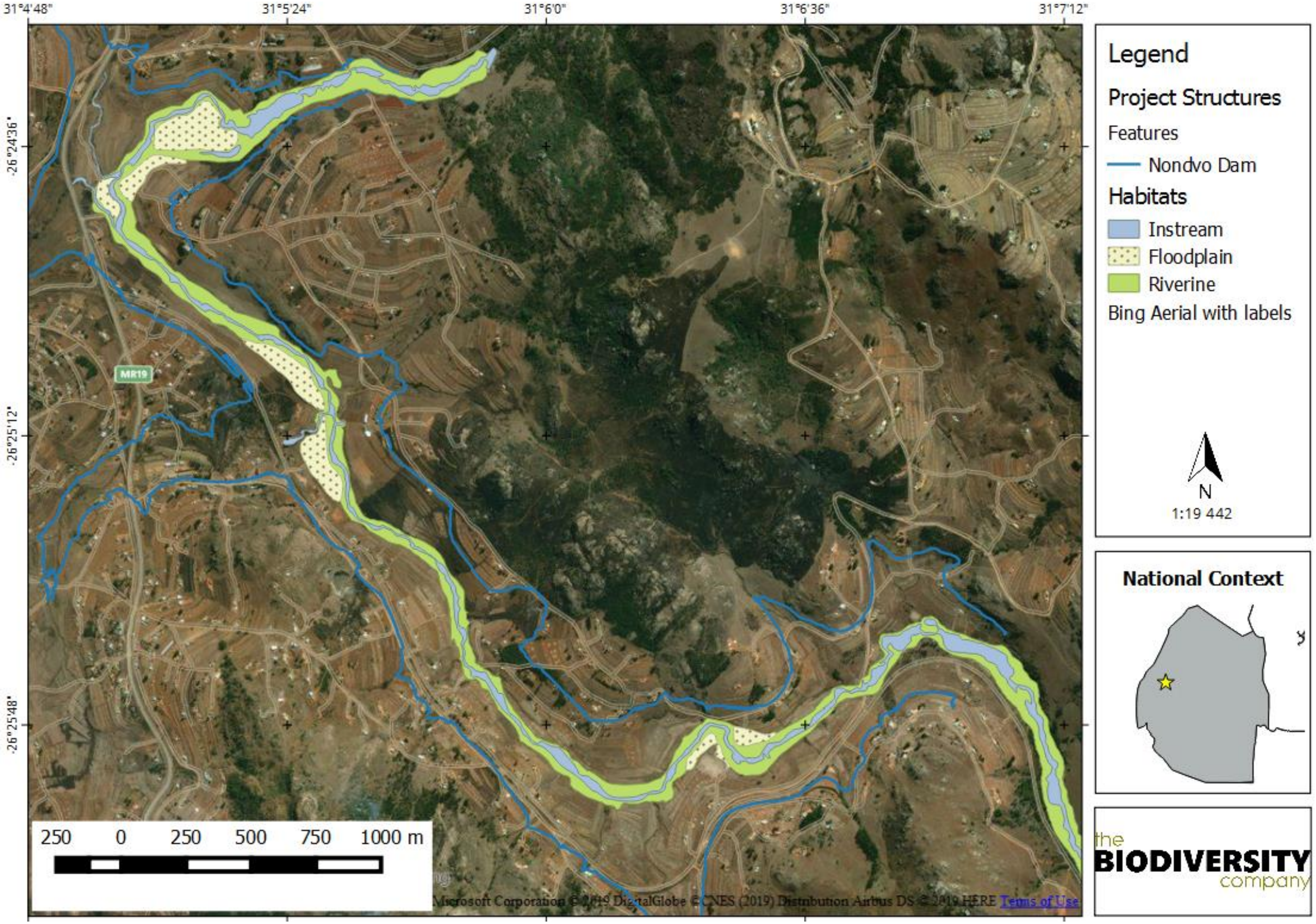


Figure 71: Riparian Habitat in the Lusushwana River

5.7.3 Aquatic Macroinvertebrate Communities

5.7.3.1 Invertebrate Habitat and Biotope Assessments

A biotope rating of available habitat was conducted at each site assessed to determine the suitability of habitat to macroinvertebrate communities. The Lusushwana River within the project area was classed as lower foothills. Each geo-class has different weightings for the various biotopes according to importance value (Table 22). The categories were calculated according to the biotope rating assessment as applied in Tate and Husted (2015). The results of the biotope assessment are presented in Table 23 and Table 24. A rating system of 0 to 5 was applied, 0 being not available and 5 being abundant and diverse.

Table 22: Biotope weightings for lower foothill geoclass

Biotope	Lower Foothills
Stones in current	18.0
Stones out of current	12.0
Bedrock	3.0
Aquatic vegetation	1.0
Marginal vegetation in current	2.0
Marginal vegetation out of current	2.0
Gravel	4.0
Sand	2.0
Mud	1.0

Table 23: Biotope scores at each site during the high flow survey (March 2019)

Biotope	S1	S2	S4	S5	S6	S7
Stones in current	1	1	2	2	1	2
Stones out of current	1	1	2	1	1	0
Bedrock	3,5	2	4	4	3	3
Aquatic Vegetation	2	1	1	2	4	1
Marginal Vegetation in Current	1	3.5	4	4	3.5	3
Marginal Vegetation Out of Current	3,5	2	4	3	4	2
Gravel	2	2	2	1	1	1
Sand	2	3	3	2	3	3
Mud	3	2	2	2	3	1
Biotope Score	19	17,5	24	21	23.5	16
Weighted Biotope Score (%)	30	29	47	38	32	30
Biotope Category (Tate and Husted, 2015)	**E**	**F**	**D**	**E**	**F**	**F**

Table 24: Biotope scores at each site during the low flow survey (March 2019)

Biotope	S1	S2	S4	S5	S6	S7	S8
Stones in current	1	1	3	2	1	2	3
Stones out of current	1	2.5	2	2	1	1	1
Bedrock	3,5	2	3	4	4	3.5	3
Aquatic Vegetation	2	2	1	1	2	2	1
Marginal Vegetation in Current	1	2	2	3	3	3	2
Marginal Vegetation Out of Current	3,5	4	2	3	4	2	2

Biotope	S1	S2	S4	S5	S6	S7	S8
Gravel	2	2	1	1	2	2	2
Sand	2	3	2	3	2	4	3
Mud	3	1	2	2	2	2	1
Biotope Score	19	19,5	19,5	21	21	21,5	18
Weighted Biotope Score (%)	30	40	47	43	32	40	44
Biotope Category (Tate and Husted, 2015)	**F**	**E**	**D**	**D**	**E**	**E**	**D**

Invertebrate habitat in the considered river reach was dominated by submerged bedrock (Figure 75) and marginal vegetation, established out of the current in bedrock pools (Figure 61). This habitat would provide sufficient substrates for taxa in the Hemiptera order. The stones-in-current biotope within the geomorphological setting is considered to be one of the more productive substrates and thus represent important habitat. The stones–in-current habitat was however largely located in isolated collections in the watercourse, within bedrock cracks or between boulders, which had allowed for their accumulation (Figure 59). It is anticipated that the limited stones habitat would have an effect on the diversity of Ephemeroptera, Plecoptera, and Trichoptera (EPT) aquatic macroinvertebrates.

The biotope diversity observed during the survey was found to be statistically higher in the May 2019 survey ($p<0.05$), whereby habitat had improved from a rating of 32±3.8 to 39±2.3. The improvement in habitat diversity could be attributed to the accessibility of the watercourse following the cessation of high flow conditions.

5.7.3.2 Aquatic Invertebrate Indices

The results of the various macroinvertebrate assemblage indices applied in this assessment are presented in Table 25, Table 26 and Table 27.

Table 25: Macroinvertebrate results for the Lusushwana River reach (March 2019)

Site	S1	S2	S4	S5	S6	S7
Sensitivity Score	213	160	203	236	247	166
Taxa	36	27	34	41	42	29
ASPT	5,9	5,9	5,9	5,7	5,8	5,7
%EPT	27	22	29	24	21	24
%O_2 Breathers	33	40	32	34	40	34
Biotope Rating	30	29	47	38	19	30

Table 26: Macroinvertebrate results for the Lusushwana River reach (May 2019)

Site	S1	S2	S4	S5	S6	S7	S8
Sensitivity Score	139	158	170	189	194	235	216
Taxa	27	29	30	33	34	36	36
ASPT	5,1	5,4	5,6	5,7	5,7	6,5	6.0
%EPT	14	24	23	24	17	33	27
%O_2 Breathers	44	34	26	33	38	27	33
Biotope Rating	30	40	47	43	32	40	44

Table 27: Macroinvertebrate results for the Lusushwana River reach (May 2019)

Survey	March 2019 (n=6)	May 2019 (n=7)	Total (n=13)
Sensitivity Score	204±14	185±12.5	194±9.4

Survey	March 2019 (n=6)	May 2019 (n=7)	Total (n=13)
Taxa	34±2.4	32±1.3	33±1.3
ASPT	5.8±0.1	5.7±0.1	5.8±0.1
%EPT	24±1.2	23±2.3	24±1.3
%O_2 Breathers	35±1.5	34±2.2	34±1.3
Biotope Rating	32±3.8	39±2.3	36±2.3

The South African Scoring System version 5 (SASS5) sensitivity scores observed in the Lusushwana River during the survey period was found to be high, with limited variability between the sites and survey at 194±9.4 (n=13). The diversity of the macroinvertebrate community was found to be high, with 33±1.3 (n=13) observed at each site considered. The most encountered taxa observed during the assessment was shared amongst Oligochaeta, Potamonautidae, Caenidae, Baetidae, Libullidae, Corixidae, Gerridae, Gyrinidae, Ceratopogoniidae and Chironomidae which were recorded at 100% of the sites. Whilst Atyidae, Baetidae, Chlorocyphidae, Ceonagrionidae, Gomphidae, Vellidae, Hydropsyhchidae, Belastomatidae, Dytiscidae and Simulidae were recorded at 92% of the sites assessed. Rare families observed during the assessment included Porifera, Lestidae, Dipseudopsidae, Psephenidae and Athericidae and were recorded at 7% of the sampled sites.

As noted above, the invertebrate assemblage sampled typically represented moderately sensitive taxa. The sensitivity of the assemblage as measured in Average Score Per Taxon (ASPT) was 5.8±0.1 and confirmed that the assemblage was largely composed of tolerant taxa. The overall EPT% contributions to the invertebrate assemblage was found to be moderate at 24±1.3%. Typical EPT% contributions included taxa such as high flow adapted Heptageniidae and generalist but sensitive taxa such as Leptophlebidae. Infrequently, highly sensitive Oligoneuridae were observed in the Lusushwana River. Perlidae taxa were also infrequently observed and were largely absent from the sites in proximity to the Luphohlo Dam wall.

Approximately one-third of the invertebrate community sampled at the sites consistently represented oxygen-breathing taxa such as the high Frequency of Occurrence (FROC) taxa including Corixidae, Gerridae and Gyrinidae. Other abundant taxa observed were those adapted to marginal vegetation habitats and this further increased the dominance of air breathers. Spatial trends versus biotope ratings were compared and are presented in Figure 72. As can be noted in the trend analysis limited correlations between biotope ratings and overall sensitivity scores were observed. An increasing trend from upstream to downstream was observed in the SASS5 sensitivity scores. The multivariate assessment of the invertebrate community and weighted biotope ratings are presented in Figure 73. No significant (*$p>0.05$*) association with the recorded biotopes and the invertebrate families was positively obtained during the assessment. Some associations between taxa such as Heptageniidae, Tricorythidae and Chlorocyphidae were derived to have strong non-significant associations with Stones-in-Current habitats. Strong associations between Nepidae was observed with Marginal Vegetation-In–Current; an expected result. As can be observed in the seasonal assessment, no significant associations between the sampled invertebrate taxa and the season were depicted, which corroborates the non-significant differences in the various indices. Additionally, no significant associations were observed with the physical water quality data, which further confirms that the water quality conditions were largely natural.

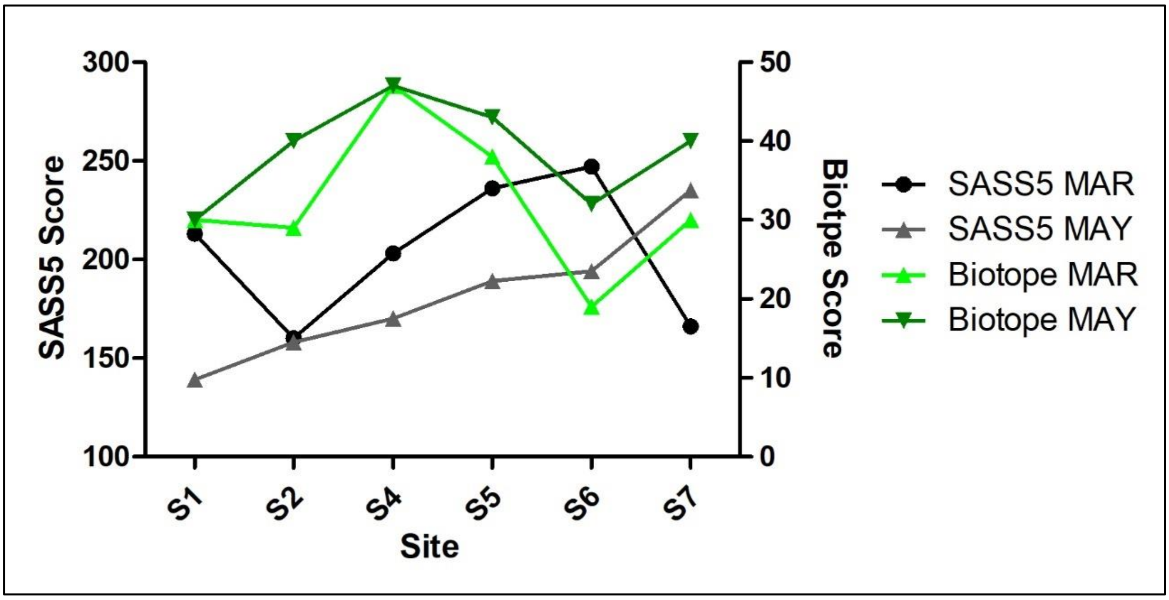


Figure 72: Spatial trends of biotope ratings and SASS5 scores

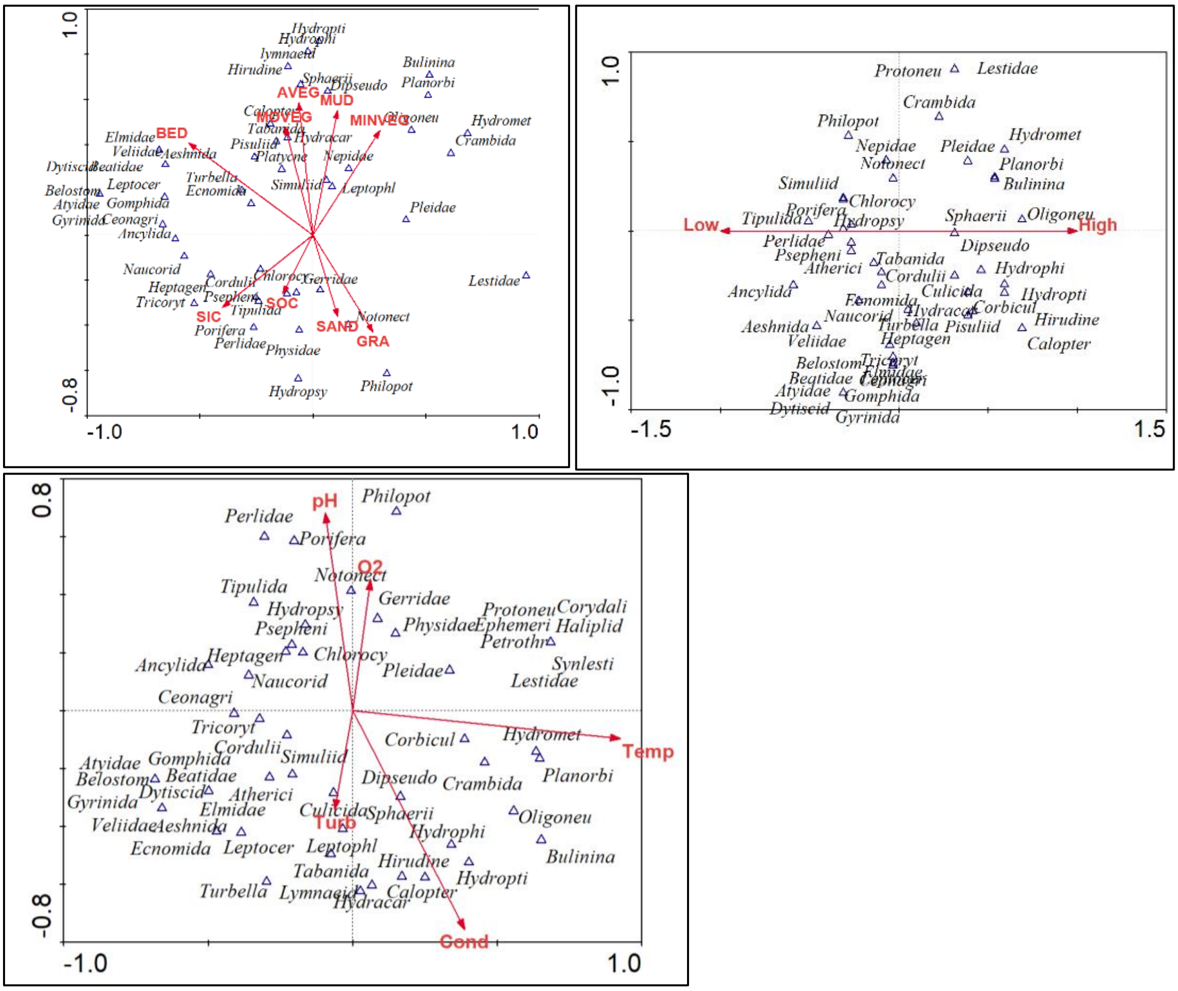


Figure 73: Results of the conical analysis of invertebrate families and biotopes (top left), season (top right) and physical in situ water quality (bottom)

5.7.3.3 Odonata

Given the sensitivity of Odonata to both water quality and the condition of the local habitat, the diversity of Odonata can serve as an effective mechanism for the monitoring of cumulative impacts and environmental degradation. In addition, Odonate diversity can also be an effective endpoint for assessing the diversity of aquatic macroinvertebrate taxa within a given river reach. The Odonate taxa observed during the assessment are presented in Table 28. A total of 42 different Odonata taxa, representing 9 families were observed during the survey. The most diverse group of taxa observed were the Libelludiae, a family with a high tolerance to both water and habitat quality modification. Observed taxa sensitive to the disturbance of marginal riparian habitat included *Phaon iridipennis, Agriocnemis* and the various *Lestes* species observed. These taxa have a preference for full canopy cover and overhanging marginal vegetation and indicate that there were sufficient conditions in isolated areas on the assessed watercourse.

Overall the diversity of Odonata was considered to be high, with a high level of sensitivity. It is noted that no species listed other than Least Concern were observed in the project area, with the Odonata community widely distributed (IUCN, 2019).

Table 28: Odonata observed in the Lusushwana River reach (March and May 2019)

Taxa observed	**Common names**	**Family**	**Conservation Status (IUCN 2019)**
Anax imperator	Blue Emperor	Aeshnidae	LC
Anax ephippiger	Vagrant Emperor	Aeshnidae	LC
Anax speratus	Orange Emperor	Aeshnidae	LC
Pinheyschna subpupillata	Stream Hawker	Aeshnidae	LC
Phaon iridipennis	Glistening Demoiselle	Calopterygidae	LC
Platycypha caligata	Dancing Jewel	Chlorocyphidae	LC
Ceriagrion glabrum	Common Pond Damsel	Coenagrionidae	LC
Pseudagrion salisburyense	Slate Sprite	Coenagrionidae	LC
Pseudagrion kersteni	Powder-faced Sprite	Coenagrionidae	LC
Pseudagrion hageni	Painted Sprite	Coenagrionidae	LC
Pseudagrion massaicum	Masai Sprite	Coenagrionidae	LC
Ischnura senegalensis	Tropical Bluetail	Coenagrionidae	LC
Africallagma glaucum	Swamp Bluet	Coenagrionidae	LC
Agriocnemis falcifera	White-masked Wisp	Coenagrionidae	LC
Paragomphus genei	Common Hooktail	Gomphidae	LC
Paragomphus cognatus	Rock Hocktail	Gomphidae	LC
Lestes plagiatus	Highland Spreadwing	Lestidae	LC
Lestes pallidus	Pale Spreadwing	Lestidae	LC
Trithemis annulata	Violet Dropwing	Libellulidae	LC
Trithemis pluvialis	Russet Dropwing	Libellulidae	LC
Trithemis arteriosa	Red-veined Dropwing	Libellulidae	LC
Trithemis stictica	Jaunty Dropwing	Libellulidae	LC
Trithemis furva	Navy Dropwing	Libellulidae	LC
Trithemis kirbyi	Orange-winged Dropwing	Libellulidae	LC
Trithemis dorsalis	Highland Dropwing	Libellulidae	LC
Zygonyx natalensis	Blue Cascader	Libellulidae	LC
Zygonyx torridus	Ringed Cascader	Libellulidae	LC
Pantala flavescens	Wandering Glider	Libellulidae	LC
Orthetrum caffrum	Two-striped Skimmer	Libellulidae	LC
Orthetrum chrysostigma	Epaulet Skimmer	Libellulidae	LC
Orthetrum julia falsum	Julia Skimmer	Libellulidae	LC

Taxa observed	Common names	Family	Conservation Status (IUCN 2019)
Orthetrum trinacria	Lond Skimmer	Libellulidae	LC
Nesciothemis farinosa	Eastern Blacktail	Libellulidae	LC
Palpopleura portia	Portia Widow	Libellulidae	LC
Palpopleura jucunda	Yellow-veined Widow	Libellulidae	LC
Diplacodes lefebvrii	Black Percher	Libellulidae	LC
Crocothemis erthraea	Broad Scarlet	Libellulidae	LC
Bradinopyga cornuta	Horned Rock-dweller	Libellulidae	LC
Brachythemis leucosticta	Banded Groundling	Libellulidae	LC
Phyllomacromia picta	Darting Cruiser	Macromiidae	LC
Elattoneura glauca	Common Threadtail	Platycnemididae	LC
Mesocnemis singularis	Common Riverjack	Platycnemididae	LC

Figure 74: Key Odonate taxa observed during the 2019 surveys. Top left: Trithemis sticta, Top Right: Lestes plagiatus, Bottom left: Pseudagrion hageni, Bottom Right: Palpopleura jucunda

5.7.4 Ichthyofaunal Assessment

5.7.4.1 Sampling Effort

The sampling effort applied for this assessment is presented in Table 30 and Table 31 with the explanatory information presented below in Table 29.

Table 29: Explanatory information

Abbreviation	Method	Effort Rating
E	Electroshock	Minutes shocking
S	Siene Net	Pull efforts
G	Gill Net	Minutes deployed - represented by multiple nets
F	Fyke Net	Minutes deployed - represented by multiple nets
C	Cast Net	Throws

Table 30: Sampling effort for the fish community assessment (March 2019)

Survey	**March**									
Method	E	Effort	S	Effort	G	Effort	F	Effort	C	Effort
S1	X	30								
S2	X	45								
S3			X	60						
S4	X	45	X	15						
S5	X	30	X	15	X	4860	X	3120	X	10
S6	X	80	X	15	X	3960	X	2640	X	20
S7	X	60							X	20

Table 31: Sampling effort for the fish community assessment (May 2019)

Site/method	E	Effort	S	Effort	G	Effort	F	Effort	C	Effort
S1	X	30	X	10					X	20
S2	X	30	X	16					X	5
S3										
S4	X	30	X	15					X	5
S5	X	30	X	18	X	5760	X	1320	X	10
S6	X	30	X	15	X	8400	X	1560	X	5
S7	X	30	X	10					X	10
S8	X	60	X	10					X	5

As noted above, five separate sampling techniques were utilised in this assessment, the most commonly used method was the electroshocking, which was conducted at almost all of the sampling points.

5.7.4.2 Habitat Characterisation

The fish habitat of the Lusushwana River, varied spatially, with slow-flowing vegetated pools below the Luphohlo Dam (Figure 61), bedrock sheet flow with isolated pools and riffle habitat within proximity and downstream of the proposed dam wall (Figure 75). Diverse velocity depth classes and river geomorphic units were noted to be present in the watercourse, these were dominated by slow deep and fast shallow bedrock runs which formed the focus of the sampling effort (Figure 76). The results of the HCR assessment completed for each site is presented in Figure 77.

As observed in Figure 77, sites S4, S5 and S8 contained the highest diversity of fish cover during the assessments. The clear dominance of the fast shallow bedrock runs can be observed in the cover ratings and was found to be present at each of the sites sampled.

Figure 75: Shallow bedrock substrates dominating the Lusushwana River instream habitats and representing the fast shallow velocity depth class (March 2019)

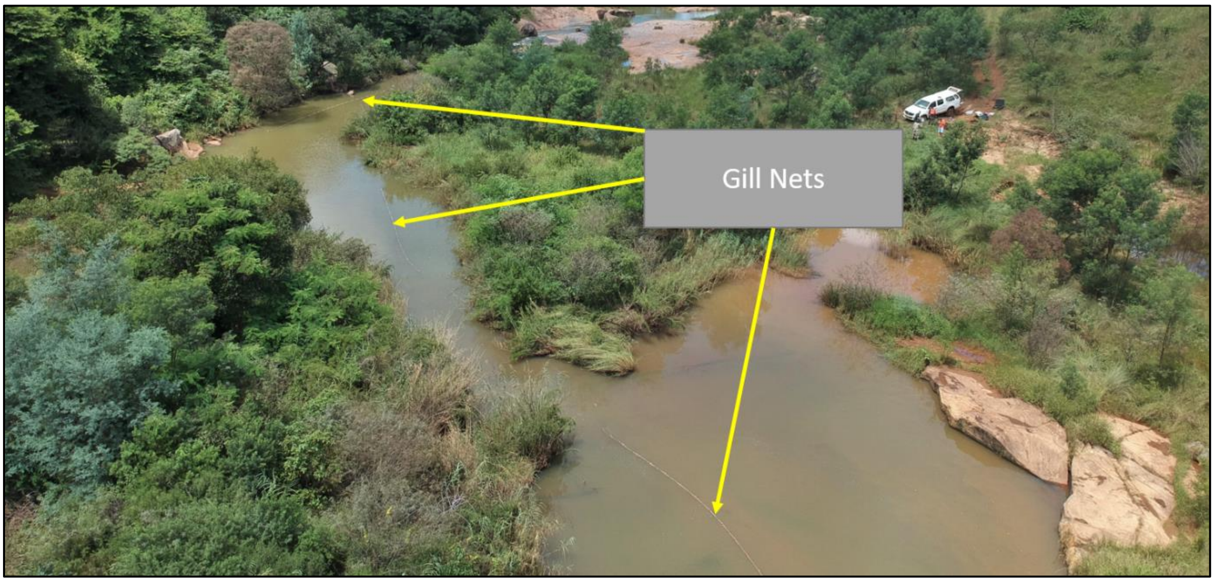


Figure 76: Diverse velocity depth classes in the Lusushwana River. The photograph captures slow and fast deep velocity depth classes at S5 (March 2019)

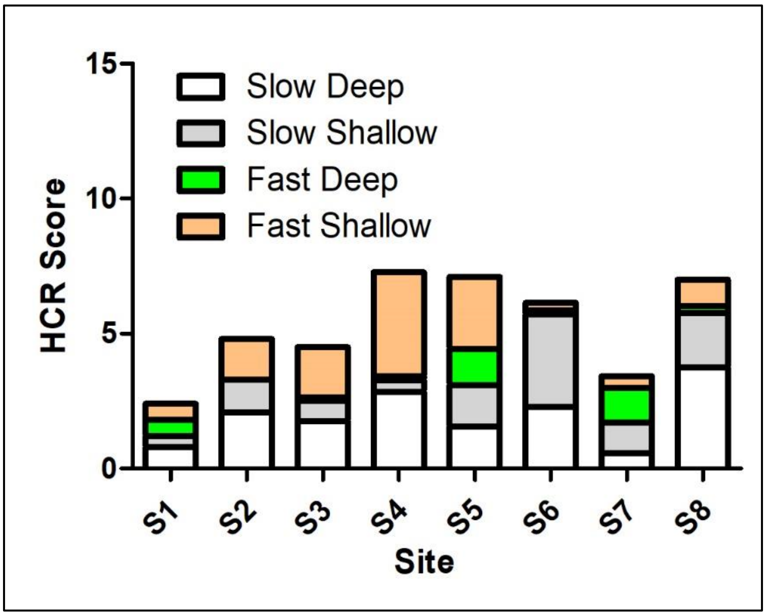


Figure 77: Habitat Cover ratings obtained at the sampling points (March and May 2019)

5.7.4.3 Fish Community Assessment

The project area considered in this assessment is located within the Zambezian Lowveld Freshwater Ecoregion (ZLFE). This ecoregion is known to contain approximately 120 freshwater fish species of which 22 are known to be endemic (Figure 78). The lower reaches of the rivers in this ecoregion are known to support numerous seasonal pans and extensive floodplains.

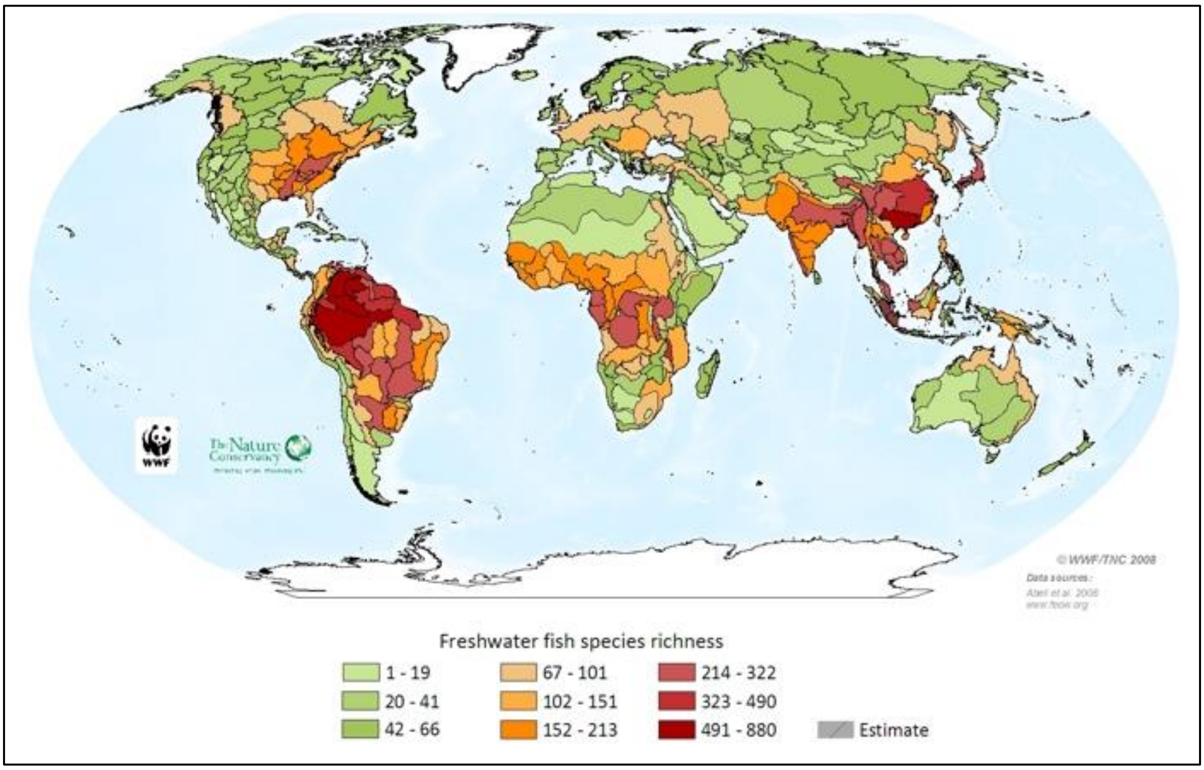


Figure 78: Fish species richness of ecoregion (Estimated 152-213) (FEOW, 2019)

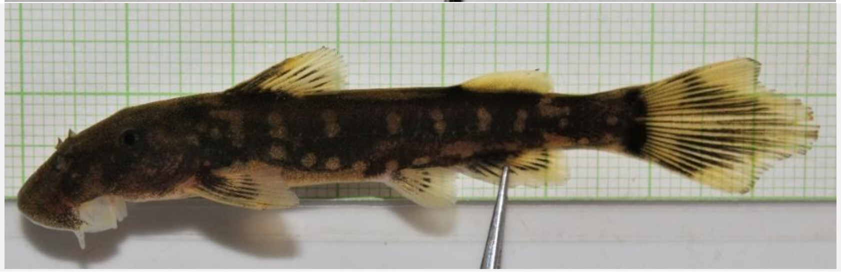
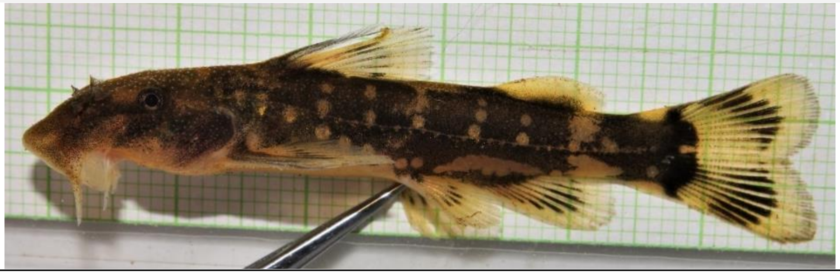
Based on the available desktop data a total of 34 species of fish are expected in the watercourse, indicating a diverse and sensitive fish fauna (Table 32). As presented in the table, a number of threatened and range-restricted species are expected in the watercourse. Three listed taxa are expected in the watercourse. These include the Near Threatened *Oreochromis mossambicus* and *Labeobarbus nelspruitensis* as well as the Vulnerable *Chiloglanis emarginatus* (IUCN, 2019). A single Data Deficient species, *Marcusenius pongolensis,* is also expected in the watercourse.

The observed species, their sizes and respective Frequency of Occurrence is presented in Table 33.

Table 32: Expected species for the Lusushwana River in the upper Usuthu-Phongola River systems and their respective IUCN status

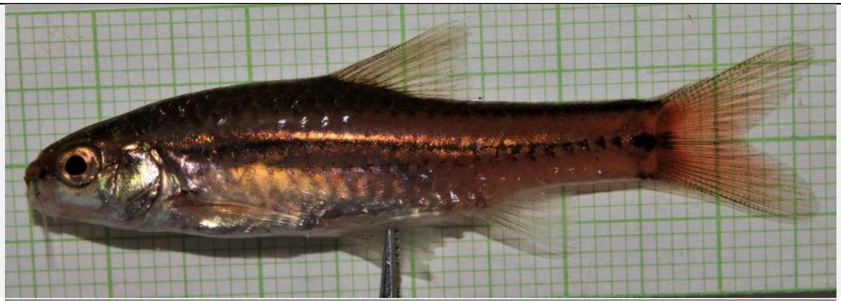
Family	Species	IUCN Status (IUCN 2019)
Amphiliidae	*Amphilius uranoscopus*	LC
Anguillidae	*Anguilla mossambica*	LC
Cichlidae	*Coptodon rendalli*	LC
Cichlidae	*Oreochromis mossambicus*	NT
Cichlidae	*Pseudacrenilabrus philander*	LC
Cichlidae	*Tilapia sparrmanii*	LC
Clariidae	*Clarias gariepinus*	LC
Cyprinidae	*Enteromius afrohamiltoni (Southern)*	LC
Cyprinidae	*Enteromius annectens*	LC
Cyprinidae	*Enteromius anoplus*	LC
Cyprinidae	*Enteromius crocodilensis*	LC
Cyprinidae	*Enteromius pallidus*	LC
Cyprinidae	*Enteromius paludinosus*	LC
Cyprinidae	*Enteromius trimaculatus*	LC
Cyprinidae	*Enteromius unitaeniatus*	LC
Cyprinidae	*Enteromius viviparus*	LC
Cyprinidae	*Labeo congoro*	LC
Cyprinidae	*Labeo cylindricus*	LC
Cyprinidae	*Labeo molybdinus*	LC
Cyprinidae	*Labeo rosae*	LC
Cyprinidae	*Labeo ruddi*	LC
Cyprinidae	*Labeobarbus marequensis*	LC
Cyprinidae	*Labeobarbus polylepis*	LC
Cyprinidae	*Engraulicypris brevianalis*	LC
Cyprinidae	*Opsaridium peringueyi*	LC
Cyprinidae	*Labeobarbus nelspruitensis*	NT
Mochokidae	*Chiloglanis anoterus*	LC
Mochokidae	*Chiloglanis emarginatus*	VU
Mochokidae	*Chiloglanis paratus*	LC
Mochokidae	*Chiloglanis swierstrai*	LC
Mormyridae	*Marcusenius pongolensis*	DD
Mormyridae	*Petrocephalus wesselsi*	LC
Poeciliidae	*Micropanchax johnstoni*	LC
Schilbeidae	*Schilbe intermedius*	LC

Table 33: Fish species observed during the March and May 2019 surveys

Species	Photograph	Average Size (mm)	FROC (%)*	Individuals Collected
Amphilius uranoscopus		59±2.0	21	3
Clarias gariepinus		311±38	71	9
Chiloglanis anoterus		61±2.1	71	55
Chiloglanis emarginatus		61.5±1.7	14	11

Species	Photograph	Average Size (mm)	FROC (%)*	Individuals Collected
Coptodon rendalli		45±2.1	78	26
Tilapia sparrmanii		57±3.8	100	57
Oreochromis mossambicus		59±2.0	100	42

Species	Photograph	Average Size (mm)	FROC (%)*	Individuals Collected
Labeo cylindricus		245±2.8	7	8
Labeobarbus polylepis		151±5.8	14	4
Enteromius trimaculatus		47.9±1.8	100	82

Species	Photograph	Average Size (mm)	FROC (%)*	Individuals Collected
Enteromius viviparus		40±1.0	28	16
Enteromius cf. anoplus		86.0±0.0	7	1
Enteromius eutania		41±1.3	7	7
Opsaridium peringueyi		30±3.5	7	9

Species	Photograph	Average Size (mm)	FROC (%)*	Individuals Collected
Anguilla mossambica		251±6.0	14	3
Micropterus salmoides		174±3.6	57	14

(*) denotes FROC (%) = Frequency of Occurence

Sixteen different species were observed during the 2019 surveys. A total of 347 individual fish were captured during the survey representing a poor catch per unit effort (CPUE) of 0.01 fish per unit effort. This low CPUE provides some indication of the abundance of fish in the Lusushwana River, which was determined to be low.

The most abundant fish species sampled in 2019 was the species *Enteromius trimaculatus* which was represented by 82 individuals during the surveys. *E. trimaculatus* were typically sampled using the scene net during the low flow period. In addition, the species was sampled in shallow still or flowing runs and pools with the electroshocking apparatus. The second most abundant fish species, at 57 individuals was *Tilapia sparrmanii,* which was sampled in abundance in fyke nets set aside submerged vegetation mats. *T. sparrmanii* abundance values were followed by *Chiloglanis anoterus,* which was represented by 55 individuals. High abundances of *C. anoterus* were sampled by the electro-shocker apparatus in the bedrock habitats, where the individuals would be observed in cracks of the bedrock or behind large boulders.

The most commonly observed species as determined by the Frequency of Occurrence was found to be *Oreochomis mossambicus, Enteromius trimaculatus* and *Tilapia sparrmanii* observed at 100% of the sampling points. *Coptodon rendalli* was observed at 78% of the sampling points during the 2019 survey. Thus, Cichlidae represented the most common fish family observed during the survey. This indicates the dominance of cichlid favouring habitats in the project area. Despite riverine conditions in the lower reaches of the watercourse, lowered flows, and the presence of impoundments in the upper and middle reaches favoured the formation of cichlid rich environments, and thus the proliferation of these taxa.

The Mantenga Falls on the Lusushwana River were determined to not be a migratory barrier to *Anguilla mossambica,* which was observed upstream of the falls. The distribution of remaining observed species in the Lusushwana River reach considered in this assessment was determined to be separated by the Matenga Falls. Whilst several species of fish were observed above and below the falls, taxa such as *Labeo cylindricus*, *Enteromius eutania* and *Opsaridium peringueyi* were only observed below the falls, thus indicating a migratory barrier for non-anguillid fish. Whilst the falls were determined to be a barrier, it is anticipated that the existing Lupophlo Dam would present a barrier to migratory taxa. This was confirmed with no samples of *Anguilla mossambica* upstream of the dam wall. The distribution of *Enteromius anoplus* was also observed to be limited to the areas above the Luphohlo Dam, with the species not sampled below the impoundment.

The size class of the fish taxa observed ranged from the larger *Clarias gariepinus* of 311±38 mm to 30 mm represented by juvenile *Opsaridium peringueyi*. The average size class of the fish assemblage was determined to be 107 mm indicating a relatively small fish size.

Two listed species *Oreochomis mossambicus* (NT) and *Chiloglanis emarginatus* (VU) were observed during the survey. It is noted that *C. emarginatus* has been noted to be common in Eswatini (Bills *et al*. 2004). Despite this, *C. emarginatus* habitat is in decline across its distribution, with its known extent of occurrence at 16 663 km^2 and an area of occupancy of 252^2 km (IUCN, 2019). *O. mossambicus* occupies a wide geographic range in numerous eastern flowing rivers in Southern Africa. The species is however threatened by hybridization with *O. niloticus*. The species was therefore listed due to the rapid decline in the *O. mossambicus* populations. The rheophilic adapted species *Labeobarbus nespruitensis* is expected in the river reach. *L. nelspruitensis* was however not observed during the survey, with only *Labeobarbus polylepis* found in the Lusushwana River. However, it is possible that the species exists in limited spatial extents in isolated areas within the watercourse, as a large percentage of the overall Lusushwana River was not surveyed for this assessment.

The non-native species, *Micropterus salmoides* was observed in high frequency (57%) in the sites assessed. This species is known to negatively affect local native fish communities and is anticipated to have had a direct impact on the results obtained in this assessment. The presence of *M. salmoides* may be the limiting factor responsible for the poor CPUE observed in this assessment. This may be particularly true for the various *Enteromius* species observed in low abundance across the project area.

Overall, the fish community of the Lusushwana River reaches assessed during this assessment was found to be dominated by Cichlidae. Indicating a slow-flowing habitat dominance across the project area and confirming impacted conditions established in the Intermediate Habitat Integrity Assessment (IHIA). The Mantenga Waterfall was found to be a migratory barrier to non-anguillid taxa and a limiting factor for the distribution of fish species in the watercourse. Flow and habitat transformation sensitive and listed taxa, including *Chiloglanis emarginatus,* were observed during the assessment indicating that the fish community will be sensitive to changes in flow.

5.8 Ecosystem Services

The project area of influence includes the inundated area itself, which covers approx. 210 ha. The inundation of the reservoir will result in the direct loss of various ecosystem services identified within the reservoir area. A regulated area surrounding the inundated area has not been assigned as part of the assessment area given the lack of impacts expected towards ecosystem services up-slope from the inundated area. An additional 52,2 ha project area has been included for the study to determine potential direct and indirect risks towards ecosystem services identified downstream of the proposed dam wall (see Figure 79).

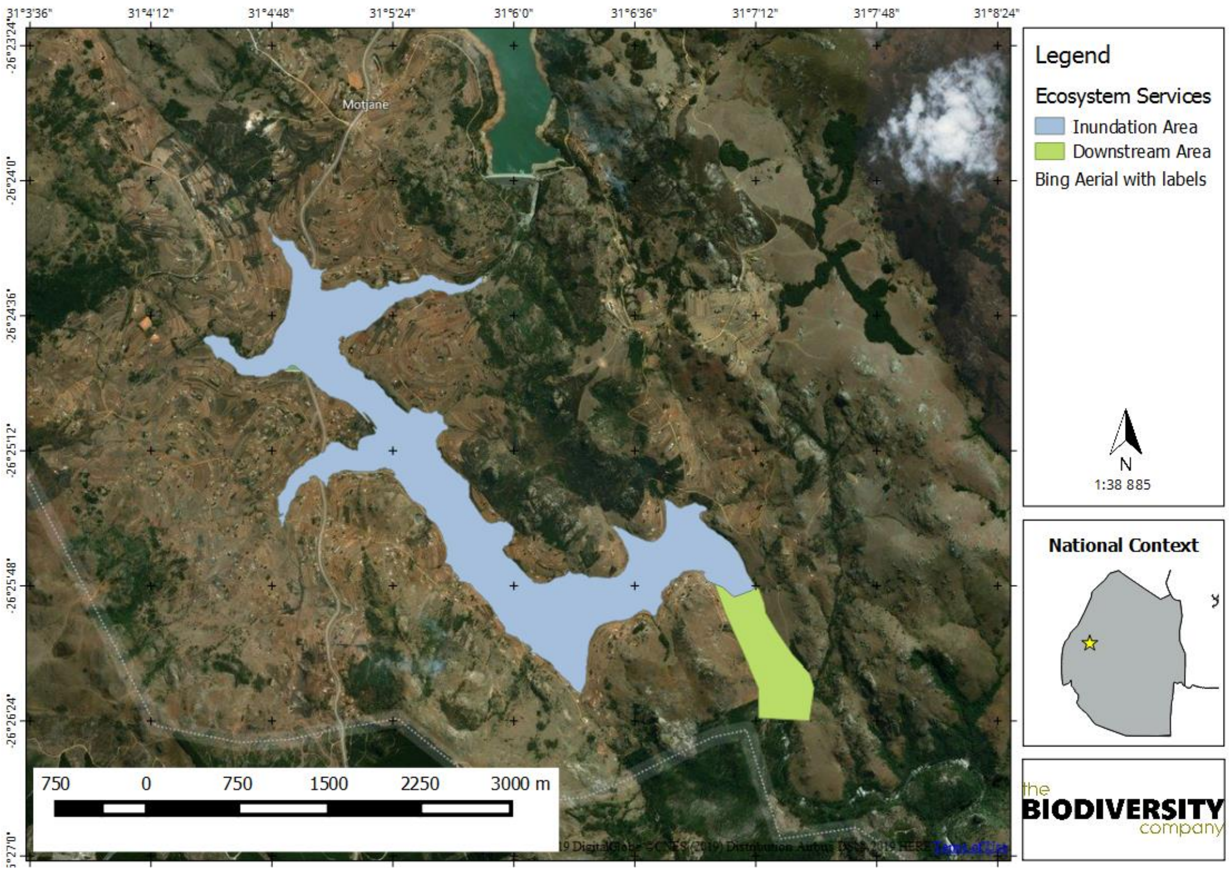


Figure 79: The project area of influence considered for the ecosystem services

5.8.1 Wetland Ecology

Wetland ecology plays a significant role in ecosystem services, given the fact that many ecosystem services are dependent on wetland conditions. The project area was assessed via desktop studies (aerial imagery and topographical river line data) to determine potential wetland areas. A conservative approach was taken to identify as many potential wetlands as possible, which includes areas covered in green vegetation, soil patterns and colours as well as land use. These identified areas were then ground-truthed during the survey periods (4th to 10th March 2019 to determine whether or not essential wetland indicators are present, which include hydromorphic soils and/or hydrophytic plant species.

Hydrophytes increase the level of biodiversity in wetlands, increase the value of habitats and various other ecosystem services including water purification, flood attenuation, etc. Various hydrophytic plant species were identified during the site survey period within the delineated wetlands, including *Schoenoplectus brachyceras, Leersia hexandra, Colocasia, Typha capensis, Imperata cylindrica, Juncus kraussii, Cyperus sexangularis, Cyperus triangularis, Sporobolus pyramidalis* and *Echinochloa holubii* (see Figure 80).

Hydromorphic soil forms identified in the delineated wetlands include the Katspruit and Tukulu soil forms. The Tukulu soil form consists of an Orthic A-horizon on top of a Neocutanic B-horizon (see Figure 81), which in turn is underlain by an unspecified material with signs of wetness. The soil family group identified for the Tukulu soil form on-site has been classified according to the South African soil classification (Soil Classification Working Group, 1991) as the Hoeko (1210) soil family due to the red colour of the soil and the non-luvic processes involved in this soil form.

The Katspruit soil form consists of an Orthic A-horizon on top of a G-horizon (see Figure 81). The soil family group identified for the Katspruit soil form on-site has been classified as the Lammersmoor (1000) soil family due to the non-calcareous nature of the G-horizon.

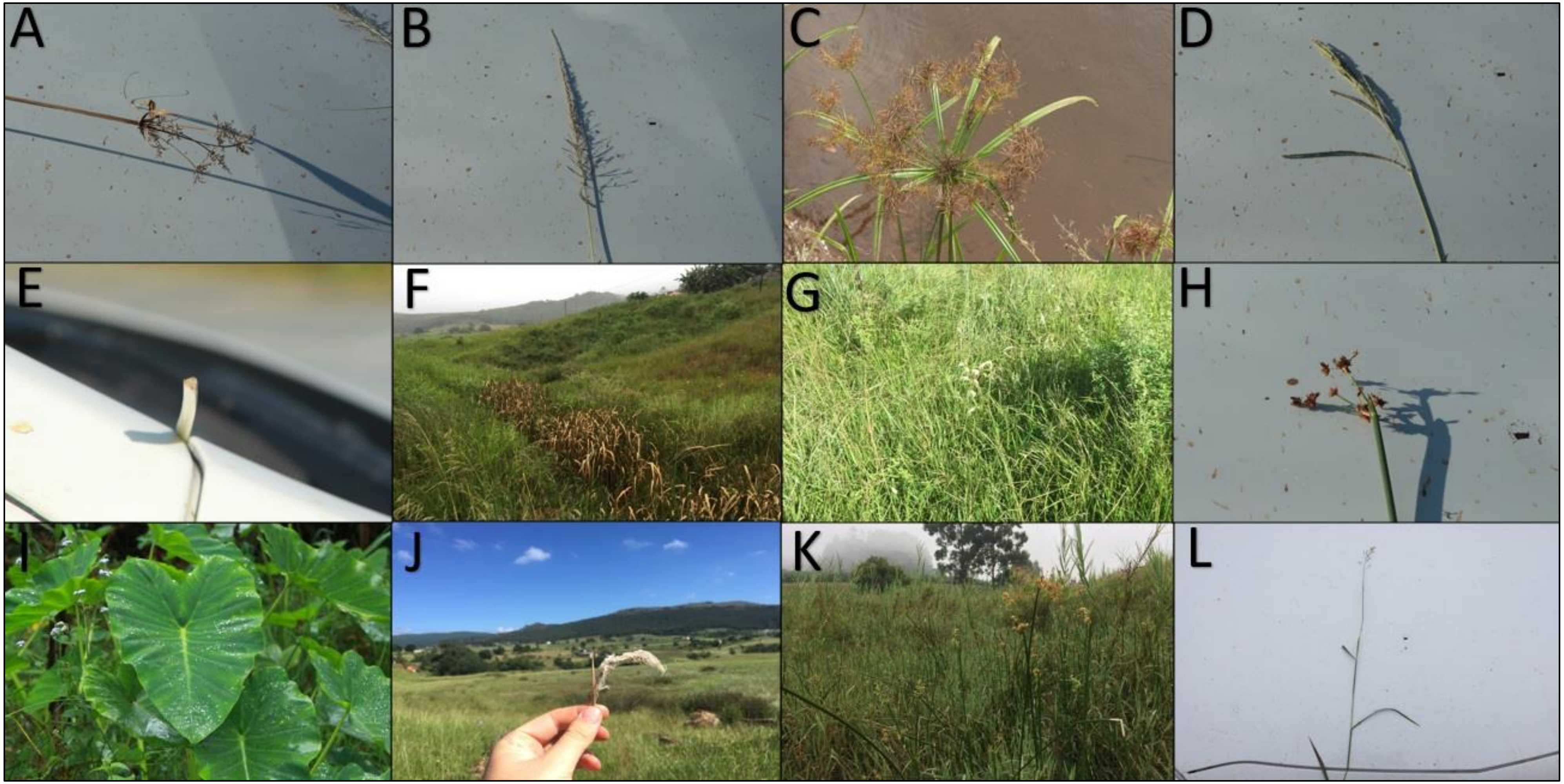


Figure 80: Hydrophytes identified within the delineated wetlands. A: Schoenoplectus brachyceras. B: Sporobolus pyramidalis. C: Cyperus sexangularis. D: Echinochloa holubii. E: Cyperus triangularis (cross sectional presentation of triangular stem). F: Typha capensis. G: Imperata cylindrica. H: Schoenoplectus brachyceras. I: Colocasia. J: Imperata cylindrica. K: Juncus kraussii. L: Leersia hexandra.

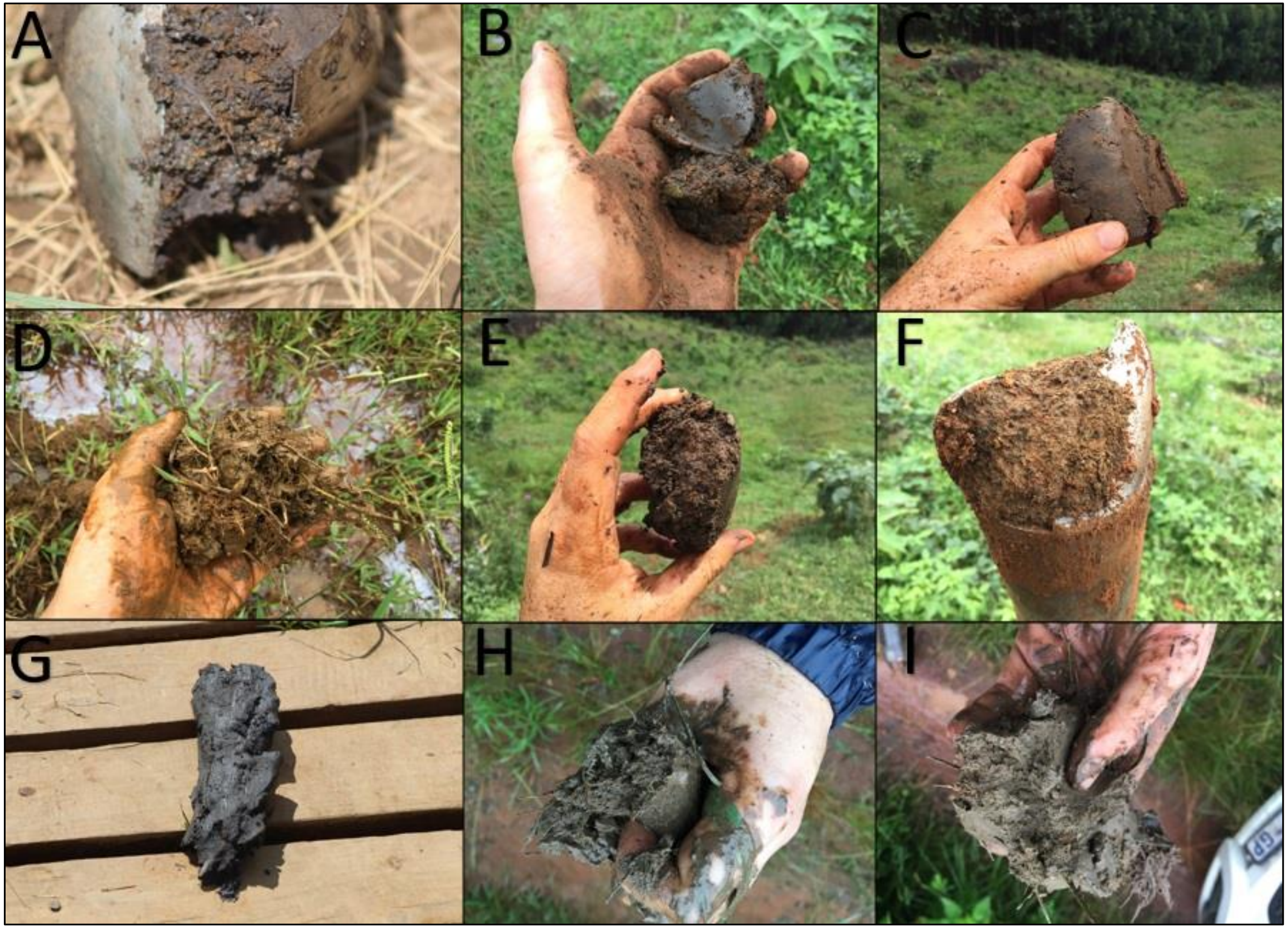


Figure 81: A: G-horizon. B: Orthic A-horizon with colour variations. Unspecific material with signs of wetness. D: Silt accumulated in vegetation. E: Unspecified material with signs of wetness. F: Unspecified material with signs of wetness. G: G-horizon. H & I: Orthic A-horizon with fibrous plant material

Channelled valley bottom wetlands, unchannelled valley bottom wetlands and hillslope seeps were identified during the site assessment (see Figure 82). The channelled valley bottom wetlands are associated with river systems and have been classified as wetlands given the volume and type of soil as well as the presence of a wide variety of hydrophytes within the system and its banks (see Figure 83).

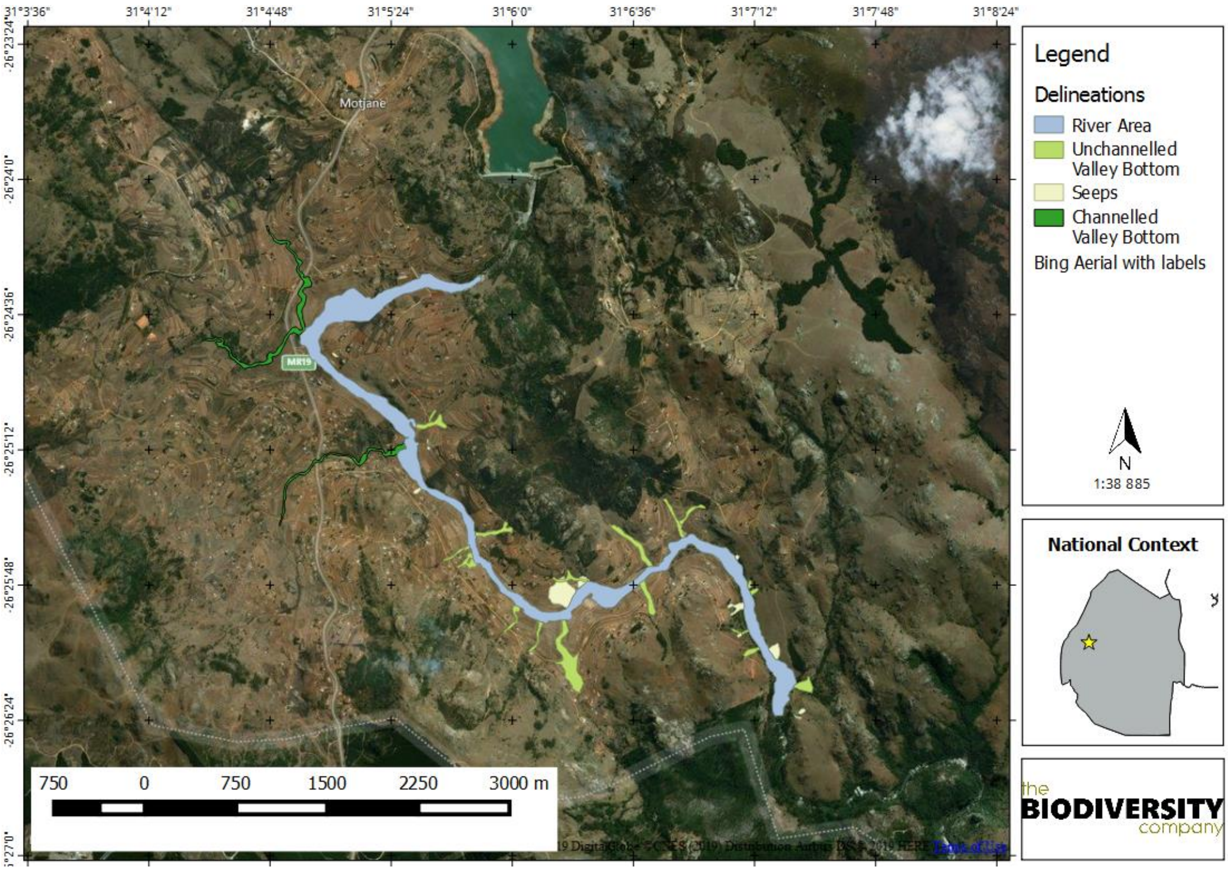


Figure 82: The wetland areas delineated for the assessment

Figure 83: Example of a channelled valley bottom wetland on-site. Green: Wetland vegetation on banks. Blue: Direction of channelled flow.

The majority of wetlands within the proposed inundation area are unchannelled valley bottom (an example presented in Figure 84) wetlands, which in some cases are also characterised by a channel. The channels within the unchannelled valley bottom wetlands are a result of erosion and are not characterised by a finite channel as in the case of the channelled valley bottom wetlands. These channels differ in-depth and in some cases intermittently change into diffuse flow and back into channelled flow throughout the unchannelled valley bottom system. Unlike the channelled valley bottom wetlands, these system's outer edges are characterised by saturated soil forms that are not dependent on the water from the erosional gully/channels that are concentrated in the wetlands.

Figure 84: Example of an unchannelled valley bottom wetland on-site. Green: Wetland edge. Red: Direction of channelled flow.

The hillslope seeps are characterised by diffuse sub-surface flows that feed watercourses downslope of the seeps (see Figure 85). These systems are characterised by temporary saturated zones with a low diversity of wetland vegetation (if any).

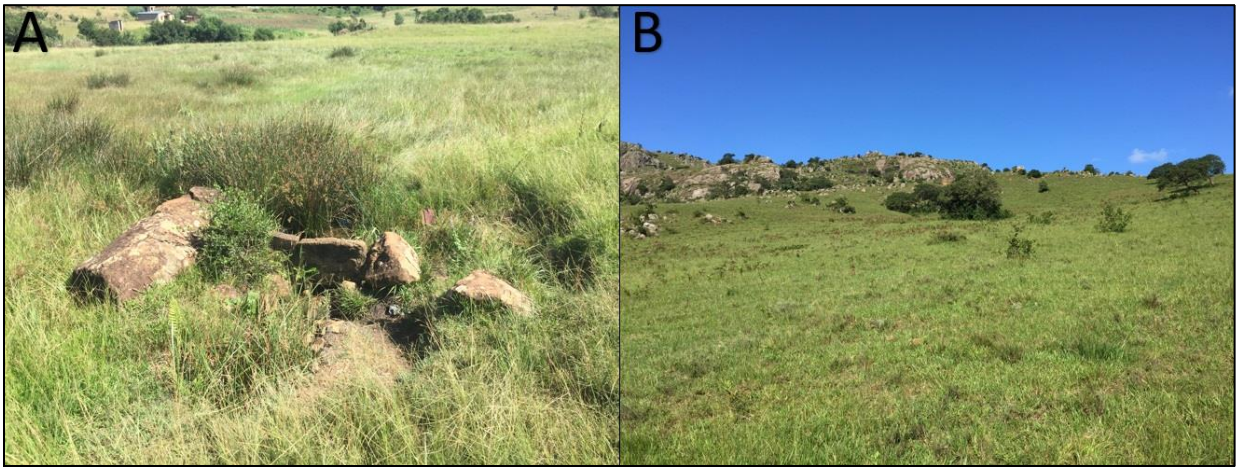


Figure 85: Example of a hillslope seeps on-site.

5.8.2 Ecosystem Services

The Ecosystem Services (ES) Toolkit by Preston & Raudsepp-Hearne (2017) has been used to determine the value of ecosystem services in the current land-use. This assessment has focussed on qualitative data rather than quantitative data (with the exception of loss in hectares) given the fact that financial values and compensation for ecosystem services will be discussed in the social assessment. Table 34 indicates the six steps required according to (Preston & Raudsepp-Hearne, 2017) for an ES assessment.

Table 34: Six steps to an ES assessment

Six Steps in ES Assessment
Step 1: Defining the issue and context
Step 2: Identifying priority ES and beneficiaries for the assessment
Step 3: Identify what needs to be evaluated to answer assessment questions Describing the priority ES within their social and ecological contexts; Tracking how system components relate to each other; and Developing a technical assessment plan.
Step 4: Going into detail Identify relevant indicators; Gathering data; and Selecting analysis methods and tools to answer assessment question.
Step 5: Synthesizing results to answer the assessment question
Step 6: Communicating assessment outcomes

5.8.2.1 Step 1: Defining the Issue and Context

An essential part of identifying an issue, or an assessment question, related to the ES assessment is to define the issue and the context of the assessment. The proposed activity includes the change of the current land-use to a dam, which emphasises permanent inundation and loss of ecosystem services located in the proposed inundated area.

5.8.2.2 Step 2: Identifying Priority Ecosystem Services and Beneficiaries for Assessment

Table 35 includes all of the identified ES and the benefits of these services to humans, as identified by Preston & Raudsepp-Hearne, 2017. The first step to identifying priority ecosystem services is by completing “Worksheet A” (Preston & Raudsepp-Hearne, 2017).

Table 35: Different types of ecosystem services (Preston & Raudsepp-Hearne, 2017)

Ecosystem Services	Category	Benefits to Humans
Provisioning services – the result of ecosystem processes and functions that provide goods or products that humans obtain and rely upon.		
Crops; **Livestock;** **Capture fisheries;** **Aquaculture; and** **Wild foods.**	General Farming Activities	Edible products derived from plants, animals, and fungi that humans require for biological sustenance or commercial use (e.g., fruits, nuts, seeds, meat, vegetables, fungi, tubers/roots, herbs, oils). Ecosystems produce many wild foods and also provide soil, nutrient, microbiological, and climatic conditions that enable humans to cultivate food. These occur through natural gross primary production and conversion of solar energy into biomass, secondary productivity through energy transfer in food chains, and water and nutrient cycling.
Timber and other wood products; and **Fibres, resins, animal skins, and ornamental resources.**	Raw Materials from the environment	Ecosystems produce raw materials from plants and animals that are used by people in many different ways. Plant fibres are used for building (e.g., wood) or are broken down for other products (e.g., pulp for paper), and are also woven to make fabric and other pliable materials (e.g., rope). Raw material derived from animals is also used by people (e.g., fur and wool for clothing, blankets and other textiles, down filler, and sinew for a variety of purposes).
Biomass fuel	Sources of Energy	Biological materials are used by humans as sources of energy, typically burned to create heat for warmth, fuel machinery, and cook food. For example, fuel may be derived from wood, dung, grasses, oil/fat, hydrocarbons, and ethanol.
Fresh water for human consumption and use	Fresh water	Freshwater is fundamental to life and is consumed by humans for drinking, irrigation, sanitation, waste management, and industrial use. Freshwater is a necessary input to the production of foods and fibres and is used for many essential and non-essential activities.
Genetic material	Genetic material	All living organisms contain genetic information that encodes their essential characteristics, which is an important resource to people. This information has been the basis of animal and plant breeding for millennia to improve desired qualities such as taste, resistance to pests, and drought tolerance. Genetic material from wild relatives continues to be necessary to maintain cultivated plants and domestic animals. Genetic material is also used in biotechnology, including medical research.
Biochemical and medicinal resources	Biochemical/ medicinal	Biological organisms produce chemicals, known as “biochemicals” which are the basis for most medicines and pharmaceuticals, and are also increasingly used in various industries, including pest management and food processing.
Regulating services – the result of ecosystem processes and functions that regulate all aspects of the environment, providing security and habitable conditions that humans rely upon.		
Air quality regulation	Air quality	The maintenance of good air quality relies on ecosystems to exchange chemicals with the atmosphere through biogeochemical cycles. Human health is directly impacted by air that is polluted, for example, through burning or industrial emissions. Air-quality regulation by ecosystems ensures numerous benefits, including clean, breathable air and the prevention of respiratory and skin disease. Ecosystems influence air quality by emitting chemicals to the atmosphere (i.e., serving as a “source”) or extracting chemicals from the atmosphere (i.e., serving as a “sink”). Lakes serve as a sink for industrial emissions of sulphur compounds. Vegetation fires emit particulates, ground-level ozone, and volatile organic compounds. (UNEP).
Climate regulation and carbon stocks **Global climate regulation; and** **Regional and local climate regulation**	Climate regulation	Ecosystems play an important role in moderating local weather and influence climate locally, regionally, and globally. Ecosystems influence global climate by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere. Topography, vegetation, decomposition (by animals, fungi and microbes), albedo, and water bodies interact with regional and global climate processes to regulate climate.

		The reflective properties of the Earth's surface, affected by ecosystem properties, such as the amount, type and structure of the vegetation and the amount of surface water, influence the amount of incoming solar energy that is absorbed or reflected back to space. Certain types of ecosystems (e.g., prairie grasslands, forests, wetlands, bogs) serve as important stores that lock up greenhouse gases from the atmosphere. Plants and marine algae remove and sequester carbon dioxide in their tissues thus influencing global temperatures. How the climate is regulated by ecosystems impacts humans in a variety of ways, for example, by altering food production conditions, controlling humidity levels, and influencing storm intensity.
Water flow regulations	Water flow regulation	Maintaining natural water-flow regimes in a watershed through intact ecosystems provides numerous benefits to people by mitigating drought and extreme flood events, for example, through buffering extreme discharge from rivers and streams and providing natural irrigation and water storage. Changes in land cover can influence the timing and magnitude of runoff, flooding, and aquifer recharge. Permeable soil facilitates aquifer recharge. River floodplains and wetlands retain water, which can decrease flooding during runoff peaks, reducing the need for engineered flood control infrastructure.
Erosion regulation	Erosion control	Vegetative cover and, in particular, the structure of vegetation both above and below ground, plays an important role in soil retention and in the stabilization of slopes. Plant roots help to stabilize soil, thus minimizing land degradation and sediment loads in rivers and streams and helping to conserve water quality.
Water purification and waste treatment	Water purification	Vegetation, soils, and soil biota can help to filter out and sequester or decompose organic wastes, including those introduced in production landscapes. Water filtering by wetlands involves the breakdown of nutrient-rich waste from human and animal sources and the removal of disease-causing bacteria such as E. coli. Bioremediation of soils and water relies on the metabolic activity of plants and microorganisms to absorb pollutants from soil or water and, in some cases, to digest toxins. The purification of freshwater for drinking and other purposes as well as the removal of microbes and other toxins provide an important benefit to human health.
Disease regulation	Disease regulation	Changes in ecosystems influence the incidence and abundance of human pathogens (e.g., cholera, malaria) in the environment. Ecosystem biodiversity helps to regulate predator-prey relationships and parasite lifecycles that affect vector-borne diseases and directly impact human health. Many different species of birds, bats, flies, wasps, frogs, and fungi act as natural control agents. Bird diversity, for example, can be a contributing factor dampening the occurrence of viruses carried by mosquitoes and minimizing human exposure to the disease.
Pest regulation	Pest regulation	Changes to ecosystems, including pest management interventions, can alter the capacity of the ecosystem to naturally regulate pests, thus potentially influencing the production of harvestable goods. Natural pest regulation supported by healthy ecosystems significantly reduces impacts of unwanted predation, for example, on crops, and the monetary and (in the case of pesticide use) health costs associated with implementing engineered controls.
Pollination	Pollination	Most plants require pollination to reproduce. Natural pollination occurs primarily by insects, and also by wind, birds, and bats. Changes to ecosystems and impacts to pollinator species from human or other activity alter the abundance and distribution of pollinators and hence their effectiveness.
Natural hazard regulation	Natural hazard regulation	The impact of extreme weather events and natural hazards such as floods, avalanches, and landslides can be ameliorated by intact ecosystems. For example, coastal dune ecosystems can dampen the impact of storm surges, thus minimizing harm to people and damage to infrastructure. Ecosystems also play a role in regulating natural disturbance regimes such as forest fires. Changes to forest ecosystems, for example, through fire suppression, can lead to more intense fires caused by higher fuel loads that can damage seed banks and be more difficult to control.
Cultural services – the result of ecosystem processes and functions that inform human physiological, psychological and spiritual well-being, knowledge and creativity		
Cultural identity and heritage	Cultural and heritage	Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies. Many societies place a high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species. (MA)

		Identity and heritage are grounded in experience everywhere, in every type of ecosystem, and are informed by relationships with nature that are distinctive to each place. Ecosystems thus support social cohesion through shared experience and shared understanding of the world.
Spirituality and religion	Spiritual and religion	Many religions, cultures, and individuals around the world attach spiritual and religious values to the earth and ecosystems or their components or find deep spiritual inspiration in their experience of nature. These values are found everywhere in the world, in industrialized as well as traditional and Indigenous societies. These beliefs and experiences provide a sense of deep purpose and profound meaning to human life.
Knowledge systems and education	Knowledge and education	As the primary context of human existence, perception of the Earth's ecosystems and their processes and functions are the foundation for all human knowledge systems. Ecosystems influence the types of knowledge systems (traditional and formal) developed by all cultures and societies. Ecosystems and their components and processes are the basis for both formal and informal education. Observation of ecosystems at all scales is increasingly the basis for technological problem-solving, for example, through biomimicry. Language, knowledge, and the natural environment have been intimately related throughout human history. (TEEB)
Cognitive development, psychological and physical health and well-being	Physiological and physical health and well-being	Direct contact with nature is essential to support human cognitive development and psychological health. Two key benefits are decreased incidence of crime and improved socialization. It is also proven to support physical health and healing (in addition to benefits that come through physical exercise). (see WHO-CBD 2015)
Aesthetic experience	Aesthetical experience	Humans experience the world through sensory perception and cognitive interpretation. Aesthetic experience refers to the cognitive and associated emotional response to perceived beauty in any form. The appreciation of beauty in the sounds, sights, scents, and sensations of nature is of recognized importance to the human condition and is documented throughout history, across cultures and traditions. While aesthetic experience can be a powerful source of inspiration for creative works or spiritual beliefs, the experience of aesthetic appreciation itself is highly significant in human quality of life by supporting emotional, psychological, and (by extension) physical health.
Inspiration for human creative thought and work	Inspiration of human creative thought	Nature has always been and continues to be an important source of inspiration for much human art, literature, folklore, music, architecture, industrial design, symbols, and science. (Adapted from MA and TEEB)
Recreation and ecotourism	Recreation and tourism	Nature-based recreation and leisure are highly valued aspects of life for people around the world, whether in urban, rural or remote wilderness settings. These activities, and ecotourism, are all dependent on the direct experience of nature and engagement with it in some form. They provide significant quality of- life benefits, including physical, psychological, and emotional well-being. These activities generate direct economic benefits to society but can be a contributing factor to ecosystem degradation if not wisely managed.
Sense of place	Sense of place	Sense of place is experienced by individuals and can be shared collectively within groups and whole communities based on common and shared experiences of a place. It is informed strongly by characteristics of that place which may be both natural and human-modified or built. Within communities, the sense of place can further inform a sense of community identity.
Supporting or habitat services – the underlying ecosystem processes and functions that are necessary for the production of all other ecosystem services, creating the biological environment.		
Soil formation	Soil formation	Soil is formed through long-term processes of rock weathering and the accumulation of organic matter. Soil provides a substrate for the growth of plants, including on cultivated land, and also contributes to the natural filtration of water for human use.
Primary production	Primary production (photosynthesis)	Primary production involves the formation of biomass through the conversion of solar energy (photosynthesis) and nutrient uptake by plants, contributing to plant growth and animal food webs.
Nutrient cycle	Nutrient cycle	Many nutrients that are essential to life flow through ecosystems (e.g., nitrogen, sulphur, phosphorus, carbon). These nutrients are decomposed and recycled, changing forms and making them available to plants and animals, for redistribution within the system.

Water cycling	Water cycling	Water flows through an ecosystem in all forms (i.e., gas, liquid, solid). Within a watershed, water is absorbed by plants and transpired, returning water moisture to the atmosphere where it can cycle back to the land and oceans through precipitation. Water is thus made available to humans for a variety of uses.
Habitat	Habitat	Habitats provide everything that an individual plant or animal needs to survive food, water, and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species, including birds, fish, mammals, and insects, all depend upon multiple ecosystems during their migrations. (TEEB)

5.8.2.3 Step 3: Identify What Needs to be Assessed

The worksheets relevant to this step have been used to describe the priority ES and the scale of these services. A detailed action plan was then set-up to ensure that relevant data is collected during the site assessment for all the ES deemed to be of high priority. The following ES has been identified to be of high concern given the parameters and results determined:

- General farming activities;
- Raw materials from the environment;
- Freshwater;
- Waterflow regulation;
- Water purification;
- Soil formation;
- Water cycle; and
- Habitat.

The following sections are applicable to each of the identified ES and will be used to increase the accuracy of ES assessments;

General Farming Activities

General farming activities are vital to many communities' well-being, especially in areas characterised by poverty and/or rural areas. Farming activities include any signs of cultivation or livestock. Cultivated areas are easily identifiable via satellite imagery, which allows for accurate delineations, which ultimately will provide for an accurate representation of the hectares within the project area that is covered in crops.

Raw Materials from the Environment

Rural and poverty-stricken communities often depend on raw materials from the environment for the construction of homes and furniture, to sell or to use for an energy source (heat and/or cooking food). This ES ensures a higher quality of life, regardless of the method of utilisation of raw materials. This ES is easily quantifiable by means of hectare calculations, to determine how much of this ES will be lost given that the proposed activity proceeds.

Fresh Water

Watercourses provide surrounding communities with a source of drinking water, a source of irrigation for crops and/or for sanitary reasons (i.e. bathing, cleaning livestock pens, cleaning infrastructure, etc.). Watercourses include river systems and wetlands, of which the latter is identifiable via wetland characteristics (topography, hydrophytic plants and/or hydromorphic soils) (see Section 5.8.1- "Wetland Ecology").

Water Flow Regulation

Water flow regulation is essential throughout the relevant catchment to ensure steady discharge into watercourses downstream from the identified watercourses, to ensure flood attenuation and water storage.

The surface roughness within the watercourses as a result of hydromorphic soil and vegetation (especially hydrophytic vegetation) ensures a decrease in flow velocity during and after sporadic rainfall events, subsequently reducing erosion and damage to infrastructure downstream of the relevant watercourses. Some of the identified watercourses are characterised by various vegetation and hydromorphic properties. As an example, some watercourses are characterised by exposed bedrock instead of hydromorphic soils, which results in a lower water flow regulation score.

The more the identified watercourses are suited for flood control, the more beneficial these wetlands will be to the local community, communities downstream of the watercourses and/or the surrounding environment (referring specifically to natural habitats). The following aspects are relevant to a high or low ES score applicable to water flow regulation;

- The size of the watercourse in regard to the catchment;
- The slope of the watercourse;
- The surface roughness of the watercourse (extent of vegetation cover);
- The frequency of which stormflow spread across the watercourse;
- The sinuosity of the stream channel;
- Runoff potential of the soil resources within the watercourse's catchment;
- Contribution of catchment land-uses to surface run-off characteristics;
- The rainfall intensity in the region; and
- The extent of property downstream of the watercourse.

Purification of Water

Given the informal layout of the residential areas and the abundance of crops in the region, contamination via toxicants, fertiliser and/or faeces is likely to occur. The watercourses in this region will play integral roles in assimilating contaminants and ensuring that the water within the watercourses are consumable and that watercourses downstream are not contaminated.

Factors contributing to a high ES in regard to water purification include hydromorphic soil (and the bacteria contained therein) as well as the presence of hydromorphic vegetation. Watercourses will be rated high or low for water purification depending on the presence (or absence) of the following aspects;

- Presence/absence of soil;
- Presence/absence of hydrophytic plants;
- Sediment trapping abilities (associated with the coverage of vegetation within the wetland);
- A pattern of low flows within the watercourses;
- The application of fertiliser in close proximity to the watercourses;
- The application of herbicides, pesticides or any other form of toxin in close proximity to the watercourses system; and
- The presence/absence of permanently saturated soils.

Soil Formation

Soil formation occurs as a result of the weathering of rock, either via chemical processes (as in the case for mafic and ultramafic rocks) and physical weathering (as in the case of felsic and intermediate rocks). Watercourses will increase weathering processes (physically via high-velocity streamflow, abrasion and/or biophysical weathering or chemically by means of the saturation of the bedrock). Newly formed soil will increase the potential for agriculture given high volumes of soil with intermittent flooding events increasing the organic carbon concentrations of terrestrial areas due to the deposition of plant material and bacteria-rich sediments. Aspects contributing to a high or low ES score in regard to soil formation include;

- Presence/absence of exposed bedrock; and
- Presence/absence of crop fields and vegetation within the relevant watercourse (indicating larger soil volumes, especially in close proximity to watercourses).

Water Cycle

The main concept behind water cycling includes evapotranspiration in general. Evaporation is increased in watercourses characterised by diffuse flow more so than for high-velocity flows. Transpiration will be higher in watercourses with a higher vegetation cover given the fact that the uptake of water by plants leads to vapor being released back into the atmosphere. The ultimate result of high evapotranspiration is the recycling of surface and sub-surface water back into the atmosphere, followed by precipitation. The following aspects contribute to the high or low ES score related to the water cycle;

- The coverage of vegetation within the watercourses;
- The presence of depressions;
- The extent of open water;
- The slope of the watercourse;
- Diffuse or high velocity flows within the wetland;
- The size of the watercourse;
- The depth of the watercourse; and
- The colour of the soil and vegetation within the watercourse (darker colours attract more sunlight).

Habitat

Habitat is an integral part of wetland ES given the role habitat and biodiversity plays in each and every other ES mentioned in Table 35. As per IFC requirements, the importance of wetlands in regard to waterfowl habitat and habitat for other significant species, in general, is emphasised (IFC, 2010). Terrestrial and aquatic habitats have also been taken into consideration for this particular ES.

5.8.2.4 Step 4: Going into Detail: Identifying and Using Indicators, Data Sources and Analysis Methods

This step incorporates the findings from the previous step (in regard to what needs to be assessed) and describes methods of identifying these specific parameters.

General Farming Activities

Farming activities are easily identifiable via satellite imagery. Desktop delineations of general farming activities were completed before the site assessment to identify potential farming activities. These were then ground-truthed, after which calculations were made to determine the amount of farming activities (in ha) present within the project area.

Raw Materials from the Environment

Thick patches of trees, grasslands, watercourses and signs of artisanal mining are imperative to this ES. Areas that potentially might be characterised by these land uses were identified via satellite imagery, which is followed by ground-truthing and assessments of those areas. Signs of the community utilising these land uses are then identified to determine whether or not the community harvests reeds, trees or grasses. Communities might also fish or hunt to make use of raw materials in the environment. Artisanal mining provides the community with construction materials (to use or to sell). Conversations with the local community prove helpful for the assessment of this ES.

Fresh Water

Watercourses are identified via desktop studies (drainage patterns and satellite imagery). Wetland systems are identified by means of topography, hydrophytic vegetation and/or hydromorphic soils. Signs of the community utilising watercourses are then identified to roughly determine the dependence of the local community on the identified watercourses. Conversations with the local community will also prove helpful for the assessment of this ES.

Water Flow Regulation

The size of watercourses in comparison to the entire catchment can be calculated by dividing the size of the relevant watercourse (ha) by the size of the relevant watercourse's catchment (ha) and multiplying that by 100. The size (in percentage) of the wetland can then be compared to the size of other wetlands to determine which watercourses are more significant. The larger the watercourses are in comparison to their catchment, the better the relevant watercourse will perform in regard to water flow regulation.

The slope of a watercourse is calculated by dividing the lateral distance between two points in the watercourse with the difference in altitude between those two points and then multiplying the result by 100 to determine the slope percentage. The slope percentage of the watercourse can then be compared to the slope of other watercourses to determine which watercourses are more significant. Watercourses with lower slope percentages will perform better in regard to water flow regulation.

To determine the surface roughness, a rough estimation of vegetation cover of the watercourse will be determined percentage-wise. Desktop studies (aerial imagery) and site-based assessments will be used for these estimations. The higher the surface cover (%) is, the better the relevant watercourse will be in regulating water flows.

The frequency of stormflows spreading across watercourses can be determined by the rainfall intensity in the region and the likelihood of stormflows spreading across the watercourse. This can be determined by identifying channels (or the lack thereof) that will allow stormflows to be channelled rather than spreading diffusely across the entire watercourse. Channels and the extent of channels can be determined via desktop studies (aerial imagery and channel networks).

The sinuosity of stream channels is related to the ability of channels to bend and curve instead of straightening and eroding away soil resources. Watercourses characterised by a stream channel (river systems and channelled valley bottom wetlands) will be assessed via desktop studies (aerial imagery) to determine the degree of sinuosity. Areas of concern will be ground-truthed to determine the extent of erosion and channel straightening. Watercourses characterised by sinuosity are more likely to regulate stream flows.

Soil types and associated physical properties will be assessed together with land uses (i.e. artificial surfaces) to determine a rough estimate of the overland flow properties within the relevant watercourse's catchment. Watercourses with lower runoff potential are more likely to have higher ratings for water flow regulation.

In cases where the property is located downstream of a watercourse, the ability of the relevant watercourse to regulate flows will be emphasised given the dependence of those individuals that own the relevant property. Desktop studies will be used to determine the location of such properties. Watercourses characterised by properties downstream will be rated higher in regard to streamflow regulation given the importance of these wetlands to regulate stormflows.

Purification of Water

Watercourses characterised by hydromorphic soils will perform better in regard to the purification of water given the filtering ability of the soil and the presence of bacteria that is vital in the purification process as appose to shallow wetlands covered in exposed rock surfaces. Delineated watercourse's soil profiles have been identified and assessed to determine the depths and properties of these soils. Wetlands characterised by permanently saturated hydromorphic soils will perform best in regard to the purification of water, followed by seasonally saturated soils, then temporarily saturated soils and lastly, watercourses characterised by alluvial sediments (river systems).

Hydrophytes increase the potential of wetlands to purify water, given the ability of these plants to absorb contaminants. Hydrophytes will be identified during the site assessment together with a surface roughness estimation. The more hydrophytes present in a watercourse, the better the wetland will perform in regard to water purification.

Diffuse flows will occur in watercourses that have gentle slopes and high vegetation cover. By taking these two aspects into consideration, patterns of low flows can be predicted. Watercourses characterised by patterns of low flows will have higher water flow regulation abilities.

Watercourses with adjacent crop fields are likely to receive inputs of fertilisers or pesticides given the application thereof within the crop fields. Crop fields have been assessed during the site assessment to identify any potential indicators of fertiliser/pesticide application (i.e. bags of fertiliser, bottles of pesticides, etc). Watercourses with crop fields located in close proximity to the delineated areas will be more likely to receive inputs of contaminants than those without crop fields. Watercourses receiving inputs of contaminants via fertiliser will have higher scores for water purification given the importance of these watercourses to purify water due to the likely potential of contamination.

Soil Formation

Deep soil profiles within wetlands are indicative of high soil formation abilities. Crop fields have been established in areas adjacent to the wetland systems where deeper soil profiles are present. Wetlands characterised by crop fields adjacent to the systems will have higher soil formation abilities. Desktop studies (aerial imagery) has been used to determine wetlands with crop fields adjacent to the systems with site-based assessments providing information as to the properties of soil resources within wetlands. Additionally, areas down-slope from rock faces and cliffs will be assessed to determine the weathered state of rock (which is essential for soil formation) as well as the accumulation of "young" soils (soils recently weathered).

Water Cycle

Watercourses characterised by areas of open water (as appose to sub-surface water) are more likely to improve the nutrient cycle. Desktop studies have been used to determine such areas and have been ground-truthed thereafter. Watercourses with large areas of open water will have higher evaporation rates, which indicates a higher nutrient cycle ability.

The depth of watercourses is important to the ability of wetlands to cycle nutrients. Evaporation is increased in shallow watercourses which indicates a higher water cycle ability. A soil auger has been used to determine a rough estimation of the depth of all wetlands and where possible river systems.

Watercourses covered in vegetation with darker colours will have higher evapotranspiration rates which increase the water cycle ability. Aerial imagery has been used to determine the colour of vegetation.

As for the slope of watercourses diffuse flows within wetlands (and river systems where possible), the size of watercourses and the vegetation coverage within the watercourses will be taken into consideration.

Habitat

Results from aquatic and terrestrial ecology studies have been taken into consideration for aquatic and terrestrial habitats, to ensure that all habitats throughout the project area are covered.

5.8.2.5 Step 5: Synthesising Results to Answer Assessment Questions

The following section describes the results from the assessments as the level of the identified priority ES provided by each of the HGM units. A score of zero to three is determined for each one of the HGM units in regard to each of the aspects per ES, with zero indicating that the specific ES is not provided by the wetland and three indicating a high level of ES. The average is then calculated to determine an average ES score for the relevant ES. It is worth noting that the DMU for the ecosystem services assessment differs from that of the ecology studies due to the fact that only direct impacts are expected to the relevant ecosystem services.

General Farming Activities

Approximately 107,2 ha of the DMU (340,18 ha) is covered in crop fields, of which only 2,26 ha is located within the downstream area and the rest (104,76 ha) located within the proposed inundation area (see Figure 86). An example of farmland is presented in Figure 87.

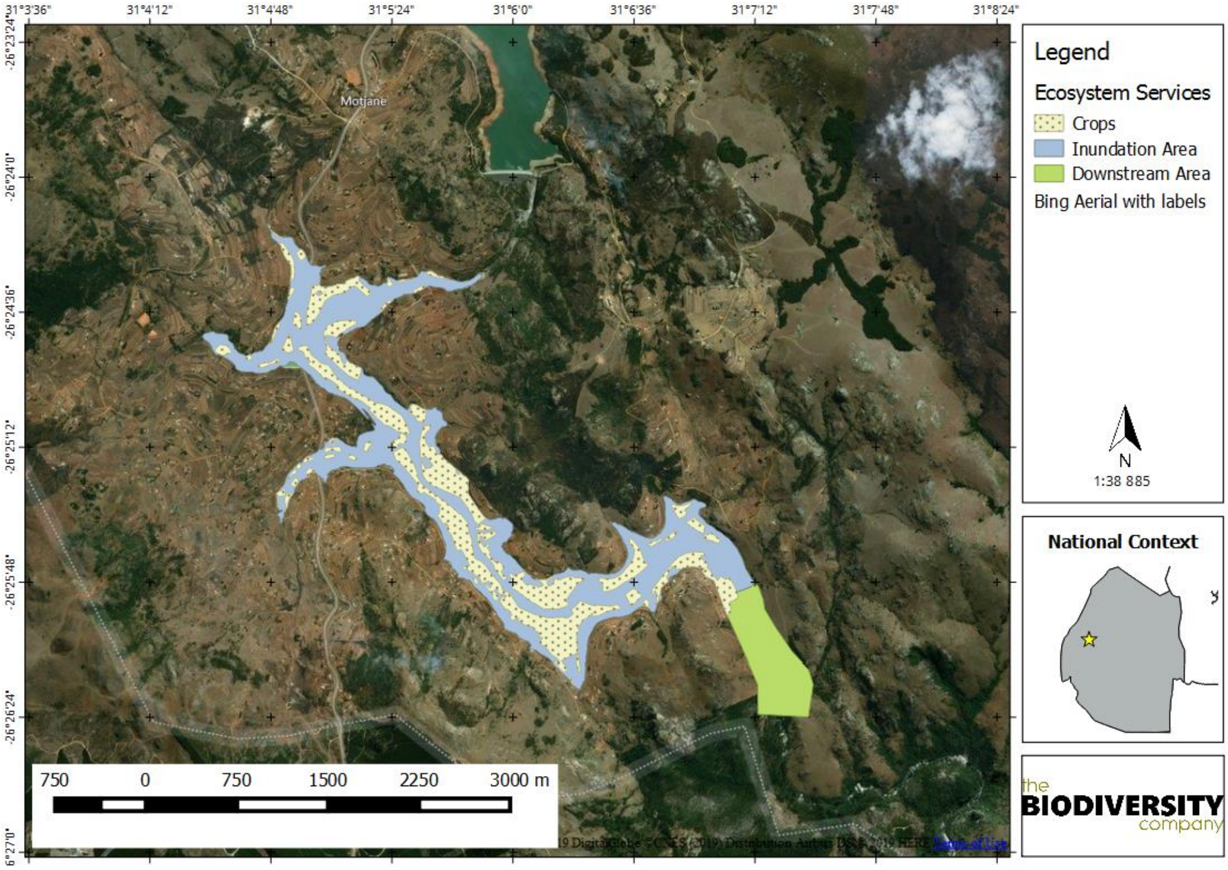


Figure 86: The location and extent of crop fields delineated for the assessment

Figure 87: Example of farmland

Raw Materials from the Environment

Approximately 28,36 ha of the DMU is characterised by densely grown tree patches (see Figure 90). These areas are often utilised for timber to use for building purposes, energy or cooking. The majority (17,4 ha) of the delineated densely grown tree patches are located in the downstream project area (where indirect, unlikely impacts are expected) with 10,96 ha located within the proposed inundation area (see Figure 88).

Sand mining also takes place within the banks of the river system in the proposed inundation area (see Figure 89). This area covers approximately 5,15 ha and is important to the well-being of the local community.

Very little to no signs of the community harvesting reeds or grass were identified during the site assessment, ultimately rendering the delineated tree areas (Figure 90) as the most likely source of raw materials in the relevant project area.

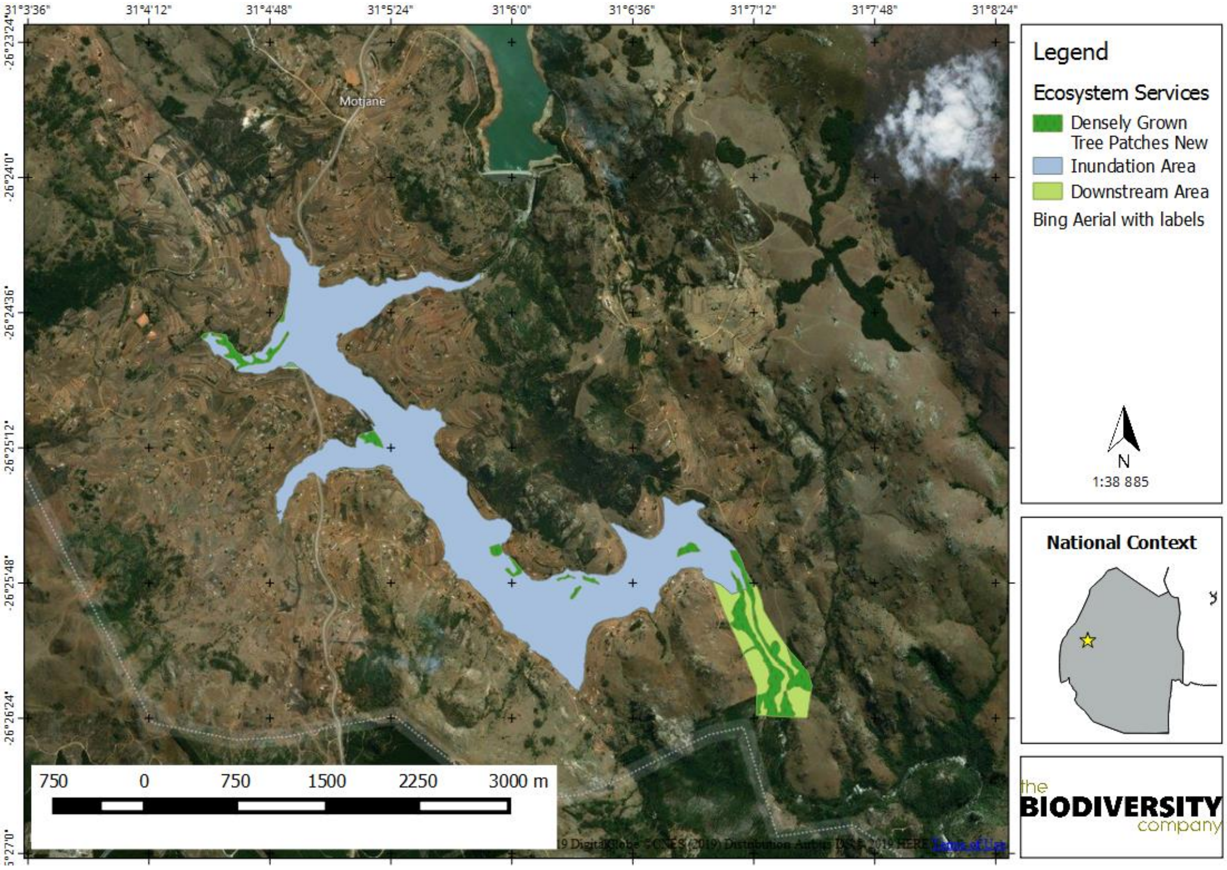


Figure 88: The location and extent of densely grown tree patches delineated for the assessment

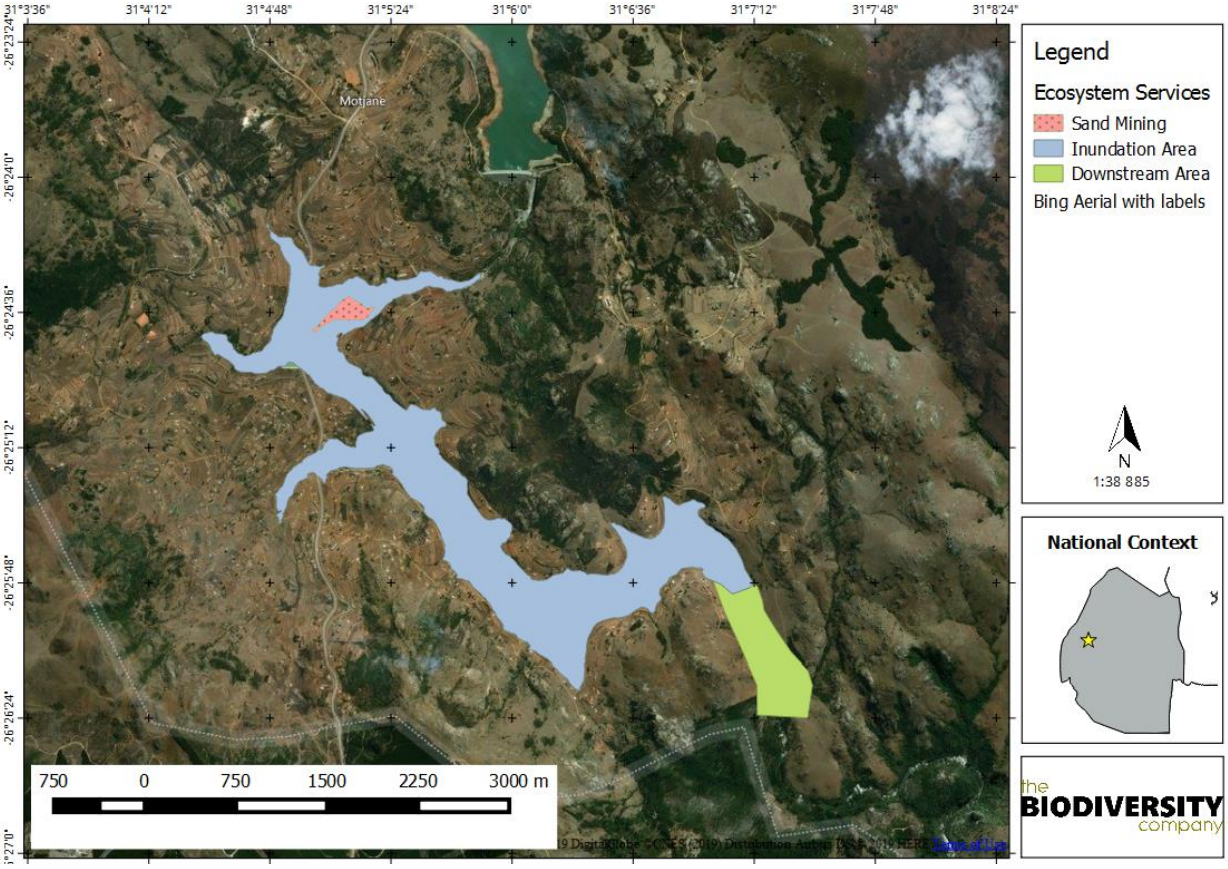


Figure 89: The location and extent of sand mining identified for the assessment

Figure 90: Dense tree patches

Fresh Water

Watercourses were identified throughout the project area to determine the potential for potable fresh water for the surrounding community. Four types of watercourses have been identified during the site assessment, namely wetlands (in the form of channelled valley bottom wetlands, unchannelled valley bottom wetlands and seeps) as well as a river system. The delineated channelled valley bottom wetlands cover 9,3 ha of the proposed inundation area, unchannelled valley bottom wetlands cover 14,29 ha with hillslope seeps covering approximately 4,35 ha of the inundated area. The delineated river system (which includes in-stream habitat, riparian areas and associated floodplain areas) covers approximately 63,29 ha of the project area (see Figure 91).

The community is provided with potable water by means of water pipelines and pipelines extending from mountains to households, ultimately providing families with clean water from springs high up in the catchment (see Figure 92).

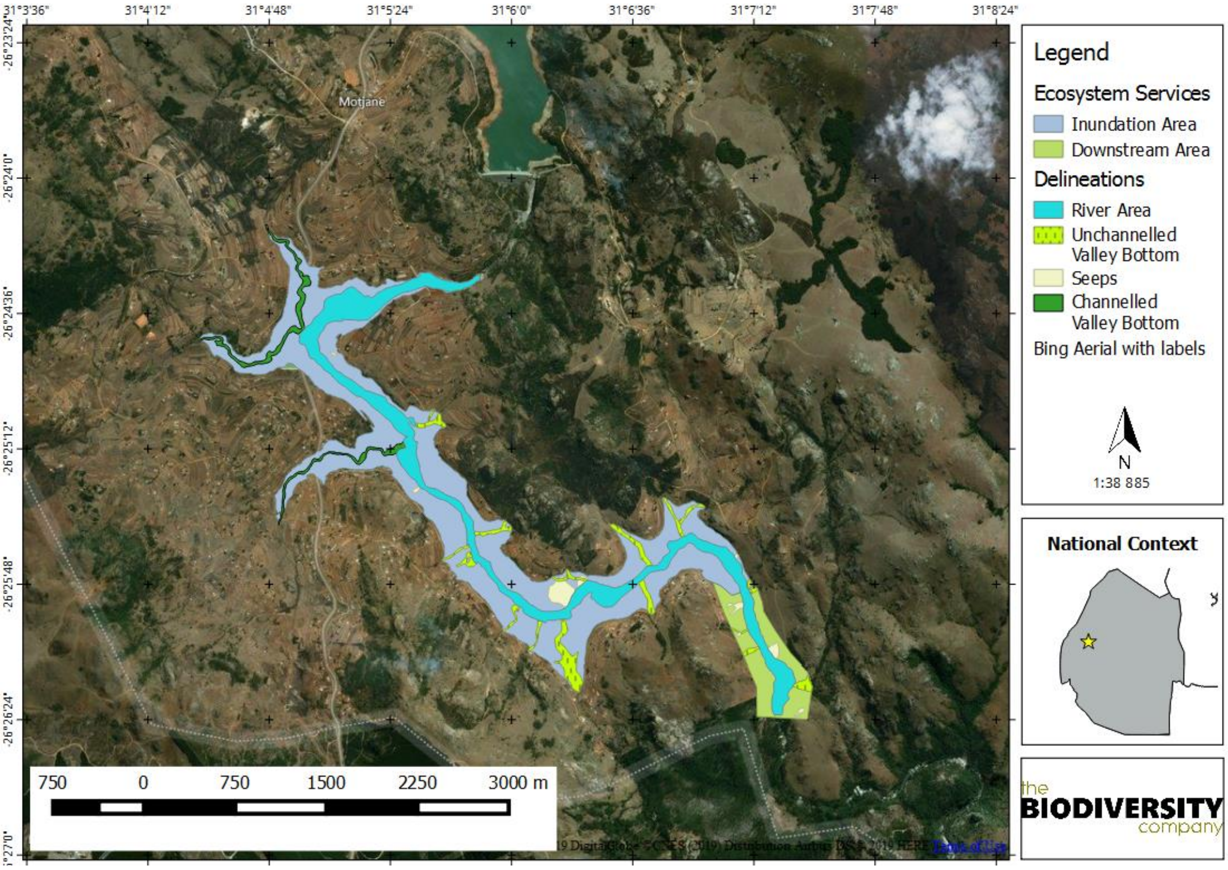


Figure 91: The extent of the delineations considered for the assessment

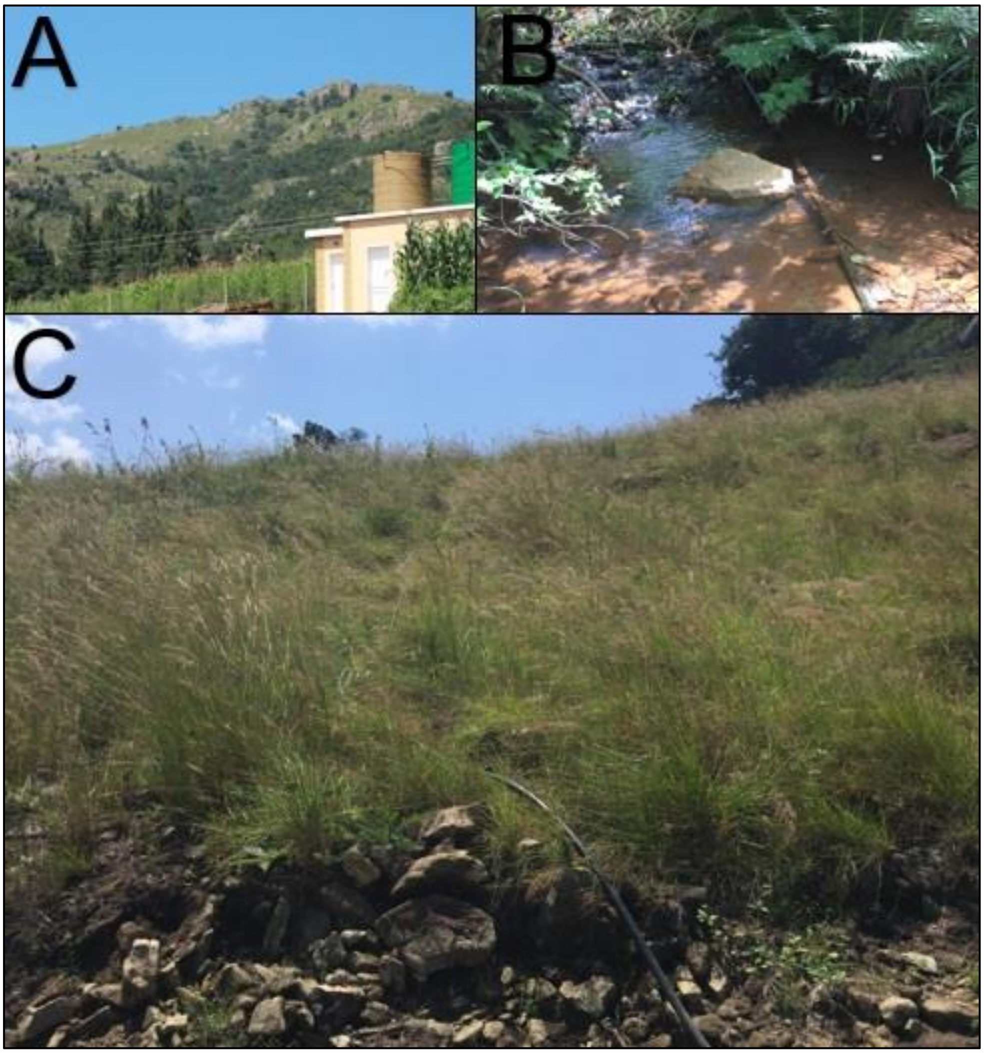


Figure 92: Pipeline systems throughout the project area. A: Reservoir tanks storing water. B: Pipeline within wetland system. C: Pipeline leading from mountain tops to lower laying households.

Water Flow Regulation

The water flow regulation services associated with the above-mentioned watercourses have been assessed and quantified by means of basic calculations associated with relevant parameters (see Appendix B). These parameters have been rated on a scoring basis from one to three (with three being "High", two being "Moderate" and one being "Low"). A comparison between water flow regulation for two wetlands is presented in Figure 93.

The river system has been scored 1,9 (out of 3,0) due to the frequency of stormflows spreading across the system, the sinuosity of the stream channel, the contribution of the watercourse's catchment to run-off characteristics and the rainfall intensity of the region. The unchannelled valley bottom wetland has also been scored an average score of 1,9 for water flow regulation due to the presence of dense patches of hydrophytes, the gentle slope of the watercourse and the frequency at which stormflows spread across the wetland.

The channelled valley bottom wetlands have been scored slightly lower (1,8) given the absence of vegetation directly within the stream channel with hillslope seeps being scored much lower (1,2) given the slope of the wetland (generally steeper than other watercourses) and the fact that stormflows do not frequently spread across the relevant wetland.

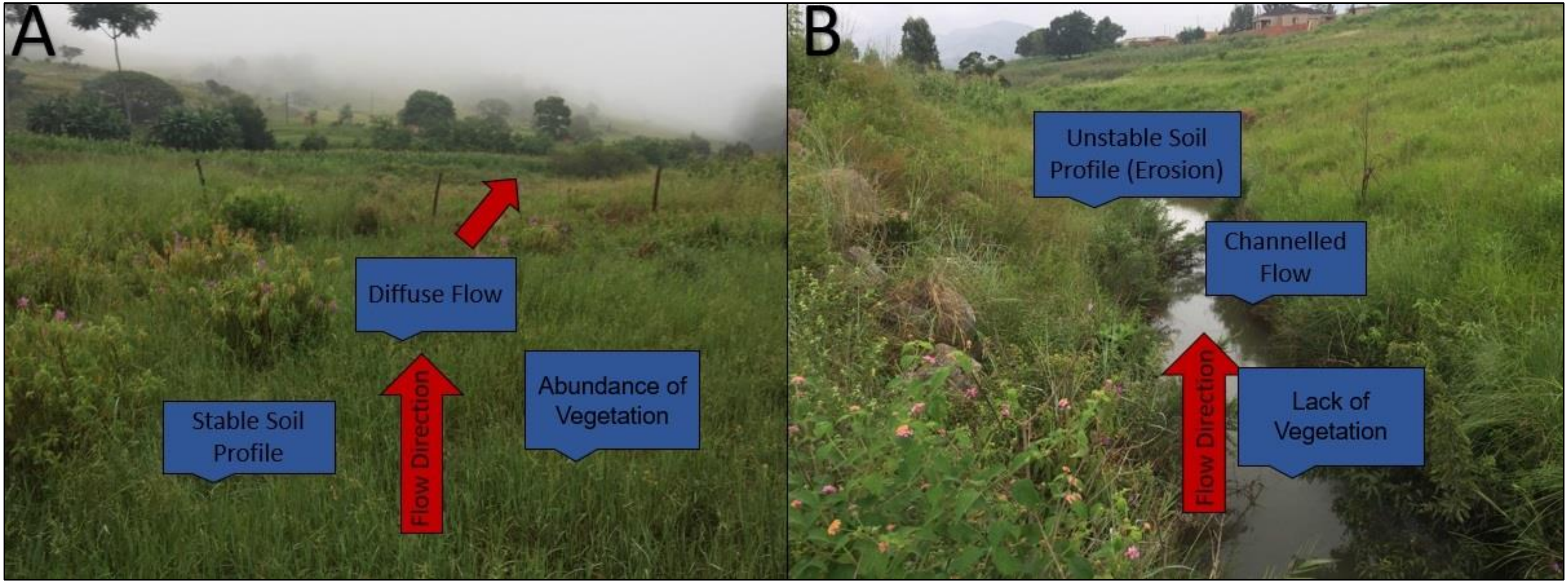


Figure 93: Comparison between "High" and "Low" ES for water flow regulation. A: High ES. B: Low ES

Purification of Water

The river system has been scored the lowest “Water Purification” ecosystem service score of all four watercourse types, with an average score of 0,7. This weak score is attributed to the lack of hydrophytes and hydromorphic soils (given the dominance of alluvial sediment) as well as the velocity of flow. The channelled valley bottom wetlands and the hillslope seeps have been scored 1,7 with the unchannelled valley bottom wetlands determined to have an average ecosystem service score for “Purification of Water” of 2,6. The latter score is attributed to the presence of hydrophytes, the presence of hydromorphic soils and the fact that the system is characterised by diffuse flows as oppose to channelled flow. The presence of crop fields in close proximity potentially threatens watercourses given the application of fertilisers and herbicides which ends up in watercourses. The potential of contamination emphasises the need for a watercourse to purify water, which ultimately results in a higher ecosystem service score for “Purification of Water” (see Figure 94).

The ability of watercourses to trap sediment also increases the ecosystem service score of a watercourse given the fact that contaminants often are adsorbed by soil particles (Figure 95). A distinct visual difference between a system with a high ecosystem service score (unchannelled valley bottom) for “Purification of Water” and a system with a low score (river system) is illustrated in Figure 96.

Figure 94: Evidence of contamination of water resources

Figure 95: Evidence of sediment trapping by wetland vegetation

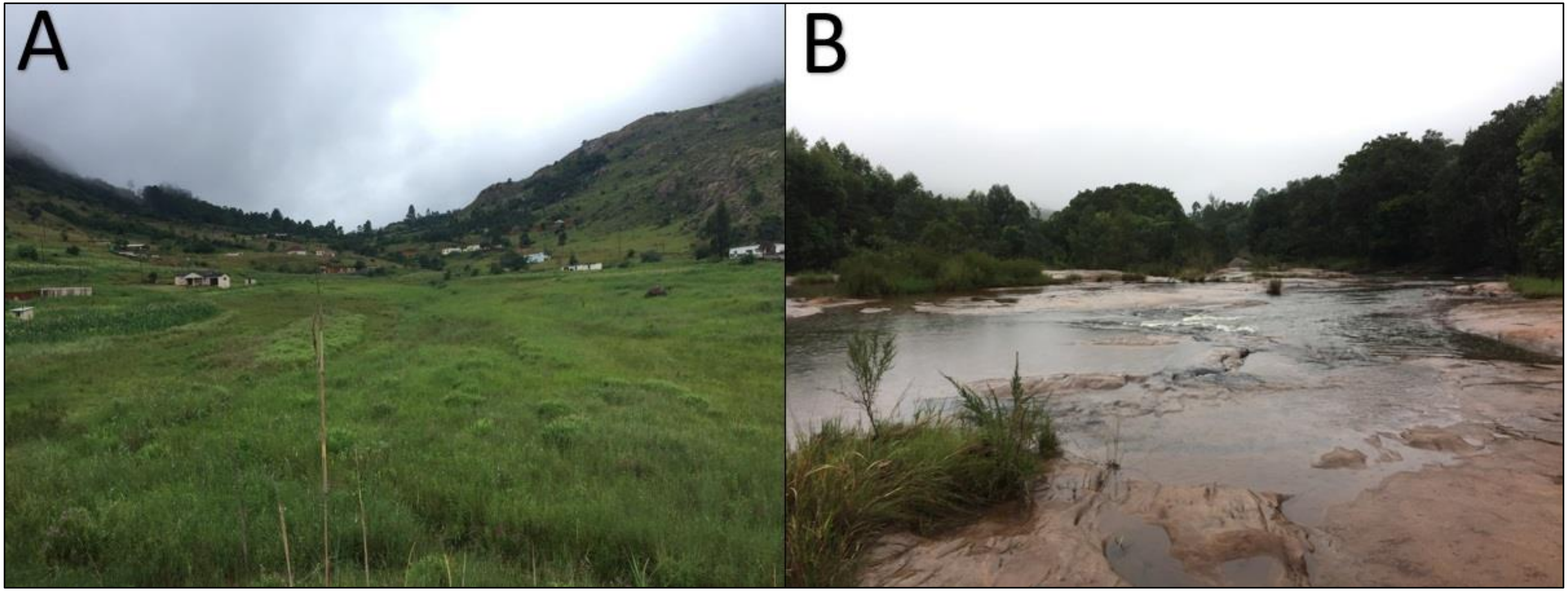


Figure 96: Difference between a watercourse with a high rating for "Purification of Water" and a watercourse with a low rating. A: Unchannelled valley bottom wetland (high ES rating for water purification). B: River system (low score for water purification).

Soil Formation

For soil formation, the river system has been rated 1,0 given the continuous deposition and removal of sediments adjacent to the river system and the presence of rocky outcrops (due to sediments washing away). The channelled valley bottom wetlands and the unchannelled valley bottom wetlands have been scored an average ecosystem service score for Soil Formation of 2,5 given the lack of rocky outcrops with the hillslope seeps being scored 2,0 (see Figure 97 and Figure 98).

Figure 97: Evidence of crop fields adjacent to wetlands (ultimately indicating deep soil resources). Orange: Crops

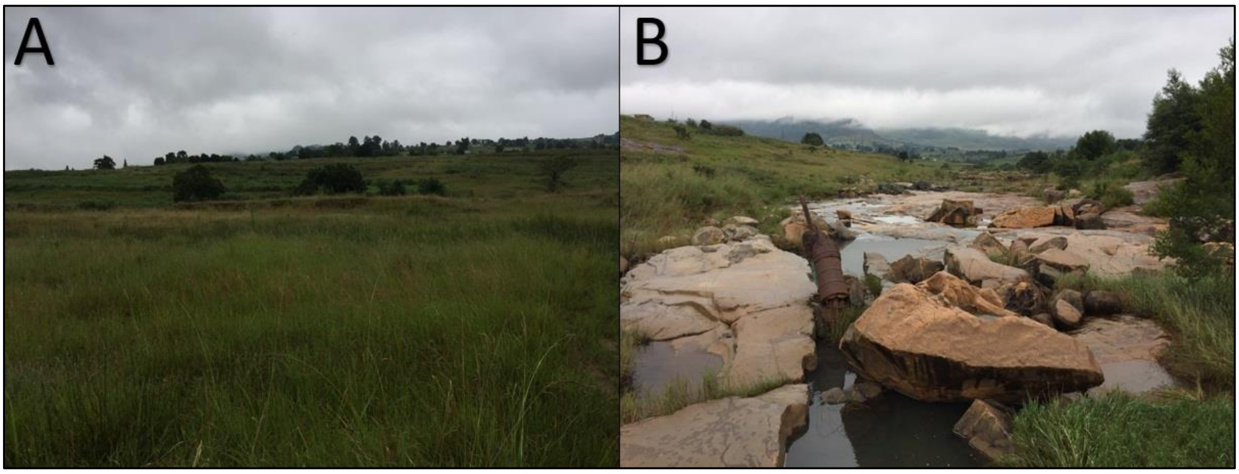


Figure 98: Comparison between a wetland with a high soil formation ES (A) and a wetland with a low ES for soil formation (B).

Water Cycle

The average ecosystem service score for "Water Cycle" has been scored 1,0 for the hillslope seeps given the fact that the main driver for the water cycle is transpiration rather than evaporation given the lack of surface water and the dominance of sub-surface flows. The river system has been scored 1,5 with the channelled valley bottom wetlands scored 1,6. The unchannelled valley bottom wetland has been determined to have the highest ES score for the water cycle given the fact that flows within this watercourse are very diffuse and the gentle slope of the wetland.

6. Impact Assessment

6.1 Methodology

The ESIA will utilise a methodological framework developed by WSP to meet the combined requirements of international best practice and the relevant EIA Regulations. The determination and assessment of impacts will be based on the following criteria:

- Nature of the Impact;
- Significance of the Impact;
- The consequence of the Impact;
- The extent of the impact;
- Duration of the Impact;
- Probability if the impact;
- The degree to which the impact:
- can be reversed;
- may cause irreplaceable loss of resources; and
- can be avoided, managed or mitigated.

Following international best practice, additional criteria have been included to determine the significant effects. These include the consideration of the following:

- Magnitude: to what extent environmental resources are going to be affected;
- Sensitivity of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), the rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor); and
- Severity of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering inter alia magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

It should be noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance will be assessed with and without mitigation measures in place. Impacts are assessed in terms of the following criteria:

- The nature; a description of what causes the effect, what will be affected and how it will be affected.

Table 36: Nature or Type of Impact

Nature or Type of Impact	Definition
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of the Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).
Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

The physical extent.

Table 37: Physical Extent Rating of Impact

Score	Description
1	the impact will be limited to the site;
2	the impact will be limited to the local area;
3	the impact will be limited to the region;
4	the impact will be national; or
5	the impact will be international;

The duration, wherein it is indicated whether the lifetime of the impact will be:

Table 38: Duration Rating of Impact

Score	Description
1	of a very short duration (0 to 1 years)
2	of a short duration (2 to 5 years)
3	medium term (5–15 years)
4	long term (> 15 years)
5	permanent

Reversibility: An impact is either reversible or irreversible. The level of reversibility is the ability of an environmental receptor to rehabilitate or restore itself after the activity has caused environmental change (i.e. how long before impacts on receptors cease to be evident).

Table 39: Reversibility of an Impact

Score	Description
1	The impact is immediately reversible.
3	The impact is reversible within 2 years after the cause or stress is removed; or
5	The activity will lead to an impact that is in all practical terms permanent.

The magnitude of impact on ecological processes, quantified on a scale from 0-10, where a score is assigned.

Table 40: Magnitude Rating of Impact

Score	Description
0	small and will have no effect on the environment.
1	minor and will not result in an impact on processes.
2	low and will cause a slight impact on processes.
3	moderate and will result in processes continuing but in a modified way.
4	high (processes are altered to the extent that they temporarily cease).
5	very high and results in complete destruction of patterns and permanent cessation of processes.

The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:

- The significance, which is determined through a synthesis of the characteristics described above (refer to the formula below) and can be assessed as low, medium or high;
- The status, which is described as either positive, negative or neutral;
- The degree to which the impact can be reversed;
- The degree to which the impact may cause irreplaceable loss of resources; and
- The degree to which the impact can be mitigated.

Table 41: Probability Rating of Impact

Score	Description
1	very improbable (probably will not happen.
2	improbable (some possibility, but low likelihood).
3	probable (distinct possibility).
4	highly probable (most likely).
5	definite (impact will occur regardless of any prevention measures).

The significance is determined by combining the above criteria in the following formula:

$$Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$$

$$[S = (E + D + R + M) \times P]$$

Where the symbols are as follows:

Symbol	Criteria	Description
S	Significance Weighting	Refer to Table 42: Significance Weightings of an Impact
E	Extent	Refer to Table 37: Physical Extent Rating of Impact
D	Duration	Refer to Table 38: Duration Rating of Impact
R	Reversibility	Refer to Table 39: Reversibility of an Impact
M	Magnitude	Refer to Table 40: Magnitude Rating of Impact
P	Probability	Refer to Table 41: Probability Rating of Impact

The significance score can therefore range from 3 (minimum) to 100 (Maximum). The significance weightings are defined as Low, Medium and High, as such the scoring system has been allocated accordingly to define the significance weighting, as identified in Table 42.

Table 42: Significance Weightings of an Impact

Overall Score	Significance (Negative)	Rating	Significance (Positive)	Rating	Description

< 30 points	**Low**	**Low**	where this impact would not have a direct influence on the decision to develop in the area
31 - 60 points	**Medium**	**Medium**	where the impact could influence the decision to develop in the area unless it is effectively mitigated
> 60 points	**High**	**High**	where the impact must have an influence on the decision process to develop in the area

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of the impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in the ESIA. The infrastructure considered for the impact assessment is presented in Figure 101.

6.2 Assessment

6.2.1 Current impacts

During the field surveys, the current impacts that are having a negative impact on the area were identified, and are listed below and some are shown in Figure 99 and Figure 100, these include:

- Presence of alien invasive plant species;
- Sand Mining from the river;
- Roads;
- Agriculture;
- Powerlines and the associated pylons and existing transformer station;
- Cutting of grass and trees (Vegetation removal);
- Plant harvesting;
- Erosion;
- Livestock grazing (cattle and goats);
- Water contamination
- Plantations;
- Farmsteads and houses;
- Snaring of wildlife and poaching; and
- Cellphone towers.

The baseline riverine environment assessment indicated largely modified conditions and confirms the classifications provided in the Joint Maputo River Basin Water Resources Study 2008 (JMRBWRS, 2018). The existing impacts were determined to be largely associated with flow and river morphological modification through the existing Luphohlo Dam.

6.3 Limitations

- Due to the nature of the project being permanent, a decommissioning and closure phase was not considered;
- The impact assessment does not include the disturbances associated with the expected regulated relocation of the residents out of the inundation zone into new areas;
- No alternatives were provided for the infrastructure associated with the development;
- No hydrological assessment was completed as part of this study;
- No ecological reserve determination was completed for this study;
- No species flow characteristics were investigated;
- Due to the rapid nature of the assessment and the survey methods applied, fish diversity and abundance was likely to be under-estimated;
- The aquatic assessment was based on the results of bi-annual surveys, temporal trends are likely to fluctuate in the long term;
- Aquatic macroinvertebrates were identified to family level only;
- The delineation of the riparian area was largely based on the definition of the macro-channel contours. The entire river reach was not directly surveyed. It is noted that there is an error in 5m contour data and therefore the accuracy of the assessment is limited to a degree, this was however not considered to be significant, but must be noted;
- It is noted that detailed results for flow/riverine community analysis are available from this study;
- No alternatives were assessed for this study;
- An environmental flow requirement of 4.4 Mm^3/year was proposed for the watercourse (JMRBWRS, 2008);
- No location for the proposed relocation of the local communities was available at the time of compiling this report;
- The preconstruction activities were not assessed in this study, these were noted to have already completed at the time of writing this report;
- The volumes of water to be abstracted was not known at the time of writing this report, and therefore could not effectively be assessed; and
- It is assumed that the impoundment will not be decommissioned.

Figure 99: Some of the impacts observed: A) Grass cutting, B) Rural developments, C) Sand mining, D) Erosion E) Agriculture, F) Livestock, G) Cell phone towers, H) Plantations and I) Powerlines.

Figure 100: Some of the impacts observed: A) Livestock, B) Sand mining, C) Geotechnical investigations impact ,D) Agriculture, E) Homesteads with gardens, F) Erosion, G) Hunting with dogs, H) Plant collection and I) Washing of clothes in the river.

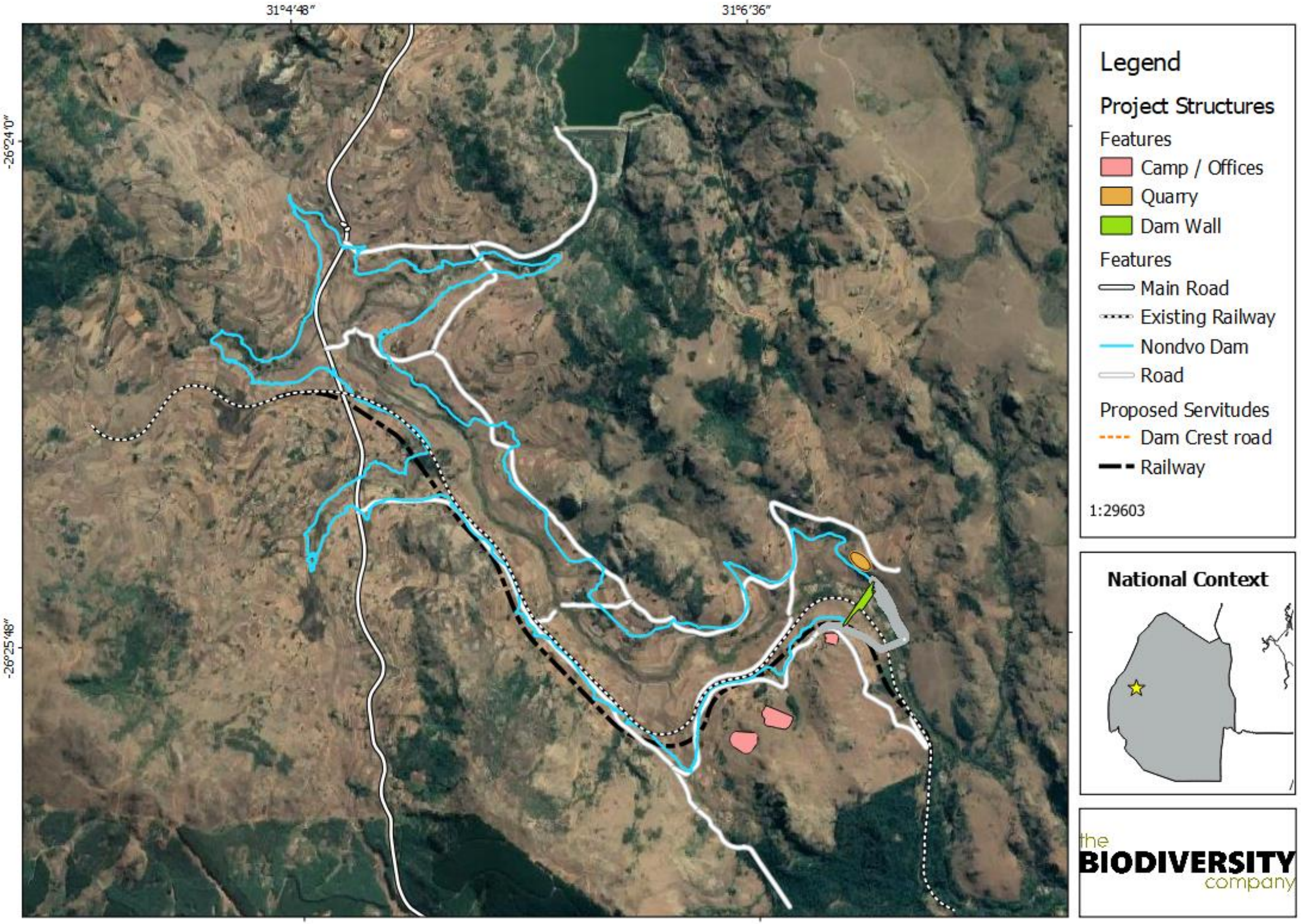


Figure 101: The project aspects considered for the impact assessment

6.4 The No-Go Option

The baseline assessment conducted in this study indicated large scale, local cumulative impacts that have rendered the local habitat, including certain ecosystems in the assessment moderately to predominantly largely modified. It is anticipated that there will be a further increase in the amount and spread of anthropogenic activities within the DMU as the population develops and grows over time, including the sensitive rocky grassland unless areas like these are conserved. The increase in population will have an impact on the state of habitat integrity and function and ultimately modifications to biodiversity. In conclusion, the no-go scenario indicates further degradation over a period of the assessed project area and the associated DMU in this assessment.

As was identified in the baseline assessment the watercourse was derived to be largely modified. The ongoing no-go scenario indicates continued rural development including housing and subsistence agricultural activities within the immediate catchment area. The no-go scenario, therefore, indicates further alteration of the Lusushwana River catchment area to a moderate degree which in turn would lead to further modification to the local river conditions. Considering this scenario, increases in salinity and the concentration of dissolved nutrients can be anticipated in the Lusushwana River catchment considered in this study.

6.5 Riverine Ecology

6.5.1 Pre-construction Phase

The physical impacts of the pre-construction phase will be associated with the geotechnical investigations which will include the removal of trees and groundcover, construction of access roads, active drilling and trenching activities. During the survey, these activities were noted to have been completed as indicated in the image below (Figure 102). Owing to the fact that the activities for the pre-construction phase were already completed, these activities were omitted from this study.

Figure 102: Geo-technical investigations at the proposed Nondvo Dam wall (March 2019)

6.5.2 Construction Phase

The impacts of impoundments have been well documented (Kingsford, 2000, Graf, 2006, McCartney, 2009, New and Xie, 2008). The anticipated impacts during the construction phase are discussed below. The activities anticipated to occur during the construction phase of the proposed project are presented in Table 43.

During the active construction phase, water quality impacts can be anticipated in the Lusushwana River system. The water quality impairment will stem from the following sources:

- Sedimentation and suspended materials from earthworks within and alongside the watercourse;
- Silt-laden runoff from disturbed catchment areas;

- Diffuse and point source seepage/runoff from material stockpiles, offices and workshops; and
- Diffuse and point source seepage/runoff from ablution facilities.

During the construction activities there will be the direct alteration of the instream and riparian habitats resulting in the permanent modification of the habitats at a local scale. The active excavations, blasting and construction of the diversion and cofferdams will alter the nature of the hydrology in the Lusushwana River which will ultimately result in a loss of riverine habitat. During these activities, runoff from exposed earthworks will contain elevated suspended and dissolved materials which may impact downstream river reaches and their associated aquatic ecology.

Following the diversion of the watercourse, hydrological changes to the nature of the river flow will occur and will have resultant negative impacts to aquatic biota within a local spatial framework downstream of the construction activities. This kind of impact will particularly affect downstream *Chiloglanis* populations.

Additional habitat level impacts can be anticipated through erosion and sedimentation of excavated and disturbed surfaces whereby bedrock and cobbled substrates with flowing waters become silted, this will reduce the effective area of aquatic habitat on the local spatial framework. The presence of the construction activities within the instream areas will also present an immediate migration barrier and thereby serve to fragment the populations of biota in the watercourse. The existing Luphohlo Dam does not have a fishway and therefore the existing fauna above the Mantenga falls and the foot of the Luphohlo Dam wall consist of fragmented populations. Migratory Eels were observed upstream of the Mantenga Falls, indicating that the species are still utilising the remaining habitats downstream of the Luphohlo Dam. However, the additional river reaches to be inundated would not be considered a significant area to be lost given the existing migratory barriers present.

The active construction of the dam wall will make use of concrete materials and various steelworks. The presence of the concrete material's present contamination hazards for downstream aquatic ecology. It is however anticipated that the construction area will be dry as maintained through the cofferdams and diversion channel, thereby limiting this impact.

Table 43: Activities anticipated for the proposed project

Project Activities	Aspects
Site establishment – site/vegetation clearing	Site preparation and clearing – vegetation removal Salinity, nutrients dissolved, and suspended element increase and water quality degradation Erosion and sedimentation Direct modification to instream habitat Direct modification to riparian habitat Alteration of hydrology (flow regime) Fragmentation of aquatic biota
Preparation of access roads	
Construction of bridge	
Construction laydown yards	
Bulk storage, stockpiling and material handling	
Transportation of staff and materials	
Construction of accommodation and offices	
Excavation	
Blasting	
River diversion and coffer dam construction	
Quarry and borrow pit areas	
Active dam wall construction	

Decommissioning of quarry, offices and accommodation	
Rehabilitation and decommissioning of roadways	

6.5.3 Mitigation Actions

6.5.3.1 Instream Construction

The implementation of clean and dirty water separation procedures in the proposed instream construction areas are considered the most important mitigation action to limit water quality deterioration during the construction phase. Dirty water must be conveyed into the proposed downstream coffer dams, or suitable alternative structure, which can serve as an effective settling pond for suspended materials. Thereafter, effective river diversion trench channels that convey water in a manner that does not result in downstream erosion are important to consider during the active instream construction activities for the proposed bridge as well as the dam wall. Considering the above, the following auditable mitigation actions are provided:

- Clean and dirty water separation must be completed in the instream working areas;
- Clean water channels must not create an impoundment upstream of the cofferdam and instream workings;
- Discharge points of clean water diversion channels must not result in erosion;
- A cut off trench to reduce ingress flow into excavations must be constructed to convey water around workings;
- Dirty water that has been in contact with instream workings must be conveyed to a settling pond/silt trap before being allowed to discharge into the environment;
- Dewatering activities in the excavations must convey water into silt traps to reduce downstream sedimentation;
- Following the completion of the instream workings, rehabilitation of the affected exposed areas in the riparian habitat must occur. An audit must be conducted within 30 days of completion;
- Following the completion of the instream workings, no waste material can be left within the river channel. An audit within 30 days of completion of the instream workings must ascertain whether this has been achieved; and
- No large boulders or material that can alter hydrology must be left within the instream areas if not originally present. An audit within 30 days of completion of the instream workings must ascertain whether this has been achieved.

6.5.3.2 Laydown Yards, Quarry, Stockpiles, Offices and Workshops

The implementation of an effective stormwater management plan must be implemented for all altered catchment areas. The following auditable mitigation actions are recommended:

- A stormwater management plan must be designed and implemented at all surface footprints. Clean and dirty water management at workshops must be implemented;
- Stockpile areas must be bermed to reduce runoff into local waterbodies;
- Fuel and oil storage and handling must be completed in a bunded area;

- Laydown yards and material storage/stockpiles must not be located within 100m of the delineated riparian zone;
- An alien invasive species management plan must be implemented for all disturbed areas;
- Suitable sewage infrastructure and handling which limits risks to local water quality must be in place for all working areas;
- Following the completion of the construction activities, the impacted areas must be rehabilitated. An audit within 60 days of completion of the workings must ascertain whether this has been achieved.

6.5.3.3 Linear Infrastructure

Similarly to the above mitigation actions, it is recommended that stormwater management is completed for all linear infrastructure

- Suitably sized culverts must be installed where roadways cross over drainage lines;
- No inundation must occur upstream of culverts;
- An invasive alien species management plan must be implemented for the road and bridge verges;
- Erosion control measures (gabions or a suitable alternative) must be implemented at the bridge crossing structure downstream of the dam wall;
- Surface run-off from the roads flowing down the embankments often scours the watercourse on the sides of the culvert causing sedimentation of the channel. This must be catered for with adequate concreted stormwater drainage depressions and channels with energy dissipaters that channel these flows into the river in a controlled manner;
- Erosion control measures (energy dissipation) must be in place for all roadways; and
- Exposed road surfaces awaiting grading must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion of the road.

Table 44: Riverine ecological assessment of impact significance for the construction phase

Impact #	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
1	Aquatic	**Activity**: Site establishment including laydown yards, offices and accommodation **Impact**: Instream habitat sedimentation and water quality modifications due to erosion	Construction Phase	Negative	Easy	3	2	1	2	3	**24**	**N1**	3	2	1	2	2	**16**	**N1**
Significance						**Low**							**Low**						
2	Aquatic	**Activity**: Roadways and bridge **Impact**: Instream and riparian habitat modification	Construction Phase	Negative	Easy	3	1	1	2	3	**21**	**N1**	3	1	1	2	2	**14**	**N1**
Significance						**Low**							**Low**						
3	Aquatic	**Activity**: Bulk material storage and handling **Impact**: contaminant seepage/runoff/spillage resultant water and habitat quality modification	Construction Phase	Negative	Easy	2	1	1	2	3	**18**	**N1**	2	1	1	2	2	**12**	**N1**
Significance						**Low**							**Low**						
4	Aquatic	**Activity**: Quarry construction and operation **Impact**: Sedimentation and water quality deterioration	Construction Phase	Negative	Easy	3	2	1	2	3	**24**	**N1**	3	2	1	2	2	**16**	**N1**
Significance						**Low**							**Low**						
5	Aquatic	**Activity**: River diversion, excavation and construction of coffer dams **Impact**: Water and quality deterioration	Construction Phase	Negative	Difficult	5	3	5	5	4	**72**	**N3**	5	3	5	5	3	**54**	**N2**
Significance						**High**							**Medium**						
6	Aquatic	**Activity**: Decommissioning and rehabilitation of accommodation, laydown yards offices and roadways **Impact**:	Construction Phase	Negative	Easy	2	1	1	1	3	**15**	**N1**	2	1	1	1	2	**10**	**N1**

		Water and habitat quality deterioration																	
Significance						**N1 - Low**							**N1 - Low**						

6.5.4 Operational Phase

Considering the data available for this area, the operating regime of the existing Luphohlo Dam indicates an Ecological Water Requirements release flow rate of 4.4 Mm^3/year (JMRBWRS, 2008) and this must be considered to be released for the proposed Nondvo Dam.

The most obvious impact during the operational phase will be the direct inundation of riverine habitats. The operational impacts of the proposed project will result in the inundation of approximately 19.7 ha of instream and 55.9 ha of riparian habitat.

Rivers exist within a continuum of linked physical parameters and are important corridors for flows of energy, matter and biology (McCartney, 2009). The fluctuating dynamic conditions within a riverine continuum are maintained by the constantly changing flow regime which produces a diverse array of aquatic habitats and subsequent biodiversity (Vannote *et al*., 1980). Nutrients and sediment (matter) generated in the headwaters of the watercourse are recycled downstream and form the primary drivers affecting plant growth and ecological productivity. Natural flood regimes regularly inundate floodplains and increase organic matter decomposition and nutrient cycling, this process has led to the biological evolution of complex adaptive strategies which are often coupled to the flood regime. The construction of a dam disrupts the river continuum through the obstruction of the longitudinal exchanges between the regions up and downstream of the dam wall. Based on the available literature, as well as reviews of the impacts of impoundment, post impoundment impacts directly influence a myriad of factors in watercourses that ultimately alter the ecological structure and function of riverine ecosystems (Kingsford, 2000).

6.5.4.1 Impacts to the Flow Regime of the Lusushwana River

The waterbody located upstream of the proposed Nondvo Dam will be converted from a lotic to a lentic system whereby obvious habitat modifications would be anticipated. This will have an immediate impact on biota with preferences to lotic habitats such as *Chiloglanis*, *Labeobarbus* and the abundant *Platycypha caligata*. (see Figure 103). Furthermore, it can be anticipated that taxa adapted to lentic conditions will proliferate, this includes the alien invasive species *Micropterus salmoides*.

Figure 103: Platycypha caligata (March 2019)

In addition to the upstream inundation, dams alter the downstream flow regime which can impact on the relative volume of water discharge, permanence of low flows as well as the frequency and magnitude of flood peaks. A common consequence of this is the reduced frequency of overbank flooding, this was noted to have already occurred downstream of the existing Luphohlo Dam. Changes in the flow regime of the downstream river reach can impact negatively on the breeding cues of local fish communities which have evolved to react with particular flood-related stimuli, this is typically enhanced for flow releases to meet diurnal variation in hydroelectricity demands. As noted above, an Ecological Flow Requirement release of 4 Mm^3/year was recommended (JMRBWRS, 2008).

6.5.4.2 Impacts to the Thermal Regime of the Lusushwana River

The impounded body of water will be deeper than 20m and therefore it is likely that temperature and oxygen stratification would take place. This may have an impact on downstream water quality as well as temperature lifecycle cues for aquatic ecology as a result of releases. Releases from the hypolimnion of a reservoir have shown to be “least natural” due to the significant impact the release has on water temperatures.

6.5.4.3 Impacts on Water Chemistry

Historical assessments of impoundments indicate that the structures are sinks for various elements and nutrients. Consequently, water that is discharged has a different chemical composition to the inflows into the reservoir. Dissolved nutrients such as phosphorous increase in the reservoir as a result of the decaying submerged vegetation and soil. This increases the chemical and biological oxygen demand and can decrease the concentration of biologically available oxygen. The incidence of subsistence agricultural activities within the impoundment catchment will therefore concentrate in the Nondvo reservoir.

According to McCartney (2009), the quality of water released from a stratified reservoir is associated with the elevation of the outflow structure relative to the different stratified layers in the waterbody. Releases from the reservoir surface contain low concentrations of nutrients and are typically well-oxygenated, whilst releases from the bottom are typically cold, rich in nutrients and low in oxygen.

6.5.4.4 Impacts on Sedimentation

The reduction in flow velocity of the flow in the Lusushwana River will result in the enhancement of sedimentation. However, the rate of sedimentation is dependent on the physiographic features of the catchment area as well as the local land use. Based on available data, approximately 0.5% – 1% of storage volumes in reservoirs across the world are lost due to sediment capture (Mahmood, 1987). Large fluctuations in the water levels of reservoirs can result in the erosion of the reservoir shoreline which can add to existing sediment loads. In addition, disproportionately discharged water volumes can also lead to erosion of the instream channel and riverbanks downstream of impoundments. This is compounded by the reduced sediment loads of the downstream river system which inherently increases the erosional capacity of the watercourse. The existing Luphohlo Dam has modified instream sediment characteristics. The presence of an additional instream barrier will prevent the movement of additional sediments generated between the foot of the Luphohlo Dam and the proposed Nondvo Dam wall. However, given the local geology of the area which is characterised by hard granites and the limited spatial extent between the above-mentioned two locations, this impact is anticipated to be negligible.

The continued operation of the linear infrastructure such as roadways and bridges present long-term disturbed areas which may be subject to erosion.

6.5.4.5 Impacts to Aquatic Biodiversity

The presence of the instream barrier will alter migratory patterns for the observed Eel species (*Anguilla mossambica*) and it can be anticipated that migratory habitats upstream of the dam wall will be inaccessible. The alteration of the existing flow regime of the Lusushwana River will reduce the available habitats available downstream which will impact local fish communities, particularly rheophilic taxa such as *Labeobarbus* and the listed *Chiloglanis* species. The anticipated reduced flood peaks and flood durations are anticipated to impact floodplain conditions in the lower Lusushwana River and a reduced biodiversity and biomass can be anticipated. The alteration of the flow regime will also affect instream, marginal and riparian vegetation which have reproductive and vegetative processes that are typically controlled by dynamic interactions of periods inundation and desiccation.

The activities expected during this phase are presented in Table 45. The ratings of the anticipated impacts for the proposed operational phase are provided in Table 46.

Table 45: Operation phase activities

Project Activities	Aspects
Inundation of area upstream of the dam wall **Modification of flow rates** **Presence of instream barrier** **Maintenance** **Bridge operation downstream of dam wall**	Direct modification to instream habitat Direct modification to riparian habitat Water quality impacts (DO, Salinity, water temp etc) Altered flow regimes, seasonal flows Altered temperatures Migration barrier River fragmentation Growth and spread of invasive vegetation, aquatic weeds and plants

6.5.5 Mitigation Actions

6.5.5.1 Inundation and Reservoir Zone

Within the inundation zone of the reservoir, the decomposition of submerged vegetation and soils can deplete dissolved oxygen. It is therefore recommended that vegetation, particularly larger trees within the inundation zone must be removed prior to the filling.

In order to prevent eutrophication in the reservoir it is recommended that a catchment management agency must be established. Examples of good practice include the establishment of a nature reserve in the catchment area of the impoundment whereby local land-use is regulated. It is recommended that flushing of the reservoir be incorporated into the operation regime to reduce residence times of water volumes.

In order to reduce the impact on sediment loads it is recommended that a dredging programme or sediment flushing programme be established inline with a completed aggradation study. The dredged materials can be added to the downstream river reach to reduce erosion and maintain channel morphology.

6.5.5.2 Flow Releases

The implementation of a suitable ecological water requirement was determined in a previous study to be 4.4 Mm^3/year (JMRBWRS, 2008). The release of the ecological flows must be completed in accordance with natural flood conditions which can be obtained from the hydrological report.

Conduct water quality monitoring to realise the impact to water quality of the impoundment. Flow outlet design must incorporate aeration if water is to be released from the bottom of the reservoir. Measures available to be incorporated include modified turbine blades that draw oxygen into the water through small holes in the turbine vanes without significantly affecting turbine performance (Sigmon *et al.*, 2000).

Ecological aquatic monitoring must take place on a quarterly basis (3 months) with a focus on the flow releases and must be assessed within 18 months of completing the instream works, for a period of at least three years. The release of the ecological flows must not result in sedimentation or erosion of the instream or riparian habitats.

6.5.5.3 Linear Infrastructure

Permanent, passive effective stormwater management plans for the linear infrastructure must be implemented for the entire duration of the activity. An exotic vegetation removal programme must be implemented according to the flora component of this study.

Table 46: Riverine ecological assessment of impact significance for the operation phase.

Impact #	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
1	Aquatic	**Activity**: Inundation of viable instream and riparian habitat **Impact**: Direct habitat loss	Operation Phase	Negative	Difficult	5	2	3	5	5	**75**	**N3**	5	2	3	5	5	**75**	**N3**
Significance						**High**							**High**						
2	Aquatic	**Activity**: Presence of the Nondvo Dam wall/barrier **Impact**: Fragmentation of the local biology	Operation Phase	Negative	Difficult	4	3	3	5	4	**60**	**N2**	4	3	3	5	4	**60**	**N2**
Significance						**Medium**							**Medium**						
3	Aquatic	**Activity**: Release of ecological flows **Impact**: Altered hydrology	Operation Phase	Negative	Difficult	4	2	3	4	5	**65**	**N3**	4	2	3	4	5	**65**	**N3**
Significance						**High**							**High**						
4	Aquatic	**Activity**: Water stratification **Impact**: water quality impacts downstream of the dam wall	Operation Phase	Negative	Difficult	3	2	3	5	3	**39**	**N2**	3	2	3	5	1	**13**	**N1**
Significance						**Medium**							**Low**						
5	Aquatic	**Activity**: Linear infrastructure operation **Impact**: Water and habitat quality deterioration via erosion and sedimentation	Operation Phase	Negative	Easy	2	2	1	5	4	**40**	**N2**	2	1	1	5	2	**18**	**N1**
Significance						**Medium**							**Low**						
6	Aquatic	**Activity**: Linear infrastructure operation **Impact**: Exotic vegetation encroachment	Operation Phase	Negative	Easy	2	2	1	5	4	**40**	**N2**	2	1	1	5	2	**18**	**N1**
Significance						**Medium**							**Low**						

6.6 Terrestrial Ecology

6.6.1 Construction Phase

The impacts considered for the terrestrial assessment components are presented in Table 47. Table 48 presents the management and mitigation measures prescribed for the construction phase of the project.

6.6.1.1 Terrestrial Impact Assessment: Construction Phase

The following potential impacts (amongst others) were considered on biodiversity. This phase refers to the period when construction of the proposed infrastructure is built/installed. This phase usually has the largest direct impact on biodiversity. This assumption is based on the proposed land clearance for the dam wall construction, access roads and servitudes, construction camps and laydown areas (Figure 104). The impacts are divided based on their major impacts with their associated subdivisions:

- Destruction, further loss and fragmentation of the vegetation community;
    - Access roads and servitudes; clearing new roads/servitudes as well as widening of existing roads/servitudes will remove habitats for terrestrial plant species;
    - Construction camps and laydown areas; these areas need to be cleared of vegetation for safe operation and therefore available habitat for terrestrial plant species will be reduced;
    - Dam wall and bridge construction; site establishment and the placement of this physical structure as well as supporting infrastructure on natural habitat will effectively remove habitat for terrestrial plant species through blasting and excavation followed by the building of foundations etc.;
    - The direct and indirect cause of erosion;
    - Quarry and borrow pit areas for aggregate used for the dam wall and road construction will lead to additional loss; and
    - Stochastic events such as fire from events such as cooking or smoking of workers; discarding of lit cigarette butts and/or glowing embers from cooking fires being blown into surrounding vegetation may cause runaway fires to remove habitat for terrestrial plant species that would otherwise have been available.
- Displacement, direct mortalities and disturbance of faunal community due to habitat loss and disturbances (such as site clearance, dust, light, vibrations, poaching and noise);
    - Displacement/loss of fauna (including rare or IUCN listed species); the removal of vegetation will result in the direct loss of habitat forcing the species to move into new areas where more challenges may be present;
    - Disruption of faunal populations by interfering with their movements and/or breeding activities; and
    - Direct mortalities from earth-moving or transport vehicles and increased traffic due to construction work and the transportation of staff/materials.
- Spread and/or establishment of alien and/or invasive species, especially in areas that are cleared;

- Increased potential for the establishment of alien and invasive vegetation; disruption in natural areas of phytomass, disturbance of soil and introduction by humans due to human movements will increase the potential and likelihood of establishment of alien and invasive vegetation.

- Infringement by humans into the natural areas due to increased access, with associated impacts such as poaching, litter and introduction of diseases and feral species such as cats and dogs;
  - Loss of targeted high-value plant species (logging, medicinal and tradable species) and the transport of these items due to increased access and in-migration provided by the inundation zone edge and associated roads. Increased access to isolated/fragmented populations of plants the logging of high-value plant species becomes more probable, especially the Rocky Grassland;
  - The unregulated movement of local people will also increase the likelihood of poaching of species in what was previously seen as secluded habitat for fauna species; and
  - The unregulated movement of local people will lead to the introduction of diseases and feral species such as cats and dogs.

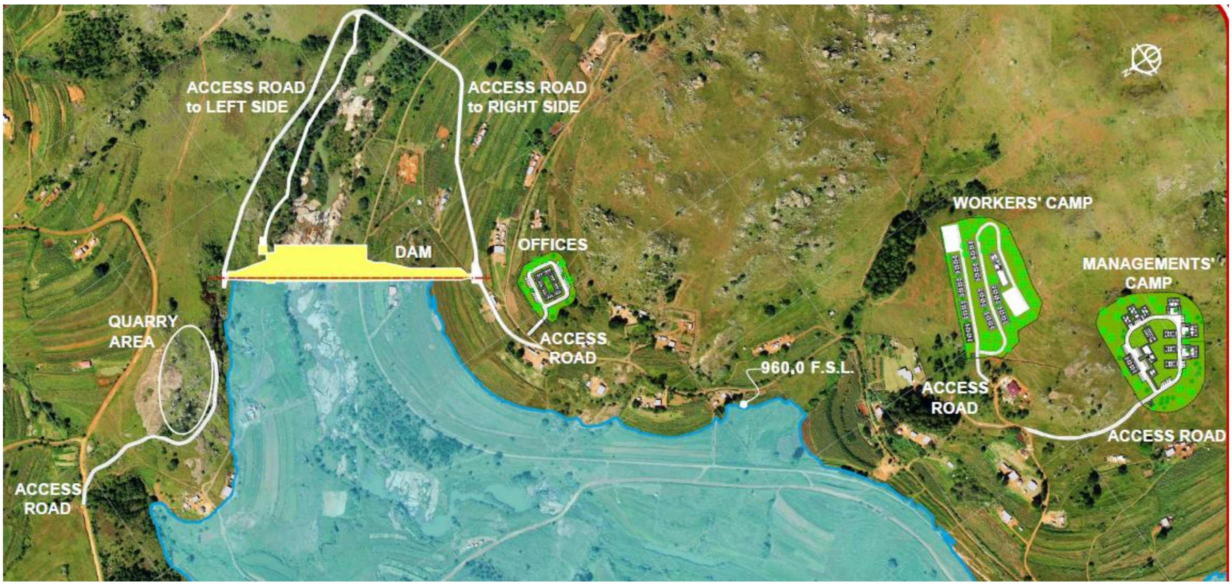


Figure 104: Image from feasibility study (Studio Pietrangeli, 2019)

Table 47: Terrestrial ecological assessment of impact significance for the construction phase.

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Flora	Destruction, further loss and fragmentation of the vegetation community.	Construction Phase	Negative	Difficult	4	3	5	4	4	**64**	**N3**	4	2	3	2	4	**44**	**N2**
Significance						**N3 - High**							**N2 - Medium**						
Impact 2:	Fauna	Displacement, direct mortalities and disturbance of faunal community (including threatened species) due to habitat loss and disturbances (such as site clearance, dust, light, vibrations, poaching and noise)	Construction Phase	Negative	Moderate	4	3	3	3	4	**52**	**N2**	3	2	3	2	2	**20**	**N1**
Significance						**N2 - Medium**							**N1 - Low**						
Impact 3:	Flora	Spread and/or establishment of alien and/or invasive species, especially in areas that are cleared.	Construction Phase	Negative	Moderate	4	3	3	4	4	**56**	**N2**	2	1	3	2	2	**16**	**N1**
Significance						**N2 - Medium**							**N1 - Low**						
Impact 4:	Flora and Fauna	Infringement by humans into the remaining natural areas, with associated impacts such as poaching, litter and introduction of diseases and feral species such as cats and dogs.	Construction Phase	Negative	Moderate	4	3	3	4	4	**56**	**N2**	3	2	3	2	2	**20**	**N1**
Significance						**N2 - Medium**							**N1 - Low**						

Table 48:Management and Mitigation measures for the construction phase

Mitigation Action	Impact Reference	Frequency	Responsible Person	Associated Cost	Applicable Safeguards
Areas rated as High sensitivity should not be considered as viable areas for the building of infrastructure, clearing of vegetation and the construction of roads.	Impact # 1,2,3	Life of Project	Project manager, Environmental Officer		
The development areas and access roads should be specifically demarcated so that during the construction phase, only the demarcated areas may be impacted upon.	Impact # 1,2,3	Construction phase	Project manager, Environmental Officer		
Signs must be put up to enforce the speed limit, and speed bumps built to force slow speeds.	Impact #2	Life of Project	Project manager, Environmental Officer		
Areas of indigenous vegetation, even secondary communities must under no circumstances be used as an area for the dumping of waste or laydown areas.	Impact # 1,2	Life of Project	Environmental Officer		
Areas rated as High sensitivity in proximity to the development areas, should be declared as 'no-go' areas during the construction phase and operational phase, and all efforts must be made to prevent access to this area from construction workers, machinery and the local community (for areas within the project area/s).	Impact # 1,2,3,4	Life of Project	Project manager, Environmental Officer		
Clearing of vegetation on slopes should be minimised and where necessary, appropriate water flow management should be put in place to limit the erosion potential of exposed soil.	Impact #1	Construction phase	Project manager, Environmental Officer		
Blasting must be restricted to daylight hours	Impact #2	Construction phase	Project manager, Environmental Officer		
Existing roads/servitudes should be considered first option over the construction of new roads/servitudes and must only be made where necessary. In addition, in the event that construction of new roads/servitudes are unavoidable, transformed areas should be prioritized over ecologically intact areas	Impact # 1,2	Construction phase	Project manager, Environmental Officer		
It should be made an offence for any staff to bring or plant any plant species into any portion of the project area. No plant species whether indigenous or exotic should be brought into the project area, to prevent the spread of exotic or invasive species. Unless part of rehabilitation practises.	Impact #1,3,4	Until end of operational phase.	Environmental Officer		
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation. This will also reduce the likelihood of encroachment by alien invasive plant species.	Impact # 2,3	Until area is rehabilitated	Project manager, Environmental Officer		
A fire management plan must be in place for the areas surrounding the project area and the road to restrict the impact of fire on the natural flora and fauna communities.	Impact # 1,2,4	Life of Project	Project manager, Environmental Officer		
An alien vegetation removal and management plan must be implemented, this is specifically relevant to the construction camp and roads as well as the area surrounding the dam wall.	Impact #3	Life of Project	Environmental Officer		
Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered during the construction process. The intentional killing of any animals including snakes, lizards, birds or other animals should be strictly prohibited. As well as the fire risk associated with smoking and cooking.	Impact #1, 2	Life of Project	Health and Safety Officer		Awareness of potentially dangerous fauna that may be present.
Prior to and during vegetation removal/trimming any larger fauna species noted should be given the opportunity to move away from the construction machinery.	Impact #2,4	Construction phase	Environmental Officer		Awareness of potentially dangerous fauna that may be present.
If any large nests (comprised of sticks only) are encountered during clearing activities within 100 m of the nest should be ceased, a picture taken and sent to an appropriately qualified avifaunal specialist, for assessment of the situation and advise on the best way forward.	Impact #2	Construction phase	Environmental Officer		Awareness of potentially dangerous fauna that may be present.

Where possible, construction activities within high sensitivity areas should take place during winter (as much as possible) when the risk of disturbing sensitive life history stages (e.g. nesting) is lowest.	Impact #1,2	Construction phase	Project manager, Environmental Officer		
Where possible, work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.	Impact #2	Construction phase	Project manager, Environmental Officer		Awareness of potentially dangerous fauna that may be present.
Prior to trimming vegetation and site activities, the area to be disturbed should be walked on foot by 1-2 individuals to create a disturbance for fauna to move off. Sites should be disturbed on a needs basis only, and just prior to the activities on the site.	Impact #2	Construction phase	Project manager, Environmental Officer		Awareness of potentially dangerous fauna that may be present.
A site plan for the individual working / establishment areas must be provided **in and around the site indicating parking & storage areas, site offices and placement of ablution facilities.**	General, Impact #4	Life of Project	Project manager, Environmental Officer		
The Contractor should inform all site staff to the use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities. A minimum of one toilet must be provided per 10 persons.	General, Impact #4	Life of Project	Health and Safety Officer Environmental Officer		
The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility.	General	Life of Project	Health and Safety Officer Environmental Officer		
Where a registered disposal facility is not available close to the site, the Contractor shall provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site. Temporary storage of domestic waste shall be in covered waste skips.	General, Impact #4	Construction phase	Health and Safety Officer Environmental Officer		
Refuse bins will be emptied and secured, to prevent unauthorized removal or access by wildlife.	General	Every 10 days, maximum.	Health and Safety Officer Environmental Officer		
Access to the sites should be via existing routes as much as possible. Planning of access to the sites should reduce the number and extent of access routes and working areas	General, Impact #4	Life of Project	Project manager, Environmental Officer Design Engineer		
Disturbance of sites must be restricted to areas within the project footprint area only	Impact # 1,2,3,5	Life of Project	Project manager, Environmental Officer		
The extent of the project area to be developed must be kept to a minimum.	Impact # 1,2,3,5	Life of Project	Environmental Officer		
Areas should be cleared and disturbed on a needs basis only, as opposed to clearing and disturb a number of sites simultaneously.	Impact # 1,2,3,5	A needs basis	Environmental Officer		
The collecting and/or destruction of plants by unauthorized persons must be prevented	Impact # 1,4	Continuously	Environmental Officer Health and Safety Officer Land Owner		
Signs stating the prohibition of poaching must be put up.	Impact # 4	Continuously	Project manager, Environmental Officer		

6.6.2 Operational Phase

The impacts considered for the terrestrial assessment components are presented in Table 49. Table 50 presents the management and mitigation measures prescribed for the operational phase of the project.

6.6.2.1 Terrestrial Impact Assessment: Operational Phase

The following potential impacts (amongst others) were considered on biodiversity during the operational phase. This phase refers to when construction has been completed and the proposed infrastructure has been built and is functional, with the expected loss of habitat due to the flooding of the inundation zone. The recommendation on the direct loss of wetlands expected in this phase can be seen in the ecosystem services section.

- Destruction, further loss and fragmentation of the vegetation community and displacement, direct mortalities and disturbance of faunal community due to habitat loss and disturbances;
    - Flooding of the area will effectively remove habitats for terrestrial plant species;
    - Drowning of fauna from flooding of inundation zone;
    - Chemicals used on site such as herbicides and cleaning surfactants have the potential to contaminate the nearby watercourses and adversely affect exposed individuals; and
    - Sensory disturbance, during operation sensory disturbances (e.g. noise, dust, vibrations) are anticipated to be minimal given the nature of the development.
- Continued habitat degradation (litter and alien vegetation encroachment);
    - The edges of the new inundation area will likely be degraded by impacts such as sand mining and livestock drinking, alien vegetation will become a concern in these disturbed areas.
- Increased infringement by humans into the remaining natural areas, with associated impacts such as habitat destruction, poaching, litter, road killings and introduction of feral species such as cats, vermin and dogs;
    - The unregulated movement of local people into the areas surrounding the inundation zone will likely result in the clearing of vegetation for housing and agriculture. This exacerbates the direct impact of loss of vegetation due to the project components; and
    - The new settling area will have an increase in challenges, secluded areas that might still be present will now be under pressure due to activities such as poaching.
- Loss in genetic diversity, habitat fragmentation and disruption of habitat corridors;
    - Due to the new geographical barrier that will be formed by the dam (the area will be divided into two sections) ultimately making it impossible for fauna and flora species to cross-breed/pollinate; and
    - The barrier restricts dispersal and migration for terrestrial species and therefore causes habitat fragmentation.
- Introduction of new waterborne diseases;

- With the influx of water into the area, the likelihood of waterborne diseases such as amoebiasis, botulism and giardiasis increase as untreated sewage from the old homesteads and surroundings will now be found in the water. All these diseases will pose a risk to the local fauna that will likely not have natural resistance.

Table 49: Terrestrial ecological assessment of impact significance for the operational phase.

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1	Flora and Fauna	Destruction, further loss and fragmentation of the vegetation community and displacement, direct mortalities and disturbance of faunal community due to habitat loss and disturbances.	Operational Phase	Negative	Difficult	4	3	5	4	5	**80**	**N3**	3	2	5	4	4	**56**	**N2**
Significance						**N3 - High**							**N2 - Medium**						
Impact 2:	Flora	Continued habitat degradation (litter, fire and alien vegetation encroachment)	Operational Phase	Negative	Difficult	4	3	5	4	4	**64**	**N3**	3	3	5	4	3	**45**	**N2**
Significance						**N3 - High**							**N2 - Medium**						
Impact 3:	Flora and Fauna	Increased infringement by humans into the remaining natural areas, with associated impacts such as habitat destruction, poaching, litter and feral species such as cats and dogs	Operational Phase	Negative	Difficult	4	3	5	4	4	**64**	**N2**	3	3	3	4	3	**39**	**N2**
Significance						**N3 - High**							**N2 - Medium**						
Impact 4:	Fauna and Flora	Loss in genetic diversity, habitat fragmentation and disruption of habitat corridors	Operational Phase	Negative	Difficult	5	4	5	4	5	**90**	**N3**	4	4	3	4	4	**60**	**N2**
Significance						**N3 - High**							**N2 - Medium**						
Impact 5:	Fauna	Introduction of new waterborne diseases	Operational Phase	Negative	Moderate	4	3	5	4	4	**64**	**N3**	4	3	3	4	3	**42**	**N2**
Significance						**N3 - High**							**N2 - Medium**						

Table 50:Management and Mitigation measures for the operational phase

Mitigation Action	Impact Reference	Frequency	Responsible Person	Applicable Safeguards
Areas rated as High sensitivity in proximity to the development areas, should be declared as 'no-go' areas during the operational phase, and all efforts must be made to prevent access to this area from construction workers and machinery.	Impact #1,2,3,4	Life of Project	Health and Safety Officer Environmental Officer	
Flooding of the area should be conducted over as long a time as possible, preferably 1-2 years to allow fauna to **migrate. A trained team must be on-site to capture and relocate any drowning or stranded fauna**.	Impact #1	Life of Project	Project manager, Environmental Officer Design Engineer	Awareness of potentially dangerous fauna that may be present.
Clearing existing vegetation within the expected **inundation zone prior to filling the dam, will cause the majority of fauna to evacuate the area. See ecosystem services section.**	Impact #1			
Control vermin and reduce poaching through staff education and enforcement.	Impact # 3	Life of Project	Environmental Officer Health and Safety Officer	
Noise must be kept to a minimum to reduce the impact of the activities on the fauna residing on the site and neighbouring areas	Impact #2	Life of Project	Environmental Officer	
A fire management plan must be in place for the areas surrounding the infrastructure and the road to restrict the impact of fire on the natural flora and fauna communities.	Impact #1,2,3	Life of Project	Project manager, Environmental Officer	
A site plan of the area must be provided on-site indicating parking & storage areas, site offices and placement of ablution facilities.	General, Impact #3	Life of Project	Project manager, Environmental Officer	
The operator should inform all site staff to the use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities. A minimum of one toilet must be provided per 10 persons.	General, Impact #5	Life of Project	Health and Safety Officer	
The operator should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility.	General	Life of Project	Health and Safety Officer	
Where a registered disposal facility is not available close to the site, the operator shall provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site. Temporary storage of domestic waste shall be in covered waste skips.	General,	Life of Project	Health and Safety Officer Environmental Officer	
Refuse bins will be emptied and secured to prevent unauthorized removal or access by wildlife.	General	Every 10 days, maximum.	Environmental Officer Health and Safety Officer	
The identification of the existing human waste facilities being used within the inundation zone, followed by the best practice to reduce the impact prior to flooding. For example, pumping the sewage out of **conservancy tank (formal) versus filling of pits (informal) or any other method.**	Impact #5	Operational Phase	Project manager, Environmental Officer Health and Safety Social Team	
French drains of the houses in the inundation zone must be pumped out and the sewage must be taken to a sewage plant. Chemicals may not be used, except if these are found to be environmentally friendly.	Impact #5	Life of Project	Project manager, Environmental Officer Health and Safety	
The collecting and/or destruction of plants by unauthorized persons must be prevented.	Impact # 2,3	Life of Project	Environmental Officer Health and Safety Officer Landowner	
Areas above and below the dam should not be fenced off, this can function as animal corridors and could assist with genetic diversity as well as movement out of the area when being flooded.	Impact #1,4	Life of Project	Environmental Officer	

Provide protection for the surrounding vegetation from unregulated settlement by the local community of the inundated area following the flooding, by regulating the movement in correlation with the ESIA and local community engagement.	Impact #1,3	Operational Phase	Project manager, Environmental Officer Health and Safety Social Team	
All maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limits, to respect all forms of wildlife.	Impact #1	Operational Phase	Project manager, Environmental Officer Health and Safety Social Team	
An alien vegetation removal and management plan must be maintained and made part of the maintenance plan.	Impact #1	Life of Project	Environmental Officer	

6.7 Conclusion

The results of the impact assessment indicated significant impacts to the riverine habitats within the inundation zone. In addition, high rated impacts to downstream riverine ecology can be anticipated from the outset of the proposed project. Should several anticipated developments proceed with the Nondvo Dam project cumulative impacts anticipated include increased salinity of the Lusushwana River in proximity to Manzini as a result of reduced flows. In addition, should the development of impoundments in the Usuthu/Maputo Rivers proceed, it is likely that there will be an impact to floodplains within the lower reaches of the Usuthu watercourse. This will likely result in the further alteration of hydrology, sediment loads and local ecology in the Pongola River floodplains and Makatini Flats in proximity to the Ndumo Game Reserve in South Africa.

The results of the impact assessment for the terrestrial ecology indicated significant impacts to the inundation zone. This is mainly due to the destruction of habitat in order to construct infrastructure, especially around the proposed dam wall area. The inundation zone is also a contributing factor to the high sensitivity rating of the Rocky Grassland habitats and the associated fauna which overlaps with the proposed infrastructure. Significant impacts to the habitats outside of the inundation zone are high due to the construction of the proposed camps within the Rocky Grassland habitat. The flooding of the proposed inundation zone will not directly have an impact on any of the sensitive habitats, and the wetlands, rivers and riparian habitats will be replaced and expanded after being flooded. The indirect impact of the expected movement of the human community and the associated impacts into the surrounding habitat, especially the rocky grassland can be considered as highly detrimental to the biodiversity in the area. Thus, the mitigation and planning regarding the movement and resettlement of the community can be regarded as the most important factor to consider.

Despite the high rated risks anticipated impacts, mitigation actions, such as the implementation of the ecological flow releases, and potentially moving the proposed locations of the dam wall and camps, can reduce impacts to local riverine conditions as well as the terrestrial ecology. Overall, given the classification of the associated riverine habitat as modified habitat, no significant fatal flaws for the proposed project could be identified.

6.8 Cumulative Impacts

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for terrestrial fauna and flora.

The area has previously and presently been impacted by rural development along with agricultural practices, in the future, should the dam be built the area will be completely changed and the surrounding areas will experience even greater stressors. Currently, there is still viable habitat in the inundation zone and even more sensitive habitat within the DMU that will be lost. The cumulative impact of the project was rated as high should the project go ahead and as moderate for the current state of the environment.

The nature and extent of the potential cumulative impact of the proposed development were assessed by adding the existing and proposed project impacts with potential future developments. The cumulative impacts associated with the project include:

- Water quality and quantity impacts on the Lusushwana River;
- Augmentation of urban water supplies to the urban areas of Mbabane and Manzini (current: 8.4 Mm^3/a in 2005 to 10.4 Mm^3/a in 2030);
- Development of largescale irrigation agriculture near Malkrerns; and
- Proposed dams in the Usuthu River catchment (JMRBWRS, 2008) (Figure 105).

Figure 105: Proposed impoundments in the Usuthu/Maputo River catchment (JMRBWRS, 2008)

Should the proposed Nondvo Dam project proceed, water quality (increased salinity) impacts in the Lusushwana River near Manzini can be anticipated as a result of reduced flows, particularly during the operation and initial flooding of the reservoir, this would likely be compounded through increased water demand in the urban areas of Mbabane and Manzini.

Should the proposed Nondvo Dam and the proposed irrigation projects near Malkerns proceed, water quality deterioration in the Lusushwana River would be anticipated as a result of the loss of dilution capacity and an influx of irrigation return flows.

Should the development of impoundments in the Usuthu/Maputo Rivers proceed, it is likely that there will be an impact to floodplains within the lower reaches of the watercourse. This will likely result in the further alteration of hydrology, sediment loads and local ecology in the Pongola River floodplains and Makatini Flats in proximity to the Ndumo Game Reserve in South Africa.

Table 51: Cumulative Impact of the proposed project

Nature of the impact: Habitat Quality Deterioration in the Nondvo Dam area		
	Cumulative impact should the project not go ahead	**Cumulative impacts should the project go ahead**

Extent	Local	Regional
Duration	Long term	Life of project
Magnitude	Medium	Major
Probability	Definite	Definite
Calculated Significance Rating	**Moderate**	**High**
Impact Status:	Negative	Negative
Reversibility:	Reversible	Irreversible
Irreplaceable loss of resources:	No	Yes
Can impacts be enhanced:	Yes	Yes

6.9 Ecosystem Services

6.9.1 General Farming Activities

Approximately 104,76 ha of the proposed inundation area used for general farming activities (livestock and cultivation). All of the delineated farming areas will be completely removed during the inundation of the reservoir area, ultimately resulting in the loss of 104,76 ha farmland. Even though the proposed land use (a dam/reservoir) will provide irrigation possibilities, farming land will be lost (see Figure 106).

As for the downstream project area, 2,26 ha of farmland has been identified. It has been assumed that the dam wall has been engineered in such a way that dam wall failure will not occur and that flooding events will occur infrequently and in an insignificant manner. Therefore, no impacts are expected to the crop fields downstream of the dam wall.

6.9.2 Raw Materials from the Environment

The proposed inundation area is covered by approximately 10,96 ha of dense tree patches, which is expected to be completely removed by means of the proposed inundation (see Figure 106). The downstream area is covered in 17,4 ha of dense patches of trees. It has been assumed that the dam wall has been engineered in such a way that dam wall failure will not occur and that flooding events will occur infrequently and in an insignificant manner. Therefore, no impacts are expected to the dense patches of trees downstream of the dam wall. As for sand mining, an area of 5,15 ha in size has been identified within the proposed inundation area.

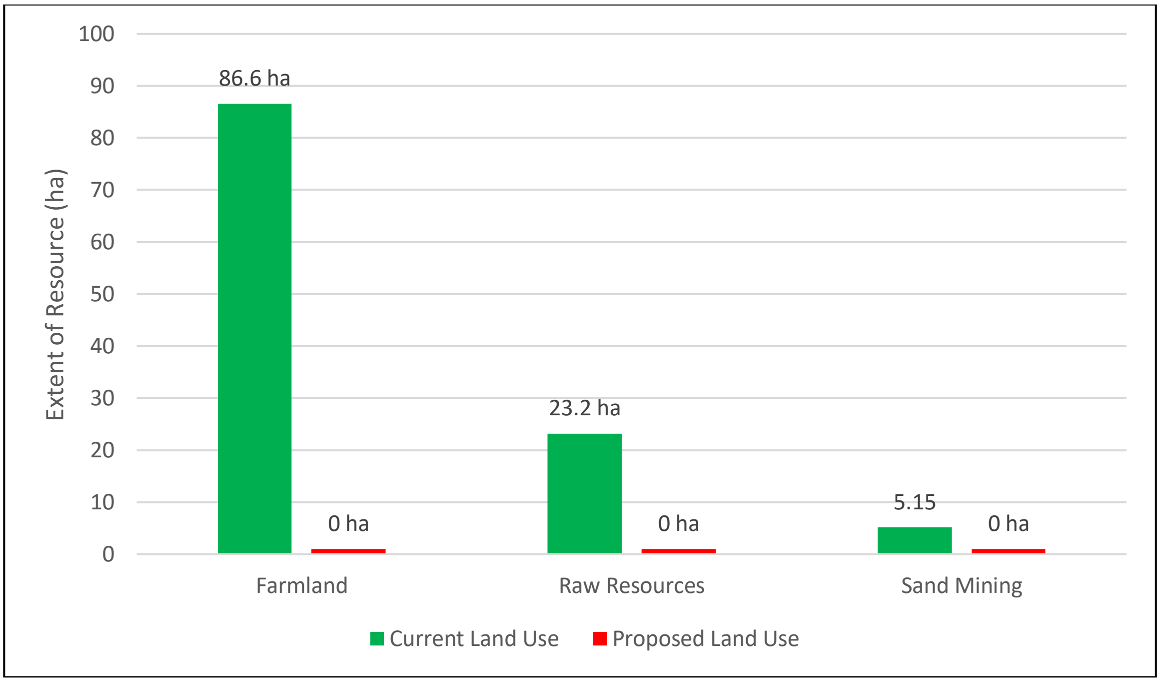


Figure 106: Extent of resources in current and proposed land use

6.9.3 Fresh Water

The proposed inundation area is covered in channelled valley bottom wetlands (9,3 ha), unchannelled valley bottom wetlands (14,29 ha), hillslope seeps (4,35 ha) and a river system (63,29 ha). These watercourses are all expected to be lost after the proposed inundation. Even though these sources are a steady source of freshwater (some more so than others), the proposed land use is for a dam/reservoir which indicates permanent inundation. The proposed land use will therefore increase freshwater resources instead of a complete removal of resources (see Figure 107, Figure 108 and Figure 109).

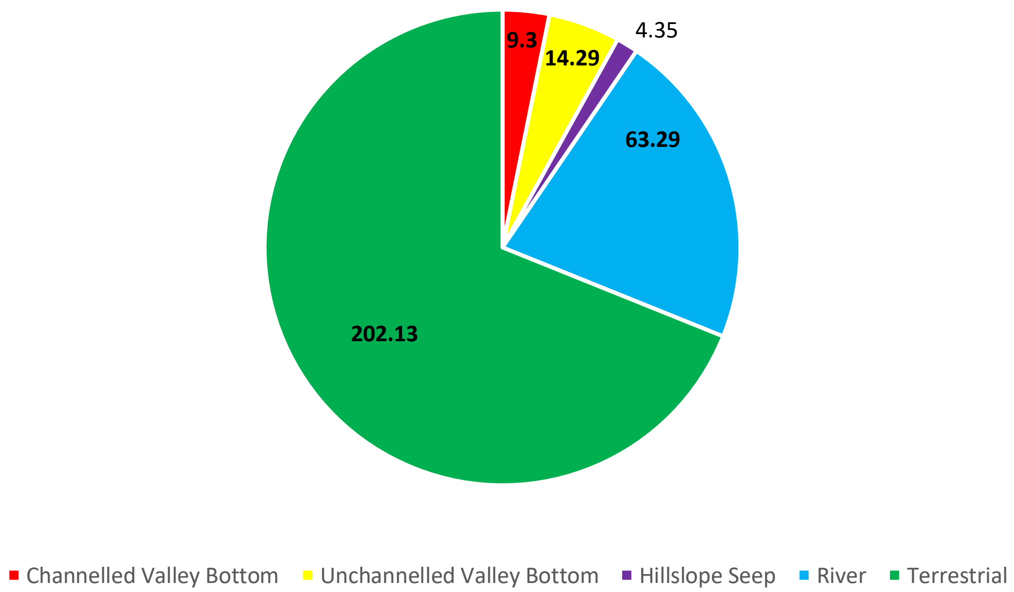


Figure 107: Extent of relevant land uses in regard to freshwater resources (in hectare) in current state

Figure 108: Extent of relevant land uses in regard to freshwater resources (in hectare) in proposed state

Figure 109: Reference site for the proposed land use (photo of the existing Luphohlo dam upstream from the proposed reservoir)

Figure 110: Sand mining

6.9.4 Water Flow Regulation

Water flow regulation refers to the ability of a watercourse to decrease the velocity of flows and therefore minimise the possibility of flooding events. All four identified watercourses (in the current land use) are characterised by moderate ES scores (ranging from 1,2 to 1,9 out of 3). The proposed land use includes permanent inundation and the engineering of a dam wall that will regulate floods (see Figure 111).

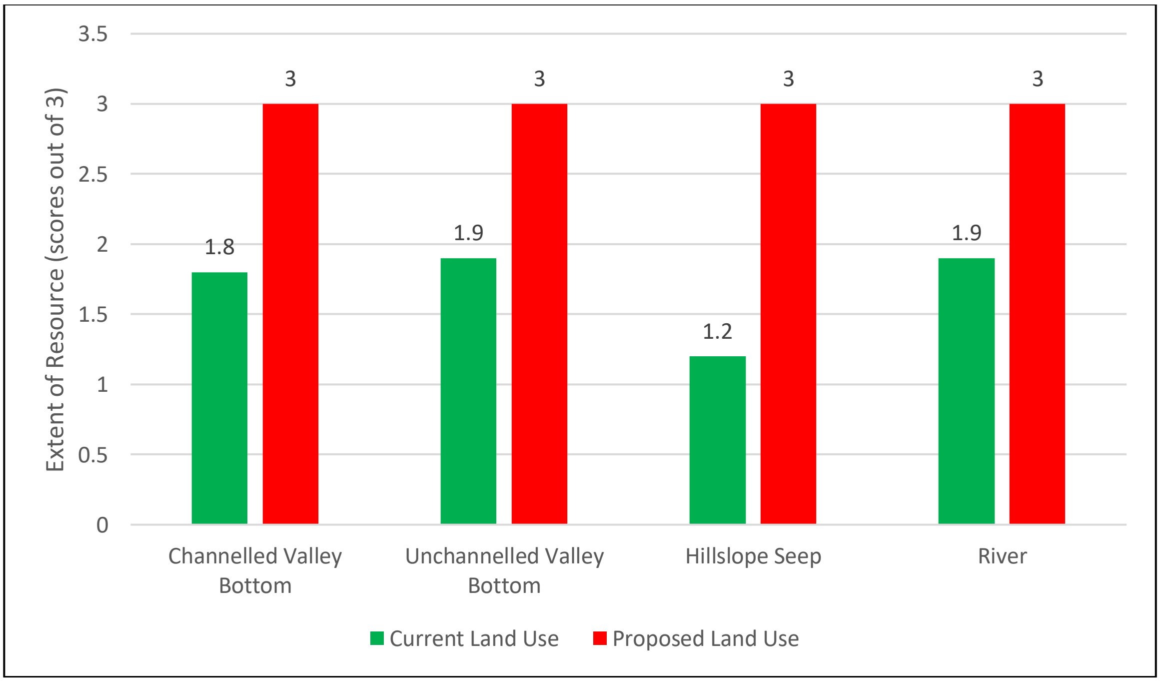


Figure 111: Water flow regulation scores (out of a total of 3) calculated for each of the identified watercourses during the current- and proposed land use

6.9.5 Purification of Water

The water purification score for the four identified watercourses ranges from low to high (from 0,7 to 2,6 out of 3) in the current land use. These scores are expected to drop to 1,1 (in the river's case increasing to 1,1) given the fact that hydrophytes and hydromorphic soils will be lost during the proposed inundation (see Figure 112).

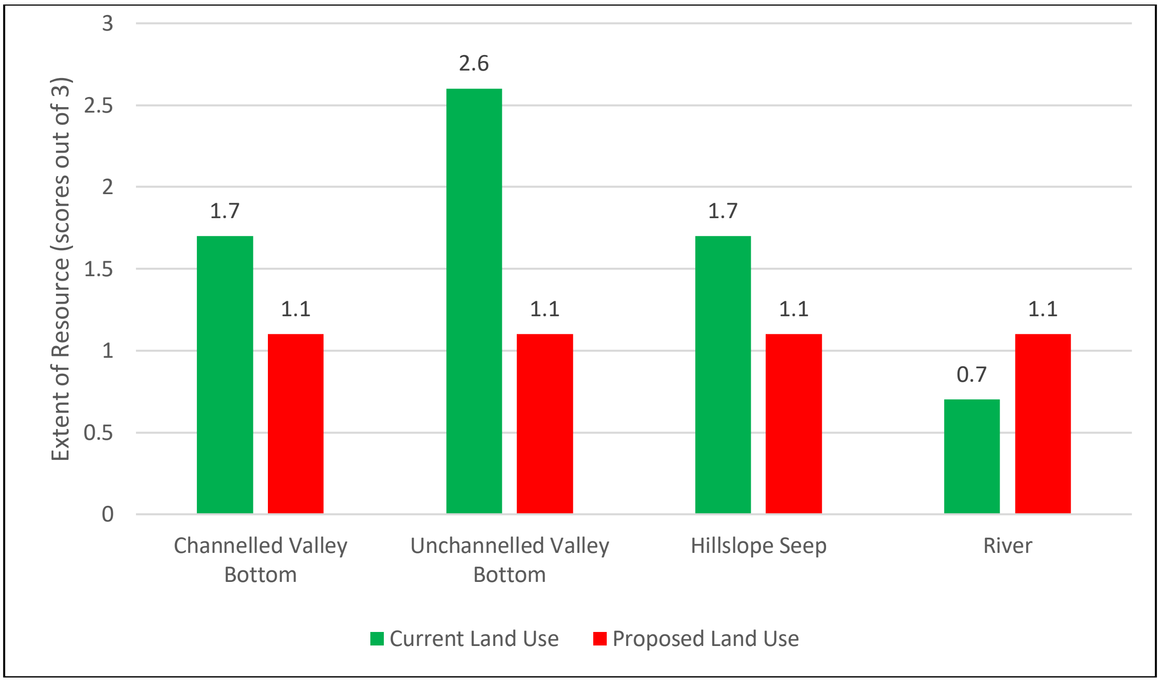


Figure 112: Purification of water scores (out of a total of 3) calculated for each of the identified watercourses during the current- and proposed land use

6.9.6 Soil Formation

The soil formation scores for the four identified watercourses range from moderate to high (from 1,0 to 2,5 out of 3) in the current land use. These scores are expected to drop to 0,5 given the loss of watercourses (see Figure 112). Even though alluvial sediments will accumulate within the proposed dam, hydromorphic properties will be lost.

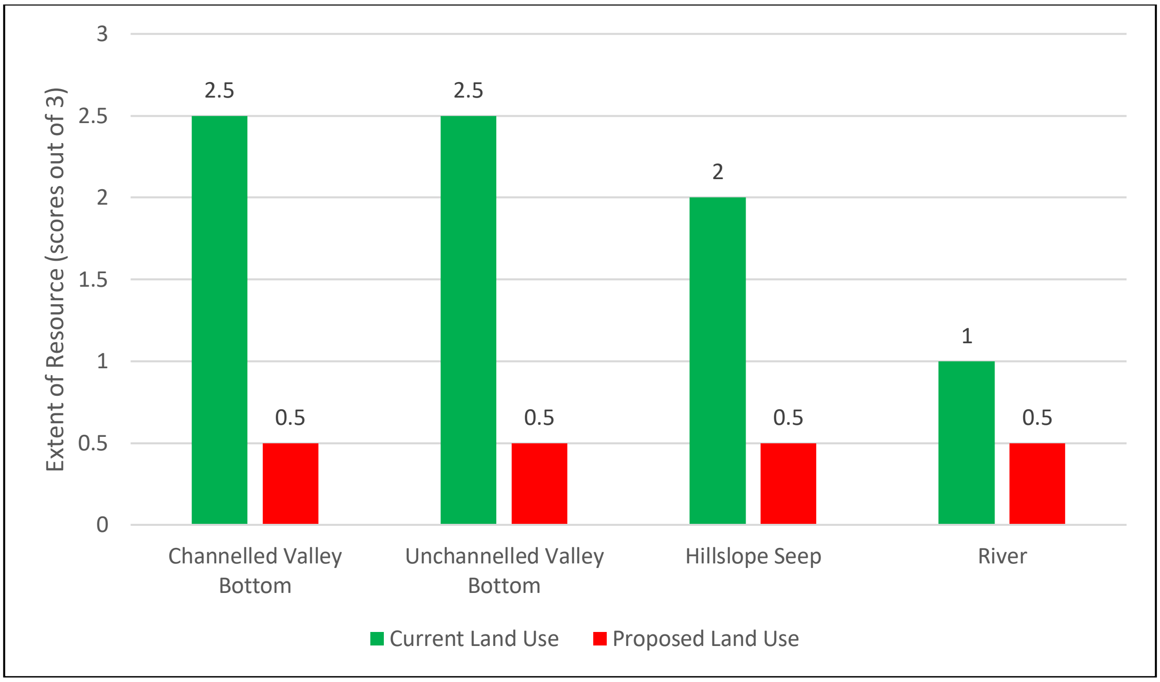


Figure 113: Soil formation scores (out of a total of 3) calculated for each of the identified watercourses during the current- and proposed land use

6.9.7 Water Cycle

The water cycle score for the four identified watercourses ranges from moderate to high (from 1,0 to 2,0 out of 3) in the current land use. The score for the water cycle is set to remain the same from the current to the proposed land use for the channelled valley bottoms, decrease in the unchannelled valley bottom wetland's case, increase in the hillslope seep's case and also slightly increase in the river's case to a score of 1,6.

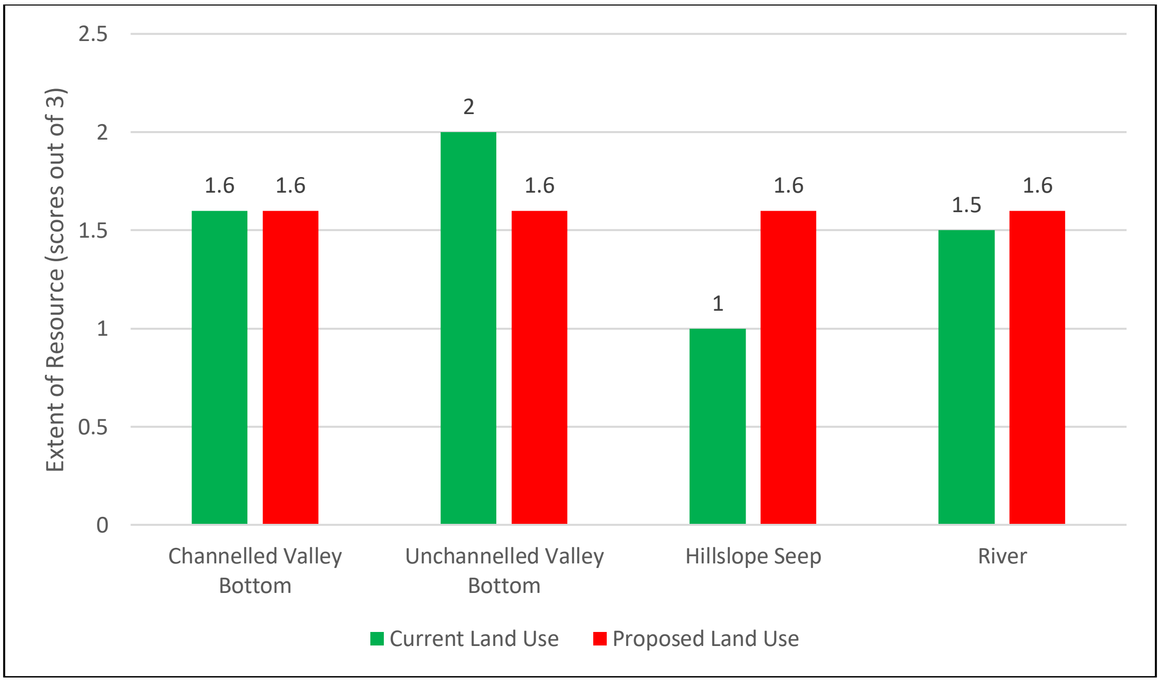


Figure 114: Water cycle scores (out of a total of 3) calculated for each of the identified watercourses during the current- and proposed land use

6.9.8 Habitat

The baseline assessment will be referred to for the updated assessment.

6.9.9 Mitigation & Management Measures

6.9.9.1 General Farming Activities

Given the fact that farmland will be directly lost within the proposed inundation area, no mitigation or recommendation measures can be prescribed that ensures the conservation of these wetlands. As for the farmland within the downstream project area, only unforeseen impacts are expected. Even though these impacts (i.e. flooding events, dam wall breaking, etc.) might occur, it is unexpected given the assumption that the dam wall will be engineered to minimise impacts. It, therefore, is recommended that all 104,76 ha of the delineated farmland areas (i.e. within the inundation zone) be compensated for rather than mitigated. A social study has been completed that includes the compensation for farmland.

6.9.9.2 Raw Materials from the Environment

The majority of the raw materials harvested are located within the downstream project area with only a small portion thereof located within the direct inundation area. As in the case with farmlands, all 10,96 ha of dense tree patches will be lost due to the proposed inundation. Given the fact that these patches of trees are natural and do not belong to a certain individual(s), these resources cannot be compensated for.

Given the fact that the majority of these tree patches are located downstream of the project area, only unforeseen impacts are expected on these resources. This phenomenon ensures that the local community can harvest these resources safely until the occurrence of such an event. The proposed land use does therefore not hinder the local community's use of this resource. It, therefore, is the specialist's opinion that no compensation is required for this resource and that the downstream area must not be fenced off, ultimately ensuring that the local community can still make use of the relevant resource.

6.9.9.3 Fresh Water

The proposed land use is expected to increase the area's volume of freshwater reserves immensely. The local community mostly makes use of water from taps or water from the mountain springs channelled towards the relevant households via self-constructed pipelines.

It is, however recommended that access to the dam must be provided for the community to ensure that the abundance of freshwater be used by the local community for those households that do not make use of mountain springs and/or tap systems.

6.9.9.4 Water Flow Regulation

The water flow regulation ecosystem service score is expected to increase significantly given the fact that the proposed dam wall will regulate floods better than any other watercourse could. Therefore, a positive impact is expected for this particular ecosystem service.

6.9.9.5 Purification of Water

The overall purification of water ecosystem service score will be decreased with the proposed land use. It, therefore, is however worth noting that the largest of the identified watercourses is the river system, which purification of water score is expected to increase, therefore compensating for the other three watercourses. It, therefore, is the specialist's opinion that this ecosystem service score will not be affected too much by the proposed activities and that no mitigation or compensation will be required.

6.9.9.6 Soil Formation

The soil formation ability of the area (especially with regard to the watercourses) will be affected significantly. No recommendations or mitigation measures can be prescribed that will improve the soil formation during the proposed activity. Therefore, as compensation, it is the specialist's opinion that a workshop must be held for the surrounding community on best farming practices to ensure the conservation of soil resources surrounding the proposed inundation area.

This activity will not only conserve valuable soil resources but will also increase the community's farming efficiency and crop yields.

6.9.9.7 Water Cycle

Only the unchannelled valley bottom wetland's ecosystem service score for the water cycle is expected to decrease with the other system's scores either expected to remain the same from the current to the proposed land use or increase in significance. The river system which represents the majority of the watercourse's ecosystem service score for the water cycle is expected to increase. It, therefore, is the specialist's opinion that a positive impact is expected for this particular ecosystem service score.

6.9.9.8 Habitat

The baseline assessment will be referred to for the updated assessment.

6.9.10 Conclusion

General farming land is expected to be lost during the proposed activities. The loss of this resource can be easily rectified by basic compensation methods**.** Raw materials from the environment are not expected to be impacted upon too much given the fact that the majority of this resource is downstream of the proposed dam wall. Even though unforeseen impacts are a reality, the proposed activity does not hamper the local community's ability to make use of the resource.

Even though all four identified watercourses (channelled valley bottom wetlands, unchannelled valley bottom wetlands, hillslope seeps and the river system) are expected to be lost during the proposed activity, the end result will be a large source of freshwater, ultimately increasing the extent of freshwater as an ecosystem service.

The water flow regulation ecosystem service score will also be increased significantly given the fact that the proposed activity includes a dam wall engineered to regulate flows and stop flooding events better than any watercourse could. The purification of water ecosystem service score is expected to remain more or less the same with no significant impacts expected.

The soil formation ecosystem service score for the area is expected to decrease significantly with the proposed activity. Rather than mitigating impacts towards the soil resources, a holistic approach is recommended in the form of soil conservation combined with farming workshops for the local community. This activity will improve the condition of the surrounding soil resources and increase the local farmer's yields.

The water cycle score also is expected to increase for the majority of watercourses (with the exclusion of unchannelled valley bottoms) which leaves this ecosystem service impacted upon in a positive manner. (A habitat description will be provided from the baseline assessment).

7. Monitoring and Measuring Plan

The following monitoring aspects are pertinent for the life of the project:

Monitoring action	Parameter being monitored	Method	Location	Frequency	Responsible person	Phase of project	Associated cost	Applicable safeguards
Waste management	Litter, spills, chemicals and human waste in and around the project area.	This includes the inspection of the collection (bins, toilets), transport, treatment and disposal of waste.	Project area.	Weekly	Environmental officer	Operational		
The collecting and/or destruction of plants by unauthorized persons.	If any plants are being collected or destroyed	Constant observation for incidents.	Project area.	Daily	Environmental officer	Life of project		Awareness of potentially dangerous fauna that may be present during inspection.
Poaching or snaring for fauna by unauthorized persons.	If any snares occur or people hunting actively	Constant observation for incidents.	Project area.	Daily	Environmental officer	Life of project		Awareness of potentially dangerous fauna that may be present during inspection.
Alien Vegetation Management	Presence of alien invasive species	Visual Survey	Construction areas, roads and construction camp	Monthly survey	Environmental officer	Life of project		

7.1 Recommendations

The following recommendations are provided:

- Carbon sequestration or storage calculations should be undertaken in order to determine the conversion of stored carbon into greenhouse gasses due to flooding of the inundation zone;
- Alternatives for the infrastructure such as the offices, camps and quarry area are recommended to reduce the impacts to the biodiversity due to their current locations being in sensitive areas resulting in the high impact rating;
- Riverine aquatic biomonitoring must be undertaken for the duration of the construction phase on a quarterly basis (Table 52);
- Riverine aquatic biomonitoring must be undertaken for the first 6 months of the operational phase on a 3-month survey basis (Table 52);
- Water quality monitoring must be undertaken for the duration of the construction phase;
- Water quality monitoring of the flow releases must be undertaken;
- A catchment agency to reduce the impact of poor land-use in the reservoir catchment mustbe established ;
- It is recommended that a PROBFLO assessment to determine and assess the current ecological water requirements is completed.

Table 52: Recommended riverine biomonitoring methods

Method	Duration	Key Performance Indicator
SASS5	Construction phase	No significant difference (*p<0.05*) in SASS5 score or ASPT between up and downstream monitoring points
Fish Observations	Construction phase	*Chiloglanis anoterus* must always be located downstream of the impoundment (FROC = 5.0)
SASS5	Operation phase – 6 months	No significant difference (*p<0.05*) in SASS5 score or ASPT between monitoring surveys that can be attributed to impacts from the proposed discharge
Fish Observations	Operation phase – 6 months	*Chiloglanis anoterus* must always be located downstream of the impoundment (FROC = 5.0)
Water Quality Monitoring	Construction Phase – Bi-monthly sampling	*Direct Comparison between up and downstream river reaches should not result in significant* (*p<0.05*) changes in parameters between every 4 sample sets. Further comparison to DWAF (1996) for Aquatic Ecosystems can be made.
Water Quality Monitoring	Operation – Monthly for 12 months after the initiation of dam dishcarge	*Direct Comparison between up and downstream river reaches should not result in significant* (*p<0.05*) changes in parameters between every 4 sample sets for Aquatic Ecosystems can be made.

8. Critical Habitat Assessment

Performance Standard 6 (PS6; IFC 2012a) and the associated Guidance Note 6 (GN6; IFC 2012b) focus on the protection and conservation of biodiversity. In most cases, the required conservation outcome under PS6 is no-net-loss of biodiversity value achieved using the "like-for-like" or better principle of biodiversity offsets. However, when a project occurs in critical habitat (CH) supporting exceptional biodiversity value, a net gain in biodiversity value is required.

CH identification is required by PS6 to manage risks and avoid, mitigate, and offset impacts to areas with high biodiversity value including: 1) habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species; 2) habitat of significant importance to endemic and/or restricted-range species; 3) habitat supporting significant global concentrations of migratory species and/or congregator species; 4) highly threatened and/or unique ecosystems; and/or 5) areas associated with key evolutionary processes.

CH exists independent of a project and can be identified without reference to a project; a project may be proposed in CH, but the CH is present under baseline conditions and is not defined by the size of the project footprint, or other project effects. CH should be determined on a case-by-case basis according to the concepts of irreplaceability and vulnerability.

8.1 Flora

The critical habitat assessment for flora are shown in Table 53.

Table 53: Critical habitat assessment for the floral species

Criterion	Description	Flora
1	The occurrence of critically endangered or endangered species.	One IUCN listed EN species was observed. *Alepidea amatymbica* was observed and is known to occur in the Rocky Grassland habitat Tier 1 critical habitat is considered as likely - it is likely that the rocky grassland may support 10% or more of the global population of any flora species.
2	Habitat types sustain any endemic species with >95% or ≥1% but <95% of its global population restricted to this habitat. And/or, taxa are restricted-range species with an extent of occurrence of 50,000km² or less. Eswatini has a land area of 17,364 km²	None of the floral taxa in the project area were restricted-range species with an extent of occurrence of 50,000km² or less.
3	Migratory or congregatory species are present on the site, with abundance values exceeding 1% of the global population size.	N/A
4	This criterion has relevance to highly threatened or unique ecosystems containing unique assemblages of species, including concentrations of biome-restricted species.	The Rocky Grassland habitat type supported assemblages of species that are considered to be unique. In addition, the KaNgwane Montane Grassland is classified as a Vulnerable vegetation unit with only 0.4 % protected within any formally proclaimed nature reserves (Malalotja, Nooitgedacht Dam and Songimvelo (Mucina & Rutherford 2006). Given the large regional extents of the habitats to be affected by the proposed inundation zone, none of the ecosystems potentially affected by the proposed dam can be considered to be unique to the inundation zone. However, this is not true to the DMU, where the rocky grassland offers unique habitat. Therefore, from a floral perspective, none of the habitats affected by the proposed inundation zone can be considered as critical habitat under Criterion 4.
5	This criterion has relevance to areas associated with key evolutionary processes (i.e. important	Rocky Grassland and the Indigenous tree clumps are considered CH under Criterion 5.

Criterion	Description	Flora
	landscape level features, which allow for key evolutionary processes to take place).	

8.1.1 Herpetofauna

The critical habitat assessment for herpetofauna are shown in Table 54.

Table 54: Critical habitat assessment for the herpetofauna

Criterion	Description	Herpetofauna
1	The occurrence of critically endangered or endangered species.	No IUCN listed CR or EN species were observed. However, the Nile Crocodile (*Crocodylus* niloticus), which is classified as Vulnerable is known to occur downstream of the project area. Tier 1 critical habitat is considered as unlikely - it is unlikely that the project area will support 10% or more of the global population of any reptile or amphibian species.
2	Habitat types sustain any endemic species with >95% or ≥1% but <95% of its global population restricted to this habitat. And/or, taxa are restricted-range species with an extent of occurrence of 50,000km² or less. Eswatini has a land area of 17,364 km²	None of the herpetofauna taxa in the project area were restricted-range species with an extent of occurrence of 50,000km² or less
3	Migratory or congregatory species are present on the site, with abundance values exceeding 1% of the global population size.	None of the herpetofauna taxa are believed to have abundance values in the project area that exceed 1% of their global population size and/ or exceeds 1% of the global population size within a definitive DMU. Furthermore, there is no terrestrial migratory herpetofauna in this region and the only congregatory herpetofauna are amphibians, which congregate in aquatic habitats in order to breed. However, these congregations are localized and there are numerous congregations in this region. No specific congregation of a single herpetofauna species is known to occur within the proposed inundation zone that would fulfill this criterion.
4	This criterion has relevance to highly threatened or unique ecosystems containing unique assemblages of species, including concentrations of biome-restricted species.	None of the habitat types supported assemblages of species that are considered to be unique. However, the KaNgwane Montane Grassland is classified as a Vulnerable vegetation unit with only 0.4 % protected within any formally proclaimed nature reserves (Malalotja, Nooitgedacht Dam and Songimvelo (Mucina & Rutherford 2006). Although the herpetofauna assemblage of this particular region is not very well known, the proposed inundation zone is unlikely to remove a significant portion of this habitat at the regional scale. Given the large regional extents of the habitats to be affected by the proposed inundation zone, none of the ecosystems potentially affected by the proposed dam can be considered to be unique to the inundation zone. Therefore, from a herpetofauna perspective, none of the habitats affected by the proposed inundation zone can be considered as critical habitat under Criterion 4.

Criterion	Description	Herpetofauna
5	This criterion has relevance to areas associated with key evolutionary processes (i.e. important landscape level features, which allow for key evolutionary processes to take place).	In general, large rivers are usually associated with key evolutionary processes as they often divide landscapes and therefore promote speciation by preventing gene flow across the river. However, no herpetofauna populations are divided by the Lusushwana River or has this river created a particular habitat exploited by only a single range-restricted species. Consequently, from a herpetofauna perspective, the rivers that will be affected by the proposed inundation zone are not considered to be associated with key evolutionary processes.

8.2 Mammals

The critical habitat assessment for herpetofauna are shown in Table 55.

Table 55: Critical habitat assessment of mammals

Criterion	Description	Mammals
1	The occurrence of critically endangered or endangered species.	No CR or EN mammal species were recorded or expected to be present in the project area. A Near Threatened, Red Duiker was however recorded during the surveys. Tier 1 critical habitat is considered as unlikely - it is unlikely that the project area will support 10% or more of the global population of any mammalian species.
2	Habitat types sustain any endemic species with >95% or ≥1% but <95% of its global population restricted to this habitat. And/or, taxa are restricted-range species with an extent of occurrence of 50,000km² or less. Eswatini has a land area of 17,364 km²	No endemic / range-restricted mammal species were recorded or are expected in the project area nor are any expected to occur.
3	Migratory or congregatory species are present on the site, with abundance values exceeding 1% of the global population size.	There are no migratory mammal species that occur in the area that would fulfill the quantitative threshold for Critical Habitat under Criterion 3.
4	This criterion has relevance to highly threatened or unique ecosystems containing unique assemblages of species, including concentrations of biome-restricted species.	None of the ecosystems potentially affected by the proposed dam can be considered to be unique to the inundation zone. Therefore, from a mammal perspective, none of the habitats affected by the proposed inundation zone can be considered as critical habitat under Criterion 4.
5	This criterion has relevance to areas associated with key evolutionary processes (i.e. important landscape level features, which allow for key evolutionary processes to take place).	Whilst the systems separate habitat features and ecosystems, no mammal populations are divided by the Lusushwana river system and this river has not created a particular habitat exploited by only a single range-restricted species.

8.3 Avifauna

The critical habitat assessment is represented in Table 56.

Table 56: Critical habitat assessment of avifauna

Criterion	Description	Birds
1	The occurrence of critically endangered or endangered species.	No IUCN listed CR or EN species were observed however the Blue Swallow *(Hirundo atrocaerulea),* and Southern Bald Ibis *(Geronticus calvus)* and Lanner Falcon (*Falco* biarmicus) are classified as Vulnerable and prefer the upper grassland habitat within the project area. Tier 1 critical habitat is considered as unlikely - it is unlikely that the project area will support 10% or more of the global population of any species.
2	Habitat types sustain any endemic species with >95% or ≥1% but <95% of its global population restricted to this habitat. And/or, taxa are	None of the bird taxa on the project area were restricted-range species with an extent of occurrence of 50,000km² or less.

	restricted-range species with an extent of occurrence of 50,000km² or less.	
3	Migratory or congregatory species are present on the site, with abundance values exceeding 1% of the global population size.	None of the bird taxa has abundance values on the project area that exceeds 1% of their global population size and/ or exceeds 1% of the global population size within a definitive DMU.
4	This criterion has relevance to highly threatened or unique ecosystems containing unique assemblages of species, including concentrations of biome-restricted species.	None of the habitat types supported assemblages of species that are considered to be unique. However, the KaNgwane Montane Grassland is classified as a Vulnerable vegetation unit with only 0.4 % protected within any formally proclaimed nature reserves (Malalotja, Nooitgedacht Dam and Songimvelo). A number of private conservation areas protect small patches of this unit. It is well suited for afforestation and 30% has already been converted to plantations of alien trees. A further 6% is under cultivation. Erosion potential is low except along the channelled valley bottom wetlands. The conservation target is 27% conserved (Mucina & Rutherford 2006).
5	This criterion has relevance to areas associated with key evolutionary processes (i.e. important landscape level features, which allow for key evolutionary processes to take place).	None of the habitat types were considered to hold important landscape-level features (at a local scale), which allows for key evolutionary processes to take place.

8.4 Aquatic Ecology

The approach followed for this CHA was completed through the following process. The first step was the designation of the DMU, which was identified as the area on the Lusushwana River system between the Luphohlo Dam and immediately downstream of the Mantenga Falls. Field surveys were then completed to identify the ecological condition and species composition of the selected DMU. The final process of the CHA was to compare the established ecological condition/composition against the above listed IFC PS criteria for Critical Habitat.

8.4.1 Critical Habitat Assessment: Criteria 1-3

The Lusushwana River reach within the DMU assessed in this study was found to be modified from natural conditions. Large-scale flow modification through the presence of the Luphohlo Dam has resulted in significant flow, bed and channel modification within the Lusushwana River. The extent of the transformation has resulted in the alteration of natural ichthyological and macroinvertebrate communities. No Critically Endangered or Endangered species of aquatic biota were observed or expected, thus not qualifying the DMU as critical habitat under criterion 1. Despite the extent of the modification, in the remaining limited extents of less impacted runs, endemic vulnerable, near threatened and migratory biota were observed thus triggering Criterion 2 and Criterion 3. However, when the assessment DMU and its ecological compositions were compared against the thresholds for Criterion 2 Tier 1 and Tier 2, both thresholds were not met, in that the habitat assessed does not subjectively contain >1% of their global populations of the endemic and threatened species. The DMU riverine habitat was determined to sustain <1% of the global *Anguilla mossambica* global population and would not be considered a source site for the species. Therefore, when the habitat in the DMU was compared to the thresholds for Criterion 3 species, none of the thresholds were met for this DMU indicating that Criterion 3 was not triggered.

8.4.2 Critical Habitat Assessment: Criterion 4 -5

A subjective desktop assessment of the ecological conditions across the headwaters of the Phongolo and Usuthu catchment indicates large-scale modification to headwater systems as a result of coal mining activities, urbanisation, agriculture and plantations (Diedericks *et al*. 2016). Despite the decreasing extent of the habitat type, the DMU within this assessment constitutes a single river reach and is extensively modified. The DMU thus does not constitute to be classified as Criterion 4 habitat.

The presence of the Mantenga Falls has likely created some degree of genetic isolation and therefore may support genetically unique subpopulations of various species. However, given the degree of modification within the DMU, the watercourse reaches considered in this assessment cannot be classified under Criterion 5.

8.4.3 Critical Habitat Assessment: Conclusion

The riverine habitat within the established DMU was determined to be a modified habitat inline with the definition below:

- 'areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition' (IFC,2012).

In addition, none of the 5 Critical Habitat criteria thresholds were triggered for DMU of this assessment. Additional criteria established in IFC PS6 indicate the need to address the project locality in terms of its position in association with Legally Protected Areas and International Recognised Areas. The current DMU is located immediately upstream of the Mantenga Nature Reserve, a legally protected area. It is noted that the proposed project footprint is not located within the protected area, but is located upstream and therefore indirect impacts can be anticipated. The proposed project must therefore apply the mitigation hierarchy to avoid and minimise the potential indirect impacts.

Table 57: Critical habitat assessment of Riverine Ecology

Criterion	Description	Riverine Ecology
1	The occurrence of critically endangered or endangered species.	The Lusushwana River reach within the DMU assessed in this study was found to be modified from natural conditions. Large-scale flow modification through the presence of the Luphohlo Dam has resulted in significant flow, bed and channel modification within the Lusushwana River. The extent of the transformation has resulted in the alteration of natural ichthyological and macroinvertebrate communities. No Critically Endangered or Endangered species of aquatic biota were observed or expected, thus not qualifying the DMU as critical habitat under criterion 1. Despite the extent of the modification, in the remaining limited extents of less impacted runs, endemic vulnerable, near threatened and migratory biota were observed thus triggering Criterion 2 and Criterion 3. However, when the assessment DMU and its ecological compositions were compared against the thresholds for Criterion 2 Tier 1 and Tier 2, both thresholds were not met, in that the habitat assessed does not subjectively contain >1% of their global populations of the endemic and threatened species. The DMU riverine habitat was determined to sustain <1% of the global Anguilla mossambica global population and would not be considered a source site for the species. Therefore, when the habitat in the DMU was compared to the thresholds for Criterion 3 species, none of the thresholds were met for this DMU indicating that Criterion 3 was not triggered.
2	Habitat types sustain any endemic species with >95% or ≥1% but <95% of its global population restricted to this habitat. And/or, taxa are restricted-range species with an extent of occurrence of 50,000km² or less.	
3	Migratory or congregatory species are present on the site, with abundance values exceeding 1% of the global population size.	

<table>
<tr><td>4</td><td>This criterion has relevance to highly threatened or unique ecosystems containing unique assemblages of species, including concentrations of biome-restricted species.</td><td rowspan="2">A subjective desktop assessment of the ecological conditions across the headwaters of the Pongola and Usuthu catchment indicates large-scale modification to headwater systems as a result of coal mining activities, urbanisation, agriculture and plantations (Diedericks et al. 2016). Despite the decreasing extent of the habitat type, the DMU within this assessment constitutes a single river reach and is extensively modified. The DMU thus does not constitute to be classified as Criterion 4 habitat. The presence of the Mantenga Falls has likely created some degree of genetic isolation and therefore may support genetically unique subpopulations of various species. However, given the degree of modification within the DMU, the watercourse reach considered in this assessment cannot be classified under Criterion 5.</td></tr>
<tr><td>5</td><td>This criterion has relevance to areas associated with key evolutionary processes (i.e. important landscape level features, which allow for key evolutionary processes to take place).</td></tr>
</table>

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Appendix A: Methodologies

9.1 Botanical Assessment

The botanical assessment will encompass an assessment of all the vegetation units and habitat types within the project area. The focus will be on a full assessment of habitat types as well as identification for any red-data species within the known distribution of the project area. The survey methodology will include the following survey techniques:

- Timed meanders;
- Sensitivity analysis based on structural and species diversity; and
- Identification of floral red-data species.

9.2 Literature study

A literature review was conducted as part of the assessment to identify the potential habitats present within the project area. The SANBI provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA), to access distribution records on southern African plants.

Based on the Plants of Southern Africa (BODATSA-POSA, 2019), 1480 plant species are expected to occur in the area Appendix B.

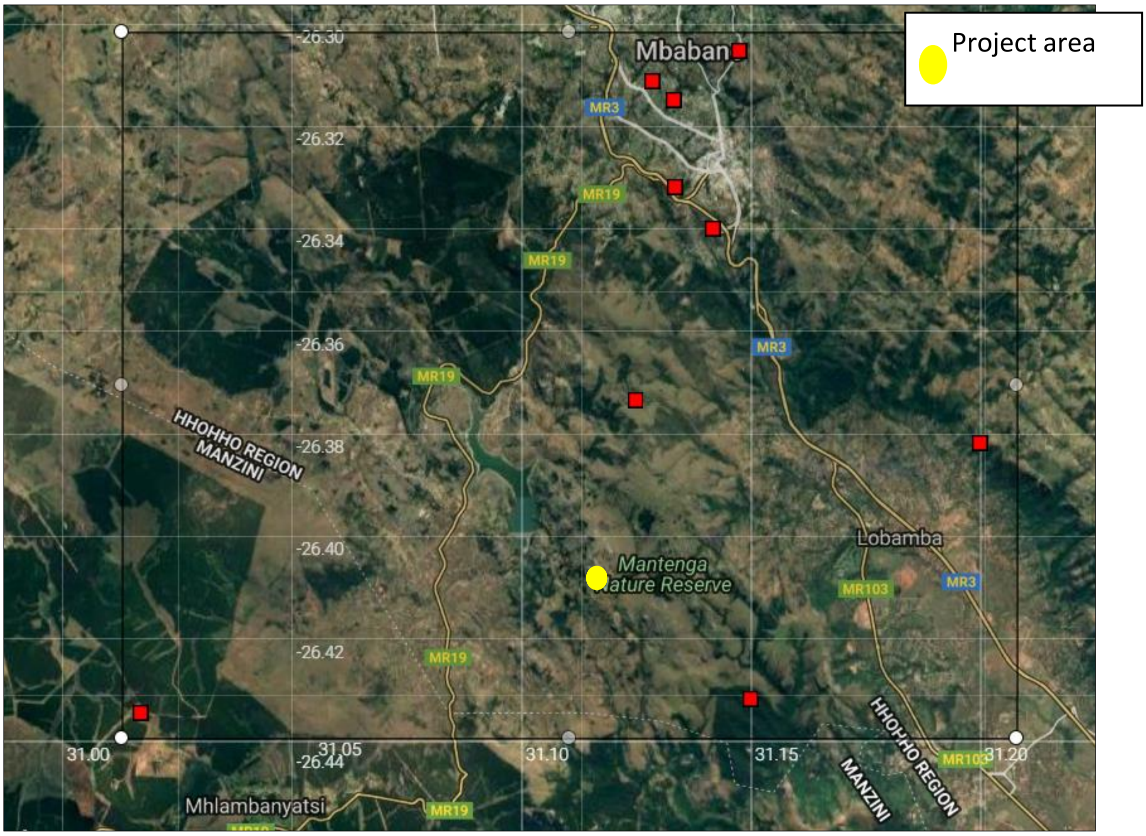

Figure 115: Map showing the grid drawn in order to compile an expected species list (BODATSA-POSA, 2019)

The Red List of Southern African Plants website (SANBI, 2017) was utilized to provide the most current account of the national status of flora. Relevant field guides (as the species in Mozambique is similar to those in SA, a number of SA guides were used) and texts consulted for identification purposes in the field during the surveys included the following:

- Guide to grasses of Southern Africa (Van Oudtshoorn, 2012);

- A Field Guide to WildFlowers: KwaZulu-Natal and Eastern Region (Pooley, E. (2005); and
- Field guide to trees of Southern Africa (Van Wyk, B. & Van Wyk, P. 2001).

Additional information regarding ecosystems, vegetation types, and species of conservation concern (SCC) included the following sources:

- The Vegetation of South Africa, Lesotho and Mozambique (Mucina & Rutherford, 2006);
- Grassland Ecosystem Guidelines: landscape interpretation for planners and managers (SANBI, 2013); and
- Red List of South African Plants (Raimondo *et al*., 2009; SANBI, 2016).

9.2.1 Floristic sampling

To scope the survey, the proposed project area was traversed by vehicle and on foot. The floristic diversity and search for flora SCC were conducted through meanders within the 2 km Discreet Management Unit (DMU) that was created from the project area. The random meander method is a highly efficient method for conducting floristic analysis specifically in detecting flora SCC and maximising floristic coverage. In addition, the method is time and cost effective and highly suited for compiling flora species lists and therefore gives a rapid indication of flora diversity. Current impacts (e.g. burning, slash and burn agriculture etc.), subjective recording of dominant vegetation species and any sensitive features (e.g. riparian, restricted habitat types etc.). In addition, opportunistic observations were made while moving through the project area.

9.3 Faunal Assessment (Mammals & Avifauna)

The faunal desktop assessment included the following:

- Compilation of expected species lists;
- Compilation of identified species lists;
- Identification of any Red Data or SCC present or potentially occurring in the area; and
- Emphasis was placed on the probability of occurrence of species of national and international conservation importance.

The field survey component of the assessment will utilise a variety of sampling techniques including, but not limited to, the following:

- Visual observations (day and night surveys), surveys were also aligned with known peak activity times ;
- Camera Trap surveys (long and short term);
- Small mammal trapping;
- Identification of tracks and signs; and
- Utilization of local knowledge.

Habitat types to be sampled will include pristine, disturbed and semi-disturbed zones, rocky ridges, drainage lines, wetlands and river habitats. Mammal and avifaunal distribution data were obtained from the following information sources:

- The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005);
- Bats of Southern and Central Africa (Monadjem *et al*., 2010);
- The 2016 Red List of Mammals of South Africa, Lesotho and Mozambique (www.ewt.org.za) (EWT, 2016);
- Animal Demography Unit (ADU) - MammalMap Category (MammalMap, 2017) (mammalmap.adu.org.za);
- A Field Guide to the Tracks and Signs of Southern, Central and East African Wildlife (Stuart & Stuart, 2013);
- The Smaller Mammals of KwaZulu-Natal (Taylor, 1998);
- Roberts Birds of Southern Africa (Roberts, 2018);
- Sasol Birds of Southern Africa (SASOL, 2016);
- Eswatini's fourth national report to the convention on biological diversity (CBD, 2009).

9.3.1 Data analysis

The data obtained was presence/absence data along with their habitats that they occur in. The statistical programmes SPS version 6 and Conoco Version2.5 were used for the analysis. A non-metric multidimensional scaling ordination of the relative abundances of bird species based on Euclidean distance with a Kruskals stress was performed. Lastly present occuring species were assigned to 12 major trophic guilds loosely based on the classification system developed by González-Salazar *et al*. (2014). Species were first classified by their dominant diet (carnivore, herbivore, granivore, frugivore, nectarivore, omnivore, then by the medium upon / within which they most frequently forage (ground, water, foliage, air) and lastly by their activity period (nocturnal or diurnal).

9.3.2 Herpetology (Reptiles & Amphibians)

A herpetofauna assessment of the project area will be conducted, including in-depth, site-specific research and focused searching. Ideally, surveys for herpetofauna should be conducted at those times when the target species or communities are known to be active because these periods of activity are more likely to lead to capture success (for most species). In Mozambique this is during the summer months and ideally after or during periods when rainfall is most likely or has recently occurred.

The herpetological field survey comprised the following techniques:

- Diurnal hand searches - are used for reptile species that shelter in or under particular microhabitats (typically rocks, exfoliating rock outcrops, fallen timber, leaf litter, bark etc.);
- Visual searches - typically undertaken for species whose behaviour involves surface activity or for species that are difficult to detect by hand-searches or pitfall trapping. May include walking transects or using binoculars to view species from a distance without them being disturbed;
- Amphibians – many of the survey techniques listed above will be able to detect species of amphibians. Over and above these techniques, vocalisation sampling techniques are often the best to detect the presence of amphibians as each species has a distinct call; and
- Opportunistic sampling - Reptiles, especially snakes, are incredibly illusive and difficult to observe. Consequently, all possible opportunities to observe reptiles are taken, in order to augment the standard sampling procedures described above. This will include talking to local

people and staff at the site and reviewing photographs of reptiles and amphibians that the other biodiversity specialists may come across while on site.

Herpetofauna distributional and species data was obtained from the following information sources:

- South African Reptile Conservation Assessment (SARCA) (sarca.adu.org);
- A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007);
- Field guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
- Atlas and Red list of Reptiles of South Africa, Lesotho and Mozambique (Bates *et al*., 2014);
- A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
- Animal Demography Unit (ADU) - FrogMAP (frogmap.adu.org.za);
- Atlas and Red Data Book of Frogs of South Africa, Lesotho and Mozambique (Mintner *et al*., 2004); and
- Ensuring a future for South Africa's frogs (Measey, 2011).

9.4 Aquatic Ecology

9.4.1 *In Situ* Water Quality

During the survey a portable Hach HQ 40d water quality meter was used to measure the following parameters *in situ*:

- pH;
- Conductivity;
- Dissolved Oxygen (DO); and
- Water Temperature.

An Extech TB400 turbidity meter was used to measure the suspended solid content of the water column.

9.4.2 Habitat Assessment

Habitat availability and diversity are major attributes for the biota found in a specific ecosystem, and thus knowledge of the quality of habitats is important in an overall assessment of ecosystem health. Habitat assessment can be defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour *et al*. 1996). Both the quality and quantity of available habitat affect the structure and composition of resident biological communities (USEPA, 1998). Habitat quality and availability plays a critical role in the occurrence of aquatic biota. For this reason, habitat evaluation is conducted simultaneously with biological evaluations to facilitate the interpretation of results.

9.4.3 Intermediate Habitat Integrity Assessment

The aim of the Intermediate Habitat Integrity Assessment (IHIA) is to make an intermediate assessment of the habitat integrity of rivers according to a modified Habitat Integrity approach which can be applied in intermediate determination of the ecological reserve for rivers in South Africa (DWS, 1999). The methodology is based on the qualitative assessment of a number of pre-weighted criteria which indicate the integrity of the in-stream and riparian habitats available for use by riverine biota.

The criteria considered indicative of the habitat integrity of the river were selected on the basis that anthropogenic modification of their characteristics can generally be regarded as the primary causes of degradation of the integrity of the river (Table 58) (DWS, 1999). This study assessed the directly impacted reach of the watercourse, which includes a 20km reach of the Lusushwana River, from S1 to S7.

Table 58: Criteria used in the assessment of habitat integrity (from Kleynhans, 1996).

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment (Gordon *et al.*, 1993 in: DWS, 1999). Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation (Hilden & Rapport, 1993 in: DWS, 1999) is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Water quality modification	Originates from point and diffuse point sources. Measured directly or agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments (Gordon *et al.*, 1992 in DWS, 1999)).
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic aquatic fauna	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
Solid waste disposal	A direct anthropogenic impact which may alter habitat structurally. Also a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river (Gordon *et al.*, 1992). Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochtonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

Table 59: Descriptive classes for the assessment of modifications to habitat integrity (from Kleynhans, 1996).

Impact Category	Description	Score
None	No discernible impact, or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	**0**
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.	**1 - 5**
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited.	**6 - 10**
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	**11 - 15**
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	**16 - 20**

Impact Category	Description	Score
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	**21 - 25**

The habitat integrity assessment takes into account the riparian zone and the instream channel of the river. Assessments are made separately for both aspects, but data for the riparian zone are primarily interpreted in terms of the potential impact on the instream component (Table 60). The relative weighting of criteria remain the same as for the assessment of habitat integrity (DWS, 1999).

Table 60: Criteria and weights used for the assessment of habitat integrity and habitat integrity (from Kleynhans, 1996).

Instream Criteria	Weight	Riparian Zone Criteria	Weight
Water abstraction	14	Indigenous vegetation removal	13
Flow modification	13	Exotic vegetation encroachment	12
Bed modification	13	Bank erosion	14
Channel modification	13	Channel modification	12
Water quality	14	Water abstraction	13
Inundation	10	Inundation	11
Exotic macrophytes	9	Flow modification	12
Exotic fauna	8	Water quality	13
Solid waste disposal	6		
Total	100	**Total**	100

The negative weights are added for the instream and riparian facets respectively and the total additional negative weight subtracted from the provisionally determined intermediate integrity to arrive at a final intermediate habitat integrity estimate. The eventual total scores for the instream and riparian zone components are then used to place the habitat integrity in a specific intermediate habitat integrity category (DWS, 1999). These categories are indicated in Table 61.

Table 61: Intermediate habitat integrity categories (From Kleynhans, 1996)

Category	Description	Score (% of Total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0

9.4.4 Riparian Habitat Delineation

The riparian delineation was completed according to DWAF (2005). Typical riparian cross sections and structures are provided in Figure 116. Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. Contour data obtained from topography spatial data was also utilised to support the infield assessment. It is noted that only the area which will be inundated was selected for the riparian habitat assessment.

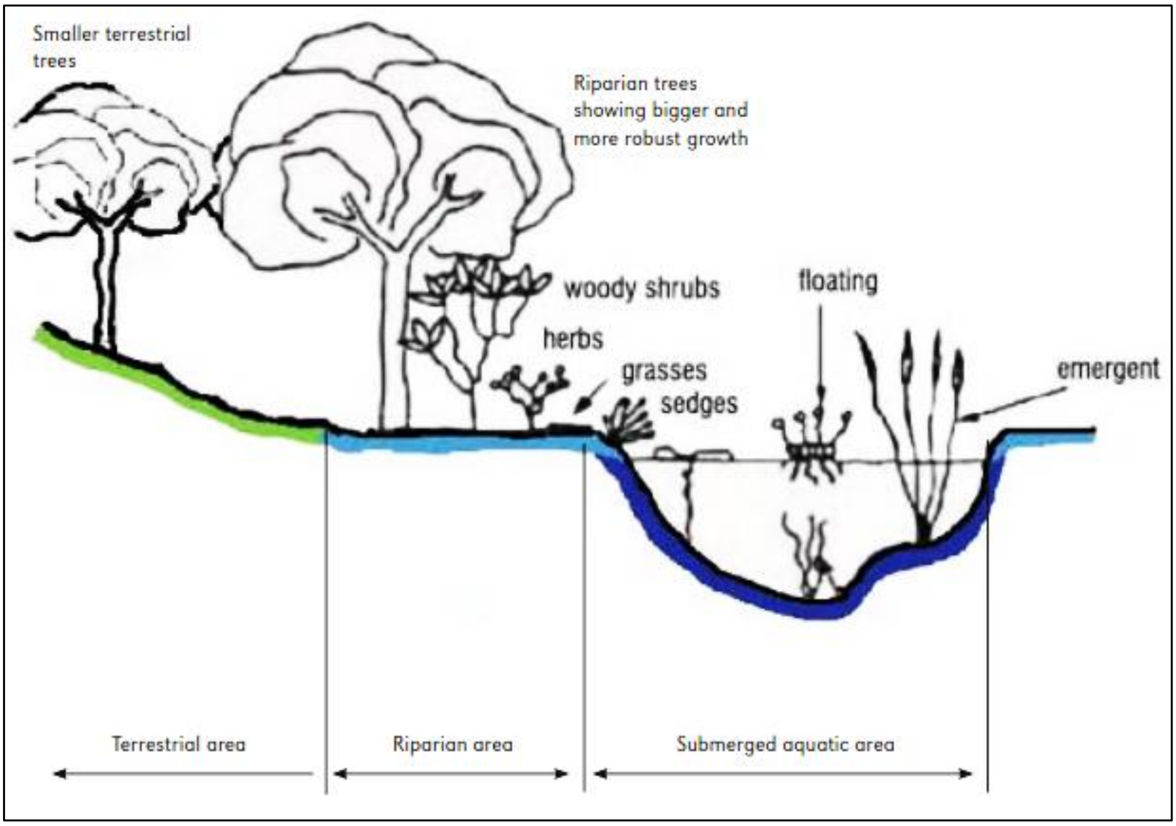

Figure 116: Riparian Habitat Delineations (DWAF, 2005)

9.4.5 Macroinvertebrate Assemblages

The monitoring of aquatic macroinvertebrates forms an integral part of the monitoring of the health of an aquatic ecosystem as they are relatively sedentary and enable the detection of localised disturbances. Their relatively long-life histories (±1 year) allow for the integration of pollution effects over time. Field sampling is easy and since the communities are heterogeneous and several phyla are usually represented, response to environmental impacts is normally detectable in terms of the community as a whole (Hellawell, 1977). Aquatic macroinvertebrates were sampled using the qualitative kick sampling method South African Scoring System version 5 (SASS5) (Dickens & Graham, 2002). This methodology was applied to macroinvertebrate collection. Taxa were identified to family levels for the scoring system. Macroinvertebrate assemblages were interpreted according to the following metrics: the number of taxa; sum of sensitivity scores for each taxon; and the Average Score Per Taxon (ASPT), proportion of Air-breathing taxa (%), Proportion of sensitive taxa (%), and sediment-sensitive invertebrates.

9.4.6 Ephemeroptera, Plecoptera, and Trichoptera (EPT) Index

The Ephemeroptera, Plecoptera, and Trichoptera (EPT) index is an independent monitoring index (based on Lenat, 1988) and is focusing on the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), which can be identified and sorted relatively easily (Barbour *et al.,* 1996). The EPT index is established by counting all distinct taxa collected within these three orders, hence the name "EPT". The EPT Index is based on the premise that higher quality water supports higher taxa richness, resulting in higher EPT index scores. Efforts will be made to identify to morphospecies level for EPT.

9.4.7 Odonata Assessment

Odonata represent a diverse order of aquatic invertebrates with a variety of environmental requirements (Samways and Simaika, 2016). The diversity of Odonata in a watercourse therefore typically reflect the environmental conditions and can be used in an integrated resource management. The Odonate diversity of the project area was assessed on a qualitative process during the survey at each of the sites considered. At each sampling points a rapid assessment for adult Odonata would occur for a total of 20 mins which would be dedicated to Odonata observation, whereby different habitat types would be surveyed, and each observed species were noted. Where possible, taxa were photographed.

9.4.8 Ichthyofaunal Assessment

9.4.9 Literature Survey

An expected species list was generated for the freshwater fishes occurring in the upper reaches of the Phongolo-Usuthu River systems. The species list was compiled through the use of fish distribution data presented in Skelton (2001). Furthermore, nomenclature has been updated according to Skelton (2016).

The following literature sources were consulted prior to the field surveys:

- Skelton (2001) was consulted for information on distributions, biology and ecology, and expected species;
- Fishbase.org (2019) was used to compile a list of expected species; and
- IUCN (2019) was used to determine the global conservation status of the expected fish species and produce an expected species list

9.4.10 Field Survey

Fish samples were collected by means of electrofishing with the LR 24V Haltech Electroshocker (Figure 117). A seine net of 3m wide by 1.5m high with 50mm mesh was also utilised (Figure 118). A single double bagged fyke net of approximately 15m was used for the survey. A fleet of gill nets, of various mesh size (48 mm, 78 mm and 100mm) were utilised during the survey (Figure 119). Cast netting was utilised where applicable. Sampling techniques employed during the survey as well as the efforts applied at each sampling points are available in the results section of this assessment. Quantitative techniques were employed whereby fish observed were enumerated and measured according to their total length. Each fish species was identified in the field, photographed and released at the point of capture.

Figure 117: Electroshocking in the Lusushwana River (S2, March 2019)

Figure 118: Seine netting in the Lusushwana River (S4, May 2019)

Figure 119: Gill nets in the Lusushwana River (S7, May 2019)

9.4.11 Habitat Characterisation

An adaptation of the Habitat Cover Rating (HCR) method of Kleynhans (1999) was used to characterise habitat at each sample site. The HCR was calculated according to the rating of the relative contribution of various depth-flow classes (df) (1=Rare/poor (<5%); 2=Sparse/poor (5-25%); 3= Moderate (25-75%); 4=Extensive (>75%). Cover features (cf) are then rated within each depth-flow class using the same scale. For each depth-flow class, the cover features were summed (∑cf). The HCR at each site was then calculated based on the contribution of each depth-flow class (df/∑df) multiplied by the summed cover feature ratings for each depth-flow class (∑cf).

9.4.12 Statistical Analysis

Canoco version 4.5 was used to complete linear redundancy analysis and determine the relationships between habitat ratings and fish species. Species abundance was assessed against depth class and cover feature ratings.

Standard distribution analysis of all data was undertaken to derive whether the data was normally or non-normally distributed. Thereafter, non-parametric or parametric standard t-tests were completed to identify temporal trends between the environmental data.

Appendix B: Floral species expected to occur in the project area as per the IUCN (2019)

Family	*Taxon*	Author	IUCN	Ecology
Cyperaceae	*Abildgaardia ovata*	(Burm.f.) Kral	LC	Indigenous
Fabaceae	*Abrus laevigatus*	E.Mey.	LC	Indigenous
Fabaceae	*Acacia dealbata*	Link	NE	Not Indigenous; Naturalised; Invasive
Fabaceae	*Acacia decurrens*	Willd.	NE	Not Indigenous; Naturalised; Invasive
Fabaceae	*Acacia longifolia*	(Andrews) Willd.	NE	Not Indigenous; Naturalised; Invasive
Fabaceae	*Acacia mearnsii*	De Wild.	NE	Not Indigenous; Naturalised; Invasive
Fabaceae	*Acacia podalyriifolia*	A.Cunn. ex G.Don	NE	Not Indigenous; Naturalised; Invasive
Euphorbiaceae	*Acalypha angustata*	Sond.	LC	Indigenous
Euphorbiaceae	*Acalypha depressinerva*	(Kuntze) K.Schum.	LC	Indigenous
Euphorbiaceae	*Acalypha ornata*	Hochst. ex A.Rich.	LC	Indigenous
Euphorbiaceae	*Acalypha punctata var. punctata*	Meisn.	LC	Indigenous
Euphorbiaceae	*Acalypha sp.*			
Euphorbiaceae	*Acalypha villicaulis*	Hochst.	LC	Indigenous
Euphorbiaceae	*Acalypha wilmsii*	Pax ex Prain & Hutch.	LC	Indigenous
Asteraceae	*Acanthospermum australe*	(Loefl.) Kuntze		Not Indigenous; Naturalised
Amaranthaceae	*Achyranthes aspera var. sicula*	L.		Not Indigenous; Naturalised
Asteraceae	*Acmella caulirhiza*	Delile		Not Indigenous; Naturalised; Invasive
Lamiaceae	*Acrotome hispida*	Benth.	LC	Indigenous
Asteraceae	*Adenanthellum osmitoides*	(Harv.) B.Nord.	LC	Indigenous
Passifloraceae	*Adenia digitata*	(Harv.) Engl.	LC	Indigenous
Passifloraceae	*Adenia gummifera var. gummifera*	(Harv.) Harms	LC	Indigenous
Euphorbiaceae	*Adenocline acuta*	(Thunb.) Baill.	LC	Indigenous
Fabaceae	*Adenopodia spicata*	(E.Mey.) C.Presl	LC	Indigenous
Asteraceae	*Adenostemma caffrum*	DC.	LC	Indigenous
Lamiaceae	*Aeollanthus parvifolius*	Benth.	LC	Indigenous
Lamiaceae	*Aeollanthus rehmannii*	Gurke	LC	Indigenous
Fabaceae	*Aeschynomene rehmannii var. leptobotrya*	Schinz	LC	Indigenous
Fabaceae	*Aeschynomene sp.*			
Asteraceae	*Afroaster comptonii*	(Lippert) J.C.Manning & Goldblatt	LC	Indigenous
Asteraceae	*Afroaster peglerae*	(Bolus) J.C.Manning & Goldblatt	LC	Indigenous; Endemic
Asteraceae	*Afroaster serrulatus*	(Harv.) J.C.Manning & Goldblatt	LC	Indigenous
Apiaceae	*Afrosciadium magalismontanum*	(Sond.) P.J.D.Winter	LC	Indigenous

Family	Taxon	Author	IUCN	Ecology
Fabaceae	*Afzelia quanzensis*	Welw.	LC	Indigenous
Agapanthaceae	*Agapanthus caulescens subsp. caulescens*	Spreng.	NE	Indigenous
Agapanthaceae	*Agapanthus caulescens subsp. gracilis*	Spreng.	LC	Indigenous; Endemic
Agapanthaceae	*Agapanthus inapertus subsp. intermedius*	P.Beauv.	LC	Indigenous
Loranthaceae	*Agelanthus transvaalensis*	(Sprague) Polhill & Wiens		Indigenous
Asteraceae	*Ageratum conyzoides*	L.		Not Indigenous; Naturalised; Invasive
Rosaceae	*Agrimonia procera*	Wallr.	LC	Not Indigenous; Naturalised; Invasive
Poaceae	*Agrostis eriantha var. eriantha*	Hack.	LC	Indigenous
Poaceae	*Agrostis lachnantha var. lachnantha*	Nees	LC	Indigenous
Poaceae	*Agrostis montevidensis*	Spreng. ex Nees	NE	Not Indigenous; Naturalised
Aizoaceae	*Aizoon canariense*	L.	LC	Indigenous
Lamiaceae	*Ajuga ophrydis*	Burch. ex Benth.	LC	Indigenous
Hyacinthaceae	*Albuca setosa*	Jacq.		Indigenous
Hyacinthaceae	*Albuca sp.*			
Hyacinthaceae	*Albuca virens subsp. virens*	(Ker Gawl.) J.C.Manning & Goldblatt		Indigenous
Orobanchaceae	*Alectra capensis*	Thunb.	LC	Indigenous
Orobanchaceae	*Alectra sessiliflora*	(Vahl) Kuntze	LC	Indigenous
Apiaceae	*Alepidea attenuata*	Weim.	NT	Indigenous
Apiaceae	*Alepidea capensis var. capensis*	(P.J.Bergius) R.A.Dyer	LC	Indigenous; Endemic
Apiaceae	*Alepidea cordifolia*	B.-E.van Wyk	EN	Indigenous
Apiaceae	*Alepidea setifera*	N.E.Br.	LC	Indigenous
Poaceae	*Alloteropsis semialata*	(R.Br.) Hitchc.		Indigenous
Poaceae	*Alloteropsis semialata subsp. eckloniana*	(R.Br.) Hitchc.	LC	Indigenous
Poaceae	*Alloteropsis semialata subsp. semialata*	(R.Br.) Hitchc.	LC	Indigenous
Asphodelaceae	*Aloe arborescens*	Mill.	LC	Indigenous
Asphodelaceae	*Aloe chabaudii var. chabaudii*	Schonland	LC	Indigenous
Asphodelaceae	*Aloe chortolirioides var. chortolirioides*	A.Berger	VU	Indigenous
Asphodelaceae	*Aloe cryptopoda*	Baker	LC	Indigenous
Asphodelaceae	*Aloe kniphofioides*	Baker	VU	Indigenous
Asphodelaceae	*Aloe maculata subsp. maculata*	All.	LC	Indigenous
Asphodelaceae	*Aloe marlothii subsp. marlothii*	A.Berger	LC	Indigenous
Asphodelaceae	*Aloe minima*	Baker	LC	Indigenous
Asphodelaceae	*Aloe mudenensis*	Reynolds	LC	Indigenous

Family	Taxon	Author	IUCN	Ecology
Asphodelaceae	*Aloe parvibracteata*	Schonland	LC	Indigenous
Asphodelaceae	*Aloe suprafoliata*	Pole-Evans	LC	Indigenous
Cyatheaceae	*Alsophila dregei*	(Kunze) R.M.Tryon	LC	Indigenous
Amaranthaceae	*Amaranthus hybridus subsp. hybridus*	L.		Not Indigenous; Naturalised
Thelypteridaceae	*Amauropelta bergiana var. bergiana*	(Schltdl.) Holttum	LC	Indigenous
Primulaceae	*Anagallis huttonii*	Harv.	LC	Indigenous
Phyllanthaceae	*Andrachne ovalis*	(E.Mey. ex Sond.) Mull.Arg.	LC	Indigenous
Poaceae	*Andropogon appendiculatus*	Nees	LC	Indigenous
Poaceae	*Andropogon eucomus*	Nees	LC	Indigenous
Poaceae	*Andropogon huillensis*	Rendle	LC	Indigenous
Poaceae	*Andropogon ravus*	J.G.Anderson	LC	Indigenous
Poaceae	*Andropogon schirensis*	Hochst. ex A.Rich.	LC	Indigenous
Commelinaceae	*Aneilema aequinoctiale*	(P.Beauv.) Loudon	LC	Indigenous
Ranunculaceae	*Anemone transvaalensis var. transvaalensis*	(Szyszyl.) Burtt Davy	LC	Indigenous
Orchidaceae	*Angraecum pusillum*	Lindl.	LC	Indigenous
Asteraceae	*Anisopappus smutsii*	Hutch.	LC	Indigenous
Apiaceae	*Annesorhiza flagellifolia*	Burtt Davy	LC	Indigenous; Endemic
Apiaceae	*Annesorhiza wilmsii*	H.Wolff	LC	Indigenous
Annonaceae	*Annona senegalensis subsp. senegalensis*	Pers.		Indigenous
Melastomataceae	*Antherotoma debilis*	(Sond.) Jacq.-Fel.	LC	Indigenous
Melastomataceae	*Antherotoma naudinii*	Hook.f.	LC	Indigenous
Melastomataceae	*Antherotoma phaeotricha*	(Hochst.) Jacq.-Fel.	LC	Indigenous
Melastomataceae	*Antherotoma sp.*			
Gentianaceae	*Anthocleista grandiflora*	Gilg	LC	Indigenous
Rubiaceae	*Anthospermum herbaceum*	L.f.	LC	Indigenous
Rubiaceae	*Anthospermum hispidulum*	E.Mey. ex Sond.	LC	Indigenous
Rubiaceae	*Anthospermum rigidum subsp. pumilum*	Eckl. & Zeyh.	LC	Indigenous
Phyllanthaceae	*Antidesma venosum*	E.Mey. ex Tul.	LC	Indigenous
Amaryllidaceae	*Apodolirion buchananii*	Baker	LC	Indigenous
Icacinaceae	*Apodytes dimidiata subsp. dimidiata*	E.Mey. ex Arn.	LC	Indigenous
Papaveraceae	*Argemone ochroleuca subsp. ochroleuca*	Sweet		Not Indigenous; Naturalised; Invasive
Fabaceae	*Argyrolobium frutescens*	Burtt Davy	LC	Indigenous
Fabaceae	*Argyrolobium pseudotuberosum*	T.J.Edwards	LC	Indigenous
Fabaceae	*Argyrolobium speciosum*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Argyrolobium tomentosum*	(Andrews) Druce	LC	Indigenous
Fabaceae	*Argyrolobium tuberosum*	Eckl. & Zeyh.	LC	Indigenous

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Iridaceae	*Aristea compressa*	Buchinger ex Baker	LC	Indigenous
Iridaceae	*Aristea ecklonii*	Baker	LC	Indigenous
Iridaceae	*Aristea torulosa*	Klatt	LC	Indigenous
Poaceae	*Aristida bipartita*	(Nees) Trin. & Rupr.	LC	Indigenous
Poaceae	*Aristida recta*	Franch.	LC	Indigenous
Poaceae	*Aristida sciurus*	Stapf	LC	Indigenous
Asteraceae	*Artemisia afra var. afra*	Jacq. ex Willd.	LC	Indigenous
Poaceae	*Arundinella nepalensis*	Trin.	LC	Indigenous
Apocynaceae	*Asclepias adscendens*	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias albens*	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias aurea*	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias crassinervis*	N.E.Br.	LC	Indigenous
Apocynaceae	*Asclepias cucullata subsp. cucullata*	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias cultriformis*	(Harv. ex Schltr.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias densiflora*	N.E.Br.	LC	Indigenous
Apocynaceae	*Asclepias eminens*	(Harv.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias fulva*	N.E.Br.	LC	Indigenous
Apocynaceae	*Asclepias gibba var. gibba*	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias meyeriana*	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias schlechteri*	(K.Schum.) N.E.Br.	EN	Indigenous
Apocynaceae	*Asclepias stellifera*	Schltr.	LC	Indigenous
Cyperaceae	*Ascolepis capensis*	(Kunth) Ridl.	LC	Indigenous
Asparagaceae	*Asparagus angusticladus*	(Jessop) J.-P.Lebrun & Stork	LC	Indigenous
Asparagaceae	*Asparagus ramosissimus*	Baker	LC	Indigenous
Asparagaceae	*Asparagus setaceus*	(Kunth) Jessop	LC	Indigenous
Asparagaceae	*Asparagus sp.*			
Asparagaceae	*Asparagus sylvicola*	S.M.Burrows	LC	Indigenous; Endemic
Asparagaceae	*Asparagus virgatus*	Baker	LC	Indigenous
Apocynaceae	*Aspidoglossum araneiferum*	(Schltr.) Kupicha	LC	Indigenous
Apocynaceae	*Aspidoglossum interruptum*	(E.Mey.) Bullock	LC	Indigenous
Apocynaceae	*Aspidoglossum ovalifolium*	(Schltr.) Kupicha	LC	Indigenous
Apocynaceae	*Aspidonepsis reenensis*	(N.E.Br.) Nicholas & Goyder	LC	Indigenous
Aspleniaceae	*Asplenium aethiopicum*	(Burm.f.) Bech.	LC	Indigenous

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Aspleniaceae	*Asplenium erectum var. erectum*	Bory ex Willd.	LC	Indigenous
Aspleniaceae	*Asplenium rutifolium*	(P.J.Bergius) Kunze	LC	Indigenous
Aspleniaceae	*Asplenium splendens subsp. splendens*	Kunze	LC	Indigenous; Endemic
Aspleniaceae	*Asplenium theciferum*	(Humb., Bonpl. & Kunth) Mett.	LC	Indigenous
Asteraceae	*Aster sp.*			
Aytoniaceae	*Asterella wilmsii*	(Steph.) S.W.Arnell		Indigenous
Asteraceae	*Athrixia elata*	Sond.	LC	Indigenous
Asteraceae	*Athrixia phylicoides*	DC.	LC	Indigenous
Poaceae	*Axonopus affinis*	Chase	NE	Not Indigenous; Naturalised
Asteraceae	*Baccharoides adoensis*	(Sch.Bip. ex Walp.) H.Rob.		Indigenous
Pottiaceae	*Barbula eubryum*	Mull.Hal.		Indigenous
Pottiaceae	*Barbula indica*	(Hook.) Spreng.		Indigenous
Acanthaceae	*Barleria gueinzii*	Sond.		Indigenous
Acanthaceae	*Barleria obtusa*	Nees		Indigenous
Acanthaceae	*Barleria ovata*	E.Mey. ex Nees		Indigenous
Passifloraceae	*Basananthe sandersonii*	(Harv.) W.J.de Wilde	LC	Indigenous
Fabaceae	*Bauhinia galpinii*	N.E.Br.	LC	Indigenous
Lepidoziaceae	*Bazzania decrescens*	(Lehm. & Lindenb.) Trevis.		Indigenous
Asparagaceae	*Behnia reticulata*	(Thunb.) Didr.	LC	Indigenous
Asteraceae	*Berkheya acanthopoda*	(DC.) Roessler	LC	Indigenous; Endemic
Asteraceae	*Berkheya bipinnatifida subsp. bipinnatifida*	(Harv.) Roessler	LC	Indigenous; Endemic
Asteraceae	*Berkheya bipinnatifida subsp. echinopsoides*	(Harv.) Roessler	LC	Indigenous
Asteraceae	*Berkheya echinacea subsp. echinacea*	(Harv.) O.Hoffm. ex Burtt Davy	LC	Indigenous
Asteraceae	*Berkheya erysithales*	(DC.) Roessler	LC	Indigenous
Asteraceae	*Berkheya insignis*	(Harv.) Thell.	LC	Indigenous
Asteraceae	*Berkheya montana*	J.M.Wood & M.S.Evans	LC	Indigenous
Asteraceae	*Berkheya rhapontica subsp. platyptera*	(DC.) Hutch. & Burtt Davy	LC	Indigenous
Asteraceae	*Berkheya rhapontica subsp. rhapontica*	(DC.) Hutch. & Burtt Davy	LC	Indigenous
Asteraceae	*Berkheya setifera*	DC.	LC	Indigenous
Asteraceae	*Berkheya sp.*			
Asteraceae	*Berkheya speciosa subsp. speciosa*	(DC.) O.Hoffm.	LC	Indigenous
Asteraceae	*Berkheya zeyheri*	Oliv. & Hiern		Indigenous
Asteraceae	*Berkheya zeyheri subsp. rehmannii*	Oliv. & Hiern	NE	Indigenous
Asteraceae	*Berkheya zeyheri subsp. rehmannii*	Oliv. & Hiern	NE	Indigenous
Asteraceae	*Berkheya zeyheri subsp. zeyheri*	Oliv. & Hiern	LC	Indigenous
Melianthaceae	*Bersama lucens*	(Hochst.) Szyszyl.	LC	Indigenous

Family	Taxon	Author	IUCN	Ecology
Apiaceae	*Berula repanda*	(Hiern) Spalik & S.R.Downie	LC	Indigenous
Asteraceae	*Bidens pilosa*	L.		Not Indigenous; Naturalised
Blechnaceae	*Blechnum attenuatum*	(Sw.) Mett.		Indigenous
Blechnaceae	*Blechnum australe*	L.		Indigenous
Blechnaceae	*Blechnum punctulatum var. atherstonei*	Sw.		Indigenous
Blechnaceae	*Blechnum punctulatum var. punctulatum*	Sw.		Indigenous
Fabaceae	*Bolusanthus speciosus*	(Bolus) Harms	LC	Indigenous
Orchidaceae	*Bonatea porrecta*	(Bolus) Summerh.	LC	Indigenous
Amaryllidaceae	*Boophone disticha*	(L.f.) Herb.	LC	Indigenous
Poaceae	*Bothriochloa bladhii*	(Retz.) S.T.Blake	LC	Indigenous
Asteraceae	*Bothriocline laxa*	N.E.Br.	LC	Indigenous
Stilbaceae	*Bowkeria cymosa*	MacOwan	LC	Indigenous
Poaceae	*Brachiaria bovonei*	(Chiov.) Robyns	LC	Indigenous
Poaceae	*Brachiaria brizantha*	(A.Rich.) Stapf	LC	Indigenous
Poaceae	*Brachiaria serrata*	(Thunb.) Stapf	LC	Indigenous
Orchidaceae	*Brachycorythis pubescens*	Harv.	LC	Indigenous
Asteraceae	*Brachylaena transvaalensis*	E.Phillips & Schweick.	LC	Indigenous
Bryaceae	*Brachymenium acuminatum*	Harv.		Indigenous
Bryaceae	*Brachymenium pulchrum*	Hook.		Indigenous
Apocynaceae	*Brachystelma coddii*	R.A.Dyer	LC	Indigenous
Apocynaceae	*Brachystelma gerrardii*	Harv.	EN	Indigenous
Apocynaceae	*Brachystelma swazicum*	R.A.Dyer	LC	Indigenous
Apocynaceae	*Brachystelma villosum*	(Schltr.) N.E.Br.	DD	Indigenous
Hedwigiaceae	*Braunia secunda*	(Hook.) Bruch & Schimp.		Indigenous
Phyllanthaceae	*Bridelia micrantha*	(Hochst.) Baill.	LC	Indigenous
Orchidaceae	*Brownleea coerulea*	Harv. ex Lindl.	LC	Indigenous
Orchidaceae	*Brownleea parviflora*	Harv. ex Lindl.	LC	Indigenous
Amaryllidaceae	*Brunsvigia natalensis*	Baker	LC	Indigenous
Amaryllidaceae	*Brunsvigia radulosa*	Herb.	LC	Indigenous
Bryaceae	*Bryum argenteum*	Hedw.		Indigenous
Bryaceae	*Bryum pycnophyllum*	(Dixon) Mohamed		Indigenous
Bryaceae	*Bryum viridescens*	Welw. & Duby		Indigenous
Orobanchaceae	*Buchnera dura*	Benth.	LC	Indigenous
Scrophulariaceae	*Buddleja salviifolia*	(L.) Lam.	LC	Indigenous
Asphodelaceae	*Bulbine abyssinica*	A.Rich.	LC	Indigenous
Asphodelaceae	*Bulbine coetzeei*	Oberm.	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Asphodelaceae	*Bulbine inflata*	Oberm.	LC	Indigenous
Orchidaceae	*Bulbophyllum sandersonii subsp. sandersonii*	(Hook.f.) Rchb.f.	LC	Indigenous
Cyperaceae	*Bulbostylis densa subsp. afromontana*	(Wall.) Hand.-Mazz.	LC	Indigenous
Cyperaceae	*Bulbostylis oritrephes*	(Ridl.) C.B.Clarke	LC	Indigenous
Rubiaceae	*Burchellia bubalina*	(L.f.) Sims	LC	Indigenous
Asteraceae	*Callilepis leptophylla*	Harv.	LC	Indigenous
Asteraceae	*Callilepis salicifolia*	Oliv.	LC	Indigenous
Fabaceae	*Calpurnia glabrata*	Brummitt	LC	Indigenous
Leucobryaceae	*Campylopus pilifer var. pilifer*	Brid.		Indigenous
Leucobryaceae	*Campylopus robillardei*	Besch.		Indigenous
Leucobryaceae	*Campylopus savannarum*	(Mull.Hal.) Mitt.		Indigenous
Leucobryaceae	*Campylopus sp.*			
Rubiaceae	*Canthium ciliatum*	(Klotzsch) Kuntze	LC	Indigenous
Rubiaceae	*Canthium inerme*	(L.f.) Kuntze	LC	Indigenous
Brassicaceae	*Cardamine africana*	L.	LC	Indigenous
Cyperaceae	*Carex cognata*	Kunth	LC	Indigenous
Cyperaceae	*Carex lancea*	(Thunb.) Baill.		Indigenous; Endemic
Cyperaceae	*Carex ludwigii*	(Hochst.) Luceno & Martin-Bravo		Indigenous; Endemic
Cyperaceae	*Carex rhodesiaca*	Nelmes	LC	Indigenous
Cyperaceae	*Carex schimperiana*	Boeck.		Indigenous
Cyperaceae	*Carex schweickerdtii*	(Merxm. & Podlech) Luceno & Martin-Bravo		Indigenous; Endemic
Cyperaceae	*Carex spartea*	Wahlenb.		Indigenous
Cyperaceae	*Carex spicatopaniculata*	Boeck. ex C.B.Clarke	LC	Indigenous
Cyperaceae	*Carex uhligii*	K.Schum. ex C.B.Clarke		Indigenous
Cyperaceae	*Carex zuluensis*	C.B.Clarke	LC	Indigenous
Apocynaceae	*Carissa bispinosa*	(L.) Desf. ex Brenan	LC	Indigenous
Celastraceae	*Cassine peragua subsp. peragua*	L.	LC	Indigenous
Icacinaceae	*Cassinopsis ilicifolia*	(Hochst.) Kuntze	LC	Indigenous
Rhizophoraceae	*Cassipourea swaziensis*	Compton	LC	Indigenous
Celastraceae	*Catha edulis*	(Vahl) Forssk. ex Endl.	LC	Indigenous
Rubiaceae	*Cephalanthus natalensis*	Oliv.	LC	Indigenous
Dipsacaceae	*Cephalaria foliosa*	Compton	VU	Indigenous
Dipsacaceae	*Cephalaria oblongifolia*	(Kuntze) Szabo	LC	Indigenous
Dipsacaceae	*Cephalaria pungens*	Szabo	LC	Indigenous
Dipsacaceae	*Cephalaria sp.*			
Dipsacaceae	*Cephalaria zeyheriana*	Szabo	LC	Indigenous
Caryophyllaceae	*Cerastium arabidis*	E.Mey. ex Fenzl		Indigenous
Achariaceae	*Ceratiosicyos laevis*	(Thunb.) A.Meeuse	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Apocynaceae	*Ceropegia carnosa*	E.Mey.	LC	Indigenous
Apocynaceae	*Ceropegia linearis subsp. woodii*	E.Mey.	LC	Indigenous
Apocynaceae	*Ceropegia sp.*			
Solanaceae	*Cestrum aurantiacum*	Lindl.		Not Indigenous; Naturalised; Invasive
Scrophulariaceae	*Chaenostoma floribundum*	Benth.	LC	Indigenous
Scrophulariaceae	*Chaenostoma polelense subsp. fraterna*	(Hiern) Kornhall	LC	Indigenous
Scrophulariaceae	*Chaenostoma polelense subsp. polelense*	(Hiern) Kornhall	LC	Indigenous
Scrophulariaceae	*Chaenostoma sp.*			
Fabaceae	*Chamaecrista capensis*	(Thunb.) E.Mey.		Indigenous
Fabaceae	*Chamaecrista capensis var. flavescens*	(Thunb.) E.Mey.	LC	Indigenous
Fabaceae	*Chamaecrista comosa var. capricornia*	E.Mey.	LC	Indigenous
Fabaceae	*Chamaecrista mimosoides*	(L.) Greene	LC	Indigenous
Verbenaceae	*Chascanum hederaceum var. natalense*	(Sond.) Moldenke		Indigenous
Verbenaceae	*Chascanum latifolium var. glabrescens*	(Harv.) Moldenke		Indigenous
Pteridaceae	*Cheilanthes eckloniana*	(Kunze) Mett.	LC	Indigenous
Pteridaceae	*Cheilanthes hirta var. hirta*	Sw.	LC	Indigenous
Pteridaceae	*Cheilanthes multifida subsp. lacerata*	(Sw.) Sw.	LC	Indigenous
Pteridaceae	*Cheilanthes multifida var. multifida*	(Sw.) Sw.	LC	Indigenous
Pteridaceae	*Cheilanthes viridis var. glauca*	(Forssk.) Sw.	LC	Indigenous
Pteridaceae	*Cheilanthes viridis var. macrophylla*	(Forssk.) Sw.	LC	Indigenous
Amaranthaceae	*Chenopodium giganteum*	D.Don		Not Indigenous; Naturalised
Amaranthaceae	*Chenopodium murale var. murale*	L.		Not Indigenous; Naturalised
Amaranthaceae	*Chenopodium phillipsianum*	Aellen		Indigenous
Gentianaceae	*Chironia krebsii*	Griseb.	LC	Indigenous
Gentianaceae	*Chironia palustris subsp. rosacea*	Burch.	LC	Indigenous
Gentianaceae	*Chironia purpurascens subsp. purpurascens*	(E.Mey.) Benth. & Hook.f.	LC	Indigenous
Poaceae	*Chloris gayana*	Kunth	LC	Indigenous
Agavaceae	*Chlorophytum angulicaule*	(Baker) Kativu		Indigenous
Agavaceae	*Chlorophytum comosum*	(Thunb.) Jacques		Indigenous
Agavaceae	*Chlorophytum cooperi*	(Baker) Nordal		Indigenous
Agavaceae	*Chlorophytum fasciculatum*	(Baker) Kativu		Indigenous
Agavaceae	*Chlorophytum galpinii var. galpinii*	(Baker) Kativu		Indigenous
Agavaceae	*Chlorophytum haygarthii*	J.M.Wood & M.S.Evans		Indigenous
Thelypteridaceae	*Christella dentata*	(Forssk.) Brownsey & Jermy	LC	Indigenous

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Thelypteridaceae	*Christella gueinziana*	(Mett.) Holttum		Indigenous
Asteraceae	*Cineraria decipiens*	Harv.	LC	Indigenous
Asteraceae	*Cineraria sp.*			
Menispermaceae	*Cissampelos torulosa*	E.Mey. ex Harv.	LC	Indigenous
Rutaceae	*Clausena anisata var. anisata*	(Willd.) Hook.f. ex Benth.	LC	Indigenous
Ranunculaceae	*Clematis brachiata*	Thunb.	LC	Indigenous
Cleomaceae	*Cleome monophylla*	L.	LC	Indigenous
Rosaceae	*Cliffortia linearifolia*	Eckl. & Zeyh.	LC	Indigenous
Rosaceae	*Cliffortia repens*	Schltr.	LC	Indigenous
Rosaceae	*Cliffortia serpyllifolia*	Cham. & Schltdl.	LC	Indigenous
Rosaceae	*Cliffortia strobilifera*	L.	LC	Indigenous
Amaryllidaceae	*Clivia caulescens*	R.A.Dyer	NT	Indigenous
Amaryllidaceae	*Clivia sp.*			
Euphorbiaceae	*Clutia affinis*	Sond.	LC	Indigenous
Euphorbiaceae	*Clutia laxa*	Eckl. ex Sond.	LC	Indigenous
Euphorbiaceae	*Clutia monticola var. monticola*	S.Moore	LC	Indigenous
Euphorbiaceae	*Clutia pulchella var. pulchella*	L.	LC	Indigenous
Euphorbiaceae	*Clutia virgata*	Pax & K.Hoffm.	LC	Indigenous
Cucurbitaceae	*Coccinia adoensis*	(A.Rich.) Cogn.	LC	Indigenous
Cucurbitaceae	*Coccinia mackenii*	Naudin ex C.Huber	LC	Indigenous
Menispermaceae	*Cocculus hirsutus*	(L.) Diels		Not Indigenous; Naturalised
Colchicaceae	*Colchicum melanthoides subsp. transvaalense*	(Willd.) J.C.Manning & Vinn.		Indigenous
Colchicaceae	*Colchicum striatum*	(Hochst. ex A.Rich.) J.C.Manning & Vinn.		Indigenous
Cyperaceae	*Coleochloa setifera*	(Ridl.) Gilly	LC	Indigenous
Lejeuneaceae	*Colura calyptrifolia*	(Hook.) Dumort.		Indigenous
Combretaceae	*Combretum erythrophyllum*	(Burch.) Sond.	LC	Indigenous
Combretaceae	*Combretum hereroense*	Schinz		Indigenous
Combretaceae	*Combretum imberbe*	Wawra	LC	Indigenous
Combretaceae	*Combretum kraussii*	Hochst.	LC	Indigenous
Combretaceae	*Combretum microphyllum*	Klotzsch	LC	Indigenous
Combretaceae	*Combretum molle*	R.Br. ex G.Don	LC	Indigenous
Commelinaceae	*Commelina africana var. africana*	L.	LC	Indigenous
Commelinaceae	*Commelina africana var. krebsiana*	L.	LC	Indigenous

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Commelinaceae	*Commelina africana var. lancispatha*	L.	LC	Indigenous
Commelinaceae	*Commelina benghalensis*	L.	LC	Indigenous
Commelinaceae	*Commelina erecta*	L.	LC	Indigenous
Commelinaceae	*Commelina modesta*	Oberm.	LC	Indigenous
Commelinaceae	*Commelina subulata*	Roth	LC	Indigenous
Nyctaginaceae	*Commicarpus plumbagineus var. plumbagineus*	(Cav.) Standl.	LC	Indigenous
Burseraceae	*Commiphora harveyi*	(Engl.) Engl.	LC	Indigenous
Rubiaceae	*Conostomium natalense var. glabrum*	(Hochst.) Bremek.	LC	Indigenous
Convolvulaceae	*Convolvulus natalensis*	Bernh. ex Krauss	LC	Indigenous
Asteraceae	*Conyza aegyptiaca*	(L.) Aiton		Indigenous
Asteraceae	*Conyza gouanii*	(L.) Willd.	LC	Indigenous
Asteraceae	*Conyza obscura*	DC.		Indigenous
Asteraceae	*Conyza pinnata*	(L.f.) Kuntze		Indigenous
Asteraceae	*Conyza scabrida*	DC.		Indigenous
Asteraceae	*Conyza sumatrensis var. sumatrensis*	(Retz.) E.Walker		Not Indigenous; Naturalised
Asteraceae	*Conyza ulmifolia*	(Burm.f.) Kuntze		Indigenous
Rubiaceae	*Cordylostigma virgata*	(Willd.) Groeninckx & Dessein		Indigenous
Myrtaceae	*Corymbia citriodora*	(Hook.) K.D.Hill & L.A.S.Johnson		Not Indigenous; Cultivated; Naturalised
Cyperaceae	*Costularia natalensis*	C.B.Clarke	LC	Indigenous
Acanthaceae	*Crabbea acaulis*	N.E.Br.		Indigenous
Acanthaceae	*Crabbea hirsuta*	Harv.		Indigenous
Asteraceae	*Crassocephalum crepidioides*	(Benth.) S.Moore	LC	Indigenous
Asteraceae	*Crassocephalum picridifolium*	(DC.) S.Moore		Indigenous
Crassulaceae	*Crassula acinaciformis*	Schinz		Indigenous; Endemic
Crassulaceae	*Crassula alba var. alba*	Forssk.		Indigenous
Crassulaceae	*Crassula alba var. pallida*	Forssk.		Indigenous; Endemic
Crassulaceae	*Crassula expansa subsp. fragilis*	Dryand.		Indigenous
Crassulaceae	*Crassula lanceolata subsp. lanceolata*	(Eckl. & Zeyh.) Endl. ex Walp.		Indigenous; Endemic
Crassulaceae	*Crassula pellucida subsp. alsinoides*	L.		Indigenous
Crassulaceae	*Crassula pellucida subsp. brachypetala*	L.		Indigenous
Crassulaceae	*Crassula sarcocaulis subsp. sarcocaulis*	Eckl. & Zeyh.	LC	Indigenous
Crassulaceae	*Crassula setulosa var. rubra*	Harv.	NE	Indigenous; Endemic
Crassulaceae	*Crassula sp.*			

Family	*Taxon*	Author	IUCN	Ecology
Crassulaceae	*Crassula swaziensis*	Schonland		Indigenous
Crassulaceae	*Crassula vaginata subsp. vaginata*	Eckl. & Zeyh.	LC	Indigenous
Campanulaceae	*Craterocapsa tarsodes*	Hilliard & B.L.Burtt	LC	Indigenous
Hymenophyllaceae	*Crepidomanes melanotrichum*	(Schltdl.) J.P.Roux	LC	Indigenous
Asteraceae	*Crepis hypochaeridea*	(DC.) Thell.		Not Indigenous; Naturalised; Invasive
Amaryllidaceae	*Crinum macowanii*	Baker	LC	Indigenous
Iridaceae	*Crocosmia aurea subsp. aurea*	(Pappe ex Hook.) Planch.	LC	Indigenous
Iridaceae	*Crocosmia paniculata*	(Klatt) Goldblatt	LC	Indigenous
Acanthaceae	*Crossandra greenstockii*	S.Moore	LC	Indigenous
Fabaceae	*Crotalaria capensis*	Jacq.	LC	Indigenous
Fabaceae	*Crotalaria globifera*	E.Mey.	LC	Indigenous
Fabaceae	*Crotalaria juncea*	L.	NE	Not Indigenous; Naturalised
Fabaceae	*Crotalaria lanceolata subsp. lanceolata*	E.Mey.	LC	Indigenous
Fabaceae	*Crotalaria natalitia var. natalitia*	Meisn.	LC	Indigenous
Fabaceae	*Crotalaria recta*	Steud. ex A.Rich.	LC	Indigenous
Cryphaeaceae	*Cryphaea jamesonii*	N.P.Taylor		Indigenous
Lauraceae	*Cryptocarya woodii*	Engl.	LC	Indigenous
Apocynaceae	*Cryptolepis oblongifolia*	(Meisn.) Schltr.	LC	Indigenous
Poaceae	*Ctenium concinnum*	Nees	LC	Indigenous
Poaceae	*Ctenium sp.*			
Commelinaceae	*Cyanotis lapidosa*	E.Phillips	LC	Indigenous
Commelinaceae	*Cyanotis speciosa*	(L.f.) Hassk.	LC	Indigenous
Asteraceae	*Cyanthillium wollastonii*	(S.Moore) H.Rob., Skvarla & V.A.Funk		Indigenous
Amaranthaceae	*Cyathula cylindrica var. cylindrica*	Moq.	LC	Indigenous
Orobanchaceae	*Cycnium adonense*	E.Mey. ex Benth.	LC	Indigenous
Orobanchaceae	*Cycnium racemosum*	Benth.	LC	Indigenous
Poaceae	*Cymbopogon caesius*	(Hook. & Arn.) Stapf	LC	Indigenous
Poaceae	*Cymbopogon nardus*	(L.) Rendle	LC	Indigenous
Poaceae	*Cynodon dactylon*	(L.) Pers.	LC	Indigenous
Boraginaceae	*Cynoglossum austroafricanum*	Hilliard & B.L.Burtt	LC	Indigenous
Boraginaceae	*Cynoglossum hispidum*	Thunb.	LC	Indigenous
Boraginaceae	*Cynoglossum lanceolatum*	Forssk.	LC	Indigenous
Boraginaceae	*Cynoglossum sp.*			
Orchidaceae	*Cynorkis kassneriana*	Kraenzl.	LC	Indigenous

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Cyperaceae	*Cyperus albostriatus*	Schrad.	LC	Indigenous
Cyperaceae	*Cyperus cyperoides subsp. cyperoides*	(L.) Kuntze	LC	Indigenous
Cyperaceae	*Cyperus deciduus*	Boeck.	LC	Indigenous
Cyperaceae	*Cyperus decurvatus*	(C.B.Clarke) C.Archer & Goetgh.	LC	Indigenous
Cyperaceae	*Cyperus denudatus*	L.f.	LC	Indigenous
Cyperaceae	*Cyperus dubius var. dubius*	Rottb.		Indigenous
Cyperaceae	*Cyperus esculentus var. esculentus*	L.	LC	Indigenous
Cyperaceae	*Cyperus keniensis*	Kuk.	LC	Indigenous
Cyperaceae	*Cyperus kirkii*	C.B.Clarke	LC	Indigenous
Cyperaceae	*Cyperus latifolius*	Poir.	LC	Indigenous
Cyperaceae	*Cyperus leptocladus*	Kunth	LC	Indigenous
Cyperaceae	*Cyperus obtusiflorus var. flavissimus*	Vahl	LC	Indigenous
Cyperaceae	*Cyperus obtusiflorus var. obtusiflorus*	Vahl	LC	Indigenous
Cyperaceae	*Cyperus parvinux*	C.B.Clarke	LC	Indigenous
Cyperaceae	*Cyperus schlechteri*	C.B.Clarke	LC	Indigenous
Cyperaceae	*Cyperus sp.*			
Cyperaceae	*Cyperus sphaerospermus*	Schrad.	LC	Indigenous
Cyperaceae	*Cyperus uitenhagensis*	(Steud.) C.Archer & Goetgh.	LC	Indigenous
Lobeliaceae	*Cyphia bolusii*	E.Phillips	VU	Indigenous
Lobeliaceae	*Cyphia elata var. elata*	Harv.	NE	Indigenous
Lobeliaceae	*Cyphia elata var. glabra*	Harv.	NE	Indigenous; Endemic
Vitaceae	*Cyphostemma cirrhosum subsp. cirrhosum*	(Thunb.) Desc. ex Wild & R.B.Drumm.		Indigenous
Vitaceae	*Cyphostemma simulans*	(C.A.Sm.) Wild & R.B.Drumm.		Indigenous
Vitaceae	*Cyphostemma woodii*	(Gilg & M.Brandt) Desc.		Indigenous
Amaryllidaceae	*Cyrtanthus bicolor*	R.A.Dyer	LC	Indigenous
Amaryllidaceae	*Cyrtanthus breviflorus*	Harv.	LC	Indigenous
Amaryllidaceae	*Cyrtanthus nutans*	R.A.Dyer	VU	Indigenous
Amaryllidaceae	*Cyrtanthus tuckii var. tuckii*	Baker	LC	Indigenous; Endemic
Fabaceae	*Dalbergia armata*	E.Mey.	LC	Indigenous
Euphorbiaceae	*Dalechampia capensis*	A.Spreng.	LC	Indigenous
Solanaceae	*Datura stramonium*	L.		Not Indigenous; Naturalised; Invasive
Aizoaceae	*Delosperma pottsii*	(L.Bolus) L.Bolus	LC	Indigenous; Endemic
Aizoaceae	*Delosperma sp.*			
Asteraceae	*Denekia capensis*	Thunb.	LC	Indigenous
Fabaceae	*Desmodium repandum*	(Vahl) DC.	LC	Indigenous
Fabaceae	*Desmodium setigerum*	(E.Mey.) Benth. ex Harv.	LC	Indigenous
Poaceae	*Diandrochloa namaquensis*	(Nees) De Winter	LC	Indigenous
Caryophyllaceae	*Dianthus mooiensis subsp. kirkii*	F.N.Williams		Indigenous

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Acanthaceae	*Dicliptera clinopodia*	Nees		Indigenous
Acanthaceae	*Dicliptera transvaalensis*	C.B.Clarke		Indigenous; Endemic
Acanthaceae	*Dicliptera verticillata*	(Forssk.) C.Chr.		Indigenous
Scrophulariaceae	*Diclis reptans*	Benth.	LC	Indigenous
Asteraceae	*Dicoma anomala subsp. anomala*	Sond.	LC	Indigenous
Gleicheniaceae	*Dicranopteris linearis*	(Burm.f.) Underw.	LC	Indigenous
Iridaceae	*Dierama galpinii*	N.E.Br.	LC	Indigenous
Iridaceae	*Dierama igneum*	Klatt	LC	Indigenous; Endemic
Iridaceae	*Dierama medium*	N.E.Br.	LC	Indigenous
Iridaceae	*Dierama mobile*	Hilliard	LC	Indigenous
Iridaceae	*Dierama pictum*	N.E.Br.	LC	Indigenous
Iridaceae	*Dierama sp.*			
Iridaceae	*Dietes iridioides*	(L.) Sweet ex Klatt	LC	Indigenous
Poaceae	*Digitaria ciliaris*	(Retz.) Koeler	NE	Not Indigenous; Naturalised
Poaceae	*Digitaria debilis*	(Desf.) Willd.	LC	Indigenous
Poaceae	*Digitaria diagonalis var. diagonalis*	(Nees) Stapf	LC	Indigenous
Poaceae	*Digitaria eriantha*	Steud.	LC	Indigenous
Poaceae	*Digitaria eylesii*	C.E.Hubb.	LC	Indigenous
Poaceae	*Digitaria maitlandii*	Stapf & C.E.Hubb.	LC	Indigenous
Poaceae	*Digitaria natalensis*	Stent	LC	Indigenous
Poaceae	*Diheteropogon amplectens var. amplectens*	(Nees) Clayton	LC	Indigenous
Poaceae	*Diheteropogon filifolius*	(Nees) Clayton	LC	Indigenous
Asteraceae	*Dimorphotheca jucunda*	E.Phillips	LC	Indigenous
Dioscoreaceae	*Dioscorea cotinifolia*	Kunth	LC	Indigenous
Dioscoreaceae	*Dioscorea retusa*	Mast.	LC	Indigenous
Dioscoreaceae	*Dioscorea rupicola*	Kunth	LC	Indigenous; Endemic
Ebenaceae	*Diospyros dichrophylla*	(Gand.) De Winter		Indigenous
Ebenaceae	*Diospyros galpinii*	(Hiern) De Winter		Indigenous
Ebenaceae	*Diospyros lycioides subsp. guerkei*	Desf.		Indigenous
Ebenaceae	*Diospyros whyteana*	(Hiern) F.White		Indigenous
Hyacinthaceae	*Dipcadi gracillimum*	Baker		Indigenous
Hyacinthaceae	*Dipcadi marlothii*	Engl.		Indigenous
Hyacinthaceae	*Dipcadi sp.*			
Hyacinthaceae	*Dipcadi viride*	(L.) Moench		Indigenous
Orchidaceae	*Disa baurii*	Bolus	LC	Indigenous
Orchidaceae	*Disa nervosa*	Lindl.	LC	Indigenous
Orchidaceae	*Disa polygonoides*	Lindl.	LC	Indigenous
Orchidaceae	*Disa saxicola*	Schltr.	LC	Indigenous

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Orchidaceae	*Disa stachyoides*	Rchb.f.	LC	Indigenous
Orchidaceae	*Disa versicolor*	Rchb.f.	LC	Indigenous
Orchidaceae	*Disa woodii*	Schltr.	LC	Indigenous
Orchidaceae	*Disperis fanniniae*	Harv.	LC	Indigenous
Orchidaceae	*Disperis lindleyana*	Rchb.f.	LC	Indigenous
Orchidaceae	*Disperis micrantha*	Lindl.	LC	Indigenous
Melastomataceae	*Dissotis canescens*	(E.Mey. ex R.A.Graham) Hook.f.	LC	Indigenous
Melastomataceae	*Dissotis princeps var. candolleana*	(Kunth) Triana	LC	Indigenous
Melastomataceae	*Dissotis princeps var. princeps*	(Kunth) Triana	LC	Indigenous
Ditrichaceae	*Ditrichum brachypodum*	(Mull.Hal.) Broth.		Indigenous
Ditrichaceae	*Ditrichum difficile*	(Duby) M.Fleisch.		Indigenous
Fabaceae	*Dolichos sericeus subsp. sericeus*	E.Mey.	LC	Indigenous
Fabaceae	*Dolichos trilobus subsp. transvaalicus*	L.	LC	Indigenous
Malvaceae	*Dombeya pulchra*	N.E.Br.	LC	Indigenous
Pteridaceae	*Doryopteris concolor*	(Langsd. & Fisch.) Kuhn	LC	Indigenous
Salicaceae	*Dovyalis lucida*	Sim	LC	Indigenous
Salicaceae	*Dovyalis rhamnoides*	(Burch. ex DC.) Burch. & Harv.	LC	Indigenous
Ruscaceae	*Dracaena aletriformis*	(Haw.) Bos	LC	Indigenous
Hyacinthaceae	*Drimia calcarata*	(Baker) Stedje		Indigenous
Hyacinthaceae	*Drimia depressa*	(Baker) Jessop		Indigenous
Hyacinthaceae	*Drimia elata*	Jacq.		Indigenous
Hyacinthaceae	*Drimia sp.*			
Droseraceae	*Drosera burkeana*	Planch.	LC	Indigenous
Droseraceae	*Drosera dielsiana*	Exell & J.R.Laundon	LC	Indigenous
Dryopteridaceae	*Dryopteris athamantica*	(Kunze) Kuntze		Indigenous
Dryopteridaceae	*Dryopteris lewalleana*	Pic.Serm.		Indigenous
Dryopteridaceae	*Dryopteris pentheri*	(Krasser) C.Chr.		Indigenous
Fabaceae	*Dumasia villosa var. villosa*	DC.	LC	Indigenous
Acanthaceae	*Dyschoriste setigera*	(Pers.) J.C.Manning & Goldblatt		Indigenous; Endemic
Meliaceae	*Ekebergia capensis*	Sparrm.	LC	Indigenous
Meliaceae	*Ekebergia pterophylla*	(C.DC.) Hofmeyr	LC	Indigenous
Dryopteridaceae	*Elaphoglossum acrostichoides*	(Hook. & Grev.) Schelpe	LC	Indigenous
Fabaceae	*Elephantorrhiza elephantina*	(Burch.) Skeels	LC	Indigenous
Poaceae	*Eleusine coracana subsp. africana*	(L.) Gaertn.	LC	Indigenous
Poaceae	*Eleusine indica*	(L.) Gaertn.	LC	Indigenous
Poaceae	*Elionurus muticus*	(Spreng.) Kunth	LC	Indigenous
Asteraceae	*Emilia transvaalensis*	(Bolus) C.Jeffrey	LC	Indigenous
Hypoxidaceae	*Empodium elongatum*	(Nel) B.L.Burtt	LC	Indigenous

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Hypoxidaceae	*Empodium monophyllum*	(Nel) B.L.Burtt	LC	Indigenous
Rubiaceae	*Empogona lanceolata*	(Sond.) Tosh & Robbr.		Indigenous; Endemic
Lamiaceae	*Endostemon obtusifolius*	(E.Mey. ex Benth.) N.E.Br.	LC	Indigenous
Onagraceae	*Epilobium salignum*	Hausskn.	LC	Indigenous
Equisetaceae	*Equisetum ramosissimum subsp. ramosissimum*	Desf.	LC	Indigenous
Poaceae	*Eragrostis caesia*	Stapf	LC	Indigenous
Poaceae	*Eragrostis capensis*	(Thunb.) Trin.	LC	Indigenous
Poaceae	*Eragrostis chapelieri*	(Kunth) Nees	LC	Indigenous
Poaceae	*Eragrostis curvula*	(Schrad.) Nees	LC	Indigenous
Poaceae	*Eragrostis gummiflua*	Nees	LC	Indigenous
Poaceae	*Eragrostis hierniana*	Rendle	LC	Indigenous
Poaceae	*Eragrostis lappula*	Nees	LC	Indigenous
Poaceae	*Eragrostis micrantha*	Hack.	LC	Indigenous
Poaceae	*Eragrostis plana*	Nees	LC	Indigenous
Poaceae	*Eragrostis planiculmis*	Nees	LC	Indigenous
Poaceae	*Eragrostis racemosa*	(Thunb.) Steud.	LC	Indigenous
Poaceae	*Eragrostis sclerantha subsp. sclerantha*	Nees	LC	Indigenous
Poaceae	*Eragrostis sp.*			
Ericaceae	*Erica cerinthoides var. barbertona*	L.	NE	Indigenous
Ericaceae	*Erica cerinthoides var. cerinthoides*	L.	NE	Indigenous
Ericaceae	*Erica drakensbergensis*	Guthrie & Bolus	LC	Indigenous
Ericaceae	*Erica oatesii var. oatesii*	Rolfe	LC	Indigenous
Ericaceae	*Erica revoluta*	(Bolus) L.E.Davidson	LC	Indigenous
Ericaceae	*Erica woodii var. woodii*	Bolus	LC	Indigenous
Asteraceae	*Erigeron karvinskianus*	DC.		Not Indigenous; Naturalised
Eriocaulaceae	*Eriocaulon sonderianum*	Korn.	LC	Indigenous
Poaceae	*Eriochloa meyeriana subsp. meyeriana*	(Nees) Pilg.	LC	Indigenous
Fabaceae	*Eriosema angustifolium*	Burtt Davy	LC	Indigenous; Endemic
Fabaceae	*Eriosema cordatum*	E.Mey.	LC	Indigenous
Fabaceae	*Eriosema ellipticifolium*	Schinz	LC	Indigenous
Fabaceae	*Eriosema kraussianum*	Meisn.	LC	Indigenous
Fabaceae	*Eriosema nutans*	Schinz	LC	Indigenous
Fabaceae	*Eriosema psoraleoides*	(Lam.) G.Don	LC	Indigenous
Fabaceae	*Eriosema simulans*	C.H.Stirt.	LC	Indigenous
Fabaceae	*Eriosema sp.*			
Ruscaceae	*Eriospermum cooperi var. cooperi*	Baker	LC	Indigenous
Ruscaceae	*Eriospermum flagelliforme*	(Baker) J.C.Manning	LC	Indigenous
Ruscaceae	*Eriospermum mackenii subsp. galpinii*	(Hook.f.) Baker	NE	Indigenous
Fabaceae	*Erythrina latissima*	E.Mey.	LC	Indigenous
Fabaceae	*Erythrina lysistemon*	Hutch.	LC	Indigenous
Entodontaceae	*Erythrodontium squarrosum*	(Hampe) Paris		Indigenous

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Erythroxylaceae	*Erythroxylum emarginatum*	Thonn.	LC	Indigenous
Ebenaceae	*Euclea crispa subsp. crispa*	(Thunb.) Gurke		Indigenous
Ebenaceae	*Euclea natalensis subsp. natalensis*	A.DC.	LC	Indigenous
Hyacinthaceae	*Eucomis pallidiflora subsp. pallidiflora*	Baker	LC	Indigenous
Myrtaceae	*Eugenia capensis subsp. capensis*	(Eckl. & Zeyh.) Sond.	LC	Indigenous
Myrtaceae	*Eugenia natalitia*	Sond.	LC	Indigenous
Myrtaceae	*Eugenia woodii*	Dummer	LC	Indigenous
Poaceae	*Eulalia villosa*	(Thunb.) Nees	LC	Indigenous
Orchidaceae	*Eulophia hians var. hians*	Spreng.	LC	Indigenous
Orchidaceae	*Eulophia hians var. nutans*	Spreng.	LC	Indigenous
Orchidaceae	*Eulophia ovalis var. bainesii*	Lindl.	LC	Indigenous
Orchidaceae	*Eulophia parviflora*	(Lindl.) A.V.Hall	LC	Indigenous
Orchidaceae	*Eulophia streptopetala*	Lindl.	LC	Indigenous
Euphorbiaceae	*Euphorbia cupularis*	Boiss.	LC	Indigenous
Euphorbiaceae	*Euphorbia ericoides*	Lam.	LC	Indigenous; Endemic
Euphorbiaceae	*Euphorbia gueinzii*	Boiss.	LC	Indigenous; Endemic
Asteraceae	*Euryops brevipapposus*	M.D.Hend.	LC	Indigenous
Asteraceae	*Euryops laxus*	(Harv.) Burtt Davy	LC	Indigenous
Asteraceae	*Euryops transvaalensis subsp. setilobus*	Klatt	LC	Indigenous
Asteraceae	*Euryops transvaalensis subsp. transvaalensis*	Klatt	LC	Indigenous
Fabroniaceae	*Fabronia pilifera*	Hornsch.		Indigenous
Fabroniaceae	*Fabronia rehmannii*	Mull.Hal.		Indigenous
Rubiaceae	*Fadogia homblei*	De Wild.	LC	Indigenous
Rubiaceae	*Fadogia sp.*			
Rubiaceae	*Fadogia tetraquetra*	K.Krause		Indigenous
Rubiaceae	*Fadogia tetraquetra var. grandiflora*	K.Krause	LC	Indigenous
Rubiaceae	*Fadogia tetraquetra var. tetraquetra*	K.Krause	LC	Indigenous
Proteaceae	*Faurea rochetiana*	(A.Rich.) Chiov. ex Pic.Serm.	LC	Indigenous
Asteraceae	*Felicia mossamedensis*	(Hiern) Mendonça	LC	Indigenous
Asteraceae	*Felicia muricata subsp. muricata*	(Thunb.) Nees	LC	Indigenous
Asteraceae	*Felicia quinquenervia*	(Klatt) Grau	LC	Indigenous
Asteraceae	*Felicia rosulata*	Yeo	LC	Indigenous
Poaceae	*Festuca costata*	Nees	LC	Indigenous
Poaceae	*Festuca scabra*	Vahl	LC	Indigenous
Cyperaceae	*Ficinia stolonifera*	Boeck.	LC	Indigenous
Moraceae	*Ficus glumosa*	Delile	LC	Indigenous
Moraceae	*Ficus ingens var. ingens*	(Miq.) Miq.		Indigenous
Moraceae	*Ficus sp.*			
Moraceae	*Ficus sur*	Forssk.	LC	Indigenous

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Moraceae	*Ficus sycomorus subsp. sycomorus*	L.	LC	Indigenous
Moraceae	*Ficus thonningii*	Blume		Indigenous
Cyperaceae	*Fimbristylis dichotoma*	(L.) Vahl		Indigenous
Cyperaceae	*Fimbristylis dichotoma subsp. dichotoma*	(L.) Vahl	LC	Indigenous
Fissidentaceae	*Fissidens curvatus var. curvatus*	Hornsch.		Indigenous
Fissidentaceae	*Fissidens erosulus*	(Mull.Hal.) Paris		Indigenous
Fissidentaceae	*Fissidens submarginatus*	Bruch		Indigenous
Fabaceae	*Flemingia grahamiana*	Wight & Arn.	LC	Indigenous
Cyperaceae	*Fuirena pachyrrhiza*	Ridl.	LC	Indigenous
Cyperaceae	*Fuirena pubescens var. pubescens*	(Poir.) Kunth	LC	Indigenous
Cyperaceae	*Fuirena stricta var. stricta*	Steud.	LC	Indigenous
Funariaceae	*Funaria hygrometrica*	Hedw.		Indigenous
Asteraceae	*Galinsoga parviflora*	Cav.		Not Indigenous; Naturalised
Rubiaceae	*Galium capense subsp. garipense*	Thunb.	NE	Indigenous
Rubiaceae	*Galium thunbergianum var. thunbergianum*	Eckl. & Zeyh.	LC	Indigenous
Rubiaceae	*Galopina aspera*	(Eckl. & Zeyh.) Walp.	LC	Indigenous
Rubiaceae	*Galopina crocyllioides*	Bar ex Schinz	LC	Indigenous
Asteraceae	*Gamochaeta coarctata*	(Willd.) Kerguelen		Not Indigenous; Naturalised
Asteraceae	*Gamochaeta sp.*			
Asteraceae	*Gazania krebsiana subsp. serrulata*	Less.	LC	Indigenous
Asteraceae	*Geigeria burkei subsp. burkei*	Harv.	NE	Indigenous
Lentibulariaceae	*Genlisea hispidula*	Stapf	LC	Indigenous
Geraniaceae	*Geranium wakkerstroomianum*	R.Knuth	LC	Indigenous; Endemic
Orobanchaceae	*Gerardiina angolensis*	Engl.	LC	Indigenous
Asteraceae	*Gerbera ambigua*	(Cass.) Sch.Bip.	LC	Indigenous
Asteraceae	*Gerbera galpinii*	Klatt	LC	Indigenous
Asteraceae	*Gerbera jamesonii*	Bolus ex Adlam	LC	Indigenous
Asteraceae	*Gerbera natalensis*	Sch.Bip.	LC	Indigenous
Asteraceae	*Gerbera piloselloides*	(L.) Cass.	LC	Indigenous
Asteraceae	*Gerbera viridifolia*	(DC.) Sch.Bip.	LC	Indigenous
Gerrardinaceae	*Gerrardina foliosa*	Oliv.	LC	Indigenous; Endemic
Iridaceae	*Gladiolus appendiculatus*	G.J.Lewis	LC	Indigenous
Iridaceae	*Gladiolus crassifolius*	Baker	LC	Indigenous
Iridaceae	*Gladiolus dalenii subsp. dalenii*	Van Geel	LC	Indigenous
Iridaceae	*Gladiolus densiflorus*	Baker	LC	Indigenous
Iridaceae	*Gladiolus longicollis subsp. platypetalus*	Baker	LC	Indigenous
Iridaceae	*Gladiolus papilio*	Hook.f.	LC	Indigenous
Iridaceae	*Gladiolus woodii*	Baker	LC	Indigenous
Gleicheniaceae	*Gleichenia polypodioides*	(L.) Sm.	LC	Indigenous

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Colchicaceae	*Gloriosa modesta*	(Hook.) J.C.Manning & Vinn.		Indigenous
Thymelaeaceae	*Gnidia fastigiata*	Rendle	LC	Indigenous
Thymelaeaceae	*Gnidia woodii*	C.H.Wright	LC	Indigenous
Apocynaceae	*Gomphocarpus fruticosus subsp. fruticosus*	(L.) Aiton f.	LC	Indigenous
Apocynaceae	*Gonioma kamassi*	E.Mey.	LC	Indigenous
Orobanchaceae	*Graderia scabra*	(L.f.) Benth.	LC	Indigenous
Malvaceae	*Grewia caffra*	Meisn.	LC	Indigenous
Malvaceae	*Grewia occidentalis var. occidentalis*	L.	LC	Indigenous
Malvaceae	*Grewia villosa*	Willd.		Indigenous
Melianthaceae	*Greyia radlkoferi*	Szyszyl.	LC	Indigenous
Melianthaceae	*Greyia sutherlandii*	Hook. & Harv.	LC	Indigenous
Gunneraceae	*Gunnera perpensa*	L.	LC	Indigenous
Asteraceae	*Gymnanthemum coloratum*	(Willd.) H.Rob. & B.Kahn	LC	Indigenous
Asteraceae	*Gymnanthemum corymbosum*	(L.f.) H.Rob.	LC	Indigenous
Asteraceae	*Gymnanthemum myrianthum*	(Hook.f.) H.Rob.	LC	Indigenous
Celastraceae	*Gymnosporia buxifolia*	(L.) Szyszyl.	LC	Indigenous
Celastraceae	*Gymnosporia harveyana subsp. harveyana*	Loes.	LC	Indigenous
Celastraceae	*Gymnosporia nemorosa*	(Eckl. & Zeyh.) Szyszyl.	LC	Indigenous
Orchidaceae	*Habenaria clavata*	(Lindl.) Rchb.f.	LC	Indigenous
Orchidaceae	*Habenaria cornuta*	Lindl.	LC	Indigenous
Orchidaceae	*Habenaria dives*	Rchb.f.	LC	Indigenous
Orchidaceae	*Habenaria dregeana*	Lindl.	LC	Indigenous
Orchidaceae	*Habenaria malacophylla*	Rchb.f.	LC	Indigenous
Orchidaceae	*Habenaria nyikana subsp. nyikana*	Rchb.f.	LC	Indigenous
Orchidaceae	*Habenaria schimperiana*	Hochst. ex A.Rich.	LC	Indigenous
Amaryllidaceae	*Haemanthus humilis subsp. hirsutus*	Jacq.	LC	Indigenous
Stilbaceae	*Halleria lucida*	L.	LC	Indigenous
Asteraceae	*Haplocarpha scaposa*	Harv.	LC	Indigenous
Leskeaceae	*Haplocladium angustifolium*	(Hampe & Mull.Hal.) Broth.		Indigenous
Poaceae	*Harpochloa falx*	(L.f.) Kuntze	LC	Indigenous
Orobanchaceae	*Harveya huttonii*	Hiern	LC	Indigenous; Endemic
Orobanchaceae	*Harveya pauciflora*	(Benth.) Hiern	LC	Indigenous
Orobanchaceae	*Harveya speciosa*	Bernh.	LC	Indigenous
Scrophulariaceae	*Hebenstretia oatesii subsp. oatesii*	Rolfe	LC	Indigenous
Scrophulariaceae	*Hebenstretia sp.*			
Hedwigiaceae	*Hedwigidium integrifolium*	(P.Beauv.) Dixon		Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Asteraceae	*Helichrysum acutatum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum adenocarpum subsp. adenocarpum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum ammitophilum*	Hilliard	LC	Indigenous
Asteraceae	*Helichrysum appendiculatum*	(L.f.) Less.	LC	Indigenous
Asteraceae	*Helichrysum argyrolepis*	MacOwan	LC	Indigenous
Asteraceae	*Helichrysum athrixiifolium*	(Kuntze) Moeser	LC	Indigenous
Asteraceae	*Helichrysum aureolum*	Hilliard	LC	Indigenous
Asteraceae	*Helichrysum aureonitens*	Sch.Bip.	LC	Indigenous
Asteraceae	*Helichrysum aureum var. candidum*	(Houtt.) Merr.	NE	Indigenous
Asteraceae	*Helichrysum caespititium*	(DC.) Harv.	LC	Indigenous
Asteraceae	*Helichrysum cephaloideum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum chionosphaerum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum chrysargyrum*	Moeser	LC	Indigenous
Asteraceae	*Helichrysum cooperi*	Harv.	LC	Indigenous
Asteraceae	*Helichrysum difficile*	Hilliard	LC	Indigenous
Asteraceae	*Helichrysum epapposum*	Bolus	LC	Indigenous
Asteraceae	*Helichrysum galpinii*	N.E.Br.	LC	Indigenous
Asteraceae	*Helichrysum interjacens*	Hilliard	LC	Indigenous
Asteraceae	*Helichrysum lepidissimum*	S.Moore	LC	Indigenous
Asteraceae	*Helichrysum melanacme*	DC.	LC	Indigenous
Asteraceae	*Helichrysum miconiifolium*	DC.	LC	Indigenous
Asteraceae	*Helichrysum mimetes*	S.Moore	LC	Indigenous
Asteraceae	*Helichrysum mixtum var. grandiceps*	(Kuntze) Moeser	NE	Indigenous
Asteraceae	*Helichrysum mixtum var. mixtum*	(Kuntze) Moeser	NE	Indigenous
Asteraceae	*Helichrysum monticola*	Hilliard	LC	Indigenous
Asteraceae	*Helichrysum mundtii*	Harv.	LC	Indigenous
Asteraceae	*Helichrysum mutabile*	Hilliard	LC	Indigenous
Asteraceae	*Helichrysum nudifolium var. nudifolium*	(L.) Less.	LC	Indigenous
Asteraceae	*Helichrysum nudifolium var. pilosellum*	(L.) Less.	LC	Indigenous
Asteraceae	*Helichrysum odoratissimum*	(L.) Sweet	LC	Indigenous
Asteraceae	*Helichrysum odoratissimum var. odoratissimum*	(L.) Sweet		Indigenous
Asteraceae	*Helichrysum oreophilum*	Klatt	LC	Indigenous
Asteraceae	*Helichrysum pallidum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum panduratum var. transvaalense*	O.Hoffm.	LC	Indigenous
Asteraceae	*Helichrysum platypterum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum polycladum*	Klatt	LC	Indigenous
Asteraceae	*Helichrysum reflexum*	N.E.Br.	LC	Indigenous
Asteraceae	*Helichrysum rugulosum*	Less.	LC	Indigenous
Asteraceae	*Helichrysum setosum*	Harv.	LC	Indigenous
Asteraceae	*Helichrysum sp.*			
Asteraceae	*Helichrysum spiralepis*	Hilliard & B.L.Burtt	LC	Indigenous
Asteraceae	*Helichrysum splendidum*	(Thunb.) Less.	LC	Indigenous

Family	Taxon	Author	IUCN	Ecology
Asteraceae	*Helichrysum spodiophyllum*	Hilliard & B.L.Burtt	LC	Indigenous
Asteraceae	*Helichrysum stenopterum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum subluteum*	Burtt Davy	LC	Indigenous
Asteraceae	*Helichrysum thapsus*	(Kuntze) Moeser	LC	Indigenous
Asteraceae	*Helichrysum transmontanum*	Hilliard	LC	Indigenous
Asteraceae	*Helichrysum truncatum*	Burtt Davy	LC	Indigenous
Asteraceae	*Helichrysum wilmsii*	Moeser	LC	Indigenous
Asteraceae	*Helichrysum zeyheri*	Less.	LC	Indigenous
Poaceae	*Helictotrichon sp.*			
Rhamnaceae	*Helinus integrifolius*	(Lam.) Kuntze	LC	Indigenous
Brassicaceae	*Heliophila rigidiuscula*	Sond.	LC	Indigenous
Boraginaceae	*Heliotropium sp.*			
Boraginaceae	*Heliotropium strigosum*	Willd.	LC	Indigenous
Poaceae	*Hemarthria altissima*	(Poir.) Stapf & C.E.Hubb.	LC	Indigenous
Malvaceae	*Hermannia auricoma*	(Szyszyl.) K.Schum.	LC	Indigenous
Malvaceae	*Hermannia cristata*	Bolus	LC	Indigenous
Malvaceae	*Hermannia grandifolia*	N.E.Br.	LC	Indigenous
Malvaceae	*Hermannia montana*	N.E.Br.	LC	Indigenous; Endemic
Iridaceae	*Hesperantha baurii subsp. baurii*	Baker	LC	Indigenous
Iridaceae	*Hesperantha coccinea*	(Backh. & Harv.) Goldblatt & J.C.Manning	LC	Indigenous
Apiaceae	*Heteromorpha arborescens var. abyssinica*	(Spreng.) Cham. & Schltdl.	LC	Indigenous
Apiaceae	*Heteromorpha involucrata*	Conrath	LC	Indigenous
Heteropyxidaceae	*Heteropyxis canescens*	Oliv.	LC	Indigenous
Heteropyxidaceae	*Heteropyxis natalensis*	Harv.	LC	Indigenous
Malvaceae	*Hibiscus aethiopicus var. ovatus*	L.	LC	Indigenous
Malvaceae	*Hibiscus engleri*	K.Schum.	LC	Indigenous
Malvaceae	*Hibiscus saxatilis*	J.M.Wood & M.S.Evans	LC	Indigenous
Malvaceae	*Hibiscus trionum*	L.		Not Indigenous; Naturalised
Asteraceae	*Hilliardiella aristata*	(DC.) H.Rob.	LC	Indigenous
Asteraceae	*Hilliardiella capensis*	(Houtt.) H.Rob., Skvarla & V.A.Funk		Indigenous
Asteraceae	*Hilliardiella elaeagnoides*	(DC.) Swelank. & J.C.Manning		Indigenous
Asteraceae	*Hilliardiella hirsuta*	(DC.) H.Rob.	LC	Indigenous
Asteraceae	*Hilliardiella sutherlandii*	(Harv.) H.Rob.		Indigenous
Asteraceae	*Hirpicium linearifolium*	(Bolus) Roessler	LC	Indigenous
Lycopodiaceae	*Huperzia gnidioides*	(L.f.) Trevis.	LC	Indigenous
Lycopodiaceae	*Huperzia verticillata*	(L.f.) Trevis.	LC	Indigenous
Pottiaceae	*Hyophila involuta*	(Hook.) A.Jaeger		Indigenous
Poaceae	*Hyparrhenia cymbaria*	(L.) Stapf	LC	Indigenous
Poaceae	*Hyparrhenia dichroa*	(Steud.) Stapf	LC	Indigenous

Family	Taxon	Author	IUCN	Ecology
Poaceae	*Hyparrhenia dregeana*	(Nees) Stapf ex Stent	LC	Indigenous
Poaceae	*Hyparrhenia filipendula var. pilosa*	(Hochst.) Stapf	LC	Indigenous
Poaceae	*Hyparrhenia gazensis*	(Rendle) Stapf	LC	Indigenous
Poaceae	*Hyparrhenia hirta*	(L.) Stapf	LC	Indigenous
Poaceae	*Hyparrhenia newtonii var. macra*	(Hack.) Stapf	LC	Indigenous
Poaceae	*Hyparrhenia newtonii var. newtonii*	(Hack.) Stapf	LC	Indigenous
Poaceae	*Hyparrhenia tamba*	(Steud.) Stapf	LC	Indigenous
Hypericaceae	*Hypericum aethiopicum subsp. sonderi*	Thunb.	LC	Indigenous
Hypericaceae	*Hypericum lalandii*	Choisy	LC	Indigenous
Hypericaceae	*Hypericum natalense*	J.M.Wood & M.S.Evans	LC	Indigenous
Hypericaceae	*Hypericum revolutum subsp. revolutum*	Vahl	LC	Indigenous
Poaceae	*Hyperthelia dissoluta*	(Nees ex Steud.) Clayton	LC	Indigenous
Hypnaceae	*Hypnum cupressiforme var. cupressiforme*	Hedw.		Indigenous
Hypodontiaceae	*Hypodontium dregei*	(Hornsch.) Mull.Hal.		Indigenous
Acanthaceae	*Hypoestes forskaolii*	(Vahl) R.Br.		Indigenous
Acanthaceae	*Hypoestes triflora*	(Forssk.) Roem. & Schult.		Indigenous
Hypoxidaceae	*Hypoxis acuminata*	Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis argentea var. argentea*	Harv. ex Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis costata*	Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis filiformis*	Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis galpinii*	Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis gerrardii*	Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis hemerocallidea*	Fisch., C.A.Mey. & Ave-Lall.	LC	Indigenous
Hypoxidaceae	*Hypoxis limicola*	B.L.Burtt	LC	Indigenous
Hypoxidaceae	*Hypoxis parvifolia*	Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis parvula var. parvula*	Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis rigidula var. pilosissima*	Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis rigidula var. rigidula*	Baker	LC	Indigenous
Aquifoliaceae	*Ilex mitis var. mitis*	(L.) Radlk.	LC	Indigenous
Balsaminaceae	*Impatiens hochstetteri subsp. hochstetteri*	Warb.	LC	Indigenous
Poaceae	*Imperata cylindrica*	(L.) Raeusch.	LC	Indigenous
Fabaceae	*Indigastrum fastigiatum*	(E.Mey.) Schrire	LC	Indigenous
Fabaceae	*Indigofera amitina*	N.E.Br.	LC	Indigenous
Fabaceae	*Indigofera buchananii*	Burtt Davy	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Fabaceae	*Indigofera confusa*	Prain & Baker f.	LC	Indigenous
Fabaceae	*Indigofera densa*	N.E.Br.	LC	Indigenous
Fabaceae	*Indigofera galpinii*	N.E.Br.	LC	Indigenous
Fabaceae	*Indigofera hilaris var. hilaris*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Indigofera melanadenia*	Benth. ex Harv.	LC	Indigenous
Fabaceae	*Indigofera nebrowniana*	J.B.Gillett	LC	Indigenous
Fabaceae	*Indigofera placida*	N.E.Br.	LC	Indigenous
Fabaceae	*Indigofera rostrata*	Bolus	LC	Indigenous
Fabaceae	*Indigofera sanguinea*	N.E.Br.	LC	Indigenous
Fabaceae	*Indigofera sp.*			
Fabaceae	*Indigofera spicata var. spicata*	Forssk.	LC	Indigenous
Fabaceae	*Indigofera swaziensis*	Bolus		Indigenous
Fabaceae	*Indigofera swaziensis var. swaziensis*	Bolus	LC	Indigenous
Fabaceae	*Indigofera tristoides*	N.E.Br.	LC	Indigenous
Asteraceae	*Inezia integrifolia*	(Klatt) E.Phillips	LC	Indigenous
Asteraceae	*Inulanthera calva*	(Hutch.) Kallersjo	LC	Indigenous
Asteraceae	*Inulanthera dregeana*	(DC.) Kallersjo	LC	Indigenous; Endemic
Convolvulaceae	*Ipomoea crassipes var. crassipes*	Hook.	LC	Indigenous
Convolvulaceae	*Ipomoea oblongata*	E.Mey. ex Choisy	LC	Indigenous
Poaceae	*Ischaemum fasciculatum*	Brongn.	LC	Indigenous
Acanthaceae	*Isoglossa ciliata*	(Nees) Engl.		Indigenous
Acanthaceae	*Isoglossa origanoides*	(Nees) S.Moore		Indigenous; Endemic
Cyperaceae	*Isolepis costata*	Hochst. ex A.Rich.	LC	Indigenous
Cyperaceae	*Isolepis fluitans var. fluitans*	(L.) R.Br.	LC	Indigenous
Escalloniaceae	*Itea rhamnoides*	(Harv.) Kubitzki		Indigenous
Scrophulariaceae	*Jamesbrittenia grandiflora*	(Galpin) Hilliard	LC	Indigenous
Euphorbiaceae	*Jatropha hirsuta var. oblongifolia*	Hochst.	LC	Indigenous
Euphorbiaceae	*Jatropha latifolia var. angustata*	Pax	NE	Indigenous; Endemic
Juncaceae	*Juncus dregeanus subsp. dregeanus*	Kunth	LC	Indigenous
Acanthaceae	*Justicia anagalloides*	(Nees) T.Anderson		Indigenous
Acanthaceae	*Justicia betonica*	L.		Indigenous
Acanthaceae	*Justicia campylostemon*	(Nees) T.Anderson		Indigenous
Crassulaceae	*Kalanchoe alticola*	Compton		Indigenous; Endemic
Crassulaceae	*Kalanchoe luciae subsp. luciae*	Raym.-Hamet		Indigenous
Crassulaceae	*Kalanchoe luciae subsp. montana*	Raym.-Hamet		Indigenous; Endemic
Crassulaceae	*Kalanchoe rotundifolia*	(Haw.) Haw.		Indigenous
Rubiaceae	*Keetia gueinzii*	(Sond.) Bridson	LC	Indigenous

Family	Taxon	Author	IUCN	Ecology
Asteraceae	*Kleinia galpinii*	Hook.f.	LC	Indigenous
Asteraceae	*Kleinia longiflora*	DC.	LC	Indigenous
Asphodelaceae	*Kniphofia linearifolia*	Baker	LC	Indigenous
Asphodelaceae	*Kniphofia porphyrantha*	Baker	LC	Indigenous
Poaceae	*Koeleria capensis*	(Steud.) Nees	LC	Indigenous
Rubiaceae	*Kohautia amatymbica*	Eckl. & Zeyh.	LC	Indigenous
Cyperaceae	*Kyllinga alba*	Nees	LC	Indigenous
Cyperaceae	*Kyllinga melanosperma*	Nees	LC	Indigenous
Cyperaceae	*Kyllinga odorata*	Vahl	LC	Indigenous
Fabaceae	*Lablab purpureus subsp. purpureus*	(L.) Sweet	NE	Not Indigenous; Naturalised
Fabaceae	*Lablab purpureus subsp. uncinatus*	(L.) Sweet	LC	Indigenous
Asteraceae	*Lactuca inermis*	Forssk.	LC	Indigenous
Asteraceae	*Laggera crispata*	(Vahl) Hepper & J.R.I.Wood	LC	Indigenous
Anacardiaceae	*Lannea edulis var. edulis*	(Sond.) Engl.	LC	Indigenous
Verbenaceae	*Lantana mearnsii var. latibracteolata*	Moldenke		Indigenous
Urticaceae	*Laportea peduncularis subsp. peduncularis*	(Wedd.) Chew		Indigenous
Thymelaeaceae	*Lasiosiphon caffer*	Meisn.	LC	Indigenous
Thymelaeaceae	*Lasiosiphon capitatus*	(L.f.) Burtt Davy	LC	Indigenous
Thymelaeaceae	*Lasiosiphon kraussianus*	(Meisn.) Meisn.		Indigenous
Thymelaeaceae	*Lasiosiphon microcephalus*	(Meisn.) J.C.Manning & Magee		Indigenous
Thymelaeaceae	*Lasiosiphon nanus*	Burtt Davy	LC	Indigenous
Thymelaeaceae	*Lasiosiphon splendens*	(Meisn.) Endl.	LC	Indigenous
Asteraceae	*Launaea rarifolia var. rarifolia*	(Oliv. & Hiern) Boulos	LC	Indigenous
Hyacinthaceae	*Ledebouria cooperi*	(Hook.f.) Jessop		Indigenous
Hyacinthaceae	*Ledebouria revoluta*	(L.f.) Jessop	LC	Indigenous
Hyacinthaceae	*Ledebouria sp.*			
Poaceae	*Leersia hexandra*	Sw.	LC	Indigenous
Fabaceae	*Leobordea carinata*	(E.Mey.) B.-E.van Wyk & Boatwr.	LC	Indigenous
Fabaceae	*Leobordea corymbosa*	(E.Mey.) B.-E.van Wyk & Boatwr.	LC	Indigenous
Fabaceae	*Leobordea eriantha*	(Benth.) B.-E.van Wyk & Boatwr.	LC	Indigenous
Fabaceae	*Leobordea foliosa*	(Bolus) B.-E.van Wyk & Boatwr.	LC	Indigenous
Fabaceae	*Leobordea mucronata*	(Conrath) B.-E.van Wyk & Boatwr.		Indigenous
Fabaceae	*Leobordea pulchra*	(Dummer) B.-E.van Wyk & Boatwr.	LC	Indigenous
Lamiaceae	*Leonotis ocymifolia*	(Burm.f.) Iwarsson	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Brassicaceae	*Lepidium transvaalense*	Marais	LC	Indigenous
Polypodiaceae	*Lepisorus schraderi*	(Mett.) Ching	LC	Indigenous
Dicranaceae	*Leptotrichella minuta*	(Hampe) Ochyra		Indigenous
Leucobryaceae	*Leucobryum madagassum*	Besch.		Indigenous
Fabroniaceae	*Levierella neckeroides*	(Griff.) O'Shea & Matcham		Indigenous
Leskeaceae	*Lindbergia patentifolia*	Dixon		Indigenous
Leskeaceae	*Lindbergia viridis*	Dixon		Indigenous
Linderniaceae	*Linderniella wilmsii*	(Engl. ex Diels) Eb.Fisch., Schaferh. & Kai Mull.		Indigenous
Linaceae	*Linum thunbergii*	Eckl. & Zeyh.	LC	Indigenous
Orchidaceae	*Liparis bowkeri*	Harv.	LC	Indigenous
Cyperaceae	*Lipocarpha chinensis*	(Osbeck) J.Kern	LC	Indigenous
Cyperaceae	*Lipocarpha nana*	(A.Rich.) Cherm.	LC	Indigenous
Verbenaceae	*Lippia javanica*	(Burm.f.) Spreng.		Indigenous
Fabaceae	*Listia marlothii*	(Engl.) B.-E.van Wyk & Boatwr.	LC	Indigenous
Boraginaceae	*Lithospermum affine*	A.DC.	LC	Indigenous; Endemic
Boraginaceae	*Lithospermum afromontanum*	Weim.	LC	Indigenous
Boraginaceae	*Lithospermum papillosum*	Thunb.	LC	Indigenous
Asteraceae	*Litogyne gariepina*	(DC.) Anderb.	LC	Indigenous
Lobeliaceae	*Lobelia erinus*	L.	LC	Indigenous
Lobeliaceae	*Lobelia eurypoda var. eurypoda*	E.Wimm.	LC	Indigenous
Lobeliaceae	*Lobelia flaccida subsp. flaccida*	(C.Presl) A.DC.	LC	Indigenous
Lobeliaceae	*Lobelia preslii*	A.DC.	LC	Indigenous
Lobeliaceae	*Lobelia sp.*			
Lobeliaceae	*Lobelia trullifolia subsp. delicatula*	Hemsl.	LC	Indigenous
Asteraceae	*Lopholaena disticha*	(N.E.Br.) S.Moore	LC	Indigenous
Asteraceae	*Lopholaena segmentata*	(Oliv.) S.Moore	LC	Indigenous
Fabaceae	*Lotononis sp.*	N.E.Br.		
Fabaceae	*Lotus discolor subsp. discolor*	E.Mey.	LC	Indigenous
Poaceae	*Loudetia densispica*	(Rendle) C.E.Hubb.	LC	Indigenous
Poaceae	*Loudetia simplex*	(Nees) C.E.Hubb.	LC	Indigenous
Onagraceae	*Ludwigia octovalvis*	(Jacq.) P.H.Raven	LC	Indigenous
Lycopodiaceae	*Lycopodiella cernua*	(L.) Pic.Serm.	LC	Indigenous
Lycopodiaceae	*Lycopodium clavatum*	L.	LC	Indigenous
Asteraceae	*Macledium zeyheri subsp. zeyheri*	(Sond.) S.Ortiz		Indigenous
Orthotrichaceae	*Macrocoma tenuis subsp. tenuis*	(Hook. & Grev.) Vitt		Indigenous
Capparaceae	*Maerua cafra*	(DC.) Pax	LC	Indigenous
Capparaceae	*Maerua sp.*			
Maesaceae	*Maesa lanceolata*	Forssk.	LC	Indigenous

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Scrophulariaceae	*Manulea parviflora var. parviflora*	Benth.	LC	Indigenous
Marchantiaceae	*Marchantia pappeana subsp. pappeana*	Lehm.		Indigenous
Celastraceae	*Maytenus acuminata var. acuminata*	(L.f.) Loes.	LC	Indigenous
Celastraceae	*Maytenus peduncularis*	(Sond.) Loes.	LC	Indigenous
Celastraceae	*Maytenus undata*	(Thunb.) Blakelock	LC	Indigenous
Scrophulariaceae	*Melanospermum swazicum*	Hilliard	LC	Indigenous
Asteraceae	*Melanthera scandens subsp. dregei*	(Schumach. & Thonn.) Roberty		Not Indigenous; Naturalised
Orobanchaceae	*Melasma scabrum var. scabrum*	P.J.Bergius	LC	Indigenous
Poaceae	*Melinis minutiflora*	P.Beauv.	LC	Indigenous
Poaceae	*Melinis nerviglumis*	(Franch.) Zizka	LC	Indigenous
Poaceae	*Melinis repens subsp. repens*	(Willd.) Zizka	LC	Indigenous
Poaceae	*Melinis sp.*			
Lamiaceae	*Mentha aquatica*	L.	LC	Indigenous
Lamiaceae	*Mentha longifolia subsp. polyadena*	(L.) Huds.	LC	Indigenous
Hyacinthaceae	*Merwilla plumbea*	(Lindl.) Speta		Indigenous
Acanthaceae	*Metarungia longistrobus*	(C.B.Clarke) Baden		Indigenous
Fabaceae	*Microcharis galpinii*	N.E.Br.	LC	Indigenous
Asteraceae	*Mikania capensis*	DC.	LC	Indigenous
Asteraceae	*Mikania natalensis*	DC.	LC	Indigenous
Sapotaceae	*Mimusops obovata*	Nees ex Sond.	LC	Indigenous
Apocynaceae	*Miraglossum pilosum*	(Schltr.) Kupicha	LC	Indigenous
Apocynaceae	*Miraglossum pulchellum*	(Schltr.) Kupicha	LC	Indigenous
Poaceae	*Miscanthus junceus*	(Stapf) Pilg.	LC	Indigenous
Anemiaceae	*Mohria rigida*	J.P.Roux	LC	Indigenous; Endemic
Anemiaceae	*Mohria vestita*	Baker	LC	Indigenous
Cucurbitaceae	*Momordica balsamina*	L.	LC	Indigenous
Cucurbitaceae	*Momordica foetida*	Schumach.	LC	Indigenous
Poaceae	*Monocymbium ceresiiforme*	(Nees) Stapf	LC	Indigenous
Lobeliaceae	*Monopsis decipiens*	(Sond.) Thulin	LC	Indigenous
Lobeliaceae	*Monopsis stellarioides subsp. stellarioides*	(C.Presl) Urb.	LC	Indigenous
Geraniaceae	*Monsonia attenuata*	Harv.	LC	Indigenous; Endemic
Geraniaceae	*Monsonia burkeana*	Planch. ex Harv.	LC	Indigenous
Geraniaceae	*Monsonia transvaalensis*	R.Knuth	LC	Indigenous; Endemic
Iridaceae	*Moraea elliotii*	Baker	LC	Indigenous
Iridaceae	*Moraea moggii subsp. moggii*	N.E.Br.	LC	Indigenous; Endemic
Iridaceae	*Moraea pubiflora*	N.E.Br.	LC	Indigenous
Iridaceae	*Moraea spathulata*	(L.f.) Klatt	LC	Indigenous
Iridaceae	*Moraea stricta*	Baker	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Myricaceae	*Morella pilulifera*	(Rendle) Killick		Indigenous
Myrsinaceae	*Myrsine africana*	L.	LC	Indigenous
Orchidaceae	*Mystacidium venosum*	Harv. ex Rolfe	LC	Indigenous
Scrophulariaceae	*Nemesia denticulata*	(Benth.) Grant ex Fourc.	LC	Indigenous; Endemic
Scrophulariaceae	*Nemesia fruticans*	(Thunb.) Benth.	LC	Indigenous
Scrophulariaceae	*Nemesia melissifolia*	Benth.	LC	Indigenous
Scrophulariaceae	*Nemesia rupicola*	Hilliard	LC	Indigenous
Fabaceae	*Neonotonia wightii*	(Wight ex Arn.) J.A.Lackey	LC	Indigenous
Amaryllidaceae	*Nerine angustifolia*	(Baker) Baker	LC	Indigenous
Amaryllidaceae	*Nerine filifolia*	Baker	LC	Indigenous; Endemic
Lythraceae	*Nesaea sagittifolia var. ericiformis*	(Sond.) Koehne		Indigenous; Endemic
Lythraceae	*Nesaea sagittifolia var. sagittifolia*	(Sond.) Koehne		Indigenous
Asteraceae	*Nidorella anomala*	Steetz	LC	Indigenous; Endemic
Asteraceae	*Nidorella auriculata*	DC.	LC	Indigenous
Asteraceae	*Nidorella resedifolia subsp. resedifolia*	DC.	LC	Indigenous
Asteraceae	*Nolletia ruderalis*	Hilliard	LC	Indigenous
Apiaceae	*Notobubon laevigatum*	(Aiton) Magee	LC	Indigenous
Stilbaceae	*Nuxia congesta*	R.Br. ex Fresen.	LC	Indigenous
Menyanthaceae	*Nymphoides indica subsp. occidentalis*	(L.) Kuntze		Indigenous
Menyanthaceae	*Nymphoides thunbergiana*	(Griseb.) Kuntze	LC	Indigenous
Urticaceae	*Obetia tenax*	(N.E.Br.) Friis		Indigenous
Ochnaceae	*Ochna arborea var. arborea*	Burch. ex DC.	NE	Indigenous
Ochnaceae	*Ochna arborea var. oconnorii*	Burch. ex DC.	NE	Indigenous
Ochnaceae	*Ochna holstii*	Engl.	LC	Indigenous
Ochnaceae	*Ochna natalitia*	(Meisn.) Walp.	LC	Indigenous
Lamiaceae	*Ocimum obovatum subsp. obovatum*	E.Mey. ex Benth.	NE	Indigenous
Lamiaceae	*Ocimum serratum*	(Schltr.) A.J.Paton	LC	Indigenous
Onagraceae	*Oenothera glazioviana*	Micheli		Not Indigenous; Naturalised; Invasive
Rubiaceae	*Oldenlandia affinis subsp. fugax*	(Roem. & Schult.) DC.	LC	Indigenous
Rubiaceae	*Oldenlandia cephalotes*	(Hochst.) Kuntze	LC	Indigenous
Rubiaceae	*Oldenlandia herbacea var. herbacea*	(L.) Roxb.	LC	Indigenous
Rubiaceae	*Oldenlandia muscosa*	Bremek.	LC	Indigenous
Rubiaceae	*Oldenlandia rupicola var. hirtula*	(Sond.) Kuntze	LC	Indigenous
Rubiaceae	*Oldenlandia rupicola var. rupicola*	(Sond.) Kuntze	LC	Indigenous
Oleandraceae	*Oleandra distenta*	Kunze	LC	Indigenous
Asteraceae	*Oocephala centaureoides*	(Klatt) H.Rob. & Skvarla		Indigenous; Endemic
Poaceae	*Oplismenus hirtellus*	(L.) P.Beauv.	LC	Indigenous
Poaceae	*Oplismenus undulatifolius*	(Ard.) Roem. & Schult.	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Hyacinthaceae	*Ornithogalum monophyllum subsp. monophyllum*	Baker		Indigenous
Hyacinthaceae	*Ornithogalum saundersiae*	Baker	LC	Indigenous
Hyacinthaceae	*Ornithogalum tenuifolium subsp. tenuifolium*	F.Delaroche		Indigenous
Orchidaceae	*Orthochilus chloranthus*	(Schltr.) Bytebier		Indigenous; Endemic
Orchidaceae	*Orthochilus ensatus*	(Lindl.) Bytebier		Indigenous
Orchidaceae	*Orthochilus odontoglossus*	(Rchb.f.) Bytebier		Indigenous
Orchidaceae	*Orthochilus welwitschii*	Rchb.f.		Indigenous
Osmundaceae	*Osmunda regalis*	L.	LC	Indigenous
Santalaceae	*Osyris lanceolata*	Hochst. & Steud.	LC	Indigenous
Fabaceae	*Otholobium polyphyllum*	(Eckl. & Zeyh.) C.H.Stirt.	LC	Indigenous; Endemic
Fabaceae	*Otholobium wilmsii*	(Harms) C.H.Stirt.	LC	Indigenous
Oxalidaceae	*Oxalis attaquana*	T.M.Salter	LC	Indigenous
Oxalidaceae	*Oxalis depressa*	Eckl. & Zeyh.	LC	Indigenous
Oxalidaceae	*Oxalis obliquifolia*	Steud. ex A.Rich.	LC	Indigenous
Oxalidaceae	*Oxalis obtusa*	Jacq.	LC	Indigenous
Polygonaceae	*Oxygonum dregeanum subsp. swazicum*	Meisn.	LC	Indigenous
Anacardiaceae	*Ozoroa sphaerocarpa*	R.Fern. & A.Fern.	LC	Indigenous
Apocynaceae	*Pachycarpus appendiculatus*	E.Mey.	LC	Indigenous
Apocynaceae	*Pachycarpus campanulatus var. sutherlandii*	(Harv.) N.E.Br.	LC	Indigenous
Apocynaceae	*Pachycarpus concolor subsp. transvaalensis*	E.Mey.	LC	Indigenous
Apocynaceae	*Pachycarpus galpinii*	(Schltr.) N.E.Br.	LC	Indigenous
Apocynaceae	*Pachycarpus scaber*	(Harv.) N.E.Br.	LC	Indigenous
Apocynaceae	*Pachycarpus suaveolens*	(Schltr.) Nicholas & Goyder	VU	Indigenous
Rubiaceae	*Pachystigma latifolium*	Sond.	LC	Indigenous
Rubiaceae	*Pachystigma macrocalyx*	(Sond.) Robyns	LC	Indigenous
Rubiaceae	*Pachystigma pygmaeum*	(Schltr.) Robyns	LC	Indigenous
Poaceae	*Panicum aequinerve*	Nees	LC	Indigenous
Poaceae	*Panicum dregeanum*	Nees	LC	Indigenous
Poaceae	*Panicum ecklonii*	Nees	LC	Indigenous
Poaceae	*Panicum maximum*	Jacq.	LC	Indigenous
Poaceae	*Panicum natalense*	Hochst.	LC	Indigenous
Poaceae	*Panicum schinzii*	Hack.	LC	Indigenous
Poaceae	*Panicum sp.*			
Poaceae	*Panicum subalbidum*	Kunth	LC	Indigenous
Asteraceae	*Parapolydora fastigiata*	(Oliv. & Hiern) H.Rob.		Indigenous
Chrysobalanaceae	*Parinari capensis subsp. capensis*	Harv.	LC	Indigenous
Poaceae	*Paspalum dilatatum*	Poir.	NE	Not Indigenous; Naturalised
Poaceae	*Paspalum scrobiculatum*	L.	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Poaceae	*Paspalum urvillei*	Steud.	NE	Not Indigenous; Naturalised
Thymelaeaceae	*Passerina montivaga*	Bredenk. & A.E.van Wyk	LC	Indigenous
Rubiaceae	*Pavetta cooperi*	Harv. & Sond.	LC	Indigenous
Rubiaceae	*Pavetta gracilifolia*	Bremek.	LC	Indigenous
Malvaceae	*Pavonia columella*	Cav.	LC	Indigenous
Fabaceae	*Pearsonia aristata*	(Schinz) Dummer	LC	Indigenous
Fabaceae	*Pearsonia sessilifolia subsp. filifolia*	(Harv.) Dummer	LC	Indigenous
Fabaceae	*Pearsonia sessilifolia subsp. marginata*	(Harv.) Dummer	LC	Indigenous
Fabaceae	*Pearsonia sessilifolia subsp. sessilifolia*	(Harv.) Dummer	LC	Indigenous
Fabaceae	*Pearsonia sessilifolia subsp. swaziensis*	(Harv.) Dummer	LC	Indigenous
Fabaceae	*Pearsonia sp.*			
Thymelaeaceae	*Peddiea africana*	Harv.	LC	Indigenous
Geraniaceae	*Pelargonium acraeum*	R.A.Dyer	LC	Indigenous
Geraniaceae	*Pelargonium alchemilloides*	(L.) L'Her.	LC	Indigenous
Geraniaceae	*Pelargonium luridum*	(Andrews) Sweet	LC	Indigenous
Pteridaceae	*Pellaea calomelanos var. calomelanos*	(Sw.) Link	LC	Indigenous
Ranunculaceae	*Peltocalathos baurii*	(MacOwan) Tamura	LC	Indigenous; Endemic
Poaceae	*Pennisetum macrourum*	Trin.	LC	Indigenous
Poaceae	*Pennisetum thunbergii*	Kunth	LC	Indigenous
Poaceae	*Pentameris natalensis*	(Stapf) Galley & H.P.Linder	LC	Indigenous
Rubiaceae	*Pentanisia angustifolia*	(Hochst.) Hochst.	LC	Indigenous
Rubiaceae	*Pentanisia prunelloides subsp. latifolia*	(Klotzsch ex Eckl. & Zeyh.) Walp.	LC	Indigenous
Rubiaceae	*Pentanisia prunelloides subsp. prunelloides*	(Klotzsch ex Eckl. & Zeyh.) Walp.	LC	Indigenous
Apocynaceae	*Pentarrhinum abyssinicum subsp. abyssinicum*	Decne.	LC	Indigenous
Piperaceae	*Peperomia retusa var. bachmannii*	(L.f.) A.Dietr.		Indigenous
Piperaceae	*Peperomia retusa var. retusa*	(L.f.) A.Dietr.		Indigenous
Piperaceae	*Peperomia tetraphylla*	(G.Forst.) Hook. & Arn.		Indigenous
Poaceae	*Perotis patens*	Gand.	LC	Indigenous
Polygonaceae	*Persicaria decipiens*	(R.Br.) K.L.Wilson	LC	Indigenous
Polygonaceae	*Persicaria lapathifolia*	(L.) Gray		Not Indigenous; Naturalised
Polygonaceae	*Persicaria madagascariensis*	(Meisn.) S.Ortiz & Paiva		Indigenous
Polygonaceae	*Persicaria meisneriana*	(Cham. & Schltdl.) M.Gomez	LC	Indigenous
Notothyladaceae	*Phaeoceros bolusii*	(Sim) S.W.Arnell		Indigenous
Acanthaceae	*Phaulopsis imbricata subsp. imbricata*	(Forssk.) Sweet		Indigenous
Fabaceae	*Philenoptera violacea*	(Klotzsch) Schrire		Indigenous
Bartramiaceae	*Philonotis africana*	(Mull.Hal.) Rehmann ex Paris		Indigenous

Family	Taxon	Author	IUCN	Ecology
Bartramiaceae	*Philonotis dregeana*	(Mull.Hal.) A.Jaeger		Indigenous
Poaceae	*Phragmites australis*	(Cav.) Steud.	LC	Indigenous
Poaceae	*Phragmites mauritianus*	Kunth	LC	Indigenous
Scrophulariaceae	*Phygelius aequalis*	Harv. ex Hiern	LC	Indigenous
Verbenaceae	*Phyla nodiflora var. nodiflora*	(L.) Greene		Not Indigenous; Naturalised
Rhamnaceae	*Phylica paniculata*	Willd.		Indigenous
Phyllanthaceae	*Phyllanthus asperulatus*	Hutch.	LC	Indigenous
Phyllanthaceae	*Phyllanthus maderaspatensis*	L.	LC	Indigenous
Phyllanthaceae	*Phyllanthus sp.*			
Asteraceae	*Phymaspermum acerosum*	(DC.) Kallersjo	LC	Indigenous; Endemic
Asteraceae	*Phymaspermum argenteum*	Brusse	NT	Indigenous; Endemic
Asteraceae	*Phymaspermum athanasioides*	(S.Moore) Kallersjo	LC	Indigenous
Asteraceae	*Phymaspermum sp.*			
Apiaceae	*Pimpinella caffra*	(Eckl. & Zeyh.) D.Dietr.	LC	Indigenous
Apiaceae	*Pimpinella transvaalensis*	H.Wolff	LC	Indigenous
Piperaceae	*Piper capense var. capense*	L.f.		Indigenous
Pittosporaceae	*Pittosporum viridiflorum*	Sims	LC	Indigenous
Plantaginaceae	*Plantago longissima*	Decne.	LC	Indigenous
Lamiaceae	*Platostoma rotundifolium*	(Briq.) A.J.Paton		Indigenous
Lamiaceae	*Plectranthus ciliatus*	E.Mey. ex Benth.	LC	Indigenous
Lamiaceae	*Plectranthus fruticosus*	L'Her.	LC	Indigenous
Lamiaceae	*Plectranthus grandidentatus*	Gurke	LC	Indigenous
Lamiaceae	*Plectranthus hadiensis var. tomentosus*	(Forssk.) Schweinf. ex Spreng.	LC	Indigenous
Lamiaceae	*Plectranthus laxiflorus*	Benth.	LC	Indigenous
Lamiaceae	*Plectranthus madagascariensis var. madagascariensis*	(Pers.) Benth.	LC	Indigenous
Lamiaceae	*Plectranthus purpuratus subsp. purpuratus*	Harv.	LC	Indigenous
Lamiaceae	*Plectranthus ramosior*	(Benth.) Van Jaarsv.	LC	Indigenous; Endemic
Lamiaceae	*Plectranthus rubropunctatus*	Codd	LC	Indigenous
Lamiaceae	*Plectranthus strigosus*	Benth.	LC	Indigenous
Lamiaceae	*Plectranthus verticillatus*	(L.f.) Druce	LC	Indigenous
Polypodiaceae	*Pleopeltis macrocarpa*	(Bory ex Willd.) Kaulf.	LC	Indigenous
Polypodiaceae	*Pleopeltis polypodioides subsp. ecklonii*	(L.) E.G.Andrews & Windham	LC	Indigenous
Podocarpaceae	*Podocarpus latifolius*	(Thunb.) R.Br. ex Mirb.		Indigenous
Poaceae	*Pogonarthria squarrosa*	(Roem. & Schult.) Pilg.	LC	Indigenous
Polytrichaceae	*Pogonatum capense*	(Hampe) A.Jaeger		Indigenous
Asteraceae	*Polydora steetziana*	(Oliv. & Hiern) H.Rob.	LC	Indigenous; Endemic

Family	*Taxon*	Author	IUCN	Ecology
Polygalaceae	*Polygala africana*	Chodat	LC	Indigenous
Polygalaceae	*Polygala albida subsp. albida*	Schinz	LC	Indigenous
Polygalaceae	*Polygala hottentotta*	C.Presl	LC	Indigenous
Polygalaceae	*Polygala houtboshiana*	Chodat	LC	Indigenous
Polygalaceae	*Polygala leendertziae*	Burtt Davy	LC	Indigenous
Polygalaceae	*Polygala ohlendorfiana*	Eckl. & Zeyh.	LC	Indigenous
Polygalaceae	*Polygala producta*	N.E.Br.	LC	Indigenous
Polygalaceae	*Polygala transvaalensis subsp. transvaalensis*	Chodat	LC	Indigenous
Polygalaceae	*Polygala virgata var. decora*	Thunb.	LC	Indigenous
Orchidaceae	*Polystachya albescens subsp. imbricata*	Ridl.	LC	Indigenous
Orchidaceae	*Polystachya mauritiana*	Spreng.	LC	Indigenous
Orchidaceae	*Polystachya modesta*	Rchb.f.	LC	Indigenous
Orchidaceae	*Polystachya ottoniana*	Rchb.f.	LC	Indigenous
Orchidaceae	*Polystachya zuluensis*	L.Bolus	DD	Indigenous
Dryopteridaceae	*Polystichum luctuosum*	(Kunze) T.Moore		Indigenous
Dryopteridaceae	*Polystichum macleae*	(Baker) Diels		Indigenous; Endemic
Dryopteridaceae	*Polystichum pungens*	(Kaulf.) C.Presl		Indigenous; Endemic
Polytrichaceae	*Polytrichum commune*	Hedw.		Indigenous
Polytrichaceae	*Polytrichum sp.*			
Polytrichaceae	*Polytrichum subpilosum*	P.Beauv.		Indigenous
Portulacaceae	*Portulaca kermesina*	N.E.Br.		Indigenous
Potamogetonaceae	*Potamogeton richardii*	Solms	LC	Indigenous
Urticaceae	*Pouzolzia parasitica*	(Forssk.) Schweinf.		Indigenous
Verbenaceae	*Priva meyeri var. meyeri*	Jaub. & Spach		Indigenous
Poaceae	*Prosphytochloa prehensilis*	(Nees) Schweick.	LC	Indigenous
Proteaceae	*Protea caffra*	Meisn.		Indigenous
Proteaceae	*Protea caffra subsp. caffra*	Meisn.	LC	Indigenous
Proteaceae	*Protea gaguedi*	J.F.Gmel.	LC	Indigenous
Proteaceae	*Protea parvula*	Beard	NT	Indigenous
Proteaceae	*Protea roupelliae*	Meisn.		Indigenous
Proteaceae	*Protea roupelliae subsp. roupelliae*	Meisn.	LC	Indigenous
Proteaceae	*Protea simplex*	E.Phillips	LC	Indigenous
Anacardiaceae	*Protorhus longifolia*	(Bernh.) Engl.	LC	Indigenous
Molluginaceae	*Psammotropha myriantha*	Sond.	LC	Indigenous

Family	Taxon	Author	IUCN	Ecology
Fabaceae	*Pseudarthria hookeri var. hookeri*	Wight & Arn.	LC	Indigenous
Asteraceae	*Pseudognaphalium luteoalbum*	(L.) Hilliard & B.L.Burtt	LC	Not Indigenous; Naturalised
Asteraceae	*Pseudognaphalium oligandrum*	(DC.) Hilliard & B.L.Burtt	LC	Indigenous
Asteraceae	*Pseudopegolettia tenella*	(DC.) H.Rob., Skvarla & V.A.Funk		Indigenous; Endemic
Fabaceae	*Psoralea arborea*	Sims	LC	Indigenous
Fabaceae	*Psoralea glabra*	E.Mey.	LC	Indigenous
Fabaceae	*Psoralea pinnata var. pinnata*	L.	LC	Indigenous; Endemic
Rubiaceae	*Psychotria capensis subsp. capensis*	(Eckl.) Vatke	NE	Indigenous
Fabaceae	*Pterocarpus angolensis*	DC.	LC	Indigenous
Celastraceae	*Pterocelastrus echinatus*	N.E.Br.	LC	Indigenous
Celastraceae	*Pterocelastrus galpinii*	Loes.	LC	Indigenous
Celastraceae	*Pterocelastrus rostratus*	(Thunb.) Walp.	LC	Indigenous
Marattiaceae	*Ptisana fraxinea var. salicifolia*	(Sm.) Murdock	NE	Indigenous
Ptychomitriaceae	*Ptychomitrium sellowianum*	(Mull.Hal.) A.Jaeger		Indigenous
Ptychomitriaceae	*Ptychomitrium subcrispatum*	Ther. & P.de la Varde		Indigenous
Asteraceae	*Pulicaria scabra*	(Thunb.) Druce	LC	Indigenous
Amaranthaceae	*Pupalia lappacea var. lappacea*	(L.) A.Juss.	LC	Indigenous
Lamiaceae	*Pycnostachys reticulata*	(E.Mey.) Benth.	LC	Indigenous
Cyperaceae	*Pycreus macranthus*	(Boeck.) C.B.Clarke	LC	Indigenous
Cyperaceae	*Pycreus mundii*	Nees	LC	Indigenous
Cyperaceae	*Pycreus nigricans*	(Steud.) C.B.Clarke	LC	Indigenous
Cyperaceae	*Pycreus oakfortensis*	C.B.Clarke	LC	Indigenous
Cyperaceae	*Pycreus polystachyos var. polystachyos*	(Rottb.) P.Beauv.	LC	Indigenous
Cyperaceae	*Pycreus pumilus*	(L.) Nees	LC	Indigenous
Cyperaceae	*Pycreus rehmannianus*	C.B.Clarke	LC	Indigenous
Rubiaceae	*Pygmaeothamnus chamaedendrum var. setulosus*	(Kuntze) Robyns	LC	Indigenous
Lamiaceae	*Rabdosiella calycina*	(Benth.) Codd	LC	Indigenous
Racopilaceae	*Racopilum capense*	Mull.Hal. ex Broth.		Indigenous
Iridaceae	*Radinosiphon leptostachya*	(Baker) N.E.Br.	LC	Indigenous
Ranunculaceae	*Ranunculus multifidus*	Forssk.	LC	Indigenous
Myrsinaceae	*Rapanea melanophloeos*	(L.) Mez	LC	Indigenous
Apocynaceae	*Raphionacme galpinii*	Schltr.	LC	Indigenous
Apocynaceae	*Raphionacme hirsuta*	(E.Mey.) R.A.Dyer	LC	Indigenous
Apocynaceae	*Raphionacme procumbens*	Schltr.	LC	Indigenous
Poaceae	*Rendlia altera*	(Rendle) Chiov.	LC	Indigenous
Rhamnaceae	*Rhamnus prinoides*	L'Her.		Indigenous
Acanthaceae	*Rhinacanthus gracilis var. latilabiatus*	Klotzsch		Indigenous; Endemic

Family	*Taxon*	Author	IUCN	Ecology
Bryaceae	*Rhodobryum commersonii*	(Schwagr.) Paris		Indigenous
Hypoxidaceae	*Rhodohypoxis baurii var. confecta*	(Baker) Nel	LC	Indigenous
Vitaceae	*Rhoicissus rhomboidea*	(E.Mey. ex Harv.) Planch.		Indigenous
Vitaceae	*Rhoicissus tridentata subsp. cuneifolia*	(L.f.) Wild & R.B.Drumm.		Indigenous
Fabaceae	*Rhynchosia albissima*	Gand.	LC	Indigenous
Fabaceae	*Rhynchosia angulosa*	Schinz	LC	Indigenous
Fabaceae	*Rhynchosia caribaea*	(Jacq.) DC.	LC	Indigenous
Fabaceae	*Rhynchosia ciliata*	(Thunb.) Schinz	LC	Indigenous; Endemic
Fabaceae	*Rhynchosia clivorum*	S.Moore		Indigenous
Fabaceae	*Rhynchosia clivorum subsp. clivorum*	S.Moore	LC	Indigenous
Fabaceae	*Rhynchosia crassifolia*	Benth. ex Harv.	LC	Indigenous
Fabaceae	*Rhynchosia harmsiana var. harmsiana*	Schltr. ex Zahlbr.	LC	Indigenous
Fabaceae	*Rhynchosia minima var. minima*	(L.) DC.	NE	Indigenous
Fabaceae	*Rhynchosia minima var. prostrata*	(L.) DC.	NE	Indigenous
Fabaceae	*Rhynchosia monophylla*	Schltr.	LC	Indigenous
Fabaceae	*Rhynchosia nervosa var. nervosa*	Benth. ex Harv.	LC	Indigenous
Fabaceae	*Rhynchosia pentheri var. hutchinsoniana*	Schltr. ex Zahlbr.	LC	Indigenous
Fabaceae	*Rhynchosia sordida*	(E.Mey.) Schinz	LC	Indigenous
Fabaceae	*Rhynchosia sp.*			
Fabaceae	*Rhynchosia sublobata*	(Schumach.) Meikle	LC	Indigenous
Fabaceae	*Rhynchosia thorncroftii*	(Baker f.) Burtt Davy	LC	Indigenous
Fabaceae	*Rhynchosia totta var. totta*	(Thunb.) DC.	LC	Indigenous
Fabaceae	*Rhynchosia woodii*	Schinz	LC	Indigenous
Cyperaceae	*Rhynchospora brownii*	Roem. & Schult.	LC	Indigenous
Apocynaceae	*Riocreuxia picta*	Schltr.	LC	Indigenous
Apocynaceae	*Riocreuxia polyantha*	Schltr.	LC	Indigenous
Apocynaceae	*Riocreuxia torulosa var. torulosa*	(E.Mey.) Decne.	LC	Indigenous
Bryaceae	*Rosulabryum capillare*	(Hedw.) J.R.Spence		Indigenous
Lamiaceae	*Rotheca hirsuta*	(Hochst.) R.Fern.		Indigenous
Lamiaceae	*Rotheca louwalbertsii*	(P.P.J.Herman) P.P.J.Herman & Retief		Indigenous; Endemic
Rubiaceae	*Rothmannia capensis*	Thunb.	LC	Indigenous
Rubiaceae	*Rothmannia globosa*	(Hochst.) Keay	LC	Indigenous
Poaceae	*Rottboellia cochinchinensis*	(Lour.) Clayton	LC	Indigenous
Rubiaceae	*Rubia cordifolia subsp. conotricha*	L.	LC	Indigenous
Rosaceae	*Rubus affinis*	Wight & Arn.		Not Indigenous; Naturalised
Rosaceae	*Rubus apetalus var. apetalus*	Poir.	NE	Indigenous
Rosaceae	*Rubus niveus*	Thunb.		Not Indigenous; Naturalised; Invasive
Rosaceae	*Rubus pinnatus*	Willd.	LC	Indigenous
Acanthaceae	*Ruellia cordata*	Thunb.		Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Polygonaceae	*Rumex dregeanus subsp. montanus*	Meisn.	LC	Indigenous
Polygonaceae	*Rumex sagittatus*	Thunb.	LC	Indigenous
Salicaceae	*Salix mucronata subsp. woodii*	Thunb.	LC	Indigenous
Orchidaceae	*Satyrium cristatum var. cristatum*	Sond.	LC	Indigenous
Orchidaceae	*Satyrium cristatum var. longilabiatum*	Sond.	LC	Indigenous
Orchidaceae	*Satyrium hallackii subsp. ocellatum*	Bolus	LC	Indigenous
Orchidaceae	*Satyrium longicauda var. longicauda*	Lindl.	NE	Indigenous
Orchidaceae	*Satyrium neglectum subsp. neglectum*	Schltr.	LC	Indigenous
Orchidaceae	*Satyrium parviflorum*	Sw.	LC	Indigenous
Orchidaceae	*Satyrium trinerve*	Lindl.	LC	Indigenous
Dipsacaceae	*Scabiosa columbaria*	L.	LC	Indigenous
Amaryllidaceae	*Scadoxus multiflorus subsp. katharinae*	(Martyn) Raf.	LC	Indigenous
Amaryllidaceae	*Scadoxus multiflorus subsp. multiflorus*	(Martyn) Raf.	LC	Indigenous
Amaryllidaceae	*Scadoxus puniceus*	(L.) Friis & Nordal	LC	Indigenous
Araliaceae	*Schefflera umbellifera*	(Sond.) Baill.		Indigenous
Asteraceae	*Schistostephium crataegifolium*	(DC.) Fenzl ex Harv.	LC	Indigenous
Asteraceae	*Schistostephium rotundifolium*	(DC.) Fenzl ex Harv.	LC	Indigenous
Poaceae	*Schizachyrium sanguineum*	(Retz.) Alston	LC	Indigenous
Schizaeaceae	*Schizaea pectinata*	(L.) Sw.		Indigenous
Orchidaceae	*Schizochilus cecilii subsp. culveri*	Rolfe	LC	Indigenous
Orchidaceae	*Schizochilus zeyheri*	Sond.	LC	Indigenous
Apocynaceae	*Schizoglossum bidens subsp. galpinii*	E.Mey.	LC	Indigenous
Apocynaceae	*Schizoglossum bidens subsp. pachyglossum*	E.Mey.	LC	Indigenous
Apocynaceae	*Schizoglossum cordifolium*	E.Mey.	LC	Indigenous
Apocynaceae	*Schizoglossum nitidum*	Schltr.	LC	Indigenous
Apocynaceae	*Schizoglossum sp.*			
Orthotrichaceae	*Schlotheimia ferruginea*	(Bruch ex Hook. & Grev.) Brid.		Indigenous
Cyperaceae	*Schoenoplectus brachyceras*	(Hochst. ex A.Rich.) Lye	LC	Indigenous
Cyperaceae	*Schoenoplectus muriculatus*	(Kuk.) Browning	LC	Indigenous
Cyperaceae	*Schoenoxiphium sp.*			
Fabaceae	*Schotia brachypetala*	Sond.	LC	Indigenous
Oleaceae	*Schrebera alata*	(Hochst.) Welw.	LC	Indigenous
Cyperaceae	*Scleria melanomphala*	Kunth	LC	Indigenous
Cyperaceae	*Scleria transvaalensis*	E.F.Franklin	LC	Indigenous
Cyperaceae	*Scleria welwitschii*	C.B.Clarke	LC	Indigenous
Anacardiaceae	*Sclerocarya birrea subsp. caffra*	(A.Rich.) Hochst.	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Acanthaceae	*Sclerochiton harveyanus*	Nees		Indigenous
Salicaceae	*Scolopia mundii*	(Eckl. & Zeyh.) Warb.	LC	Indigenous
Salicaceae	*Scolopia zeyheri*	(Nees) Harv.	LC	Indigenous
Anacardiaceae	*Searsia chirindensis*	(Baker f.) Moffett		Indigenous
Anacardiaceae	*Searsia dentata*	(Thunb.) F.A.Barkley		Indigenous
Anacardiaceae	*Searsia discolor*	(E.Mey. ex Sond.) Moffett		Indigenous
Anacardiaceae	*Searsia gerrardii*	(Harv. ex Engl.) Moffett		Indigenous
Anacardiaceae	*Searsia pondoensis*	(Schonland) Moffett		Indigenous; Endemic
Anacardiaceae	*Searsia pyroides var. integrifolia*	(Burch.) Moffett		Indigenous
Anacardiaceae	*Searsia pyroides var. pyroides*	(Burch.) Moffett		Indigenous
Anacardiaceae	*Searsia rehmanniana var. rehmanniana*	(Engl.) Moffett		Indigenous
Anacardiaceae	*Searsia rigida var. margaretae*	(Mill.) F.A.Barkley		Indigenous
Anacardiaceae	*Searsia transvaalensis*	(Engl.) Moffett		Indigenous
Anacardiaceae	*Searsia tumulicola var. tumulicola*	(S.Moore) Moffett		Indigenous
Gentianaceae	*Sebaea erosa*	Schinz	LC	Indigenous
Gentianaceae	*Sebaea junodii*	Schinz	LC	Indigenous
Gentianaceae	*Sebaea rehmannii*	Schinz	LC	Indigenous
Gentianaceae	*Sebaea sedoides var. confertiflora*	Gilg	LC	Indigenous
Gentianaceae	*Sebaea sedoides var. sedoides*	Gilg	LC	Indigenous
Apocynaceae	*Secamone alpini*	Schult.	LC	Indigenous
Selaginellaceae	*Selaginella dregei*	(C.Presl) Hieron.		Indigenous
Selaginellaceae	*Selaginella kraussiana*	(Kunze) A.Braun		Indigenous
Selaginellaceae	*Selaginella mittenii*	Baker		Indigenous
Scrophulariaceae	*Selago compacta*	Rolfe	LC	Indigenous
Sematophyllaceae	*Sematophyllum brachycarpum*	(Hampe) Broth.		Indigenous
Sematophyllaceae	*Sematophyllum gueinzii*	(Hampe) Magill		Indigenous
Sematophyllaceae	*Sematophyllum sphaeropyxis*	(Mull.Hal.) Broth.		Indigenous
Sematophyllaceae	*Sematophyllum subpinnatum*	(Brid.) E.Britton		Indigenous
Sematophyllaceae	*Sematophyllum wageri*	C.H.Wright ex Wager		Indigenous
Asteraceae	*Senecio albanensis*	DC.		Indigenous
Asteraceae	*Senecio albanensis var. doroniciflorus*	DC.	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Asteraceae	*Senecio barbatus*	DC.	LC	Indigenous
Asteraceae	*Senecio bupleuroides*	DC.	LC	Indigenous
Asteraceae	*Senecio coronatus*	(Thunb.) Harv.	LC	Indigenous
Asteraceae	*Senecio decurrens*	DC.	LC	Indigenous
Asteraceae	*Senecio eminens*	Compton	DD	Indigenous
Asteraceae	*Senecio erubescens var. erubescens*	Aiton	NE	Indigenous; Endemic
Asteraceae	*Senecio gerrardii*	Harv.	LC	Indigenous
Asteraceae	*Senecio glaberrimus*	DC.	LC	Indigenous
Asteraceae	*Senecio helminthioides*	(Sch.Bip.) Hilliard	LC	Indigenous
Asteraceae	*Senecio inornatus*	DC.	LC	Indigenous
Asteraceae	*Senecio isatideus*	DC.	LC	Indigenous
Asteraceae	*Senecio isatidioides*	E.Phillips & C.A.Sm.	LC	Indigenous
Asteraceae	*Senecio latifolius*	DC.	LC	Indigenous
Asteraceae	*Senecio madagascariensis*	Poir.	LC	Indigenous
Asteraceae	*Senecio mbuluzensis*	Compton	LC	Indigenous
Asteraceae	*Senecio neoviscidulus*	Soldano	DD	Indigenous; Endemic
Asteraceae	*Senecio othonniflorus*	DC.	LC	Indigenous
Asteraceae	*Senecio oxyriifolius*	DC.		Indigenous
Asteraceae	*Senecio oxyriifolius subsp. oxyriifolius*	DC.	LC	Indigenous
Asteraceae	*Senecio paludaffinis*	Hilliard	LC	Indigenous
Asteraceae	*Senecio pleistocephalus*	S.Moore	LC	Indigenous
Asteraceae	*Senecio polyanthemoides*	Sch.Bip.	LC	Indigenous
Asteraceae	*Senecio polyodon var. polyodon*	DC.	LC	Indigenous
Asteraceae	*Senecio purpureus*	L.	LC	Indigenous; Endemic
Asteraceae	*Senecio rhyncholaenus*	DC.	LC	Indigenous
Asteraceae	*Senecio serratuloides*	DC.	LC	Indigenous
Asteraceae	*Senecio sp.*			
Asteraceae	*Senecio speciosus*	Willd.	LC	Indigenous
Asteraceae	*Senecio subrubriflorus*	O.Hoffm.	LC	Indigenous
Asteraceae	*Senecio tamoides*	DC.	LC	Indigenous
Asteraceae	*Senecio variabilis*	Sch.Bip.	LC	Indigenous; Endemic
Asteraceae	*Senecio viminalis*	Bremek.	LC	Indigenous
Fabaceae	*Senegalia ataxacantha*	(DC.) Kyal. & Boatwr.	LC	Indigenous
Fabaceae	*Senegalia brevispica subsp. dregeana*	(Harms) Seigler & Ebinger	LC	Indigenous
Fabaceae	*Senegalia burkei*	(Benth.) Kyal. & Boatwr.	LC	Indigenous
Fabaceae	*Senna septemtrionalis*	(Viv.) H.S.Irwin & Barneby	NE	Not Indigenous; Naturalised; Invasive
Fabaceae	*Senna siamea*	(Lam.) H.S.Irwin & Barneby	NE	Not Indigenous; Naturalised
Asteraceae	*Seriphium plumosum*	L.		Indigenous
Pedaliaceae	*Sesamum triphyllum var. triphyllum*	Welw. ex Asch.	LC	Indigenous
Poaceae	*Setaria megaphylla*	(Steud.) T.Durand & Schinz	LC	Indigenous
Poaceae	*Setaria nigrirostris*	(Nees) T.Durand & Schinz	LC	Indigenous
Poaceae	*Setaria sphacelata var. sericea*	(Schumach.) Stapf & C.E.Hubb. ex M.B.Moss	LC	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Poaceae	*Setaria sphacelata var. sphacelata*	(Schumach.) Stapf & C.E.Hubb. ex M.B.Moss	LC	Indigenous
Rubiaceae	*Sherardia arvensis*	L.		Not Indigenous; Naturalised
Malvaceae	*Sida acuta subsp. acuta*	Burm.f.	LC	Indigenous
Malvaceae	*Sida cordifolia*	L.		Indigenous
Malvaceae	*Sida serratifolia*	R.Wilczek & Steyaert	LC	Indigenous
Caryophyllaceae	*Silene burchellii subsp. modesta*	Otth		Indigenous
Caryophyllaceae	*Silene burchellii subsp. pilosellifolia*	Otth		Indigenous
Caryophyllaceae	*Silene undulata*	Aiton		Indigenous
Caryophyllaceae	*Silene undulata subsp. polyantha*	Aiton	LC	Indigenous
Apocynaceae	*Sisyranthus huttoniae*	(S.Moore) S.Moore	LC	Indigenous
Apocynaceae	*Sisyranthus imberbis*	Harv.	LC	Indigenous
Apocynaceae	*Sisyranthus randii*	S.Moore	LC	Indigenous
Smilacaceae	*Smilax anceps*	Willd.		Indigenous
Fabaceae	*Smithia erubescens*	(E.Mey.) Baker f.	LC	Indigenous
Solanaceae	*Solanum campylacanthum*	Hochst. ex A.Rich.		Indigenous
Solanaceae	*Solanum dasyphyllum*	Schumach. & Thonn.		Indigenous
Solanaceae	*Solanum giganteum*	Jacq.	LC	Indigenous
Solanaceae	*Solanum retroflexum*	Dunal	LC	Indigenous
Solanaceae	*Solanum sp.*			
Lamiaceae	*Solenostemon latifolius*	(Hochst. ex Benth.) J.K.Morton	LC	Indigenous
Asteraceae	*Sonchus integrifolius var. integrifolius*	Harv.	LC	Indigenous
Asteraceae	*Sonchus integrifolius var. schlechteri*	Harv.	LC	Indigenous
Asteraceae	*Sonchus nanus*	Sond. ex Harv.	LC	Indigenous
Orobanchaceae	*Sopubia cana var. cana*	Harv.	LC	Indigenous
Orobanchaceae	*Sopubia karaguensis var. karaguensis*	Oliv.	LC	Indigenous
Orobanchaceae	*Sopubia simplex*	(Hochst.) Hochst.	LC	Indigenous
Orobanchaceae	*Sopubia sp.*			
Poaceae	*Sorghum bicolor subsp. arundinaceum*	(L.) Moench	LC	Indigenous
Rubiaceae	*Spermacoce natalensis*	Hochst.	LC	Indigenous
Rubiaceae	*Spermacoce senensis*	(Klotzsch) Hiern	LC	Indigenous
Podostemaceae	*Sphaerothylax algiformis*	Bisch. ex C.Krauss	LC	Indigenous
Malpighiaceae	*Sphedamnocarpus pruriens subsp. pruriens*	(A.Juss.) Szyszyl.	LC	Indigenous
Fabaceae	*Sphenostylis angustifolia*	Sond.	LC	Indigenous
Fabaceae	*Sphenostylis marginata subsp. marginata*	E.Mey.	LC	Indigenous
Poaceae	*Sporobolus africanus*	(Poir.) Robyns & Tournay	LC	Indigenous

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Poaceae	*Sporobolus centrifugus*	(Trin.) Nees	LC	Indigenous
Poaceae	*Sporobolus pyramidalis*	P.Beauv.	LC	Indigenous
Poaceae	*Sporobolus sp.*			
Poaceae	*Sporobolus stapfianus*	Gand.	LC	Indigenous
Lamiaceae	*Stachys arachnoidea*	Codd	LC	Indigenous
Lamiaceae	*Stachys graciliflora*	C.Presl	LC	Indigenous
Lamiaceae	*Stachys grandifolia*	E.Mey. ex Benth.	LC	Indigenous
Lamiaceae	*Stachys natalensis var. galpinii*	Hochst.	LC	Indigenous
Lamiaceae	*Stachys natalensis var. natalensis*	Hochst.	LC	Indigenous
Lamiaceae	*Stachys nigricans*	Benth.	LC	Indigenous
Lamiaceae	*Stachys simplex*	Schltr.	LC	Indigenous
Orchidaceae	*Stenoglottis fimbriata subsp. fimbriata*	Lindl.	LC	Indigenous
Menispermaceae	*Stephania abyssinica var. tomentella*	(Quart.-Dill. & A.Rich.) Walp.	LC	Indigenous
Stereophyllaceae	*Stereophyllum radiculosum*	(Hook.) Mitt.		Indigenous
Gleicheniaceae	*Sticherus umbraculiferus*	(Kunze) Ching	LC	Indigenous
Asteraceae	*Stomatanthes africanus*	(Oliv. & Hiern) R.M.King & H.Rob.	LC	Indigenous
Strelitziaceae	*Strelitzia caudata*	R.A.Dyer		Indigenous
Gesneriaceae	*Streptocarpus cyaneus subsp. cyaneus*	S.Moore	LC	Indigenous
Gesneriaceae	*Streptocarpus daviesii*	N.E.Br. ex C.B.Clarke	LC	Indigenous
Gesneriaceae	*Streptocarpus dunnii*	Hook.f.	LC	Indigenous
Gesneriaceae	*Streptocarpus galpinii*	Hook.f.	LC	Indigenous
Gesneriaceae	*Streptocarpus pentherianus*	Fritsch	LC	Indigenous
Gesneriaceae	*Streptocarpus wilmsii*	Engl.	LC	Indigenous
Orobanchaceae	*Striga bilabiata subsp. bilabiata*	(Thunb.) Kuntze	LC	Indigenous
Araceae	*Stylochaeton natalensis*	Schott	LC	Indigenous
Fabaceae	*Stylosanthes fruticosa*	(Retz.) Alston	LC	Indigenous
Poaceae	*Styppeiochloa gynoglossa*	(Gooss.) De Winter	LC	Indigenous
Gentianaceae	*Swertia welwitschii*	Engl.	LC	Indigenous
Pallaviciniaceae	*Symphyogyna brasiliensis*	Nees & Mont.		Indigenous
Lamiaceae	*Syncolostemon albiflorus*	(N.E.Br.) D.F.Otieno	LC	Indigenous
Lamiaceae	*Syncolostemon foliosus*	(S.Moore) D.F.Otieno	LC	Indigenous
Lamiaceae	*Syncolostemon modestus*	(Codd) D.F.Otieno	LC	Indigenous
Lamiaceae	*Syncolostemon parviflorus var. parviflorus*	E.Mey. ex Benth.	LC	Indigenous
Lamiaceae	*Syncolostemon pretoriae*	(Gurke) D.F.Otieno	LC	Indigenous
Lamiaceae	*Syncolostemon thorncroftii*	(N.E.Br.) D.F.Otieno	LC	Indigenous
Pottiaceae	*Syntrichia laevipila*	Brid.		Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Calymperaceae	*Syrrhopodon gaudichaudii*	Mont.		Indigenous
Myrtaceae	*Syzygium cordatum subsp. cordatum*	Hochst. ex C.Krauss	LC	Indigenous
Myrtaceae	*Syzygium gerrardii*	(Harv. ex Hook.f.) Burtt Davy	LC	Indigenous
Myrtaceae	*Syzygium guineense subsp. guineense*	(Willd.) DC.	LC	Indigenous
Loranthaceae	*Tapinanthus rubromarginatus*	(Engl.) Danser	LC	Indigenous
Asteraceae	*Tarchonanthus parvicapitulatus*	P.P.J.Herman	LC	Indigenous
Asteraceae	*Tarchonanthus trilobus var. galpinii*	DC.	LC	Indigenous
Cleomaceae	*Tarenaya hassleriana*	(Chodat) Iltis		Not Indigenous; Naturalised; Invasive
Scrophulariaceae	*Teedia lucida*	(Sol.) Rudolphi	LC	Indigenous
Asteraceae	*Tenrhynea phylicifolia*	(DC.) Hilliard & B.L.Burtt	LC	Indigenous
Fabaceae	*Tephrosia cordata*	Hutch. & Burtt Davy	LC	Indigenous
Fabaceae	*Tephrosia elongata*	E.Mey.		Indigenous
Fabaceae	*Tephrosia elongata var. elongata*	E.Mey.	LC	Indigenous
Fabaceae	*Tephrosia kraussiana*	Meisn.	LC	Indigenous
Fabaceae	*Tephrosia longipes*	Meisn.		Indigenous
Fabaceae	*Tephrosia macropoda var. diffusa*	(E.Mey.) Harv.	LC	Indigenous
Fabaceae	*Tephrosia polystachya var. latifolia*	E.Mey.	LC	Indigenous
Fabaceae	*Tephrosia polystachya var. polystachya*	E.Mey.	LC	Indigenous
Fabaceae	*Tephrosia purpurea subsp. leptostachya*	(L.) Pers.	NE	Indigenous
Fabaceae	*Tephrosia purpurea subsp. purpurea*	(L.) Pers.	NE	Not Indigenous; Naturalised
Fabaceae	*Tephrosia sp.*			
Lamiaceae	*Tetradenia bainesii*	(N.E.Br.) Phillipson & C.F.Steyn	LC	Indigenous
Lamiaceae	*Tetradenia galpinii*	(N.E.Br.) Phillipson & C.F.Steyn	LC	Indigenous
Lamiaceae	*Tetradenia riparia*	(Hochst.) Codd	LC	Indigenous
Scrophulariaceae	*Tetraselago longituba*	(Rolfe) Hilliard & B.L.Burtt	LC	Indigenous
Lamiaceae	*Teucrium kraussii*	Codd	LC	Indigenous
Ranunculaceae	*Thalictrum rhynchocarpum*	Quart.-Dill. & A.Rich.	LC	Indigenous
Pilotrichaceae	*Thamniopsis utacamundiana*	(Mont.) W.R.Buck		Indigenous
Thelypteridaceae	*Thelypteris confluens*	(Thunb.) C.V.Morton	LC	Indigenous
Poaceae	*Themeda triandra*	Forssk.	LC	Indigenous
Santalaceae	*Thesium asterias*	A.W.Hill	LC	Indigenous
Santalaceae	*Thesium costatum var. costatum*	A.W.Hill	LC	Indigenous
Santalaceae	*Thesium costatum var. paniculatum*	A.W.Hill	LC	Indigenous
Santalaceae	*Thesium gracilarioides*	A.W.Hill	LC	Indigenous
Santalaceae	*Thesium gypsophiloides*	A.W.Hill	LC	Indigenous
Santalaceae	*Thesium lobelioides*	A.DC.	LC	Indigenous
Santalaceae	*Thesium sp.*			
Acanthaceae	*Thunbergia alata*	Bojer ex Sims		Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Acanthaceae	*Thunbergia atriplicifolia*	E.Mey. ex Nees	LC	Indigenous
Acanthaceae	*Thunbergia dregeana*	Nees	LC	Indigenous
Asteraceae	*Tolpis capensis*	(L.) Sch.Bip.	LC	Indigenous
Pottiaceae	*Tortella humilis*	(Hedw.) Jenn.		Indigenous
Asphodelaceae	*Trachyandra asperata var. nataglencoensis*	Kunth	LC	Indigenous
Asphodelaceae	*Trachyandra asperata var. swaziensis*	Kunth	LC	Indigenous
Asphodelaceae	*Trachyandra erythrorrhiza*	(Conrath) Oberm.	LC	Indigenous; Endemic
Asphodelaceae	*Trachyandra gerrardii*	(Baker) Oberm.	LC	Indigenous
Asphodelaceae	*Trachyandra reflexipilosa*	(Kuntze) Oberm.	LC	Indigenous
Asphodelaceae	*Trachyandra saltii var. oatesii*	(Baker) Oberm.	LC	Indigenous; Endemic
Asphodelaceae	*Trachyandra saltii var. saltii*	(Baker) Oberm.	LC	Indigenous
Balantiopsidaceae	*Trachyphyllum gastrodes*	(Welw. & Duby) A.Gepp		Indigenous
Poaceae	*Trachypogon spicatus*	(L.f.) Kuntze	LC	Indigenous
Euphorbiaceae	*Tragia capensis*	Thunb.		Indigenous
Euphorbiaceae	*Tragia meyeriana*	Mull.Arg.	LC	Indigenous
Euphorbiaceae	*Tragia okanyua*	Pax	LC	Indigenous
Euphorbiaceae	*Tragia sonderi*	Prain	LC	Indigenous
Cannabaceae	*Trema orientalis*	(L.) Blume	LC	Indigenous
Bruchiaceae	*Trematodon intermedius*	Welw. & Duby		Indigenous
Rubiaceae	*Tricalysia capensis var. galpinii*	(Meisn. ex Hochst.) Sim		Indigenous; Endemic
Rubiaceae	*Tricalysia capensis var. transvaalensis*	(Meisn. ex Hochst.) Sim	LC	Indigenous
Hamamelidaceae	*Trichocladus grandiflorus*	Oliv.	LC	Indigenous
Boraginaceae	*Trichodesma physaloides*	(Fenzl) A.DC.	LC	Indigenous
Poaceae	*Trichopteryx dregeana*	Nees	LC	Indigenous
Sematophyllaceae	*Trichosteleum perchlorosum*	Broth. & Bryhn		Indigenous
Pottiaceae	*Trichostomum brachydontium*	Bruch		Indigenous
Orchidaceae	*Tridactyle tricuspis*	(Bolus) Schltr.	LC	Indigenous
Fabaceae	*Trifolium africanum var. africanum*	Ser.	NE	Indigenous
Fabaceae	*Trifolium africanum var. lydenburgense*	Ser.	NE	Indigenous
Salicaceae	*Trimeria grandifolia*	(Hochst.) Warb.		Indigenous
Salicaceae	*Trimeria grandifolia subsp. grandifolia*	(Hochst.) Warb.	LC	Indigenous
Poaceae	*Tristachya leucothrix*	Trin. ex Nees	LC	Indigenous
Malvaceae	*Triumfetta annua forma annua*	L.	NE	Indigenous
Malvaceae	*Triumfetta pilosa var. tomentosa*	Roth	NE	Indigenous

Family	*Taxon*	Author	IUCN	Ecology
Malvaceae	*Triumfetta rhomboidea var. rhomboidea*	Jacq.	LC	Indigenous
Malvaceae	*Triumfetta welwitschii var. hirsuta*	Mast.	LC	Indigenous
Cucurbitaceae	*Trochomeria hookeri*	Harv.	LC	Indigenous
Asteraceae	*Troglophyton capillaceum subsp. capillaceum*	(Thunb.) Hilliard & B.L.Burtt	LC	Indigenous
Alliaceae	*Tulbaghia acutiloba*	Harv.	LC	Indigenous; Endemic
Alliaceae	*Tulbaghia leucantha*	Baker	LC	Indigenous
Apocynaceae	*Tylophora lycioides*	(E.Mey.) Decne.	LC	Indigenous
Asteraceae	*Ursinia alpina*	N.E.Br.	LC	Indigenous; Endemic
Asteraceae	*Ursinia saxatilis*	N.E.Br.	LC	Indigenous
Asteraceae	*Ursinia tenuiloba*	DC.	LC	Indigenous
Lentibulariaceae	*Utricularia arenaria*	A.DC.	LC	Indigenous
Lentibulariaceae	*Utricularia livida*	E.Mey.	LC	Indigenous
Lentibulariaceae	*Utricularia prehensilis*	E.Mey.	LC	Indigenous
Fabaceae	*Vachellia karroo*	(Hayne) Banfi & Gallaso	LC	Indigenous
Fabaceae	*Vachellia sieberiana var. woodii*	(DC.) Kyal. & Boatwr.	LC	Indigenous
Valerianaceae	*Valeriana capensis var. capensis*	Thunb.	LC	Indigenous
Rubiaceae	*Vangueria infausta subsp. infausta*	Burch.	LC	Indigenous
Fabaceae	*Vigna schlechteri*	Harms	LC	Indigenous
Fabaceae	*Vigna unguiculata subsp. protracta*	(L.) Walp.	LC	Indigenous
Fabaceae	*Vigna unguiculata subsp. stenophylla*	(L.) Walp.	LC	Indigenous
Fabaceae	*Vigna unguiculata subsp. unguiculata*	(L.) Walp.	NE	Indigenous
Fabaceae	*Vigna vexillata var. angustifolia*	(L.) A.Rich.	LC	Indigenous
Fabaceae	*Vigna vexillata var. davyi*	(L.) A.Rich.	LC	Indigenous
Fabaceae	*Vigna vexillata var. ovata*	(L.) A.Rich.	LC	Indigenous
Fabaceae	*Vigna vexillata var. vexillata*	(L.) A.Rich.	LC	Indigenous
Santalaceae	*Viscum oreophilum*	Wiens		Indigenous
Santalaceae	*Viscum pauciflorum*	L.f.		Indigenous; Endemic
Santalaceae	*Viscum sp.*			
Santalaceae	*Viscum triflorum*	DC.		Indigenous
Lamiaceae	*Volkameria glabra*	(E.Mey.) Mabb. & Y.W.Yuan	LC	Indigenous
Campanulaceae	*Wahlenbergia epacridea*	Sond.	LC	Indigenous
Campanulaceae	*Wahlenbergia huttonii*	(Sond.) Thulin	LC	Indigenous
Campanulaceae	*Wahlenbergia krebsii subsp. krebsii*	Cham.	LC	Indigenous
Campanulaceae	*Wahlenbergia madagascariensis*	A.DC.	LC	Indigenous
Campanulaceae	*Wahlenbergia pinnata*	Compton	NT	Indigenous
Campanulaceae	*Wahlenbergia sp.*			

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Campanulaceae	*Wahlenbergia squamifolia*	Brehmer	LC	Indigenous
Campanulaceae	*Wahlenbergia undulata*	(L.f.) A.DC.	LC	Indigenous
Campanulaceae	*Wahlenbergia virgata*	Engl.	LC	Indigenous
Malvaceae	*Waltheria indica*	L.	LC	Indigenous
Iridaceae	*Watsonia bella*	N.E.Br. ex Goldblatt	LC	Indigenous
Iridaceae	*Watsonia latifolia*	N.E.Br. ex Oberm.	LC	Indigenous
Iridaceae	*Watsonia pulchra*	N.E.Br. ex Goldblatt	LC	Indigenous
Iridaceae	*Watsonia watsonioides*	(Baker) Oberm.	LC	Indigenous
Solanaceae	*Withania somnifera*	(L.) Dunal	LC	Indigenous
Colchicaceae	*Wurmbea kraussii*	Baker		Indigenous; Endemic
Convolvulaceae	*Xenostegia tridentata subsp. angustifolia*	(L.) D.F.Austin & Staples		Indigenous
Velloziaceae	*Xerophyta retinervis*	Baker	LC	Indigenous
Monimiaceae	*Xymalos monospora*	(Harv.) Baill.		Indigenous
Xyridaceae	*Xyris capensis*	Thunb.		Indigenous
Xyridaceae	*Xyris rehmannii*	L.A.Nilsson		Indigenous
Apocynaceae	*Xysmalobium acerateoides*	(Schltr.) N.E.Br.	LC	Indigenous
Apocynaceae	*Xysmalobium asperum*	N.E.Br.	LC	Indigenous
Apocynaceae	*Xysmalobium undulatum var. undulatum*	(L.) Aiton f.	LC	Indigenous
Scrophulariaceae	*Zaluzianskya elongata*	Hilliard & B.L.Burtt	LC	Indigenous
Scrophulariaceae	*Zaluzianskya natalensis*	Bernh.	LC	Indigenous
Araceae	*Zantedeschia albomaculata subsp. albomaculata*	(Hook.) Baill.	LC	Indigenous
Araceae	*Zantedeschia rehmannii*	Engl.	LC	Indigenous
Rutaceae	*Zanthoxylum davyi*	(I.Verd.) P.G.Waterman	LC	Indigenous
Rhamnaceae	*Ziziphus mucronata subsp. mucronata*	Willd.		Indigenous
Fabaceae	*Zornia capensis subsp. capensis*	Pers.	LC	Indigenous

Appendix C: Mammal species expected to occur in the project area as per the IUCN (2019). Red text shows theSCCs.

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Aepyceros melampus	Impala	LC	LC
Aethomys ineptus	Tete Veld Rat	LC	LC
Aethomys namaquensis	Namaqua rock rat	LC	LC
Amblysomus hottentotus	Hottentot's Golden Mole	LC	LC
Amblysomus septentrionalis	Highveld Golden Mole	NT	NT
Aonyx capensis	Cape Clawless Otter	NT	NT
Atilax paludinosus	Water Mongoose	LC	LC
Canis mesomelas	Black-backed Jackal	LC	LC
Caracal caracal	Caracal	LC	LC
Cephalophus natalensis	Natal Red Duiker	NT	LC
Ceratotherium simum	White Rhinoceros	NT	NT
Chaerephon ansorgei	Ansorge's Free-tailed Bat	LC	LC
Chaerephon pumilus	Little Free-tailed Bat	LC	LC
Chlorocebus pygerythrus	Vervet Monkey	LC	LC
Civettictis civetta	African Civet	LC	LC
Cloeotis percivali	Short-eared Trident Bat	EN	LC
Connochaetes gnou	Black Wildebeest	LC	LC
Connochaetes taurinus	Blue Wildebeest	LC	LC
Crocidura cyanea	Reddish-grey Musk Shrew	LC	LC
Crocidura flavescens	Greater Red Musk Shrew	LC	LC
Crocidura maquassiensis	Makwassie musk shrew	VU	LC
Crocidura mariquensis	Swamp Musk Shrew	NT	LC
Crocidura silacea	Lesser Grey-brown Musk Shrew	LC	LC
Cryptomys hottentotus	Common Mole-rat	LC	LC
Damaliscus lunatus	Tsessebe	VU	LC
Damaliscus pygargus	Blesbok	LC	LC
Dasymys incomtus	African Marsh rat	NT	LC
Dendromus melanotis	Grey Climbing Mouse	LC	LC
Dendromus mesomelas	Brant's Climbing Mouse	LC	LC
Dendromus mystacalis	Chestnut Climbing Mouse	LC	LC
Diceros bicornis	Black Rhinoceros	EN	CR
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT
Epomophorus wahlbergi	Wahlberg's epauletted fruit bat	LC	LC
Eptesicus hottentotus	Long-tailed Serotine Bat	LC	LC
Equus quagga	Plains Zebra	LC	NT
Felis silvestris	African Wildcat	LC	LC
Galago moholi	Southern Lesser Galago	LC	LC
Genetta maculata	Rusty-spotted Genet	LC	LC
Graphiurus platyops	Rock Dormouse	LC	LC
Graphiurus rupicola	Stone Dormouse	NT	LC
Helogale parvula	Dwarf Mongoose	LC	LC
Herpestes icheumon	Large Grey Mongoose	LC	LC

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Herpestes ichneumon	Large Grey Mongoose	LC	LC
Herpestes pulverulentus	Cape Grey Mongoose	LC	LC
Herpestes sanguineus	Slender Mongoose	LC	LC
Hippopotamus amphibius	Hippopotamus	LC	VU
Hipposideros caffer	Sundevall's Leaf-nosed Bat	LC	LC
Hystrix africaeaustralis	Cape Porcupine	LC	LC
Ichneumia albicauda	White-tailed Mongoose	LC	LC
Ictonyx striatus	Striped Polecat	LC	LC
Kerivoula lanosa	Lesser Woolly Bat	LC	LC
Kobus ellipsiprymnus	Common Waterbuck	LC	LC
Lemniscomys rosalia	Single-striped Mouse	LC	LC
Leptailurus serval	Serval	NT	LC
Lepus capensis	Cape Hare	LC	LC
Lepus saxatilis	Scrub Hare	LC	LC
Lepus victoriae	African Savanna Hare	LC	LC
Mastomys natalensis	Natal Multimammate Mouse	LC	LC
Mellivora capensis	Honey Badger	LC	LC
Mungos mungo	Banded Mongoose	LC	LC
Mus minutoides	Pygmy Mouse	LC	LC
Mus musculus	House Mouse	Unlisted	LC
Myosorex varius	Forest Shrew	LC	LC
Myotis welwitschii	Welwitsch's Hairy Bat	LC	LC
Neoromicia capensis	Cape Serotine Bat	LC	LC
Neoromicia zuluensis	Aloe Bat	LC	LC
Oreotragus oreotragus	Klipspringer	LC	LC
Orycteropus afer	Aardvark	LC	LC
Otolemur crassicaudatus	Thick-tailed Bushbaby	LC	LC
Otomys angoniensis	Angoni Vlei Rat	LC	LC
Otomys irroratus	Vlei Rat (Fynbos type)	LC	LC
Ourebia ourebi	Oribi	EN	LC
Panthera pardus	Leopard	VU	VU
Papio ursinus	Chacma Baboon	LC	LC
Parahyaena brunnea	Brown Hyaena	NT	NT
Pelea capreolus	Grey Rhebok	NT	LC
Petrodromus tetradactylus	Four-toed Sengi	LC	LC
Pipistrellus anchietae	Anchieta's Bat	LC	LC
Pipistrellus hesperidus	African Pipistrelle	LC	LC
Poecilogale albinucha	African Striped Weasel	NT	LC
Potamochoerus larvatus	Bushpig	LC	LC
Procavia capensis	Rock Hyrax	LC	LC
Pronolagus crassicaudatus	Natal Red Rock Rabbit	LC	LC
Pronolagus saundersiae	Hewitt's Red Rock Rabbit	LC	LC
Proteles cristata	Aardwolf	LC	LC
Raphicerus campestris	Steenbok	LC	LC
Rattus rattus	House Rat	Exotic (Not listed)	LC

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Redunca arundinum	Southern Reedbuck	LC	LC
Redunca fulvorufula	Mountain Reedbuck	EN	LC
Rhabdomys pumilio	Xeric Four-striped Mouse	LC	LC
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	LC	LC
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	LC
Rhinolophus simulator	Bushveld Horseshoe Bat	LC	LC
Rhinolophus swinnyi	Swinny's horseshoe bat	VU	LC
Rousettus aegyptiacus	Egyptian Fruit Bat	LC	LC
Scotophilus dinganii	Yellow House Bat	LC	LC
Steatomys pratensis	Fat Mouse	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC
Syncerus caffer	African Buffalo	LC	LC
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	LC
Taphozous mauritianus	Mauritian Tomb Bat	LC	LC
Thryonomys swinderianus	Greater Cane Rat	LC	LC
Tragelaphus oryx	Eland	LC	LC
Tragelaphus scriptus	Cape Bushbuck	LC	LC
Tragelaphus strepsiceros	Greater Kudu	LC	LC
Vulpes chama	Cape Fox	LC	LC

Appendix D: Expected Reptile species in the project area

Species	Common Name	Conservation Status Regional (ESKOM 2015)	IUCN (2019)
Acontias plumbeus	Giant Legless Skink	LC	LC
Afroedura major	Swazi Flat Gecko	NT	NT
Afroedura marleyi	Marley's Flat Gecko	LC	LC
Afrotyphlops bibronii	Bibron's Blind Snake	LC	LC
Afrotyphlops schlegelii	Schlegel's Beaked Blind Snake	LC	Unlisted
Agama aculeata distanti	Eastern Ground Agama	LC	LC
Amblyodipsas concolor	Kwazulu-Natal Purple-Glossed Snake	LC	LC
Amblyodipsas polylepsis polylepsis	Common Purple-Glossed Snake	LC	LC
Aparallactus capensis	Black-headed Centipede-eater	LC	LC
Aspidelaps scutatus intermedius	Intermedius Shield Snake	LC	Unlisted
Atractaspis bibronii	Bibron's Stiletto Snake	LC	Unlisted
Bitis arietans arietans	Puff Adder	LC	Unlisted
Boaedon capensis	Brown House Snake	LC	LC
Bradypodion transvaalense	Nothern Dwarf Chameleon	LC	LC
Broadleysaurus major	Rough-scaled Plated Lizard	LC	Unlisted
Causus defilippii	Snouted Night Adder	LC	Unlisted
Causus rhombeatus	Rhombic Night Adder	LC	LC
Chamaeleo dilepis	Common Flap-neck Chameleon	LC	LC
Chamaesaura aenea	Coppery Grass Lizard	NT	NT
Chamaesaura anguina anguina	Cape Grass Lizard	LC	Unlisted
Chamaesaura macrolepis	Large-scaled Grass Lizard	NT	NT
Chondrodactylus turneri	Turner's Gecko	LC	Unlisted
Cordylus jonesii	Jones' Girdled Lizard	LC	Unlisted
Cordylus vittifer	Common Girdled Lizard	LC	LC
Crocodylus niloticus	Nile Crocodile	VU	LC
Crotaphopeltis hotamboeia	Red-lipped Snake	LC	Unlisted
Dasypeltis inornata	Southern Brown Egg-eater	LC	LC
Dasypeltis scabra	Common egg eater	LC	LC
Dendroaspis polylepis	Black Mamba	LC	LC
Dipsadoboa aulica	Marbled Tree Snake	LC	Unlisted
Dispholidus typus typus	Boomslang	LC	Unlisted
Duberria lutrix	Common Slug-eater	LC	LC
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	LC	Unlisted
Gonionotophis capensis	Common File Snake	LC	LC
Gonionotophis nyassae	Black File Snake	LC	LC
Hemachatus haemachatus	Rinkhals	LC	LC
Hemidactylus mabouia	Common Tropical House Gecko	LC	Unlisted
Homopholis wahlbergii	Wahlberg's velvet Gecko	LC	LC
Homoroselaps lacteus	Spotted Harlequin Snake	LC	LC
Homoroselaps lacteus	Spotted Harlequin Snake	LC	LC
Inyoka swazicus	Swazi Rock Snake	LC	LC
Kinixys natalensis	KwaZulu Natal Hinged-Back Tortoise	LC	NT

Species	Common Name	Conservation Status Regional (ESKOM 2015)	IUCN (2019)
Kinixys Spekii	Speke's Hinged-Back Tortoise	LC	Unlisted
Lamprophis aurora	Aurora House Snake	LC	LC
Lamprophis fuscus	Yellow-bellied House Snake	LC	LC
Lamprophis guttatus	Spotted Rock Snake	LC	LC
Leptotyphlops distanti	Distant's Tread Snake	LC	LC
Leptotyphlops nigricans	Black Thread Snake	LC	LC
Leptotyphlops scutifrons scutifrons	Peters' Thread Snake	LC	Unlisted
Limaformosa capensis	Common File Snake	LC	Unlisted
Lycodonomorphus inornatus	Olive House Snake	LC	LC
Lycodonomorphus laevissimus	Dusky-bellied Water Snake	LC	LC
Lycodonomorphus rufulus	Brown Water Snake	LC	Unlisted
Lycophidion capense capense	Cape Wolf Snake	LC	Unlisted
Lygodactylus capensis capensis	Common Dwarf Gecko	LC	Unlisted
Lygodactylus ocellatus	Spotted Dwarf Gecko	LC	LC
Matobosaurus validus	Common Giant Plated Lizard	LC	Unlisted
Naja annulifera	Snouted Cobra	LC	Unlisted
Naja mossambica	Mozambique Spitting Cobra	LC	Unlisted
Nucras holubi	Holub's Sandveld Lizard	LC	Unlisted
Nucras lalandii	Delalande's Sandveld Lizard	LC	LC
Nucras ornata	Ornate Sandveld Lizard	LC	Unlisted
Pachydactylus maculatus	Spotted Gecko	LC	LC
Pachydactylus vansoni	VAN Son's Gecko	LC	LC
Panaspis wahlbergii	Wahlberg's Snake-eyed Skink	LC	Unlisted
Pelomedusa subrufa	Central Marsh Terrapin	LC	Unlisted
Pelusios sinuatus	Serrated Hinged Terrapin	LC	Unlisted
Philothamnus hoplogaster	South Eastern Green Snake	LC	Unlisted
Philothamnus natalensis occidentalis	Western Natal Green Snake	LC	Unlisted
Philothamnus semivariegatus	Spotted Bush Snake	LC	Unlisted
Platysaurus intermedius natalensis	Kwazulu-Natal Flat Lizard	LC	LC
Platysaurus lebomboensis	Lebombo Flat Lizard	LC	LC
Prosymna ambigua	Angolan Shovel-snout	Unlisted	LC
Prosymna stuhlmannii	East African Shovel-snout	LC	LC
Psammophis brevirostris	Short-snouted Grass Snake	LC	Unlisted
Psammophis crucifer	Cross-marked Grass Snake	LC	LC
Psammophis mossambicus	Olive Grass Snake	LC	Unlisted
Psammophis subtaeniatus	Stripe-bellied Sand Snake	LC	LC
Psammophis trinasalis	Fork-marked Sand Snake	LC	Unlisted
Psammophylax rhombeatus rhombeatus	Spotted Grass Snake	LC	Unlisted
Pseudaspis cana	Mole Snake	LC	Unlisted
Pseudocordylus melanotus melanotus	Common Crag Lizard	LC	LC
Python natalensis	Southern African Python	LC	Unlisted
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	LC	Unlisted
Scelotes bidigittatus	Lowveld Dwarf Burrowing Skink	LC	LC
Scelotes mirus	Montane Dwarf Burrowing Skink	LC	LC

Species	Common Name	Conservation Status	
		Regional (ESKOM 2015)	IUCN (2019)
Scelotes mossambicus	Mozambique Dwarf Burrowing Skink	LC	LC
Smaug barbertonensis	Baberton Girdled Lizard	Unlisted	LC
Smaug warreni warreni	Warren's Dragon Lizard	LC	LC
Stigmochelys pardalis	Leopard Tortoise	LC	LC
Telescopus semiannulatus semiannulatus	Eastern Tiger Snake	LC	Unlisted
Tetradactylus africanus	Eastern Long-tailed Seps	LC	LC
Thelotornis capensis	Southern Twig Snake	LC	LC
Trachylepis capensis	Cape Skink	LC	Unlisted
Trachylepis margaritifer	Rainbow Skink	LC	LC
Trachylepis occidentalis	Western Three-striped Skink	LC	Unlisted
Trachylepis punctatissima	Speckled Rock Skink	LC	LC
Trachylepis striata	Striped Skink	LC	Unlisted
Trachylepis varia	Variable Skink	LC	LC
Varanus albigularis albigularis	Southern Rock Monitor	LC	Unlisted
Varanus niloticus	Water Monitor	LC	Unlisted
Zygaspis vandami	Van Dam's Dwarf Worm Lizard	LC	Unlisted

Appendix E: Amphibian species recorded in the project area

Species	Common Name	Conservation Status Regional (ESKOM, 2015)	IUCN (2019)
Afrixalus aureus	Golden Leaf-folding Frog	LC	LC
Amietia delalandii	Delalande's River Frog	LC	Unlisted
Breviceps adspersus	Bushveld Rain Frog	LC	LC
Breviceps mossambicus	Mozambique Rain Frog	LC	LC
Breviceps sopranus	Whistling Rain Frog	DD	LC
Breviceps verrucosus	Plaintive Rain Frog	LC	LC
Cacosternum boettgeri	Common Caco	LC	LC
Cacosternum nanum nanum	Bronze Caco	LC	LC
Cacosternum nanum parvum	Mountain Caco	LC	LC
Chiromantis xerampelina	Southern Foam Nest Frog	LC	LC
Hadromophryne natalensis	Natal Ghost Frog	LC	LC
Hemisus marmoratus	Mottled Shovel-nosed Frog	LC	LC
Hyperolius marmoratus	Painted Reed Frog	LC	LC
Hyperolius pusillus	Water Lily Frog	LC	LC
Hyperolius semidiscus	Yellowstriped Reed Frog	LC	LC
Hyperolius tuberilinguis	Tinker Reed Frog	LC	LC
Kassina senegalensis	Bubbling Kassina	LC	LC
Leptopelis mossambicus	Mozambique forest tree frog	LC	LC
Phlyctimantis maculatus	Redlegged Kassina	LC	Unlisted
Phrynobatrachus mababiensis	Dwarf Puddle Frog	LC	LC
Phrynobatrachus natalensis	Snoring Puddle Frog	LC	LC
Phrynomantis bifasciatus	Banded Rubber Frog	LC	LC
Poyntonophrynus fenoulheti	Northern Pygmy Toad	LC	LC
Ptychadena anchietae	Plain Grass Frog	LC	LC
Ptychadena mossambica	Broad-banded Grass Frog	LC	LC
Ptychadena oxyrhynchus	Sharp-nosed Grass Frog	LC	LC
Ptychadena porosissima	Striped Grass Frog	LC	LC
Pyxicephalus edulis	African Bullfrog	LC	LC
Schismaderma carens	African Red Toad	LC	LC
Schismaderma carens	Red Toad	LC	LC
Sclerophrys capensis	Raucous Toad	LC	LC
Sclerophrys garmani	Olive Toad	LC	LC
Sclerophrys gutturalis	Guttural Toad	LC	LC
Sclerophrys pusilla	Flatbacked Toad	LC	LC
Semnodactylus wealii	Rattling Frog	LC	LC
Strongylopus fasciatus	Striped Stream Frog	LC	LC
Strongylopus grayii	Clicking Stream Frog	LC	LC
Tomopterna cryptotis	Tremelo Sand Frog	LC	LC
Tomopterna krugerensis	Knocking Sand Frog	LC	LC
Tomopterna marmorata	Russet-backed Sand Frog	LC	LC
Tomopterna natalensis	Natal Sand Frog	LC	LC
Xenopus laevis	Common Platanna	LC	LC
Xenopus muelleri	Müller's Platanna	LC	LC

Appendix F: Expected Avifauna in the project area. Red text shows the expected SCCs

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Accipiter melanoleucus	Sparrowhawk, Black	Unlisted	LC
Accipiter minullus	Sparrowhawk, Little	Unlisted	LC
Accipiter rufiventris	Sparrowhawk, Rufous-breasted	Unlisted	LC
Accipiter tachiro	Goshawk, African	Unlisted	LC
Acridotheres tristis	Myna, Common	Unlisted	LC
Acrocephalus baeticatus	Reed-warbler, African	Unlisted	Unlisted
Acrocephalus gracilirostris	Swamp-warbler, Lesser	Unlisted	LC
Actitis hypoleucos	Sandpiper, Common	Unlisted	LC
Actophilornis africanus	Jacana, African	Unlisted	LC
Alcedo cristata	Kingfisher, Malachite	Unlisted	Unlisted
Alcedo semitorquata	Kingfisher, Half-collared	NT	LC
Alopochen aegyptiacus	Goose, Egyptian	Unlisted	LC
Amandava subflava	Waxbill, Orange-breasted	Unlisted	Unlisted
Amaurornis flavirostris	Crake, Black	Unlisted	LC
Amblyospiza albifrons	Weaver, Thick-billed	Unlisted	LC
Anas erythrorhyncha	Teal, Red-billed	Unlisted	LC
Anas sparsa	Duck, African Black	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Anastomus lamelligerus	Openbill, African	Unlisted	LC
Andropadus importunus	Greenbul, Sombre	Unlisted	LC
Anhinga rufa	Darter, African	Unlisted	LC
Anomalospiza imberbis	Finch, Cuckoo	Unlisted	LC
Anthropoides paradiseus	Crane, Blue	NT	VU
Anthus cinnamomeus	Pipit, African	Unlisted	LC
Anthus leucophrys	Pipit, Plain-backed	Unlisted	LC
Anthus lineiventris	Pipit, Striped	Unlisted	LC
Anthus similis	Pipit, Long-billed	Unlisted	LC
Apalis flavida	Apalis, Yellow-breasted	Unlisted	LC
Apalis thoracica	Apalis, Bar-throated	Unlisted	LC
Apaloderma narina	Trogon, Narina	Unlisted	LC
Aplopelia larvata	Dove, Lemon	Unlisted	LC
Apus affinis	Swift, Little	Unlisted	LC
Apus barbatus	Swift, African Black	Unlisted	LC
Apus caffer	Swift, White-rumped	Unlisted	LC
Apus horus	Swift, Horus	Unlisted	LC
Aquila verreauxii	Eagle, Verreaux's	VU	LC
Aquila wahlbergi	Eagle, Wahlberg's	Unlisted	LC
Ardea cinerea	Heron, Grey	Unlisted	LC
Ardea melanocephala	Heron, Black-headed	Unlisted	LC
Ardea purpurea	Heron, Purple	Unlisted	LC
Aviceda cuculoides	Hawk, African Cuckoo	Unlisted	LC
Balearica regulorum	Crane, Grey Crowned	EN	EN
Batis capensis	Batis, Cape	Unlisted	LC

Batis molitor	Batis, Chinspot	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bradornis pallidus	Flycatcher, Pale	Unlisted	LC
Bradypterus baboecala	Rush-warbler, Little	Unlisted	LC
Bubo africanus	Eagle-owl, Spotted	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC
Burhinus vermiculatus	Thick-knee, Water	Unlisted	LC
Buteo rufofuscus	Buzzard, Jackal	Unlisted	LC
Buteo vulpinus	Buzzard, Steppe	Unlisted	Unlisted
Butorides striata	Heron, Green-backed	Unlisted	LC
Bycanistes bucinator	Hornbill, Trumpeter	Unlisted	LC
Calendulauda sabota	Lark, Sabota	Unlisted	LC
Camaroptera brachyura	Camaroptera, Green-backed	Unlisted	LC
Camaroptera brevicaudata	Camaroptera, Grey-backed	Unlisted	Unlisted
Campephaga flava	Cuckoo-shrike, Black	Unlisted	LC
Campethera abingoni	Woodpecker, Golden-tailed	Unlisted	LC
Caprimulgus pectoralis	Nightjar, Fiery-necked	Unlisted	LC
Caprimulgus tristigma	Nightjar, Freckled	Unlisted	LC
Centropus burchellii	Coucal, Burchell's	Unlisted	Unlisted
Centropus superciliosus	Coucal, White-browed	Unlisted	LC
Cercomela familiaris	Chat, Familiar	Unlisted	LC
Cercotrichas leucophrys	Scrub-robin, White-browed	Unlisted	LC
Certhilauda benguelensis	Lark, Benguela Long-billed	Unlisted	Unlisted
Certhilauda curvirostris	Lark, Cape Long-billed	Unlisted	LC
Certhilauda semitorquata	Lark, Eastern Long-billed	Unlisted	LC
Certhilauda subcoronata	Lark, Karoo Long-billed	Unlisted	LC
Ceryle rudis	Kingfisher, Pied	Unlisted	LC
Chalcomitra amethystina	Sunbird, Amethyst	Unlisted	LC
Chalcomitra senegalensis	Sunbird, Scarlet-chested	Unlisted	LC
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC
Chloropeta natalensis	Warbler, Dark-capped Yellow	Unlisted	LC
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC
Chrysococcyx cupreus	Cuckoo, African Emerald	Unlisted	LC
Chrysococcyx klaas	Cuckoo, Klaas's	Unlisted	LC
Ciconia ciconia	Stork, White	Unlisted	LC
Ciconia nigra	Stork, Black	VU	LC
Cinnyricinclus leucogaster	Starling, Violet-backed	Unlisted	LC
Cinnyris afer	Sunbird, Greater Double-collared	Unlisted	LC
Cinnyris chalybeus	Sunbird, Southern Double-collared	Unlisted	LC
Cinnyris mariquensis	Sunbird, Marico	Unlisted	LC
Cinnyris talatala	Sunbird, White-bellied	Unlisted	LC
Circaetus pectoralis	Snake-eagle, Black-chested	Unlisted	LC
Circus ranivorus	Marsh-harrier, African	EN	LC
Cisticola aberrans	Cisticola, Lazy	Unlisted	LC
Cisticola ayresii	Cisticola, Wing-snapping	Unlisted	LC
Cisticola chiniana	Cisticola, Rattling	Unlisted	LC

Cisticola erythrops	Cisticola, Red-faced	Unlisted	LC
Cisticola fulvicapilla	Neddicky, Neddicky	Unlisted	LC
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC
Cisticola lais	Cisticola, Wailing	Unlisted	LC
Cisticola natalensis	Cisticola, Croaking	Unlisted	LC
Cisticola textrix	Cisticola, Cloud	Unlisted	LC
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC
Coccopygia melanotis	Waxbill, Swee	Unlisted	LC
Colius striatus	Mousebird, Speckled	Unlisted	LC
Columba arquatrix	Olive-pigeon, African	Unlisted	LC
Columba guinea	Pigeon, Speckled	Unlisted	LC
Columba livia	Dove, Rock	Unlisted	LC
Coracias garrulus	Roller, European	NT	LC
Corvus albicollis	Raven, White-necked	Unlisted	LC
Corvus albus	Crow, Pied	Unlisted	LC
Corvus capensis	Crow, Cape	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Cossypha dichroa	Robin-Chat, Chorister	Unlisted	LC
Cossypha heuglini	Robin-Chat, White-browed	Unlisted	LC
Cossypha natalensis	Robin-chat, Red-capped	Unlisted	LC
Coturnix coturnix	Quail, Common	Unlisted	LC
Creatophora cinerea	Starling, Wattled	Unlisted	LC
Crithagra gularis	Seedeater, Streaky-headed	Unlisted	LC
Crithagra mozambica	Canary, Yellow-fronted	Unlisted	LC
Crithagra scotops	Canary, Forest	Unlisted	LC
Crithagra sulphurata	Canary, Brimstone	Unlisted	Unlisted
Cuculus clamosus	Cuckoo, Black	Unlisted	LC
Cuculus gularis	Cuckoo, African	Unlisted	LC
Cuculus solitarius	Cuckoo, Red-chested	Unlisted	LC
Cyanomitra olivacea	Sunbird, Olive	Unlisted	LC
Cypsiurus parvus	Palm-swift, African	Unlisted	LC
Delichon urbicum	House-martin, Common	Unlisted	LC
Dendrocygna viduata	Duck, White-faced Whistling	Unlisted	LC
Dendropicos fuscescens	Woodpecker, Cardinal	Unlisted	LC
Dendropicos griseocephalus	Woodpecker, Olive	Unlisted	LC
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Dicrurus ludwigii	Drongo, Square-tailed	Unlisted	
Dryoscopus cubla	Puffback, Black-backed	Unlisted	LC
Egretta alba	Egret, Great	Unlisted	LC
Egretta garzetta	Egret, Little	Unlisted	LC
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC
Emberiza capensis	Bunting, Cape	Unlisted	LC
Emberiza flaviventris	Bunting, Golden-breasted	Unlisted	LC
Emberiza tahapisi	Bunting, Cinnamon-breasted	Unlisted	LC
Estrilda astrild	Waxbill, Common	Unlisted	LC
Euplectes albonotatus	Widowbird, White-winged	Unlisted	LC
Euplectes ardens	Widowbird, Red-collared	Unlisted	LC

Euplectes axillaris	Widowbird, Fan-tailed	Unlisted	LC
Euplectes capensis	Bishop, Yellow	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Euplectes progne	Widowbird, Long-tailed	Unlisted	LC
Falco amurensis	Falcon, Amur	Unlisted	LC
Falco biarmicus	Falcon, Lanner	VU	LC
Falco peregrinus	Falcon, Peregrine	Unlisted	LC
Falco rupicolus	Kestrel, Rock	Unlisted	LC
Falco subbuteo	Hobby, Eurasian	Unlisted	LC
Fulica cristata	Coot, Red-knobbed	Unlisted	LC
Gallinago nigripennis	Snipe, African	Unlisted	LC
Gallinula chloropus	Moorhen, Common	Unlisted	LC
Gallirex porphyreolophus	Turaco, Purple-crested	Unlisted	LC
Geocolaptes olivaceus	Woodpecker, Ground	Unlisted	NT
Geronticus calvus	Ibis, Southern Bald	VU	VU
Guttera edouardi	Guineafowl, Crested	Unlisted	LC
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC
Hedydipna collaris	Sunbird, Collared	Unlisted	LC
Hirundo abyssinica	Swallow, Lesser Striped	Unlisted	LC
Hirundo albigularis	Swallow, White-throated	Unlisted	LC
Hirundo atrocaerulea	Swallow, Blue	CR	VU
Hirundo cucullata	Swallow, Greater Striped	Unlisted	LC
Hirundo fuligula	Martin, Rock	Unlisted	Unlisted
Hirundo rustica	Swallow, Barn	Unlisted	LC
Hirundo semirufa	Swallow, Red-breasted	Unlisted	LC
Hirundo smithii	Swallow, Wire-tailed	Unlisted	LC
Indicator indicator	Honeyguide, Greater	Unlisted	LC
Indicator minor	Honeyguide, Lesser	Unlisted	LC
Indicator variegatus	Honeyguide, Scaly-throated	Unlisted	LC
Ispidina picta	Pygmy-Kingfisher, African	Unlisted	LC
Jynx ruficollis	Wryneck, Red-throated	Unlisted	LC
Kaupifalco monogrammicus	Buzzard, Lizard	Unlisted	LC
Lagonosticta rubricata	Firefinch, African	Unlisted	LC
Lagonosticta senegala	Firefinch, Red-billed	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Laniarius ferrugineus	Boubou, Southern	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Lanius collurio	Shrike, Red-backed	Unlisted	LC
Lanius minor	Shrike, Lesser Grey	Unlisted	LC
Lioptilus nigricapillus	Blackcap, Bush	VU	NT
Lissotis melanogaster	Bustard, Black-bellied	Unlisted	LC
Lophaetus occipitalis	Eagle, Long-crested	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Macronyx capensis	Longclaw, Cape	Unlisted	LC
Macronyx croceus	Longclaw, Yellow-throated	Unlisted	LC
Malaconotus blanchoti	Bush-shrike, Grey-headed	Unlisted	LC

Mandingoa nitidula	Twinspot, Green	Unlisted	LC
Megaceryle maximus	Kingfisher, Giant	Unlisted	Unlisted
Melaenornis pammelaina	Flycatcher, Southern Black	Unlisted	LC
Merops apiaster	Bee-eater, European	Unlisted	LC
Merops bullockoides	Bee-eater, White-fronted	Unlisted	LC
Merops hirundineus	Bee-eater, Swallow-tailed	Unlisted	LC
Merops pusillus	Bee-eater, Little	Unlisted	LC
Milvus aegyptius	Kite, Yellow-billed	Unlisted	Unlisted
Milvus migrans	Kite, Black	Unlisted	LC
Mirafra africana	Lark, Rufous-naped	Unlisted	LC
Monticola explorator	Rock-thrush, Sentinel	Unlisted	LC
Monticola rupestris	Rock-thrush, Cape	Unlisted	LC
Motacilla aguimp	Wagtail, African Pied	Unlisted	LC
Motacilla capensis	Wagtail, Cape	Unlisted	LC
Motacilla clara	Wagtail, Mountain	Unlisted	LC
Muscicapa adusta	Flycatcher, African Dusky	Unlisted	LC
Muscicapa caerulescens	Flycatcher, Ashy	Unlisted	LC
Muscicapa striata	Flycatcher, Spotted	Unlisted	LC
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC
Nectarinia famosa	Sunbird, Malachite	Unlisted	LC
Nicator gularis	Nicator, Eastern	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Nycticorax nycticorax	Night-Heron, Black-crowned	Unlisted	LC
Oena capensis	Dove, Namaqua	Unlisted	LC
Oenanthe bifasciata	Chat, Buff-streaked	Unlisted	LC
Oenanthe monticola	Wheatear, Mountain	Unlisted	LC
Onychognathus morio	Starling, Red-winged	Unlisted	LC
Oriolus larvatus	Oriole, Black-headed	Unlisted	LC
Ortygospiza atricollis	Quailfinch, African	Unlisted	LC
Parus niger	Tit, Southern Black	Unlisted	Unlisted
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Passer griseus	Sparrow, Northern Grey-headed	Unlisted	LC
Peliperdix coqui	Francolin, Coqui	Unlisted	LC
Pentholaea arnotti	Chat, Arnot’s	Unlisted	Unlisted
Petronia superciliaris	Petronia, Yellow-throated	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC
Phalacrocorax carbo	Cormorant, White-breasted	LC	LC
Philomachus pugnax	Ruff	Unlisted	LC
Phoeniculus purpureus	Wood-hoopoe, Green	Unlisted	LC
Phyllastrephus terrestris	Brownbul, Terrestrial	Unlisted	LC
Phylloscopus ruficapilla	Warbler, Yellow-throated Woodland	Unlisted	LC
Phylloscopus trochilus	Warbler, Willow	Unlisted	LC
Platalea alba	Spoonbill, African	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Plegadis falcinellus	Ibis, Glossy	Unlisted	LC
Ploceus capensis	Weaver, Cape	Unlisted	LC

Ploceus cucullatus	Weaver, Village	Unlisted	LC
Ploceus intermedius	Masked-weaver, Lesser	Unlisted	LC
Ploceus ocularis	Weaver, Spectacled	Unlisted	LC
Ploceus velatus	Southern Masked-weaver, Southern	Unlisted	LC
Ploceus xanthops	Weaver, African (Holub's) Golden	Unlisted	LC
Podica senegalensis	Finfoot, African	VU	LC
Pogoniulus bilineatus	Tinkerbird, Yellow-rumped	Unlisted	LC
Pogonocichla stellata	Robin, White-starred	Unlisted	LC
Polemaetus bellicosus	Eagle, Martial	EN	VU
Polyboroides typus	Harrier-Hawk, African	Unlisted	LC
Porphyrio madagascariensis	Swamphen, African Purple	Unlisted	Unlisted
Prinia hypoxantha	Prinia, Drakensberg	Unlisted	LC
Prinia maculosa	Prinia, Karoo	Unlisted	LC
Prinia subflava	Prinia, Tawny-flanked	Unlisted	LC
Prionops plumatus	Helmet-shrike, White-crested	Unlisted	LC
Prodotiscus regulus	Honeybird, Brown-backed	Unlisted	LC
Promerops gurneyi	Sugarbird, Gurney's	Unlisted	NT
Psalidoprocne holomelaena	Saw-wing, Black (Southern race)	Unlisted	Unlisted
Pseudhirundo griseopyga	Swallow, Grey-rumped	Unlisted	LC
Psophocichla litsipsirupa	Thrush, Groundscraper	Unlisted	Unlisted
Pternistis natalensis	Spurfowl, Natal	Unlisted	LC
Pternistis swainsonii	Spurfowl, Swainson's	Unlisted	LC
Pycnonotus tricolor	Bulbul, Dark-capped	Unlisted	Unlisted
Rallus caerulescens	Rail, African	Unlisted	LC
Riparia cincta	Martin, Banded	Unlisted	LC
Riparia paludicola	Martin, Brown-throated	Unlisted	LC
Sagittarius serpentarius	Secretarybird	VU	VU
Sarothrura elegans	Flufftail, Buff-spotted	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Schoenicola brevirostris	Warbler, Broad-tailed	NT	LC
Scleroptila levaillantii	Francolin, Red-winged	LC	LC
Scleroptila shelleyi	Francolin, Shelley's	Unlisted	LC
Scopus umbretta	Hamerkop, Hamerkop	Unlisted	LC
Serinus canicollis	Canary, Cape	Unlisted	LC
Sigelus silens	Flycatcher, Fiscal	Unlisted	LC
Spermestes bicolor	Mannikin, Black and White	LC	LC
Spermestes cucullatus	Mannikin, Bronze	Unlisted	Unlisted
Spermestes fringilloides	Mannikin, Magpie	NT	LC
Sphenoeacus afer	Grassbird, Cape	Unlisted	LC
Spreo bicolor	Starling, Pied	Unlisted	LC
Stephanoaetus coronatus	Eagle, African Crowned	VU	NT
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Strix woodfordii	Owl, African Wood	Unlisted	LC
Struthio camelus	Ostrich, Common	Unlisted	LC
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC

Tachymarptis melba	Swift, Alpine	Unlisted	LC
Tchagra senegalus	Tchagra, Black-crowned	Unlisted	LC
Tchagra tchagra	Tchagra, Southern	Unlisted	LC
Telophorus olivaceus	Bush-shrike, Olive	Unlisted	LC
Telophorus quadricolor	Bush-shrike, Gorgeous	Unlisted	LC
Telophorus sulfureopectus	Bush-shrike, Orange-breasted	Unlisted	LC
Telophorus zeylonus	Bokmakierie, Bokmakierie	Unlisted	LC
Terpsiphone viridis	Paradise-flycatcher, African	Unlisted	LC
Thamnolaea cinnamomeiventris	Cliff-chat, Mocking	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Treron calvus	Green-pigeon, African	Unlisted	LC
Tringa glareola	Sandpiper, Wood	Unlisted	LC
Tringa nebularia	Greenshank, Common	Unlisted	LC
Trochocercus cyanomelas	Crested-Flycatcher, Blue-mantled	Unlisted	LC
Turdoides jardineii	Babbler, Arrow-marked	Unlisted	LC
Turdus libonyanus	Thrush, Kurrichane	Unlisted	Unlisted
Turdus olivaceus	Thrush, Olive	Unlisted	LC
Turdus smithi	Thrush, Karoo	Unlisted	LC
Turnix sylvaticus	Buttonquail, Kurrichane	Unlisted	LC
Turtur chalcospilos	Wood-dove, Emerald-spotted	Unlisted	LC
Turtur tympanistria	Dove, Tambourine	Unlisted	LC
Tyto alba	Owl, Barn	Unlisted	LC
Upupa africana	Hoopoe, African	Unlisted	LC
Uraeginthus angolensis	Waxbill, Blue	Unlisted	LC
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vanellus melanopterus	Lapwing, Black-winged	Unlisted	LC
Vanellus senegallus	Lapwing, African Wattled	Unlisted	LC
Vidua funerea	Indigobird, Dusky	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC
Zosterops pallidus	White-eye, Orange River	Unlisted	LC
Zosterops virens	White-eye, Cape	Unlisted	LC

Appendix G: Riverine Ecological Flow Discussion - Proposed Nondvo Dam Project

Riverine Ecological Flow Discussion - Proposed Nondvo Dam Project

Mhlambanyatsi, Eswatini

October 2019

CLIENT

wsp

Prepared by:

The Biodiversity Company

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Report Name	**Riverine Ecological Flow Study - Proposed Nondvo Dam Project**	
Reference	**Eswatini**	
Submitted to		
Report Writer and Survey	**Russell Tate**	
	Russell Tate was the lead specialist for this freshwater ecology assessment. Russell is a water resource scientist with a Master of Science Degree (MSc) in aquatic health, specializing in aquatic ecotoxicology. He is a registered professional scientist with the South African Council for Natural Scientific Professions (SACNASP). Russell Tate has eight years working experience and has completed aquatic assessments in over 20 countries.	
Reviewer	**Andrew Husted**	
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.	
Reviewer	**Dr Mahomed Dessai**	
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.	

Non-Technical Summary

The outcomes of this assessment indicate that the existing flows in the Nondvo Dam catchment do not comply with % MAR values established at downstream Ecological Flow Requirement's (EFR's). The impact of further negative water balance activities in the Lusushwana River reach must be investigated. Hydraulic models which can evaluate the anticipated flow changes in the Lusushwana River must be investigated. The impact of such changes to riverine habitat and water resources must be further investigated.

In order to address the gaps presented above it is recommended that the holistic methodologies applied in the PROBFLO framework as indicated in O'Brien et al. (2018) are applied.

Standard riverine ecology sampling techniques were applied to derive the Present Ecological Status of the Lusushwana River within the specified Discrete Management Unit (DMU). Two surveys were completed, one in March and the other in May of 2019. Methods applied in the TBC (2019) survey were such that the habitat preferences of the local freshwater biota could be established, with detailed notes on the abundance, size and habitat occurrences.

The results of the surveys indicated that the Lusushwana River reach was classified as modified habitat. Based on the assessed water quality parameters, the water quality was derived to be natural, with low conductivity, neutral pH levels and fair clarity. Instream habitats were found to be modified as a result of the existing Luphohlo Dam, whereby flow and channel morphology had been impacted. The riparian habitat was determined to be modified as an effect of the Luphohlo impoundment compounded by the presence of extensive stands of alien vegetation. Aquatic macroinvertebrate assemblages were found to be diverse but composed of largely tolerant invertebrate taxa. A reflection of the high diversity of aquatic macroinvertebrates was corroborated through the direct observation of 42 Odonata taxa.

The fish community of the Lusushwana River reach assessed during this study was found to be dominated by Cichlidae, indicating the dominance of slow flowing habitats across the study area. The Mantenga Waterfall was found to be a migratory barrier to non-anguillid taxa and a limiting factor for the distribution of fish species in the watercourse. However, the existing flows were such that sensitive and listed fish species such as *Chiloglanis emarginatus (VU)* were observed during the study indicating that the fish community was still sensitive to changes in flow (Table 2).

The results of the Critical Habitat Assessment indicated that the considered riverine DMU did not exceed any thresholds for the classification, and therefore the riverine habitat within the DMU of this study would not constitute Critical Habitat. However, given the locality of the Mantenga Nature Reserve immediately downstream of the project area, the proposed activities must adhere to the mitigation hierarchy and commit to avoid, mitigate and minimise the indirect impacts that can be anticipated.

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Declaration

I, Russell Tate declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Russell Tate

Aquatic Specialist

The Biodiversity Company

09 June 2019

1 Introduction

The Biodiversity Company (TBC) was commissioned to conduct riverine ecological baseline and impact assessments, as part of the environmental authorisation process for the proposed Nondvo Dam situated between Manzini and Mbabane in Eswatini. Following the completion of the study, a recommendation to establish the Ecological Flow Requirements (EFR) of the potentially impacted watercourse was presented (TBC, 2019). Thus, TBC were requested to provide a discussion documents on the existing ecological flow information and to provide suitable recommendations.

The aim of this report was to present the available information with regards to the EFR of the potentially effected watercourse. Further, the aim of this report was to provide recommendations to address identified gaps. The information presented in this report was largely derived based on the outcomes of the riverine ecological study (TBC, 2019). It is noted that no ecological flow or hydraulic studies took place for the TBC (2019) study.

2 Hydrological Setting

The proposed Nondvo Dam is located between the towns of Mhlambanyatsi, Lobamba and Mbabane, in Eswatini. The proposed dam will be situated approximately 7.5km downstream of the foot of the existing Luphohlo Dam (Figure 1; Figure 4) on the Lusushwana River (Figure 2), upstream of the Mantenga Falls (Figure 3). The Lusushwana River, with a catchment size of 1 190 km^2, is a left tributary of the Usutu River above its confluence with the Phongolo River. The watercourse potentially affected by the proposal is located within the Phongola-Mtamvuma Water Management Area within the W56C quaternary catchment. The specific reach considered for this study was a 34 km reach as delineated by the W56C-1514 Sub Quaternary Reach (SQR).

An existing water transfer from the Luphohlo Dam occurs via a tunnel system to the Ezulwini Power Station in the adjacent Mbabane River catchment. Thereafter, the water is released into the Mbabane River which subsequently flows into the Lusushwana River below the Mantenga Falls.

Figure 1: The Luphohlo Dam on the Lusushwana River upstream of the proposed impoundment (March 2019)

Figure 2: The Lusushwana River downstream of the proposed impoundment (March 2019)

Figure 3: The Mantenga Falls on the Lusushwana River downstream of the proposed impoundment (March 2019)

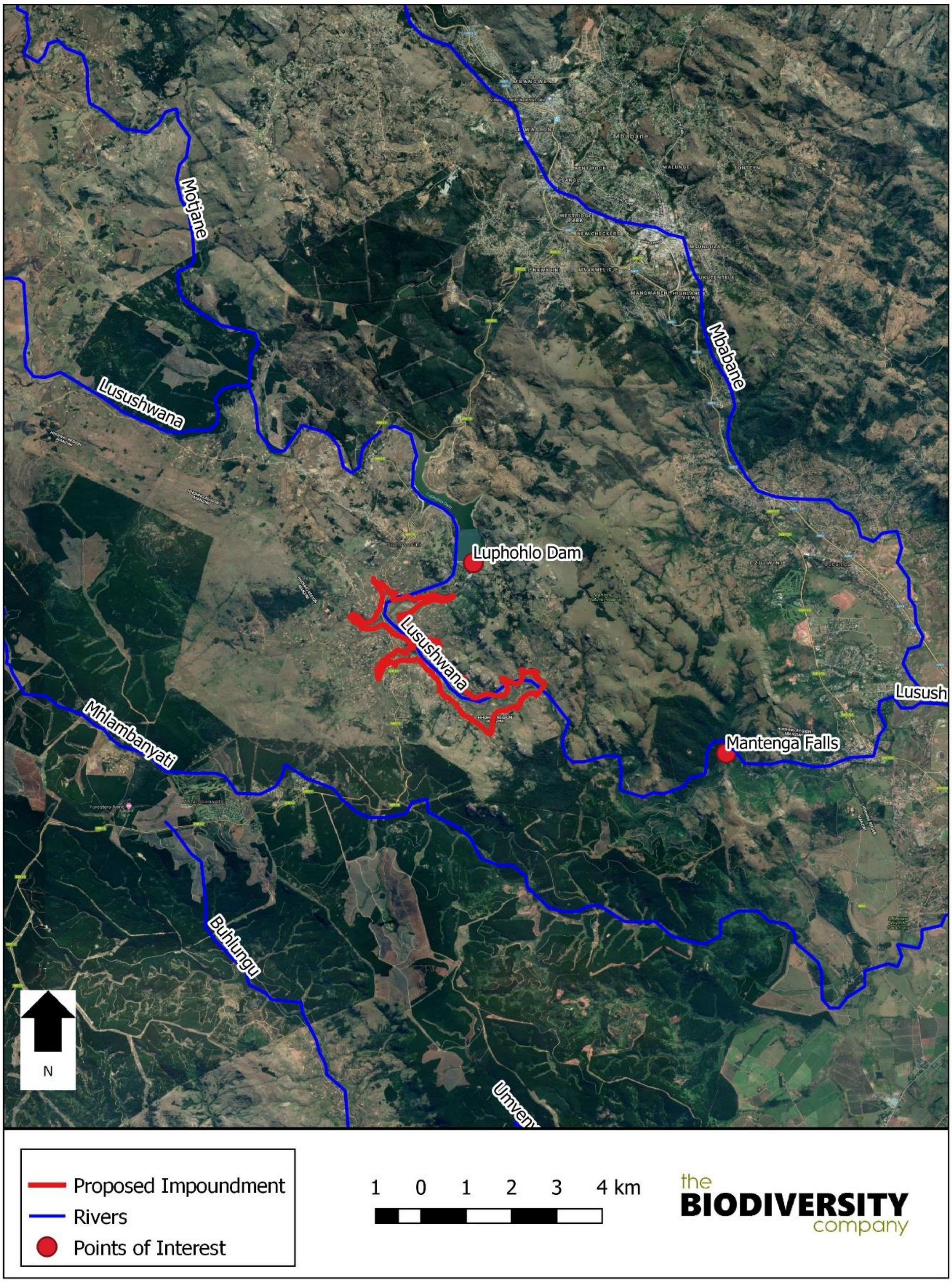


Figure 4: Locality of the proposed project

The watercourse considered in this study was located in the Southern Temperate Highveld Freshwater Ecoregion. This ecoregion spans the interior of South Africa, with the western boundary formed by the Magaliesberg, Pilansberg and Waterberg ranges, the northern boundary the Soutpansberg, and the eastern boundary formed by the Drakensburg mountain range.

The topography of the freshwater ecoregion is dominated by rolling hills with grassy plateaus and extensive source zone wetlands. The climate of the region is temperate with rainfall that varies from 1400 mm in the east to 400mm in the west. High intensity rainfall events are known to frequent the area, with the highest frequency of hailstorms in Southern Africa. According to Studio Pietrangeli Consulting Engineers (SPCE) (2018), the average annual rainfall within the project area was 1090 mm. The rainy season in the considered catchment area occurs between October and May, is 6 months long and receives on average 900mm in this period (SPCE, 2018). The dry season occurs between April and September and is characterised by low values of precipitation, with the driest months experienced being June and July (SPCE, 2018).

As anticipated the flood regime of the watercourses in this catchment are unimodal, with floods occurring in the months between October and March on an annual basis (Figure 5). Mean temperatures in the study area range from 17°C in the highveld to 22°C in the lowveld.

Figure 5: Unimodal flood observations in the Lusushwana River (S8 March 2019 left, May 2019 right)

3 Hydrology/Flows

The flow of a watercourse determines the nature and extent of the available riverine habitats. Further, aquatic biota has evolved to react with particular flood related stimuli whereby discharge related environmental cues are important for the initiation of breeding cues. Aspects such as above form critical aspects of the riverine ecosystem which makes the understanding of hydrology in watercourse of great importance.

No hydrological measurements were completed during the 2019 surveys as per the TBC (2019) study. A hydrology study was completed for the Lusushwana River in July 2018 as part of the Nondvo Dam Feasibility Study (SPCE, 2018). The SPCE (2018) study stipulates that flows were obtained from the GS 015 gauging station. It is important to note that this station is located approximately 15 km upstream of the proposed Nondvo Dam, immediately upstream of the existing Luphohlo Dam. According to SPCE (2017), at gauging station GS 015 the highest monthly average flow occurs in February at approximately 7 m^3/s with the mean annual discharge recorded at 3.5 m^3/s (Table 1).

Table 1: Discharge in the Lusushwana River (SPCE, 2017)

Criterion	Measure
Mean Annual Discharge (m^3/s)	3.5
Highest Average Flow Observed (February) (m^3/s)	7.0
Mean Annual Runoff (Mm^3/yr)	119

In addition to the GS 015 gauging station, the hydrological study presented by SPCE (2018) made use of an additional gauging station, GS 002, located upstream of the Water Treatment Plant of Matshapha, a town located approximately 25 km straight line distance of the base of the Luphohlo Dam wall. It is noted that the location of the GS 002 gauging station is downstream of the confluence between the Mbabane, Mhambanyati, Umtilane and Lusushwana Rivers. The discharge recorded at this gauging station therefore receives a significantly higher discharge in comparison to the Nondvo Dam catchment. The hydrological study completed in the SPCE (2018) made use of the gauging station to perform statistical analysis and calibrate the hydrological model.

The mean monthly runoff values for the abovementioned gauging stations is presented in Figure 6.

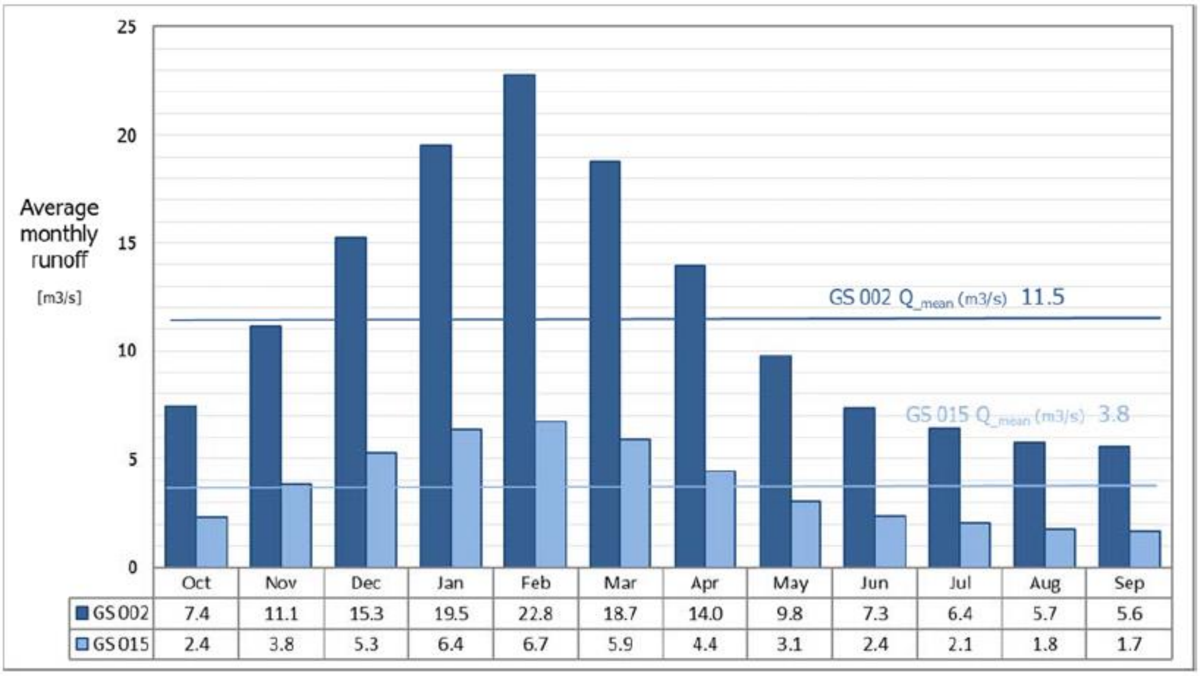


Figure 6: Mean Month Runoff (SPCE, 2017)

A critical gap in the information presented above relate to the location of the gauging station above the existing Luphohlo Dam. Criteria effecting the available discharge for the proposed Nondvo Dam was therefore not available. Factors such as evaporation, abstraction and water transfer for electricity generation as well as the overall operational regime from the Luphohlo Dam were not available. A similar conclusion was drawn in the SPCE (2018) study whereby the below abstract was obtained verbatim:

- "Due to the presence of the upstream plant, in order to estimate the available water resource at Nondvo dam, the reservoir operating rules of the Luphohlo reservoir are of key importance, being part of the water resources deviated to Ezulwini power plant for hydropower."

Based on the data presented in the Final Scoping Study Report (SPCE, 2017), this gap was largely addressed. The mean annual water balance of the Nondvo Dam was calculated and is presented at 16 Mm^3/year (Figure 7), this value roughly equates to an average flow of 0.5 m^3/s. It is important to note that this water balance does not include the smaller tributaries which enter into the proposed Nondvo reservoir below the Luphohlo Dam.

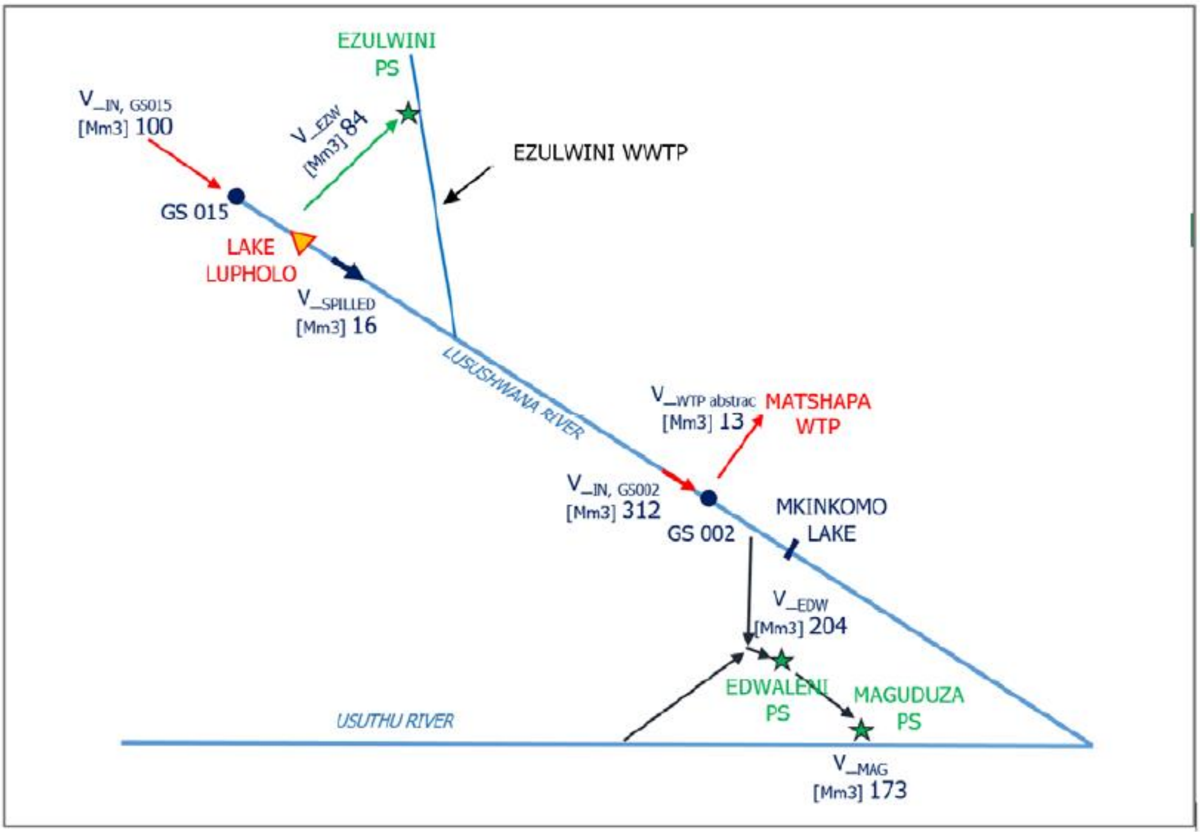


Figure 7: Lusushwana River Mean Annual Water Balance (SPCE, 2017)

4 Geomorphological Setting

The geomorphology of a watercourse is closely correlated to that of the hydrology, with flow volumes influencing the nature of the geomorphological features. River geomorphological features are the driving factors for the nature of the available aquatic habitats. The understanding of the local hydraulic geomorphology of the watercourse can therefore aid in the interpretation of potential impacts.

No hydraulic assessments were completed in the TBC (2019) study. The Lusushwana River rises approximately 5km south of the Oshoek border post within proximity to the South Africa-Eswatini border, and 25 km upstream of the current project area. The Lusushwana River in its upper reaches was a characteristic upland watercourse, with steep gradients, moderate widths (±3m) and cobbled substrates (Rountree et al., 2000;Figure 8). Downstream of the Luphohlo Dam, flows and gradients in the watercourse become gentle and present lowland river gradients as represented by a class E geoclass (Rountree et al., 2000). As a resultant effect of the Luphohlo Dam, which has reduced flood peaks and overall discharge, over and above the geomorphological effects of the reduced gradient, the instream channel of the Lusushwana River forms deep slow flowing pools which are densely vegetated as presented in Figure 9.

Figure 8: The Lusushwana River upstream of the Luphohlo Dam illustrating typical upland river geomorphic features (O2; May 2019)

Figure 9: The Lusushwana River downstream of the Luphohlo Dam illustrating typical lowland river geomorphic features (S4; March 2019)

Within the lower reaches of the proposed inundation zone, and in proximity of the proposed Nondvo Dam wall, the gradients of the Lusushwana River increase to a class C geoclass, representing a rejuvenated lower foothill zonation (Rountree et al., 2000). The effect of the increased gradient has created berock cascades with intermittent pools and shallow runs (Figure 10, Figure 11). In addition, large instream boulders and bedrock run complexes create diverse habitats of cascades, pools and rapids. The zone of rejuventation continues until downstream of the Mantenga Falls where after lowland geomorphic watercourses were observed. Downstream of the Mantenga Falls, and following the confluence with the Mbabane River, the Lusushwana River has typical lowland characteristics as inidated by the increased width and sandy substrates of the watercourse.

Figure 10: The Lusushwana River downstream of the Luphohlo Dam illustrating typical rejuvenated bedrock cascade geomorphic features (S6; March 2019)

Figure 11: The Lusushwana River downstream of the Luphohlo Dam illustrating typical rejuvenated reaches with bedrock boulders and pools dominating the river profile geomorphic features (S9; May 2019)

5 Ecological Water Requirements

5.1 Baseline Present Ecological Status

Standard riverine ecology sampling techniques were applied to derive the Present Ecological Status of the Lusushwana River within the specified Discrete Management Unit (DMU). Two surveys were completed, one in March and the other in May of 2019. Methods applied in the TBC (2019) survey were such that the habitat preferences of the local freshwater biota could be established, with detailed notes on the abundance, size and habitat occurrences.

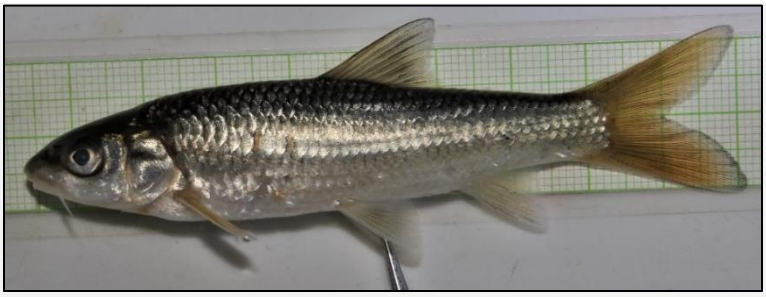
The results of the surveys indicated that the Lusushwana River reach of the was classified as modified habitat. Based on the assessed water quality parameters, the water quality was derived to be natural, with low conductivity, neutral pH levels and fair clarity. Instream habitats were found to be modified as a result of the existing Luphohlo Dam, whereby flow and channel morphology had been impacted. The riparian habitat was determined to be modified as an effect of the Luphohlo impoundment compounded by the presence of extensive stands of alien vegetation. Aquatic macroinvertebrate assemblages were found to be diverse, but composed of largely tolerant invertebrate taxa. A reflection of the high diversity of aquatic macroinvertebrates was corroborated through the direct observation of 42 Odonata taxa.

The fish community of the Lusushwana River reach assessed during this study was found to be dominated by Cichlidae, indicating the dominance of slow flowing habitats across the study area. The Mantenga Waterfall was found to be a migratory barrier to non-anguillid taxa and a limiting factor for the distribution of fish species in the watercourse. However, the existing flows were such that sensitive and listed fish species such as *Chiloglanis emarginatus (VU)* were observed during the study indicating that the fish community was still sensitive to changes in flow (Table 2).

The results of the Critical Habitat Assessment indicated that the considered riverine DMU did not exceed any thresholds for the classification, and therefore the riverine habitat within the DMU of this study would not constitute Critical Habitat. However, given the locality of the Mantenga Nature Reserve immediately downstream of the project area, the proposed activities must adhere to the mitigation hierarchy and commit to avoid, mitigate and minimise the indirect impacts that can be anticipated.

Table 2: Flow Sensitive Fish Species in the Lusushwana River (TBC, 2019)

Species	Conservation Status (IUCN, 2019)	Photograph
Chiloglanis emarginatus	VU	

Species	Conservation Status (IUCN, 2019)	Photograph
Amphilius uranoscopus	LC	
Labeobarbus polylepis	LC	

5.2 Recommended Ecological Flows

The proposed EWR releases for the Luphohlo Dam were initially presented in SPCE (2017) at of 4.4 Mm^3/year – 0.14 m^3/s for the Lusushwana River at approximately 28% of the current flows into the Nondvo Dam. The SPCE (2017) study referenced the JMRBWRS (2008) report. However, the JMRBWRS (2008) studies consisted of several reports detailing various water resource aspects of the Maputo River basin. On review of the relevant section within the main document, namely JMRBWRS Main Report – Integrated Water Resources Management and Future Scenarios for the Maputo River Basin (JMRBWRS, 2008), the EFR's in the Lusushwana River are presented as per Table 3.

Table 3: Ecological Flow Requirements required to maintain Present Ecological States at outlets to water management sub catchments (JMRBWRS (2008)

Water Management Sub-Catchment (WNSC)	PES to be Maintained	EFR Derived in this Study		Mean Flows (Mm^3/a) at Key Points in the WMSC
		Average Flow (Mm^3/a)	% Natural MAR (Mm^3/a)	
Lusushwana	D	87	21	35

Although the exact location where the EFR is applicable was not clearly indicated, interpretation of the JMRBWRS (2008) study indicates the likely outlet was of the A56A to F quaternary catchments located within the W56F-1762 SQR. This location is approximately 56 km downstream of the proposed Nondvo Dam site.

Considering the % natural MAR for the EFR's presented in Table 3 at 21%, applying the similar approach to the MAR in the Nondvo Dam, the EFR mean flows should approximate 24.99 Mm^3/a or 0.7 m^3/s. This value differs from the 4.4 Mm^3/a presented in SPCE (2017). It is worthwhile to note that within the Nondvo Dam catchment, the established average flows of 0.5 m^3/s were already below the values calculated inline with the % Natural MAR calculations (JMRBWRS, 2008).

The outcomes of this assessment indicate that the existing flows in the Nondvo Dam catchment do not comply with % MAR values established at downstream EFR's. The impact of further negative water balance activities in the Lusushwana River reach must be investigated further. Hydraulic models which can evaluate the anticipated flow changes in the Lusushwana River must be investigated. The impact of such changes to riverine habitat and water resources must be further investigated.

In order to address the gaps presented above it is recommended that the holistic methodologies applied in the PROBFLO framework as indicated in O'Brien et al. (2018) are applied.

6 Impact Assessment of the Modified Flows

This section of the report was obtained directly from TBC (2019) and addresses riverine ecology. Impacts to local water users were not considered.

6.1 Existing Impacts

The baseline riverine environment assessment indicated largely modified conditions and confirms the classifications provided in the Joint Maputo River Basin Water Resources Study 2008 (JMRBWRS, 2018). The existing impacts were determined to be largely associated with flow and river morphological modification through the existing Luphohlo Dam.

6.2 The No-Go-Scenario

As was identified in the baseline assessment the watercourse was derived to be largely modified. The ongoing no-go scenario indicates continued rural development including housing and subsistence agricultural activities within the immediate catchment area. The no-go scenario therefore indicates further alteration of the Lusushwana River catchment area to a moderate degree which in turn would lead to further modification to the local river conditions. Considering this scenario, increases in salinity and the concentration of dissolved nutrients can be anticipated in the Lusushwana River catchment considered in this study.

6.3 Pre-construction Phase

The physical impacts of the pre-construction phase will be associated with the geotechnical investigations which will include the removal of trees and groundcover, construction of access roads, active drilling and trenching activities. During the survey, these activities were noted to have been completed as indicated in the image below (Figure 12). Owing to the fact that the activities for the pre-construction phase were already completed, these activities were omitted from this study.

Figure 12: Geo-technical investigations at the proposed Nondvo Dam wall (March 2019)

6.4 Construction Phase

The impacts of impoundments have been well documented (Kingsford, 2000, Graf, 2006, McCartney, 2009, New and Xie, 2008). The anticipated impacts during the construction phase are discussed below.

During the active construction phase, water quality impacts can be anticipated in the Lusushwana River system. The water quality impairment will stem from the following sources:

- Sedimentation and suspended materials from earthworks within and alongside the watercourse;
- Silt-laden runoff from disturbed catchment areas;
- Diffuse and point source seepage/runoff from material stockpiles, offices and workshops; and
- Diffuse and point source seepage/runoff from ablution facilities.

During the construction activities there will be the direct alteration of the instream and riparian habitats resulting in the permanent modification of the habitats at a local scale. The active excavations, blasting and construction of the diversion and coffer dams will alter the nature of the hydrology in the Lusushwana River which will ultimately result in a loss of riverine habitat. During these activities, runoff from exposed earthworks will contain elevated suspended and dissolved materials which may impact on downstream river reaches and their associated aquatic ecology.

Following the diversion of the watercourse, hydrological changes to the nature of the river flow will occur and will have resultant negative impacts to aquatic biota within a local spatial framework downstream of the construction activities. This kind of impact will particularly effect downstream *Chiloglanis* populations.

Additional habitat level impacts can be anticipated through erosion and sedimentation of excavated and disturbed surfaces whereby bedrock and cobbled substrates with flowing waters become silted, this will reduce the effective area of aquatic habitat on local spatial framework. The presence of the construction activities within the instream areas will also present an immediate migration barrier and thereby serve to fragment the populations of biota in the watercourse. The existing Luphohlo Dam does not have a fishway and therefore the existing fauna above the Mantenga falls and the foot of the Luphohlo Dam wall consist of fragmented populations. Migratory Eels were observed upstream of the Mantenga Falls, indicating that the species are still utilising the remaining habitats downstream of the Luphohlo Dam. However, the additional river reach to be inundated would not be considered a significant area to be lost given the existing migratory barriers present.

The active construction of the dam wall will make use of concrete materials and various steelworks. The presence of the concrete materials present contamination hazards for downstream aquatic ecology. It is however anticipated that the construction area will be dry as maintained through the coffer dams and diversion channel, thereby limiting this impact.

6.5 Operational Phase

Considering the data available for this area, the operating regime of the existing Luphohlo Dam indicates an Ecological Water Requirements release flow rate of 4.4 Mm^3/year (JMRBWRS, 2008) and this must be considered to be released for the proposed Nondvo Dam.

The most obvious impact during the operational phase will be the direct inundation of riverine habitats. The operational impacts of the proposed project will result in the inundation of approximately 197 246 m^2 of instream and 559 379 m^2 of riparian habitat.

Rivers exist within a continuum of linked physical parameters and are important corridors for flows of energy, matter and biology (McCartney, 2009). The fluctuation dynamic conditions within a riverine continuum are maintained by the constantly changing flow regime which produces a diverse array of aquatic habitats and subsequent biodiversity (Vannote et al., 1980). Nutrients and sediment (matter) generated in the headwaters of the watercourse are recycled downstream and form the primary drivers effecting plant growth and ecological productivity. Natural flood regimes regularly inundate floodplains and increase organic matter decomposition and nutrient cycling, this process has led to the biological evolution of complex adaptive strategies which are often coupled to the flood regime. The construction of a dam disrupts the river continuum through the obstruction of the longitudinal exchanges between the regions up and downstream of the dam wall. Based on available literature, as well as reviews of the impacts of impoundment, post impoundment impacts directly influence a myriad of factors in watercourses which ultimately alter the ecological structure and function of riverine ecosystems (Kingsford, 2000).

6.5.1 Impacts to the Flow Regime of the Lusushwana River

The waterbody located upstream of the proposed Nondvo Dam will be converted from a lotic to a lentic system whereby obvious habitat modifications would be anticipated. This will have an immediate impact on biota with preferences to lotic habitats such as *Chiloglanis*, *Labeobarbus* and the abundant *Platycypha caligata*. Furthermore, it can be anticipated that taxa adapted to lentic conditions will proliferate, this includes the alien invasive species *Micropterus salmoides*.

Figure 13: Platycypha caligata (March 2019)

In addition to the upstream inundation, dams alter the downstream flow regime which can impact on the relative volume of water discharge, permanence of low flows as well as the frequency and magnitude of flood peaks. A common consequence of this is the reduced frequency of overbank flooding, this was noted to have already occurred downstream of the existing Luphohlo Dam. Changes in the flow regime of the downstream river reach can impact negatively on the breeding cues of local fish communities which have evolved to react with particular flood related stimuli, this is typically enhanced for flow releases to meet di0urnal variation in hydroelectricity demands. As noted above, an Ecological Flow Requirement release of 4 Mm^3/year was recommended (JMRBWRS, 2008).

6.5.2 Impacts to the Thermal Regime of the Lusushwana River

The impounded body of water will be deeper than 20m and therefore it is likely that temperature and oxygen stratification would take place. This may have an impact on downstream water quality as well as temperature lifecycle cues for aquatic ecology as result of releases. Releases from the hypolimnion of a reservoir have shown to be “least natural” due to the significant impact the release has on water temperatures.

6.5.3 Impacts on Water Chemistry

Historical assessments of impoundments indicate that the structures are sinks for various elements and nutrients. Consequently, water that is discharged has a different chemical composition to the inflows into the reservoir. Dissolved nutrients such as phosphorous increase in the reservoir as a result of the decaying submerged vegetation and soil. This increases the chemical and biological oxygen demand and can decrease the concentration of biologically available oxygen. The incidence of subsistence agricultural activities within the impoundment catchment will therefore concentrate in the Nondvo reservoir.

According to McCartney (2009), the quality of water released from a stratified reservoir is associated with the elevation of the outflow structure relative to the different stratified layers in the waterbody. Releases from the reservoir surface contains low concentrations of nutrients and it typically well oxygenated, whilst releases from the bottom are typically cold, rich in nutrients and low in oxygen.

6.5.4 Impacts on Sedimentation

The reduction in flow velocity of the flow in the Lusushwana River will result in the enhancement of sedimentation. However, the rate of sedimentation is dependent on the physiographic features of the catchment area as well as the local land use. Based on available data, approximately 0.5% – 1% of storage volumes in reservoirs across the world are lost due to sediment capture (Mahmood, 1987). Large fluctuations in the water levels of reservoirs can result in the erosion of the reservoir shoreline which can add to existing sediment loads. In addition, disproportionately discharged water volumes can also lead to erosion of the instream channel and river banks downstream of impoundments. This is compounded by the reduced sediment loads of the downstream river system which inherently increases the erosional capacity of the watercourse. The existing Luphohlo Dam has modified instream sediment characteristics. The presence of an additional instream barrier will prevent the movement of additional sediments generated between the foot of the Luphohlo Dam and the proposed Nondvo Dam wall. However, given the local geology of the area which is characterised by hard granites and the limited spatial extent between the above-mentioned two locations, this impact is anticipated to be negligible.

The continued operation of the linear infrastructure such as roadways and bridges present long-term disturbed areas which may be subject to erosion.

6.5.5 Impacts to Aquatic Biodiversity

The presence of the instream barrier will alter migratory patterns for the observed Eel species (*Anguilla mossambica*) and it can be anticipated that migratory habitats upstream of the dam wall will be inaccessible. The alteration of the existing flow regime of the Lusushwana River will reduce the available habitats available downstream which will impact on local fish communities, particularly rheophilic taxa such as *Labeobarbus* and the listed *Chiloglanis* species. The anticipated reduced flood peaks and flood durations are anticipated to impact on floodplain conditions in the lower Lusushwana River and a reduced biodiversity and biomass can be anticipated. The alteration of the flow regime will also affect instream, marginal and riparian vegetation which have reproductive and vegetative processes that are typically controlled by dynamic interactions of periods inundation and desiccation.

6.6 Cumulative Impact

The nature and extent of the potential cumulative impact of the proposed development was assessed by adding the existing and proposed project impacts with potential future developments. The cumulative impacts associated with the project include:

- Water quality and quantity impacts on the Lusushwana River;
- Augmentation of urban water supplies to the urban areas of Mbabane and Manzini (current: 8.4 Mm^3/a in 2005 to 10.4 Mm^3/a in 2030);
- Development of largescale irrigation agriculture near Malkrerns; and
- Proposed dams in the Usuthu River catchment (JMRBWRS, 2008).

Figure 6-14: Proposed impoundments in the Usuthu/Maputo River catchment (JMRBWRS, 2008)

Should the proposed Nondvo Dam project proceed, water quality (increased salinity) impacts in Lusushwana River near Manzini can be anticipated as a result of reduced flows, particularly during the construction and initial flooding of the reservoir, this would likely be compounded through increased water demand in the urban areas of Mbabane and Manzini.

Should the proposed Nondvo Dam and the proposed irrigation projects near Malkerns proceed, water quality deterioration in the Lusushwana River would be anticipated as a result of the loss of dilution capacity and influx of irrigation return flows.

Should the development of impoundments in the Usuthu/Maputo Rivers proceed, it is likely that there will be an impact to floodplains within the lower reaches of the watercourse. This will likely result in the further alteration of hydrology, sediment loads and local ecology in the Phongola River floodplains and Makatini Flats in proximity to the Ndumo Game Reserve in South Africa.

7 Recommendations

The following recommendations were derived from the completion of this study:

- Riverine aquatic biomonitoring for the duration of the construction phase on quarterly basis (Table 4);
- Riverine aquatic biomonitoring for the first 6 months of the operational phase on 3-month survey basis (Table 4);
- Water quality monitoring for the duration of the construction phase;
- Water quality monitoring of the flow releases;
- It has been recommended that a catchment agency is established to reduce the impact of poor land-use in the reservoir catchment;
- The establishment of a nature reserve in the immediate inundation area to prevent erosion and other associated impacts;
- It is recommended that a PROBFLO assessment to determine and assess the current EFR is completed.

Table 4: Recommended riverine biomonitoring methods

Method	Duration	Key Performance Indicator
SASS5	Construction phase	No significant difference ($p<0.05$) in SASS5 score or ASPT between up and downstream monitoring points
Fish Observations	Construction phase	*Chiloglanis anoterus* must always be located downstream of the impoundment (FROC = 5.0)
SASS5	Operation phase – 12 months	No significant difference ($p<0.05$) in SASS5 score or ASPT between monitoring surveys that can be attributed to impacts from the proposed discharge
Fish Observations	Operation phase – 6 months	*Chiloglanis anoterus* must always be located downstream of the impoundment (FROC = 5.0)

8 Budgets Required for Monitoring Programme

The budgets anticipated to be required for water resource related monitoring is presented in Table 5.

Table 5: Anticipated budgets required for the water resource monitoring

Method	Period Required	Expected Budget
Riverine aquatic biomonitoring quarterly basis	3 years	R 1 778 010.00
Riverine aquatic biomonitoring for the first 12 months of the operational phase on 3-month survey basis	12 months	R 94 000.00
Monthly Water quality monitoring for the duration of the construction phase	3 Years	R 91 9269.00
Water quality monitoring of the flow releases	2 years	R 291 600.00
PROBFLO	12 Months	R 450 000.00

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