Basic Assessment for the proposed development of aquaculture cage culture fish farm in Albasini Dam, Thulamela Local Municipality in the Vhembe District Municipality, Limpopo.

Appendix D:
Specialist Studies

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HERITAGE IMPACT ASSESSMENT

(REQUIRED UNDER SECTION 38(8) OF THE NHRA (No. 25 OF 1999)

FOR THE PROPOSED MOZAMBIQUE TILAPIA FARM PROJECT, ALBASINI DAM, ELIM, LOUIS TRICHARDT LIMPOPO PROVINCE

Type of development:

Agricultural

Client:

CSIR

Client info:

Karabo Mashabela

E – mail:

KMashabela1@csir.co.za

Developer: Makwaria Trading

HCAC - Heritage Consultants
Private Bag X 1049
Suite 34
Modimolle
0510
Tel: 082 373 8491
Fax: 086 691 6461
E-Mail: jaco.heritage@gmail.com

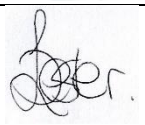
Report Author:
Mr. J. van der Walt

Project Reference:
HCAC Project number 218403

Report date:
April 2018

APPROVAL PAGE

Project Name	**Makwaria Fish Farm**
Report Title	Heritage Impact Assessment **Makwaria Fish Farm**
Authority Reference Number	SAHRA Case 12199
Report Status	Final Report
Applicant Name	Makwaria Trading

	Name	Signature	Qualifications and Certifications	Date
Document Compilation	Jaco van der Walt		MA Archaeology ASAPA #159	April 2018
	Marko Hutten		BA Hons Archaeology	April 2018
	Liesl Bester		BHCS Honours	April 2018

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Amendments on Document

Date	Report Reference Number	Description of Amendment

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REPORT OUTLINE

Appendix 6 of the GNR 326 EIA Regulations published on 7 April 2017 provides the requirements for specialist reports undertaken as part of the environmental authorisation process. In line with this, Table 1 provides an overview of Appendix 6 together with information on how these requirements have been met.

Table 1. Specialist Report Requirements.

Requirement from Appendix 6 of GN 326 EIA Regulation 2017	Chapter
(a) Details of - (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	Section a Section 12
(b) Declaration that the specialist is independent in a form as may be specified by the competent authority	*Declaration of Independence*
(c) Indication of the scope of, and the purpose for which, the report was prepared	Section 1
(cA)an indication of the quality and age of base data used for the specialist report	Section 3.4 and 7.1.
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	9
(d) Duration, Date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.4
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 8 and 9
(g) Identification of any areas to be avoided, including buffers	Section 8 and 9
(h) Map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 8
(I) Description of any assumptions made and any uncertainties or gaps in knowledge	Section 3.7
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity **including identified alternatives on the environment** or activities;	Section 9
(k) Mitigation measures for inclusion in the EMPr	Section 9
(I) Conditions for inclusion in the environmental authorisation	Section 9
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 9
(n) Reasoned opinion - (i) as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 9.2
(o) Description of any consultation process that was undertaken during the course of preparing the specialist report	Section 6
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Refer to BA report
(q) Any other information requested by the competent authority	Section 10

Executive Summary

The CSIR conducted a Basic Assessment for the Makwaria Fish Farm, near Elim, in the Blouberg Local Municipality of Limpopo Province. HCAC was appointed by the CSIR to conduct a Heritage Impact Assessment to determine the presence of cultural heritage sites and the impact of the proposed development on these non-renewable resources. The study area was assessed both on desktop level and by a field survey. The field survey was conducted as a non-intrusive pedestrian survey to cover the extent of property as development plans are not available at this stage.

No archaeological sites or material of significance was recorded during the survey. According to the SAHRIS Paleontological Sensitivity map the area is of insignificant paleontological sensitivity. No further mitigation prior to construction is recommended in terms of Section 35 for the proposed development to proceed. In terms of the built environment of the area (Section 34), no standing structures older than 60 years occur within the study area. In terms of Section 36 of the Act no burial sites were recorded. If any graves are located in future they should ideally be preserved *in-situ* or alternatively relocated according to existing legislation. No public monuments are located within or close to the study area. The proposed application is in line with the general agricultural land use of the area and will therefore not impact further on significant cultural landscapes or viewscapes. During the public participation process conducted for the project no heritage concerns was raised.

Due to the lack of significant heritage resources in the study area the impact of the proposed project on heritage resources is considered low and it is recommended that the proposed project can commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA:

- Implementation of a chance find procedure.

.

Declaration of Independence

Specialist Name	Jaco van der Walt
Declaration of Independence	I declare, as a specialist appointed in terms of the National Environmental Management Act (Act No 108 of 1998) and the associated 2014 Environmental Impact Assessment (EIA) Regulations, that I: • 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 48 and is punishable in terms of section 24F of the Act.
Signature	
Date	06/04/2018

a) Expertise of the specialist

Jaco van der Walt has been practising as a CRM archaeologist for 15 years. He obtained an MA degree in Archaeology from the University of the Witwatersrand focussing on the Iron Age in 2012 and is a PhD candidate at the University of Johannesburg focussing on Stone Age Archaeology with specific interest in the Middle Stone Age (MSA) and Later Stone Age (LSA). Jaco is an accredited member of ASAPA (#159) and have conducted more than 500 impact assessments in Limpopo, Mpumalanga, North West, Free State, Gauteng, KZN as well as he Northern and Eastern Cape Provinces in South Africa.

Jaco has worked on various international projects in Zimbabwe, Botswana, Mozambique, Lesotho, DRC Zambia and Tanzania. Through this he has a sound understanding of the IFC Performance Standard requirements, with specific reference to Performance Standard 8 – Cultural Heritage.

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ABBREVIATIONS

AIA: Archaeological Impact Assessment
ASAPA: Association of South African Professional Archaeologists
BGG Burial Ground and Graves
BIA: Basic Impact Assessment
CFPs: Chance Find Procedures
CMP: Conservation Management Plan
CRR: Comments and Response Report
CRM: Cultural Resource Management
DEA: Department of Environmental Affairs
EA: Environmental Authorisation
EAP: Environmental Assessment Practitioner
ECO: Environmental Control Officer
EIA: Environmental Impact Assessment*
EIA: Early Iron Age*
EIA Practitioner: Environmental Impact Assessment Practitioner
EMP: Environmental Management Programme
ESA: Early Stone Age
ESIA: Environmental and Social Impact Assessment
GIS Geographical Information System
GPS: Global Positioning System
GRP Grave Relocation Plan
HIA: Heritage Impact Assessment
LIA: Late Iron Age
LSA: Late Stone Age
MEC: Member of the Executive Council
MIA: Middle Iron Age
MPRDA: Mineral and Petroleum Resources Development Act
MSA: Middle Stone Age
NEMA National Environmental Management Act, 1998 (Act No. 107 of 1998)
NHRA National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NID Notification of Intent to Develop
NoK Next-of-Kin
PRHA: Provincial Heritage Resource Agency
SADC: Southern African Development Community
SAHRA: South African Heritage Resources Agency

**Although EIA refers to both Environmental Impact Assessment and the Early Iron Age both are internationally accepted abbreviations and must be read and interpreted in the context it is used.*

GLOSSARY

Archaeological site (remains of human activity over 100 years old)
Early Stone Age (~ 2.6 million to 250 000 years ago)
Middle Stone Age (~ 250 000 to 40-25 000 years ago)
Later Stone Age (~ 40-25 000, to recently, 100 years ago)
The Iron Age (~ AD 400 to 1840)
Historic (~ AD 1840 to 1950)
Historic building (over 60 years old)

1 Introduction and Terms of Reference:

Heritage Contracts and Archaeological Consulting CC (**HCAC)** has been contracted by the CSIR to conduct a heritage impact assessment of the proposed Makwaria Fish Farm development. The report forms part of the Basic Assessment Report (BAR) and Environmental Management Programme Report (EMPR) for the development. The study area was assessed both on desktop level and by a field survey. The field survey was conducted as a non-intrusive pedestrian survey to cover the extent of property as development plans are not available at this stage.

The aim of the study is to survey the proposed development footprint to identify cultural heritage sites, document, and assess their importance within local, provincial and national context. It serves to assess the impact of the proposed project on non-renewable heritage resources, and to submit appropriate recommendations with regard to the responsible cultural resources management measures that might be required to assist the developer in managing the discovered heritage resources in a responsible manner. It is also conducted to protect, preserve, and develop such resources within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999). The report outlines the approach and methodology utilized before and during the survey, which includes: Phase 1, review of relevant literature; Phase 2, the physical surveying of the area on foot and by vehicle; Phase 3, reporting the outcome of the study.

During the survey, no heritage sites were identified. General site conditions and features on sites were recorded by means of photographs, GPS locations, and site descriptions. Possible impacts were identified and mitigation measures are proposed in the following report. SAHRA as a commenting authority under section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) require all environmental documents, complied in support of an Environmental Authorisation application as defined by NEMA EIA Regulations section 40 (1) and (2), to be submitted to SAHRA. As such the Basic Assessment report and its appendices must be submitted to the case as well as the EMPr, once it's completed by the Environmental Assessment Practitioner (EAP).

1.1 Terms of Reference

Field study

Conduct a field study to: (a) locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources affected by the proposed development.

Reporting

Report on the identification of anticipated and cumulative impacts the operational units of the proposed project activity may have on the identified heritage resources for all 3 phases of the project; i.e., construction, operation and decommissioning phases. Consider alternatives, should any significant sites be impacted adversely by the proposed project. Ensure that all studies and results comply with the relevant legislation, SAHRA minimum standards and the code of ethics and guidelines of ASAPA.

To assist the developer in managing the discovered heritage resources in a responsible manner, and to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999).

Table 2: Project Description

Size of farm and portions	1,26 hectares on Portions 17 and 22 of the Farm Goede Hoop 8 LT
Magisterial District	Thulamela Local Municipality Vhembe District Municipality
1: 50 000 map sheet number	2330 AA
Central co-ordinate of the development	23° 6'40.20"S 30° 6'15.14"E

Table 3: Infrastructure and project activities

Type of development	Agricultural Development
Project size	1,26 ha
Project Components	Fish farm related infrastructure

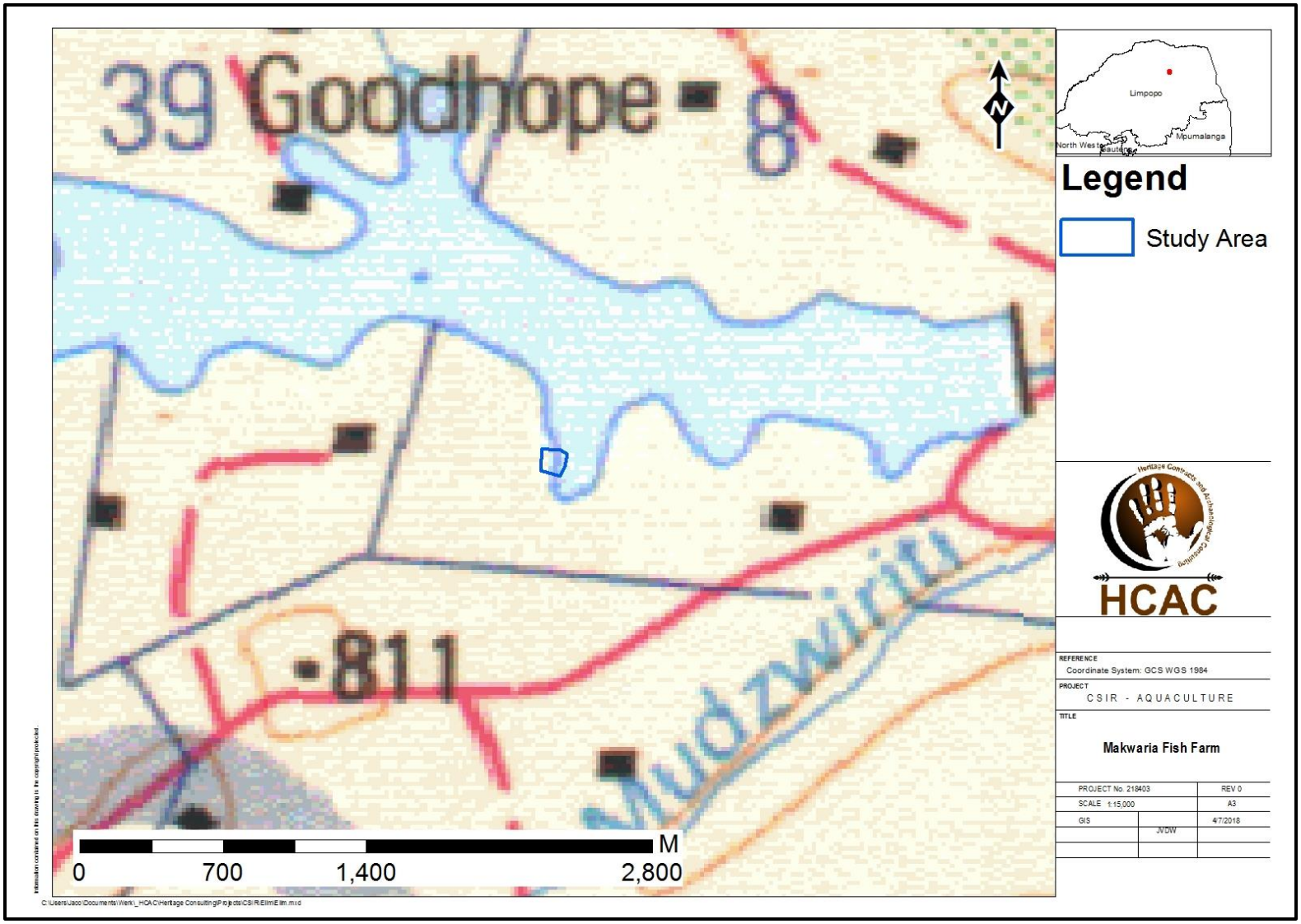


Figure 1. Provincial locality map (1: 250 000 topographical map)

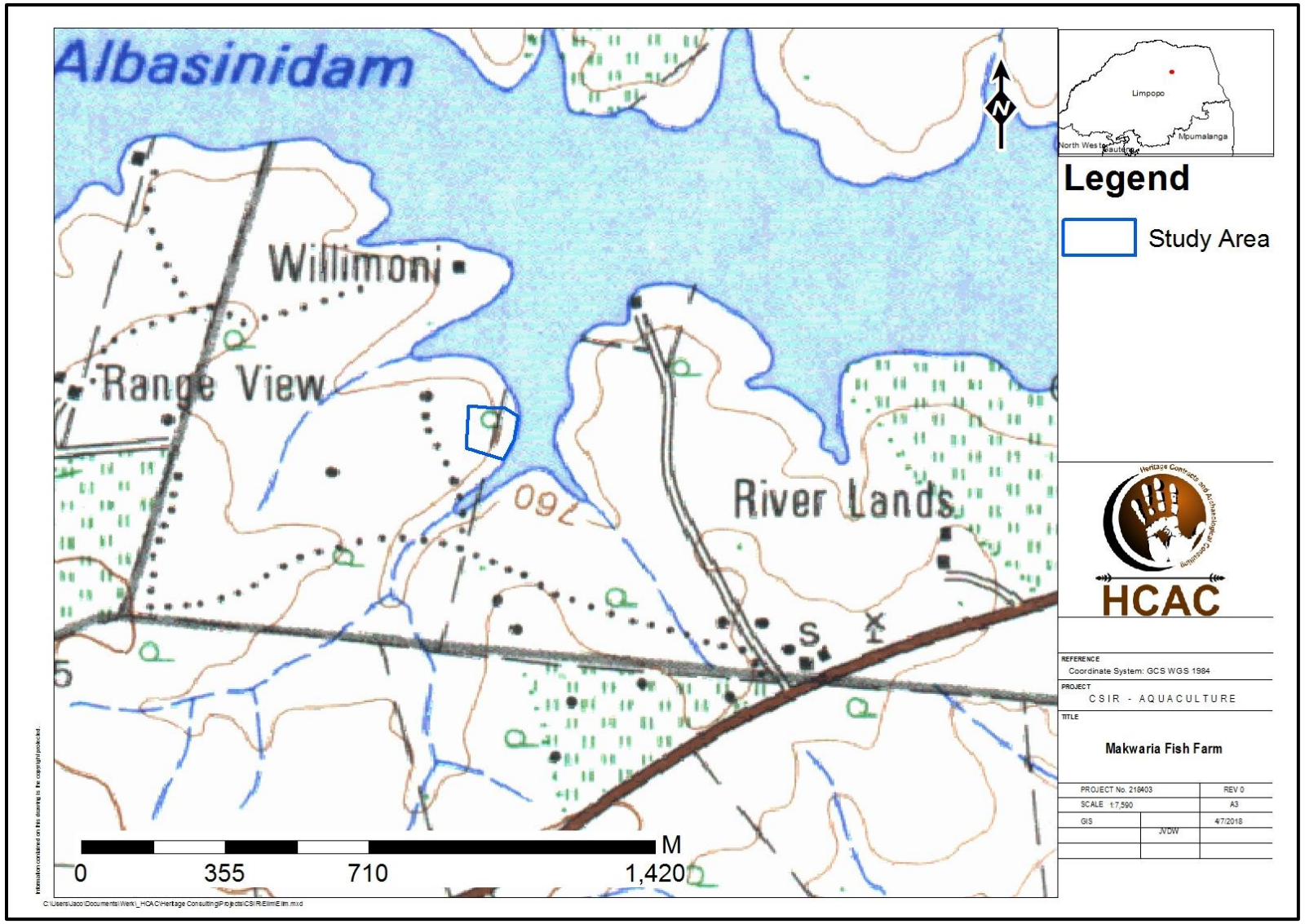


Figure 2: Regional locality map (1:50 000 topographical map).

Figure 3. Satellite image of the study area (Google Earth 2016).

2 Legislative Requirements

The HIA, as a specialist sub-section of the EIA, is required under the following legislation:

- National Heritage Resources Act (NHRA), Act No. 25 of 1999)
- National Environmental Management Act (NEMA), Act No. 107 of 1998 - Section 23(2)(b)
- Mineral and Petroleum Resources Development Act (MPRDA), Act No. 28 of 2002 - Section 39(3)(b)(iii)

A Phase 1 HIA is a pre-requisite for development in South Africa as prescribed by SAHRA and stipulated by legislation. The overall purpose of heritage specialist input is to:

- Identify any heritage resources, which may be affected;
- Assess the nature and degree of significance of such resources;
- Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance;
- Assess the negative and positive impact of the development on these resources; and
- Make recommendations for the appropriate heritage management of these impacts.

The HIA should be submitted, as part of the impact assessment report or EMPr, to the PHRA if established in the province or to SAHRA. SAHRA will ultimately be responsible for the professional evaluation of Phase 1 AIA reports upon which review comments will be issued. 'Best practice' requires Phase 1 AIA reports and additional development information, as per the impact assessment report and/or EMPr, to be submitted in duplicate to SAHRA after completion of the study. SAHRA accepts Phase 1 AIA reports authored by professional archaeologists, accredited with ASAPA or with a proven ability to do archaeological work.

Minimum accreditation requirements include an Honours degree in archaeology or related discipline and 3 years post-university CRM experience (field supervisor level). Minimum standards for reports, site documentation and descriptions are set by ASAPA in collaboration with SAHRA. ASAPA is based in South Africa, representing professional archaeology in the SADC region. ASAPA is primarily involved in the overseeing of ethical practice and standards regarding the archaeological profession. Membership is based on proposal and secondment by other professional members.

Phase 1 AIA's are primarily concerned with the location and identification of heritage sites situated within a proposed development area. Identified sites should be assessed according to their significance. Relevant conservation or Phase 2 mitigation recommendations should be made. Recommendations are subject to evaluation by SAHRA.

Conservation or Phase 2 mitigation recommendations, as approved by SAHRA, are to be used as guidelines in the developer's decision-making process.

Phase 2 archaeological projects are primarily based on salvage/mitigation excavations preceding development destruction or impact on a site. Phase 2 excavations can only be conducted with a permit, issued by SAHRA to the appointed archaeologist. Permit conditions are prescribed by SAHRA and includes (as minimum requirements) reporting back strategies to SAHRA and deposition of excavated material at an accredited repository.

In the event of a site conservation option being preferred by the developer, a site management plan, prepared by a professional archaeologist and approved by SAHRA, will suffice as minimum requirement.

After mitigation of a site, a destruction permit must be applied for with SAHRA by the applicant before development may proceed.

Human remains older than 60 years are protected by the National Heritage Resources Act, with reference to Section 36. Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act), as well as the Human Tissues Act (Act 65 of 1983), and are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36[5]) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in this age category, located inside a formal cemetery administrated by a local authority, require the same authorisation as set out for graves younger than 60 years, in addition to SAHRA authorisation. If the grave is not situated inside a formal cemetery, but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws, set by the cemetery authority, must be adhered to.

Human remains that are less than 60 years old are protected under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance No. 7 of 1925), as well as the Human Tissues Act (Act 65 of 1983), and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning; or in some cases, the MEC for Housing and Welfare. Authorisation for exhumation and reinternment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. To handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

3 METHODOLOGY

3.1 Literature Review

A brief survey of available literature was conducted to extract data and information on the area in question to provide general heritage context into which the development would be set. This literature search included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS).

3.2 Genealogical Society and Google Earth Monuments

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where sites of heritage significance might be located; these locations were marked and visited during the field work phase. The database of the Genealogical Society was consulted to collect data on any known graves in the area.

3.3 Public Consultation and Stakeholder Engagement:

Stakeholder engagement is a key component of any BAR process, it involves stakeholders interested in, or affected by the proposed development. Stakeholders are provided with an opportunity to raise issues of concern (for the purposes of this report only heritage related issues will be included). The aim of the public consultation process was to capture and address any issues raised by community members and other stakeholders during key stakeholder and public meetings. The process involved:

- Placement of advertisements and site notices
- Stakeholder notification (through the dissemination of information and meeting invitations);
- Stakeholder meetings undertaken with I&APs;
- Authority Consultation
- The compilation of a Basic Assessment Report (BAR).

Please refer to section 6 for more detail.

3.4 Site Investigation

Conduct a field study to: a) systematically survey the proposed project area to locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources recorded in the project area.

Table 4: Site Investigation Details

	Site Investigation
Date	5 April 2018
Season	Summer – The site is overgrown with dense vegetation, hampering archaeological visibility. The impact area was sufficiently covered (Figure 4) to adequately record the presence of heritage resources.

Figure 4: Track logs of the survey in black.

.

3.5 Site Significance and Field Rating

Section 3 of the NHRA distinguishes nine criteria for places and objects to qualify as 'part of the national estate' if they have cultural significance or other special value. These criteria are:

- Its importance in/to the community, or pattern of South Africa's history;
- Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
- Sites of significance relating to the history of slavery in South Africa.

The presence and distribution of heritage resources define a 'heritage landscape'. In this landscape, every site is relevant. In addition, because heritage resources are non-renewable, heritage surveys need to investigate an entire project area, or a representative sample, depending on the nature of the project. In the case of the proposed project the local extent of its impact necessitates a representative sample and only the footprint of the areas demarcated for development were surveyed. In all initial investigations, however, the specialists are responsible only for the identification of resources visible on the surface. This section describes the evaluation criteria used for determining the significance of archaeological and heritage sites. The following criteria were used to establish site significance with cognisance of Section 3 of the NHRA:

- The unique nature of a site;
- The integrity of the archaeological/cultural heritage deposits;
- The wider historic, archaeological and geographic context of the site;
- The location of the site in relation to other similar sites or features;
- The depth of the archaeological deposit (when it can be determined/is known);
- The preservation condition of the sites; and
- Potential to answer present research questions.

In addition to this criteria field ratings prescribed by SAHRA (2006), and acknowledged by ASAPA for the SADC region, were used for the purpose of this report. The recommendations for each site should be read in conjunction with section 10 of this report.

FIELD RATING	***GRADE***	***SIGNIFICANCE***	***RECOMMENDED MITIGATION***
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP. A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP. B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

3.6 Impact Assessment Methodology

The criteria below are used to establish the impact rating on sites:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0-1 years), assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years), assigned a score of 2;
  - medium-term (5-15 years), assigned a score of 3;
  - long term (> 15 years), assigned a score of 4; or
  - permanent, assigned a score of 5;
  - The **magnitude**, quantified on a scale from 0-10 where; 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
  - The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1-5 where; 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
  - The **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
  - the **status**, which will be 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.
  - the *degree* to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:

S=(E+D+M) P

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e., where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e., where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- 60 points: High (i.e., where the impact must have an influence on the decision process to develop in the area).

3.7 Limitations and Constraints of the study

The authors acknowledge that the brief literature review is not exhaustive on the literature of the area. Due to the subsurface nature of archaeological artefacts, the possibility exists that some features or artefacts may not have been discovered/recorded during the survey and the possible occurrence of unmarked graves and other cultural material cannot be excluded. Similarly, the depth of the deposit of heritage sites cannot be accurately determined due its subsurface nature. This report only deals with the footprint area of the proposed development and consisted of non-intrusive surface surveys. This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components would have been highlighted through the public consultation process if relevant. It is possible that new information could come to light in future, which might change the results of this Impact Assessment.

4 Description of Socio Economic Environmental

As per StatsSA the majority of the people residing in the municipality speak Tshivenda as their first language at 63,2%, followed by Xitsonga at 32,5%. Other languages share the remaining 4,3%, with English taking the bigger share at 0,7%. The population in the Vhembe district is dominated by the young generation with 37,6% of people aged 15–35 years, followed by those aged 5–14 years at 22,6%. Adults (36–64) are 20,9%, those aged 0–4 are 12,7%, and lastly, those aged 65+ amount to 6%. Only 4,7% of the population have tertiary education and more than 40% are still in Grade 8–Grade 12 (secondary school). 10% had no schooling.

There are over 156 594 household in Thulamela Municipality, with an average of 3,9 persons per household. The majority of these households live in houses or brick/concrete block structures, which make up 85%, followed by those who live in traditional dwellings (13%).The majority of households in the district have access to piped water at 88%. The municipality's economic growth potential is in agriculture and eco-tourism. Most people in the district derive their livelihood through agricultural pursuits. The main occupation sector is agriculture (commercial and subsistence).

5 Description of the Physical Environment:

The proposed Tilapia Aquaculture Facility (Fish Farm) development will be situated on parts of Portions 17 and 22 of the Farm Goede Hoop 8 LT. It is situated approximately 6km north-east of Elim Hospital in the Makhado Local Municipality in the Vhembe District Municipality within the Limpopo Province. The town of Elim around the Elim Hospital, has expanded rapidly the last two decades and is situated approximately 20km south-east of Louis Trichardt which is the administrative seat and the economic hub of the region.

The proposed site is situated next to a small sloop or gully to its east, which was formed by an intermittent stream feeding into the Albasini Dam from the south. The site slopes down towards this gully to the east of it.
The site measures approximately 1.2ha in size and its eastern boundary is formed by the shoreline of the dam when it is 100% full. The northern boundary is an access road to the dam and the western and southern boundaries are formed by overgrown tracks across the property. The site is not fenced off, but the larger property, which it is situated within is fenced off. A power line crosses the western part of the site.

The prevailing vegetation type and landscape features of the area form part of the Tzaneen Sour Bushveld within the savannah Biome. It is described as deciduous, tall open bushveld (parkland) with a well-developed, tall grass layer, occurring on low to high mountains with undulating plains mainly at the base of, and on the lower to middle slopes of the north-eastern escarpment (Mucina & Rutherford, 2006).

Figure 5. General Site conditions -Access road

Figure 6. General site conditions.

Figure 7. General site conditions.

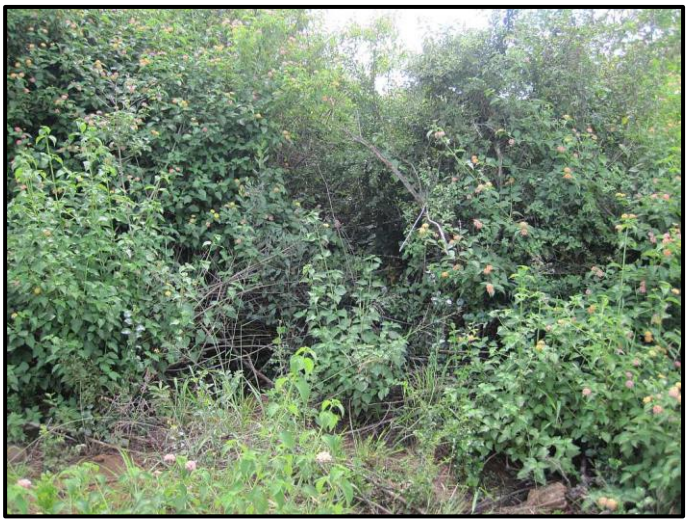


Figure 8. General site conditions

6 Results of Public Consultation and Stakeholder Engagement:

6.1.1 Stakeholder Identification

Adjacent landowners and the public at large were informed of the proposed activity as part of the BA process. Site notices and advertisements notifying interested and affected parties were placed at strategic points and in local newspapers as part of the process.

7 Literature / Background Study:

7.1 Literature Review

The following reports were conducted in the immediate vicinity of the study area and were consulted for this report:

Author	Year	Project	Findings
Roodt, F.	2007	Phase 1 Heritage Resource Impact Assessment (Scoping & Evaluation) Black Hawk Golf and Spa: Phase 2 Residential Development Albasini Dam, Louis Trichardt, Limpopo.	No sites were recorded
Hutten, M.	2008	Phase 1 Heritage Resource Impact Assessment for the proposed Shiluvari Lakeside at Albasini Dam, Elim, Limpopo.	Graves
Gaigher, S.	2013	Heritage Impact Assessment Report for the Proposed Renovation of The Lemana College, Elim, Limpopo Province	Historic structures

7.1.1 Genealogical Society and Google Earth Monuments

No known grave sites are indicated in the study area.

7.2 General History of the area

7.2.1 Archaeology of the area

The archaeological record for the greater study area consists of the Stone Age, Iron Age and Historic period.

7.2.1.1 Stone Age

South Africa has a long and complex Stone Age sequence of more than 2 million years. The broad sequence includes the Later Stone Age (LSA), the Middle Stone Age (MSA) and the Earlier Stone Age (ESA). Each of these phases contain sub-phases or industrial complexes, and within these we can expect regional variation regarding characteristics and time ranges. The three main phases can be divided as follows;

- Later Stone Age; associated with Khoi and San societies and their immediate predecessors. Recently to ~30 thousand years ago
- Middle Stone Age; associated with Homo sapiens and archaic modern humans. 30-300 thousand years ago.
- Earlier Stone Age; associated with early Homo groups such as Homo habilis and Homo erectus. 400 000-> 2 million years ago.

Important LSA deposits have been excavated in Oliboompoort Cave (Mason, 1962) and other sites in the Waterberg (Van der Ryst, 1998). According to Bergh (1999) no Stone Age sites or occurrences are known in the direct area, although some MSA sites, including rock paintings, are known in the larger geographical area around Polokwane (Bergh 1999:4-5). This includes a site called Grace Dieu and another called Mwulu's Cave. Sites in the open are usually poorly preserved and therefore have less value than sites in caves or rock shelters.

7.2.1.2 The Iron Age

The Iron Age as a whole represents the spread of Bantu speaking people and includes both the pre-Historic and Historic periods. The Iron Age is characterised by the ability of these early people to manipulate and work Iron ore into implements that assisted them in creating a favourable environment to make a better living. The Iron Age is divided into three distinct periods:

- The Early Iron Age: Most of the first millennium AD.
- The Middle Iron Age: 10th to 13th centuries AD
- The Late Iron Age: 14th century to colonial period.

Bantu-speaking people moved into Eastern and Southern Africa about 2,000 years ago (Mitchell, 2002). These people cultivated sorghum and millets, herded cattle and small stock and manufactured iron tools and copper ornaments. Because metalworking represents a new technology, archaeologists call this period the Iron Age. Characteristic ceramic styles help archaeologists to separate the sites into different groups and time periods. The first 1,000 years is called the Early Iron Age.

As mixed farmers, Iron Age people usually lived in semi-permanent settlements consisting of pole-and-daga (mud mixed with dung) houses and grain bins arranged around a central area for cattle (Huffman, 1982). Usually, these settlements with the 'Central Cattle Pattern' (CCP) were sited near water and good soils that could be cultivated with an iron hoe. For the project area, archaeological sites such as these may occur.

The study area was in the past, settled by two African tribes, the BaVenda and the Tsonga. The BaVenda broke away from the Karanga in Zimbabwe and crossed the Limpopo entering the Soutpansberg region in two main streams of migration, the Vhatavhatsinde and the Singo, in the 17th century (Stayt 1968). These groups found other tribes occupying the area including the Ngona, Mbedzi, and Twamamba and researchers concurs that peaceful integration between them took place under the rule of Chief Thohoyandou (Eloff 1968). The Madzivhandila and Lwamondo and their followers were integrated

with the BaVenda during the rule of Tshikalanga (the son of Thohoyandou). The Tsonga tribes were farming communities who settled in southern Mozambique from the 16th century onwards. These tribes were disturbed during the Difaquane period of the early 1800‟s by raiding Nguni-groups under the leadership of Zwangendaba, Nxaba and lastly Soshangana. Soshangana gathered various Tsonga tribes under his rule and settled in the Limpopo valley of southern Mozambique, forming the Gaza Empire and the Shangana people of the region. Many Tsonga tribes fled from the raiding Nguni-groups during this period and crossed the Lebombo mountains to the west and settled in the Lowveld of the eastern parts of today's Limpopo Province. A large group of Tsonga people also followed the Portuguese trader Joao Albasini who settled at Goedewensch to the north-west of the study area. After the death of Soshangana in 1858, more Tsonga groups moved to the Lowveld and Limpopo Province to avoid the violence between his two fighting sons Muzila and Mawewe. The tribe was now known as Shangana. Later clashes with the colonial Portuguese authorities also saw some of these Shangana groups fled to the Lowveld and Limpopo Province. These groups all settled amongst and to the south of the Venda in the areas as we find them today (Pienaar, 2007).

7.3 Historical Information

The current farm owners, the Girardin family, are direct descendants of the Swiss missionary George Liengwe who founded the Elim Hospital in 1899. They run Shiluvari Lakeside Lodge on the property since democracy in 1994 in conjunction with the Tlakula and Baloyi families. Before that, the farm was part of the local farming community and contributed in cattle farming as its main focus.

Figure 9. The old Goede Hoop farm house (Shiluvari Lakeside Lodge – www.shiluvari.com)

The proposed site for the development is situated on the southern side of the Albasini Dam. The Albasini Dam was built in 1952 and was subsequently raised to 34 meters, by means of spillway gates in 1971. This dam was built to supply the Levubu Irrigation Scheme with water, but now mostly supply water across the Makhado Local Municipality.

7.3.1. Anglo-Boer War

The Anglo-Boer War was the greatest conflict that had taken place in South Africa up to date and Pietersburg was the northernmost concentration camp in the Transvaal system, it was isolated and difficult to service (www2.lib.uct.ac.za/mss/bccd/Histories/Pietersburg/).

7.3.2. Cultural Landscape

The area under investigation is located just to the south of Albasini Dam, about 20 km to the east of Louis Trichardt, Limpopo Province.

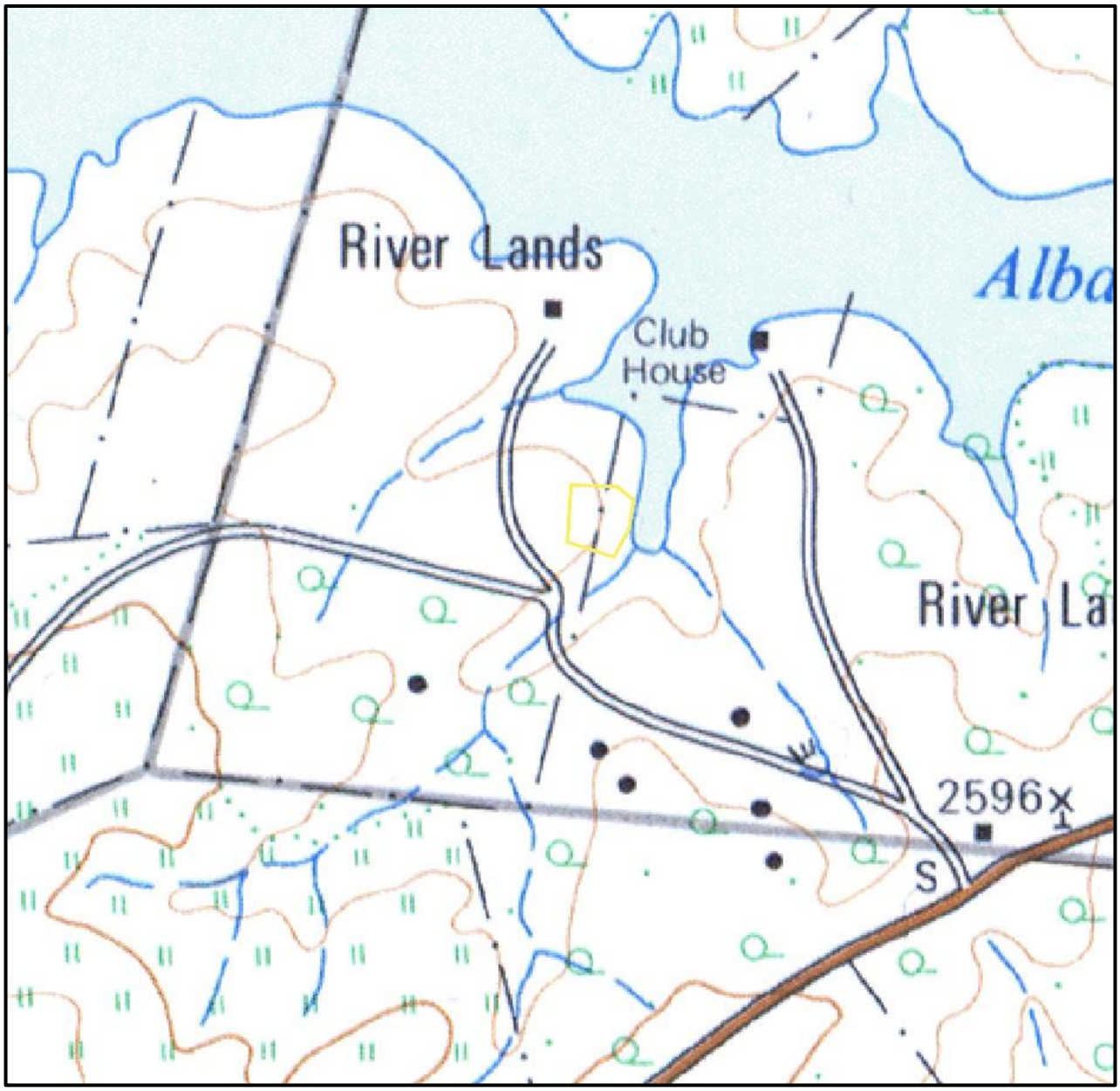


Figure 10. 1967 Topographical map of the site under investigation. The approximate study area is indicated with a yellow border. It seems that a farm boundary went through the study area. The site bordered the Albasini Dam. No developments are visible within the study area. (Topographical Map 1967)

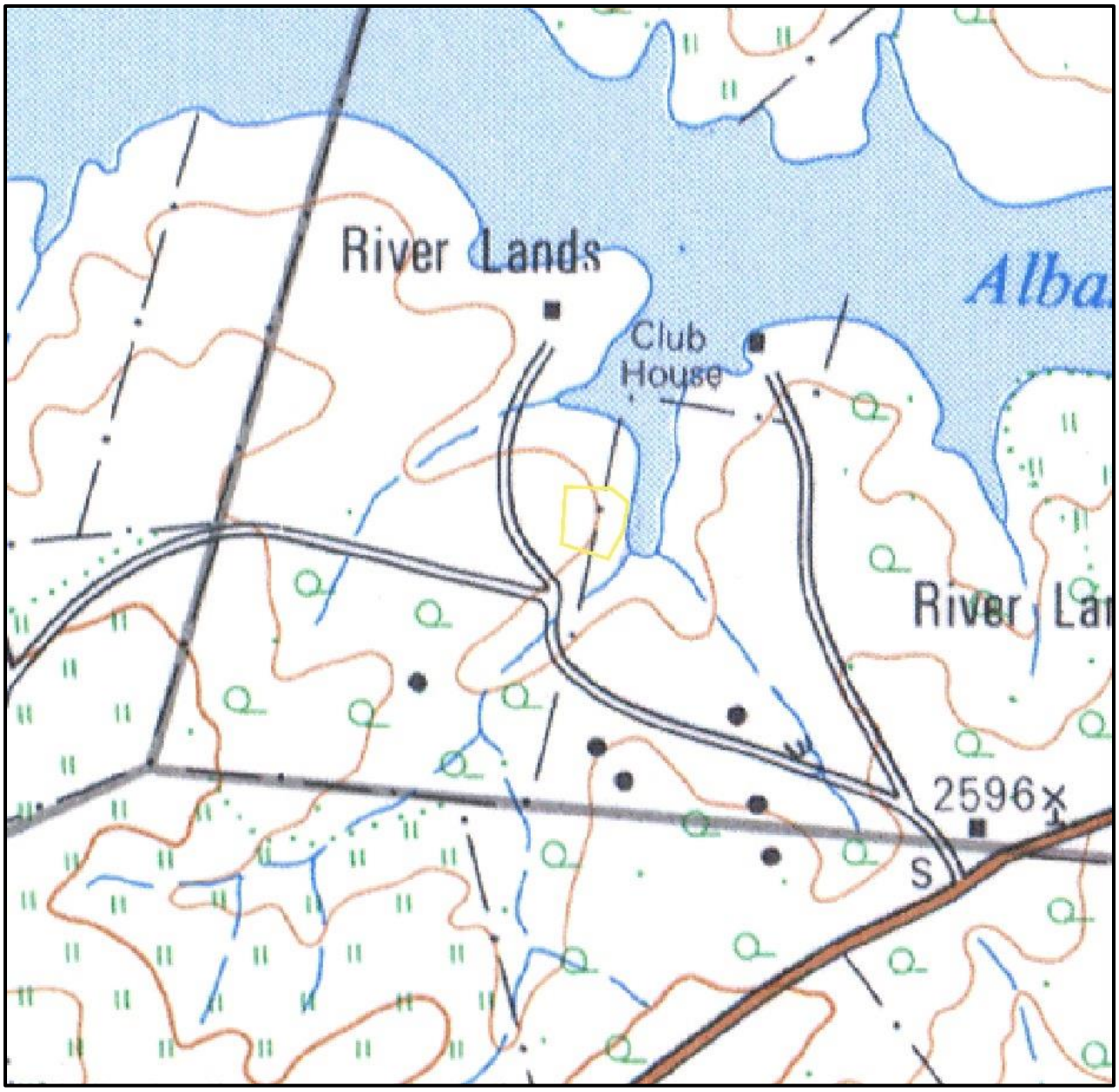


Figure 11. 1980 Topographical map of the site under investigation. The approximate study area is indicated with a yellow border. It seems that a farm boundary went through the study area. The site bordered the Albasini Dam. No developments are visible within the study area. (Topographical Map 1980)

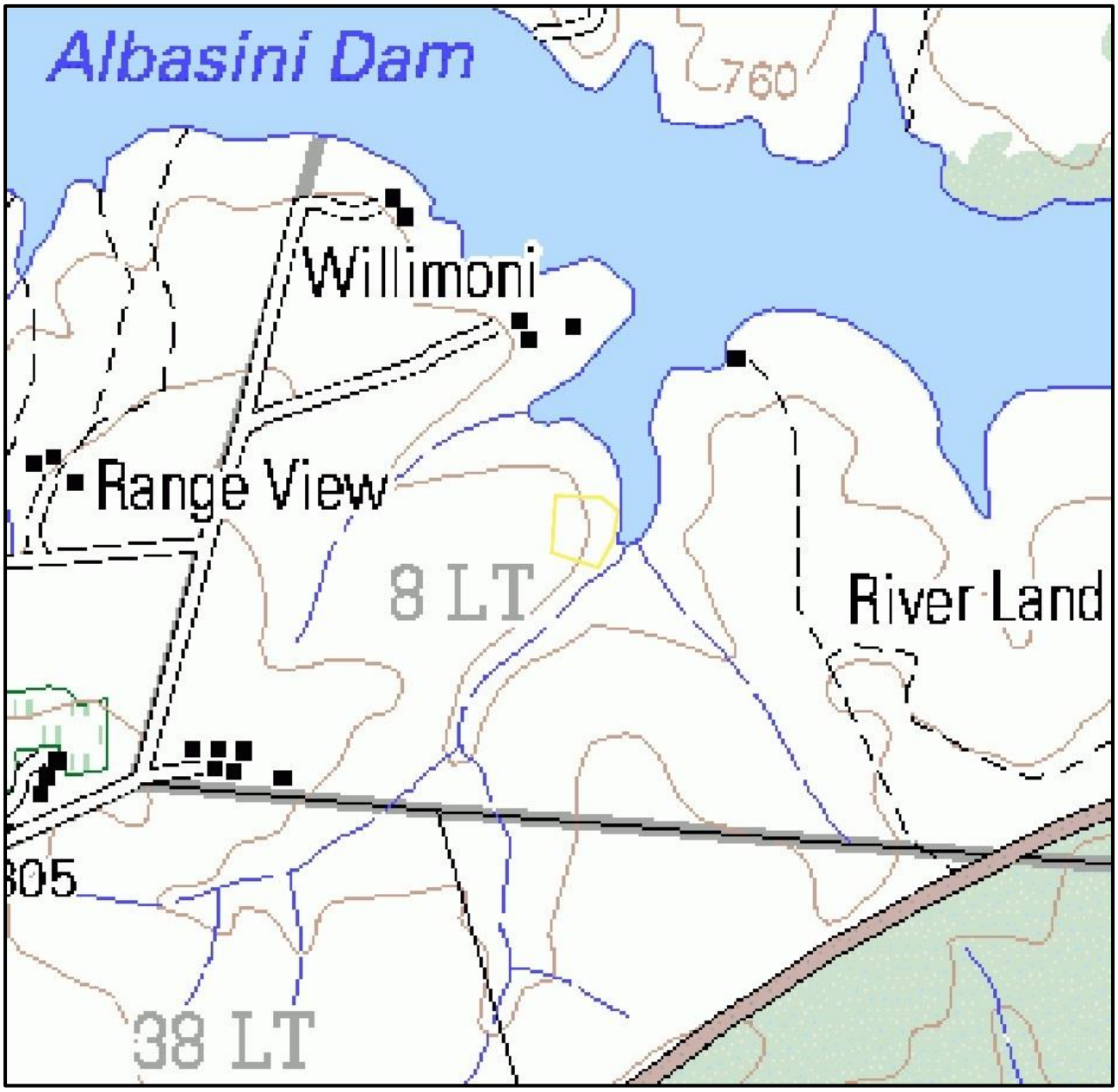


Figure 12. 1997 Topographical map of the site under investigation. The approximate study area is indicated with a yellow border. No developments are visible within the study area. (Topographical Map 1997)

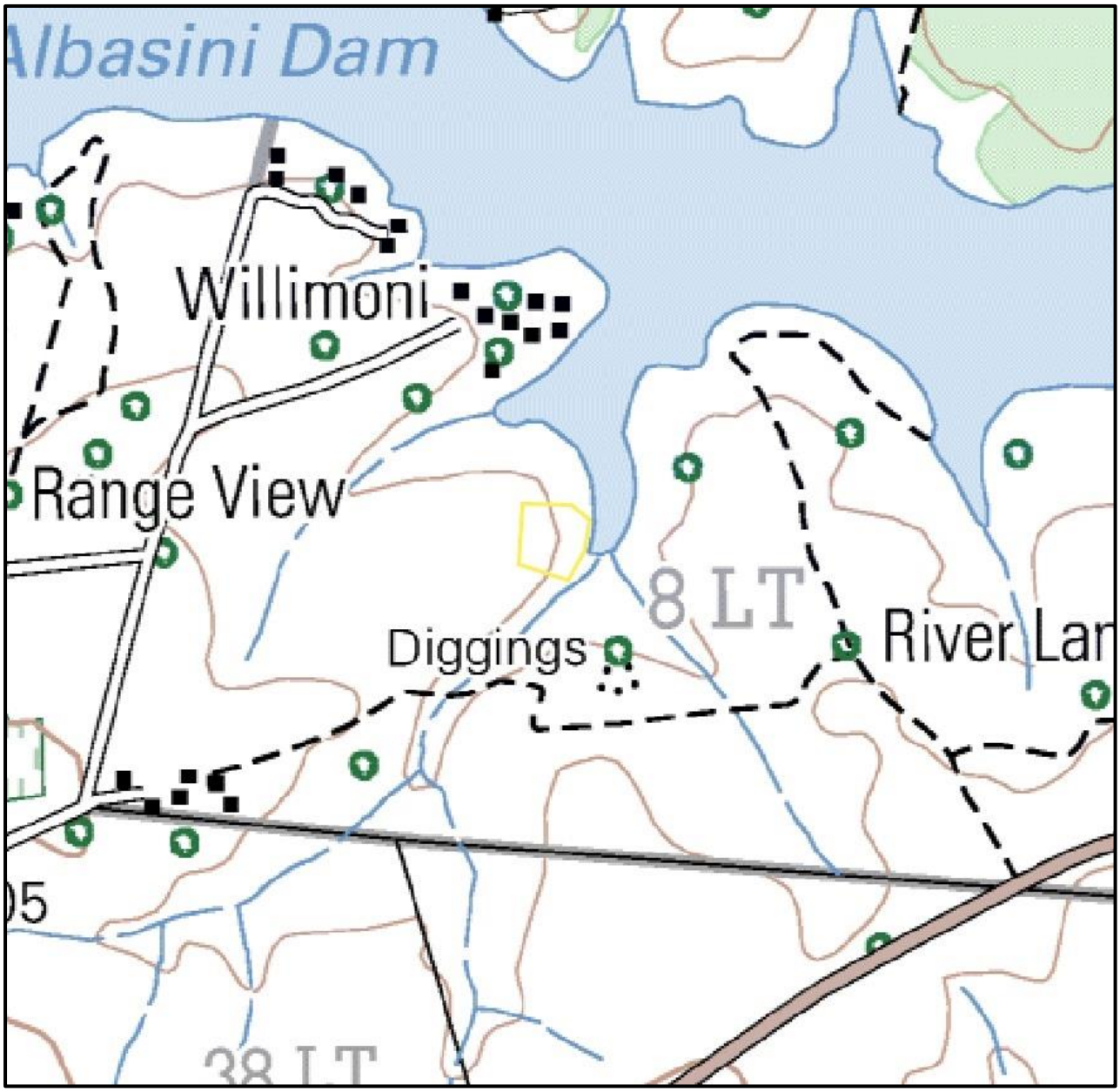


Figure 13. 2008 Topographical map of the site under investigation. The approximate study area is indicated with a yellow border. No developments are visible within the study area. (Topographical Map 2008)

Figure 14. 2017 Google Earth image showing the study area in relation to Louis Trichardt, the R524, Valdezia and other sites. (Google Earth 2017)

8 Findings of the Survey

The study area is situated in the Thulamela Local Municipality in the Vhembe District Municipality and is located 8 km north-east of Elim outside the town of Louis Trichardt. The site is heavily overgrown with grasses, *Lantana camara* (Lantana) and *Rubus cuneifolius* (Bramble Bush). The overgrown vegetation is so dense that most parts of it are impenetrable and it resulted in limited access to large parts of the proposed site.

One of the farm workers, Zake, accompanied the investigating team to show them the location of the proposed development site. Zake was asked if he knew about any heritage resources (such as graves) within the proposed area. He indicated that he was not aware of any heritage resources within the area but did point out graves on other parts of the farm. No sites or finds of any heritage value or significance was identified within the proposed study area.

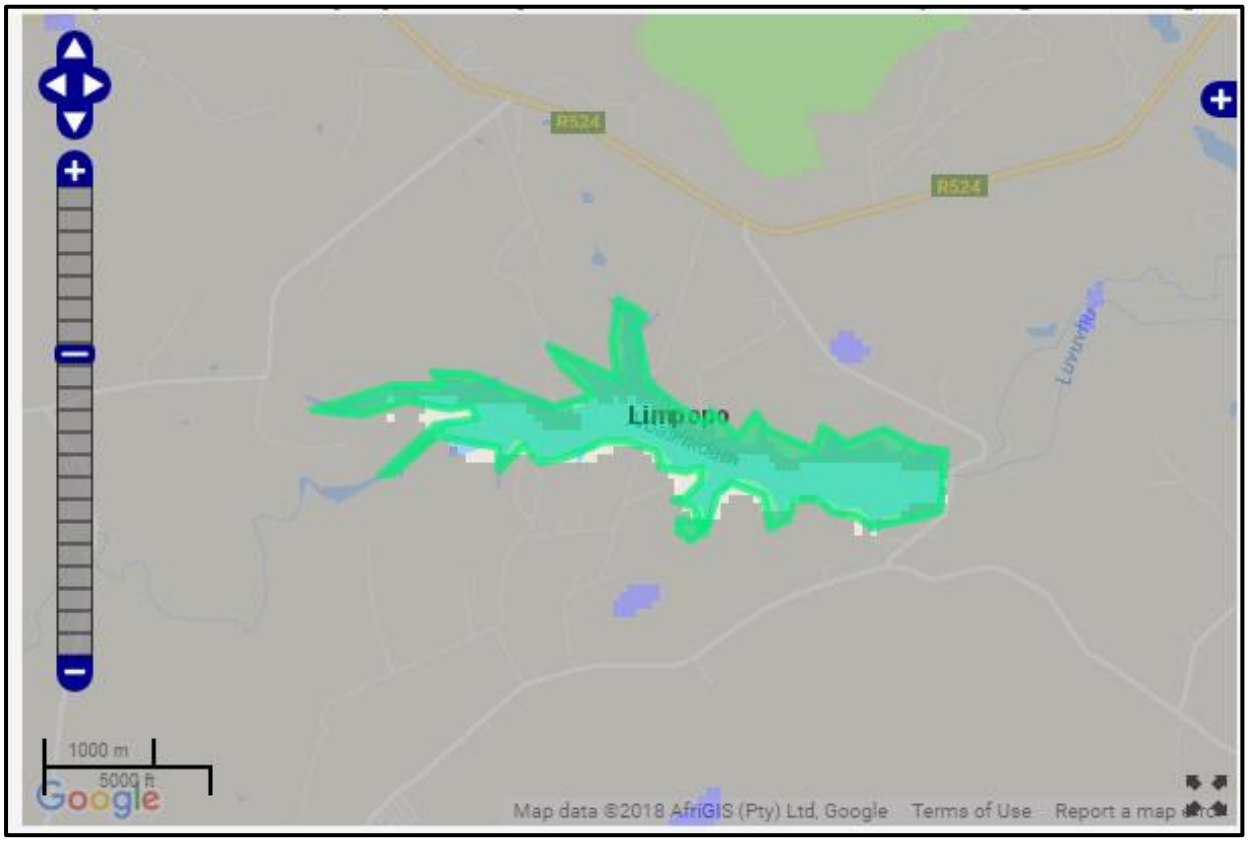
8.1 Built Environment (Section 34 of the NHRA)

No standing structures older than 60 years occur in the study area.

8.2 Archaeological and palaeontological resources (Section 35 of the NHRA)

No archaeological sites or material was recorded during the survey. Therefore, no further mitigation prior to construction is recommended in terms of the archaeological component of Section 35 of the NHRA for the proposed development to proceed.

According to the SAHRIS palaeontological sensitivity map (Figure 15) the study area is of insignificant palaeontological sensitivity no further Paleontological studies are required.



Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 15.Palaeontological sensitivity map with the study area indicated as of no significance.

8.3 Burial Grounds and Graves (Section 36 of the NHRA)

In terms of Section 36 of the Act no burial sites were recorded.

8.4 Cultural Landscapes, Intangible and Living Heritage.

Long term impact on the cultural landscape is considered to be negligible as the study area has previously been disturbed by agricultural activities and the development impact on land is fairly small in size. Visual impacts to scenic routes and sense of place are also considered to be low.

8.5 Battlefields and Concentration Camps

There are no battlefields or concentration camp sites in the study area.

8.6 Potential Impact

The chances of impacting unknown archaeological sites in the study area is considered to be negligible. Any direct impacts that did occur would be during the construction phase only and would be of very low significance. Cumulative impacts occur from the combination of effects of various impacts on heritage resources. The importance of identifying and assessing cumulative impacts is that the whole is greater than the sum of its parts. In the case of the development, it will, with the recommended mitigation measures and management actions, not impact any heritage resources directly. However, this and other projects in the area could have an indirect impact on the larger heritage landscape. The lack of any heritage resources in the immediate area and the extensive existing development surrounding the study area minimises additional impact on the landscape.

8.6.1 Pre-Construction phase:

It is assumed that the pre-construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure needed for the construction phase. These activities can have a negative and irreversible impact on heritage sites. Impacts include destruction or partial destruction of non-renewable heritage resources.

8.6.2 Construction Phase

During this phase, the impacts and effects are similar in nature but more extensive than the pre-construction phase. These activities can have a negative and irreversible impact on heritage sites. Impacts include destruction or partial destruction of non-renewable heritage resources.

8.6.3 Operation Phase:

No impact is envisaged for the recorded heritage resources during this phase.

Table 5. Impact Assessment table.

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological material or objects.		
	Without mitigation	**With mitigation (Preservation/ excavation of site)**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (2)
Probability	Not probable (2)	Not probable (2)
Significance	**16 (Low)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	No resources were recorded	No resources were recorded.
Can impacts be mitigated?	Yes, a chance find procedure should be implemented.	Yes
Mitigation: Due to the lack of apparent significant archaeological resources no further mitigation is required prior to construction. A Chance Find Procedure should be implemented for the project should any sites be identified during the construction process.		
Cumulative impacts: Since no heritage significant resources occur in the study area cumulative impacts are considered to be low.		
Residual Impacts: If sites are destroyed this results in the depletion of archaeological record of the area. However, if sites are recorded and preserved or mitigated this adds to the record of the area.		

9 Conclusion and recommendations

The CSIR conducted a Basic Assessment for the Makwaria Fish Farm. The project is a proposed medium sized aquaculture facility that will produce up to 200 tons of Mozambique tilapia, *Oreochromis mossambicus* species native to the area in cages in the Albasini Dam in rural Elim, Louis Trichardt in the Limpopo Province coordinates 23°10'66.55" S, 30°11'10.36" E. The dam is located 8 km north-east of Elim outside the town of Louis Trichardt. HCAC was appointed by the CSIR to conduct a Heritage Impact Assessment to determine the presence of cultural heritage sites and the impact of the proposed development on these non-renewable resources. The study area was assessed both on desktop level and by a field survey. The field survey was conducted as a non-intrusive pedestrian survey to cover the extent of property as development plans are not available at this stage.

No archaeological sites or material of significance was recorded during the survey. According to the SAHRIS Paleontological Sensitivity map the area is of insignificant paleontological sensitivity and the extend of the current developments would have destroyed any surface indications of paleontological resources. No further mitigation prior to construction is recommended in terms of Section 35 for the proposed development to proceed. In terms of the built environment of the area (Section 34), no standing structures older than 60 years occur within the study area. In terms of Section 36 of the Act no burial sites were recorded. If any graves are located in future they should ideally be preserved *in-situ* or alternatively relocated according to existing legislation. No public monuments are located within or close to the study area. The proposed application is in line with the general land use and will therefore not impact further on significant cultural landscapes or viewscapes. During the public participation process conducted for the project no heritage concerns was raised.

Due to the lack of significant heritage resources in the study area the impact of the proposed project on heritage resources is considered low and it is recommended that the proposed project can commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA:

- Implementation of a chance find procedure.

9.1 Chance Find Procedures

The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find and therefor chance find procedures should be put in place as part of the EMP. A short summary of chance find procedures is discussed below.

This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below.

- If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
- It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area.
- The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

9.2 Reasoned Opinion

The impact of the proposed project on heritage resources is considered low and no further pre-construction mitigation in terms of archaeological resources is required based on approval from SAHRA. Furthermore, the socio-economic benefits also outweigh the possible impacts of the development on heritage resources. With the correct mitigation measures (i.e. chance find procedure) implemented for the project, impacts can be mitigated to an acceptable level.

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11 Appendices:

Curriculum Vitae of Specialist

Jaco van der Walt
Archaeologist

jaco.heritage@gmail.com
+27 82 373 8491
+27 86 691 6461

Education:

Particulars of degrees/diplomas and/or other qualifications:

Name of University or Institution:		University of Pretoria
Degree obtained	**:**	BA Heritage Tourism & Archaeology
Year of graduation	**:**	2001
Name of University or Institution:		University of the Witwatersrand
Degree obtained	**:**	BA Hons Archaeology
Year of graduation	**:**	2002
Name of University or Institution	**:**	University of the Witwatersrand
Degree Obtained	**:**	MA (Archaeology)
Year of Graduation	:	2012
Name of University or Institution	**:**	University of Johannesburg
Degree	**:**	PhD
Year	:	Currently Enrolled

EMPLOYMENT HISTORY:

2011 – Present:	**Owner – HCAC (Heritage Contracts and Archaeological Consulting CC)**.
2007 – 2010 :	**CRM Archaeologist,** Managed the Heritage Contracts Unit at the University of the Witwatersrand.
2005 - 2007:	**CRM Archaeologist**, Director of Matakoma Heritage Consultants
2004:	**Technical Assistant**, Department of Anatomy University of Pretoria
2003:	**Archaeologist**, Mapungubwe World Heritage Site
2001 - 2002:	**CRM Archaeologists,** For R & R Cultural Resource Consultants, Polokwane
2000:	**Museum Assistant**, Fort Klapperkop.

Countries of work experience include:

Republic of South Africa, Botswana, Zimbabwe, Mozambique, Tanzania, The Democratic Republic of the Congo, Lesotho and Zambia.

SELECTED PROJECTS INCLUDE:

Archaeological Impact Assessments (Phase 1)

Heritage Impact Assessment Proposed Discharge Of Treated Mine Water Via The Wonderfontein Spruit Receiving Water Body Specialist as part of team conducting an Archaeological Assessment for the Mmamabula mining project and power supply, Botswana

Archaeological Impact Assessment Mmamethlake Landfill

Archaeological Impact Assessment Libangeni Landfill

Linear Developments

Archaeological Impact Assessment Link Northern Waterline Project At The Suikerbosrand Nature Reserve

Archaeological Impact Assessment Medupi – Spitskop Power Line,

Archaeological Impact Assessment Nelspruit Road Development

Renewable Energy developments

Archaeological Impact Assessment Karoshoek Solar Project

Grave Relocation Projects

Relocation of graves and site monitoring at Chloorkop as well as permit application and liaison with local authorities and social processes with local stakeholders, Gauteng Province.

Relocation of the grave of Rifle Man Maritz as well as permit application and liaison with local authorities and social processes with local stakeholders, Ndumo, Kwa Zulu Natal.

Relocation of the Magolwane graves for the office of the premier, Kwa Zulu Natal

Relocation of the OSuthu Royal Graves office of the premier, Kwa Zulu Natal

Phase 2 Mitigation Projects

Field Director for the Archaeological Mitigation For Booysendal Platinum Mine, Steelpoort, Limpopo Province. Principle investigator Prof. T. Huffman

Monitoring of heritage sites affected by the ARUP Transnet Multipurpose Pipeline under directorship of Gavin Anderson.

Field Director for the Phase 2 mapping of a late Iron Age site located on the farm Kameelbult, Zeerust, North West Province. Under directorship of Prof T. Huffman.

Field Director for the Phase 2 surface sampling of Stone Age sites effected by the Medupi – Spitskop Power Line, Limpopo Province

Heritage management projects

Platreef Mitigation project – mitigation of heritage sites and compilation of conservation management plan.

MEMBERSHIP OF PROFESSIONAL ASSOCIATIONS:

- Association of Southern African Professional Archaeologists. Member number 159

  Accreditation:
  - Field Director Iron Age Archaeology
  - Field Supervisor Colonial Period Archaeology, Stone Age Archaeology and Grave Relocation
- Accredited CRM Archaeologist with SAHRA
- Accredited CRM Archaeologist with AMAFA
- Co-opted council member for the CRM Section of the Association of Southern African Association Professional Archaeologists (2011 – 2012)

PUBLICATIONS AND PRESENTATIONS

- A Culture Historical Interpretation, Aimed at Site Visitors, of the Exposed Eastern Profile of K8 on the Southern terrace at Mapungubwe.
  - J van der Walt, A Meyer, WC Nienaber
  - Poster presented at Faculty day, Faculty of Medicine University of Pretoria 2003
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1. Prof Marlize Lombard — Senior Lecturer, University of Johannesburg, South Africa
   E-mail: mlombard@uj.ac.za
2. Prof TN Huffman — Department of Archaeology Tel: (011) 717 6040
   University of the Witwatersrand
3. Alex Schoeman — University of the Witwatersrand
   E-mail: Alex.Schoeman@wits.ac.za

FRESHWATER AND AQUATIC ECOLOGICAL ASSESSMENT AND TERRESTRIAL ECOLOGICAL SCAN AS PART OF THE WATER USE LICENCING AND ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED MAKWARIA FISHERY, BORDERING THE ALBASINI DAM, LIMPOPO PROVINCE

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Prepared by:	**Scientific Aquatic Services**
Report author:	**M. Meintjies**
	K. Dyamond
Report reviewer:	**S. van Staden (Pr. Sci. Nat)**
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Scientific Aquatic Services CC
CC Reg No 2003/078943/23
Vat Reg. No. 4020235273
PO Box 751779
Gardenview
2047
Tel: 011 616 7893
Fax: 086 724 3132
E-mail: admin@sasenvgroup.co.za

EXECUTIVE SUMMARY

It is the opinion of the specialists, from an aquatic, freshwater and terrestrial resource conservation perspective, that the proposed project be considered favourably, with the proviso that strict adherence to mitigation measures, including a rigorous monitoring program is enforced, and approval and permits where applicable, are obtained from the various authorities, in order to ensure that the ecological integrity of the ecological resources is not further compromised.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater resource, aquatic and terrestrial ecological assessment as part of the Water Use Licencing (WUL) and Environmental Impact Assessment (EIA) process for the proposed Makwaria Fisheries Mozambique Tilapia (*Oreochromis mossambicus*) aquaculture and primary processing facility on Albasini Dam, near Louis Trichard, Limpopo Province.

Following the assessment of the terrestrial ecology associated with the proposed primary processing facility, it is clear that a single habitat unit is associated with the proposed primary processing facility, namely the Secondary Bushveld Habitat Unit. This habitat was associated with severe bush encroachment by *Dichrostachys cinerea* subsp. *africana* (Sickle bush), and the alien invasive species *Lantana camara* (Common Lantana), as a result of overgrazing by domestic livestock such as cattle. The proposed primary processing facility falls within the Tzaneen Sour Bushveld vegetation type (Mucina & Rutherford, 2012), which is considered a vulnerable ecosystem according to the National Threatened Ecosystem Database (2011).Although various tree species observed within the proposed primary processing facility, such as *S. birrea* subsp. *caffra* (Marula), *Peltophorum africanum* (African Wattle), and *Oleo europaea* subsp. *africana* (Wild Olive) are indigenous to the Tzaneen Sour Bushveld, the proposed primary processing facility is no longer considered to be truly representative of the Tzaneen Sour Bushveld vegetation type. As such proposed primary processing facility is considered to be comprised of secondary vegetation, and the ecological importance and sensitivity considered moderately low. During the assessment, it was evident that the proposed primary processing facility did provide suitable habitat for the tree species *Sclerocarya birrea* subsp. *caffra* (Marula) protected under the National Forest Act (NFA) of 1998 (amended 2011), of which saplings were observed on the western boundary of the proposed primary processing facility. It is, however, likely that more individuals might be present within the proposed primary processimg facility, although they were not observed as bush encroachment limited movement within the proposed primary processing plant. It is therefore recommended that once the layout of the proposed primary processing facility have been finalised a specialist be consulted to mark all *S. birrea* subsp. *caffra* individuals situated within the development footprint areas, that as many of these individuals as possible be avoided and a permit for the removal of all identified individuals to be destroyed be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF), prior to the commencement of vegetation clearance.

A single freshwater resource was identified within the investigation area, namely the Albasini Dam. Even though the Albasini Dam is an artificial impoundment within the Luvuvhu River, it is still considered an ecologically functional feature as it forms part of a natural watercourse. The impoundment of the system has significantly altered the hydrology of the Luvuvhu River, albeit the area surrounding the Albasini Dam is not significantly impacted by anthropogenic activities. As such, the Present Ecological State (PES) of the system is considered to be moderately modified. The Ecological Importance and Sensitivity (EIS) of the Albasini Dam falls within Category C, which is described as a resource that is considered to be ecologically important on a local scale, albeit that the biodiversity of these systems is not usually very sensitive to limited flow and habitat modifications. The Albasini Dam, however, provides valuable ecosystem services functions such as water supply for domestic and agricultural activities. As a subsistence, fishery it also provides harvestable protein resources for the local community.

The southern portion of the proposed primary processing plant falls within the 32 m Zone of Regulation as per National Environmental Management Act (NEMA), while the majority of the proposed primary processing plant falls within the 100 m Zone of Regulation (GN 509). As such an application will have to filed with the relevant authorities (DAFF and the Department of Water and Sanitation (DWS)) for all infrastructure situated within the respective regulatory zones.

The aquatic ecological assessment concluded that the general water quality of the Albasini Dam was found to be fair during the current assessment. Electrical conductivity (EC) was within the ideal range limit (30 mS/m) recommended by the DWA 2011 Resource Water Quality Objectives (RWQO) of South Africa at both sites Dam Point 1 and Dam Point 2, and dissolved oxygen (DO) saturation exceeded 80% and hence complied with recommended natural conditions.

The absolute pH value of both sites did not comply with the recommended range (< 6.5 and > 8.4) as defined by the DWA RWQO's (2011). Adverse effects on the aquatic ecology resulting from pH is, however, unlikely at the time of the assessment, as the absolute pH is very close to the lower end of the recommended range. Temperature at the time of the assessment is normal considering seasonal and diurnal cycles.

The assessment of aquatic macro-invertebrate community resulted in the identification of thirteen (13) different taxa (combined from both sites), with the three dominant taxa being identified as Atyidae, Baetidae and Corixidae. The number of taxa and the sensitivity scores for each taxon were used to calculate the average score per taxon (indicating sensitivity), which resulted in a value of 4.15 for site Dam Point 1 and 3.44 for site Dam Point 2. These scores indicate a relatively diverse community of aquatic macro-invertebrates given that the system is non-flowing. It is evident from the assessment that more air-breathing macro-invertebrates, such as Belostomatidae, Corixidae, Gerridae, Veliidae, Lymnaeidae, Planorbinae and Thiaridae, were present in the dam. The presence of these macro-invertebrates is not uncommon in a lentic system such as the Albasini Dam. In addition, the lack of flowing water largely contributes to the absence of many of the common flow-dependant macro-invertebrate species that were not observed in the current assessment, such as the Perlidae, Heptageniidae, Hydropsychidae and Simulidae families. The instream and riparian zones at both sites could be regarded as largely modified at the time of the assessment, which is indicated by the overall Category D score obtained after employing the IHIA index.

The depth of the dam and the unstable nature of the emergent vegetation at the dam's edge restricted electrofishing and cast-netting to a large degree. In addition, fish tend to remain deeper at lower temperatures in dam environments, thus increasing the difficulty with which to reach them employing the fish sampling methods mentioned. However, the results from the FRAI assessment at both sites indicated a Category D, as *Enteromius unitaeniatus, Pseudocrenilabrus philander*, *Coptodon rendalii* and *Oreochromis mossambicus* were observed and reported by local anglers during the current field assessment in April 2018.

The primary impact on the terrestrial ecology will arise from clearing of vegetation during the construction of the proposed primary processing plant, which will result in a loss of floral and faunal habitat, diversity, and Species of Conservation Concern (SCC) if not appropriately mitigated.

Although the development of the proposed infrastructure adjacent to the dam, will result in an increase in hardened surfaces in the area, and as such additional storm water input into the dam, the small development footprint of the processing plant, is unlikely to have a significant impact on the hydrology, geomorphology, or biota of the receiving watercourse. It is anticipated that the only impact on the freshwater ecology will derive from the farming of the *O. mossambicus* during the operational phase of the proposed project. The most significant risk is that of eutrophication (increased organic input resulting from feeding and fish waste products).

As such the potential impacts of the farming of *O. mossambicus* on the aquatic ecology for both the construction and operational phase, as well as the construction and operation of the primary processing plant on the terrestrial ecology, is anticipated to be moderate to low prior to implementation of mitigation measures. With mitigation fully implemented and regular monitoring, the impact significance of all impacts during all phases can be lowered from moderate/low to low/very low levels.

DOCUMENT GUIDE

The table below provides the NEMA (2017) Requirements for Biodiversity Assessments, and also the relevant sections in the reports where these requirements are addressed.

No.	Requirement	Section in report
a)	Details of -	-
(i)	The specialist who prepared the report	Appendix L
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix L
b)	A declaration that the specialist is independent	Appendix L
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.2
cA)	An indication of the quality and age of base data used for the specialist report	Section 2 and 3
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4 to 6
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix C to F
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 4.4 and 5.3
g)	An identification of any areas to be avoided, including buffers	Section 4.4 and 5.3
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 4.4 and 5.3
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.3
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 7
k)	Any mitigation measures for inclusion in the EMPr	Section 7
l)	Any conditions for inclusion in the environmental authorisation	Section 7
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 7
n)	A reasoned opinion -	-
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 8
(iA)	Regarding the acceptability of the proposed activity or activities	Section 8
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 8
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome - usually international in origin.
Alluvial soil:	A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
Base flow:	Long-term flow in a river that continues after storm flow has passed.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area contributing to runoff at a particular point in a river system.
Chroma:	The relative purity of the spectral colour, which decreases with increasing greyness.
Delineation:	To determine the boundary of the full supply level of the dam based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Obligate species:	Species almost always found in wetlands (>99% of occurences).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater.
Perennial:	Flows all year round.

RAMSAR:	The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface.
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.

ACRONYMS

% DO sat	Dissolved Oxygen Saturation
°C	Degrees Celsius.
ASPT	Average Score Per Taxon
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
BMWP	British Biological Monitoring Working Party
BOD	Biological Oxygen Demand
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CR	Critically Endangered
CSIR	Council of Scientific and Industrial Research
DD	Data Deficient
DEA	Department of Environmental Affairs
DEMC	Desired Ecological Management Class
DO	Dissolved Oxygen
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EN	Endangered
ES	Ecological Sensitivity
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Area
FRAI	Fish Response Assessment Index
GIS	Geographic Information System
GN	General Notice
GPS	Global Positioning System
HGM	Hydro-geomorphic
IBA	Important Bird Area
IHAS	Invertebrate Habitat Assessment System
IHI	Index of Habitat Integrity
IUCN	International Union for the Conservation of Nature
LC	Least Concern
LEMA	Limpopo Environmental Management Act
m.a.m.s.l	Metres above Mean Sea Level
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MC	Management Class
MFD	Mean Frost Days
mm	Millimetre
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy

NT	Near Threatened
NWA	National Water Act
NYBA	Not Yet Been Assessed
PEMC	Present Ecological Management Class
PES	Present Ecological State
POC	Probability of Occurrence
PRECIS	National Herbarium Pretoria Computerised Information System
R	Rare
REC	Recommended Ecological Category
RHP	River Health Program
RQIS	Research Quality Information Services
RWQO	** Resource Water Quality Objectives
SA RHP	South African River Health Programme
SACAD	South African Conservation Areas Database
SACNASP	South African Council for Natural Scientific Professions
SAIAB	South African Institute of Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SAPAD	South African Protected Areas Database
SAS	Scientific Aquatic Services CC
SASS5	South African Scoring System
SCC	Species of Conservation Concern
SoER	State of Environment Report
SQR	Sub-Quaternary Reach
SubWMA	Sub-Water Management Area
TIN	Total Inorganic Nitrogen
TP	Total Phosphate
TWQR	* Target Water Quality Requirement
VU	Vulnerable
WET	Whole Effluent Toxicity
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Area
WMS	Water Management System
WRC	Water Research Council
WUL	Water Use Licence

***** South African water quality guidelines volume 7, Aquatic ecosystems (DWS 1996): This reference provides percentage change guidelines as follows:

- **Electrical conductivity (EC)/Total Dissolved Solids (TDS)** concentrations should not be changed by > 15 % from the normal cycles of the water body under unimpacted conditions at any time of the year, and the amplitude and frequency of natural cycles in EC/TDS concentrations should not be changed;
- **pH values** should not be allowed to vary from the range of the background pH values for a specific site and time of day, by > 0.5 of a pH unit, or by > 5 %, and should be assessed by whichever estimate is the more conservative.
- **Dissolved Oxygen (DO)** concentration should be 80% to 120% of saturation. In addition, for the purposes of this report, any spatial or temporal change exceeding 15% will be considered significant.

Note that EC and pH comparisons refer to temporal comparisons. However, as no guidelines are available for spatial comparisons, the percentage change recommendations will also be applied to spatial comparisons. For the purpose of this report, a temporal or spatial change of 15% will be considered significant with reference to DO.

**** The Resource Water Quality Objectives (RWQO) of South Africa (DWA, 2011).**

Electrical Conductivity (mS/m)		pH	
Ideal Range Limit	30 mS/m	Ideal Range Limit	≥ 6.5 - ≤ 8.0
Acceptable Range Limit	50 mS/m	Acceptable Range Limit	> 8.0 - ≤ 8.4
Tolerable Range Limit	85 mS/m	Tolerable Range Limit	No Range Limit
Unacceptable Range Limit	>85 mS/m	Unacceptable Range Limit	< 6.5 and > 8.4

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater resource, aquatic and terrestrial ecological assessment as part of the Water Use Licencing (WUL) and Environmental Impact Assessment (EIA) process for the proposed Makwaria Fisheries Mozambique Tilapia (*Oreochromis mossambicus*) aquaculture facility on Albasini Dam, near Louis Trichard, Limpopo Province (hereafter referred to as "study area"). The proposed primary processing plant is located approximately 3.47km north-east of the periphery of the Mpheni town, 6.2km west of the town of Valdezia and approximately 19km east of the town of Louis Trichardt [Geodesic Distance] (Figure 1 and 2).

Growing public demand for a healthy, tasty and affordable food (particularly proteins), as well as a decline in wild fish populations as a result of overharvesting and water pollution, has stimulated and promoted the culture of farm-fresh fish that are grown in contaminant-free waters in indoor tank systems. Makwaria Holdings is proposing to establish a medium sized cage culture (flow-through system) aquaculture facility that will produce up to 200 tons of Mozambique tilapia, (*Oreochromis mossambicus)* native to the area in cages in the Albasini Dam. The project is also proposing use of 1.5 ha of land for the on-shore facilities related to the fish farm (workers unit, storage and fish harvesting). The dam has a capacity of 28200 m^3, with the current water level being 750.8 m above mean sea level (mamsl), the surface area 3.498 km^2 and the dam wall 34 m high.

Cages will be placed at defined points (A to E) with the depth varying from 18.5 m to 20 m (Table 1 and Figure 3 below). The fish will be distributed into five adjustable grow out cages of varying diameters (10 m to 50 m), with a flow through system to culture aquatic organisms.

Table 1: Co-ordinates of the proposed cage sites on the Albasini Dam.

Points	Coordinates		Height (m)	Depth (m)
	Latitude (S)	Longitude (E)		
A	23:06:27.7365 S	30:07:18.6881 E	732.251	18.5
B	23:06:27.6667 S	30:07:01.2198 E	731.903	18.9
C	23:06:22.5669 S	30:06:24.7368 E	730.856	20.0
D	23:06:13.4585 S	30:06:00.1875 E	731.382	19.5
E	23:06:11.8988 S	30:05:24.5429 E	731.670	19.2

In order to identify all freshwater resources that may potentially be impacted by the Makwaria Fishery, a 500m “zone of investigation” around the proposed primary processing plant, in accordance with General Notice 509 of 2016 as it relates to the National Water Act (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500m zone of investigation around the proposed primary processing plant, will henceforth be referred to as the “investigation area”.

The purpose of this report is to define the ecology of the proposed primary processing plant in terms of freshwater, aquatic and terrestrial aspects, mapping of the resources, defining areas of increased Ecological Importance and Sensitivity (EIS), and to define the Present Ecological State (PES) of the area under investigation. In addition, this report aims to define the socio-cultural and ecological service provision of the Albasini Dam and the Recommended Ecological Category (REC) for the Albasini Dam. It is a further objective of this study to provide detailed information to guide the proposed activities within and in the vicinity of the Albasini Dam and other sensitive areas, to ensure that ongoing functioning of the ecosystem, such that local and regional conservation requirements and the provision of ecological services in the local area are supported.

A further aim of this report is to present the results obtained during the aquatic ecological assessment, which include the *in-situ* water quality at two points along the Albasini Dam, a survey of habitat integrity, aquatic macro-invertebrate community integrity and fish community integrity. The protocols of applying the relevant indices were strictly adhered to and all work was carried out by a South African River Health Program (SA RHP) accredited assessor. Table 2 below contains geographic information with regard to the biomonitoring points, selected along the Albasini Dam in the vicinity of the proposed primary processing plant.

Table 2: Co-ordinates of the biomonitoring sites

Site	Description	GPS co-ordinates	
		South	East
Dam Point 1	Located on the south edge of the Albasini Dam, adjacent to the proposed processing site and upstream of the dam wall.	23° 6'39.08" S	30° 6'17.22" E
Dam Point 2	Located on the south edge of the Albasini Dam, downstream of Dam Point 1 and the proposed processing site and adjacent to the dam wall.	23° 6'35.48" S	30° 7'28.74" E

This report, after consideration and description of the ecological integrity of the proposed primary processing plant, must guide the Environmental Assessment Practitioner (EAP) and any other relevant authorities, by means of a reasoned opinion and recommendations, as to the viability of the proposed fisheries project and associated on-shore processing facilities.

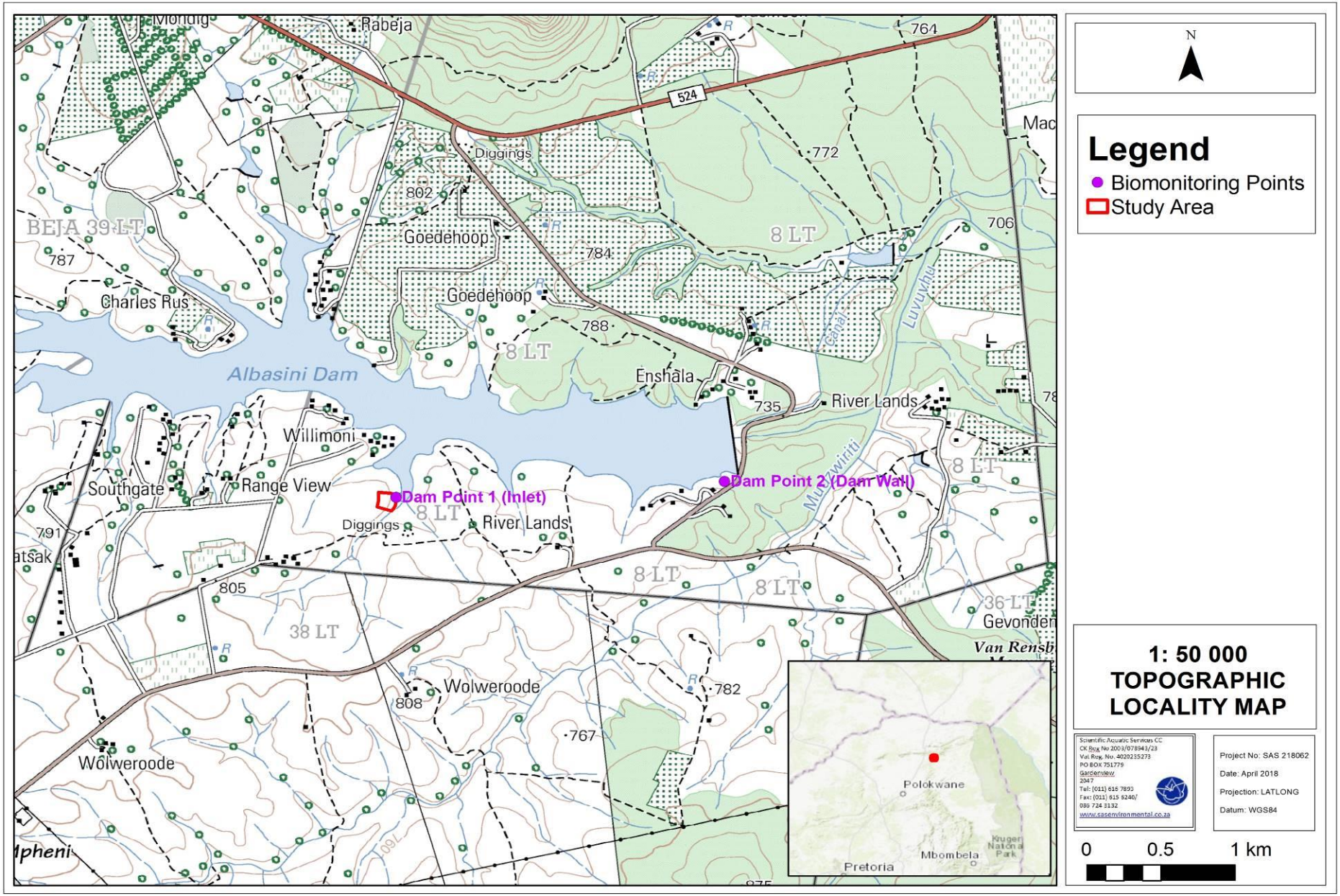


Figure 1: The study area and biomonitoring points depicted on a 1:50 000 topographical map in relation to the surrounding area.

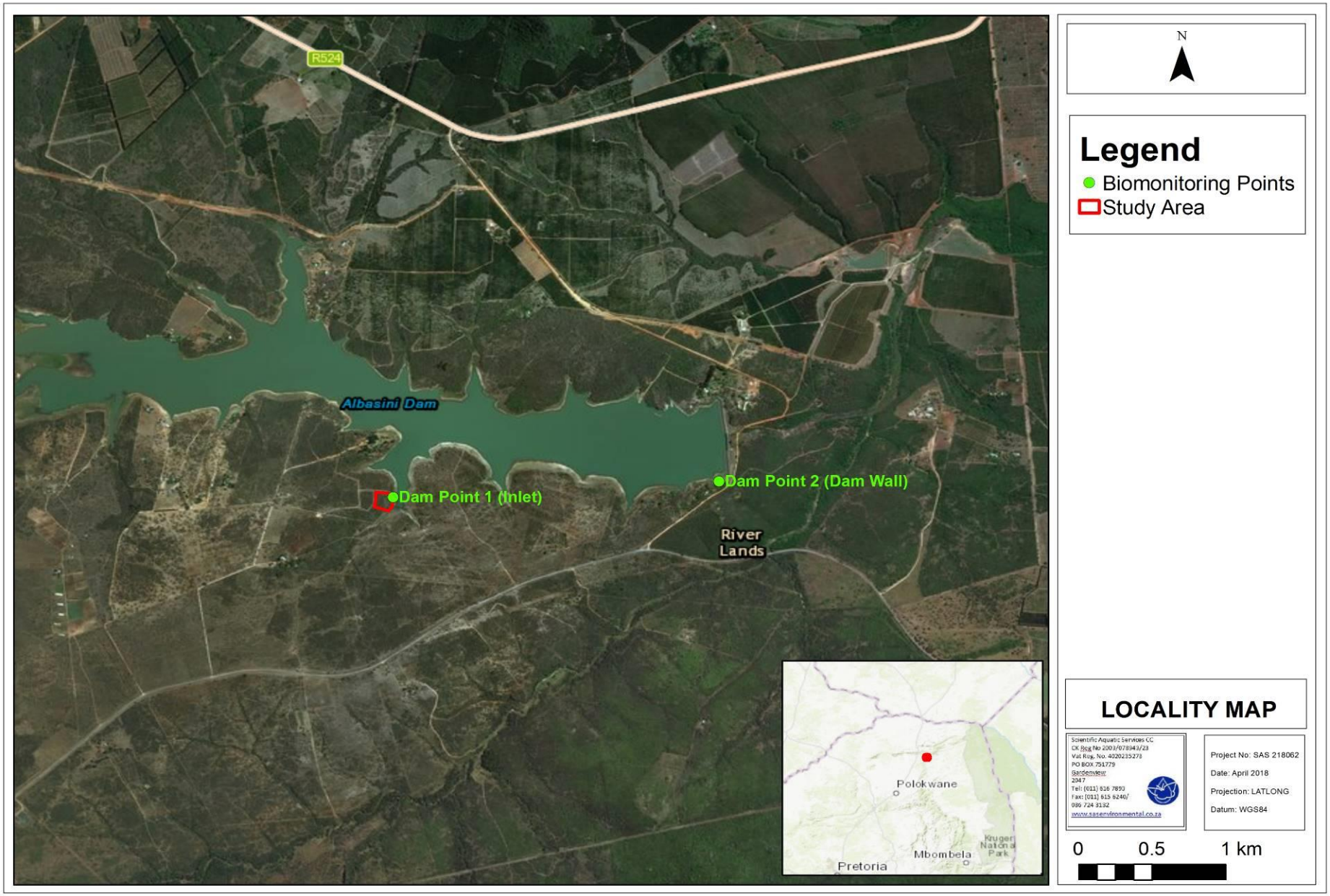


Figure 2: Satellite image depicting the location of the study area and biomonitoring points in relation to surrounding areas.

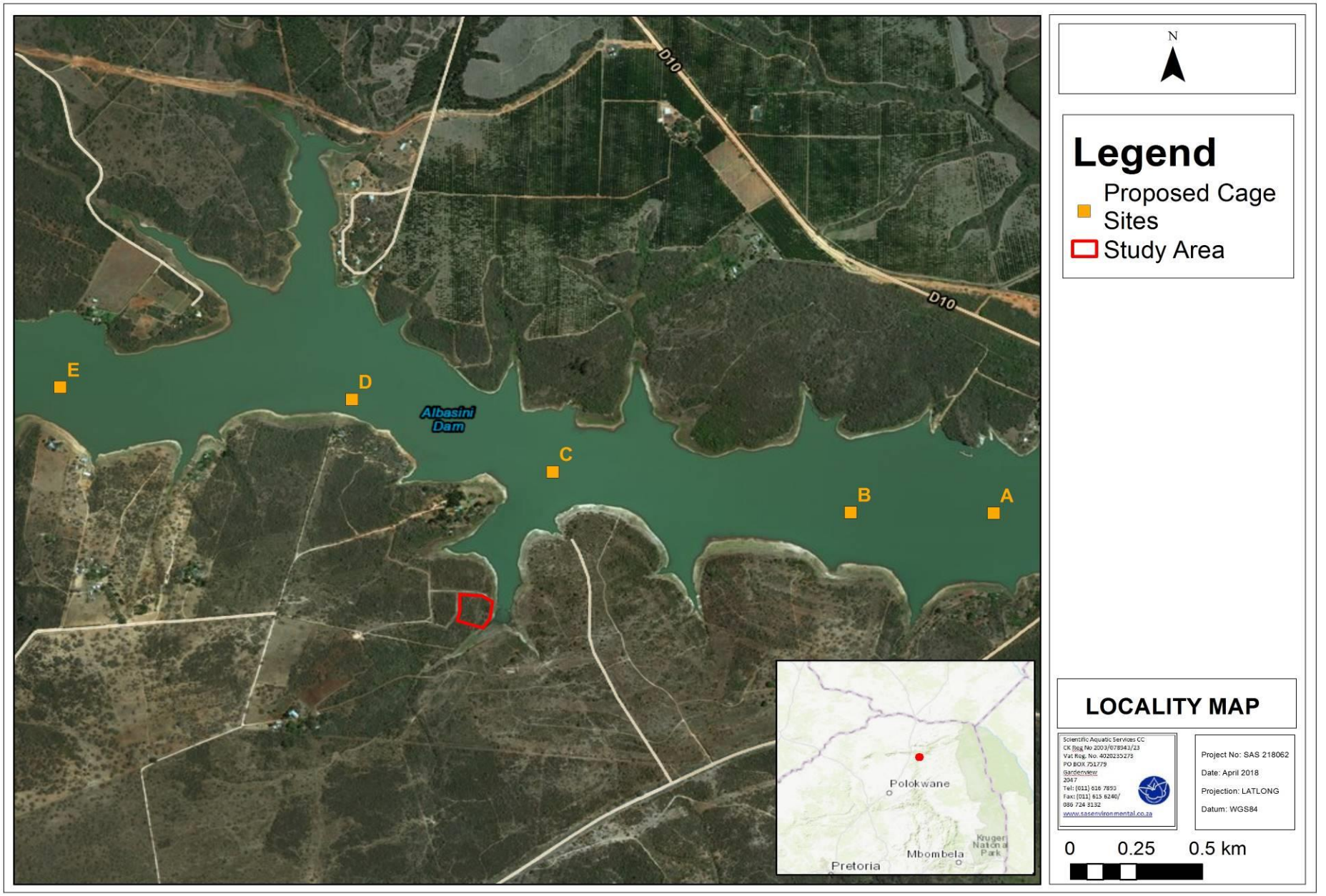


Figure 3: Satellite image depicting the location of the proposed cage sites in relation to surrounding areas.

1.2 Scope

Specific outcomes in terms of this report are outlined below:

- A background study of relevant national and provincial datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA] 2011 database; DWS RQIS PES/EIS 2014 database, National Threatened Ecosystems (2011), South African Protected Areas Database (SACAD, 2017 Q4), and the Limpopo Conservation Plan Version 2 (2013) was undertaken to aid in defining the PES and EIS of the freshwater resources, and terrestrial ecology of the area.

Terrestrial Assessment:

- To define the Present Ecological State (PES) of the terrestrial ecological resources associated with the proposed primary processing plant;
- To determine and describe habitats, communities and the ecological state of the proposed primary processing plant;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the proposed primary processing plant;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features, if present; and

Freshwater Resource Assessment:

- The freshwater resources were delineated according to "DWAF[1], 2008: A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Aspects such as soil morphological characteristics, vegetation types and wetness were used to delineate the resources;
- The freshwater resource classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The services provided by the freshwater resources in close proximity to the proposed primary processing plant was assessed according to the method of Kotze *et al.* (2009) in which services to the ecology and to the people were defined;

[1] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA). At present, the Department is known as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.

- Allocation of a suitable REC to the freshwater resources based on the results obtained from the PES, Ecoservices and EIS assessments (the PES and EIS of the Albasini Dam was determined in the Aquatic Ecological Assessment); and
- Freshwater resources were mapped according to the ecological sensitivity of each hydrogeomorphic unit in relation to the proposed primary processing plant. In addition to the freshwater resource boundaries, the applicable zones of regulation were depicted where applicable;

Aquatic Ecological Assessment

- To define the Present Ecological State (PES) of the Albasini Dam associated with the proposed primary processing plant;
- To define the Ecological Importance and Sensitivity (EIS) of the Albasini Dam;
- To provide information to guide the project, so as to maintain the PES of the system in support of the EIS of the aquatic ecosystem; and
- Ensure that no significant persistent impact on water quality will take place.

Impact Assessment

- The pre-defined impact assessment was applied to identify potential impacts that may affect the resources as a result of the proposed development activities, and aim to quantify the significance thereof; and
- To present management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact on the receiving environment.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The terrestrial ecological assessment is confined to the proposed primary processing plant and does not include the neighbouring and adjacent properties; these were, however, considered as part of the desktop assessment;
- The proposed primary processing facility was subjected to severe bush encroachment at the time of assessment, rendering movement within the proposed primary processing plant limited, thus a thorough walk around was conducted were possible, and floral SCC marked. Due to movement constraints, it is likely that floral SCC might have been overlooked. It is therefore recommended that once the layout of the proposed primary processing facility have been finalised a specialist be consulted to mark all *S. birrea* subsp. *caffra* individuals situated within the development footprint

areas, and a permit for the removal of all identified individuals be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF), prior to the removal of these individuals commencement of vegetation clearance.

- The determination of the freshwater resource boundaries and the assessment thereof, is confined to the portion of the Albasini Dam situated adjacent to the proposed primary processing plant.

  The portions of the Albasini Dam located within 500 m of the proposed primary processing plant was delineated in fulfilment of Regulation GN509 of the NWA using various desktop methods, including use of topographic maps, historical and current digital satellite imagery and aerial photographs. The general surroundings were, however, considered in the desktop assessment of the proposed primary processing plant;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities have been accurately assessed and considered;
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the proposed primary processing plant and Albasini Dam may have been missed during the assessment;
- The data presented in this report are based on one site visit, undertaken in April 2018 (autumn). A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the proposed primary processing plant and Albasini Dam;
- The Albasini Dam delineation as presented in this report are regarded as a best estimate of the full supply level of the dam based on the site conditions present, as observed during the site assessment. Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the full supply level of the Albasini Dam will need to be surveyed and pegged according to surveying principles;
- Freshwater resources and terrestrial zones create transitional areas where an ecotone is formed, as vegetation species change from terrestrial to obligate/facultative species.

Within this transition zone, some variation of opinion on the freshwater resource boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results;

- The composition of aquatic biota in the Albasini Dam, prior to major disturbance, is unknown. All aquatic assessment methodologies are based on lotic systems and as such, the Albasini Dam is a lentic system, thus no standardised methods for assessment of lentic environments are available. The results of the aquatic assessment must therefore be interpreted with caution.

1.4 Legislative Considerations

The following legislative requirements were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in Appendix B:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- National Forest Act (Act No. 84 of 1998);
- National Water Act (NWA) (Act No. 36 of 1998);
- General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998);
- Limpopo Environmental Management Act (LEMA) (Act 7 of 2003); and
- Conservation of Agricultural Resources Act (CARA, Act 43 of 1983)

2 ASSESSMENT APPROACH

2.1 Terrestrial Ecological Field Verification

In order to accurately determine the PES of the proposed primary processing plant and capture comprehensive data with respect to the terrestrial ecology, the following methodology was used:

- Maps, aerial photographs and digital satellite images were consulted prior to the field assessment, in order to determine broad habitats, vegetation types and potentially sensitive sites. The results of this analyses were then used to focus the field work on specific areas of concern and to identify areas where target specific investigations were required;
- A literature review with respect to habitats, vegetation types and species distribution was conducted; and
- A visual on-site assessment of the proposed primary processing plant was conducted in April 2018, in order to confirm the assumptions made during consultation of the maps and to determine the ecological status of the proposed primary processing plant. A

thorough 'walk through' on foot was undertaken (with consideration of movement limitations, see Section 1.3), in order to identify the occurrence of the dominant floral species and faunal and floral habitat diversities.

2.2 Freshwater Resource Field Verification

The delineation of the full supply level of the Albasini Dam took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that freshwater resources have several distinguishing factors, including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

During the site visit undertaken in April 2018, the presence of any freshwater resource characteristics as defined by DWAF (2008) were noted. In addition to the delineation process, a detailed assessment of the delineated resources was undertaken, whereby factors affecting the integrity of the resource were taken into consideration and aided in the determination of the functioning of the resource and the ecological and socio-cultural services provided by the Albasini Dam.

A detailed explanation of the methods of assessment is provided in Appendix D of this report.

2.3 Aquatic Ecological Assessment

Best practice methodologies (detailed methodologies provided in Appendix E) were used to assess the aquatic ecological integrity of the various sites based on water quality, instream and riparian habitat condition and biological impacts and integrity. All work was undertaken by a South African River Health Program (SA RHP) accredited assessor. Factors investigated included the following:

- Visual conditions of the site, including an assessment of impacts on the Albasini Dam, at each point;
- On-site testing of biota specific water quality parameters including pH, Electrical Conductivity (EC), dissolved oxygen concentration (DO) and temperature. The results aid in the interpretation of the data obtained by the biomonitoring. Results are

discussed against the guideline water quality values for aquatic ecosystems (DWAF 1996 vol. 7) as well as the Resource Water Quality Objectives (RWQO) of South Africa (DWA, 2011).

Although the guideline water quality values pertain to temporal comparisons, it will also be applied to spatial comparisons for the purpose of this report, as no suitable alternative is currently available;

- The general habitat integrity of the site was assessed based on the application of the Index of Habitat Integrity (IHI), based on the protocol of Kleynhans *et al.* (2008);
- Aquatic macro-invertebrates were sampled incorporating all available biotopes at the respective sites. This was done to provide an indication of the integrity of the of the aquatic macro-invertebrate community through recording the presence of various macro-invertebrate families at each site, as well as consideration of abundance of various populations, community diversity and community sensitivity (Dallas, 1997). Aquatic macro-invertebrates expected within the system were derived from the (DWS) Resource Quality Information Services (RQIS) PES/EIS database;
- The integrity of the fish community was assessed using the Fish Response Assessment Index (FRAI) as described by Kleynhans (2007); and
- The Ecological Importance and Sensitivity (EIS) of the Albasini Dam was determined according to the protocols of DWAF (1999).

2.4 Sensitivity mapping

All the ecological features associated with the proposed primary processing plant and freshwater resources associated with the immediate surrounding area were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity maps presented in Sections 4.4 and 5.3 should guide the design, layout and management of the proposed development.

2.5 Impact Assessment

Following the completion of the aquatic and field assessments, a pre-defined impact assessment was conducted (please refer to Appendix F for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed development.

The recommendations provided also include general ‘best practice’ management measures, which apply to the proposed developments as a whole, and which are presented in

Section 7.3. Mitigation measures have been developed to address issues in all phases throughout the life of the operation including planning, construction and operation. The detailed site-specific mitigation measures are outlined in Sections 7.1 and 7.2 of this report.

3 RESULTS OF THE DESKTOP ANALYSIS

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard” report below (Table 3). The dashboard report aims to present concise summaries of the data on as few pages as possible, in order to allow for integration of results to take place by the reader. Where required, further discussion and interpretation is provided.

It is important to note that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the proposed primary processing plant’s actual site characteristics at the scale required to inform the Environmental Assessment process. However, this information is considered to be useful as background information to the study. Thus, this data was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance.

3.1 National and Provincial Datasets

Table 3: Desktop data relating to the characteristics associated with the study area according to various National and Provincial Datasets.

Dominant characteristics of the Lowveld Ecoregion Level II (3.01) (Kleynhans *et al.*, 2005)	
Dominant primary terrain morphology	Slightly irregular pains; strongly undulating plains, hills and lowlands, high mountains
Dominant primary vegetation types	Sour Lowveld Bushveld; Mixed Bushveld, patches Afromontane Forest
Altitude (m a.m.s.l)	500 to 900
MAP (mm)	<20 to 34
Coefficient of Variation (% of MAP)	55 to 65
Rainfall concentration index	NA
Rainfall seasonality	Mid-summer
Mean annual temp. (°C)	16 to 22
Winter temperature (July)	6 to 24 ºC
Summer temperature (Feb)	17 – 32 ºC
Median annual simulated runoff (mm)	40 to 200; >250
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014) (Figure 3)	
Sub-quaternary reach	A91B – 00119 (Luvuvhu River)
Proximity to site	Approximately 560 m north of the study area
Assessed by expert?	Yes
Mean Ecological Importance (EI) Class	**Low**
Mean Ecological Sensitivity (ES) Class	**High**
Stream Order	2
Default Ecological Class (based on median PES and highest EI or ES mean)	Class B (High)
Details of the study area in terms of Mucina & Rutherford (2012)	
Biome	The study area is situated within the **Savanna Biome**
Bioregion	The study area is situated within the **Lowveld Bioregion**.
Vegetation Type	The study area is situated within the, **Tzaneen Sour Bushveld** vegetation type**.**
NBA (2011)	The study area falls within an area that is currently poorly protected
National Threatened Ecosystems (2011)	The entire study area falls within the remaining extent of the vulnerable Tzaneen Sour Bushveld ecosystem.

Aquatic ecoregion and sub-regions in which the study area is located	
Ecoregion	Lowveld (Figure 6)
Catchment	Limpopo
Quaternary Catchment	A91B
WMA	Luvuvhu and Letaba
subWMA	Levuvhu/Mutale
Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
FEPACODE	The study area is located within a subWMA currently considered as an Upstream Management Catchment, which aids in the prevention of downstream degradation of FEPAs and Fish Support Areas.
NFEPA Wetlands (Figures 6)	According to the NFEPA wetlands layer, an artificial channelled valley bottom wetland is situated on the eastern border of the study area. The channelled valley bottom wetland is considered to be in a heavily to critically modified ecological condition (WETCON Z3) *.
Wetland vegetation Type	The study area falls within the Lowveld Group 7 wetland vegetation type, considered to be critically endangered.
NFEPA Rivers (Figure 7)	According to the NFEPA Rivers layer the Luvuvhu River is situated approximately 560m north of the study area, flowing into the channelled valley bottom wetland identified by the NFEPA Database. The Luvuvhu River is considered to be in a largely modified ecological condition (Class D).
Description of the vegetation type(s) relevant to the study area (Mucina & Rutherford 2012)	
Vegetation Type	Tzaneen Sour Bushveld
Climate	Summer rainfall with dry winters. Frost is infrequent
Altitude (m)	600 to 1000
MAP* (mm)	781
MAT* (°C)	19.7
MFD* (Days)	1
MAPE* (mm)	2097
MASMS* (%)	74
Distribution	Limpopo Province
Geology & Soils	The potassium-poor gneiss of the Goudplaats Gneiss and an Archean granite dyke underlie most of the area. Shales and quartzite of the Wolkberg Group are present but not common. Soils are Mispah, Glenrosa and Huttons, shallow to deep, sandy or gravelly and well-drained.

NPAES (2009) & SAPAD and SACAD (2017)	According to SACAD (2017) the study area falls within the Vhembe Biosphere Reserve. The Mary Lavin No. 3 Private Nature Reserve is situated approximately 4.2km northwest of the study area, according to SAPAD (2017). According to NPAES there are no protected areas within a 10km radius of the study area.	**Conservation**	Endangered. Target 19%. Only little over 1% statutorily conserved. ±41% transforme mainly by cultivation and plantations. The higher-lying area have been heavily afforested with tree plantations while the lower-lying areas are under agricultural and horticultural crops.
IBA (2015)	The Soutpansberg Important Bird Area is situated approximately 2.8km north of the study area (Figure 5).	**Vegetation & Landscape features (Dominant floral taxa in Appendix C)**	Deciduous, tall open bushveld (parkland) with a well-developed, tall grass layer, occurring on low to high mountains with undulating plains mainly at the base of, and on the lower to middle slopes of the northeastern escarpment. Scattered alien plants include *Solanum mauritianum*, *Melia azedarach* and *Caesalpinia decapetala*. The subtropical climate is conducive to the spread of *Chromolaena odorata*, *Lantana camara* and *Psidium guajava*. Erosion is very variable—from very low to high in some areas.
Detail of the study area in terms of the Limpopo Conservation Plan Version 2 (2013)			
According to the Limpopo Conservation Plan version 2 (2013) the entire study area is of high conservation importance as it is considered a Critical Biodiversity Area 2 (CBA 2). A CBA 2 is considered the best design selected sites, areas selected to meet biodiversity patterns and/or ecological process targets and alternative sites may be available to meet these targets.			

DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; IBA = Important Bird Area; m.a.m.s.l = Metres above Mean Sea Level; MAP = Mean Annual Precipitation; mm = millimeters; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMS = Mean Annual Soil Moisture Stress; NBA = National Biodiversity Assessment; NPAES = National Protected Areas Expansion Strategy; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; SACAD = South African Conservation Areas Database; SAPAD = South African Protected Areas Database; WMA = Water Management Area;
***WETCON C: Percentage natural land cover 25-75%; WETCON Z1: Wetlands overlap with a 1:50 000 "artificial" inland waterbody from the Department of Land Affairs; WETCON Z2: Majority of wetland unit classified as artificial; WETCON Z3: Percentage natural land cover < 25%; PNR = Private Nature Reserve**

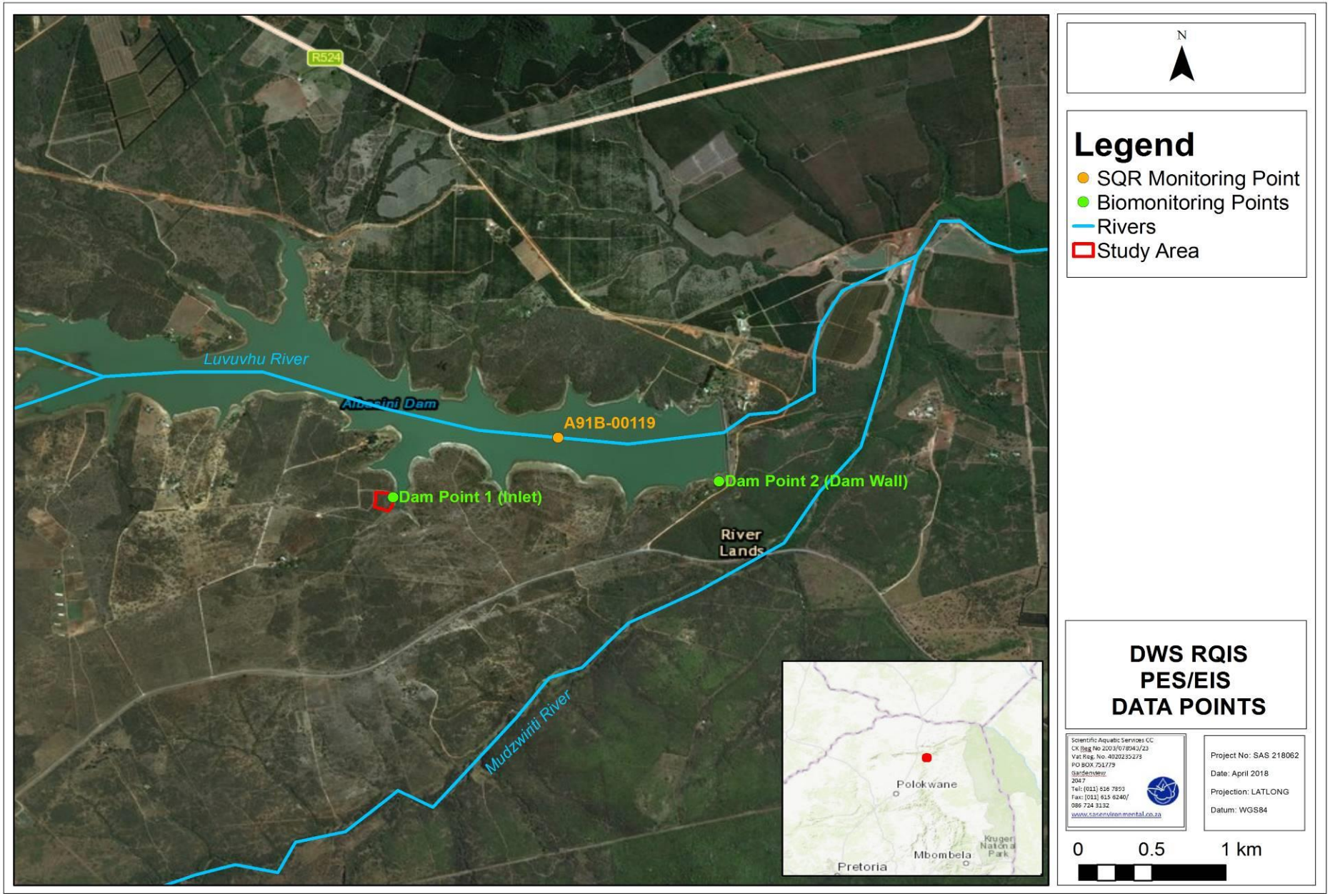


Figure 4: Relevant Sub-Quaternary Catchment Reach (SQR) in the vicinity of the study area.

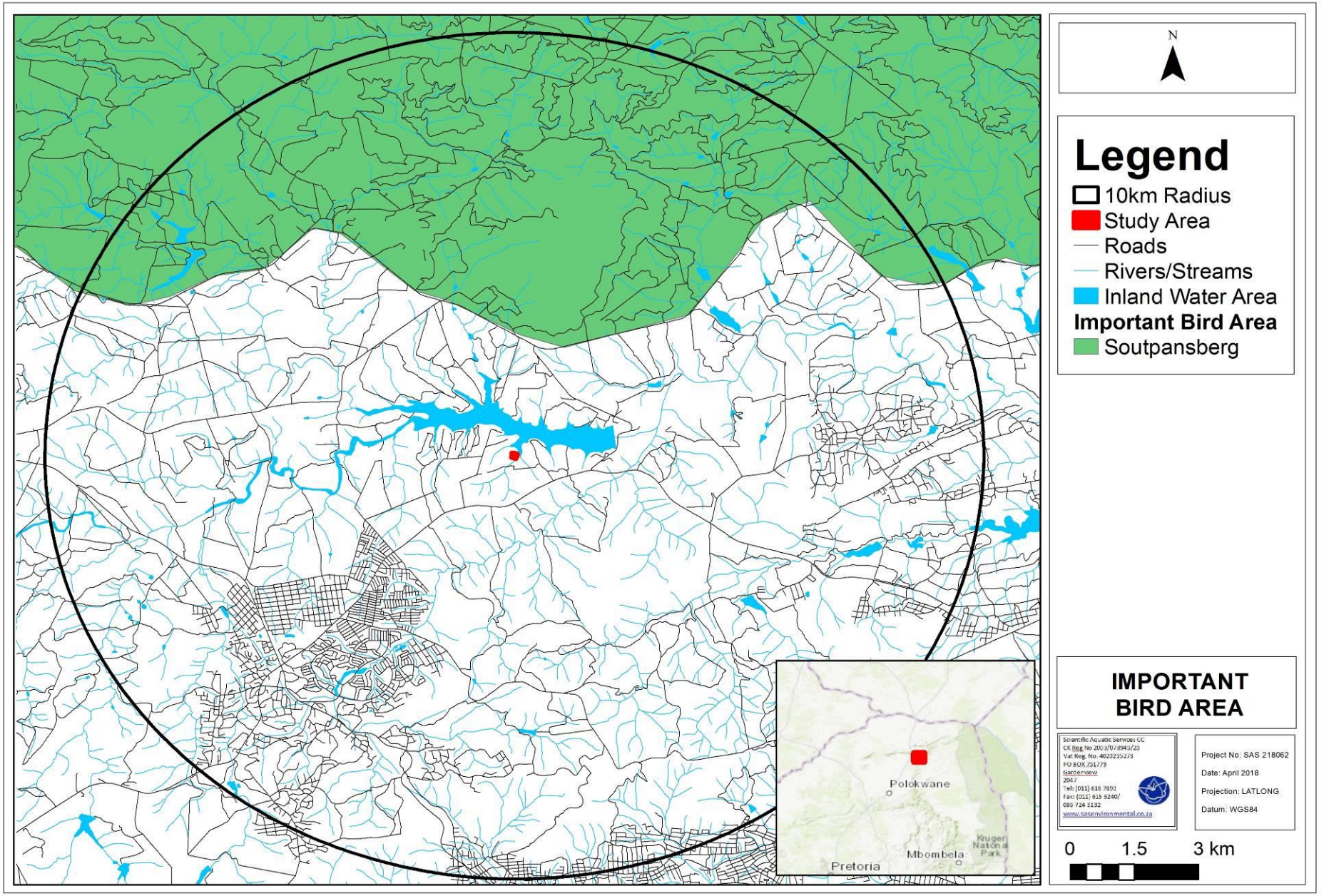


Figure 5: The Soutpansberg Important Bird Area situated approximately 2.8 km north of the study area (IBA, 2015).

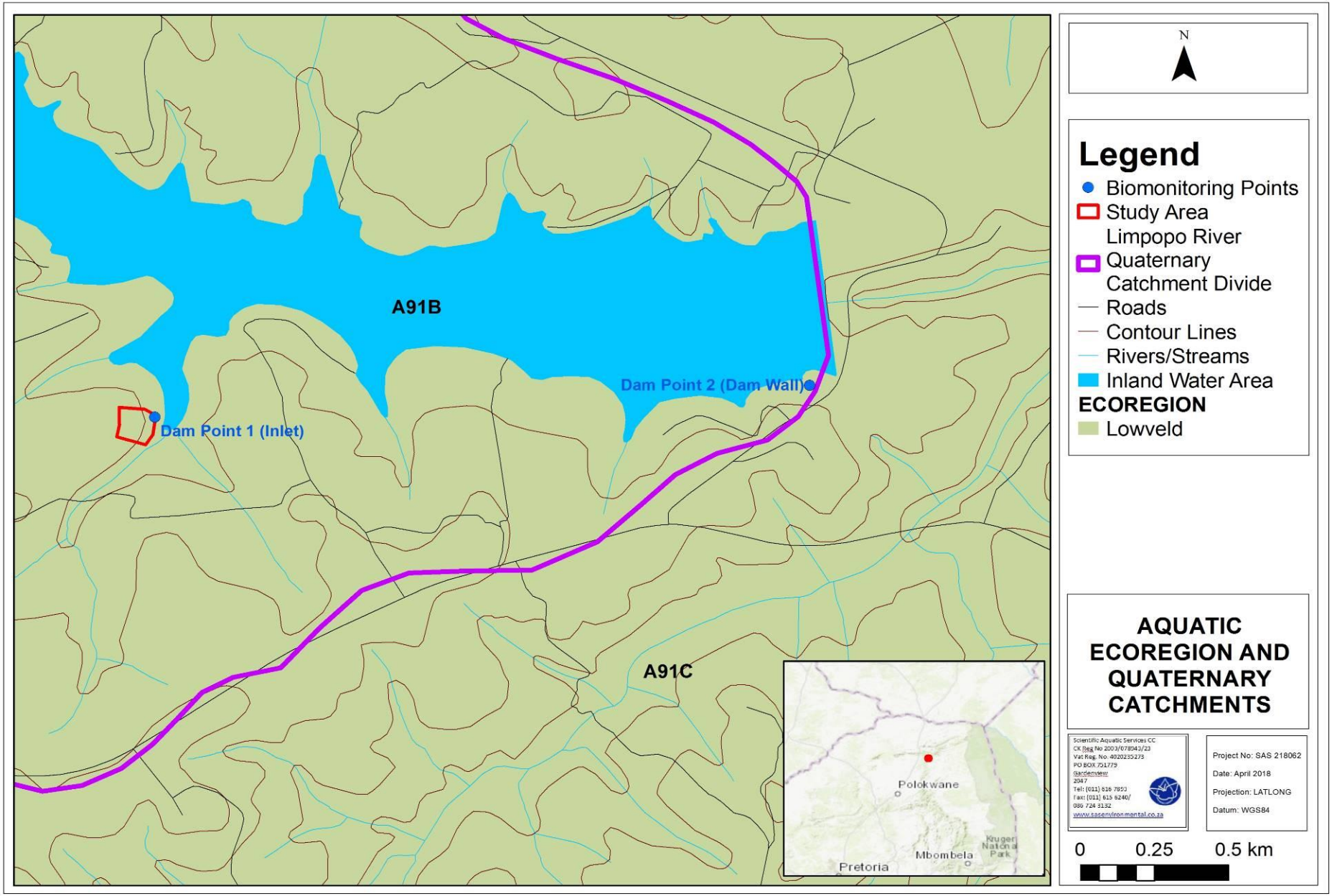


Figure 6: The Lowveld Aquatic Ecoregion and quaternary catchment applicable to the study area and surrounding area.

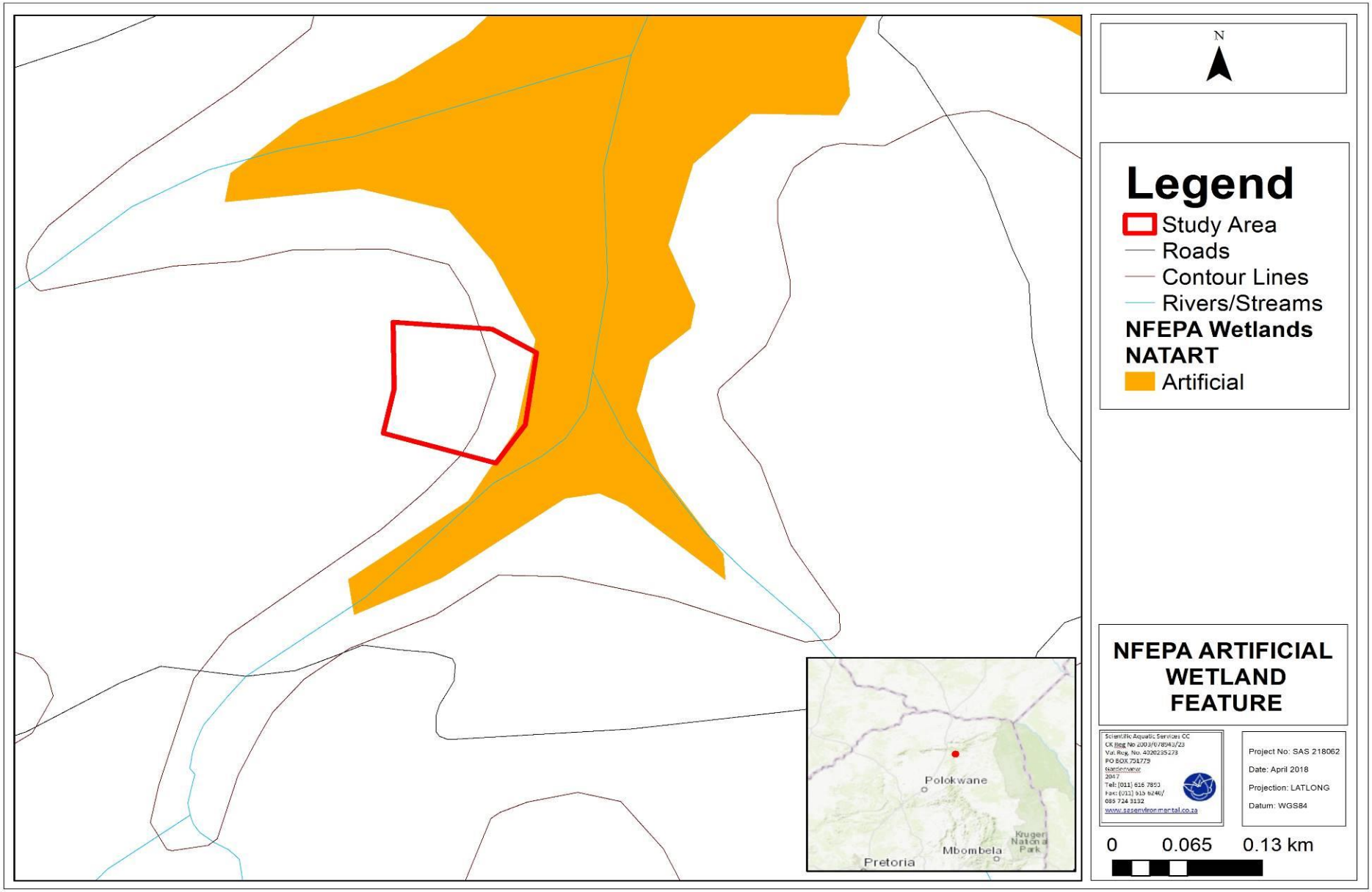


Figure 7: The NFEPA database indicating artificial channeled valley bottom wetlands situated on the eastern border of the study area (NFEPA, 2011).

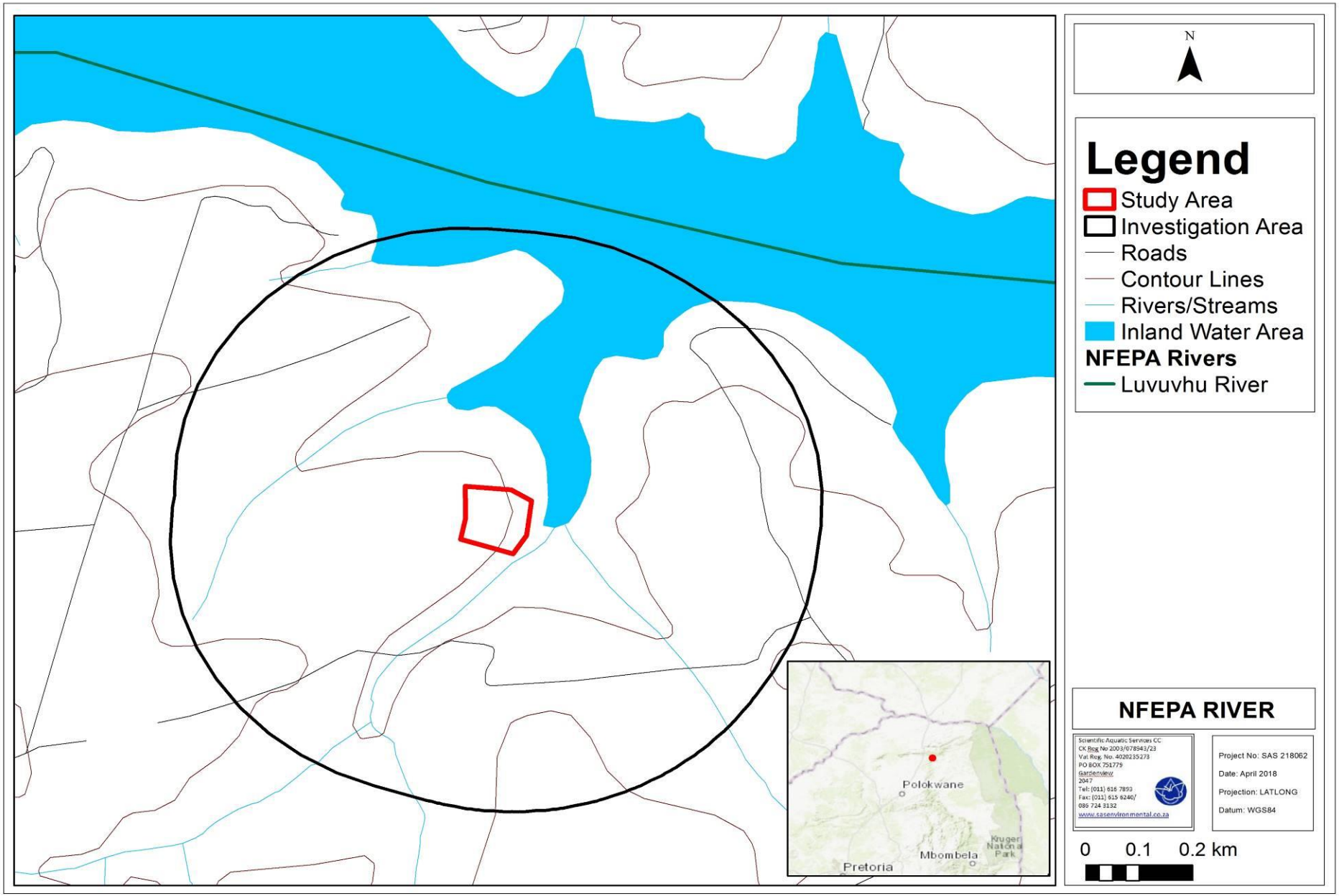


Figure 8: The Luvuvhu River situated approximately 560 m north of the study area (NFEPA, 2011).

3.2 Ecological Status of Sub-Quaternary Catchments [Department of Water and Sanitation (DWS) Resource Quality Services (RQS) PES/EIS Database]

The PES/EIS database, as developed by the DWS RQS department, was utilised to obtain additional background information on the project area. The PES/EIS database has been made available to consultants since mid-August 2014. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as SA RHP sites, EWR sites and Hydro WMS sites.

Key information on background conditions associated with the study area, as contained in this database and pertaining to the PES and EIS for the SQR A91B 00119 (Luvuvhu River) is tabulated in Table 4, and indicated in Figure 4 above.

The Ecological Importance (EI) data for SQR A91B 00119 (Luvuvhu River) indicates that the following fish species are expected to occur at this site:

Amphilius uranoscopus
Enteromius lineomaculatus
Enteromius neefi
Enteromius paludinosus
Enteromius trimaculatus
Enteromius unitaeniatus
Enteromius viviparus
Chiloglanis pretoriae
Clarias gariepinus
Labeo cylindricus
Labeo molybdinus
Labeobarbus marequensis
Marcusenius pongolensis
Mesobola brevianalis
Micralestes acutidens
Petrocephalus wesselsi
Pseudocrenilabrus philander
Coptodon rendalli
Tilapia sparrmani

The Ecological Importance (EI) data for SQR A91B 00119 (Luvuvhu River) indicate that the following macro-invertebrate species are expected to occur at this site:

Aeshnidae
Ancylidae
Athericidae
Atyidae
Baetidae 2 sp
Belostomatidae
Caenidae
Ceratopogonidae
Chironomidae
Chlorocyphidae
Elmidae/dryopidae
Gerridae
Gomphidae
Gyrinidae
Helodidae
Hirudinea
Hydracarina
Hydrometridae
Hydrophilidae
Hydropsychidae 2 sp
Naucoridae
Nepidae
Notonectidae
Oligochaeta
Philopotamidae
Pleidae
Potamonautidae
Simuliidae
Tabanidae
Tipulidae

Coenagrionidae	Hydroptilidae	Tricorythidae
Corduliidae	Leptoceridae	Turbellaria
Corixidae	Leptophlebiidae	Veliidae/mesoveliidae
Culicidae	Libellulidae	
Dytiscidae	Muscidae	

Table 4: Summary of the ecological status of the sub-quaternary catchment (SQ) reach SQR A91B 00119 (Luvuvhu River) based on the DWS RQS PES/EIS database

Synopsis SQR A91B 00119 (Luvuvhu River)					
PES[1] category median	**Mean EI[2] class**	**Mean ES[3]**	**Length**	**Stream order**	**Default EC[4]**
E (Serious Modification	Low	High	5.87	2	B (High)
PES details					
Instream habitat continuity MOD	Serious	**Riparian/wetland zone MOD**	Large		
RIP/wetland zone continuity MOD	Serious	**Potential flow MOD activities**	Serious		
Potential instream habitat MOD activities	Large	**Potential physico-chemical MOD activities**	Large		
EI details					
Fish spp/SQ	19	**Fish average confidence**	3.42		
Fish representivity per secondary class	Moderate	**Fish rarity per secondary class**	High		
Invertebrate taxa/SQ	43	**Invertebrate average confidence**	2.95		
Invertebrate representivity per secondary class	High	**Invertebrate rarity per secondary class**	Very High		
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Low	**Habitat diversity class**	Low		
Habitat size (length) class	Very Low	**Instream migration link class**	Low		
Riparian-wetland zone migration link	Low	**Riparian-wetland zone habitat integrity class**	Moderate		
Instream habitat integrity class	Moderate	**Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m**	Low		
Riparian-wetland natural vegetation rating based on expert rating			Very Low		
ES details					
Fish physical-chemical sensitivity description	Very High	**Fish no-flow sensitivity**	Very High		
Invertebrates physical-chemical sensitivity description	Very High	**Invertebrates velocity sensitivity**	Very High		
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description			Low		
Stream size sensitivity to modified flow/water level changes description			High		
Riparian-wetland vegetation intolerance to water level changes description			Low		

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;
[2] EI = Ecological Importance;
[3] ES = Ecological Sensitivity
[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

4 TERRESTRIAL ECOLOGICAL ASSESSMENT RESULTS

4.1 Terrestrial Habitat Units

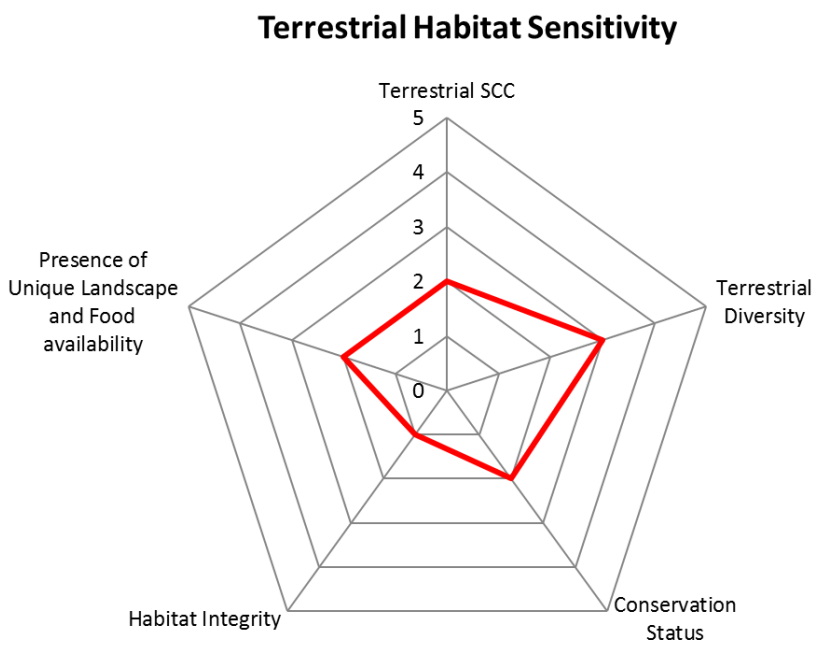
During the site assessment a single habitat unit was associated with the proposed primary processing facility, namely the Secondary Bushveld. As mentioned in section 3.1 the proposed primary processing facility falls within the Tzaneen Sour Bushveld vegetation type, (Mucina and Rutherford, 2012). This vegetation type is described as tall open bushveld, with a well-developed tall grass layer. During the site assessment it was evident that the proposed primary processing plant is subjected to cattle grazing, which has resulted in severe bush encroachment and as such a thickening of the tree layer, with grass limited to areas where clearance has previously taken place, such as the clearance for historic gravel roads, or maintenance of the overhead powerline. The proposed primary processing plant is therefore no longer considered to be representative of the Tzaneen Sour Bushveld vegetation type, and classified as Secondary Bushveld. The tree *Sclerocarya birrea* subsp. *caffra* (Marula), protected under the National Forest Act (NFA) of 1998 (amended 2011), were observed on the western boundary of the proposed primary processing plant. It is, however, likely that more individuals might be present within the proposed primary processing plant, although they were not observed, as movement within the proposed primary processing plant was limited as a result of bush encroachment. The habitat unit is discussed in detail below.

Figure 9: Habitat units associated with the proposed primary processing plant.

Table 5: Summary of results for the Secondary Bushveld Habitat Unit.

Secondary Bushveld Habitat Unit	Terrestrial Sensitivity	Moderately Low

Faunal Sensitivity Graph:



Photographs:

Notes on photographs: Above Left: Typical view of the Secondary Bushveld, associated with severe bush encroachment **Above Right:** Saplings of the protected tree *S. birrea* subsp. *caffra* (Marula) **Below left:** *Cercopithecus aethiops* (Vervet Monkey) observed within the vicinity of the proposed primary processing plant **Below Right**: *Phalanta phalantha* (Common Leopard) observed within the proposed primary processing plant

Species of Conservation Concern (SCC)	A single tree species protected under the NFA of 1998 (amended 2011) was encountered within the proposed primary processing plant during the field assessment namely *S. birrea* subsp. *caffra* (Marula). As such these species cannot be removed for any purposes unless a license was granted by the Department of Agriculture, Forestry and Fisheries (DAFF) (or a delegated authority). No faunal SCC were encountered during the field assessment. However, the possibility exists that *Polemaetus bellicosus* (Martial Eagle), *Aquila rapax* (Tawny Eagle), and *Ciconia nigra* (Black Stork) can utilise the proposed primary processing plant and Albasini Dam occasionally for feeding. It is, however, highly unlikely that any faunal SCC will reside within the proposed primary processing plant permanently.

Terrestrial Habitat Integrity	During the site assessment it was evident that the proposed primary processing plant is subjected to grazing by cattle, and predominantly in a pioneer state of succession, with extensive proliferation of bush encroachment and alien plant invasion, by species such as *Dichrostachys cinerea* subsp. a*fricana* (Sickle Bush) and *Lantana camara* (common Lantana). Although various tree species observed, such as *S. birrea* subsp. *caffra* (Marula), *Peltophorum africanum* (African Wattle), and *Olea europaea* subsp. a*fricana* (Wild Olive) are indigenous to the Tzaneen Sour Bushveld, the proposed primary processing plant is no longer considered to be a true representative of the Tzaneen Sour Bushveld vegetation type. The habitat unit is, however, connected to a larger open space and does provide the potential for a variety of faunal species to move through the area. Overall the proposed primary processing plant is considered to have a low habitat integrity. Continued proliferation of species associated with bush encroachment and alien infestation will result in the continued loss of the remaining indigenous vegetation, culminating in the continued degradation of the habitat in the area.	**Business Case, Conclusion and Mitigation Requirements:** This habitat unit has undergone severe degradation as a result of overgrazing by livestock. This has resulted in severe bush encroachment and alien infestation, and as such the proposed primary processing plant location is considered to be of moderately low ecological importance. The protected tree species *S. birrea* subsp. *caffra* (Marula) was still, however, encountered within the proposed primary processing plant. Although the area where individuals were encountered were marked, it is likely that individuals might have been missed during the field assessment, due to limited access to the majority of the proposed primary processing plant as a result of bush encroachment. As such it is advised that once layouts of the proposed primary processing facility have been finalised, a specialist be consulted to mark all *S. birrea* subsp. *caffra* individuals situated within the development footprint areas, and avoidance of them should take place as far as possible. A permit for the removal of all affected individuals be applied for from the DAFF, prior to the commencement of vegetation clearance.
Terrestrial Species Diversity	Although the floral species diversity has been severely altered from what is expected within the Tzaneen Sour Bushveld, and the area was associated with severe bush encroachment and alien infestation, the proposed primary processing plant still comprised of a variety of tree, forb, and grass species, such as *Vachellia sieberiana* var. *woodii* (Paper-back Thorn), *S. birrea* subsp. *caffra* (Marula), *Cymbopogon plurinoides* (Narrow-leaved Turpentine Grass), *Sporobolus pyramidalis* (Catstail Dropseed Grass) and *Pavonia burchellii* (Dainty Pavonia). It is further expected that a variety of common faunal species, particularly small mammals, avifaunal and invertebrate species will be associated with the proposed primary processing plant, although a limited number of faunal species, such as *Uraeginthus angolensis* (Blue Waxbill), *Pternistis natalensis* (Natal Spurfowl), *Hypolimnas misippus* (Diadem), and *Danaus chrysippus* (African Monarch) were observed during the field assessment. This is due to the limited time on site as well as the secretive nature of most faunal species. As such the species diversity of the proposed primary processing plant is considered to be of an intermediate level.	
Presence of Unique Landscapes and food availability	As a result of severe bush encroachment, this habitat unit offers limited food for a wide diversity of faunal species, and as such is not considered a unique landscape in terms of floral and faunal conservation. This habitat unit did, however, offer suitable habitat for the protected tree species *S. birrea* subsp. *Caffra* (Marula).	
Conservation Status	According to the National Threatened Ecosystem (2011) database, the proposed primary processing plant falls within the remaining extent of the vulnerable Tzaneen Sour Bushveld. The Limpopo Conservation Plan V.2 (2013) further classified the area as a CBA 2. After the field investigation, it is the opinion of the specialist that the habitat unit is no longer in a pristine condition, or a true representation of the Tzaneen Sour Thornveld vegetation type. As such, the conservation importance of the proposed primary processing plant is considered to be of a moderately low level.	

4.2 Floral Species of Conservation Concern Assessment

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species was undertaken. The complete SANBI PRECIS Red Data Listed plants was acquired for the Quarter Degree Square (QDS) 2330AA. Also taken into consideration was protected and specially protected species as mentioned in the List of Protected Tree Species (GN 809 of 2014) under the National Forest Act (NFA) (Act 84 of 1998, amended 2011), the Limpopo Environmental Management Act (LEMA) of 2003 as well as the Threatened or Protected Species (TOPS) Regulations (GN 255 of 2015) under Section 56(1) of the National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004).

Threatened species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is considered a threatened species.

SCC are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare and Declining.

The tree species protected by the National Forest Act (1998), *S. birrea* subsp *caffra* (Marula), are present within the proposed primary processing plant, and individuals were encountered on the western boundary. In terms of this act, protected tree species may not be cut, disturbed, damaged or destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the Department of Agriculture, Forestry and Fisheries (DAFF) or a delegated authority. Thus, if any of these species are likely to be disturbed by the proposed project, the relevant permits must be applied for.

As the area was associated with extensive bush encroachment, rendering movement within the area limited, it is likely that more individuals of *S. birrea* subsp. *caffra* might be present within the proposed primary processing plant. It is therefore recommended that clearing of *Dichrostachys cinerea* subsp. a*fricana* (Sickle Bush) and *Lantana camara* (common Lantana) take place prior to any construction activities, in order to mark any potential *S. birrea* subsp. *caffra* individuals that might be associated with the footprint areas. Should any such individuals be present within the footprint areas, they should be avoided and not disturbed as much as possible. A permit will have to be obtained from DAFF, prior to the removal of these individuals.

4.3 Faunal Species of Conservation Concern Assessment

During field assessments, it is not always feasible to identify or observe all species within an area, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, and to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of faunal SCC occurrence within the proposed primary processing plant. Species listed in Appendix J whose known distribution ranges and habitat preferences include the proposed primary processing plant were taken into consideration.

During the site investigation, no faunal SCC were observed. Furthermore, due to the severely degraded state of the proposed primary processing plant, specialized habitat requirements of certain SCC, distribution ranges and low levels of suitable SCC habitat within the proposed primary processing plant, it is deemed unlikely that any faunal SCC will permanently reside within the proposed primary processing plant, nor utilise it for breeding purposes. It is, however, likely that the avifaunal SCC *Polemaetus bellicosus* (Martial Eagle), *Aquila rapax* (Tawny Eagle), and *Ciconia nigra* (Black Stork) might utilise the proposed primary processing plant and surrounding area, such as the Albasini dam, for feeding purposes from time to time. As a precaution, it is recommended that should any faunal SCC listed in Appendix J of this report, be encountered during the construction of the proposed development, all operations must be stopped immediately, a biodiversity specialist consulted, and a conservation plan designed and implemented.

4.4 Terrestrial Sensitivity

The figure below (Figure 10) conceptually illustrates the areas considered to be of increased ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for floral and faunal SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The table below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Table 6: A summary of sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Secondary Bushveld	Moderately Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects	This habitat unit is considered to be of moderately low terrestrial ecological sensitivity. Thus, development of infrastructure for the Makwaria Fisheries project is not considered to have a significant impact on the faunal and floral ecology of the area. Should any individuals of *S. birrea* subsp. *caffra,* however, be removed during the construction phase, a permit will have to be obtained from the DAFF. Furthermore, the development footprint and edge effects on surrounding areas should be managed

Figure 10: Presentation of the terrestrial sensitivity in relation to the proposed primary processing plant.

5 RESULTS: FRESHWATER RESOURCE ASSESSMENT

5.1 Freshwater Resource System Characterisation

During the field assessment it was evident that Albasini Dam is situated immediately east of the proposed primary processing plant (Figure 11). Even though Albasini Dam is an artificial impoundment within the Luvuvhu River, it is still considered to be an ecologically functional feature as it forms part of a natural watercourse and was therefore assessed.

Usually natural freshwater features are classified as being wetland or riparian features, based on the definitions set out by the NWA, and classified according to the Classification system developed by Ollis *et al.* (2013), however, since the Albasini Dam is an artificial impoundment, it could not be classified by this classification system.

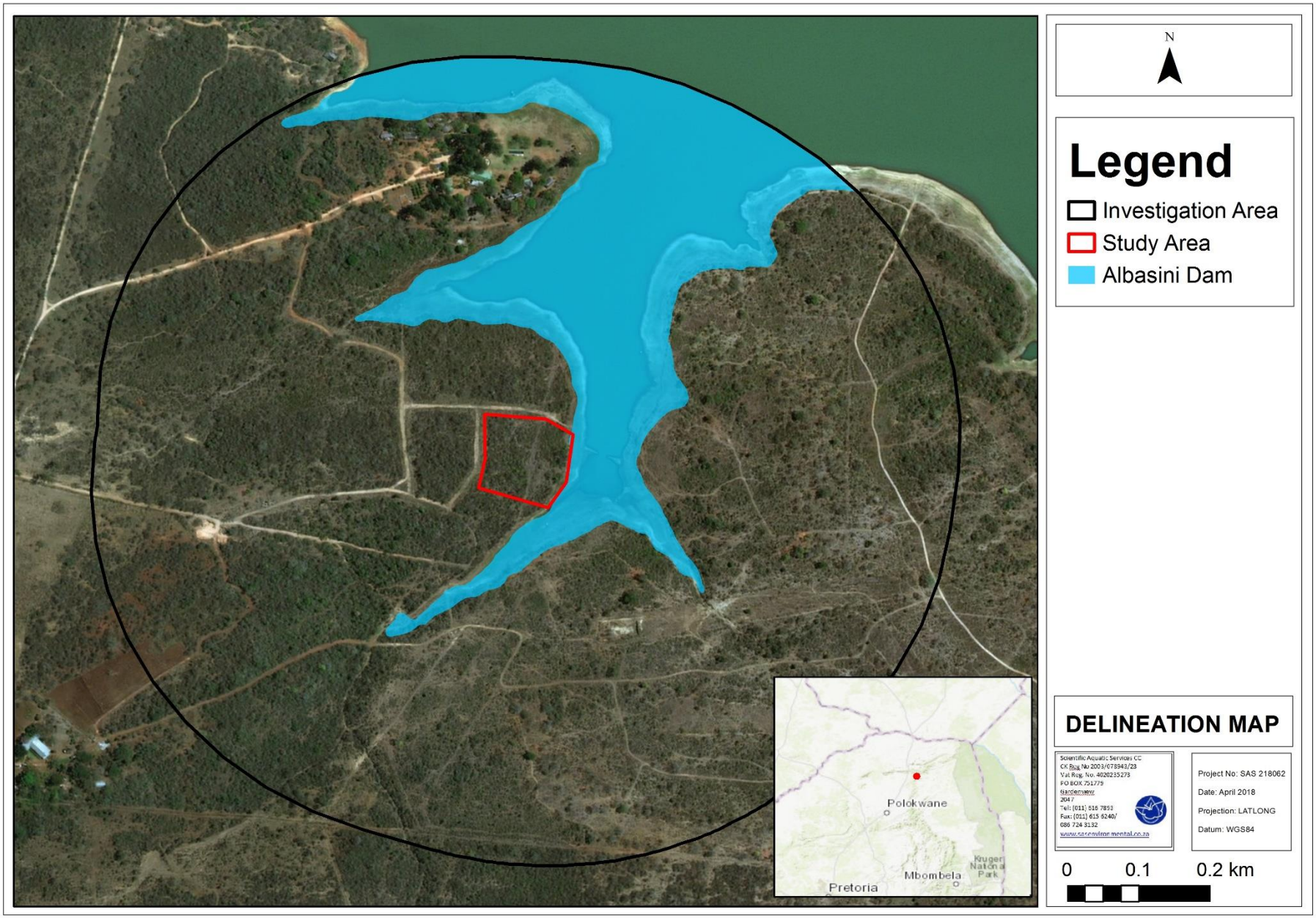
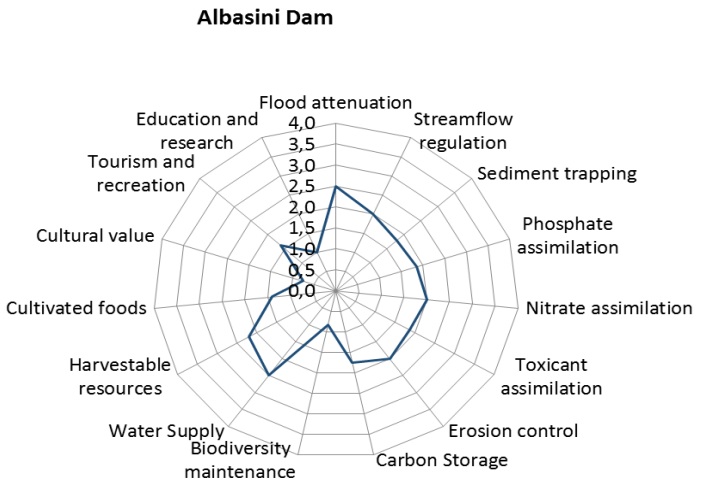


Figure 11: The location of the Albasini Dam within the investigation area, in relation to the proposed primary processing plant.

5.2 Field Verification Results

Table 7: Summary of the assessment of the Albasini Dam.

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td colspan="2">  </td></tr>
<tr><td colspan="2"></td><td>Photograph notes</td><td>Left: Representative photograph of the Albasini Dam adjacent to the proposed primary processing plant. Right: Members of the local community fishing on the bank of the Albasini Dam, immediately upstream of the Dam wall.</td></tr>
<tr><td>PES discussion</td><td>PES Category: C (Moderately modified)
Since the Albasini Dam is an artificial impoundment within a natural watercourse, the feature is considered to be in an altered state. The area surrounding the Albasini Dam is not significantly impacted by anthropogenic activities. Although the construction of the Albasini Dam wasll has significantly impacted on the hydrology of the Luvuvhu River system downstream, the overall PES of the Albasini Dam is considered to be in a Class C (moderately modified) ecological state.</td><td colspan="2">Watercourse driver:
a) Hydrology
The Albasini Dam was built to serve as a storage reservoir, and therefore experiences frequent water releases. Thus, the water level within the dam is constantly changing due to water abstraction for irrigation purposes by large scale and subsistence farming in the surrounding area, as well for purification of potable water for domestic use by residents in the nearby towns and villages. The Albasini Dam, dams the Luvuvhu river, and as such the construction of the dam wall has had a significant impact on the hydrology of the river downstream of the dam, which currently functions as a non-perennial river for large parts of the year, except during high flood events when the Albasini Dam overflows.</td></tr>
<tr><td rowspan="2">Ecoservice provision</td><td rowspan="2">Intermediate
The Albasini Dam is considered most important to supply water for domestic and agricultural activities as well as provide harvestable resources for the local community. This is apparent as local fisherman were encountered during the field assessment. The Albasini Dam further plays an important role in flood attenuation, streamflow regulation, as well as phosphate, nitrate and toxicant assimilation abilities. This feature has little cultural value; it is not considered important for biodiversity maintenance, and research purposes.</td><td colspan="2">b) Water quality
The general water quality of the Albasini Dam is considered fair based on the findings during the current assessment. For more detail pertaining to the water quality, please refer to section 6.1 of this report.</td></tr>
<tr><td colspan="2">c) Topography: Geomorphology and sediment balance
Since this is an artificial impoundment that has been dammed, the geomorphology has thus been influenced by the historical construction of the dam wall. Agricultural practices within the catchment, as well as vegetation clearing for the construction of various hardened infrastructures areas such as lodges, cause an increase in the sediment yield of the dam, although the additional sediment input from surrounding anthropogenic activities are considered to be moderately low.</td></tr>
</table>

EIS discussion	**EIS Category: C (Moderate).** The EIS of the Albasini Dam falls within Category C, which is a resource that is considered ecologically important on a local scale, albeit that the biodiversity of these systems is not usually very sensitive to limited flow and habitat modifications. The Albasini Dam is also defined as a CBA 2 (Limpopo Conservation Plan V2, 2013), which is an area considered important for meeting biodiversity patterns and/or ecological process targets. Therefore, it is important to conserve the remaining habitat and the connectivity of the Albasini Dam to the Luvuvhu River downstream of the dam.	**d) Habitat and biota** The outer edge of the Albasini Dam was associated with obligate floral species such as *Typha capensis* and *Cyperus spp.*. The fluctuating littoral zone of the Albasini Dam was associated with facultative floral species such *Sporobolus pyramidales* ,and *S. africanus.* The surrounding terrestrial area was associated with severe bush encroachment by *L. camara* and *D. cinerea* subsp. *africana*. The Albasini Dam further provides suitable habitat and food availability for a variety of faunal species (refer to Appendix J for a list of faunal species identified within the area). The aquatic diversity of the Albasini Dam is considered to be of moderate diversity (Refer to section 6 for a detailed discussion of the aquatic ecology of the dam).
REC Category	**REC Category: C (Moderately modified)** Even though this is an artificial feature, this REC category indicates that management measures should be implemented to ensure that present levels of ecological services and functioning of this feature are retained and are not permitted to deteriorate further.	**Possible significant impacts, Business case, Conclusion and Mitigation Requirements:** The Albasini Dam, although an artificial impoundment, still provides essential ecological and socio-cultural services, including water supply and harvestable resources (subsistence fishing) for the local community. In the context of the proposed development the impact of the farming of *O. mossambicus* will result in an increase in the nutrient load and biological oxygen demand of the dam, due to the increase in the biological load. As such, regular monitoring of the water needs to be conducted to ensure nutrient levels do not exceed the recommended levels. Although the development of the proposed infrastructure adjacent to the dam will result in an increase in hardened surfaces in the area, and as such additional storm water input into the dam, the limited development footprint of the processing plant, is not anticipated to have a significant impact on the hydrology, geomorphology, or biota of the system. The southern portion of the proposed primary processing plant falls within the 32 m Zone of Regulation as per NEMA, while the majority of the proposed primary processing plant falls within the 100 m Zone of Regulation (GN 509). As such an application will have to filed with the relevant authorities for all infrastructure situated within the respective regulatory zones.

5.3 Delineation and Sensitivity Mapping

5.3.1 Delineation

It should be noted that the littoral zone of the Albasini Dam could not be delineated, since this zone fluctuates over time and between seasons, and as such the boundary of the full supply level of the Albasini Dam was delineated. The Albasini Dam delineations as presented in this report are regarded as a best estimate of the full supply level of the dam based on the site conditions present at the time; however, use was made of historical and current digital satellite imagery to further aid in the delineation of the resource. During the assessment, the following indicators were used to ascertain the boundaries of the full supply level of the dam:

- The soil form indicator was utilised as a primary indicator. The presence of redoxymorphic soil features, which are morphological signatures that appear in soils with prolonged periods of saturation, were specifically utilised to determine the full supply level; and
- Vegetation was considered indicative, as the change between the terrestrial zone and littoral zone of the dam was clear. As such the full supply level of the dam was delineated on the boundary where vegetation changes from predominantly grass species to Savanna vegetation comprising of predominantly trees species.

5.3.2 Legislative Considerations

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however, in summary it is considered to be “a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another”. Buffer zones are considered to be important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits” (Macfarlane *et. al,* 2015). It should be noted, however, that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

Although the Albasini Dam is an artificial impoundment, the dam forms part of the natural Luvuvhu River, and as such is considered important to be conserved, in order to allow for continuous functioning of the watercourse.

Legislative requirements were taken into consideration when determining a suitable buffer zone for the Albasini Dam. The definition and motivation for a regulated zone of activity for the protection of the Albasini Dam can be summarised as follows:

- Listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) EIA Regulations as amended in April 2017 must be taken into consideration if any infrastructure is to be placed within the applicable 32 m zone of regulation. This must be determined by the EAP in consultation with the relevant authorities;
- In accordance with GN 509 of 2016 as it relates to the NWA, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as:
    - the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
    - in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
    - A 500 m radius from the delineated boundary (extent) of any wetland or pan.

Figure12 below illustrates the respective NEMA and GN 509 zones of regulation relevant to the Albasini Dam. The southern portion of the proposed primary processing plant falls within the 32 m Zone of Regulation as per NEMA, while the majority of the proposed primary processing plant falls within the 100 m Zone of Regulation (GN 509). As such an application will have to filed with the relevant authorities for all infrastructure situated within the respective regulatory zones.

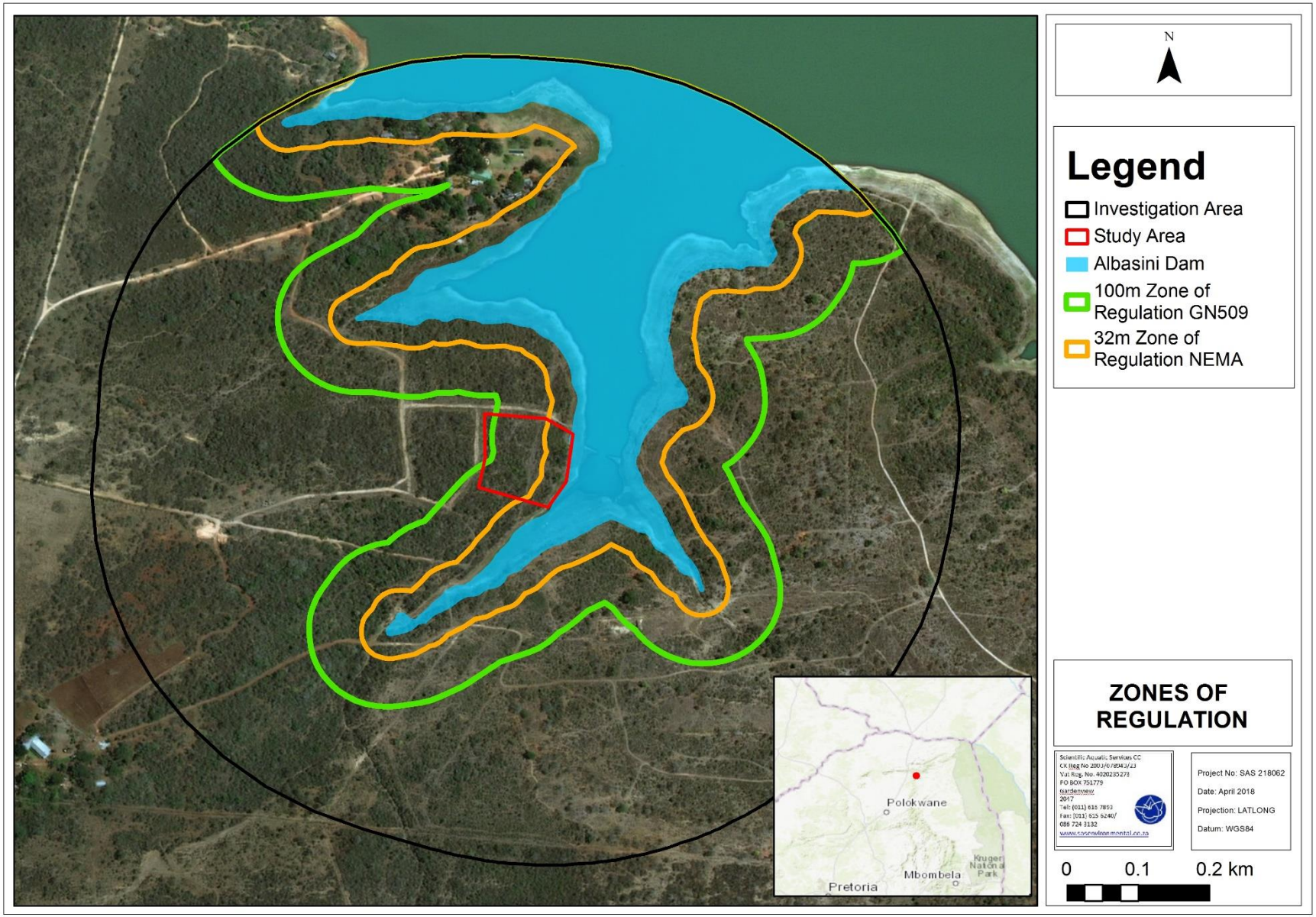


Figure 12: Presentation of the Albasini Dam and its associated zones of regulation in relation to the proposed primary processing plant.

6 RESULTS: AQUATIC ECOLOGICAL ASSESSMENT

The field assessment took place on the 17th of April 2018. Results are presented as "dashboard style" reports (Tables 8 and 9 as well as Figures 14 and 15). These dashboard reports aim to present concise summaries of the data on as few pages as possible, in order to allow for integration of results by the reader to take place. Where required, further discussion and interpretation is provided.

Table 8: Results of the aquatic biomonitoring assessment at both sites, Dam Point 1 and Dam Point 2.

<table>
<tr><th colspan="4">Site Dam Point 1</th><th colspan="4">Site Dam Point 2</th></tr>
<tr><td colspan="4"> 
Figure 13: General view of the Dam Point 1 site at the time of the assessment.</td><td colspan="4"> 
Figure 14: General view of the Dam Point 2 site at the time of the assessment.</td></tr>
<tr><td colspan="2">Algal proliferation</td><td colspan="2">None observed</td><td colspan="2">Algal proliferation</td><td colspan="2">None observed</td></tr>
<tr><td colspan="2">Depth profiles</td><td colspan="2">Deep (average depth > 2 m)</td><td colspan="2">Depth profiles</td><td colspan="2">Deep (average depth > 2 m)</td></tr>
<tr><td colspan="2">Flow condition</td><td colspan="2">Still</td><td colspan="2">Flow condition</td><td colspan="2">Still</td></tr>
<tr><td colspan="2">Riparian zone characteristics</td><td colspan="2">Good vegetation cover (mixture of grass and shrubs)</td><td colspan="2">Riparian zone characteristics</td><td colspan="2">Good vegetation cover (mixture of grass and shrubs)</td></tr>
<tr><td colspan="2">Water clarity and odour</td><td colspan="2">Silty and relatively turbid, but no odours evident.</td><td colspan="2">Water clarity and odour</td><td colspan="2">Relatively turbid, but no odours evident.</td></tr>
<tr><td colspan="2">In situ physico-chemical water quality</td><td colspan="2">Habitat Integrity</td><td colspan="2">In situ physico-chemical water quality</td><td colspan="2">Habitat Integrity</td></tr>
<tr><td>pH
EC (mS/m)
DO (mg/L)
DO (% sat)
Temp (℃)</td><td>6.39
18.0
6.53
86.0
24.9</td><td colspan="2">Index of Habitat Integrity (IHI)
Instream IHI %
Riparian IHI %
60.1 (Category C/D)
69.7 (Category C)</td><td>pH
EC (mS/m)
DO (mg/L)
DO (% sat)
Temp (℃)</td><td>6.28
17.2
6.61
87.6
25.3</td><td colspan="2">Index of Habitat Integrity (IHI)
Instream IHI %
Riparian IHI %
60.1 (Category C/D)
69.7 (Category C)</td></tr>
<tr><td colspan="2">Aquatic macro-invertebrate community integrity</td><td colspan="2">Fish Community Assessment Index</td><td colspan="2">Aquatic macro-invertebrate community integrity</td><td colspan="2">Fish Community Assessment Index</td></tr>
<tr><td colspan="2">Invertebrate community assessment
Number of Taxa
Average Score Per Taxa (ASPT)
13
4.15
Dominant Taxa:
Atyidae, Baetidae and Corixidae</td><td colspan="2">FRAI Score 55.3 (Category D)
Enteromius unitaeniatus, Pseudocrenilabrus philander, Coptodon rendalii and Oreochromis mossambicus were observed and reported by local anglers at the time of the assessment.</td><td colspan="2">Invertebrate community assessment
Number of Taxa
Average Score Per Taxa (ASPT)
9
3.44
Dominant Taxa:
Atyidae, Baetidae and Corixidae</td><td colspan="2">FRAI Score 52.0 (Category D)
Pseudocrenilabrus philander, Coptodon rendalii and Oreochromis mossambicus were observed and reported by local anglers at the time of the assessment.</td></tr>
<tr><td colspan="2">SITE ECOSTATUS CATEGORY
Instream IHI
Riparian IHI
FRAI
Ecological Category C/D
Ecological Category C
Ecological Category D</td><td colspan="2">Impacts
Flow variability, inundation.</td><td colspan="2">Key Drivers of System Change
Flow variability and inundation.</td><td colspan="2"></td></tr>
</table>

Table 8 (continued): Results of the aquatic biomonitoring assessment at both sites, Dam Point 1 and Dam Point 2

Comment:
➢ The general water quality of the Albasini Dam is considered fair based on the findings during the current assessment;
➢ Electrical conductivity (EC) for both site Dam Point 1 and Dam Point 2 is considered to be below the ideal range limit (30 mS/m) according to the DWA 2011 Resource Water Quality Objectives (RWQO) of South Africa recommendation;
➢ Dissolved Oxygen (DO) saturation complies with the recommendation for expected natural conditions as it exceeds 80% (DWS 1996) at both sites;
➢ The absolute pH value of each site does not comply with the recommended range (< 6.5 and > 8.4) as defined by the DWA RWQO's (2011). Adverse effects on the aquatic ecology resulting from pH is, however, unlikely at the time of the assessment, as the absolute pH at each site is very close to the lower end of the recommended range;
➢ Temperature at the time of the assessment is normal considering seasonal and diurnal cycles;
➢ The assessment of aquatic macro-invertebrate community resulted in the identification of thirteen (13) different taxa (combined from both sites), with the three dominant taxa being identified as Atyidae, Baetidae and Corixidae.
➢ At the Dam Point 1 site: the number of taxa and the sensitivity scores for each taxon were used to calculate the average score per taxon (indicating sensitivity) which resulted in a value of 4.15. At the Dam Point 2 site; the number average score per taxon was 3.44. These scores indicate a relatively diverse community of aquatic macro-invertebrates for a non-flowing system;
➢ It is evident from the assessment that more air-breathing macro-invertebrates, such as Belostomatidae, Corixidae, Gerridae, Veliidae, Lymnaeidae, Planorbinae and Thiaridae, were present in the dam. The presence of these macro-invertebrates is not uncommon in an impounded system such as the Albasini Dam;
➢ In addition, the lack of flowing water largely contributes to the absence of many of the common flow-dependant macro-invertebrate species that were not observed in the current assessment, such as the Perlidae, Heptageniidae, Hydropsychidae and Simulidae families;
➢ The instream and riparian zones can be regarded as moderately modified at the time of the assessment due to forestry and agricultural activities as well as some invasive riparian vegetation observed during the assessment;
➢ The depth of the dam and the unstable nature of the marsh at the dams' edge restricted electrofishing and cast-netting to a large degree. In addition, fish tend to remain deeper at lower temperatures in dam environments, thus increasing the difficulty with which to reach them employing the fishing methods mentioned;
➢ However, the results from the FRAI assessment indicate a Category D, as *Enteromius unitaeniatus, Pseudocrenilabrus philander*, *Coptodon rendalii* and *Oreochromis mossambicus* were observed and reported by local anglers.

6.1 Ecological Importance and Sensitivity Assessment

The Ecological Importance and Sensitivity (EIS) method (DWAF, 1999) was applied to the Albasini Dam, in order to ascertain the current sensitivity and importance of the system. The results of the assessment are presented in the table below:

Table 9. Results of the EIS assessment for the Albasini Dam

Biotic Determinants	Score
Rare and endangered biota	0
Unique biota	1
Intolerant biota	1
Species/taxon richness	2
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	2
Refuge value of habitat type	1
Sensitivity of habitat to flow changes	1
Sensitivity of flow-related water quality changes	1
Migration route/corridor for instream and riparian biota	1
Nature Reserves, Natural Heritage sites, Natural areas, PNEs	2
RATINGS	**1.2**
EIS CATEGORY	**Moderate**

The Ecological Importance and Sensitivity Assessment analysis of the Albasini provided a score of 1.2 which is regarded as representative of a **moderate importance and sensitivity**. The moderate importance and sensitivity of the Albasini Dam means that the system is unique on a local scale due to the biodiversity (habitat diversity, species diversity and potential unique species). The biota and habitat of this system are generally not very sensitive to flow modifications and usually have substantial capacity for use. The system has a moderate importance with regards to sensitivity to alterations in flow and flow-related water quality changes, as well as species richness (Kleynhans, 1999).

7 ECOLOGICAL IMPACT ASSESSMENT

7.1 Terrestrial Impact Assessment

7.1.1 Potential Impact 1: Impact on terrestrial habitat and diversity

The clearance of vegetation for the construction of the primary processing plant of the development, will impact on the terrestrial habitat and diversity of the proposed primary processing plant. Although the clearance activities are limited to the footprint area of the processing plant, the removal of vegetation can result in a spread of alien invasive species and species associated with bush encroachment, such as *L. camera,* and *D. cinerea subsp. africana,* to the surrounding areas. This will result in a further loss of floral habitat and diversity of the surrounding area (local region), which in turn will affect the habitat and diversity of faunal species. As the proposed primary processing plant is considered to be highly degraded as a result of severe bush encroachment, and the ecological importance is considered to be moderately low, the impact on terrestrial habitat and diversity is considered to be low prior to mitigation being implemented (both the construction and operational phases). With appropriate mitigation implemented, the impact can be lowered to very low levels for all phases of the development.

Proposed mitigation measures:

- Clearance of vegetation should be limited to what is absolutely essential, and should not exceed the boundaries of the proposed primary processing plant;
- Cleared vegetation should be disposed of at a registered waste disposal facility, and no vegetation should be allowed to be burned on site, to prevent further spread of alien and bush encroachment species;
- During the disposal process, vehicles transporting vegetation, should be covered with tarpaulins, to limit seed dispersal to the surrounding area during the transporting process; and
- Alien vegetation as listed in Appendix H must be removed from the proposed primary processing plant during both the construction and operational phases, with specific mention of Category 1b species in line with the NEMBA Alien and Invasive Species Regulations (2016).

7.1.2 Potential Impact 2: Loss of Floral SCC

During the field assessment, saplings of *S. birrea* subsp *caffra* (Marula) were observed on the western boundary of the proposed primary processing plant. Due to severe bush encroachment, movement within the proposed primary processing plant was limited, and as

such it is likely that more individuals might be situated within the proposed primary processing plant.

It is therefore recommended that once the layout of the proposed primary processing facility have been finalised a specialist be consulted to mark all *S. birrea* subsp. *caffra* individuals situated within the development footprint areas and as many individuals as possible be avoided and a permit for the removal of all affected individuals be applied for from the DAFF, prior to the commencement of vegetation clearance..

Proposed mitigation measures:

- Should any individuals of *S. birrea* subsp *caffra* be disturbed during the construction of the project permits must be obtained from the DAFF;
- Care should be taken that no individuals of these species falling outside of the development footprint are harvested by construction or operational personnel for medicinal or firewood purposes;
- Alien invasive species and species associated with bush encroachment should be removed and controlled during both the construction and operational phases of the development, to prevent further spread of such species, and result in further loss of floral SCC.

7.1.3 Potential Impact 3: Loss of Faunal SCC

No floral SCC were observed during the field assessment, nor are any expected to permanently utilise the proposed primary processing plant due to the habitat degradation associated with the proposed primary processing plant. It is however likely that avifaunal SCC such as *P. bellicosus* (Martial Eagle), *A. rapax* (Tawny Eagle), and *C. nigra* (Black Stork) might utilise the proposed primary processing plant and surrounding area, such as the Albasini Dam for feeding purposes from time to time. The impact on the loss of the faunal SCC is considered to be very low prior to mitigation being implemented for both the construction and operational phase. If the following mitigation measures are adhered to the impact on faunal SCC can be considered negligible.

Proposed mitigation measures:

- Prevent hunting by construction or operational personal of any potential SCC that might utilise the area from time to time;
- Should any faunal SCC be observed within the proposed primary processing plant during the construction or operational phase, individuals should be left undisturbed,

and a specialist be consulted as to the best way forward should they interfere with the construction or operation of the development

7.1.4 Cumulative Impacts

Due to the small scale of the project footprint, and the degraded state of the proposed primary processing plant and surrounding area, the development of the primary processing plant is not considered to have a significant cumulative impact on the terrestrial habitat, diversity or SCC of the area. Particularly when considering that the majority of the area surrounding the dam is still undeveloped.

7.1.5 Impact assessment summary

The assessment of impacts and recommendation of mitigation measures as discussed above, is collated in the tables below.

Table 10: Impact assessment summary table for the Construction Phase

Construction Phase												
Activity	**Impact Summary**	**Status**	**Extent**	**Duration**	**Intensity**	**Reversibility**	**Irreplace-ability**	**Probability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**	
Clearance of Vegetation for construction of the primary Processing Plant	Impact on terrestrial habitat and diversity	Negative	Local	Long term	Moderate	Low	Low	Definite	• Ensure vegetation clearing is limited to what is essential, and does not extend beyond the footprint area and access road; • Vegetation should be disposed of at a registered waste facility and should not be burned on site.	Low	Very Low	Medium
	Loss of floral SCC	Negative	Local	Long term	Moderate	Moderate	Moderate	Highly probable	• All *S. birrea* subsp. *caffra* (Marula) individuals should be marked prior to construction, and a permit be obtained from DAFF should any individuals be removed during the construction phase. • Care should be taken not to remove or damage any individuals of *S. birrea* subsp. *caffra* not situated within the development footprint	Moderate	Low	Medium
	Loss of faunal SCC	Negative	Local	Short term	Low	High	Low	Improbable	• Prevent hunting by construction personnel of any potential SCC that might utilise the area from time to time; • Should any faunal SCC be observed within the proposed primary processing plant during the construction phase, all activities should be stopped, and a specialist should be consulted as to the best way forward.	Very Low	Very Low	Medium

Table 11: Impact assessment summary table for the Operation Phase

Operation Phase												
Activity	**Impact Summary**	**Status**	**Extent**	**Duration**	**Intensity**	**Reversibility**	**Irreplace-ability**	**Probability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**	
Operation of the plant, resulting in further spread of alien invasive species and bush encroachment	Impact on terrestrial habitat and diversity	Negative	Local	Permanent	Low	Low	Low	Probable	• No harvesting of plant material is to be allowed during the operation of the development; • Ensure ongoing monitoring of alien vegetation and bush encroachment, through the removal of alien invasive floral species and bush thinning within the surrounding area, to prevent further spread of such species to surrounding areas resulting in a loss of floral SCC as well as terrestrial habitat and diversity	Low	Very Low	Medium
	Loss of floral SCC	Negative	Local	Permanent	Low	Moderate	Moderate	Probable		Low	Very Low	Medium
	Loss of faunal SCC	Negative	Local	Permanent	Low	High	Low	Improbable	• Prevent hunting by personnel of any potential SCC that might utilise the area from time to time; • Should any faunal SCC be observed within the proposed primary processing plant during the operational phase, individuals should be left undisturbed. Should the SCC interfere with the operation of the development a specialist be consulted as to the best way forward	Very Low	Very Low	Medium

7.2 Freshwater Impact Assessment

Although the development of the proposed infrastructure adjacent to the dam will result in an increase in hardened surfaces in the area, and as such also additional storm water input into the dam, the small development footprint of the processing plant is unlikely to have a significant impact on the hydrology, geomorphology, or biota of the system. It is anticipated that the only significant impact on the freshwater ecology will derive from the farming of the *O. mossambicus* during the operational phase of the proposed project. The impact assessment was undertaken based on the following assumptions:

- a barge will transport the fish from the cages to the primary processing facility and dock on a small jetty;
- waste generated during the primary processing portion of the project will be disposed of at a registered waste facility.

7.2.1 Potential Impact 1: Increase in nutrient load

During the operational phase of the proposed operation, a potential impact resulting from an increase in nutrient load in the Albasini Dam is anticipated. Due to the nature of the project, the farming of *O. mossambicus*, an increased biological load (both physical and chemical) will occur. The potential impact is anticipated to have a long-term effect (the lifetime of the project) on a local extent with moderate intensity. As the fish are grown, they are fed nutrient-rich food which if measured incorrectly is likely to increase the nutrient load within the dam along with the waste produced by the fish themselves, posing a long-term eutrophication risk. Mitigation measures to ensure that the significance of the impact remains low, include:

- regular monitoring of the water quality in the dam with specific mention of nitrate and phosphate loads as Total Inorganic Nitrogen (TIN) and Total Phosphate (TP);
- regular monitoring of the ammonia (NH_3) levels within the dam as chronic effects of ammonia to fish include a reduction in hatching success, reduction in growth rate and morphological development;
- , not exceeding the assimilative capacity of the dam;
- , optimising the feeding of the fish with minimal waste and regular pumping/circulating of water within the farming system.

Overall, the probability of this potential impact occurring is high, however, it is reversible and with mitigation and management the residual impact will be low.

7.2.2 Potential Impact 2: Increase Biological Oxygen Demand (BOD)

Along with the potential impact of increased nutrient load within the Albasini Dam, the potential increase in biological oxygen demand (BOD) follows. The potential impact is anticipated to have a long-term effect (the lifetime of the project) on a local extent with moderate intensity. As the fish grow, and the nutrient load within the dam increases, the levels of dissolved oxygen within the system will decrease which leads to an increase in oxygen demand.

This potential impact will not only potentially affect the fish being farmed, but also the other biota occurring in the Albasini Dam prior to commencement of the aquaculture project. Mitigation measures to ensure the significance of the impact remains low are the same as the previous potential impact (regular monitoring of the water quality in the dam, not exceeding the assimilative capacity of the dam and optimising the feeding of the fish with minimal waste). The most important mitigation measure in this case is the regular pumping/circulating of water within the farming system, which will assist in increasing the overall dissolved oxygen and lowering the demand. Overall, the probability of this potential impact occurring is high, however, it is reversible and with mitigation and management the residual impact will be low.

7.2.3 Potential Impact 3: Impact on established biota

During the operational phase of the proposed operation, a potential impact on the established biota of Albasini Dam is anticipated. Some of the *O. mossambicus* might escape through gaps or holes in the cages and impact on the established biota present in the Albasini Dam, however, because this species of fish is already established in the system, the intensity of the impact is slight. Mitigation measures to ensure the significance of the impact remains low includes regular monitoring of the cages, ensuring that all gaps and holes are repaired immediately so that fish are securely enclosed within the farming system. Overall, the probability of this potential impact occurring is high, however, with mitigation and management the residual impact will be very low.

7.2.4 Potential Impact 4: Introduced parasites

The farming of the *O. mossambicus* brings with it the potential impact of parasitic infections and diseases. This potential impact would be probable when the fish are put into the cages as fingerlings, if any of the fingerlings are carrying parasites or diseases, the impact is likely to spread quickly throughout the farming system due to the close proximity of the fishes. Also, considering that it is an open cage system, said parasites or diseases can also be introduced to areas and biota of the Albasini Dam not associated with the project. The other possible

source of this potential impact is from the established biota in the Albasini Dam, with stocked fish in the project contracting infection or disease agent already present in the system. Mitigation measures to ensure the significance of the impact remains low include:

- an initial assessment of the fingerlings before they are put into the farming system to ensure they are healthy and show no signs of disease;
- regular fish health monitoring of the growing fish, in order to identify any diseases or infections before they spread, report any noticeable infections during the processing operation (worms found in the guts or cysts found on the scales) and control the infections as soon as they are diagnosed.

The potential impact is probable and likely to have a short-term effect (depending on the time from detection to treatment) with moderate intensity, it is reversible and with mitigation and management the residual impact will be very low. Overall, should the mitigation measures mentioned above for each of the potential impacts be adhered to, the significance of the impacts will be low to very low.

7.2.5 Cumulative Impacts

The largest potential impact from the proposed project on the Albasini Dam is the increased nutrient load, which will likely positively correlate with an increased BOD. These potential impacts are likely to have an effect in a downstream direction when water is released from the dam and this factor needs to be considered when regarding the cumulative impacts of the proposed project. However, proper management and mitigation of potential impacts of the project can result in low residual impact and risk.

7.2.6 Impact assessment summary

The assessment of impacts and recommendation of mitigation measures as discussed above, is collated in the tables below.

Table 12: Impact assessment summary table for the Operational Phase

Operational Phase												
Activity	**Impact Summary**	**Status**	**Extent**	**Duration**	**Intensity**	**Reversibility of Impact**	**Irreplace-ability**	**Probability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**	
Growing and Farming of *Oreochromis mossambicus*	Increase in nutrient load	Negative	Local	Long term	Moderate	Moderate	Moderate irreplace-ability	Highly probable	• Regular monitoring of the water quality in the system. • Do not exceed the assimilative capacity of the dam. • Optimise the feeding of the fish so that there is no excess energy-rich material in the system. • Regular pumping or circulation of water within the farming system.	Moderate	Low	Medium
	Increase BOD	Negative	Local	Long term	Moderate	Moderate	Low irreplace-ability	Highly probable		Moderate	Low	Medium
	Impact on established biota	Negative	Site	Long term	Slight	Moderate	Low irreplace-ability	Probable	• Ensure the cages do not have holes or gaps where fish can escape. • Regular monitoring of the cages to ensure the integrity of the cages.	Low	Very Low	Medium
	Impact of introduced parasites	Negative	Site	Short term	Slight	Moderate	Low irreplace-ability	Probable	• Ensure that the fingerlings are in good health and do not show signs of disease. • Monitor potential parasitic infections with regular fish health inspections. • Control infections as soon as diagnosed.	Low	Very Low	Medium

7.3 Mitigation Measures

General management and good housekeeping practices

The following essential mitigation measures are considered to be standard best practice measures applicable to development of this nature, and must be implemented together with the specific mitigation measured identified in Section 7.1 and 7.2 during all phases of the development.

Development and operational footprint

- The development footprint area should remain as small as possible and should not unnecessarily encroach into the full supply level of the Albasini Dam. As far as possible the development footprint should also be kept outside of the 32m Zone of Regulation as per NEMA, to ensure ongoing functioning of the system;
- Planning of temporary roads and/or access routes should avoid the full supply level of the Albasini Dam and be restricted to existing roads where possible;
- Restrict construction to the non-rainy periods if possible to avoid additional sedimentation of the Albasini Dam, and to minimise the severity of disturbance of the in-stream habitat;
- Appropriate sanitary facilities must be provided during the construction phase, and all waste must be removed to an appropriate waste facility;
- Informal fires by construction personnel should be prohibited, and no uncontrolled fires whatsoever should be allowed;
- All soils compacted as a result of construction activities, should be ripped and reprofiled to natural levels and revegetated with indigenous vegetation. Special attention should be paid to the control of alien and invasive plants and species associated with bush encroachment;
- No dumping of waste should take place. If any spills occur, they should be immediately cleaned up, and be disposed of at a registered waste facility;
- No trapping or hunting of any faunal species is to take place;
- Upon completion of construction activities, it must be ensured that no bare areas remain and that indigenous grass species are reintroduced;
- Alien vegetation as listed in Appendix F must be removed from the proposed primary processing plant during both the construction and operational phases, with specific mention of Category 1b species in line with the NEMBA Alien and Invasive Species Regulations (2016); and
- Establishment of reintroduced vegetation must be monitored during the rehabilitation phase.

Floral and Faunal diversity

- A speed limit of 60km/h should be implemented, and road signs warning motorists of animals crossing the road should be installed at distances complying with national standards; and
- Should any other floral or faunal SCC, not encountered during the field assessment, be encountered during any phase of the proposed development, all activities should be stopped, and a qualified expert be consulted to implement a suitable biodiversity management plan.

Vehicle access

- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; and
- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil.

Soils

- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise environmental damage;
- All soil stockpiles must be protected by water diversion berms on the upgradient edge of the stockpile and a suitable geotextile such as Geojute or hessian sheeting, to avoid runoff and sediment from the stockpiles reaching the Albasini Dam;
- Such stockpiles must either be removed or levelled following the completion of construction activities;
- Storm water must be managed accordingly to ensure that no sediment deposits occur within the Albasini Dam; and
- Edge effects of activities including erosion and alien and invasive plant control need to be strictly managed in these areas.

Rehabilitation

- Construction rubble must be collected and disposed of at a suitable landfill site;
- All alien vegetation within the 32m zone of regulation of the Albasini Dam as a result of edge effects from the construction activities should be removed upon completion of construction. Alien vegetation control within the proposed primary processing plant should take place for a minimum period of two growing seasons after construction is

completed. Alien vegetation control should take place with manual labour; no vehicles must be permitted during the control / monitoring phase.

- As much vegetation growth as possible should be promoted within the proposed development area in order to protect soils. In this regard, special mention is made of the need to use indigenous vegetation species as the first choice during landscaping; and
- All areas of disturbed and compacted soils need to be ripped and reprofiled.

Freshwater and Aquatic

- regular monitoring of the water quality in the dam with specific mention of nitrate, phosphate and ammonia loads;
- not exceeding the assimilative capacity of the dam;
- optimising the feeding of the fish with minimal waste and regular pumping/circulating of water within the farming system;
- regular pumping/circulation of water within the farming system to assist with increasing the oxygen levels;
- regular monitoring of the cages, ensuring that all gaps and holes are repaired immediately so that fish are securely enclosed within the farming system;
- an initial assessment of the fingerlings before they are put into the farming system to ensure they are healthy and show no signs of disease; and
- regular fish health monitoring of the growing fish, in order to identify any diseases or infections before they spread, report any noticeable infections during the processing operation (worms found in the guts or cysts found on the scales) and control the infections as soon as they are diagnosed.

8 CONCLUSION

SAS was appointed to conduct a freshwater resource, aquatic and terrestrial ecological assessment as part of the WUL and EIA)process for the proposed Makwaria Fisheries Mozambique Tilapia (*Oreochromis mossambicus*) aquaculture and primary processing facility on Albasini Dam, near Louis Trichard, Limpopo Province.

Following the assessment of the terrestrial ecology associated with the proposed primary processing facility, it is clear that a single habitat unit is associated with the proposed primary processing facility, namely the Secondary Bushveld Habitat Unit. This habitat was associated with severe bush encroachment by *Dichrostachys cinerea* subsp. a*fricana* (Sickle bush), and the alien invasive species *Lantana camara* (Common Lantana), as a result of overgrazing by

domestic livestock such as cattle. The proposed primary processing facility falls within the Tzaneen Sour Bushveld vegetation type (Mucina & Rutherford, 2012), which is considered to be a vulnerable ecosystem according to the National Threatened Ecosystem Database (2011).Although various tree species observed within the proposed primary processing facility, such as *S. birrea* subsp. *caffra* (Marula), *Peltophorum africanum* (African Wattle), and *Oleo europaea* subsp. *africana* (Wild Olive) are indigenous to the Tzaneen Sour Bushveld, the proposed primary processing facility is no longer considered to be a true representative of the Tzaneen Sour Bushveld vegetation type. As such the terrestrial ecology of the proposed primary processing facility is considered to be secondary vegetation, and the ecological importance and sensitivity considered to be moderately low. During the assessment, it was evident that the proposed primary processing facility did provide suitable habitat for the tree species *Sclerocarya birrea* subsp. *caffra* (Marula) protected under the NFA of 1998 (amended 2011), of which saplings were observed on the western boundary of the proposed primary processing facility. It is, however, likely that more individuals might be present within the proposed primary processimg facility, although they were not observed as bush encroachment limited movement within the proposed primary processing plant. It is therefore recommended that once the layout of the proposed primary processing facility have been finalised a specialist be consulted to mark all *S. birrea* subsp. *caffra* individuals situated within the development footprint areas, and a permit for the removal of all identified individuals that cannot be retained must be obtained from the DAFF, prior to the commencement of vegetation clearance.

A single freshwater resource was identified within the investigation area, namely the Albasini Dam. Even though the Albasini Dam is an artificial impoundment within the Luvuvhu River, it is still considered an ecologically functional feature as it forms part of a natural watercourse. The impoundment of the system has significantly altered the hydrology of the Luvuvhu River, albeit the area surrounding the Albasini Dam is not significantly impacted by anthropogenic activities. As such, the PES of the system is considered to be moderately modified. The EIS of the Albasini Dam falls within Category C, which is described as a resource that is considered to be ecologically important on a local scale, albeit that the biodiversity of these systems is not usually very sensitive to limited flow and habitat modifications. The Albasini Dam, however, provides valuable ecosystem services functions such as water supply for domestic and agricultural activities. As a subsistence, fishery it also provides harvestable protein resources for the local community.

The southern portion of the proposed primary processing plant falls within the 32 m Zone of Regulation as per NEMA, while the majority of the proposed primary processing plant falls within the 100 m Zone of Regulation (GN 509). As such an application will have to filed with

the relevant authorities (DAFF and the DWS) for all infrastructure situated within the respective regulatory zones.

The aquatic ecological assessment concluded that the general water quality of the Albasini Dam was found to be fair during the current assessment. Electrical conductivity (EC) was within the ideal range limit (30 mS/m) recommended by the DWA 2011 Resource Water Quality Objectives (RWQO) of South Africa at both sites Dam Point 1 and Dam Point 2, and dissolved oxygen (DO) saturation exceeded 80% and hence complied with recommended natural conditions.

The absolute pH value of both sites did not comply with the recommended range (< 6.5 and > 8.4) as defined by the DWA RWQO's (2011). Adverse effects on the aquatic ecology resulting from pH is, however, unlikely at the time of the assessment, as the absolute pH is very close to the lower end of the recommended range. Temperature at the time of the assessment is normal considering seasonal and diurnal cycles.

The assessment of aquatic macro-invertebrate community resulted in the identification of thirteen (13) different taxa (combined from both sites), with the three dominant taxa being identified as Atyidae, Baetidae and Corixidae. The number of taxa and the sensitivity scores for each taxon were used to calculate the average score per taxon (indicating sensitivity), which resulted in a value of 4.15 for site Dam Point 1 and 3.44 for site Dam Point 2. These scores indicate a relatively diverse community of aquatic macro-invertebrates given that the system is non-flowing. It is evident from the assessment that more air-breathing macro-invertebrates, such as Belostomatidae, Corixidae, Gerridae, Veliidae, Lymnaeidae, Planorbinae and Thiaridae, were present in the dam. The presence of these macro-invertebrates is not uncommon in a lentic system such as the Albasini Dam. In addition, the lack of flowing water largely contributes to the absence of many of the common flow-dependant macro-invertebrate species that were not observed in the current assessment, such as the Perlidae, Heptageniidae, Hydropsychidae and Simulidae families. The instream and riparian zones at both sites could be regarded as largely modified at the time of the assessment, which is indicated by the overall Category D score obtained after employing the IHIA index.

The depth of the dam and the unstable nature of the emergent vegetation at the dam's edge restricted electrofishing and cast-netting to a large degree. In addition, fish tend to remain deeper at lower temperatures in dam environments, thus increasing the difficulty with which to reach them employing the fish sampling methods mentioned. However, the results from the

FRAI assessment at both sites indicated a Category D, as *Enteromius unitaeniatus, Pseudocrenilabrus philander*, *Coptodon rendalii* and *Oreochromis mossambicus* were observed and reported by local anglers during the current field assessment in April 2018.

The primary impact on the terrestrial ecology will arise from clearing of vegetation during the construction of the proposed primary processing plant, which will result in a loss of floral and faunal habitat, diversity, and SCC if not appropriately mitigated.

Although the development of the proposed infrastructure adjacent to the dam, will result in an increase in hardened surfaces in the area, and as such additional storm water input into the dam, the small development footprint of the processing plant, is unlikely to have a significant impact on the hydrology, geomorphology, or biota of the receiving watercourse. It is anticipated that the only impact on the freshwater ecology will derive from the farming of the *O. mossambicus* during the operational phase of the proposed project. The most significant risk is that of eutrophication (increased organic input resulting from feeding and fish waste products).

As such the potential impacts of the farming of *O. mossambicus* on the aquatic ecology for both the construction and operational phase, as well as the construction and operation of the primary processing plant on the terrestrial ecology, is anticipated to be moderate to low prior to implementation of mitigation measures. With mitigation fully implemented and regular monitoring, the impact significance of all impacts during all phases can be lowered from moderate/low to low/very low levels.

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It is the opinion of the specialists, from an aquatic, freshwater and terrestrial resource conservation perspective, that the proposed project be considered favourably, with the proviso that strict adherence to mitigation measures, including a rigorous monitoring program is enforced, and approval and permits where applicable, are obtained from the various authorities, in order to ensure that the ecological integrity of the ecological resources is not further compromised.

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APPENDIX A – Indemnity and Terms of Use

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B – Legislative Requirements

National Environmental Management Act (NEMA) (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
National Environmental Management Biodiversity Act (NEMBA, Act No. 10 of 2004)	The objectives of this act are (within the framework of NEMA) to provide for: ➢ The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➢ The use of indigenous biological resources in a sustainable manner; ➢ The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources; ➢ To give effect to ratify international agreements relating to biodiversity which are binding to the Republic; ➢ To provide for cooperative governance in biodiversity management and conservation; and ➢ To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either: a) A specimen of a listed threatened or protected species; b) Specimens of an alien species; or c) A specimen of a listed invasive species without a permit.
NATIONAL FOREST ACT (ACT NO. 84 OF 1998)	Principles to guide decisions affecting forestry resources applicable to land development management are contained in the following principle: **Principle 3** 3) The principles are that— (a) natural forests must not be destroyed save in exceptional circumstances where, in the opinion of the Minister, a proposed new land use is preferable in terms of its economic, social or environmental benefits; (b) a minimum area of each woodland type should be conserved and forests must be developed and managed to - (i) conserve biological diversity, ecosystems and habitats; (ii) sustain the potential yield of their economic, social and environmental benefits. This section of the Act alludes to the fact that the conservation status of all vegetation types needs to be considered when any development is taking place to ensure that the adequate conservation of all vegetation types is ensured. **Principle 6** (6) Criteria and indicators may include but are not limited to, those for determining—

	◦ the level of maintenance and development of— (i) forest resources: (ii) biological diversity in forests: (iii) the health and vitality of forests: (iv) the productive functions of forests: (v) the protective and environmental functions of forests; and (vi) the social functions of forests.
National Water Act (NWA) (Act No. 36 of 1998)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: ➢ The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; ➢ In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or ➢ A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and stormwater management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.

Limpopo Environmental Management Act (Act 7 of 2003)	The objectives of this Act are: ➢ to manage and protect the environment in the Province; ➢ to secure ecologically sustainable development and responsible use of natural resources in the Province; ➢ generally, to contribute to the progressive realisation of the fundamental rights contained in section 24 of the Constitution of the Republic of South Africa Act, 1996 (Act No. 108 of 1996), and ➢ to give effect to international agreements effecting environmental management which are binding on the Province. This Act must be interpreted and applied in accordance with the national environmental management principles set out in Section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)
Conservation of Agricultural Resources Act (CARA, Act 43 of 1983)	Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.

APPENDIX C – Terrestrial Ecology Method of Assessment

C1: Floral Method of assessment

Floral Species of Conservation Concern Assessment

Prior to the field visit, a record of floral SCC and their habitat requirements was acquired from SANBI for the Quarter Degree Square in which the study area is situated, as well as relevant regional, provincial and national lists. Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC was determined using the following calculations wherein the distribution range for the species, specific habitat requirements and level of habitat disturbance were considered. The accuracy of the calculation is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Each factor contributes an equal value to the calculation.

Distribution						
	Outside of known distribution range					**Inside known distribution range**
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat availability						
	No habitat available					**Habitat available**
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat disturbance						
	0	**Very low**	**Low**	**Moderate**	**High**	**Very high**
Site score						
EVC 1 score	5	4	3	2	1	0

[Distribution + Habitat availability + Habitat disturbance] / 15 x 100 = POC%

Vegetation Surveys

Vegetation surveys were undertaken by first identifying different habitat units and then analysing the floral species composition that was recorded during detailed floral assessments using the step point vegetation assessment methodology. Different transect lines were chosen throughout the entire study area (with consideration of movement constraints as described in report text) within areas that were perceived to best represent the various plant communities. Floral species were recorded and a species list was compiled for each habitat unit. These species lists were also compared with the vegetation expected to be found within the relevant vegetation types as described in Section 4, which serves to provide an accurate indication of the ecological integrity and conservation value of each habitat unit (Evans & Love, 1957; Owensby, 1973).

C2: Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the study area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations. In order to increase overall observation time within the study area, as well as increasing the likelihood of observing shy and hesitant species, camera traps were strategically placed within the study area. Sherman traps were also used to increase the likelihood of capturing and observing small mammal species, notably small nocturnal mammals.

Mammals
Small mammals are unlikely to be directly observed in the field because of their nocturnal/crepuscular and cryptic nature. A simple and effective solution to this problem is to use Sherman traps. A Sherman trap is a small aluminium box with a spring-loaded door. Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut, thereby capturing the individual. In the event of capturing a small mammal during the night, the animal would be photographed and then set free unharmed early the following morning. Traps were baited with a universal mixture of oats, peanut butter, and fish paste.

Medium to large mammal species were recorded during the field assessment with the use of visual identification, spoor, call and dung. Specific attention was paid to mammal SCC as listed by the IUCN, 2015.

Avifauna
The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) was compared with the recent field survey of avifaunal species identified on the study area. Field surveys were undertaken utilising a pair of Bushnell 10x50 binoculars and bird call identification techniques were utilised during the assessment, in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Reptiles
Reptiles were identified during the field survey. Suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected and all reptiles encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the study area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Amphibians
Identifying amphibian species is done by the use of direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the study area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Invertebrates
Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken. Furthermore, at suitable and open sites within the study area sweep netting was conducted, and all the insects captured identified.

It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the study area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Arachnids
Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC scorpions within the study area.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC was determined using the following four parameters:

- Species distribution;
- Habitat availability;
- Food availability; and
- Habitat disturbance.

The accuracy of the calculation is based on the available knowledge about the species in question. Therefore, it is important that the literature available is also considered during the calculation.
Each factor contributes an equal value to the calculation.

Scoring Guideline				
Habitat availability				
No Habitat	**Very low**	**Low**	**Moderate**	**High**
1	2	3	4	5
Food availability				
No food available	**Very low**	**Low**	**Moderate**	**High**
1	2	3	4	5
Habitat disturbance				
Very High	**High**	**Moderate**	**Low**	**Very Low**
1	2	3	4	5
Distribution/Range				
Not Recorded		**Historically Recorded**		**Recently Recorded**
1		3		5

[Habitat availability + Food availability + Habitat disturbance + Distribution/Range] / 20 x 100 = POC%

C3: Habitat Sensitivity

The habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral and faunal communities and provide an indication of the overall terrestrial ecological integrity, importance and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Terrestrial SCC:** The confirmed presence or potential for floral and/or faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes and Food Availability:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region, as well as the availability of food within the habitat unit for faunal species;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases;
- **Terrestrial Diversity:** The recorded floral and faunal diversity compared to a suitable reference condition such as surrounding natural areas or available floral and faunal databases; and
- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the terrestrial habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question.
In order to present the results use is made of spider diagrams to depict the significance of each aspect of terrestrial ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table C1: Terrestrial habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX D – Freshwater System Method of Assessment

1. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The freshwater resources encountered in close proximity to the proposed development were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa, where applicable. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table D1 and D2, below.

Table D1: Proposed classification structure for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table D2: Hydrogeomorphic (HGM) Unit for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the Classification System, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean[2] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There are a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the National Freshwater Ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the Classification System, for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- Slope: an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley.
- Valley floor**:** The base of a valley, situated between two distinct valley side-slopes.
- Plain**:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land.
- Bench (hilltop/saddle/shelf): an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope,

[2] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table C2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- River**:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.
- Channelled valley-bottom wetland**:** a valley-bottom wetland with a river channel running through it.
- Unchannelled valley-bottom wetland**:** a valley-bottom wetland without a river channel running through it.
- Floodplain wetland**:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank.
- Depression: a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- Wetland Flat: a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat
- Seep: a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et al*., 2009).

2. *Wetland Function Assessment*

“The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class”.[3] The assessment of the ecosystem services supplied by the identified freshwater resources was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation
- Stream flow regulation
- Sediment trapping
- Phosphate trapping
- Nitrate removal
- Toxicant removal
- Erosion control
- Carbon storage
- Maintenance of biodiversity
- Water supply for human use
- Natural resources
- Cultivated foods
- Cultural significance
- Tourism and recreation
- Education and research

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the freshwater resources. Each characteristic was scored to give the likelihood that the service is being

[3] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

provided. The scores for each service were then averaged to give an overall score to the freshwater resources.

Table D5: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

3. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purposed of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table D6) of the wetland system being assessed.

Table D6: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

4. Recommended Ecological Category (REC)

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability, but carries a higher risk of ecosystem failure." [4]

The REC (Table D7) was determined based on the results obtained from the PES, reference conditions and EIS of the resource (sections above). Followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

A freshwater resource may receive the same class for the PES as the REC if the freshwater resource is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the freshwater resource.

Table D7: Description of REC classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

10. Freshwater Resource Delineation

The riparian zone delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that wetlands have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005 & 2008).

Riparian and wetland zones can be divided into three zones (DWAF, 2005 & 2008). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant part of the rainy season and the temporary zone surrounds the seasonal zone and is only saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

[4] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources 1999

APPENDIX E – Aquatic Ecological Assessment Methodology

The sections below describe the methodology used to assess the aquatic ecological integrity of the two sites selected based on water quality, instream and riparian habitat condition and biological impacts and integrity as well as toxicological analysis.

1. Visual Assessment

Each site was investigated in order to identify visible impacts on the site, with specific reference to impacts from surrounding activities. Both natural constraints placed on ecosystem structure and function, as well as anthropogenic alterations to the system, were identified by observing conditions and relating them to professional experience. Photographs of each site were taken to provide visual indications of the conditions at the time of assessment. Factors which were noted in the site specific visual assessments included the following (note that some may not be relevant to an impoundment of this type):

- Stream morphology;
- Instream and riparian habitat diversity;
- Stream continuity;
- Erosion potential;
- Depth flow and substrate characteristics;
- Signs of physical disturbance of the area; and
- Other life forms reliant on aquatic ecosystems.

2. Physico Chemical Water Quality Data

On-site testing of biota specific water quality parameters including pH, Electrical Conductivity (EC), dissolved oxygen concentration (DO) and temperature. The results aid in the interpretation of the other aquatic data obtained during the assessment. Results are discussed against the guideline water quality values for aquatic ecosystems (DWAF 1996 vol. 7) as well as the Resource Water Quality Objectives (RWQO) of South Africa (DWA, 2011). Although the guideline water quality values pertain to temporal comparisons, it will also be applied to spatial comparisons (where applicable) for the purpose of this report, as no suitable alternative is currently available.

3. General Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table E1 below.

Table E1: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans *et al.* 2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. 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	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
F	Critically / Extremely modified. Modifications have reached a critical level and the 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 - 19

4. Aquatic Macro-Invertebrates:

Aquatic Macro-invertebrates were sampled incorporating all available biotopes at the site. This was done to provide an indication of the integrity of the of the aquatic macro-invertebrate community through recording the presence of various macro-invertebrate families at each site, as well as consideration of abundance of various populations, community diversity and community sensitivity (Dallas, 1997). The sampling method used relies on churning up the substrate with your feet and sweeping a finely meshed SASS net (pore size of 1000 micron mounted on a 300 mm square frame) over the churned-up area several times.

5. Fish biota: Fish Response Assessment Index (FRAI)

The FRAI (Kleynhans, 2007) is based on the premise that “drivers” (environmental conditions) may cause fish stress which shall then manifest as changes in fish species assemblage. The index employs preferences and intolerances of the reference fish assemblage, as well as the response of the actual (present) fish assemblage to particular drivers to indicate a change from reference conditions. Intolerances and preferences are divided into metric groups relating to preferences and requirements of individual species. This allows cause-effect relationships to be understood, i.e. between drivers and responses of the fish assemblage to changes in drivers. These metric groups are subsequently ranked, rated and finally integrated as a fish Ecological Category.

The fish community of each site was sampled for a period of twenty minutes by means of a battery operated electro-fishing device. Fish species identified were compared to those expected to be present at the sites, which were compiled from a literature survey from Skelton (2001) and the Reference Frequency of Occurrence of Fish Species in South Africa (Kleynhans, *et al*., 2007c). Fish expected to occur in the system is summarised in Section 3.2. Comparisons between upstream and downstream points were made where applicable.

6. Ecological Importance and Sensitivity (EIS) Method of assessment

The EIS method considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale (Table E3). The median of the resultant score is calculated to derive the EIS category (Table E4).

Table E3: Definition of the four-point scale used to assess biotic and habitat determinants presumed to indicate either importance or sensitivity

Four point scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

Table E4: Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General Description	Range of median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

APPENDIX F – Impact Assessment Methodology

According to the DEA IEM Series guideline on "Impact Significance" (2002), there are a number of quantitative and qualitative methods that can be used to identify the significance of impacts resulting from a development. The process of determining impact significance should ideally involve a process of determining the acceptability of a predicted impact to society. Making this process explicit and open to public comment and input would be an improvement of the EIA/BA process. The CSIR's approach to determining significance is generally as follows:

- Use of expert opinion by the specialists ("professional judgement"), based on their experience, a site visit and analysis, and use of existing guidelines and strategic planning documents and conservation mapping (e.g. SANBI biodiversity databases);
- Review of specialist assessment by all stakeholders including authorities such as nature conservation officials, as part of the report review process (i.e. if a nature conservation official disagreed with the significance rating, then we could negotiate the rating); and
- Our approach is more a qualitative approach - we do not have a formal matrix calculation of significance as is sometimes done.

The following methodology has been provided by the CSIR to the specialist who conducted the **Assessment of Potential Impacts**

The assessment of impact significance is based on the following conventions:

Nature of Impact - this reviews the type of effect that a proposed activity will have on the environment and should include "what will be affected and how?"

Spatial Extent - this should indicate whether the impact will be:
- Site specific;
- Local (<2 km from site);
- Regional (within 30 km of site); or National.

Duration - The timeframe during which (lifetime of) the impact will be experienced:
- Temporary (less than 1 year);
- Short term (1 to 6 years);
- Moderate term (6 to 15 years);
- Long term (the impact will cease after the operational life of the activity); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient).

Intensity - it should be established whether the impact is destructive or innocuous and should be described as either:
- High (severe alteration of natural systems, patterns or processes such that they temporarily or permanently cease);
- Moderate (notable alteration of natural systems, patterns or processes; where the environment continues to function but in a modified manner); or
- Low (negligible or no alteration of natural systems, patterns or processes); can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision making

Probability - this considers the likelihood of the impact occurring and should be described as:
- Improbable (little or no chance of occurring);
- Probable (<50% chance of occurring);
- Highly probable (50 – 90% chance of occurring); or
- Definite (>90% chance of occurring).

Reversibility - this considers the degree to which the adverse environmental impacts are reversible or irreversible. For example, an impact will be described as low should the impact have little chance of being rectified to correct environmental impacts. On the other hand, an impact such as the nuisance factor caused by noise impacts from wind turbines can be considered to be highly reversible at the end

of the project lifespan. The assessment of the reversibility of potential impacts is based on the following terms:

- High - impacts on the environment at the end of the operational life cycle are highly reversible;
- Moderate - impacts on the environment at the end of the operational life cycle are reasonably reversible;
- Low - impacts on the environment at the end of the operational life cycle are slightly reversible; or
- Non-reversible - impacts on the environment at the end of the operational life cycle are not reversible and are consequently permanent.

Irreplaceability - this reviews the extent to which an environmental resource is replaceable or irreplaceable. For example, if the proposed project will be undertaken on land that is already transformed and degraded, this will yield a low irreplaceability score. The assessment of the degree to which the impact causes irreplaceable loss of resources is based on the following terms:

- High irreplaceability of resources (this is the least favourable assessment for the environment);
- Moderate irreplaceability of resources;
- Low irreplaceability of resources; or
- Resources are replaceable (this is the most favourable assessment for the environment).

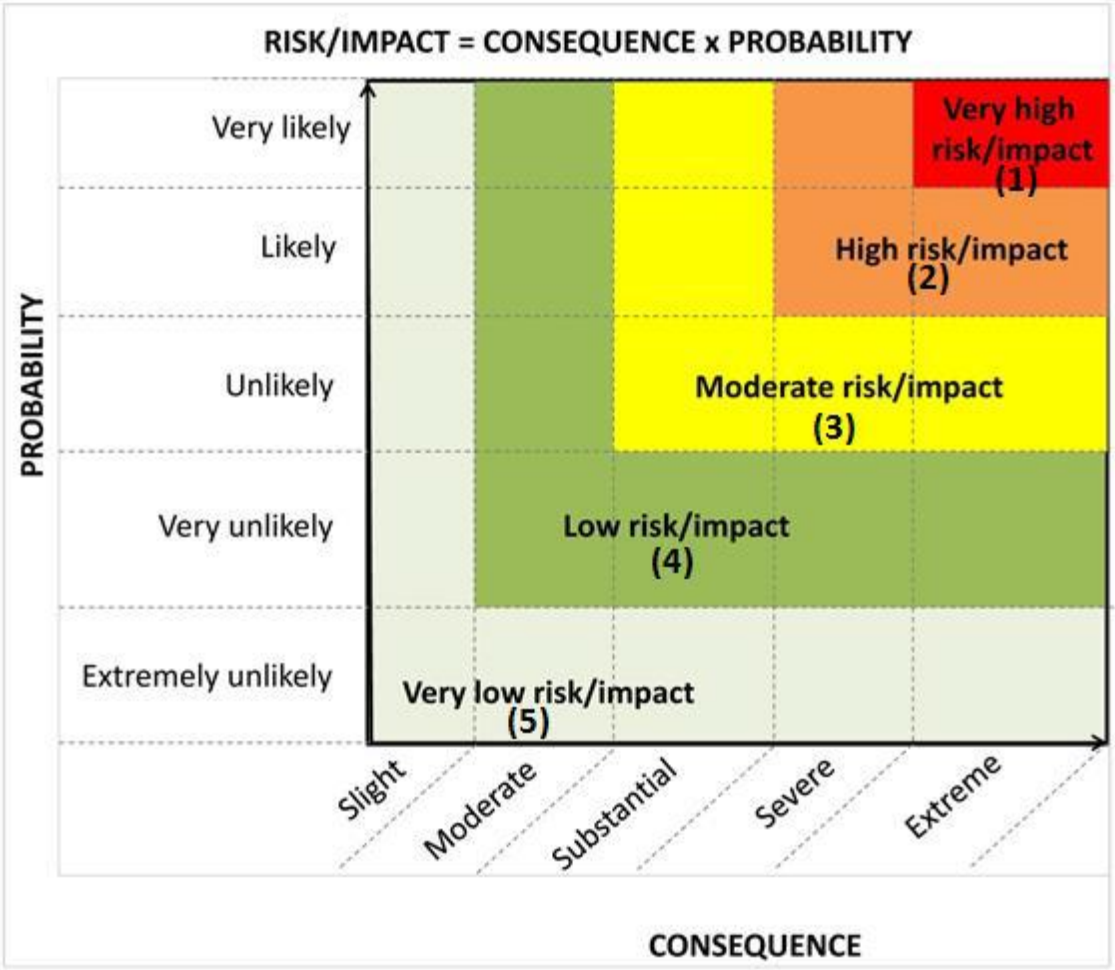


Figure F1: Guide to assessing risk/impact significance as a result of consequence and probability.

The status of the impacts and degree of confidence with respect to the assessment of the significance is stated as follows:

Status of the impact: A description as to whether the impact will be:

- Positive (environment overall benefits from impact);
- Negative (environment overall adversely affected); or

- Neutral (environment overall not affected).

Degree of confidence in predictions: The degree of confidence in the predictions, based on the availability of information and specialist knowledge. This should be assessed as:

- High;
- Moderate; or
- Low.
-

Based on the above considerations, the specialist provides an overall evaluation of the significance of the potential impact, which should be described as follows:

- **Low to very low:** the impact may result in minor alterations of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated;
- **Moderate:** the impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated; or
- **High:** Where it could have a "no-go" implication for the project unless mitigation or re-design is practically achievable.

Furthermore, the following must be considered:

- Impacts should be described both before and after the proposed mitigation and management measures have been implemented.
- All impacts should be evaluated for the construction, operation and decommissioning phases of the project, where relevant.
- The impact evaluation should take into consideration the cumulative effects associated with this and other facilities which are either developed or in the process of being developed in the region, if relevant.

Management Actions:

- Where negative impacts are identified, mitigatory measures will be identified to avoid or reduce negative impacts. Where no mitigatory measures are possible this will be stated.
- Where positive impacts are identified, augmentation measures will be identified to potentially enhance these.
- Quantifiable standards for measuring and monitoring mitigatory measures and enhancements will be set. This will include a programme for monitoring and reviewing the recommendations to ensure their ongoing effectiveness.

Monitoring:

Specialists should recommend monitoring requirements to assess the effectiveness of mitigation actions, indicating what actions are required, by whom, and the timing and frequency thereof.

Cumulative Impact:

Consideration is given to the extent of any accumulative impact that may occur due to the proposed development. Such impacts are evaluated with an assessment of similar developments already in the environment. Such impacts will be either positive or negative, and will be graded as being of negligible, low, Moderate or high impact.

Mitigation:

The objective of mitigation is to firstly avoid and minimise impacts where possible and where these cannot be completely avoided, to compensate for the negative impacts of the development on the receiving environment and to maximise re-vegetation and rehabilitation of disturbed areas. For each impact identified, appropriate mitigation measures to reduce or otherwise avoid the potentially negative impacts are suggested. All impacts are assessed without mitigation and with the mitigation measures as suggested.

APPENDIX G – Vegetation Type

Tzaneen Sour Bushveld

Dominant Floral Taxa

Table G1: Dominant & typical floristic species of Tzaneen Sour Bushveld (Mucina & Rutherford, 2012)

Floral Community	Species
Tall Trees	*Pterocarpus angolensis, Sclerocarya birrea subsp. caffra.*
Small Trees	*Acacia polyacantha (d), Albizia versicolor (d), Ficus sansibarica (d), Parinari curatellifolia (d), Piliostigma thonningii (d), Pterocarpus rotundifolius (d), Trichilia emetica (d), Acacia davyi, A. sieberiana var. woodii, Antidesma venosum, Catha edulis, Faurea rochetiana, F. saligna, Ficus burkei, F. petersii, Heteropyxis natalensis, Peltophorum africanum, Terminalia sericea, Vernonia colorata.*
Tall Shrubs	*Olea europaea subsp. africana, Pseudarthria hookeri var. hookeri, Rhus pentheri, Triumfetta pilosa var. tomentosa.*
Low Shrubs	*Agathisanthemum bojeri, Barleria elegans, Dicliptera clinopodia, Flemingia grahamiana, Indigofera filipes, Polygala producta.*
Woody Climbers	*Bauhinia galpinii, Pterolobium stellatum*
Graminoids	*Cymbopogon caesius (d), C. nardus (d), Hyparrhenia cymbaria (d), H. poecilotricha (d), Hyperthelia dissoluta (d), Alloteropsis semialata subsp. semialata, Andropogon schirensis, Bothriochloa bladhii, Monocymbium ceresiiforme, Paspalum scrobiculatum, Schizachyrium sanguineum, Themeda triandra.*
Herbs	*Waltheria indica*

***(d) – Dominant species for the vegetation type**

APPENDIX H - Species List

Table H1: Dominant floral species encountered in the proposed primary processing plant. Alien species are indicated with an asterisk (*). Also indicated are species falling within an alien invasive category as per the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, 2016.

Scientific name	Common name
Trees and Shrubs	
Lantana camara* **1b	Common Lantana
Senna pendula* var. *glabrata* **1b	Rambling Cassia
Senegalia caffra	Common Hook Thorn
Vachellia sieberiana var. *woodii*	Paperback Thorn
Combretum erythrophyllum	River bushwillow
Combretum molle	Velvet Bushwilloq
Cussonia paniculate	Mountain Cabbage-tree
Dichrostachys cinerea subsp. *africana*	Sickle bush
Dombeya rotundifolia	Wild Pear
Euclea divinorum	Magic Guarri
Gomphocarpus fruticosus	Cotton Milkweed
Gymnosporia buxifolia	Common Spikethorn
Oleo europaea subsp. *africana*	Wild Olive
Ormocarpum trichocarpum	Hairy Caterpillar-pod
Peltophorum africanum	African Wattle
Pilostigma thonningii	Camel's Foot
Sclerocarya birrea* subsp. *caffra	Marula
Searsia leptodictya	Mountain Karee
Terminalia sericea	Silver Cluster-leaf
Vachellia rehmanniana	Silky thorn
Ziziphus mucronata	Buffalo Thorn
Grasses	
Aristida junciformis	Gongoni Tree-awn
Chloris pycnothrix	Spiderweb Grass
Cymbopogon plurinoides	Narrow-leaved Turpentine Grass
Cyperus esculentis	
Cyperus spp	
Eragrostis lehmanniana	Lehmann's Love Grass
Hyparrhenia hirta	Common Thatching Grass
Melinis repens	Natal Red Top
Panicum maximum	Guinea grass
Setaria sphacelate var. *sericia*	Golden Bristle Grass
Sporobolus africanus	Ratstail dropseed
Sporobolus pyramidalis	Catstail Dropseed
Forbs	
Ageratum conyzoides* **1b	Invading Ageratum
**Gomphrena celosioides*	Prostrate Globe Amaranth
**Hibiscus cannabinus*	Wild Stockrose
**Richardia brasiliensis*	Mexican clover
**Ricinus communis* var. *communis*	Castor-oil Plant
**Tagetus minuta*	Tall Khaki Weed
Verbena bonariensis* **1b	Purple Top
Crinum sp.	
Dicerocaryum eriocarpum	Devil's Thorn
Helichrysum nudifolium var. *pilosellum*	
Pavonia burchellii	Dainty Pavonia
Protasparagus setaceus	Asparagus fern
Solanum panduriforme	Poison apple
Vernonia oligocephala	Bicoulered-leaved Vernonia

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

Table H2: Mammal species observed

Scientific name	Common Name	IUCN Red List Status
Cercopithecus aethiops	Vervet Monkey	LC
Helogale parvula	Dwarf Mongoose	LC

LC = Least Concern,

Table H3: Avifaunal species observed

Scientific Name	Common Name	IUCN status
Uraeginthus angolensis	Blue Waxbill	LC
Dicrurus adsimilis	Fork-tailed Drongo	LC
Gallirex porphyreolophus	Purple-crested Turaco	LC
Lamprotornis nitens	Cape Glossy Starling	LC
Merops nubicoides	Southern Carmine Bee-eater	LC
Tockus leucomelas	Southern Yellow-billed Hornbill	LC
Pternistis natalensis	Natal Spurfowl	LC
Ardea cinerea	Grey Heron	LC
Phoeniculus purpureus	Green Wood-Hoopoe	LC
Pycnonotus tricolor	Dark-Capped Bulbul	NYBA
Turtur chalcospilos	Emerald Spotted Wood-Dove	LC

LC = Least concerned, NYBA = Not yet been assessed by the IUCN.

Table H4: Insect species observed

Scientific Name	Common Name	IUCN Status
Thyrididae	Window Wings	NYBA
Danaus chrysippus	African Monarch	NYBA
Hypolimnas misippus	Diadem	NYBA
Phalanta Phalantha	Common Leopard	NYBA
Mylothris agathina	Common Dotted Border	NYBA
Trithemis kirbyi	Kirby's Dropwing	LC
Eurema brigitta	Broad-bordered Grass Yellow	LC
Precis archesia	Garden Inspector	NYBA
Cantatops sp.		NYBA
Lagria sp.	Hairy Darkling Beetle	NYBA

NYBA = Not Yet Been Assessed, LC = Least Concern

APPENDIX I – Floral SCC

Table I1: PRECIS plant list for the QDS 2330AA (Raimondo *et al*., 2009; SANBI, www.sanbi.org).

Family	Species	Habitat	2016 Threat Status	POC (%)
CELASTRACEAE	*Elaeodendron transvaalense*	Savanna or bushveld, from open woodland to thickets, often on termite mounds	NT	40

NT = Near Threatened; LC = Least Concern

APPENDIX J – Faunal SCC

Red Data Mammal species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status 2015
Diceros bicornis	Black Rhinoceros	CR	CR
Neamblysomus julianae	Juliana's golden mole	CR	VU
Loxodonta africana	African elephant	VU	VU
Lycaon pictus	African wild dog	EN	EN
Amblysomus gunningi	Gunning's golden mole	VU	EN
Lutra maculicollis	Spotted-necked otter	VU	LC
Acinonyx jubatus	Cheetah	VU	VU
Felis lybica	African Wild Cat	VU	NYBA
Panthera leo	Lion	VU	VU
Ceratotherium simum	White rhinoceros	NT	NT

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN.

Red Data Bird species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status 2015
Gyps coprotheres	Cape Vulture	T	VU
Ciconia nigra	Black Stork	T	LC
Falco naumanni	Lesser Kestrel	T	LC
Certhilauda chuana	Short-clawed Lark	T	LC
Pterocles gutturalis	Yellowthroated Sandgrouse	T	LC
Anthropoides paradiseus	Blue Crane	T	VU
Gyps africanus	Whitebacked Vultures	T	EN
Ardeotis kori	Kori Bustard	T	LC
Scotopelia peli	Pel's Fishing Owl	T	LC
Bucorvus leadbeateri	Southern Ground Hornbill	T	VU
Buphagus erythrorhynchus	Red-billed Oxpecker	T	LC
Terathopius ecaudatus	Bateleur	T	NT
Polemaetus bellicosus	Martial Eagle	T	NT
Aquila rapax	Tawny Eagle	T	LC
Torgos tracheliotos	Lappetfaced Vulture	T	VU
Trigonoceps occipitalis	Whiteheaded Vulture	T	VU
Buphagus africanus	Yellow billed Oxpecker	T	LC
Stephanoaetus coronatus	Crowned hawk Eagle	T	NT

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province.

Red Data Amphibian species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status 2015
Breviceps sylvestris	Transvaal forest rain frog	VU	EN
Ptychadena uzungwensis		P	LC
Leptopelis bocagii		P	LC
Hemisus guineensis	Guinea Snout-burrower	P	LC

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Red Data Reptile species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status 2015
Homoroselaps dorsalis	Striped Harlequin snake	R	NT
Xenocalamus transvaalensis	Transvaal Quill-snout snake	R	DD
Lamprophis swazicus	Swazi Rock Snake	R	NT
Python natalensis	African Python	VU	NYBA
Lygodactylus methueni	Methuen's Dwarf Gecko	VU	VU
Crocodylus niloticus	Nile Crocodile	VU	LC
Lycophidion variegatum	Variegated Wolf snake	P	NYBA
Psammophis jallae	Jalla's Sand snake	P	NYBA

R = Rare, DD = Data Deficient, LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Red Data Invertebrates species mentioned in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status 2015
Taurhina splendens	Splendid fruit chafer *	T	NYBA
Charaxes marieps	Marieps Charaxes butterfly *	T	NYBA
Trichostetha fasicularis	Protea beetle *	T	NYBA
Ischnestoma ficqui	Fruit eating beetles *	T	NYBA

R = Rare, DD = Data Deficient, LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province. * Very little detailed or general information exists on terrestrial invertebrates in the Limpopo Province, thus in general there is very little consolidated information regarding invertebrates (Limpopo SOER, 2004).

Soutpansberg IBA

http://www.birdlife.org.za/conservation/important-bird-areas/iba-directory/item/144-sa003-soutpansberg

The Soutpansberg is an east–west trending mountain range that stretches c. 130 km from 10 km west of Thohoyandou in the east to Vivo in the west. Louis Trichardt lies in the centre of the range, below its southern slopes. The mountains rise c. 700 m from the surrounding plains to form the spectacular peaks of Maditshwene (1 606 m a.s.l.) and Letjume (1 747 m a.s.l.) in the west and Entabeni (1 449 m a.s.l.) in the east. To the north, the plains drop into the Lowveld of the Limpopo Valley. The Soutpansberg is made up of an ancient sequence of sedimentary rocks and basaltic lavas that have been strongly faulted and displaced along east–west trending fractures, giving rise to the characteristic series of ridges and troughs that make up most of the range.

The mountains hold the catchments of several important Limpopo Province rivers, including the Sand, Mutamba, Nzhelele, Nwanedzi, Mutale and Luvuvhu. All of these flow north into the province's most important river, the Limpopo. Rainfall is highly variable, ranging up to an average of 1 860 mm p.a. for Entabeni, which is one of the highest annual rainfalls recorded in South Africa. Average annual rainfall decreases both farther west and on the north-facing rain-shadow slopes, where Langjan receives only 400 mm p.a.

Patches of high-altitude Afromontane forest are found in valleys and moist basins, especially on the Soutpansberg's south-facing slopes. Trees can be up to 30–40 m tall and distinct strata of emergent, canopy, shrub and ground layers are present.

Birds

The Soutpansberg supports one colony of Cape Vulture (*Gyps coprotheres*). The thick forest vegetation in the valleys and basins holds Crowned Eagle (*Stephanoaetus coronatus*), Forest Buzzard (*Buteo trizonatus*), Knysna Turaco (*Tauraco corythaix*), Chorister Robin-Chat (*Cossypha dichroa*), Narina Trogon (*Apaloderma narina)*, Grey Cuckooshrike (*Coracina caesia)*, Olive Bush-Shrike (*Chlorophoneus olivaceus)*, Black-fronted Bush-Shrike (*C. nigrifrons*), Green Twinspot (*Mandingoa nitidula)* and Forest Canary (*Crithagra scotops*). The bushveld on the slopes supports Gorgeous Bush-Shrike (*Chlorophoneus viridis*), White-throated Robin-Chat (*Cossypha humeralis*) and Burnt-necked Eremomela (*Eremomela usticollis*).

The grasslands at the summit of the Soutpansberg hold protea woodland suitable for Gurney's Sugarbird (*Promerops gurneyi*). In the rivers that flow from the catchment area towards the Lowveld there are small populations of African Finfoot (*Podica senegalensis*) and White-backed Night Heron (*Gorsachius leuconotus*). African Broadbill (*Smithornis capensis*) breeds in the natural forests.

IBA trigger species

Cape Vulture (300 individuals and 147 breeding pairs) and Crowned Eagle are the globally threatened species in this IBA. Regionally threatened species are Black Stork (*Ciconia nigra)* and Orange Ground Thrush (*Zoothera gurneyi)*. Common biome-restricted and restricted-range species are Knysna Turaco, Gurney's Sugarbird, White-starred Robin (*Pogonocichla stellate)*, White-throated Robin-Chat, Chorister Robin-Chat, Kurrichane Thrush (*Turdus libonyanus)*, Barred Wren-Warbler (*Calamonastes fasciolatus)*, Gorgeous Bush-Shrike, White-bellied Sunbird (*Cinnyris talatala)* and Swee Waxbill (*Coccopygia melanotis)*. Uncommon species in these categories are Grey Cuckooshrike, Yellow-throated Woodland Warbler (*Phylloscopus ruficapilla)*, Forest Canary, Orange Ground Thrush, Kalahari Scrub Robin (*Erythropygia paena)* and Barratt's Warbler (*Bradypterus barratti)*.

Other biodiversity

The stapeliads (*Huernia nouhuysii, Stapelia clavicorona)* and *Orbeanthus conjunctus* are rare and endemic to these mountains. Other spectacular endemics restricted to the Soutpansberg include *Aloe angelica, A. soutpansbergensis, Kalanchoe crundallii* and *Euphorbia soutpansbergensis*. Modjadji cycad *Encephalartos transvenosus*, which is endemic to the Soutpansberg and northern Drakensberg escarpment, is known from near the IBA's border. Also endemic to the Soutpansberg are Soutpansberg rock lizard (*Australolacerta rupicola)* and a subspecies of the range-restricted Transvaal rain frog, (*Breviceps sylvestris taeniatus*,) which may be a valid species.

Warren's girdled lizard (*Cordylus warren)* and spotted dwarf gecko (*Lygodactylus ocellatus)* are endemic to the Soutpansberg and Mpumalanga/Swaziland escarpment zone and occur in rocky montane grassland areas. Lang's round-headed worm lizard (*Chirindia langi)* may be found at the base of the mountain on sandy Kalahari soils. The southern African endemic giant legless skink (*Acontias plumbeus)* may occur in the Soutpansberg forests and there is an isolated population of Van Dam's girdled lizard (*Cordylus vandami)* in the vicinity of the IBA.

Dwarf flat lizard (*Platysaurus guttatus)*, relict flat lizard (*P. relictus)* and black-spotted dwarf gecko (*Lygodactylus nigropuncatus)* have global ranges restricted to the Soutpansberg and nearby Waterberg (IBA SA007), although the gecko also occurs patchily elsewhere in central Limpopo Province. Cregoi's blind legless skink (*Typhlosaurus cregoi)* is a southern African endemic common on the Soutpansberg, and Lowveld flat gecko (*Afroedura langi)* has also been recorded here. Threatened mammals include pangolin (*Manis temminckii)*.

Conservation issues

Threats

Commercial timber is grown extensively in the eastern section of the massif, although no new plantations have been established recently. Parts of the range are also used for subtropical fruit farming, mainly avocados, mangoes, nuts and citrus.

A number of power lines occur in the IBA that could impact on its trigger species. No collision and electrocution data are available. Of concern is the proposed construction of the Borutho to Nzhelele power line, which will run between the Blouberg (SA004) and Soutpansberg IBAs. It is possible that this line could affect vultures moving between the colonies in these two sites. A large number of mining applications have been submitted for an area to the north and bordering the IBA. There is a concern that, if approved, these developments could have a negative impact on it.

Conservation action

The eastern section of the Soutpansberg holds various forest reserves, including the Timbadola, Klein Australië, Goedehoop and Roodewal, as well as Entabeni and Hanglip State forests, and the private Buzzard Mountain Retreat, which lies 20 km west of Louis Trichardt. Most of these protected areas are partly afforested and partly indigenous. There are two small formal nature reserves and the rest of the land is privately owned. The IBA falls within the Vhembe Biosphere Reserve.

South African Bird Atlas Project 2 list for quadrant 2330AA

Pentads associated with the proposed primary processing plant according to the SABAP 2 database:

http://sabap2.adu.org.za/pentad_info.php?pentad=2305_3005#menu_top

APPENDIX K – Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table K1: Presentation of the results of the ecosystem services provided by the Albasini Dam.

Ecosystem service	Albasini Dam
Flood attenuation	2,5
Streamflow regulation	2,0
Sediment trapping	1,8
Phosphate assimilation	1,9
Nitrate assimilation	2,0
Toxicant assimilation	1,9
Erosion control	2,0
Carbon Storage	1,8
Biodiversity maintenance	0,8
Water Supply	2,5
Harvestable resources	2,2
Cultivated foods	1,4
Cultural value	0,8
Tourism and recreation	1,6
Education and research	1,0
SUM	**26,1**
Average score	**1,7**

Table K2: Aquatic macro-invertebrates noted during the assessment site Dam Point 1 in April 2018.

Scientific Name	Common Name	Sensitivity	Abundance*
Atyidae	Freshwater Shrimp	8	B
Oligochaeta	Earthworms	1	1
Hydracarina	Water Mites	10	A
Baetidae	Mayflies	4	B
Coenagrionidae	Damselfly	4	1
Belostomatidae	Giant Water Bugs	3	A
Corixidae	Water Boatmen	3	B
Gerridae	Water Striders	5	A
Veliidae	Ripple Bugs	5	A
Chironomidae	Midges	2	1
Lymnaeidae	Pond Snails	3	A
Planorbinae	Orb Snails	3	A
Thiaridae	Snail	3	A
Number of Taxa			**13**
Average Score Per Taxon			**4.15**

*Abundances: A = 2-10; B = 11 – 100

Table K3: Aquatic macro-invertebrates noted during the assessment site Dam Point 2 in April 2018.

Scientific Name	Common Name	Sensitivity	Abundance*
Atyidae	Freshwater Shrimp	8	B
Oligochaeta	Earthworms	1	A
Baetidae	Mayflies	4	B
Coenagrionidae	Damselfly	4	A
Belostomatidae	Giant Water Bugs	3	A
Corixidae	Water Boatmen	3	B
Chironomidae	Midges	2	A
Lymnaeidae	Pond Snails	3	A
Thiaridae	Snail	3	A
Number of Taxa			**9**
Average Score Per Taxon			**3.44**

*Abundances: A = 2-10; B = 11 – 100

Table K4: IHI Scoresheets for site Dam Points.

	MRU
INSTREAM IHI	
Base Flows	1,0
Zero Flows	0,5
Floods	1,0
HYDROLOGY RATING	**0,9**
pH	0,5
Salts	1,0
Nutrients	1,5
Water Temperature	1,5
Water clarity	1,5
Oxygen	1,5
Toxics	1,0
PC RATING	**2,0**
Sediment	2,5
Benthic Growth	2,5
BED RATING	**2,5**
Marginal	2,5
Non-marginal	2,0
BANK RATING	**2,3**
Longitudinal Connectivity	3,0
Lateral Connectivity	2,5
CONNECTIVITY RATING	**2,9**
INSTREAM IHI %	**60,1**
INSTREAM IHI EC	**C/D**
INSTREAM CONFIDENCE	**2,9**

	MRU
RIPARIAN IHI	
Base Flows	-1,5
Zero Flows	1,0
Moderate Floods	1,0
Large Floods	1,0
HYDROLOGY RATING	**1,1**
Substrate Exposure (marginal)	1,0
Substrate Exposure (non-marginal)	0,5
Invasive Alien Vegetation (marginal)	1,0
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	2,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	2,0
Physico-Chemical (non-marginal)	
Marginal	2,0
Non-marginal	1,0
BANK STRUCTURE RATING	**1,4**
Longitudinal Connectivity	2,5
Lateral Connectivity	2,0
CONNECTIVITY RATING	**2,3**
RIPARIAN IHI %	**69,7**
RIPARIAN IHI EC	**C**
RIPARIAN CONFIDENCE	**2,2**

Table K5: FRAI Scoresheets for site Dam Point 1.

		PES/REC %	55,31
		PES/REC CATEGORY	D
ABBREVIATIONS: REFERENCE SPECIES (INTRODUCED SPECIES EXCLUDED)	SCIENTIFIC NAMES: REFERENCE SPECIES (INTRODUCED SPECIES EXCLUDED)	REFERENCE FREQUENCY OF OCCURRENCE CATEGORY A	FREQUENCY OF OCCURRENCE: EC
AURA	AMPHILIUS URANOSCOPUS (PFEFFER, 1889)	2	0
BLIN	BARBUS LINEOMACULATUS BOULENGER, 1903	2	0
BMAR	LABEOBARBUS MAREQUENSIS SMITH, 1841	2	0
BNEE	BARBUS NEEFI GREENWOOD, 1962	2	0
BPAU	BARBUS PALUDINOSUS PETERS, 1852	3	0
BTRI	BARBUS TRIMACULATUS PETERS, 1852	3	0
BUNI	BARBUS UNITAENIATUS GÜNTHER, 1866	5	5
BVIV	BARBUS VIVIPARUS WEBER, 1897	2	0
CGAR	CLARIAS GARIEPINUS (BURCHELL, 1822)	5	4
CPRE	CHILOGLANIS PRETORIAE VAN DER HORST, 1931	2	0
LCYL	LABEO CYLINDRICUS PETERS, 1852	4	4
LMOL	LABEO MOLYBDINUS DU PLESSIS, 1963	3	0
MACU	MICRALESTES ACUTIDENS (PETERS, 1852)	1	0
MBRE	MESOBOLA BREVIANALIS (BOULENGER, 1908)	1	0
MMAC	MARCUSENIUS MACROLEPIDOTUS (PETERS, 1852)	1	0
PCAT	PETROCEPHALUS WESSELSI KRAMER & VAN DER BANK, 2000	1	0
PPHI	PSEUDOCRENILABRUS PHILANDER (WEBER, 1897)	4	4
TREN	TILAPIA RENDALLI (BOULENGER, 1896)	4	4
TSPA	TILAPIA SPARRMANII SMITH, 1840	4	4
OMOS	OREOCHROMIS MOSSAMBICUS (PETERS, 1852)	5	5

Table K6: FRAI Scoresheets for site Dam Point 2.

		PES/REC %	52,03
		PES/REC CATEGORY	D
ABBREVIATIONS: REFERENCE SPECIES (INTRODUCED SPECIES EXCLUDED)	SCIENTIFIC NAMES: REFERENCE SPECIES (INTRODUCED SPECIES EXCLUDED)	REFERENCE FREQUENCY OF OCCURRENCE CATEGORY A	FREQUENCY OF OCCURRENCE: EC
AURA	AMPHILIUS URANOSCOPUS (PFEFFER, 1889)	2	0
BLIN	BARBUS LINEOMACULATUS BOULENGER, 1903	2	0
BMAR	LABEOBARBUS MAREQUENSIS SMITH, 1841	2	0
BNEE	BARBUS NEEFI GREENWOOD, 1962	2	0
BPAU	BARBUS PALUDINOSUS PETERS, 1852	3	0
BTRI	BARBUS TRIMACULATUS PETERS, 1852	3	0
BUNI	BARBUS UNITAENIATUS GÜNTHER, 1866	5	3
BVIV	BARBUS VIVIPARUS WEBER, 1897	2	0
CGAR	CLARIAS GARIEPINUS (BURCHELL, 1822)	5	5
CPRE	CHILOGLANIS PRETORIAE VAN DER HORST, 1931	2	0
LCYL	LABEO CYLINDRICUS PETERS, 1852	4	4
LMOL	LABEO MOLYBDINUS DU PLESSIS, 1963	3	0
MACU	MICRALESTES ACUTIDENS (PETERS, 1852)	1	0
MBRE	MESOBOLA BREVIANALIS (BOULENGER, 1908)	1	0
MMAC	MARCUSENIUS MACROLEPIDOTUS (PETERS, 1852)	1	0
PCAT	PETROCEPHALUS WESSELSI KRAMER & VAN DER BANK, 2000	1	0
PPHI	PSEUDOCRENILABRUS PHILANDER (WEBER, 1897)	4	5
TREN	TILAPIA RENDALLI (BOULENGER, 1896)	4	3
TSPA	TILAPIA SPARRMANII SMITH, 1840	4	3
OMOS	OREOCHROMIS MOSSAMBICUS (PETERS, 1852)	5	5

APPENDIX L – Specialists Details

1.(a)(i) Details of the specialist who prepared the report

Stephen van Staden	MSc (Environmental Management) (University of Johannesburg)
Marelie Meintjies	MSc Medicinal Plant Science (University of Pretoria)
Kelly Dyamond	MSc Zoology Aquatic Health (University of Johannesburg)

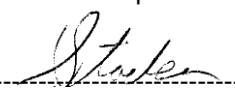
1.(a)(ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	086 724 3132 / 011 615 6240
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

Declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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



Signature of the Specialist

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing member, Ecologist, Aquatic Ecologist
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of IAIA South Africa

EDUCATION

Qualifications

MSc (Environmental Management) (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland Assessment short course Rhodes University	2016

COUNTRIES OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

SELECTED PROJECT EXAMPLES

Client	Project	Project Description	Area
RESIDENTIAL			
GIBB (PTY) LTD	Bloemwater Knelpoort Project	Full ECO Assessment	Free State
DLC Town Plan (Pty) Ltd	Bongwini and Toekomsrus Project Gold 1	Environmental Sensitivity Analyses as part of the development of site Development Plans and Precinct Planning on the outskirts of Takoradi Ghana (2000 ha)	Randfontein
SRK Consulting (PTY) Ltd	Skoenmaker River	Wetland, Aquatic & ECO Assessment	Somerset East
Century Property Development	The Hills Eco Estate	Wetland delineation and ecological assessment, and rehabilitation plan	Midrand, Gauteng
ROADS, PIPELINES, POWERLINES AND OTHER LINEAR DEVELOPMENTS			
Delta Built Environment Consultants	Lesotho Border Road Project	Soil & Land Capability Assessment, full wetland ecological assessment and aquatic assessment as part of the EIA process	Lesotho
Spoor Environmental	Thabazimbi Waste Water Treatment Works; Upgrade of Sewer Pipeline	Freshwater resource ecological assessment and rehabilitation and management plan	Limpopo
Royal Haskoning DHV (Pty) Ltd	N11 Ring Road	Freshwater Ecological Assessment	Limpopo
Chameleon Environmental	N7 Road Upgrade Cederberg & Kransvleikloof	Floral RDL scan and delineation of the wetland areas along the proposed N7 road upgrade between Clanwilliam and Citrusdal	Western Cape
Iliso Consulting (Pty Ltd)	N3TC De Beers Pass Route	Variation order for additional work on N3TC De Beers pass route and existing N3 route	Kwa-Zulu Natal
MINING			
Anglo Platinum	Der Brochen Mine	Ongoing bi-annual seasonal aquatic biomonitoring from 2011 to present	Steelport Limpopo
Anglo Platinum	Der Brochen Mine	Wetland Ecological Assessment (2014) Full terrestrial, wetland and aquatic ecological assessment, soil and land capability assessment (2018)	Steelpoort, Limpopo
Bokoni Platinum Mine	Bokoni Platinum Mine	Annual Soil Monitoring & Soil Contamination	Free State
GIBB (PTY) LTD	Rustenburg Bridges	Aquatic Biomonitoring Assessment	Rustenburg, North West
Assmang Chrome Machadodorp	Assmang Chrome Machadodorp Works	Biomonitoring & Toxicological Monitoring for the 2015 period	Machadodorp, Mpumalanga
Globesight Advisory, Consulting & Training	Sabie TGME Project	Freshwater Ecological Assessment as part of the environmental assessment and authorization process for the proposed development (gold mining project – pre-mined residue and hard rock mining near Sabie)	Mpumalanga
Ikwezi Mining (Pty) Ltd	Ikwezi Doornkop Colliery	Develop freshwater resource rehabilitation and management plans, and conduct ecological biomonitoring in fulfillment of the water use licensing process for the Ikwezi Doornkop Colliery near Newcastle	Newcastle
Sappi Southern Africa (Pty) Ltd	Blesbokspruit Enstra Mill	Biomonitoring studies, whole effluent toxicity (WET) studies, bioaccumulation assessment and sediment heavy metal contaminant analyses	Johannesburg
Stibium Mining	Malati Opencast	Freshwater ecological assessment, risk assessment and freshwater rehabilitation and management plan and plant species plan as part of the water use authorization process for a proposed Malati opencast near Tzaneen	Limpopo
EXM Advisory Services	Heuningkranz Mine	Freshwater assessment, soil and land capability assessment done for Sishen Iron Ore Company (Pty) Ltd part of Kumba Iron Ore limited as part of the environmental management services for the Heuningkranz project	Northern Cape
Shangoni Management Services (Pty) Ltd	Leslie Colliery	Project manager, freshwater ecological assessment as part of the environmental impact assessment process for the underground coal mine to determine the status of the freshwater resources within the proposed mining area	Mpumalanga

SLR Consulting (Africa) (Pty) Ltd	Commissiekraal Colliery	Full Ecological investigation, including a terrestrial fauna and flora assessment as well as an assessment of the wetland and aquatic PES and wetland ecoservices on the site.	Kwa-Zulu Natal
Jacana Environmental CC	Leandra Colliery	Full Ecological Assessment, including a terrestrial fauna and flora assessment as well as an assessment of the wetland and aquatic PES and wetland ecoservices on the site.	Mpumalanga
SRK Consulting (PTY) Ltd	Marula Platinum Mine	Freshwater resource ecological assessment. Development of a plant species plan in line with the project's rehabilitation objectives	Burgersfort
Jacana Environmental CC	Donkerhoek Dam development	Full ecological assessment (Fauna, floral, wetland and aquatic assessment) as part of the EIA process	Mpumalanga
EXM Advisory Services	Evander Gold Mining (Pty) Ltd	Determination of the Wetland Offset Requirements for the proposed expansion of the Elikhulu Tailings Storage Facility	Mpumalanga
EXM Advisory Services	Canyon Coal - Witfontein mining project	Delineate and characterize the wetland and aquatic resources for the Witfontein mining project located by the farms Holfontein and Witrand near Bethal	Mpumalanga
SRK Consulting (South Africa) (PTY) Ltd	The Sierra Rutile Mine	Specialist terrestrial ecology, aquatic ecology and wetland ecology studies	Moyamba District - Sierra Leona
INFRASTRUCTURE			
GIBB (Pty) Ltd	Bronkhorstspruit Feeder Line	Monthly Aquatic Biomonitoring as part of the environmental assessment and authorization process for the proposed conversion of the Bronkhorstspruit plots feeder from 6.6kv to 22kv	Bronkhorstspruit
SRK Consulting (PTY) Ltd	South Dunes Precinct Project	Full Ecological Assessment	Richards Bay
SRK Consulting (PTY) Ltd	Braamfonteinspruit Rehabilitation	Terrestrial, Freshwater and Aquatic Ecological Assessment as part of the rehabilitation and management plan for the Braamfonsteinspruit, Johannesburg	Johannesburg
Iliso Consulting (Pty Ltd)	City of Johannesburg	Aquatic Ecological Assessment, monitoring and managing the ecological state of rivers in the City Of Johannesburg Metropolitan area	Johannesburg
Maanakana Projects and Consulting (Pty) Ltd	Lethabo Pump Station	Aquatic present ecological state assessment of the Vaal river	Vereeniging
SRK Consulting	CTIA runway re-alignment project – Wetland Offset	Determination of the Wetland offset requirements for Cape Town international Airport runway realignment, identification of a suitable offset location and compilation of relevant baseline assessments (Wetland and faunal), Khayelitsha. (2017)	Cape Town
GIBB (Pty) Ltd	Musami Dam	Determination of the draft environmental water quality requirements for the project	Zimbabwe
Nemai Consulting (PTY) Ltd	uMkhomazi Water Project	Determination of the Wetland and Terrestrial Biodiversity Offset Requirements for the proposed uMkhomazi Water Project	Richmond - KZN
POWER GENERATION			
Iliso Consulting	Mzimvubu Dam	Full Terrestrial (Flora and Faunal), Wetland and Aquatic Baseline Ecological Assessment	Eastern Cape
WKN-Wind current SA C/O Alan Wolfromm	HGA HAGA WEF	Hydrological Assessment	Eastern Cape
SRK Consulting (PTY) Ltd	RPM Crossing	Wetland Delineation	Free State
SRK Consulting (Pty) Ltd	Eskom Denova Powerline and sub-station	Freshwater assessment as part of the EIA process for the proposed Eskom powerline (1, 75 km in length) and sub-station (132kV) near Denova, Western Cape. (2014)	Western Cape
CSIR Consulting & Analytical Services	Sutherland WEF	Freshwater Ecological Assessments	Northern Cape
CSIR Consulting & Analytical Services	Victoria West WEF	Freshwater Ecological Assessments	Northern Cape

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF MARELIE MEINTJIES

PERSONAL DETAILS

Position in Company	Junior Field Biologist
Date of Birth	8 July 1986
Nationality	South African
Languages	English, Afrikaans
Joined SAS	April 2015

EDUCATION

Qualifications

MSc Medicinal Plant Science (University of Pretoria)	2014
BSc (Hons) Medicinal Plant Science (University of Pretoria)	2012
BSc Biotechnology (University of Pretoria)	2011

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, Northern Cape, Western Cape

SELECTED PROJECT EXAMPLES

Terrestrial Assessments

- Floral Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Leslie 2 underground coal mining operation, Gauteng Province.
- Floral Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the proposed development of Zwavelpoort 373-JR Portions 116 and 130, Pretoria, Gauteng Province
- Floral Ecological assessment for the Jeannette Expansion Project at the Taung Gold International Mine near Welkom, Free State Province.
- Terrestrial Sensitivity Scan as part of the Environmental Authorisation Process for the proposed Sagewood Ext 17 development within the Summerset Area, Gauteng
- Terrestrial Sensitivity Scan as part of the Environmental Authorisation Process for the proposed Kyalami X4 development, Midrand, Gauteng Province
- Terrestrial Ecological Sensitivity Scan as part of the Environmental Assessment and Authorisation Process for the proposed development on erf 199, Witfield, Boksburg, Gauteng Province
- Terrestrial Ecological Scan as part of the Environmental Authorisation Process for the proposed development of Witfontein Ext 87, Gauteng province
- Terrestrial Sensitivity Scan as part of the environmental impact assessment and authorisation process for the proposed development of a pipeline in Kriel, Mpumalanga Province.

Wetland Assessments

- Riparian Zone Ecological Assessment as well as a Riparian Rehabilitation and Management Plan for the proposed maintenance activities associated with the LC de Villiers Sports Campus of the University of Pretoria, Gauteng Province.
- Wetland Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Expansion of the Cambrian Cemetery, Gauteng Province
- 'Wetland Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Expansion of the Kromvlei Cemetery, Gauteng Province

Wetland Rehabilitation and Monitoring Plans

- Wetland Rehabilitation and Management Plan for the wall construction within the Riversands Estate, Midrand, Gauteng Province
- Freshwater Resource Rehabilitation and Management Plan as part of the Water Use Authorisation for the Proposed Belhar Potable Water Pipeline over the Kuils River, Western Cape Province
- Wetland Rehabilitation and Management Plan for the wetland and open space area associated with the Carlswald Valley Residential Development, City of Johannesburg, Gauteng Province.
- Wetland Rehabilitation and Management Plan for the wetland resource within the Carlswald Valley Residential Development, Kyalami, Gauteng Province

Desktop Ecological Assessments

- Aquatic and Wetland Scoping Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Witfontein Mining Project, near Bethal, Mpumalanga Province
- Freshwater Resource Scoping Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Photovoltaic Solar Energy Facility on the Heuningklip Farm near Vredenburg, Western Cape Province
- Desktop Ecological Assessment and Site Sensitivity Report as part of the Environmental Assessment and Authorisation Process prior to Prospecting Activities on the Farm Zeekoebaart 306 Rd, Postmasburg, Northern Cape Province
- Desktop Ecological Assessment as part of the environmental assessment and authorisation process for the Genet Manganese (Pty) Ltd prospecting area on the farm Lemoenkloof No 456, Northern Cape Province.

Screening Assessment

- Desktop Ecological Assessment and Field Verification Report as part of the Screening Assessment for the Proposed Soweto Power Park Ext 3, Gauteng Province

Water Use Applications

- General Authorisation Application Process to obtain authorisation from the Department of Water and Sanitation for the water uses related to the proposed road upgrades associated with the Pearl Valley Phase II Development, Paarl, Western Cape Province

Miscellaneous Projects

- Desktop Ecological Assessment and Site Sensitivity Report as part of the Elikhulu TSF Facility site selection process, Evander, Mpumalanga Province
- Ecological Screening Assessment, Ground Truthing and Site Sensitivity Report for the Proposed Tubatse SEZ. Steelpoort, Limpopo Province
- Identification of Important Medicinal Plant Species to be rescued and relocated as part of the Rescue and Relocation Plan for the area earmarked for surface infrastructure at the Yzermyn Colliery near Dirkiesdorp, Mpumalanga
- Biodiversity Survey for the BMW Group South Africa at the Rosslyn Manufacturing Plant, Rosslyn, Gauteng Province
- Biodiversity and Ecosystem Health for Limpopo Province, South Africa Thematic Chapter as part of Limpopo Environmental Outlook Report
- Literature Review and Initial Assessment on the control of Alien and Invasive Plants associated with aquatic environments within the City of Johannesburg

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KELLY DYAMOND

PERSONAL DETAILS

Position in Company	Junior Field Biologist with specific focus on Aquatic and Wetland Ecology
Date of Birth	8th April 1991
Nationality	South African
Languages	English
Joined SAS	2017

MEMBERSHIP IN PROFESSIONAL SOCIETIES

SASAqS Member (South African Society of Aquatic Scientists)

EDUCATION

Qualifications

MSc (Cum Laude) Aquatic Health (University of Johannesburg)	2017
BSc Zoology (Hons) (University of Johannesburg)	2014
BSc Zoology and Environmental Management (University of Johannesburg)	2010

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, Kwa-Zulu Natal

SELECTED PROJECT EXAMPLES

Aquatic Biomonitoring

- Aquatic biomonitoring programs for SAPPI Entra Paper Mill.
- Aquatic biomonitoring programs for Uitkomst Mine.
- Aquatic biomonitoring programs for Sibanye Stillwater Burnstone Operation.
- Aquatic biomonitoring programs for SCAW Metals.
- Aquatic biomonitoring programs for NECSA.
- Aquatic biomonitoring programs for Pilansberg Platinum Mine and Sedibelo Mine.
- Aquatic biomonitoring for Rhovan Mine.
- Aquatic biomonitoring for Assmang Chrome Machadodorp Works.
- Aquatic biomonitoring for Bakubung Platinum Mine.

Water Quality and Toxicity Monitoring

- Annual and Quarterly Water Monitoring and Management for the SAPPI Enstra Paper Mill.
- Toxicological monitoring programs for SCAW Metals.
- Toxicological monitoring programs for NECSA.
- Toxicological monitoring programs for Pilansberg Platinum Mine and Sedibelo Mine.
- Toxicological monitoring for Rhovan Mine.
- Toxicological monitoring for Assmang Chrome Machadodorp Works.
- Toxicological monitoring for Bakubung Platinum Mine.