Environmental Consultants

Aquatic Ecology Impact Assessment:

Matai Mining (Pty) Ltd Mining Right Application for Vanadium, Titanium and Iron Ore on various Farms within the Magisterial District of Mankwe, North West Province

kimopax

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- 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;
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- 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;
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- 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;
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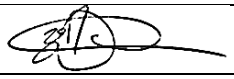
Signature of the environmental assessment practitioner:	
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Executive Summary

The modification of land use within a river catchment has the potential to degrade local water resources. Proposed developments thus have the potential to negatively impact on local water resources and ecosystem services. Matai Mining (Pty) Ltd (Matai) intend intends to develop an open pit mine in the Mankwe Magisterial District, North West Province. All mining blocks will be mined by means of conventional open pit mining method. Mining will be at an average stripping ratio of 3: 1. Opencast mining will take place through series of drill and blast, supported by conventional truck and shovel operation, assisted by roll-over dozing, to allow for continuous backfilling and rehabilitation of the mined out are. The proposed project has triggered several environmental conditions and therefore requires an Environmental Impact Assessment Report (EIA) and Water Use Licence Application (WULA) before the project can continue. This report presents the specialist Aquatic Ecology component of the overall environmental applications.

Niara Environmental Consultants (Pty) Ltd was appointed by Kimopax (Pty) Ltd to undertake an Aquatic Ecology Impact Assessment for the proposed Matai Mining Project in the Mankwe Magisterial District of the North West Province. The objectives of this Report are to describe the current state of the flora and fauna within the proposed Project area and assess the impacts of the proposed Project activities on the aquatic biophysical environment. The Report delivers various flora and fauna findings in compliance with existing provincial and national legislation.

An in-depth desktop study was undertaken as well as two field surveys. The first visit took place in the 14 December 2018 and the second visit took place in 17 January 2019. The Matai Mining Project is situated within the A24E and A24D Quaternary Catchments within the Limpopo Water Management area and Bushveld Basin Ecoregion. The project area falls within the portion of the WMA that was previously known as the Crocodile West and Marico WMA.

The identified watercourses associated with the Matai project area have no freshwater priority areas designated to them. The A24E-00642 SQR (Sefathlane) and A24E00688 (Lesobeng) directly associated with the Matai Project area span 35.03 km and 25.04 km of the Sefathlane and Lesobeng Rivers, respectively. The desktop Present Ecological State (PES) of the Sefathlane river reach is a class C (moderately modified), Ecological Sensitivity (ES) and Ecological Importance (EI) are rated as high. The desktop Present Ecological State (PES) of the Lesobeng river reach is a class B (Largely natural), Ecological Sensitivity (ES) and Ecological Importance (EI) are rated as high.

Anthropogenic impacts identified within the sub-quaternary catchment included road crossings (causeways), irrigation for rural villages, subsistence farming, over-grazing which results in erosion and sediment deposition. There were nine (9) fish species that were expected within the project area. None of the expected fish species were of conservation concern.

A field assessment was conduct over two surveys in December 2018 and January 2019. Three (3) aquatic sampling points were selected for the assessment namely Mat 01, Mat 02 and Mat 03. Mat 01 was on the Sefathlane River, Mat 02 was on the Lesobeng River and Mat 03 was on the Sefathlane River after the confluence with the Lesobeng River. Sampling points Mat 01 and Mat 03 were determined to be dry and could not be assessed. Sampling point Mat 02 was determined to hold a little water; however, could not be sampled as the watercourse presented wetland features and did not meet the minimum requirements for an aquatic survey

The impact assessment identified several impacts to the aquatic resources as a result of the proposed project; however, all the impacts were indirect impacts. The impacts during the construction phase will be brought about by the site clearing and establishment activities. The impacts during the construction phase were considered to medium to low pre-mitigation and low after mitigation. The impacts are considered low as the aquatic health of the water resources could not be determined, there are no direct impacts and mitigation measures further reduce the impact rating.

The impacts during the operational phase will be brought about by the operation of the mine, access roads and associated activities and are expected to be long term. The impact of water resources pollution from the resultant mining waste was considered to be medium impacts pre-mitigation and post-mitigation. Although the impacts are indirect, the impacts will be prolonged and may cause significant contamination to water resources, they are considered a medium impact.

Impacts during the closure and rehabilitation phase will be brought about by the activities relating to the removal of infrastructure, closing and sealing-off of pits and the final landscape shaping and vegetation. The impacts were considered medium impacts pre-mitigation and medium to low post-mitigation. The rehabilitation will most likely result in increased sediment loads; however, the mitigation measures will ensure that sedimentation of water resources is minimised as far as possible. The post-closure phase consists primarily of the monitoring of the final rehabilitation and remedying of any issues identified. The impacts are viewed as positive low impacts with and without mitigation. The post-closure monitoring will aid in the identification of issues that may exist after the final rehabilitation.

The points below serve to summarise the measures deemed necessary in order to ensure protection of the riparian and aquatic resources, and to ensure environmental protection in the vicinity of the proposed Matai Mining Project:

- No surface structures or construction should occur in the vicinity of any riverine systems in the study area and it must be ensured that downstream impacts on the ecology of the system do not occur. Special mention is made of the following:
- Stream flow continuity needs to be maintained downstream of any disturbed areas in order to ensure the ongoing viability of the instream aquatic communities in these areas.

- Water quality with special mention of pH, dissolved salts and specific problem substances like sulphate need to be managed, and monitored in order to ensure that reasonable water quality occurs downstream of the proposed expansion area in order to allow for the ongoing survival of an aquatic community of some diversity and reasonable sensitivity
- Ensure that all activities take the wetland and riverine boundaries into account. No activities are to infringe upon the wetland and riverine boundaries unless it is absolutely unavoidable. In this regard specific mention is made of the following:
- Wherever , no activities should take place within 100m of the aquatic resources;
- As an absolute minimum no infrastructure should be placed within 32m of any aquatic resources except for bridge crossings;
- Roadways and crossings should cross any features encountered at a 90 degree angle to minimise the footprint of the impact on these resources;
- Demarcate all wetland and riverine boundaries;
- No vehicles are to enter or drive through demarcated areas except at designated roadways;
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.
- No dumping of waste or any other materials is allowed within these areas. If any spills occur, they should be immediately cleaned up;
- No activities are to infringe upon the riverine boundaries. Should this be absolutely unavoidable that activities occur within these areas, relevant authorisation should be obtained according to the National Environmental Management Act (NEMA) 107 of 1998 and Section 21 c and i of the National Water Act 36 of 1998.
- No dirty water runoff must be permitted to reach the drainage features in the study area and the requirements of regulation GN 704 of the National Water Act (Act 36 of 1998) need to be strictly adhered to.
- Regularly inspect all vehicles for leaks. Re-fuelling of vehicles must take place on a sealed/ bunded surface area surrounded by berms to prevent ingress of hydrocarbons into topsoil.
- Ongoing monitoring of the groundwater resources in the vicinity of the proposed resources should take place on an ongoing basis.
- Adequate stormwater management must be incorporated into the design of the proposed development in order to prevent erosion and the associated sedimentation of the riparian and instream areas, as these systems have aquatic communities which rely on stream substrates clear of sediment and on clear, fast flowing water.
- Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed. Runoff from paved surfaces should be slowed down by the strategic placement of berms.

- During the construction and operational phases of the proposed Project, erosion berms should be installed to prevent gully formation and siltation of the riparian resources.
- Any river crossings must ensure that the creation of turbulent flow in the system is minimised, in order to prevent downstream erosion. No support pillars should be constructed within the active channel.
- The duration of impacts on any drainage feature should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised.
- All areas affected by any river crossing should be rehabilitated upon completion of the construction phase of the development. Areas should be reseeded with indigenous grasses as required.
- During the construction phase, no vehicles should be allowed to indiscriminately drive through any riparian areas.
- All riparian areas of disturbed and compacted soils need to be ripped, reprofiled and reseeded with indigenous grasses.
- All riparian areas affected by construction should be rehabilitated upon completion of the proposed Project. Areas should be reseeded with indigenous grasses as required. All rehabilitated areas should be rehabilitated to a point where natural processes will allow the pre-development ecological functioning and biodiversity of the area to be re-instated.
- Ongoing alien vegetation removal should take place in any riparian areas where disturbance of the soil takes place.
- Ongoing biomonitoring of the aquatic resources in the vicinity of the proposed Matai Mining Project must take place. Biomonitoring should take place at points located upstream and downstream of the activities. Biomonitoring should take place on a six monthly basis in the autumn and spring of each year. Biomonitoring should take place using the SASS5 and IHAS indices. Biomonitoring should be undertaken by a South African River Health Program (SARHP) accredited practitioner and extended contracts should be set up for this monitoring in order to ensure that good interpretation of complex biological data takes place.
- Toxicity testing of any features which contain water which may come into contact with the receiving environment as well as key areas indicating a pollution plume as a result of the proposed Project should be tested on a 6 monthly basis in conjunction with the biomonitoring surveys. Toxicity tests should be run on four trophic levels including *Poecilia reticulata, Daphnia pulex, Selenastrum capricornutum* and *Vibrio fischeri*.
- The results of the biomonitoring surveys should be compared to this baseline data in order to determine if any impacts on the aquatic ecosystems on the subject property are occurring. In addition if any impacting trends are observed, measures to prevent the impacts from occurring should be immediately sought.

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1. Introduction

To complete the EIA and WULA, environmental specialist studies were required. Considering this, Niara Environmental Consultants (Pty) Ltd was commissioned by Kimopax (Pty) Ltd to conduct aquatic ecology specialist studies to supplement the abovementioned application.

The purpose of the assessment was to survey the general habitat integrity, habitat conditions for aquatic macro-invertebrates, aquatic macro-invertebrate and fish community integrity. The protocols of applying the necessary indices were strictly adhered to and all work was undertaken by a South African River Health Program accredited assessor. This Report presents the results of an aquatic ecological study on the riverine environments associated with the proposed infrastructure project. This report should be interpreted after taking into consideration the findings and recommendations provided by the specialist herein. Further, this Report should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed Matai Mining Project.

The proposed project area is situated in the Moses Kotane Local Municipality within the Mankwe Magisterial District of Northwest Province. The mining right is held on the farm Wildebeestkuil 7 JQ, and certain portions of the farms Magazynskraal 3 JQ, Haakdoorn 6 JQ, Syferkuil 9 JQ and Middelkuil 8 JQ. The main objective of the assessment is to evaluate the impact of the mining operations on the ambient air quality of the surrounding areas.

2. Scope of Work

This Aquatic Impact Assessment report serves to provide the baseline description of the aquatic systems associated with the proposed Project and identify potential impacts (if any) on the associated aquatic ecology prior to commencement of the Project. Appropriate mitigation measures to prevent, minimise and/or reduce any potential impacts are also included within this Report.

2.1 Purpose of this Report

Niara was appointed to undertake a Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) analysis of the terrestrial wetland, aquatic and riparian resources and to assess the impact associated with the proposed Matai Mining development and to provide mitigatory measures as necessary as part of the environmental assessment and authorisation process for the proposed Matai Mining Project in the in the Mankwe Magisterial District of the North West Province.

Specific outcomes required from this report in terms of the aquatic assessment include the following:

- Define the ecostatus of the river systems;

- Define the ecological importance and sensitivity of the systems based on stressor and receptor assessments, including habitat assessments;
- Biota specific water quality assessment;
- Aquatic and riparian zone habitat assessments;
- Aquatic community integrity assessments;
- Define impacts on the systems;
- Provide an opinion based on the study from an aquatic ecological point of view; and
- Present required mitigation measures to minimise the impact on the receiving aquatic environment.

2.2 Aims and Objectives

The aim of the assessment was to provide information to guide the construction and operation of the proposed development with respect to the current ecological state of the aquatic ecosystems in the study area. As part of this assessment, the following objectives were established:

- Aquatic Ecology Studies Scope:
  - The determination of the baseline Present Ecological Status (PES) of the local river systems;
  - The evaluation of the extent of site-related impacts;
  - A risk assessment for the proposed development; and
  - The prescription of mitigation measures and recommendations for identified risks..

2.3 Terms of Reference

The following deliverables were agreed upon as part of the study:

- Low flow aquatic assessment;
- Aquatic ecology scoping report highlighting potential impacts posed by the proposed Matai Mining Project;
- A high flow aquatic assessment; and
- Aquatic ecology baseline and impact assessment report.

2.4 Structure of this Report

Aspect	Section
The person who prepared the report; and the expertise of that person to carry out the specialist study or specialised process.	Section 7
A declaration that the person is independent	Page iii
An indication of the scope of, and the purpose for which, the report was prepared	Section 2

Aspect	Section
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 4
A description of any assumptions made and any uncertainties or gaps in knowledge	Section 6
(f) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 10 and Section 11
Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority	Section 11.7
A description of any consultation process that was undertaken during the course of carrying out the study	Section 15
A summary and copies of any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A

3. Legislative Requirements

3.1 National Water Act (NWA, 1998)

The Department of Water and Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998) (NWA; RSA, 1998a) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource;

A watercourse means;

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

No activity may take place within a watercourse unless it is authorised by the 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) and (i).

3.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (RSA, 1998 b) and the associated Regulations as amended in December 2014, 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 EIA process depending on the scale of the impact.

4. Approach

As a part of the Environmental Authorisation process for the proposed Matai Mining Project, an aquatic impact assessment was required to be undertaken within the surrounding aquatic ecosystems, in order to establish baseline conditions prior to the commencement of the Project. To complete the aquatic survey there are a number of tasks which need to be completed. These tasks are in line with the River Health Programme (RHP), which is the national monitoring programme used to monitor and assess the freshwater resources within South Africa. To determine the ecological integrity of the aquatic environment, individual biophysical attributes of the streams will be assessed. These biophysical attributes refer to the drivers and biological responses of an aquatic ecosystem. The selected drivers and biological responses for this study include:

The Abiotic Driver Assessment

The abiotic driver assessment includes:

- The assessment of physio-chemical variables of the water;
- Habitat indices:
- Index of Habitat Integrity (IHI); and
- Invertebrate Habitat Assessment System (IHAS).

The Biotic Response Indicator Assessment

The biotic response indicator assessment consists of the following:

- South African Scoring System version 5 (SASS5);

- The Average Score Per Taxon (ASPT);
- Macro – Invertebrate Assessment Index (MIRAI); and
- Fish Response Assessment Index (FRAI).

4.1 Site visit

To best understand the variable conditions of the aquatic ecology associated with the proposed Project area, the surveys should have, ideally, been selected during a low flow/rainfall period and during a high flow/rainfall period. These selections were based on average rainfall data gathered from provincial rainfall trend data provided by the Department of Water and Sanitation (DWS, 2018) as illustrated in Figure 4-1: Annual Rainfall Trend for the North West Province (DWS, 2018) below. According to the gathered data, the onset of the North West rainy season occurs during the months of October to November with the highest average monthly rainfall occurring during the month of January. Two site visits were conducted – December and January. Streams were dry during both site visits.

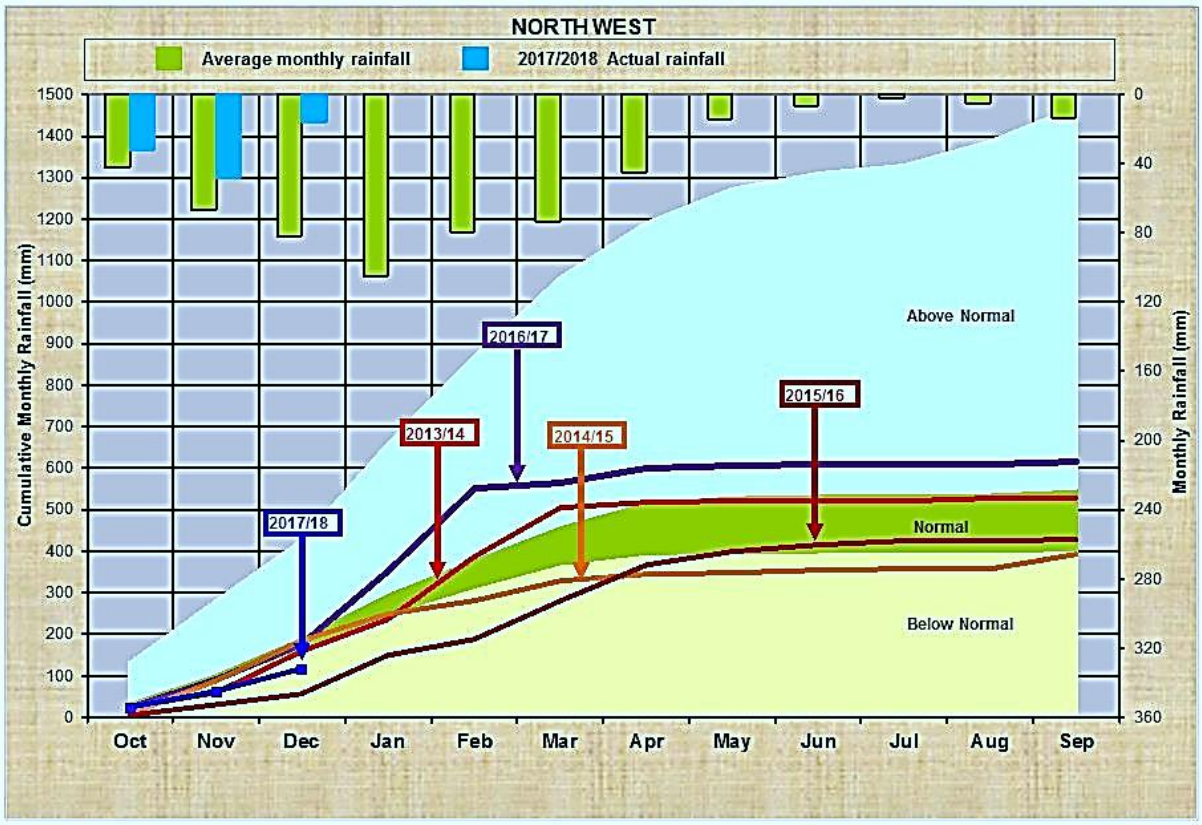


Figure 4-1: Annual Rainfall Trend for the North West Province (DWS, 2018)

The assessment site was investigated in order to identify visible impacts on the site, with specific reference to impacts from surrounding activities and any effects occurring upstream in the catchment. Both natural constraints placed on ecosystem structure and function, as well as anthropogenic alterations to the system, was 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:

- 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

4.2 Literature review

A desktop study was compiled with all relevant information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org). Wetland specific information resources taken into consideration during the desktop assessment of the study area included:

- National Freshwater Ecosystem Priority Areas (NFEPAs, 2011)
- NFEPA water management area (WMA)
- NFEPA wetlands/National wetlands map
- Wetland and estuary FEPA
- FEPA (sub)WMA % area
- Sub water catchment area FEPAs
- Water management area FEPAs
- Fish sanctuaries
- Wetland ecosystem types
- Threatened Terrestrial Ecosystems for South Africa, 2009
- National Wetlands Inventory, 2006

Studies undertaken by the Institute for Water Quality Studies assessed all quaternary catchments as part of the Resource Directed Measures for Protection of Water Resources. In these assessments, the EIS, Present Ecological Management Class (PEMC) and Desired Ecological Management Class (DEMC) were defined, and serve as a useful guideline in determining the importance and sensitivity of aquatic ecosystems.

4.3 Aquatic Ecological Description

Water resources are generally classified according to the degree of modification or level of impairment. The classes used by the South African River Health Program (RHP) are presented in Table 4-1 and will be used as the basis of classification of the systems in the Project area.

4.3.1 Ecoregions

When assessing the ecology of any area (aquatic or terrestrial), it is important to know which ecoregion the study area is located within. This knowledge allows for improved interpretation of data to be made, since reference information and representative species lists are often available on this level of assessment to guide the assessment. The study area falls within the Bushveld Basin Ecoregion, which consists of an upper and lower category. The upper category of the ecoregion can be considered to contain high aquatic biodiversity and a fairly sensitive aquatic community, whereas the lower category may be considered to contain moderate aquatic biodiversity. The study area falls within the A24E quaternary catchment. Refer to Table 4-1 below.

4.3.2 Ecostatus

Water resources are generally classified according to the degree of modification or level of impairment. The classes used by the South African River Health Program (RHP) are presented in the table below and will be used as the basis of classification of the systems in this field and desktop study, as well as future field studies.

Table 4-1: Classification of river health assessment classes in line with the RHP

Class	Description
A	Unmodified, natural.
B	Largely natural, with few modifications.
C	Moderately modified.
D	Largely modified.
E	Extensively modified.
F	Critically modified.

In addition the ecological category (EC) classification will be employed using the ecostatus A to F continuum approach (Kleynhans and Louw, 2007). This approach allows for boundary categories denoted as B/C, C/D etc., as illustrated in Figure 4-2.

Figure 4-2: Ecological categories (EC) eco-status A to F continuum approach employed (Kleynhans and Louw, 2007)

4.4 Baseline Determination

To complete this study and to enable an adequate description of the representative status of the aquatic biodiversity associated with the affected aquatic ecosystems, the following indicators were evaluated as part of the assessment:

- Stressor Indicators:
  - In situ water quality.
- Habitat Indicators:
  - Instream and riparian habitat integrity.
- Response Indicators:
  - Aquatic macroinvertebrates assemblages; and
  - Ichthyofaunal assemblages.

Water quality and habitat quality assessments were to be conducted in order to best characterise the aforementioned aquatic indicators associated with the Project but due to the waterbodies being dry, these could not be done.

4.5 Visual Assessment of Aquatic Assessment Points

Each site was selected in order to identify current conditions, with specific reference to impacts from surrounding activities where applicable. Both natural constraints placed on ecosystem structure and function, as well as anthropogenic alterations to the systems identified, was identified by observing conditions and relating them to professional experience. Photographs of each site were taken to provide visual records of the conditions at the time of assessment.

Factors which were noted in the site-specific visual assessments included the following:

- Upstream and downstream significance of each point, where applicable;
- Significance of the point in relation to the study area;
- Stream morphology;
- Instream and riparian habitat diversity;
- Stream continuity;
- Erosion potential;
- Depth flow and substrate characteristics;
- Signs of physical disturbance of the area;
- Other life forms reliant on aquatic ecosystems.

4.6 Physico-Chemical Water Quality Data

On site testing of biota specific water quality variables would have taken place on all sites where surface water was present. Unfortunately, the identified watercourses did not hold any water at the time of the assessment and thus water quality data could not be measured. These results of on-site biota specific water quality analyses would then be used to aid in the interpretation of the data obtained from assessments of the aquatic community assemblages at each point. Results would have been discussed against the guideline water quality values for aquatic ecosystems (DWAF, 1996 vol. 7).

4.7 Intermediate Habitat Integrity Assessment (IHIA)

It is important to assess the habitat of riverine systems in order to aid in the interpretation of the results of the community integrity assessments by taking habitat conditions and impacts into consideration. The general habitat integrity of the sites was assessed based on the application of the Intermediate Habitat Integrity Assessment for (Kemper 1999). The Intermediate Habitat Integrity Assessment (IHIA) protocol, as described by Kemper (1999), was used using the site specific application protocols. This is a simplified procedure, which is based on the Habitat Integrity approach developed by Kleynhans (1996). The IHIA is conducted as a first level exercise, where a comprehensive exercise is not practical. The Habitat Integrity of each site was scored according to 12 different criteria which represent the most important (and easily quantifiable) anthropogenically induced possible impacts on the system.

The in-stream and riparian zones were analysed separately, and the final assessment was then made separately for each, in accordance with Kleynhans' (1999) approach to Habitat Integrity Assessment. Data for the riparian zone is, primarily interpreted in terms of the potential impact on the in-stream component. The assessment of the severity of impact of modifications is based on six descriptive categories with ratings. Analysis of the data was carried out by weighting each of the criteria according to Kemper (1999). By calculating the mean of the instream and riparian Habitat Integrity scores, an overall Habitat Integrity score can be obtained for each site. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitats of the sites. The method classifies Habitat Integrity into one of six classes, ranging from unmodified/natural (Class A), to critically modified (Class F).

4.8 Invertebrate Habitat Suitability [Invertebrate Habitat Assessment (IHAS)]

The Invertebrate Habitat Assessment System (IHAS) was to be applied to all the sites according to the protocol of McMillan (1998). This index was used to determine specific habitat suitability for aquatic macro-invertebrates, as well as to aid in the interpretation of the results of the South African Scoring System version 5 (SASS5) scores. Scores for the IHAS index were interpreted according to the guidelines of McMillan (1998) as follows:

- <65%: habitat diversity and structure is inadequate for supporting a diverse aquatic macro-invertebrate community.
- 65%-75%: habitat diversity and structure is adequate for supporting a diverse aquatic macro-invertebrate community.
- 75%: habitat diversity and structure is highly suited for supporting a diverse aquatic macro-invertebrate community.

4.9 Aquatic Macro-Invertebrates: South African Scoring System (SASS5)

Aquatic macro-invertebrate communities of all the sites were investigated according to the SASS5 method, which is specifically designed to comply with international accreditation protocols. This method is based on the British Biological Monitoring Working Party (BMWP) method and has been adapted for South African conditions by Chutter (1998).

The assessment was undertaken according to the South African Scoring System (SASS) protocol as defined by Dickens and Graham (2001). All work was undertaken by an accredited South African Scoring System, version 5 (SASS5) practitioners.

Interpretation of the results of biological monitoring depends, to a certain extent, on interpretation of site-specific conditions (Thirion et al. 1995). In the context of this investigation it would be best not to use SASS5 scores in isolation, but rather in comparison with relevant habitat scores.

The reason for this is that some sites have a less desirable habitat or fewer biotopes than others do. In other words, a low SASS5 score is not necessarily regarded as poor in conjunction with a low habitat score. Also, a high SASS5 score in conjunction with a low habitat score can be regarded as better than a high SASS5 score in conjunction with a high habitat score.

A low SASS5 score together with a high habitat score would be indicative of poor conditions. The IHAS Index is valuable in helping to interpret SASS5 scores and the effects of habitat variation on aquatic macro-invertebrate community integrity.

Interpretation of the results in relation to the reference scores was made according to the classification of SASS5 scores presented in the SASS5 methodology published by Dickens and Graham (2001) –refer to Table 4-2.

Table 4-2: Definition of Present State Classes in terms of SASS and ASPT scores as presented in Dickens and Graham (2001)

Class	Description	SASS Score%	ASPT%
A	Unimpaired. High diversity of taxa with numerous sensitive taxa.	90-100 80-89	Variable >90
B	Slightly impaired. High diversity of taxa, but with fewer sensitive taxa.	80-89 70-79 70-89	<75 >90 76-90
C	Moderately impaired. Moderate diversity of taxa.	60-79 50-59 50-79	<60 >75 60-75
D	Largely impaired. Mostly tolerant taxa present.	50–59 40-49	<60 Variable
E	Severely impaired. Only tolerant taxa present.	20-39	Variable
F	Critically impaired. Very few tolerant taxa present.	0-19	Variable

The project is located within the Bushveld Basin Ecoregion and the modelled reference conditions for the aquatic macro-invertebrates is presented in Table 4-3. Figure 3 presents the ecological bands for the Bushveld Basin.

Table 4-3: Modelled reference conditions for the Bushveld Basin – upper and lower ecoregion based on SASS5 and ASPT scores (adapted from Dallas, 2007)

SASS Score	ASPT*	Class	Description
> 124	> 5.7	A	Unimpaired. High diversity of taxa with numerous sensitive taxa.
102 - 124	5.1 - 5.7	B	Slightly impaired. High diversity of taxa, but with fewer sensitive taxa.
83 - 102	4.8 – 5.1	C	Moderately impaired. Moderate diversity of taxa.
65 - 82	4.5 - 4.8	D	Considerably impaired. Mostly tolerant taxa present.
< 65	< 4.5	E/F	Severely impaired. Only tolerant taxa present.

**** Average Score per Taxa***

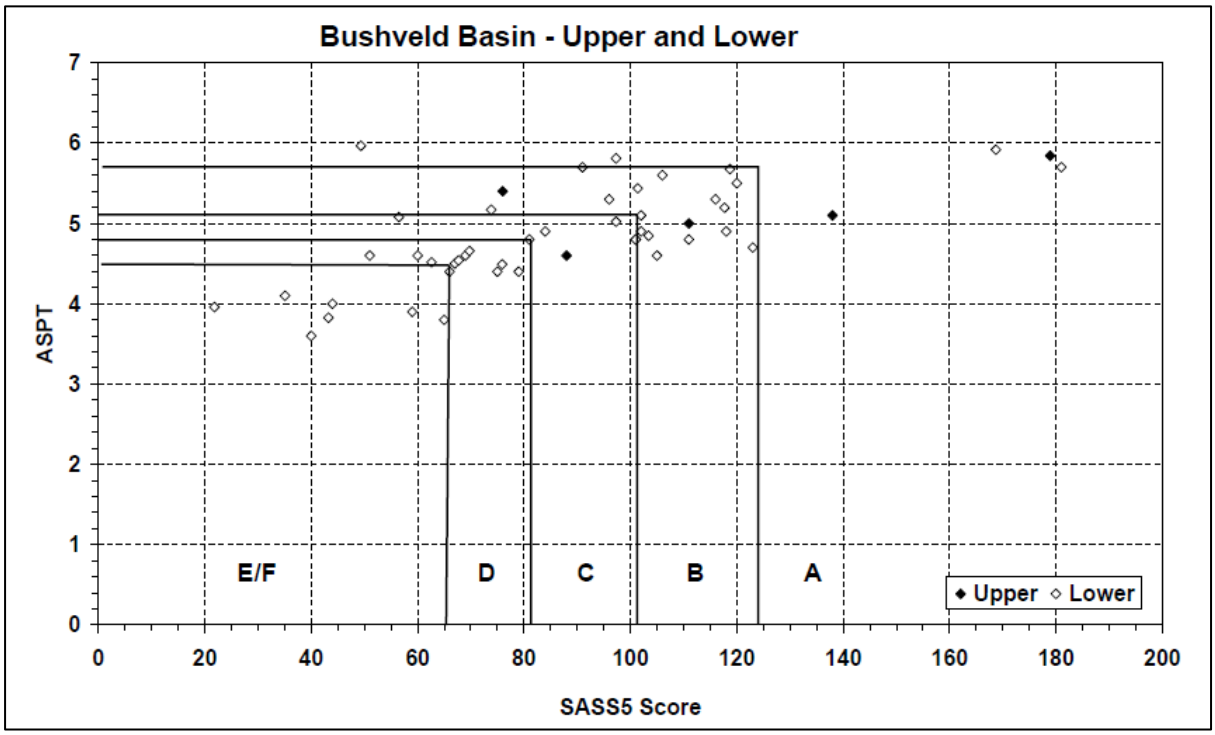


Figure 3: The ecological bands for the Bushveld Basin Ecoregion _ Upper and Lower

4.10 Fish Response Assessment Index

The purpose of the Fish Response Assessment Index (FRAI) is to provide a habitat-based cause-and-effect underpinning to interpret the deviation of the fish assemblages from the identified reference conditions. The information gained using the FRAI provides an indication of the PES of the river based on the fish assemblage structures observed. It must be noted that a reach based FRAI assessment was completed utilising only sampling sites in the upper reaches of the three tributaries of concern. These findings should be interpreted with

caution as the assumption was made that the fish assemblages were homogenous throughout the assessed reaches. In order to obtain more accurate FRAI results, sites need to be assessed along the entirety of each SQR of concern instead of only the upper reaches.

4.11 Present Ecological Status

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions (Kleynhans and Louw, 2007). For the purpose of this study the Present Ecological Status (PES) of tributaries considered in the study was derived through the characterisation of the various biophysical attributes as described in the above sections. The River Eco-status Monitoring Programme (REMP) Ecological Classification manual by Kleynhans and Louw (2007) was used in order to accomplish this task. It is important to note that an adapted version of the Riparian Ecological Category surrogate (Dr. C.J. Kleynhans, pers. comm., 2015) will be used in this assessment as follows:

*Riparian Vegetation EC = 100-(((IHIA 'Natural vegetation removal')+(IHIA 'Exotic Vegetation Encroachment'))/50*100).*

5. Impact Assessment Methodology

The anticipated impacts associated with the proposed project have been assessed according to Niara's standardised impact assessment methodology which is presented below. The following Impact Assessment Methodology has been utilised for the assessment of the environmental impacts.

Generally, the impact assessment is divided into three parts:

- Issue identification - each specialist will be asked to evaluate the 'aspects' arising from the project description and ensure that all issues in their area of expertise have been identified;
- Impact definition - positive and negative impacts associated with these issues (and any others not included) then need to be defined – the definition statement should include the activity (source of impact), aspect and receptor as well as whether the impact is direct, indirect or cumulative. Fatal flaws should also be identified at this stage.
- Impact evaluation – this is not a purely objective and quantitative exercise. It has a subjective element, often using judgement and values as much as science-based criteria and standards. The need therefore exists to clearly explain how impacts have been interpreted so that others can see the weight attached to different factors and can understand the rationale of the assessment.

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the management and approval process; secondly, it shows the primary impact

characteristics, as defined above, used to evaluate impact significance. The methodology below will be used when determining the significance of impacts associated with the proposed Power Transformer Manufacturing, Repairing and Testing Facility.

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the management and approval process; secondly, it shows the primary impact characteristics, as defined above, used to evaluate impact significance.

The impact significance rating system is presented in Table 5-1, Table 5-2 and Table 5-3 and involves three parts:

1 **Part A**: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale/ population and duration;
2 **Part B**: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
3 **Part C**: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from **Part B**) and the probability of occurrence.

5.1 Part A: Defining Consequence in Terms of Magnitude, Duration and Spatial Scale:

Use these definitions to define the consequence in Part B.

Table 5-1: Consequence Rating Methodology

Impact Characteristics	Definition	Criteria
Magnitude	Major -	Substantial deterioration or harm to receptors; receiving environment has an inherent value to stakeholders; receptors of impact are of conservation importance; or identified threshold often exceeded
	Moderate -	Moderate/measurable deterioration or harm to receptors; receiving environment moderately sensitive; or identified threshold occasionally exceeded
	Minor -	Minor deterioration (nuisance or minor deterioration) or harm to receptors; change to receiving environment not measurable; or identified threshold never exceeded
	Minor +	Minor improvement; change not measurable; or threshold never exceeded

Impact Characteristics	Definition	Criteria
	Moderate +	Moderate improvement; within or better than the threshold; or no observed reaction
	Major +	Substantial improvement; within or better than the threshold; or favourable publicity
Spatial scale or population	Site or local	Site specific or confined to the immediate project area
	Regional	May be defined in various ways, e.g. cadastral, catchment, topographic
	National/ International	Nationally or beyond
Duration	Short term	Up to 18 months.
	Medium term	18 months to 5 years
	Long term	Longer than 5 years

5.2 Part B: Determining Consequence Rating:

Rate consequence based on definition of magnitude, spatial extent and duration.

Table 5-2: Consequence Rating Methodology

			Spatial Scale/ Population		
			Site or Local	**Regional**	**National/ International**
MAGNITUDE					
Minor	**DURATION**	**Long term**	Medium	Medium	High
		Medium term	Low	Low	Medium
		Short term	Low	Low	Medium
Moderate	**DURATION**	**Long term**	Medium	High	High
		Medium term	Medium	Medium	High
		Short term	Low	Medium	Medium
Major	**DURATION**	**Long term**	High	High	High
		Medium term	Medium	Medium	High
		Short term	Medium	Medium	High

5.3 Part C: Determining Significance Rating:

Rate significance based on consequence and probability.

Table 5-3: Significance Rating Methodology

		Consequence		
		Low	**Medium**	**High**
PROBABILITY (of exposure to impacts)	**Definite**	Medium	Medium	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium

6. Assumptions and Limitations

The following assumptions and limitations are applicable to this Report:

- Only sites in proximity to proposed activity (project area) were selected for this assessment;
- Sites where raw sewage was observed were not considered for assessment due to health risks to the aquatic ecology practitioner;
- The in-situ water quality results could not be determined as there was no water available at the identified assessment points; and
- The fish and aquatic macro-invertebrates could not be assessed for the project as there was no water available at the selected assessment points.

7. Expertise of the Specialists

Ndumiso Dlamini obtained his BSc Hons degree in Botany in 2011 at the University of Johannesburg and is a registered Pr. Sci. Nat with SACNASP (116579) in Botanical Science and Ecological Science. Ndumiso has been conducting biodiversity, ecological and water resource assessments as an Environmental Consultant for 5 years. He has performed numerous ecological impact assessments for various projects which include mining, housing developments, roads and infrastructure and rehabilitation. A detailed CV is attached in Appendix A.

8. Site Location

The Matai Mining Project is located in the Moses Kotane Municipality, Bojanala Platinum District Municipality, North West Province, South Africa. It lies about 13 km south-west of the closest town Northam, approximately, 70 km north of Rustenburg and 150 km north-west of Johannesburg. The Pilanesberg Nature Reserve lies approximately 13 km to the south of the proposed pit area. Other large sources of particulate matter in the area include the Union North and South Mines, the Pilanesberg Platinum mine, and the Dishaba Mine, all of which mine for platinum group minerals, and the Kalaka Mine which mines for limestone (Figure 8-1).

The Matai Mining Project is situated within the A24E and A24D Quaternary Catchments within the Limpopo Water Management area and Bushveld Basin Ecoregion. The project area falls within the portion of the WMA that was previously known as the Crocodile West and Marico WMA and lies adjacent to the Botswana border to

the north-west, predominantly within Limpopo. It is situated in a semi-arid part of the country with a mean annual precipitation of 400 to 800 mm. Its main rivers, the Crocodile and Marico Rivers, give rise to the Limpopo River at their confluence. The area is characterised by the urban and industrial complexes of northern Johannesburg and Pretoria and platinum mining north-east of Rustenburg, and activities include extensive irrigation development along the main rivers with grain, livestock and game farming. A substantial portion of the WMA water is transferred from the Vaal River with small transfers out of the WMA to Gaborone in Botswana and to Modimolle in the Limpopo WMA. Increasing quantities of effluent return flow from urban and industrial areas is a major cause of pollution in some rivers (StatsSA, 2010).

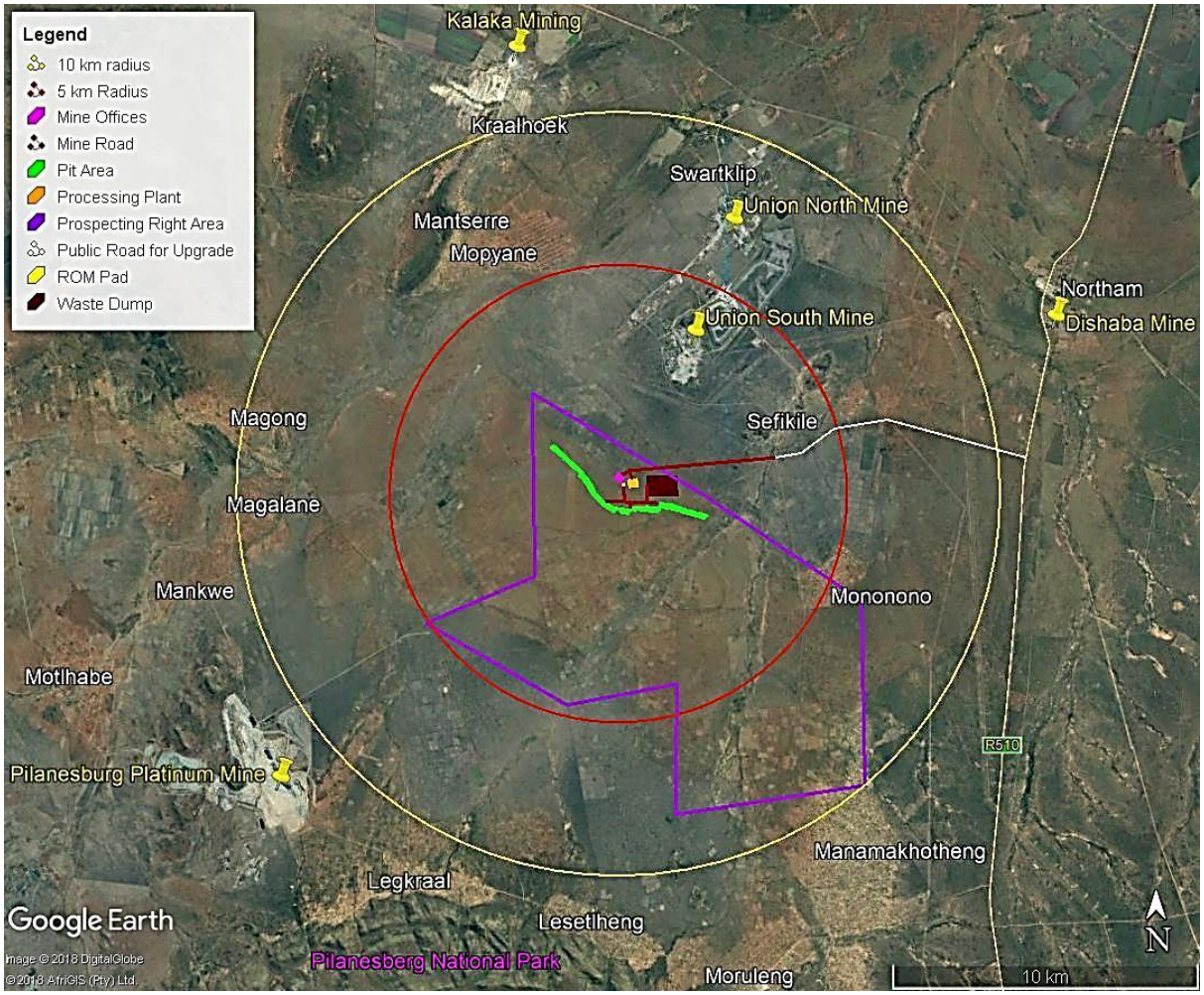


Figure 8-1: Location of the proposed Matai Mining Project.

The topography immediately surrounding the site is gently undulating with no prominent topographic features in the project area. The Pilanesberg formation to the south, rises from the surrounding plains and consists of the crater of a long extinct volcano fringed by three concentric ridges or rings of hills.

9. Overview of the Matai Project Mining Process

Opencast mining starts with the stripping of usable soil and soft overburden material using a fleet of diesel trucks and shovels. This topsoil and overburden is stockpiled for use in the rehabilitation of the area once the mining is completed. A process of roll-over or strip mining is then followed in which the overburden of each strip is drilled and blasted and then placed in the excavation produced by the previous strip. This backfilling and rehabilitation will be undertaken as the mining progresses. The ore will be mined from the open pit using excavators, bulldozers, trucks, bowl scrapers and shovels.

Crushers will be used to reduce large rocks into smaller rocks, gravel, or rock dust. Three stages of crushing are planned. Trucks will deposit material into a receiving bin at the primary tip. A single jaw crusher will be used as the primary crusher. A static grizzly is placed at the primary tip to remove oversize material, with a vibrating grizzly placed before the crusher to screen off the fines before it enters the crusher. For the purposes of modelling for this report, it was assumed that this primary crushing will take place in the pit. From there, apron feeders will be utilised to extract ore from the bins and feed it to downstream equipment at a predetermined rate. Cone crushers or toothed roll crushers will be used for the secondary and tertiary crushing phases at the processing plant to reduce the size of the material to less than 32mm. Conveyors will also be used to transport the overburden (Kimopax, 2018).

A tripper conveyor will also be used to stack ore onto the stockpile. The ore will be removed from the stockpile by means of bottom extraction. This consists of a tunnel underneath the stockpile with a travelling rotary plough feeder and a conveyor (Kimopax, 2018).

From the crushing plant, ore will be transported in trucks on a gravel road to the R510, and from there by tarred road to its final destination. The final void will be backfilled with the overburden from the initial boxcut.

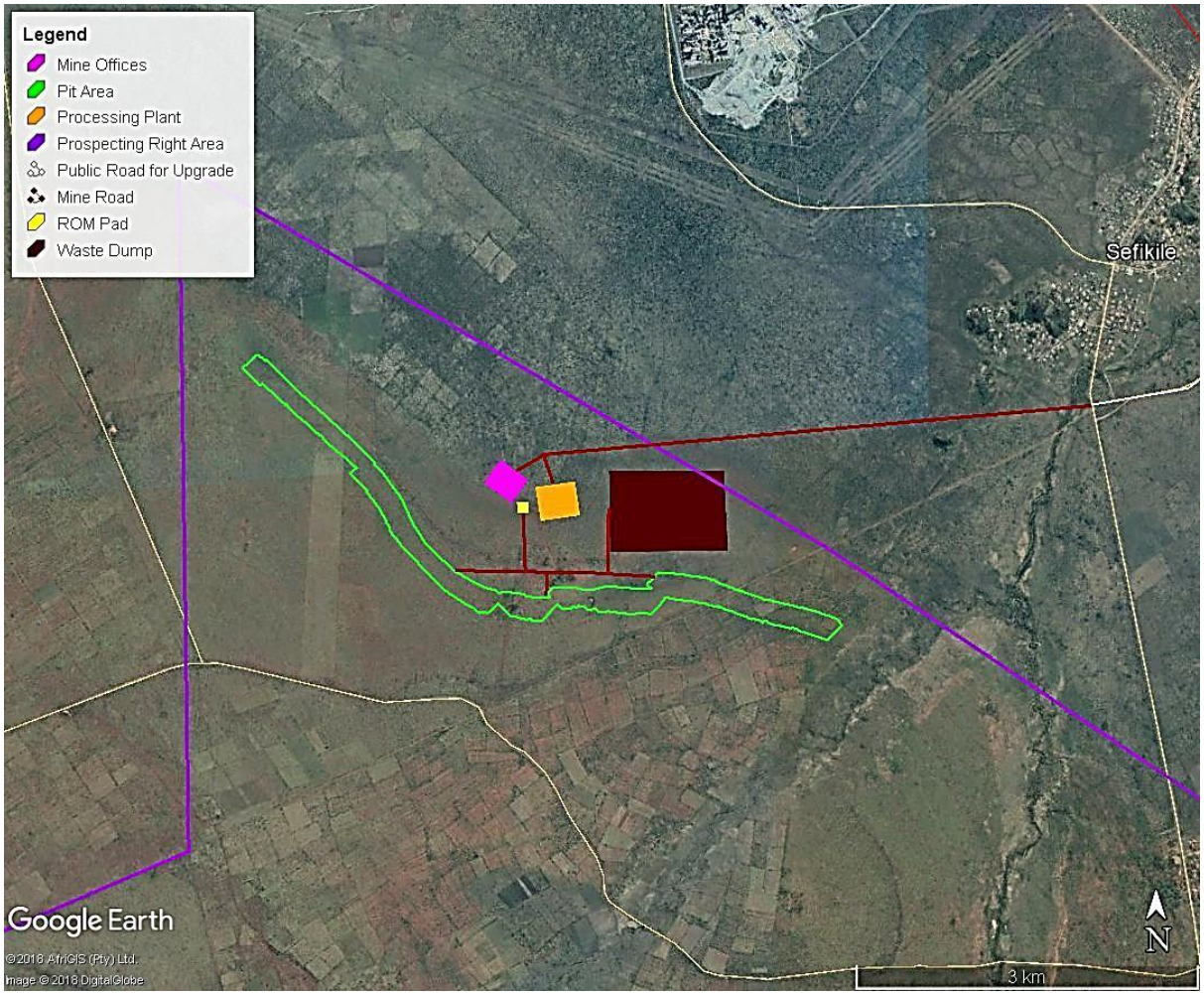


Figure 9-1: Proposed mine layout.

10. Findings

The sections below outline the findings from the various assessments and tasks conducted for the aquatic study.

10.1 Desktop Assessment

10.1.1 National Freshwater Ecological Priority Areas for the Sub-Quaternary Reaches

The identified watercourses have no freshwater priority areas designated to them (Driver *et al*., 2011). Their location within the National Freshwater Ecological Priority Areas (NFEPA) map is presented in Figure 2.

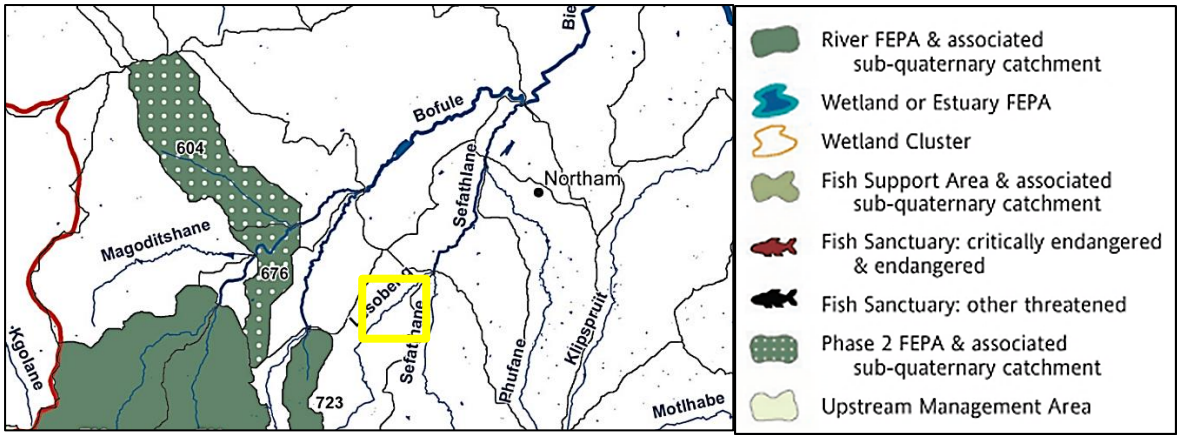


Figure 2: NFEPA associated with the project area. Yellow square indicates location of proposed project (Nel et al., 2011)

It is important to note that river FEPAs currently in an A or B ecological category, as both these are, may still require some rehabilitation effort, e.g. clearing of invasive alien plants and/or rehabilitation of river banks. In regard to the biodiversity, rehabilitation programmes should therefore focus on securing the ecological structure and functioning of FEPAs before initiating any rehabilitation programmes.

10.1.2 Status of Sub-Quaternary Reaches

Desktop information was obtained from DWS (2018). The A24E-00642 SQR (Sefathlane) and A24E00688 (Lesobeng) directly associated with the Matai Project area span 35.03 km and 25.04 km of the Sefathlane and Lesobeng Rivers, respectively. The desktop Present Ecological State (PES) of the Sefathlane river reach is a class C (moderately modified), Ecological Sensitivity (ES) and Ecological Importance (EI) are rated as high. The desktop Present Ecological State (PES) of the Lesobeng river reach is a class B (Largely natural), Ecological Sensitivity (ES) and Ecological Importance (EI) are rated as high. The results are presented in Table 10-1.

Anthropogenic impacts identified within the sub-quaternary catchment included road crossings (causeways), irrigation for rural villages, subsistence farming, over-grazing which results in erosion and sediment deposition.

Table 10-1: Summary of the status of the Sub-Quaternary Reaches

SQRS	A24E-00642 (Sefathlane)	A24E00688 (Lesobeng)
Present Ecological Status	Moderately Modified (Class C)	Largely Natural (Class B)
Ecological Importance	High	High
Ecological Sensitivity	High	High

10.1.3 Expected Fish Species

There were nine (9) fish species that were expected within the project area. There was one expected fish species of conservation concern. The expected fish species are presented in Table 10-3. It must be noted that the possible fish list indicates species that may be present within the area.

Table 10-2: The expected fish species within the Project area

Family	Scientific name	Common name	IUCN Status
Cichlidae	*Coptodon rendalli*	Redbreast Tilapia	Not evaluated
Cichlidae	*Oreochromis mossambicus*	Mozambique Tilapia	Near threatened
Cichlidae	*Pseudocrenilabrus philander*	Southern Mouth-Brooder	Least concern
Cichlidae	*Tilapia sparrmanii*	Banded Tilapia, Or Vlei Kurper	Least concern
Clariidae	*Clarias gariepinus*	African Sharptooth Catfish	Least concern
Cyprinidae	*Barbus paludinosus*	Straightfin Barb	Least concern
Cyprinidae	*Barbus trimaculatus*	Threespot Barb, Threespot Ghielemientjie or "Ghielie"	Least concern
Cyprinidae	*Labeo molybdinus*	*Laden Labeo*	Lest concern
Poeciliidae	*Gambusia affinis*	Western mosquitofish	Invasive

10.2 Field Assessment

A field assessment was conduct over two surveys in December 2018 and January 2019. The selected assessments points are presented in Figure 3.

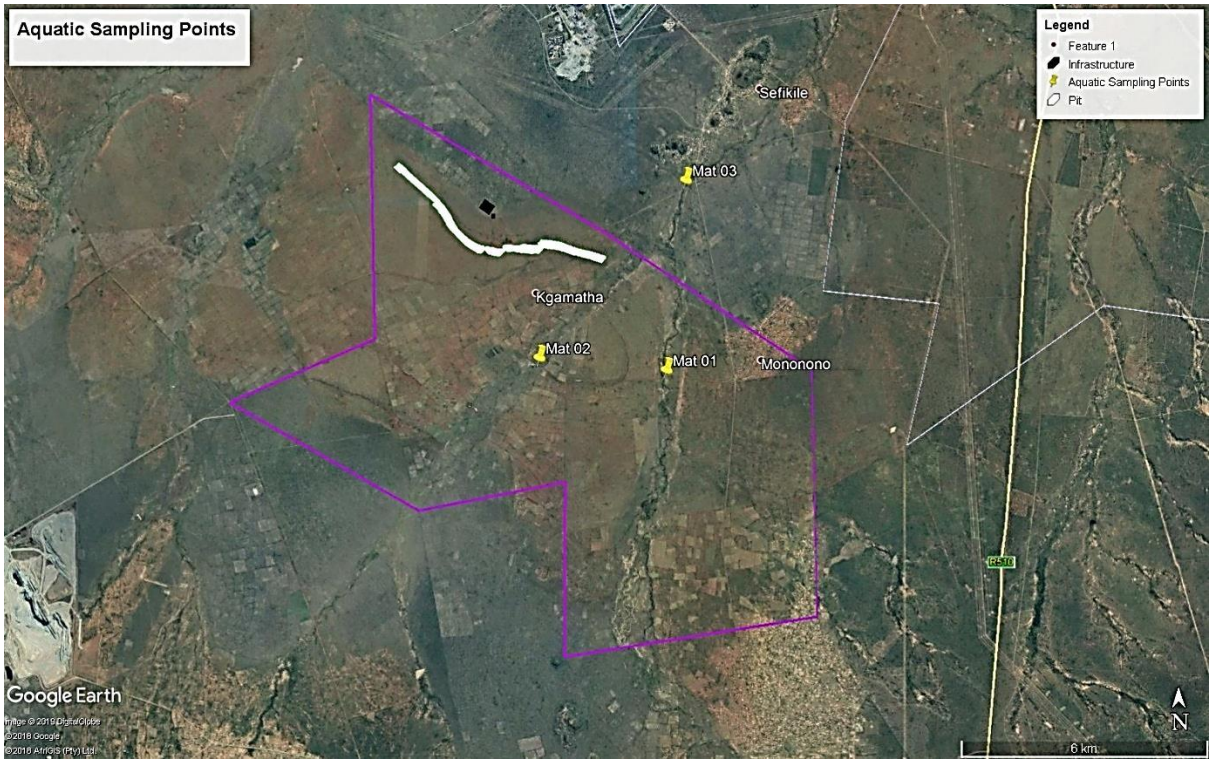
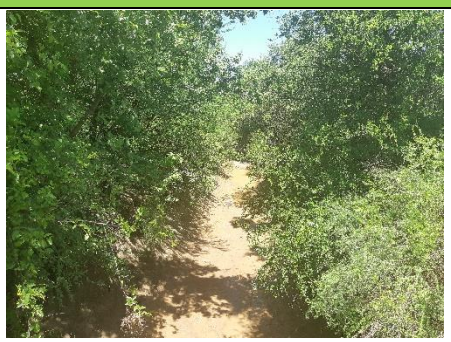


Figure 3: Aquatic Sampling points associated with the Matai Project area

Three (3) aquatic sampling points were selected for the assessment namely Mat 01, Mat 02 and Mat 03. Mat 01 was on the Sefathlane River, Mat 02 was on the Lesobeng River and Mat 03 was on the Sefathlane River after the confluence with the Lesobeng River. Images of the selected sample points are presented in Table 10-3.

Sampling points Mat 01 and Mat 03 were determined to be dry and could not be assessed. Sampling point Mat 02 was determined to hold a little water; however, could not be sampled as the watercourse presented wetland features and did not meet the minimum requirements for an aquatic survey.

Table 10-3: The identified and assessed aquatic sampling points

Aquatic Sampling Point	Upstream	Downstream
Mat 01 (Sefathlane River)		
Mat 02 (Lesobeng River)		
Mat 03 (Sefathlane River after confluence with Lesobeng River)		

11. Impact Assessment

The impact assessment considered the impacts that may result in the proposed opencast mining of Vanadium, Titanium and Iron Ore. The following potential activities and potential impacts are expected:

The aquatic impact assessment includes the following:

- Assess impacts of ongoing and proposed activities on aquatic resources within the Project area;
- Assess whether proposed activities are likely to have significant impacts on aquatic resources;

- Identify practically implementable mitigation measures to reduce the significance of proposed activities on aquatic resources; and
- Assess residual and cumulative impacts after implementation of mitigation measures.

The proposed project will not pose direct impacts to the aquatic water resources identified. The project will; however, pose potential indirect impacts to the watercourses. The description of potential impacts is described in the following sections.

11.1 Impacts of the Construction Phase

11.1.1 Impact Description

The impacts during the construction phase will be brought about by the site clearing and establishment activities. The expected impacts during the construction phase are:

- Sedimentation as a result of bare areas of soil;
- Disturbance of watercourse channels and sedimentation;
- Pollution of water resources as result of hydrocarbon spills;
- Physical alteration of riparian habitat;
- Alteration of aquatic habitat through increased flow and water level;
- Modification to stream morphology due to increased flow and runoff (i.e. increased erosion / sedimentation and bank instability);
- Use of contaminants/ substances harmful to aquatic biota entering the downstream reaches during construction - Increasing the toxicity of the associated water leading to loss of aquatic biota sensitive to physiochemical changes;
- Increased impermeable surface area

11.1.2 Management Objectives

The objective of management measures is to ensure that the potential impacts to the watercourses are minimised as far as possible and that no undue harm to the aquatic habitat takes place as a result of development.

11.1.3 Impact Ratings

The ratings for the impacts during the construction phase are presented in

Table 11-1.

Table 11-1: The impact ratings and mitigation measures for impacts during the construction phase

Activity	Impact Description	BEFORE MITIGATION SIGNIFICANCE	Mitigation measures / Recommendations	AFTER MITIGATION SIGNIFICANCE
Site clearance for establishment of access roads, infrastructure and pit area	Sedimentation as a result of bare areas of soil	Medium	Sediment trapping berms Stormwater management plans Dry season construction	Low
Establishment or access roads and crossings structures	Disturbance of watercourse channels and sedimentation	Low	Upgrade existing roads and causeways Dry season construction	Low
Hydrocarbon spills	Pollution of water resources as result of hydrocarbon spills	Low	Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area Vehicle maintenance and inspection daily Spill kits must always be available and ready on-site	Low

11.2 Impacts of the Operational Phase

11.2.1 Impact Description

The impacts during the operational phase will be brought about by the operation of the mine, access roads and associated activities. The expected impacts during the operational phase are:

- Vehicular movement and sedimentation;
- Pollution of water resources as a result of mine waste;
- Pollution of water resources as result of hydrocarbon spills;
- Aquatic species may be poisoned thus resulting in death (in the localised area) or movement away from the site. This may influence the ability of the aquatic species from breeding successfully as the lack of breeding species may disrupt upstream and downstream populations. Changes to Dissolved Oxygen (DO) and Total Dissolved Solids (TDS) as a result of a reduction in aquatic plants may detrimentally impact on invertebrate and vertebrate species. However, these impacts are very unlikely.

11.2.2 Management Objectives

The objective of management measures is to ensure that the potential impacts to the watercourses are minimised as far as possible and that no undue harm to the aquatic habitat takes place as a result of development.

11.2.3 Impact Ratings

The ratings for the impacts during the operational phase are presented in Table 11-2.

Table 11-2: The impact ratings and mitigation measures for impacts of the operational phase

Activity	Impact Description	BEFORE MITIGATION SIGNIFICANCE	Mitigation measures / Recommendations	AFTER MITIGATION SIGNIFICANCE
Operation of mine and access roads	Vehicular movement and sedimentation	Medium	Sediment trapping berms Stormwater management plans	Low
Operation of mine and access roads	Pollution of water resources as a result of mine waste	Medium	Implement Integrated Waste Water Management Plan Aquatic biomonitoring	Medium
Operation of mine and access roads	Pollution of water resources as result of hydrocarbon spills	Medium	Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area Vehicle maintenance and inspection daily Spill kits must always be available and ready on-site	Low

11.3 Impacts of the Closure and Rehabilitation Phase

11.3.1 Impact Description

Impacts during the closure and rehabilitation phase will be brought about by the activities relating to the removal of infrastructure, closing and sealing-off of pits and the final landscape shaping and revegetation. The expected impacts during the closure and rehabilitation phase are:

- Sedimentation as a result of bare areas of soil
- Pollution of water resources as result of hydrocarbon spills

11.3.2 Management Objectives

The objective of management measures is to ensure that the potential impacts to the watercourses are minimised as far as possible and that no undue harm to the aquatic habitat takes place as a result of development.

11.3.3 Impact Ratings

The ratings for the impacts during the closure phase are presented in Table 11-3.

Table 11-3: The impact ratings and mitigation measures for the closure phase

Activity	Impact Description	BEFORE MITIGATION SIGNIFICANCE	Mitigation measures / Recommendations	AFTER MITIGATION SIGNIFICANCE
Shaping of landscape	Sedimentation as a result of bare areas of soil	Medium	Sediment trapping berms Stormwater management plans Dry season working Aquatic biomonitoring	Low
Vehicular and machinery movement	Pollution of water resources as result of hydrocarbon spills	Medium	Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area Vehicle maintenance and inspection daily Spill kits must always be available and ready on-site	Low

11.4 Impacts of the Post-Closure Phase

11.4.1 Impact Description

The post-closure phase consists primarily of the monitoring of the water resources after the final rehabilitation and impacts will likely be:

- Monitoring the (improving) health of water resources.

11.4.2 Management Objectives

The objective of management measures is to ensure that in the post-mining environment the aquatic resources are not continually degraded as a result of the previous mining activities. The monitoring will alert of any residual impacts of the mining operation after rehabilitation.

11.4.3 Impact Ratings

The ratings for the impacts during the closure phase are presented in Table 11-4.

Table 11-4: The impact ratings and mitigation measures of the closure phase

Activity	Impact Description	BEFORE MITIGATION SIGNIFICANCE	Mitigation measures / Recommendations	AFTER MITIGATION SIGNIFICANCE
Monitoring of rehabilitation	Improving the health of water resources	Low (+)	Implement rehabilitation biomonitoring plan and remedy actions	Low (+)

11.5 Unplanned Events

The planned activities will have known impacts as discussed above; however, unplanned events may occur on any project and may have potential impacts which will need mitigation and management. Table 39 is a summary of the findings from an aquatic ecology perspective.

Please note not all potential unplanned events may be captured herein and this must therefore be managed throughout all phases.

Table 11-5: Unplanned Events, Low Risks and their Management Measures

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spill into riverine habitat	Contamination of sediments and water resources associated with the spillage.	A spill response kit must be available at all times. The incident must be reported on and if necessary a wetland specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Uncontrolled erosion	Sedimentation of downstream river reach.	Erosion control measures must be put in place.
PCD overflow	The degradation of downstream water quality.	The overflow must be stopped immediately, and the impacted area remediated. Spill protection berms must be in place as well.

11.6 Cumulative Impacts

Cumulative impacts are contextual and encompass a broad spectrum of impacts at different spatial and temporal scales (IFC, 2013) i.e. cumulative impacts can result from individually minor but collectively significant activities taking place over a period of time (Dutta, *et al*., 2012). These are not new types of impacts but recognition that impacts from individual projects and activities can combine together in time and space. In some cases, cumulative impacts occur because a series of projects of the same type are being developed. In other cases, cumulative impacts occur from the combined effects over a given resource of a mix of different types of projects; for example, the development of a manufacturing site, access roads, transmission lines, and other adjacent land uses.

Even with extensive mitigation, significant latent impacts on the receiving aquatic ecological environment are deemed likely. The following points highlight the key latent impacts that have been identified:

- Disturbance of ecologically sensitive aquatic habitats and downstream areas;
- Sedimentation of aquatic habitat;
- Deterioration of water quality of the aquatic resources;
- Alteration of aquatic habitat.

11.7 Mitigation

The mitigation actions provided below are important to consider with other specialist assessment which include but are not limited to the following specialist studies: Groundwater, Surface Water and Wetlands. These mitigation measures should be implemented in the Environmental Management Plan (EMP) should the proposed Matai Mining Project go-ahead.

The mitigation hierarchy is international best practice for managing risks and impacts, and is listed by the International Finance Corporation (IFC) as the primary objective of Performance Standard 1 as follows: "To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment." This mitigation hierarchy is represented in Figure 4.

Figure 4: The mitigation hierarchy

The mitigation hierarchy is now widely accepted as an approach for biodiversity conservation for sustainable development. To comply with the International Finance Corporation's (IFC) Performance Standard 6 for Biodiversity Conservation and Sustainable Management of Living Natural Resources, and the performance

standards of several other multilateral finance institutions, a project proponent must develop and verify the implementation of a mitigation hierarchy that complies with the Standard.

- Avoidance includes activities that change or stop actions before they take place, in order to prevent their expected negative impacts on biodiversity and decrease the overall potential impact of an operation. For example, adjusting the location, scope or timing of a development could avoid negative impacts to a vulnerable species or sensitive ecosystem. Avoidance not only makes good business sense, for example by reducing later steps in the mitigation hierarchy, but is imperative for protecting the integrity of valuable and threatened biodiversity and ecosystem services.
- Minimisation measures are taken to reduce the duration, intensity, extent and/or likelihood of impacts that cannot be completely avoided. An example of a minimisation measure would be improvement to the quality treatment of water outflows from mining areas, thereby reducing impacts on aquatic systems.
- Restoration involves altering an area in such a way as to re-establish an ecosystem's composition, structure and function, usually bringing it back to its original (pre-disturbance) state or to a healthy state close to the original.3 This is a holistic process aiming to return an ecosystem to a former natural condition and to restore ecological function. Restoration is preferred to rehabilitation which implies putting the landscape to a new or altered use to preserve a particular human purpose. Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development and persisting after appropriate avoidance, minimisation and restoration measures have been taken.
- Biodiversity offsets are effectively a 'last resort'. A biodiversity offset should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity; however, a net gain is required in critical habitats – habitats with high biodiversity value, as defined by the IFC.

A graphical representation of the mitigation hierarchy is illustrated in Figure 11-5.

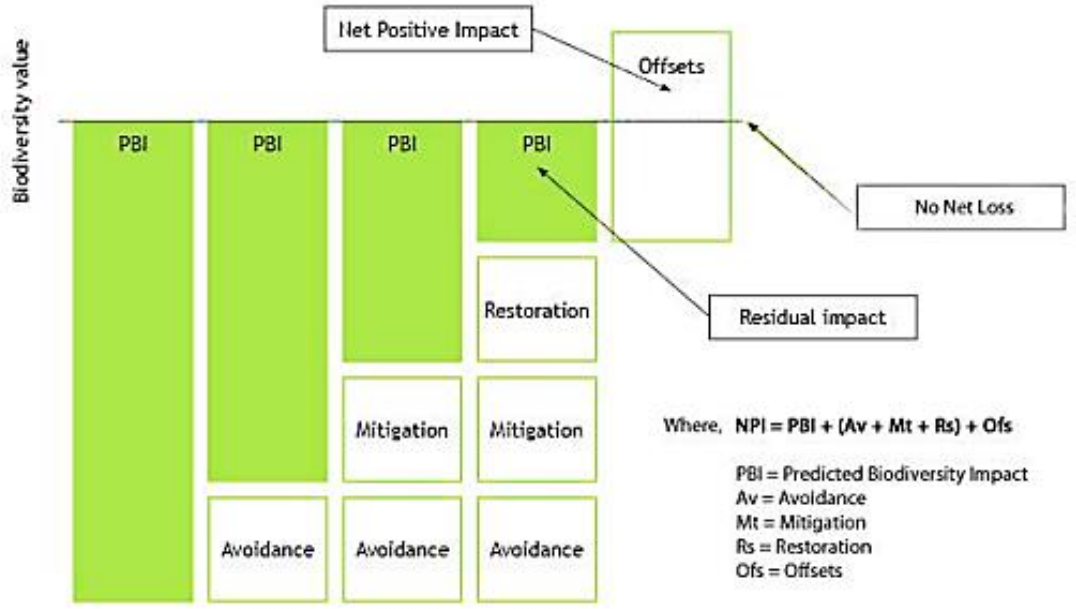


Figure 11-5: A graphical representation of the mitigation hierarchy

Mitigation measures for the proposed development are thus categorized according to the mitigation hierarchy as follows:

11.7.1 Avoidance

Some of the impacts can be avoided this may be achieved by, for example:

- Placing sediment trapping berms;
- Implementing a stormwater management plan with purpose to re-use the water for dust suppression.

11.7.2 Minimization

Impacts that cannot be avoided can be minimized; such mitigation measures include the following, for example:

- Construction taking place in dry season; and
- Maintaining as small a footprint as possible.

11.9.1 Restoration

Affected watercourse areas must rehabilitated to maintain functionality. The banks of rivers and streams are often susceptible to collapse and must be monitored and reinforced if needed.

11.9.2 Offsets

Considering that areas will be lost as a direct result of the development, as well as the possible impacts to the water resources, it is recommended that offsets be considered. Offsets will ensure Net Positive Impact on

Aquatic Biodiversity for the project. As discussions are underway for the Matai Mining development of a trust that will ensure conservation of the site, offsets have effectively been taken into consideration. This could potentially result in an overall positive impact on biodiversity as a result of the development.

The following are considered as offsets for the proposed project:

- The rehabilitation of collapsed and eroded banks of watercourses throughout the project area;
- The removal of alien invasive plant species within the riparian zones and instream zones of the water resources; and
- Revegetation and restoration of areas in proximity to the watercourses.

11.8 Recommendations for Ensuring Application of Mitigation Measures

In line with the prevention component of this study, it is proposed that two additional studies are completed for the proposed Matai Mining Project.

It is recommended that an Erosion Risk Assessment and Management Plan is completed and implemented to derive the areas at highest risk for erosion. These high risk areas should then be key points for erosion management.

The establishment of a clearly marked buffer zone, which is defined as a region of natural vegetation between the rivers/wetlands and the proposed activity, is the primary management action that should take place. Literature suggests that a buffer zone can reduce aquatic habitat and water quality impacts of large developments, making this management action of particular importance (WRC, 2014). According to WRC (2014) the efficacy of a buffer is related to the distance between the river system and the zone of disturbance. Therefore, by increasing the length of a buffer, the potential aquatic modification related to the proposed activity is reduced.

During the various phases of the proposed project, waste generated and stored can result in the runoff and seepage of contaminated water from the various activities which can cause degradation of the aquatic ecosystems PES. In order to prevent this, the compilation of a stormwater management plan is advised, this would typically form a component of the surface water assessment. The use of diversion and containment management is of significant importance. This can be achieved through effective groundwater and surface water management.

- Diversion trench and berm systems which diverts clean storm water around pollution sources and convey and contain dirty water to central pollution control impoundments;
- Barrier systems, including synthetic, clay and geological liners or other approved mitigation methods to minimise contaminated seepage and runoff from entering the local aquatic systems;

- Where storm water enters river systems from disturbed sites, sediment and debris trapping, as well as energy dissipation control measures must be put in place; and
- The planting of indigenous vegetation around pollution control impoundments and structures should be completed as this has been shown to be effective in erosion and nutrient control.

The construction of linear infrastructure such as roadways and conveyor systems should consider the following mitigation actions when encountering wetland systems and watercourses:

- No crossings over riffle/rapid habitats. These should be avoided as these are the most sensitive; slow deep/shallow habitats should be favoured;
- The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation;
- Structures must not be damaged by floods exceeding the magnitude of those which may occur on average once in every 50 years;
- The indiscriminate use of heavy vehicles and machinery within the instream and riparian habitat will result in the compaction of soils and vegetation and must be controlled;
- Erosion prevention mechanisms such as gabions must be employed to ensure the sustainability of all structures to prevent instream sedimentation;
- The crossing points should be unobtrusive (outside riparian and instream habitat) to prevent the obstruction and subsequent habitat modification of downstream portions;
- Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff;
- Soils adjacent to the river that have been compacted must be loosened to allow for germination;
- Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river; and
- A structure should be in place to capture any spillage under the conveyor, especially where this interacts with the watercourse.

The removal of vegetative cover, as well as the construction of roads has been recognised as being responsible for increased runoff, sedimentation and subsequent water and habitat quality degradation in downstream portions of river systems (WRC, 2014). As such the careful management of vegetation removal and sedimentation control should take place. This can be achieved through the brief points below:

- Minimise the removal of vegetation in the infrastructure footprint area;
- Re-vegetation of the construction footprint as soon as possible;
- Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place;
- Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow;
- Sequential removal of the vegetation (not all vegetation immediately); and

- The vegetation of unpaved roadsides.

During the operational phase of the proposed Matai Mining Project, the storage and handling of carboniferous material can result in the degradation of downstream aquatic ecosystems. To prevent this, the use of diversion and containment management is of importance. This can be achieved through effective groundwater and surface water management as per the surface and groundwater studies; however important management actions are briefly listed below:

- Diversion trench and berm systems which diverts clean storm water around pollution sources and convey and contain dirty water to central pollution control impoundments;
- Barrier systems, including synthetic, clay and geological or other approved mitigation methods to minimise contaminated seepage and runoff from stockpiles and pollution control facilities from entering the local aquatic systems;
- Where storm water enters river systems from disturbed sites, sediment and debris trapping, as well as energy dissipation control measures must be put in place; and
- The planting of indigenous vegetation around pollution control impoundments and structures should be completed as this has been shown to be effective in erosion and nutrient control.

It is vital that mitigation measures are applied as recommended (based on practicality and cost effectiveness). This can be achieved with a series of plans assuring the process to be followed for monitoring and application of mitigation measures. Plans recommended for the proposed Matai Mining development are as follows:

- Stormwater Management Plan;
- An additional low flow survey to assess temporal trends;
- An aquatic biomonitoring plan;
- A rehabilitation plan detailing the methods used for the rehabilitation of areas cleared for construction but not required for operation of the development; and
- An offset plan should be developed should the proponent wish to demonstrate a net gain of biodiversity for the proposed Matai Mining Project.

It is further recommended that all such plans be included in an overall Biodiversity Action Plan or BAP (optional) as is usually required for IFC projects to meet international best practice. Such a plan will allow for centralization of biodiversity-related mitigation actions with associated responsibility assignations and monitoring.

12. Environmental Management Plan

The aims and objectives of the Environmental Management Plan (EMP) are:

- To provide a detailed action plan for the implementation of the recommendations made in the impact assessment report;
- To provide goals and targets for environmental control that are measurable and auditable;
- To provide a basis on which the prospective contractor can accurately price for environmental management in his tender document;
- To specify particular roles, responsibilities and time scales;
- To provide a basis for monitoring compliance; and
- To provide a site management tool.

12.1 Project Activities with Potentially Significant Impacts

In summary, the impacts of the development on the aquatic ecology are primarily related to the potential erosion and sedimentation of water resources. This may modify the habitat within the water resources and have an adverse effect on the aquatic species in the area. Furthermore, the impacts of erosion and sedimentation will not be localised and my affect downstream areas.

12.2 Summary of Mitigation and Management

Table 12-1 provides a description of the mitigation and management options for the environmental impacts anticipated during the construction, operations and closure and rehabilitations phases on the fauna and flora.

Table 12-1: The summary of impacts and mitigation measures for the aspects of the proposed project

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Site clearance for establishment of access roads, infrastructure and pit area	Sedimentation as a result of bare areas of soil	Aquatics	C	Sediment trapping berms Stormwater management plans Dry season construction	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	Prior to commencement of activities and throughout
Establishment or access roads and crossings structures	Disturbance of watercourse channels and sedimentation	Aquatics	C	Upgrade existing roads and causeways Dry season construction	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	Prior to commencement of activities and throughout

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Hydrocarbon spills	Pollution of water resources as result of hydrocarbon spills	Aquatics	C	Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area Vehicle maintenance and inspection daily Spill kits must always be available and ready on-site	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	Prior to commencement of activities and throughout
Operation of mine and access roads	Vehicular movement and sedimentation	Aquatics	O	Sediment trapping berms Stormwater management plans	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	Prior to commencement of activities and throughout

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Operation of mine and access roads	Pollution of water resources as a result of mine waste	Aquatics	O	Implement Integrated Waste Water Management Plan Aquatic biomonitoring	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	Throughout
Operation of mine and access roads	Pollution of water resources as result of hydrocarbon spills	Aquatics	O	Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area Vehicle maintenance and inspection daily Spill kits must always be available and ready on-site	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Shaping of landscape	Sedimentation as a result of bare areas of soil	Aquatics	C&R	Sediment trapping berms Stormwater management plans Dry season working Aquatic biomonitoring	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	Throughout
Vehicular and machinery movement	Pollution of water resources as result of hydrocarbon spills	Aquatics	C&R	Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area Vehicle maintenance and inspection daily Spill kits must always be available and ready on-site	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	Throughout

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Monitoring of rehabilitation	Improving the health of water resources	Aquatics	P-C		National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 National Water Act (NWA). 2016. Act 36 of 1998	Throughout

C: Construction Phase
O: Operational Phase
C&R: Closure and Rehabilitation Phase
P-C: Post-Closure Phase

13. Monitoring Requirements

The main aims of compliance monitoring by the authorities are to:

- Evaluate the adherence by the contractors and developer to the conditions attached to the letter of authorisation;
- To check compliance with the Environmental Management Plan (EMP) and any other legal requirements referred to in the letter of authorisation;
- To assess the contractor's and applicant's effectiveness in implementing the conditions of authorisation and the EMP; and
- To recommend how and where improvements could be made to ensure compliance, enhance environmental performance and promote sustainability of the development.

The biomonitoring program should be initiated pre-construction and continue through construction thereafter conducted annually during the growing season as close to the same time of year as possible. If the monitoring results indicate the additional presence of red data species, or threatened species, this may require the need to undergo monitoring for that particular species more frequently, especially during the breeding season and birthing season for that species.

Monitoring will include sites in the undisturbed vegetation which will act as control plots, plots within the disturbed infrastructure areas which will have baseline data and then be monitored during the rehabilitation phase. These same plots will be monitored with each survey to ensure collected data is comparable and trends are identified. Where rehabilitation has been conducted, additional plots will be included to monitor the effectiveness of the re-vegetation.

Aspects that will be monitored in the annual surveys will include, species richness, vegetation composition i.e. proportion grasses, forbs and woody species, canopy height, cover percentage, presence of Red Data or protected species, and presence of alien invasive species.

13.1 Monitoring Plan

The aquatic biomonitoring program should be initiated pre-construction and continue through construction thereafter conducted bi-annually during the wet season (November to March) and the dry season (April to July) as close to the same time of year as possible. Should the monitoring results indicate negative alterations to the baseline results, these must be addressed immediately to prevent further degradation of the aquatic systems.

The biomonitoring plan must utilise the same points as the baseline assessment so as to maintain consistency. Based on the results of this assessment a full aquatic assessment, to be conducted by a qualified specialist, may be required prior to commencement of any activities.

14. Recommendation/ Opinion of the Specialist

Considering the status of the aquatic ecosystems, and furthermore the nature and requirements of the project, the proposed layout would not constitute a significant risk to local aquatic ecology. The impacts as described, rated and mitigated in this Report does not pose a risk to large natural areas of Very High sensitivity, neither is SSC with restricted ranges being threatened with destruction. All aquatic habitat and species present on site that could be affected by the activities could not be quantified due to the climate conditions in the area. Furthermore, the proposed infrastructure areas and pit area will not directly affect any water resources identified in this report as all proposed infrastructure and the pit will be beyond the aquatic habitats with a significant buffer zone (over 150m). With firm adherence to the mitigation measures prescribed in this Report, the impacts have been rated as acceptable and it is the opinion of the specialist the proposed Matai Mining Project may proceed.

15. Consultation Undertaken

The consultation process affords Interested and Affected Parties (I&APs) opportunities to engage in the EIA process. The objectives of the Stakeholder Engagement Process (SEP) include the following:

- To ensure that the I&APs are informed of the Project;
- To provide the I&APs with an opportunity to engage and provide comment on the Project;
- To draw on local knowledge by identifying environmental and social concerns associated with the Project;
- To involve the I&APs in identifying methods in which concerns can be addressed;
- To verify stakeholder comments have been recorded accurately; and
- To comply with legal requirements.

No comments relating to fauna and flora were received during the SEP undertaken during the original EIA process.

16. Conclusion

The identified watercourses associated with the Matai project area have no freshwater priority areas designated to them. The A24E-00642 SQR (Sefathlane) and A24E00688 (Lesobeng) directly associated with the Matai Project area span 35.03 km and 25.04 km of the Sefathlane and Lesobeng Rivers, respectively. The desktop Present Ecological State (PES) of the Sefathlane river reach is a class C (moderately modified), Ecological Sensitivity (ES) and Ecological Importance (EI) are rated as high. The desktop Present Ecological State (PES) of the Lesobeng river reach is a class B (Largely natural), Ecological Sensitivity (ES) and Ecological Importance (EI) are rated as high.

Anthropogenic impacts identified within the sub-quaternary catchment included road crossings (causeways), irrigation for rural villages, subsistence farming, over-grazing which results in erosion and sediment deposition. There were nine (9) fish species that were expected within the project area. None of the expected fish species were of conservation concern.

A field assessment was conduct over two surveys in December 2018 and January 2019. Three (3) aquatic sampling points were selected for the assessment namely Mat 01, Mat 02 and Mat 03. Mat 01 was on the Sefathlane River, Mat 02 was on the Lesobeng River and Mat 03 was on the Sefathlane River after the confluence with the Lesobeng River. Sampling points Mat 01 and Mat 03 were determined to be dry and could not be assessed. Sampling point Mat 02 was determined to hold a little water; however, could not be sampled as the watercourse presented wetland features and did not meet the minimum requirements for an aquatic survey

The impact assessment identified several impacts to the aquatic resources as a result of the proposed project; however, all the impacts were indirect impacts. The impacts during the construction phase will be brought about by the site clearing and establishment activities. The impacts during the construction phase were considered to medium to low pre-mitigation and low after mitigation. The impacts are considered low as the aquatic health of the water resources could not be determined, there are no direct impacts and mitigation measures further reduce the impact rating.

The impacts during the operational phase will be brought about by the operation of the mine, access roads and associated activities and are expected to be long term. The impact of water resources pollution from the resultant mining waste was considered to be medium impacts pre-mitigation and post-mitigation. Although the impacts are indirect, the impacts will be prolonged and may cause significant contamination to water resources, they are considered a medium impact.

Impacts during the closure and rehabilitation phase will be brought about by the activities relating to the removal of infrastructure, closing and sealing-off of pits and the final landscape shaping and vegetation. The impacts were considered medium impacts pre-mitigation and medium to low post-mitigation. The rehabilitation will most likely result in increased sediment loads; however, the mitigation measures will ensure that sedimentation of

water resources is minimised as far as possible. The post-closure phase consists primarily of the monitoring of the final rehabilitation and remedying of any issues identified. The impacts are viewed as positive low impacts with and without mitigation. The post-closure monitoring will aid in the identification of issues that may exist after the final rehabilitation.

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Appendix A: Specialist CV

Ndumiso Dlamini

BSc Hons Botany (Pri. Sci. Nat.)

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Profile Summary

Experience with mining projects in South Africa, parts of Africa and providing specialist input into ESHIAs and EMPs.

Specialist guidance, support and facilitation for the compliance with legislative processes, in South Africa as well as with IFC

Provide specialist and technical input for faunal, terrestrial (fauna and flora) ecology and wetland studies.

Areas of Interest

Renewable Energy and Urban & Infrastructure Development Projects, Sustainability and Conservation.

Rehabilitation of Wetlands and Land

Conservation of Water Resources

Publication of scientific journals and articles.

Key Experience

- Familiar with International Finance Corporation requirements
- Environmental, Social and Health Impact Assessments (ESHIA)
- Environmental Management Programmes (EMP)
- Ecological Water Requirement determination experience
- Wetland Ecological Assessments
- Fauna and Flora Assessments
- Biodiversity Assessments
- Protected Plant Relocation
- Wetland Rehabilitation
- Mine Rehabilitation
- Monitoring Programmes

Countries worked in

South Africa

Malawi

Mozambique

Zambia

Nationality

South African

Qualifications

- BSc Honours (University of Johannesburg) – Botany
- BSc Life and Environmental Science
- Tools for a Wetland Assessment (Certificate of Competence) – Rhodes University 2015
- Wetland Rehabilitation (Certificate of Competence) – University of Free Sate 2015

RELEVANT PROJECT EXPERIENCE

Project Name: The Baseline Environmental Assessment and Rehabilitation of Anker Coal Mining Operation (Golfview and Elandsfontein Operations)

Client: Anker Coal

Personal position / role on project: Terrestrial Ecology Specialist and Wetland Rehabilitation

Location: Ermelo, South Africa (2015).

Main project features: To identify and map the ecological factors and provide input and guidance for the rehabilitation of wetland areas and to support contractor activities.

Project Name: Environmental Studies for the Liwonde Dry Port

Client: Mota Engil.

Personal position / role on project: Terrestrial Ecology specialist.

Location: Liwonde, Malawi (2015).

Main project features: To determine the current status of the environment and assess potential risks to the environment.

Project Name: The relocation and post-relocation monitoring of *Khadia carolinensis* plants at the Exxaro Eerstelingsfontein Coal Mine.

Client: Exxaro.

Personal position / role on project: Botanist.

Location: Belfast, South Africa (2014 – 2015).

Main project features: Determine suitable relocation habitat for plants and monitor the success of the relocation of the plants.

Project Name: Wetland Impact Assessment for the Northern Coal Jagust Colliery

Client: Northern Coal

Personal position / role on project: Wetland Specialist.

Location: Carolina, South Africa (2015).

Main project features: Delineate and assess the health of wetland areas and provide mitigation measures for potential impacts on wetland areas.

Project Name: Environmental Impact Assessment for the Ixia Imvula Opencast Coal Mine

Client: Ixia Coal.

Personal position / role on project: Wetland Specialist

Location: Secunda, South Africa (2015 – 2016).

Main project features: Conduct a wetland delineation and impact assessment for the proposed opencast mine and river diversion.

Project Name: Water Resource Risk Assessment for several infrastructure development projects (Pipelines, Roads, Residential and Commercial Housing)

Client: Department of Roads and Transport, Various Municipalities

Personal position / role on project: Wetland Specialist.

Location: KwaZulu-Natal, Gauteng, Limpopo, South Africa (2016 – 2018).

Main project features: Delineate and assess the health of wetland areas and provide mitigation measures for potential impacts on wetland areas.

OVERVIEW

An overview of the specialist technical expertise includes the following:

- Conducting onsite investigations of Flora, Fauna and Wetlands;
- Conducting research on ecology and compile technical reports;
- Conduct assessments for rehabilitation of wetlands, compile reports and monitor the progress of rehabilitation of wetlands;
- Conduct and complete Alien Invasive Plant Management Plans;
- Project and budget management;
- Proposal compilation and client liaison;
- Compile integrated biodiversity reports; and
- Complete legislative and regulatory authorisation processes for various projects, which include Environmental Impact Assessments, Basic Assessments and Water Use License Applications, Environmental Management Plans and consult with state departments on legal frameworks.

TRAINING

Some of the more pertinent training undergone include the following:

- Tools for Wetland Delineation Course (Certificate of Competence) – Rhodes University 2015
- Wetland Rehabilitation Methods and Techniques – University of Free State 2015
- Alien Invasive Species Identification and Management – 2016
- Grass Identification – 2017 Land-Use Management Training

EMPLOYMENT EXPERIENCE

EMPLOYMENT: Niara Environmental Consultants (December 2016 – Present)

I was employed as the Ecology Lead Specialist and tasked management of the unit and with providing specialist input into Environmental Impact Assessments and other biodiversity projects. Key focus areas included:

- Wetland Assessments;
- Wetland Rehabilitation;
- Fauna and Flora Assessments;
- Alien Invasive Plant Management; and
- Biodiversity Assessments.

PREVIOUS EMPLOYMENT: The Biodiversity Company (March 2016 – October 2018)

I am currently employed with The Biodiversity Company as an Environmental Consultant. My key responsibilities are to conduct specialist studies of Wetland Assessments, Ecological Assessments and Biodiversity Assessments. Key focus areas include:

- Wetland and Riparian Assessments;
- Wetland Rehabilitation;
- Vegetation Assessments;
- Alien Invasive Plant Management; and
- Biodiversity Assessments.

PREVIOUS EMPLOYMENT: Digby Wells Environmental (May 2014 – February 2016)

I was employed in role of Junior Ecologist and was tasked with providing specialist input into Environmental Impact Assessments and other biodiversity projects. Key focus areas included:

- Wetland Assessments;
- Wetland Rehabilitation;
- Fauna and Flora Assessments;
- Alien Invasive Plant Management; and
- Biodiversity Assessments.

PREVIOUS EMPLOYMENT: University of Pretoria – Genetics Department

- October 2012 – April 2014: Junior Genetic Researcher
  - Researcher
  - Technical assistant for fieldwork
  - Reporting writing
  - Project management

GENERAL SKILLS

Literacy	Read, write and speak English fluently. Read, write and speak Afrikaans. Read, write and speak IsiZulu fluently. Speak and understand other indigenous South African languages.
Generic	Advanced user of Microsoft Office applications.
Mapping	Introductory skill level for ArcGIS and Quantum GIS.

ADDITIONAL EXPERIENCE

Control officer	Acting as an independent Environmental Control Officer (ECO), acting as a quality controller and monitoring agent regarding all environmental concerns and associated environmental impacts
Public consultation	The provision of specialist input in order to communicate project findings as well as assist with providing feedback if and when required.
Water use licenses	Consultation with the relevant authorities in order to establish the project requirements, as well as provide specialist (aquatics/wetland) input for the application in order to achieve authorisation.

ACADEMIC QUALIFICATIONS

University of Johannesburg (UJ), Johannesburg, South Africa (2011): BACCALAUREUS SCIENTIAE HONORIBUS (Hons) – Botany

University of Johannesburg (UJ), Johannesburg, South Africa (2008 - 2010): BACCALAUREUS SCIENTIAE IN LIFE AND ENVIRONMENTAL SCIENCES. Majors: Biochemistry and Botany.