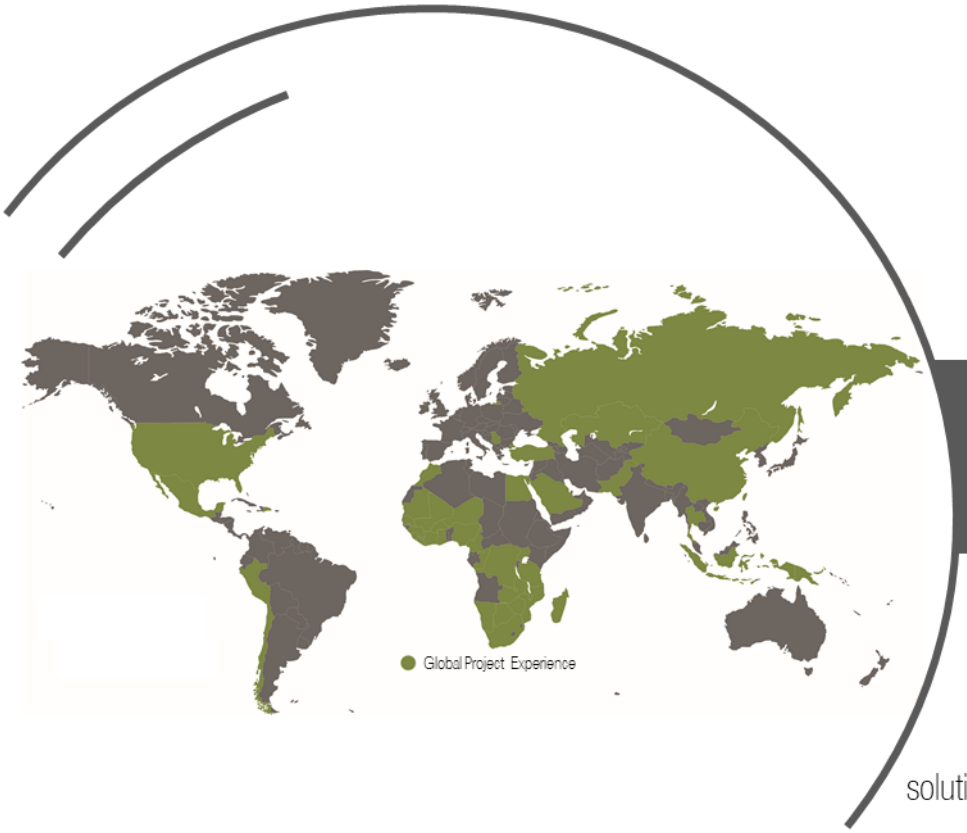

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Basic Assessment Process for the Construction of Pump Station and Pipeline for the Wollie se Gat Project

Wetland Environmental Impact Assessment

Prepared for:

Sasol Mining (Pty) Ltd Twistdraai Export Plant (TEP)

Project Number:

SAS6986

March 2021

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This document has been prepared by Digby Wells Environmental.

Report Type:	Wetland Environmental Impact Assessment
Project Name:	Basic Assessment Process for the Construction of Pump Station and Pipeline for the Wollie se Gat Project
Project Code:	SAS6986

Name	Responsibility	Signature	Date
Aamirah Dramat	Report Compiler		March 2021
Willnerie Janse van Rensburg	Report Compiler and Site Survey		March 2021
Stephen Burton	Reviewer		March 2021

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DETAILS AND DECLARATION OF THE SPECIALIST

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Qualification(s):	BSc. Honours Soil Science
Experience (years):	5
Registration(s):	SACNASP: 117870

I, Willnerie Janse van Rensburg, declare that: –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
    - I declare that there are no circumstances that may compromise my objectivity in performing such work;
    - I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and

- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

March 2021

Signature of the Specialist *Date*

Findings, recommendations and conclusions provided in this report are based on the best available scientific methods and the author's professional knowledge and information at the time of compilation. Digby Wells employees involved in the compilation of this report, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.

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Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. Whenever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

EXECUTIVE SUMMARY

Sasol Mining (Pty) Ltd Twistdraai Export Plant (TEP) appointed Digby Wells Environmental (Digby Wells) to conduct a Wetland Impact Assessment to form part of a Basic Assessment (BA) Process to obtain an Environmental Authorisation (EA) for the Twistdraai Export Plant (TEP) operation near Secunda, Mpumalanga province. The Project Area focused on the demarcated area for the newly proposed pipeline from Wollie se Gat to the solution trench at the Discard Dump.

The wetlands were assessed according to a previously conducted assessment done by Digby Wells (Digby Wells Environmental, 2019). The wetlands were desktop assessed and confirmed during a rapid site survey.

One Unchannelled Valley Bottom (UVB) was identified within the Project Area, however the Present Ecological State (PES), WET-EcoServices and Ecological Importance and Sensitivity (EIS) were re-calculated to allow for a comparison with the previous data. The PES and EIS of the wetland remained the same as the previous assessment. The PES was rated as **E** and the EIS as **Moderate**. The Ecosystem Services (ES) were not previously determined, however they were determined during this assessment as **Moderate**, with the main ecological services provided being flood attenuation, phosphate assimilation, nitrate assimilation, toxicant assimilation and education and research.

Recommendations to reduce the impacts on the UVB wetland include:

- Recreate wetland habitat after construction of the pipeline. Ensure proper landscaping, shaping and revegetation;
- Improved vegetation cover and establish hydrophytic plants and facultative hydrophytes that are native to the area. Reduced risk of erosion and sedimentation. If self-vegetation has not occurred in 3 months, re-seeding should be done;
- Reduced risk of erosion, compaction, and the creation of preferential flow paths. Maintain linear infrastructure such as roads; and
- Improved water quality and prevention of pollution. Prevent contaminated water entering the wetland. If spills or leakages from the pipe occur, it should be cleaned up immediately.

The impact assessment indicated that the proposed activities would have a minor to moderate effects on the wetland. The Project Area is currently heavily impacted by other land use activities and the proposed pipeline will therefore not have a large effect on the wetland, given the mitigation measures are followed.

Based on the impact assessment, it is the opinion of the specialist that this project will have minor impacts on the wetlands. The proposed pipeline will help remediate the current pollution within the wetland. The Project Area is heavily disturbed, and the proposed pipeline might rather have a positive effect on the wetland in the long-term. It is however important to follow the mitigation measures provided to ensure minimal impacts to the wetland.

A Rehabilitation Audit Programme, one year after the Rehabilitation Phase is complete, is recommended to ensure successful rehabilitation and to achieve the committed land use and sustainability of the wetlands after mining activities have ceased.

As the proposed Project Area is comprised largely of wetland habitat, it is recommended that the WET-Health and WET-EcoServices tools should be used to re-evaluate the PES and ES six months after the Construction Phase, and annually thereafter until the PES and ES are evaluated as to prior-construction.

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ACRONYMS, ABBREVIATIONS AND DEFINITION

°C	Degree Celsius
AIP	Alien Invasive Plant
CARA	The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
cm	Centimetre
CMA	Catchment Management Agencies
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
Digby Wells	Digby Wells Environmental
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation, previously Department of Water Affairs and Forestry (DWAF)
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EMPr	Environmental Management Program
EP	Environmental Practitioner
ES	Ecosystem Services
EWT	Endangered Wildlife Trust
FEPA	Freshwater Ecological Priority Area
ha	Hectare
HGM	Hydro-geomorphic
HDPE	High Density Polyethylene
IA	Impact Assessment
km	Kilometre
m	Metre
m.a.m.s.l.	Metres above mean sea level
MAP	Mean Annual Precipitation
MBSP	Mpumalanga Biodiversity Sector Plan
mm	Millimetre

MM	Mine Manager
MRA	Mining Right Area
NBA	National Biodiversity Assessment
NBF	National Biodiversity Framework
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEM:WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecological Priority Area
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PCD	Pollution Control Dam
PES	Present Ecological State
RBCT	Richards Bay Coal Terminal
RoM	Run of Mine
RWD	Return Water Dam
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
Sasol	Sasol Mining (Pty) Ltd
SCS	Sasol Coal Supply
SEP	Stakeholder Engagement Process
SFI	Soil Form Indicator
SSO	Sasol Synfuels Operation
SWI	Soil Wetness Indicator
TCTS	Twistdraai Colliery Thubelisha Shaft
TEP	Twistdraai Export Plant
TOPS	Threatened or Protected Species
TUI	Terrain Unit Indicator
UVB	Unchannelled Valley Bottom
WET-EcoServices	Wetland Ecological Services
WET-Health	Wetland Ecological Health Assessment
WRC	Water Research Commission
WUL	Water Use License

WULA	Water Use License Application
IWULA	Integrated Water Use License Application
WWF	Worldwide Fund for Nature

Legal Requirement		**Section in Report**
(1)	A specialist report prepared in terms of these Regulations must contain-	
(a)	details of- (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 4
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Before Introduction.
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
cA	And indication of the quality and age of the base data used for the specialist report;	Appendix A
cB	A description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7
(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 7
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of the equipment and modelling used;	Section ● and Appendix A
(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives;	Section 1
(g)	an identification of any areas to be avoided, including buffers;	Section 7
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 7
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 7
(k)	any mitigation measures for inclusion in the Environmental Management Programme (EMPr);	Section 9
(l)	any conditions/aspects for inclusion in the environmental authorisation;	Section 9

Legal Requirement		Section in Report
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 10
(n)	a reasoned opinion (Environmental Impact Statement) - whether the proposed activity, activities or portions thereof should be authorised; and if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 13
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 11
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q)	any other information requested by the competent authority.	

1. Introduction

Sasol Mining (Pty) Ltd Twistdraai Export Plant (TEP) appointed Digby Wells Environmental (Digby Wells) to conduct a Wetland Impact Assessment to form part of the Basic Assessment (BA) Process for the application of an Environmental Authorisation (EA) for the construction of a pump station and associated infrastructure (i.e., pump and pipeline through a wetland) at and from Wollie se Gat to the Twistdraai Export Plant (TEP) Fine Coal and Discard Facility. Wollie se Gat is an old quarry located in close proximity to Sasol Synfuels Operations (SSO), near Secunda, Mpumalanga province.

The Wetland Impact Assessment was undertaken as part of Appendix 6 of the EIA Regulations, 2014 (as amended) under the National Environmental Management Act (NEMA).

1.1. Project Locality

The Project Area falls under the jurisdiction of the Govan Mbeki Local Municipality, which is located in the Gert Sibande District Municipality, Mpumalanga Province as shown in Figure 1-1 and Figure 1-2. The Project Area is approximately 4 kilometres (km) south of Secunda, 8 km south-west of Trichardt and 10 km east of Embalenhle. The Bossiespruit Dam is located directly south of the Project Area.

The TEP is situated approximately 4 km south of Secunda within the secondary area of the Sasol SSO. The Project Area is focused on the direct area around the proposed pipeline, extending from Wollie se Gat to the cur-off trench at the Discard Dump. The proposed pipeline is approximately 380 meters (m) in length. The Project Area included a 500 m buffer zone around the pipeline (Figure 1-3).

Table 1-1: Summary of the Project Location Details

Province	Mpumalanga
District Municipality	Gert Sibande District Municipality
Local Municipality	Govan Mbeki Local Municipality
Nearest Town	Secunda (4 km), Trichardt (8 km), Embalenhle (10 km)
GPS Co-ordinates (relative centre point of study area)	26°33'28.85"S
	29°11'38.02"E

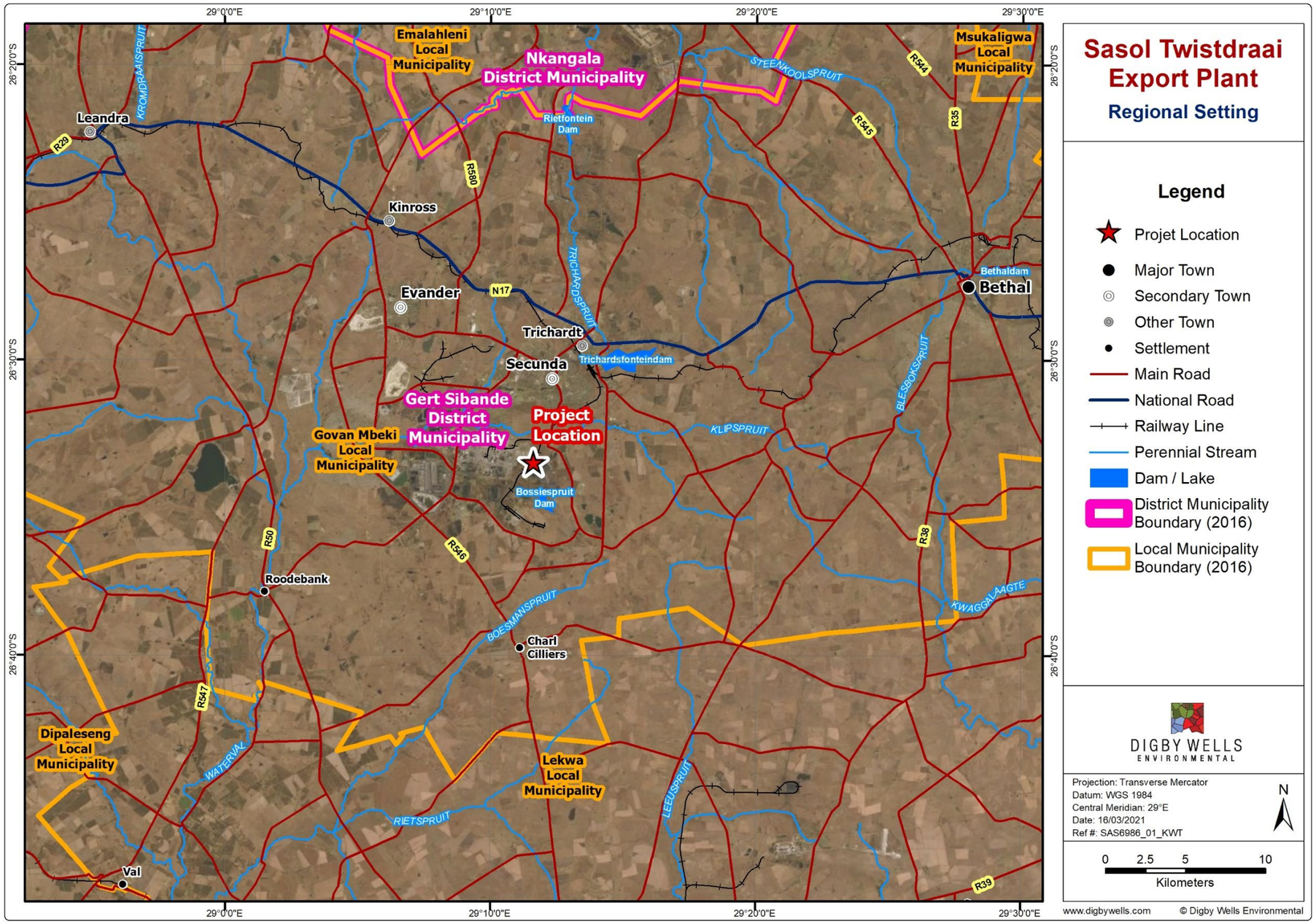


Figure 1-1: Regional Setting

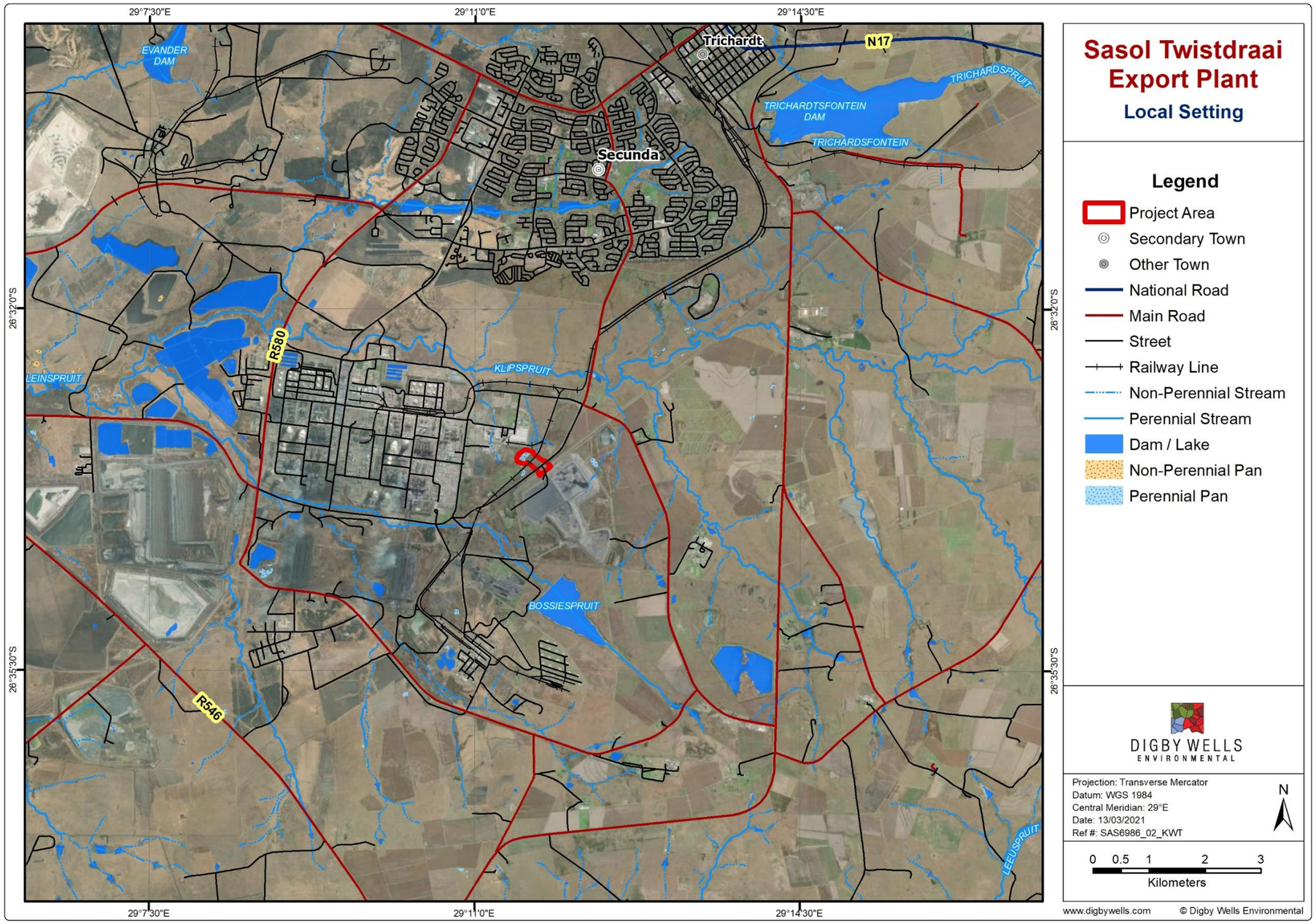


Figure 1-2: Local Setting

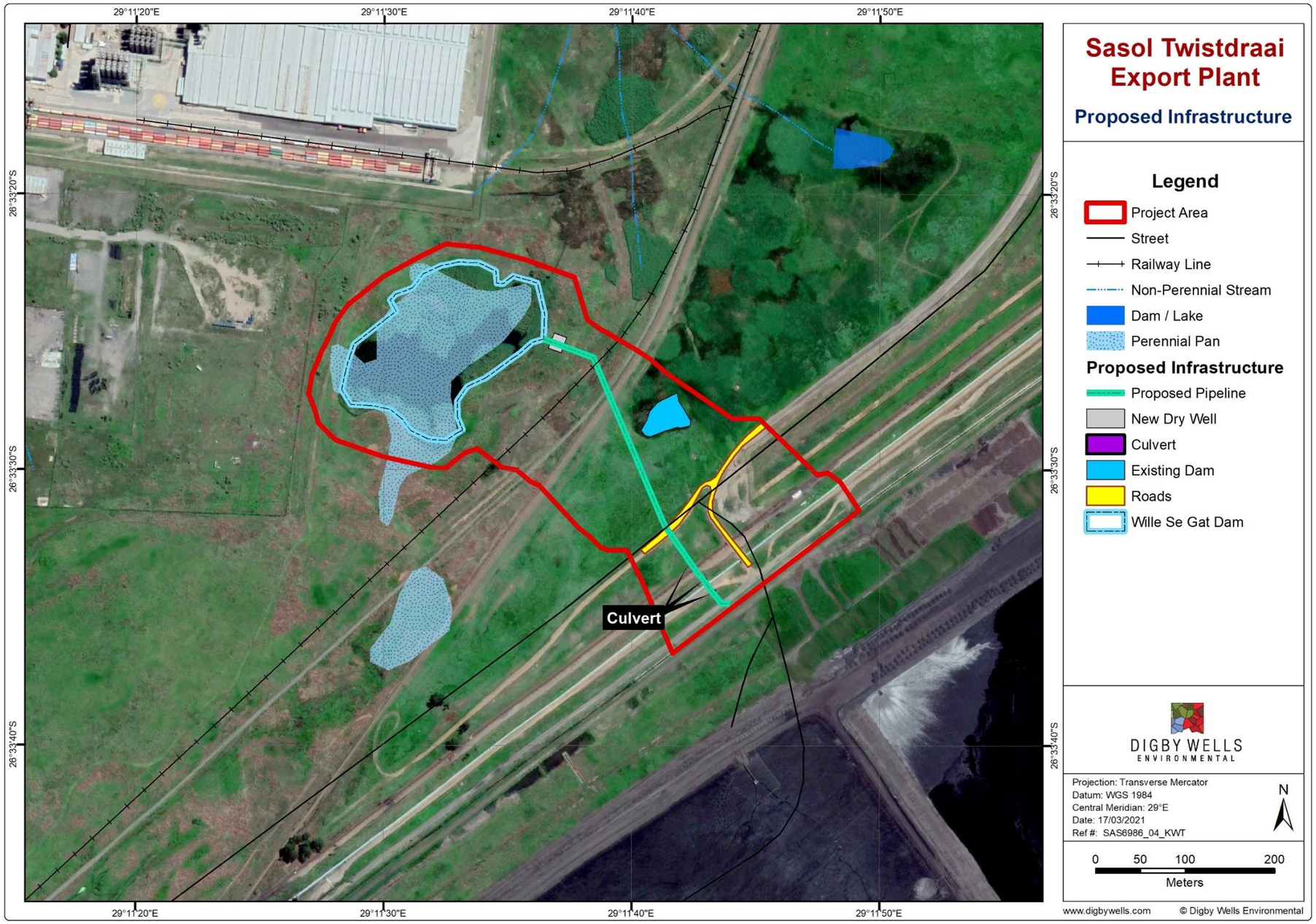


Figure 1-3: Infrastructure Layout

1.2. Project Background

The TEP receives coal via an overland conveyor belt from the Twistdraai Colliery Thubelisha Shaft (TCTS) underground mining operation. The Run of Mine (RoM) coal is stockpiled prior to going to the beneficiation plant where it is washed, crushed, and screened. The processed coal is then separated into different product stockpiles, depending on the grade of the coal.

The export-grade coal is reclaimed from the product stockpiles and transported to the load-out silo, where it is loaded onto rail trucks through a rapid load-out station and transported directly to the Richards Bay Coal Terminal (RBCT) for export. The remaining coal, which generally contains a high ash content, known as the secondary product or Middlings, is separated from the primary product and stockpiled at the Middlings Stockpile Area for use by the SSO via Sasol Coal Supply (SCS).

The discard coal extracted from the beneficiation plant is transported via a conveyor belt to a stockpile at the Discard Facility and disposed of using trucks. The discard material is used to build the outer walls of the disposal facility for the containment of the slurry and fine coal. Water from the Discard Facility is drained via penstocks to the Return Water Dam (RWD) and reused as process water back into the plant. The remaining fine coal is thickened and pumped via a pipeline, to the Discard Facility.

TEP appointed an external service provider to assess the potential impacts from the Discard Facility on RESM 7 and 13 who then recommended practical workable and implementable solutions that can be implemented to mitigate the identified problems (Aquisim, 2019). The assessment concluded that the Twistdraai Discard Facility potentially is the single major contamination source at the monitoring points RESM 13 and RESM 7.

One of the proposed remediation options that were considered and that will be implemented, is the interception of contaminated water to ensure the contamination is limited and confined to the immediate area. Therefore, pumping from Wollie se Gat is a cost-effective remediation option. The water will be abstracted from Wollie se Gat and pumped to the concrete lined cut-off trenches and allowed to flow to the RWD from where it is reused in the process.

1.3. Proposed Infrastructure and Activities

The project entails the construction of a pipeline from Wollie se Gat to the cut-off trenches. The project will include associated infrastructure such as a temporary office building, temporary ablutions blocks, a pump station and the pipeline. The water from Wollie se Gat will be pumped via a High-Density Polyethylene (HDPE) pipeline with a diameter of 200 millimetre (mm) and a length of 380 m to the Discard Facility.

The project will entail the pre-construction, construction and operational phases as set out in Table 1-2 below.

Table 1-2: Project Phases and Associated Activities

Project Phase	Activities
Construction Phase	Development and upgrading of a permanent access road to the site.
	Clearing and grubbing of approximately 0.3 hectare (ha).
	Establishment of the laydown area and contractors camp.
	Construction of the pump station and the pipeline from the pump station to the Discard Dump solution trench.
	Installation of parking bays for the construction area and vehicles.
	Installation of temporary warning signage.
	Topsoil stripping and stockpiling.
	Provision of sanitation facilities during the construction phase.
	Demarcation of the site using fencing and gates.
	Waste generation and removal of waste.
Operational Phase	Maintenance will be undertaken of the pumps as required.
Rehabilitation Phase	All rubble and redundant material shall be removed from site to an appropriate licensed facility.
	Areas where compaction has occurred will be ripped to allow the growth of vegetation.
	Area shall be shaped and contoured to mimic its surrounding areas and to encourage the recovering and continuity of the wetland vegetation.

1.4. Alternatives Considered

Alternatives to consider ensuring minimal impacts to the wetland includes:

- Restrict surface infrastructure and associated footprint within wetlands and associated regulation zones (100 m and 500 m regulation zones);
- Avoid construction of surface infrastructure (pump station, waste, office etc.) and movement in wetlands;
- Implement wetland monitoring through the life of the project to ensure rehabilitation success; and
- Construct the pipeline above the surface with appropriate mitigation measures.

2. Relevant Legislation, Standards and Guidelines

The Project is required to comply with all the obligations in terms of the provisions of the national legislations, regulations, guidelines and by-laws. The legal framework and guidelines directing the Wetland Environmental Impact Assessment are detailed in Table 2-1.

Table 2-1: Applicable Legislation, Regulations, Guidelines and By-Laws

Legislation, Regulation, Guideline or By-Law	Applicability
Section 24 of the Constitution of the Republic of South Africa,1996 (Act No. 108 of 1996) Wetlands are protected under the Act that states that everyone has the right to an environment that is not harmful to their health or wellbeing. It also states that the environment must be protected for the benefit of present and future generations through responsible legislative measures. The Act: • Prevents pollution and ecological degradation; • Promote conservation and secure ecological sustainability; and Promote justifiable economic and social development using natural resources.	• The project is initiated to prevent and address the deterioration of water quality at RESM 7 and RESM 13. • The construction of the pipeline is proposed to be within a wetland. The construction as well as the operation of the activities will affect the functionality of the wetland as well as possible pollution and degradation thereof; • The Wetland IA will assess the possibility of pollution and include an Environmental Management Plan and Monitoring Program for the conservation of the ecological sustainability; and • Provide recommendations to prevent, avoid, and rehabilitate possible impacts.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: • Alien and Invasive Species Lists, 2020 (terms of GNR 1003 in GG 43726 dated 18 September 2020 – effective from 18 October 2020); • Threatened and Protected Species Regulations; and • National list of Ecosystems Threatened and in need of protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GNR 1002, 9 December 2011).	• The construction of the pipeline is proposed to be within a wetland. The construction as well as the operation of the activities will affect the natural biodiversity; and • The Wetland Impact Assessment (IA) will assess the biodiversity of the area, including Alien Invasive Plants (AIPs), threatened and protected species and the wetland ecosystems.
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). NEMA (as amended) was set in place under Section 24 of the Constitution. Certain environmental principles under NEMA must be adhered to, to inform decision making for issues affecting the environment.	• Activities that will influence the Wetlands of the proposed Project Area are listed in Table 1-2 and have been identified as Listed Activities in the Listing Notices (as amended) and therefore require environmental

Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment must be considered, investigated and assessed before their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The NEMA requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided be minimised and treated.	authorisation before being undertaken.
Department of Water and Forestry (DWAF) Guidelines for the Delineation of Wetlands (2005) To delineate any wetland the following criteria are used as in line with the Department of Water Affairs and Forestry (DWAF): A practical field procedure for identification and delineation of wetlands and riparian areas (2005). These criteria are: • Topographical location of the wetland in the landscape; • Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation (such as grey horizons, mottling streaks, hardpans, organic matter depositions, iron and manganese concretion resulting from prolonged saturation); • A high-water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 centimetre (cm) of the soil; and • The presence, at least occasionally, of water-loving (hydrophilic) plants (i.e. hydrophytes).	• This guideline was used as a tool to improve procedures for mapping wetlands using a set of standards for data collection and storage, so that data feeds into national-level databases such as the National Wetland Inventory, and that informs national policy tools such as National Freshwater Ecosystem Priority Areas (NFEPA); and • The tool also includes tips on recognising, digitising, and classifying wetlands and human impacts on wetlands from desktop imagery and in the field.
Wetland Management Series (published by Water Research Commission (WRC, 2007) The WET-Management Series is a set of integrated tools that can be used to guide well-informed and effective wetland management and rehabilitation. The WET-Management tools are designed to be used at different spatial and institutional levels as needed, from national and provincial to the level of specific wetland sites involving individual landowners, to meet a range of wetland management and rehabilitation needs.	• This was used as a tool to provide background information about wetlands and natural resource management as well as tools that was used to guide decisions around wetland management.
National Freshwater Ecosystems Priority Areas (NFEPA, (Nel, et al., 2011)**)** The NFEPA project was a multi-partner project between the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water and	• This database was used to ensure that healthy freshwater ecosystems continue to form the cornerstone of the implementation of our water resource classification system and the development of catchment

Sanitation (DWS) formerly known as the Department of Water Affairs and Forestry (DWAF)), Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute for Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The NFEPA project aimed to: • Identify Freshwater Ecosystem Priority Areas (hereafter referred to as 'FEPAs') to meet national biodiversity goals for freshwater ecosystems; and • Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers. The NFEPA study responded to the high levels of threat prevalent in a river, wetland, and estuary ecosystems of South Africa. It provides strategic spatial priorities for conserving the country's freshwater ecosystems and supporting the sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or 'FEPAs'.	management strategies throughout the country. The database also informs planning and decisions about land use and the expansion of the protected area network. By highlighting which ecosystems should remain in a healthy and well-functioning state, the maps provide a tool to guide our choices for the strategic development of water resources and to support sustainable development.
SANBI, in collaboration with the DWS report on "Wetland offsets: a Best-Practice Guideline for South Africa" (SANBI and DWS, 2016) This guideline serves as a practical tool to aid in the consistent application of wetland offsets in South Africa. The guideline is primarily aimed at wetland offsets required as part of water use authorisation processes (e.g. in an application for a Water Use Licence under the National Water Act) where compensatory actions are required to achieve water resources management and biodiversity conservation objectives. The guideline is equally relevant for use in EIA processes (e.g. as part of the environmental authorisation process in terms of the NEMA or an application for a mining license or development of an Environmental Management Programme under the Mineral and Petroleum Resources Development Act). Wetland offsets are enduring measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse impacts on wetlands. They are implemented to address any anticipated significant residual impacts arising from development projects after appropriate avoidance, minimisation, and rehabilitation measures have been considered. The goals of wetland offsets are to achieve 'No Net Loss' and preferably a net gain concerning the full spectrum of functions and values provided by wetlands. These include:	• The guideline provided practical guidance for determining the size and characteristics of a wetland offset and determining the requirements for its implementation, once a decision on the need for a wetland offset has been taken through the water use authorisation process by the DWS.

• Water resource and ecosystem service value, especially concerning regulating and supporting functions pertinent to water resource management and disaster risk reduction, such as flood control and water quality enhancement, but also including direct services such as food and water provisioning and cultural services such as spiritual, recreational, and cultural benefits that sustain communities; • Ecosystem conservation, especially in terms of meeting national, provincial, and local objectives for habitat protection and avoiding a deterioration in ecosystem threat status; and • Species of conservation concern, to ensure that the status of threatened, rare or keystone wetland dependant species is maintained or improved.	
General Authorisation in Terms of Section 39 of the National, Water Act, 1998 (Act No. 36 Of 1998). The GA defines a 'regulated area of a water course' for Section 21(C) Or Section 21(I) of the Act water uses in terms of this notice as: • The outer edge of the 1 in 100-year flood line and /or delineated riparian habitat whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • In the absence of a determined 1 in 100 year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench *(subject to compliance to section 144 of the Act)*; or A 500 m radius from the delineated boundary (extent) of any wetland or pan.	• Wetlands are delineations and sensitivity maps include a 500 m "regulated area of a water course', also known as a 500 m 'zone of regulation'

3. Assumptions, Limitations and Exclusions

The compilation of this Report is based on the following assumptions and limitations in Table 3-1.

Table 3-1: Limitations and Assumptions with Resultant Consequences of this Report

Assumptions and Limitations	Consequences
Wetland delineations were taken from a previously conducted report by Digby Wells (Digby Wells Environmental, 2019) and assumed to be correct.	Wetland delineations were not confirmed during this assessment. The delineations are assumed to be accurate and correct.

Wetlands situated within the 500 m zone of regulation were assessed mostly on a desktop level with very limited ground-truthing.	Some discrepancies within the zone may occur.
This wetland study forms part of a BA process and should be read in conjunction with the BA process and other related specialist studies.	This report does not include any other specialist studies other than the wetland assessment. The wetland report should be read in conjunction with the other specialist studies.
The Wetland Assessment was conducted during March 2021 having some restrictions to vegetation diversity, identification and low flows in the systems.	Findings, recommendations, and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation.

4. Details of the Specialist

The following is a list of Digby Wells' staff who was involved in the Wetland Environmental Impact Assessment:

- **Stephen Burton** is the Ecology and Atmospheric Sciences Divisional Manager at Digby Wells. He received a Bachelor of Science in Zoology and Entomology and an Honours degree in Zoology from the University of Natal. He also has received her MSc in Zoology through the University of KwaZulu-Natal. Stephen is an ecologist with fields of interest in wetlands, fauna, and flora. In his 14-year career he has undertaken numerous wetland delineations and functional assessments, faunal assessments, wetland offset and rehabilitation assessments and audits, as well as project management of various environmental impact assessment and water use license projects. He has also worked extensively with wetland rehabilitation implementation projects for large scale developments. He has published a variety of journal articles and presented at various South African and international conferences and is a registered Professional Natural Scientist with the South African Council for Natural Scientific Professionals.
- **Willnerie Janse van Rensburg** is a Soil Scientist in the Rehabilitation, Closure and Soils Division at Digby Wells. She received her Bachelor of Science in Environmental Geography as well as her Honours degree in Soil Science from the University of the Free State. She has five years' experience in the fields of Soil Science and Environmental Science. She has experience in completing soil surveys, land capability assessments, irrigation scheduling and provides recommendations on soil amelioration. Willnerie also completes wetland delineations and assessments. She has undertaken work in Lesotho, Botswana and throughout South Africa. Willnerie is registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professionals.
- **Aamirah Dramat** is an Assistant Rehabilitation Consultant in the Rehabilitation, Closure and Soils Department at Digby Wells. She received her Bachelor of Science Degree in Applied Biology and Environmental and Geographical Science (EGS) as

well as her Honours Degree in Biological Sciences from the University of Cape Town. She joined Digby Wells in 2020 as a Rehabilitation Intern and has since gained experience in the environmental services sector with specialised focus in Soils, Wetlands and Rehabilitation, both locally and internationally. She has been involved in the report compilation and undertaking of Baseline Assessments, Environmental Impact Assessments (EIAs), Rehabilitation and Closure Plans (RCPs), Rehabilitation Strategy and Implementation Plans (RSIPs), Alien Invasive Plant (AIP) Assessments, Re-vegetation Trial Studies and Monitoring Assessments. Aamirah is registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professionals.

5. Methodology

This section provides the methodology used in the compilation of the Wetland Impact Assessment. A detailed methodology is described in Appendix A and is summarized in Figure 5-1 below.

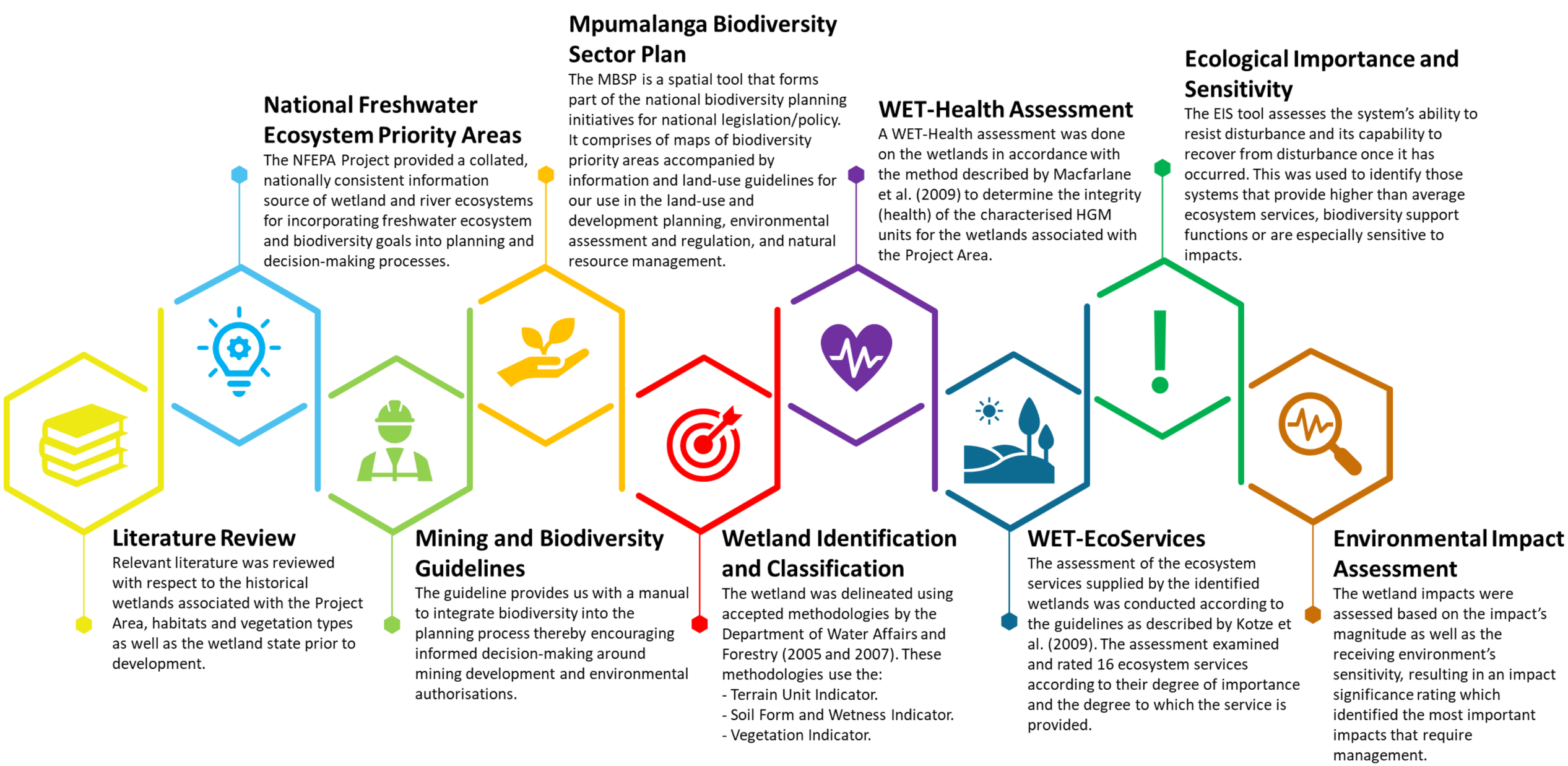


Figure 5-1: Wetland Assessment Methodology

6. Baseline Environment

Table 6-1: Baseline Environment and Literature Review

Bioregional Context (Darwell W. , Smith, Tweddle, & Skelton, 2009)		**Characteristics of the Highveld Ecoregion** (Kleynhans, Thirion, & Moolman, 2005)		**Plant Species Characteristic of the Soweto Highveld Grasslands** (Mucina & Rutherford, 2012) Figure 6-1	
Political Region/ Geomorphic Province	Mpumalanga	Terrain Morphology	Plains; Low Relief; Plains; Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to high Relief Closed Hills. Mountains; Moderate and High Relief.	Graminoids	*Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischilii, Cynodon dactylon, Elionurus muticus, Eragrostis capensis, E. chloromelas, E. curvula, E. plana, E. planiculmis, E. racemosa, Heteropogon contortus, Hyparrhenia hirta, Setaria nigrirostris, S. sphacelata, Themeda triandra, Tristachya leucothrix, Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum.*
Level 1 Ecoregion	Highveld	Vegetation Types	Mixed Bushveld (limited); Rocky Highveld Grassland; Dry Sandy Highveld Grassland; Dry Clay Highveld Grassland; Moist Cool Highveld Grassland; Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited).	Herbs	*Hermannia depressa, Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugulosum, Hibiscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata.*
WMA	Vaal	Altitude (m.a.m.s.l.) (modifying)	1 100-2 100, 2 100-2 300 (very limited)	Geophytic Herbs	*Haemanthus humilis subsp. hirsutus, H. montanus.*
Sub-WMA	Upper Vaal	Mean Annual Precipitation (MAP) (mm) (Secondary)	400 to 1 000	Herbaceous Climber	*Rhynchosia totta.*
Quaternary Catchment Figure 6-2	C12D	Rainfall Seasonality	Early to late summer	Low Shrubs	*Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana.*
Watercourse	Bossiespruit and Klipspruit.	Mean Annual Temp. (°C)	12 to 20	Status	Endangered.
Mining and Biodiversity Guideline Category, DEA (2013) Figure 6-3				**MBSP Category** (MTPA, 2014) Figure 6-4	
The Project Area is predominantly classified as **D: Moderate Biodiversity Importance – Moderate Risk for Mining.**				The Project Area is predominantly classified as **Other Natural Areas** with minor areas classified as **Moderately Modified – Old Lands** and **Heavily Modified.**	
National Biodiversity Assessment (NBA) (SANBI, 2018) Figure 6-5				**NFEPA Wetland Classification** (Nel, et al., 2011) Figure 6-6	
A **Least Concern** Wetland Ecosystem is located to the north of the Project Area. It is **Poorly Protected** according to the Wetland Ecosystem Protection Level.				NFEPA Wetlands	The Project Area comprises of a **Depression (Rank 5) NFEPA Wetland**.
				River FEPA	The entire Project Area is classified as an **Upstream Management Area**.

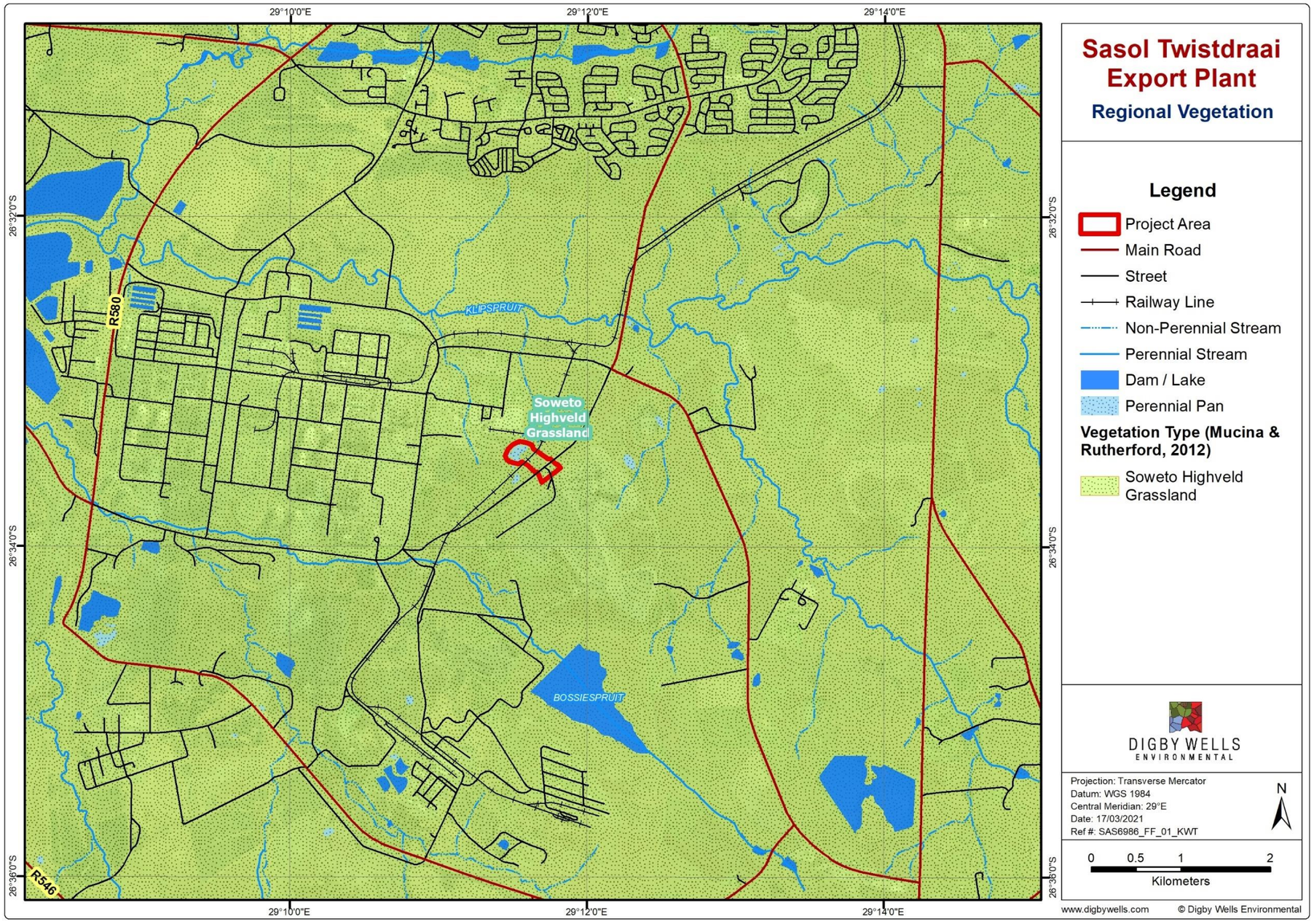


Figure 6-1: Regional Vegetation

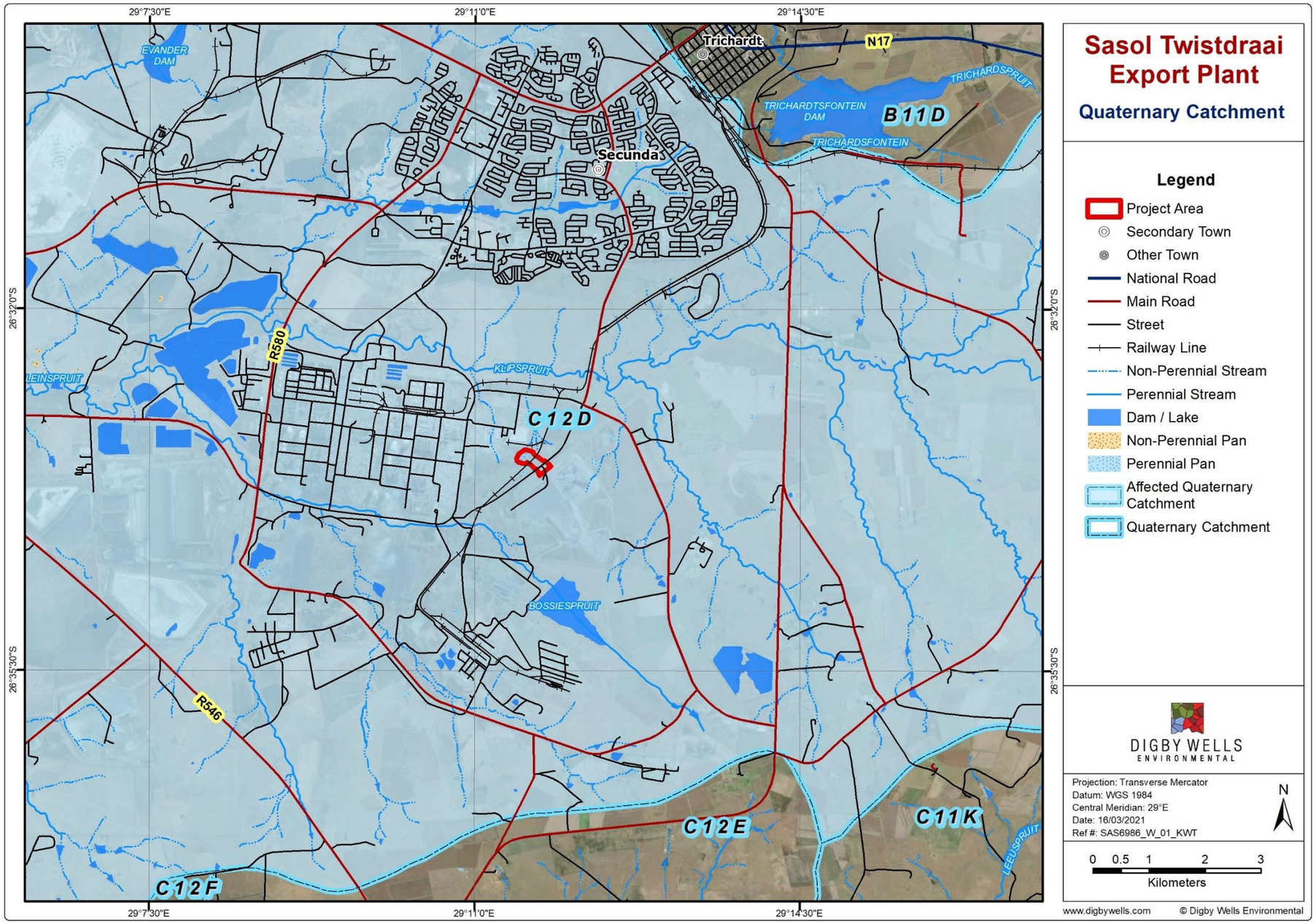


Figure 6-2: Quaternary Catchment

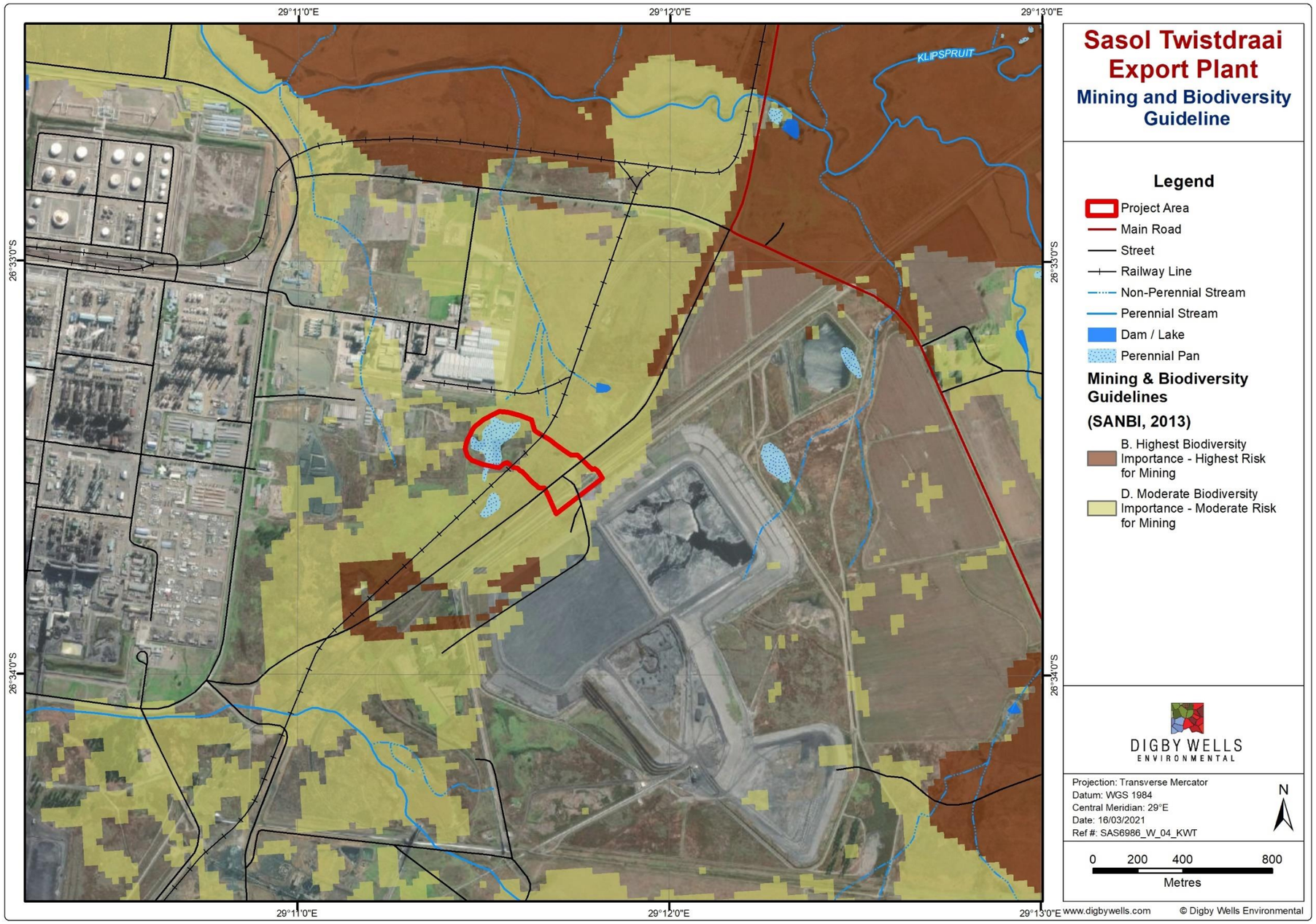


Figure 6-3: Mining and Biodiversity Guidelines

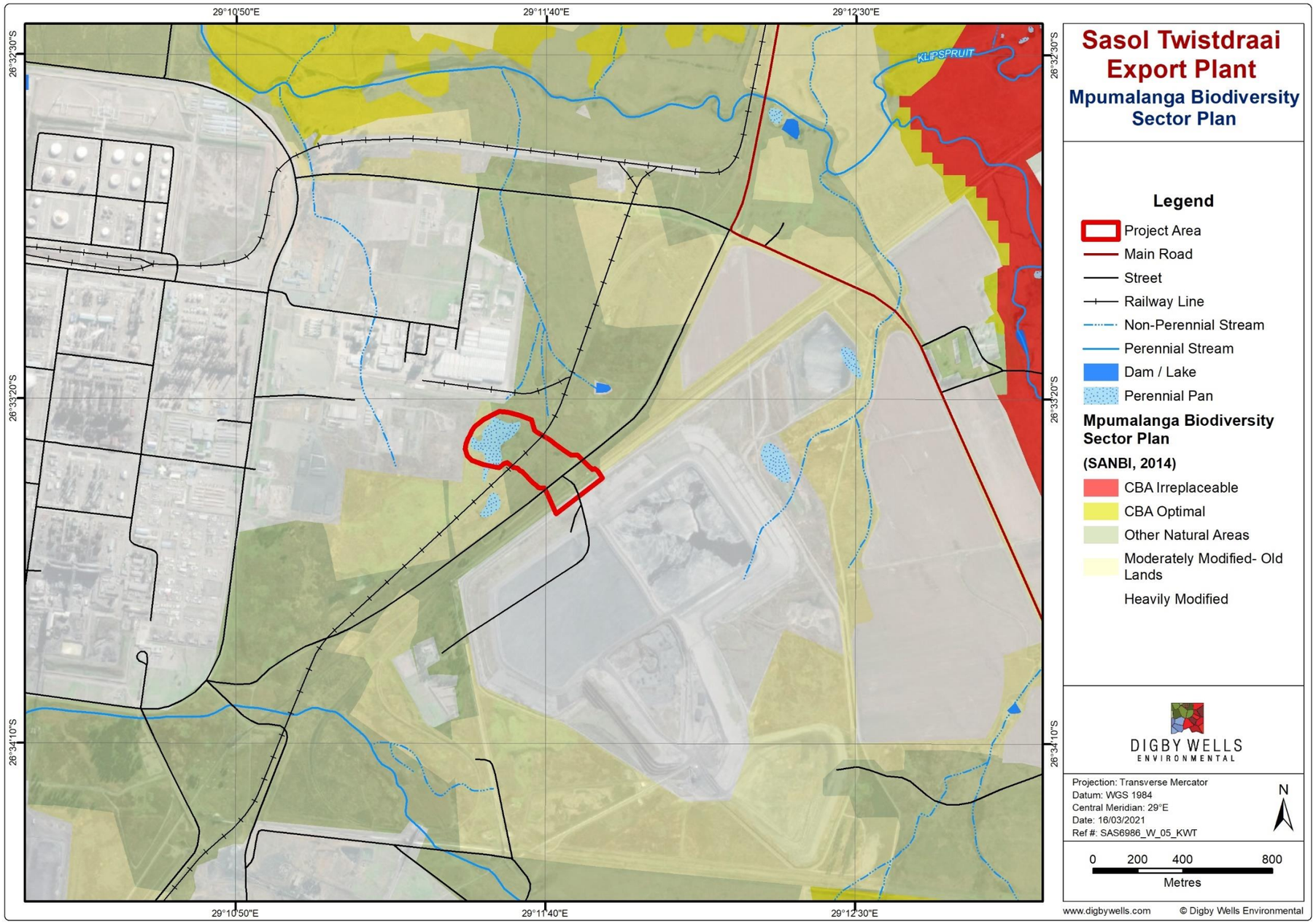


Figure 6-4: Mpumalanga Biodiversity Sector Plan Category

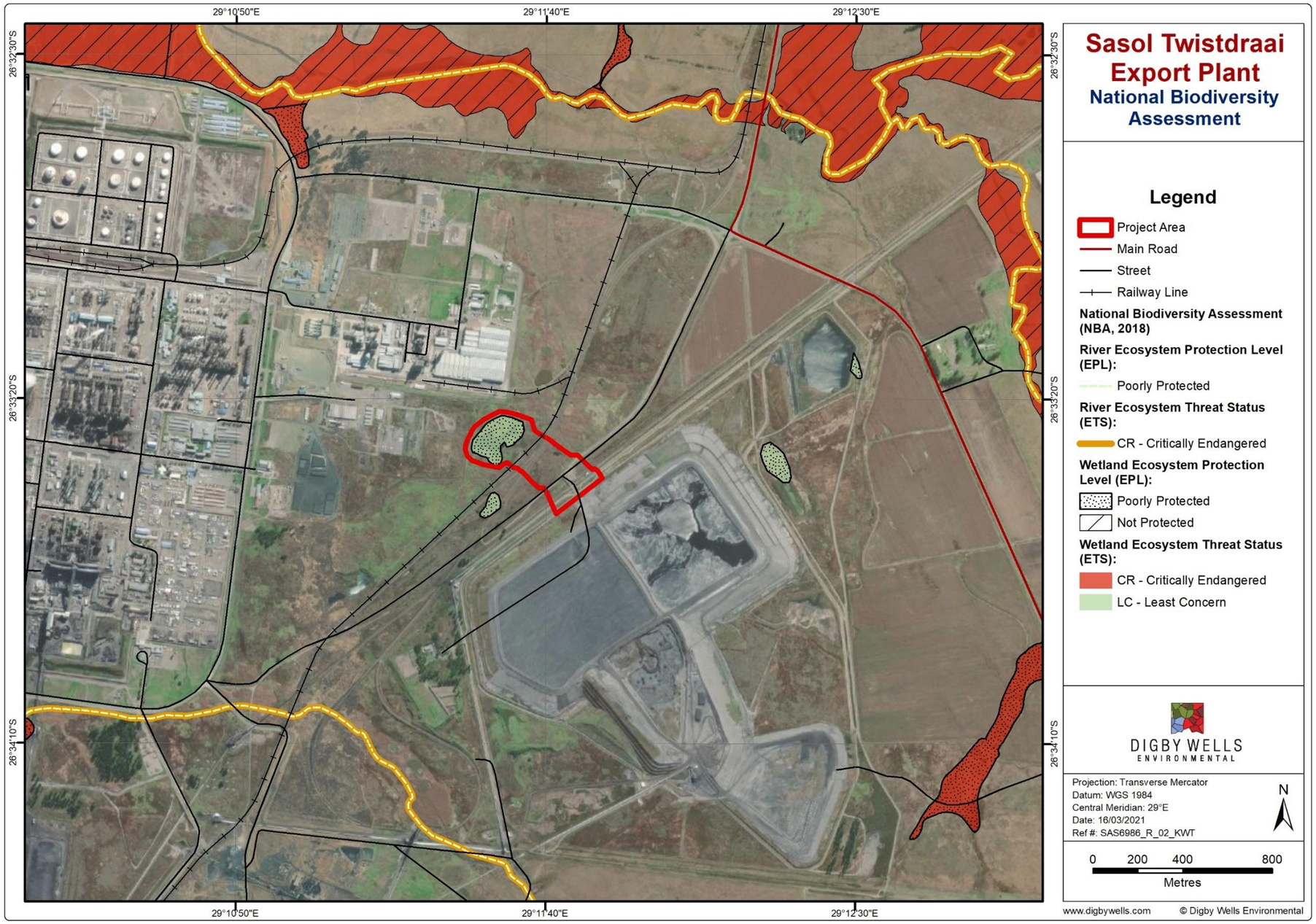


Figure 6-5: National Biodiversity Assessment

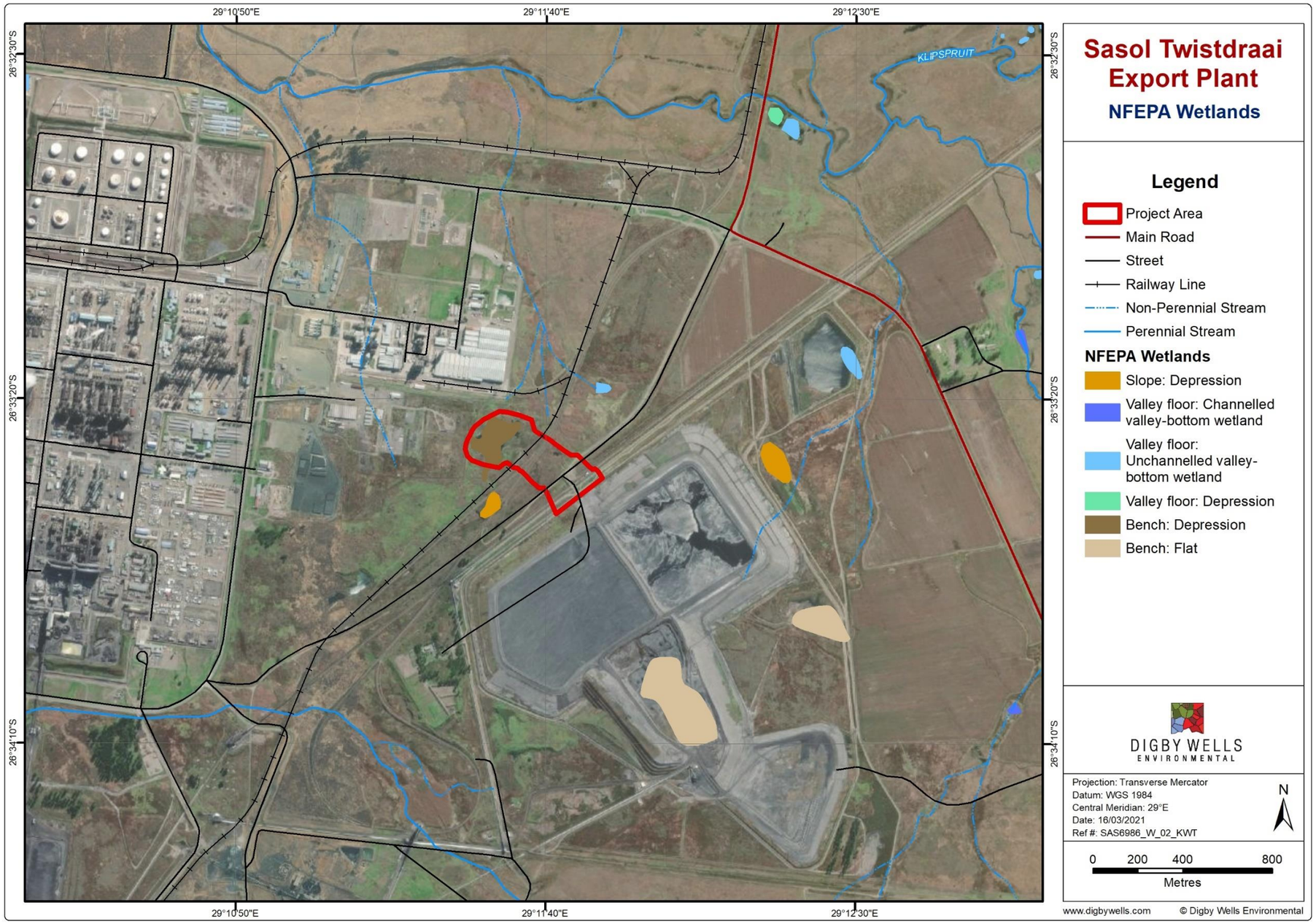


Figure 6-6: Wetland National Freshwater Ecosystem Priority Areas

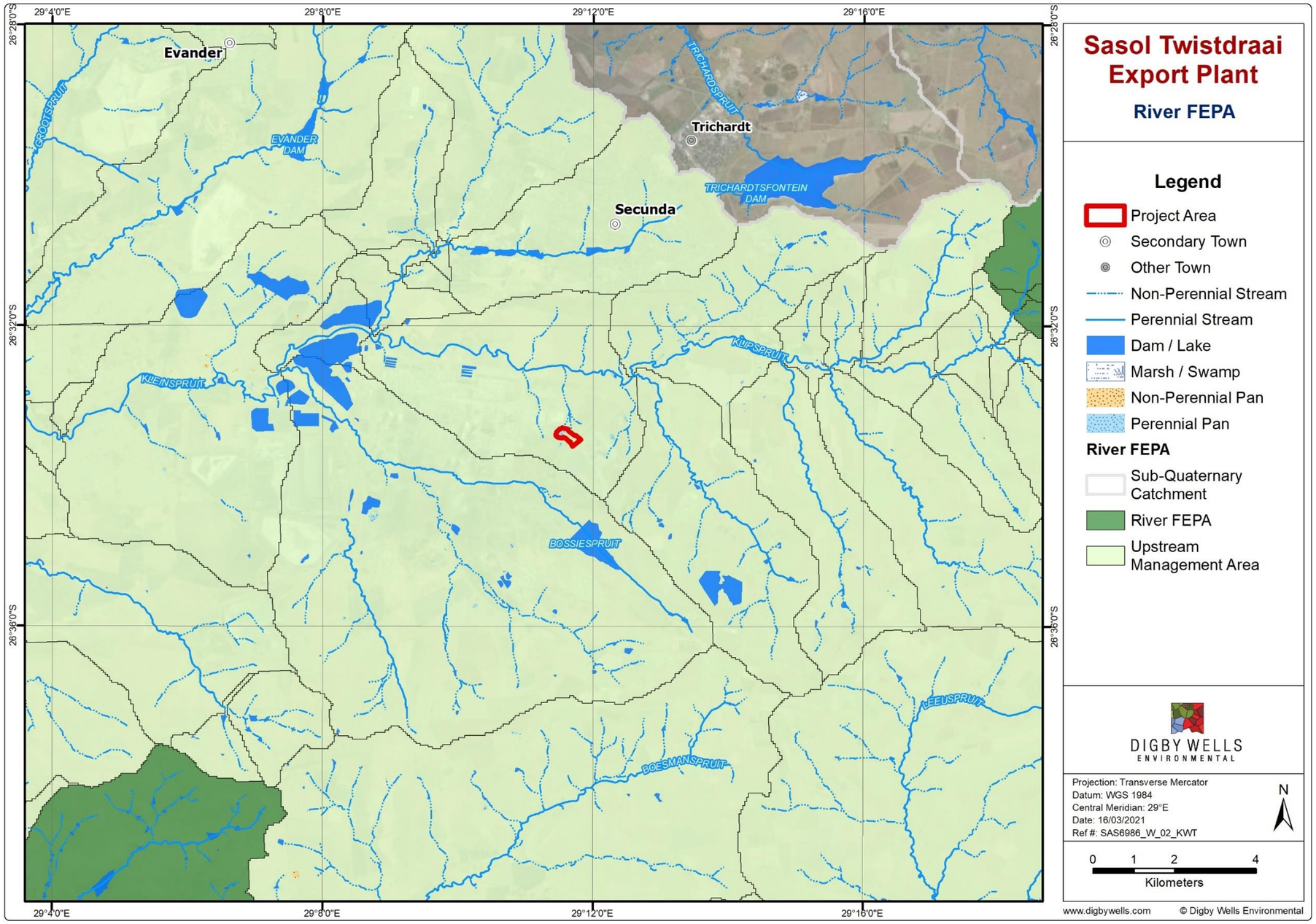


Figure 6-7: River National Freshwater Ecosystem Priority Areas

7. Findings and Discussion

The wetlands were assessed according to a previously conducted assessment done by Digby Wells (Digby Wells Environmental, 2019). The wetlands were desktop assessed and confirmed during a rapid site survey. The site survey was conducted on 16 March 2021 to determine their Present Ecological State (PES), WET-Ecoservices and Ecological Importance and Sensitivity (EIS) values. One Hydrogeomorphic Unit (HGM unit) was identified within the Project Area, namely:

- Unchannelled Valley Bottom (UVB).

The PES, WET-EcoServices and EIS was re-calculated accordingly and compared to the previous data.

7.1. Wetland Delineations

Previously, the wetlands were delineated using the accepted methodology from the DWS (Department of Water Affairs and Forestry, 2005) as well as the "Updated manual for identification and delineation of wetlands and riparian areas" (Department of Water Affairs and Forestry, 2008) which states the four wetland indicators as Soil Wetness Indicators (SWI), Soil Form Indicators (SFI), Vegetation Indicators and Terrain Unit Indicators (TUI).

The wetland delineations were assumed to be accurate and correct and were not reassessed during the 2021 site visit. Some wetland indicators observed during the 2021 rapid site survey are presented in Table 7-1 below.

Figure 7-1 illustrates the wetland delineations for the Project Area. The UVB wetland cover approximately 6.28 ha which amounts to 51% of the total 12.41 ha Project Area.

Table 7-1: Wetland Indicators

	
SFI – Arcadia and Rensburg soil forms	SWI – Mottles and gleying

	
Obligated wetland species – *Cynodon dactylon, Sedge sp.* and *Pennisetum sp.*	TUI – UVB wetland

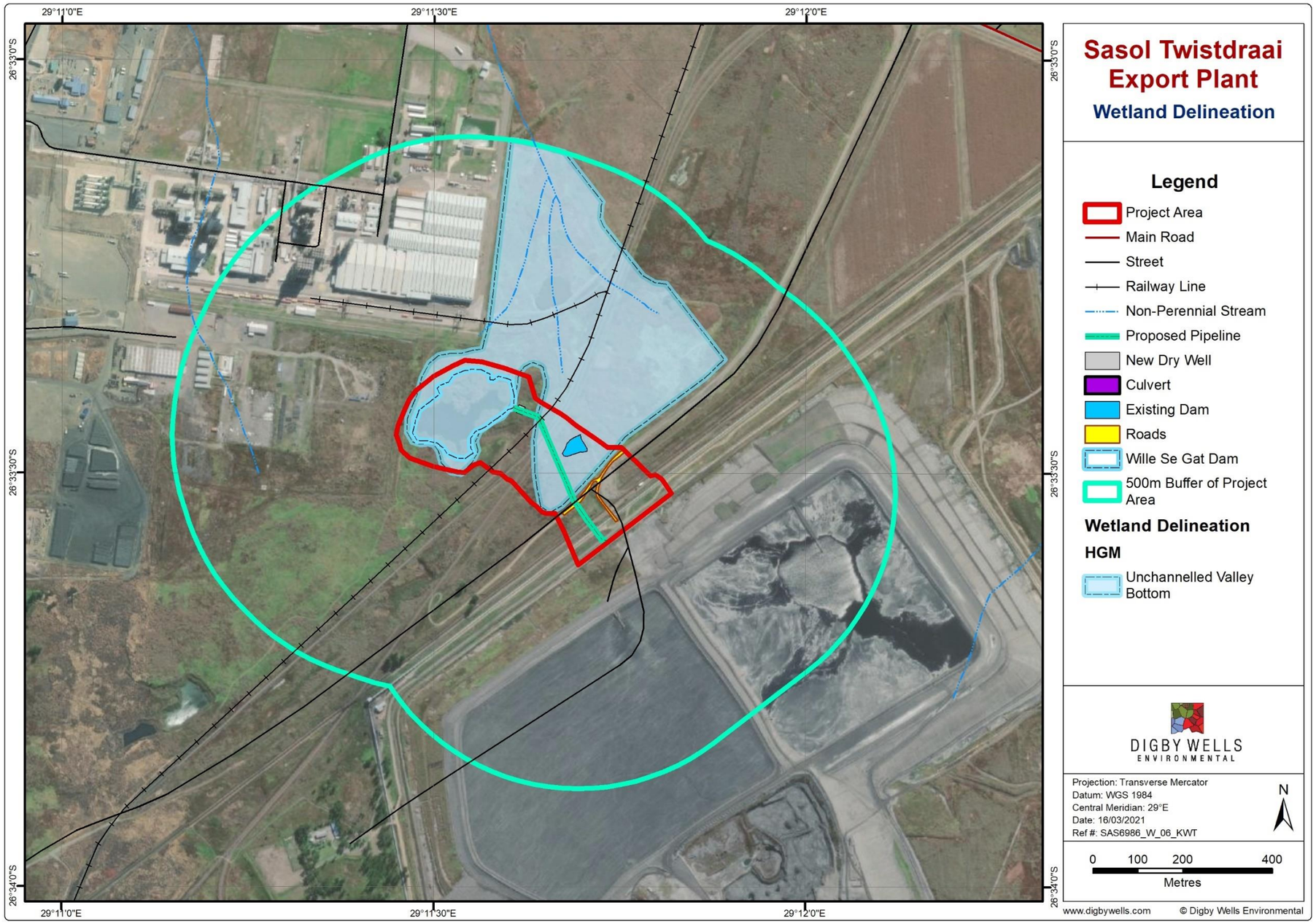


Figure 7-1: Wetland Delineation of the Project Area

7.2. Wetland Ecological Health Assessment

The wetland PES of the HGM unit was assessed according to its' hydrology, geomorphology and vegetation functionality and health. The PES scores were compared to the previously conducted assessment (Digby Wells Environmental, 2019) to determine whether the wetlands health improved, stabilized, or deteriorated. The land use of the area directly impacts the PES of each HGM unit. The current land use of the area is industrial as the area is within the SSO area of the TEP. The wetlands have been altered from their natural state as the area has been largely transformed. Examples of these impacts recorded on site are shown and described in Figure 7-2 below.

Land Use and Description	
	**Infrastructure** – Dams, roads, fence lines, power lines and boreholes within wetland systems impacting the natural functionality of the wetland. Infrastructure can result in fragmentation of wetlands, erosion, increased runoff and increased AIPs.
Site clearing – Clearing of the natural vegetation can result in increased runoff and consequently increased erosion and sedimentation within the wetlands. Site clearing and disturbances of the vegetation can also lead to decreased soil fertility, increased AIPs and loss of wetland habitat.	
	**Industries** – The presence of industrial infrastructure in the area (such as powerlines, railways and roads) affect the ecological integrity of the wetlands and avifaunal populations. Mining directly impacts the hydrological quality, quantity and functionality, geomorphology and changes the natural occurring vegetation.
AIPs – The establishment of alien and invasive plant species, particularly *Tagetes minuta* (Khaki Bush), *Cosmos bipinnatus* and *Bidens pilosa* (Blackjack) limit the ability of the natural hydromorphic grasslands to function correctly.	

Figure 7-2: Land Use and Description

The UVB HGM unit was considered to have a PES of **E** during both the 2019 and 2021 assessments (Table 7-2). According to the integrity (health) method described by Kotze *et al.* (2009) a **Category E** (serious) wetland has undergone changes in the ecosystem processes and large losses of natural habitat and biota; however, some remaining natural habitat features are still recognizable.

Table 7-2: Wetland Ecological Importance and Sensitivity Score

Analysis Date	HGM Unit	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final PES	PES Category
2021	UVB	27	5.7	15.6	6.9	**E**
2019	UVB	-	-	-	-	**E**

Wetlands are important ecosystems and include various wetland habitat types, such as grassland, open water and seepage areas. The ecological functioning of these ecosystems is directly linked to their position in the landscape as well as their ecological condition. Wetlands of the Grassland biome represent important ecosystems providing many goods and services to people and biodiversity in general. However, this does lead often to over exploitation of these systems which compromises their ecological integrity.

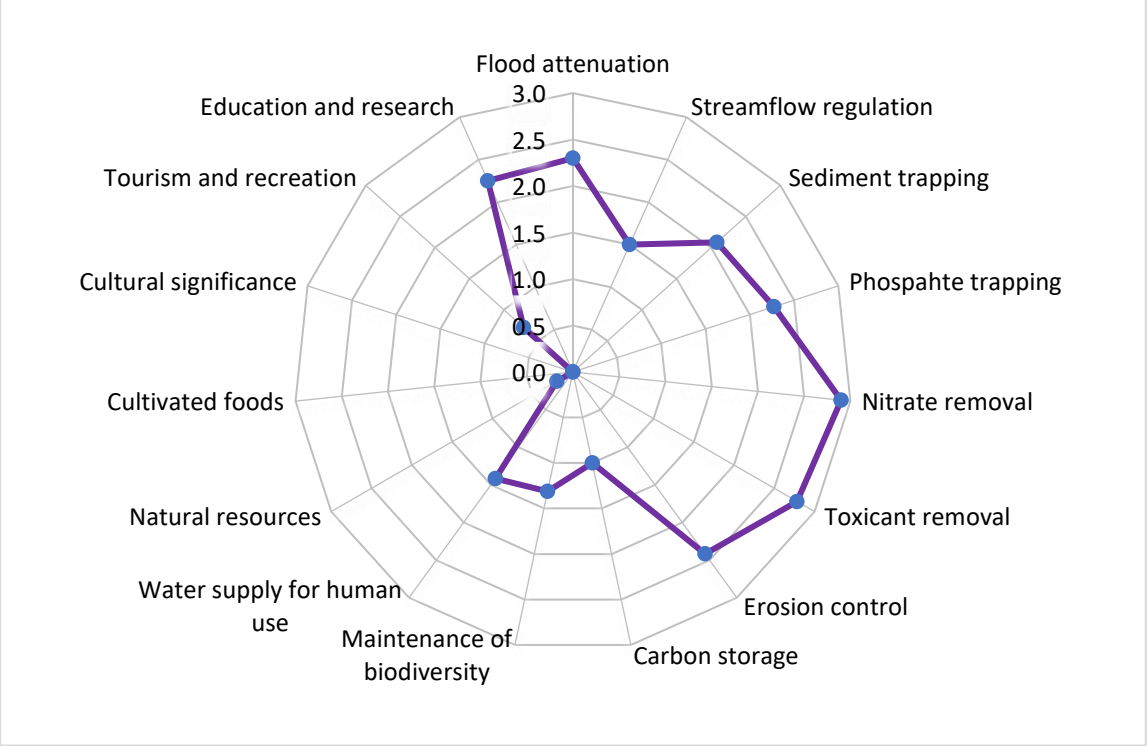
7.3. Wetland Ecosystem Services (WET-EcoServices)

The general features of the UVB were assessed in terms of functioning and the overall importance at a landscape level. Figure 7-3 represents the radial plot showing the relative importance of each Ecosystem Service (ES) and a summary of the scores obtained. The ESs' were not assessed during the 2019 assessment and could therefore not be compared to previous data.

The ESs' of the UVB were rated as Moderate. The dominant services provided by the UVB are indicated in bold in the table below and includes:

- Flood attenuation;
- Phosphate assimilation;
- Nitrate assimilation;
- Toxicant assimilation; and
- Education and Research.

UVB



Ecosystem Service	UVB
Flood Attenuation	**2.3**
Streamflow Regulation	1.5
Sediment Trapping	2.1

Phosphate Assimilation	**2.3**
Nitrate Assimilation	**2.9**
Toxicant Assimilation	**2.8**
Erosion Control	2.4
Carbon Storage	1.0
Biodiversity Maintenance	1.3
Water Supply	1.4
Harvestable Resources	0.2
Cultivated Foods	0.0
Cultural Value	0.0
Tourism and Recreation	0.7
Education and Research	**2.3**
SUM	23.1
Average Score	1.5
Category	**Intermediate**

Figure 7-3 Ecosystem Services

7.4. Ecological Importance and Sensitivity (EIS)

The ecological importance of a wetland is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. On the other hand, ecological sensitivity refers to the wetland's ability to resist disturbance and is capability to recover from disturbance that has occurred (Department of Water Affairs and Forestry, 1999).

Table 7-4 indicates the EIS scores for the 2019 and 2021 assessments.

The UVB were measured as **Moderate** during both assessments due to its Hydrological/Functional Importance.

The wetland is important in flood attenuation, phosphate assimilation, nitrate assimilation and toxicant assimilation. The wetland also provides habitat for various animals, such as birds, rodents, and small mammals (Table 7-3). Evidence (feces and discussions with the client) was seen of the possible occurrence of Serval Cats and *Tyto sp* (owl species). Serval Cats (*Leptailurus serval*) are rated as Near Threatened according to the South African National Biodiversity Institute (SANBI) and listed as a Threatened or Protected Species (TOPS) according to Endangered Wildlife Trust (EWT).

Table 7-3 Animal Activity within the wetland

	
Possible Serval Cats (*Leptailurus serval*) signs	Presence of *Tyto sp.* (owl species)
	
Prescence of *Bovidae* species (common name??	Presence of *Hystricida Sp.* (porcupine)

Table 7-4: Wetland Ecological Importance and Sensitivity Scores

Analysis Date	HGM Unit	Ecological Importance & Sensitivity	Hydrological/Functional Importance	Direct Human Benefits	Final EIS	EIS Category
2021	UVB	1.3	2.0	0.8	2.0	**Moderate**
2019	UVB	-	-	-	-	**Moderate**

8. Wetland Impact Assessment

This section aims to rate the significance of the identified potential impacts pre-mitigation and post-mitigation. The potential impacts identified in this section are a result of both the environment in which the proposed Project activities take place, as well as the actual activities. The potential impacts are discussed per aspect and per each phase of the Project i.e., the Construction Phase, Operational and Rehabilitation/decommissioning Phases where applicable.

8.1. Construction Phase

Activities during the Construction Phase that may have potential impacts on the wetland is described in Table 8-1 below.

Table 8-1: Interactions and Impacts of Activity

No.	Interaction	Impact	Description
1	Development and upgrading of a permanent access road to the site.	• Wetland fragmentation; • Water quality and quantity contamination and deterioration; • Habitat and biodiversity loss; and • Loss of wetland areas.	The storage of hydrocarbons and hazardous materials may cause direct impacts to the water and wetland resources within the study area and surrounding wetland areas. The contamination of water resources will result in the deterioration of water quality which will cause a loss of aquatic faunal species, terrestrial faunal species and vegetation.
2	Clearing and grubbing of approximately 0.3 ha.	• Direct loss of wetland areas; • Habitat loss; • Loss of biodiversity; and • Erosion and sedimentation of wetland areas.	The removal of vegetation and topsoil will result in the loss of wetland areas. This will also alter the hydrological regime which could contribute to further loss of wetland areas. The altered water flows may increase the erosion risk of wetland areas and, along with the excess soil, cause sedimentation of water resources.
3	Establishment of the laydown area and contractor's office.	• Indirect loss of wetland areas; • Habitat loss; • Loss of biodiversity; and • Erosion and sedimentation of wetland areas.	The laydown area will create hardened surfaces that will lead to secondary impacts to the wetlands such as increased runoff, erosion and sedimentation.

No.	Interaction	Impact	Description
4	Construction of the pump station and the pipeline from the pump station to the Discard Facility solution trench.	• Wetland fragmentation; • Water quality and quantity contamination and deterioration; • Habitat and biodiversity loss; • Increased AIPs; • Erosion and sedimentation of wetland areas; and • Loss of wetland areas.	The establishment of infrastructure could potentially result in the direct loss of wetlands as the proposed pipe will cross the UVB. The activities may also lead to wetland fragmentation, water quality deterioration due to erosion and sedimentation and therefore loss in wetland habitat. Disturbance of the area may lead to increased AIPs.
5	Installation of parking bays for the construction area and vehicles.	• Erosions and sedimentation of wetland areas; • Water quality and quantity contamination and deterioration; and • Habitat and biodiversity loss.	Parking bays may lead to hardened surfaces which will lead to increased surface runoff and increasing the potential for erosion and sedimentation. Machinery parked in these areas may lead to water contamination and thus lead to loss of wetland habitat and biodiversity.
6	Installation of temporary warning signage.	• Wetland fragmentation; and • Erosion and sedimentation of wetland areas.	The temporary installation may lead to fragmentation of wetlands due to construction and movement of vehicles. The construction of signs may also lead to hardened surfaces (soil compaction) and increased runoff that will lead to erosion and sedimentation.
7	Topsoil stripping and stockpiling.	• Erosion and sedimentation of wetland areas; and • Water quality and quantity contamination and deterioration.	The removal of vegetation and topsoil will result in the direct loss of wetland areas. This will alter the hydrological regime and flow of water which may contribute to further loss of wetland areas. The altered water flows may increase the erosion risk of wetland areas and the eroded material may result in sedimentation of downstream water resources.

No.	Interaction	Impact	Description
8	Provision of temporary sanitation facilities during the construction phase.	• Water quality and quantity contamination and deterioration.	Sanitation facilities may leak and contaminate the water and soil which could result in wetland contamination.
9	Demarcation of the site using fencing and gates.	• Wetland fragmentation; and • Erosions and sedimentation of wetland areas.	Linear infrastructure may lead to wetland and habitat fragmentation as well as increased erosion.
10	Waste generation and removal of waste.	• Water quality and quantity contamination and deterioration; • Habitat and biodiversity loss; • Erosion and sedimentation of wetland areas.	During waste removal, spillages may occur which could lead to water quality and quantity deterioration, affecting the wetland health and functionality. During the removal process, vehicles may compact the area, leading to hardened surfaces, increased runoff, erosion and sedimentation.

8.1.1. Management Objectives

The mitigation hierarchy includes firstly the avoidance of an impact. When it is not possible to avoid an impact, such as in the case of during the Construction Phase, the next step is to minimize the impact and thereafter to rectify or reduce the impact. When it is not possible to rectify or reduce the impact, offsets need to be implemented.

The aim during the Construction Phase is to:

- Minimize the impact footprint on the wetlands as it is not possible to avoid the impacts;
- Keep the impact size to a minimal with as little changes to the natural state of the Project Area as far as possible; and
- Prevent spillage, seepage and runoff of hydrocarbons and other hazardous materials to the wetland areas.

8.1.2. Impact Ratings

Table 8-2 present the impact ratings associated the Construction Phase of the Project.

Table 8-2: Construction Phase Interactions and Impacts of Activity Rating

1. **Activity and Interaction:** Development and upgrading of a permanent access road to the site.			
Impact Description: • Wetland fragmentation; • Water quality and quantity contamination and deterioration; • Habitat and biodiversity loss; and • Loss of wetland areas.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Permanent (7)	The road will be permanent.	Minor (negative) - 48
Extent	Limited (2)	Impact will only be in a small section of the wetland.	
Intensity	Moderate loss (3)	Due to the area being very impacted already, the intensity will be moderate.	
Probability	Probable (4)	Impacts will probably occur without mitigation.	
Nature	Negative		
Mitigation Measures			
• The footprint shall be contained to the immediate servitude and demarcated to prevent the movement of unauthorised vehicles into the wetlands; • Keep to designated areas. Movement must be restricted to development footprint. Light vehicles should be used where possible; • All movement of construction equipment shall be contained to one road and small servitude, not larger than 4 m. Where practically possible, as little movement as possible within the wetlands will take place and the width of the servitude shall not be increased where the wetlands are located; and • The footprint for the proposed activity shall be demarcated to prevent the unauthorised entrance to the wetlands.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**

Duration	Permanent (7)	The road will be permanent.	Negligible (negative) - 30
Extent	Very limited (1)	Impact will only be in a small section of the wetland.	
Intensity	Minor loss (2)	Due to the area being very impacted already, the intensity will be minor if mitigation measures are followed.	
Probability	Unlikely (3)	Impacts are unlikely should mitigation measures be followed.	
Nature	Negative		
2. Activity and Interaction: Clearing and grubbing of approximately 0.3 ha.			
Impact Description: • Direct loss of wetland areas; • Habitat loss; • Loss of biodiversity; and • Erosion and sedimentation of wetland areas.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Long Term (4)	Site clearing should only take place during construction but the impact may be long term without mitigation.	Minot (negative) - 50
Extent	Local (3)	Impact will only be in a small section of the wetland and impact the local area.	
Intensity	Moderate loss (3)	Due to the area being very impacted already, the intensity will be moderate.	
Probability	Likely (5)	Impacts will likely occur without mitigation.	
Nature	Negative		
Mitigation Measures			

• Vegetation clearance will be undertaken during the dry season where practically possible; • Small equipment shall be used to minimize the area of impact within the immediate wetland area; • All movement must be contained to one road. Where practical possible, as little movement as possible within the wetland and catchment will take place; and • Areas that are not self-vegetated within 3 months will be ripped, landscaped, and reseeded.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium Term (3)	Site clearing should only take place during construction and impacts should not be longer than 1 year.	Negligible (negative) - 32
Extent	Local (3)	Impact will only be in a small section of the wetland and impact the local area.	
Intensity	Minor loss (2)	Due to the area being very impacted already, the intensity will be minor.	
Probability	Probable (4)	Impacts will probably occur without mitigation.	
Nature	Negative		
3. Activity and Interaction: Establishment of the laydown area and contractors office.			
Impact Description: • Indirect loss of wetland areas; • Habitat loss; • Loss of biodiversity; and • Erosion and sedimentation of wetland areas.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium Term (3)	Impact should only occur during the Construction Phase but the impact may last for the medium term without mitigation.	Negligible (negative) - 21
Extent	Limited (2)	Impact will occur outside the wetland area.	
Intensity	Minor loss (2)	Due to the activities being outside the wetlands, the intensity will be minor.	

Probability	Unlikely (3)	Impacts are unlikely.	
Nature	Negative		

Mitigation Measures

- Excavation shall be undertaken during the dry season where practically possible;
- Small equipment shall be used to minimize the area of impact within the immediate wetland area;
- If the construction is going to take longer than 3 months, vegetate the areas to prevent erosion and loss of soil and sedimentation; and
- Movement and construction activities, such as mixing of cement will take place outside of the wetlands and no spillage will take place within the wetland area. If any spillage occurs, it will be dealt with immediately.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Short Term (3)	Impact should only occur during the Construction Phase. The impact will be short term should the mitigation be implemented.	Negligible (negative) - 12
Extent	Very limited (1)	Impact will be mostly outside the wetland area, but with very limited impacts to the wetlands.	
Intensity	Minimal loss (2)	Due to the activities being outside the wetlands, the intensity will be minimal.	
Probability	Rare/improbable (2)	Impacts are improbable should the proposed mitigation be followed.	
Nature	Negative		

4. Activity and Interaction: Construction of the pump station and the pipeline from the pump station to the Discard Dump solution trench.

Impact Description:

- Wetland fragmentation;
- Water quality and quantity contamination and deterioration;
- Habitat and biodiversity loss;
- Increased AIPs;
- Erosion and sedimentation of wetland areas; and
- Loss of wetland areas.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Project Life (5)	Construction of the pipe may cause impacts for the life of the project.	Moderate (negative) - 91
Extent	Local Area (3)	The loss of wetland areas may lead to reduced water to the local area.	
Intensity	Moderate (5)	Construction will result in the complete loss some wetland areas.	
Probability	Definite (7)	Loss of wetland area will definitely occur.	
Nature	Negative		

Mitigation Measures

- Excavation shall be undertaken during the dry season where practically possible;
- Small equipment shall be used to minimize the area of impact within the immediate wetland area;
- All soil removed from the excavated area during the construction of the pipeline shall be stockpiled separately adjacent to the trench, but within the 4 m servitude area. A new road will have to be constructed and vegetation cleared to connect the existing road to the new construction area. The working servitude will be a maximum of 4 m wide and all vehicle movement shall be restricted to the servitude;
- The area will be revegetated after construction if not self-vegetated within 3 months;
- Conserve the topsoil so that it can be used for the rehabilitation of the disturbed areas;
- If the construction is going to take longer than 3 months, vegetate the stockpiles to prevent erosion and loss of soil and sedimentation;
- Movement, stockpiling and delivery of cement will take place outside of the wetlands and no spillage will take place within the wetland area. If any spillage occurs, it will be dealt with immediately; and
- Place sediment trapping berms on the boundary of the 100 m buffer of the wetland, or at the edge of the development area.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Long Term (4)	Site clearing should only take place during construction but the impact may last for the long term.	Minor (negative) - 55
Extent	Limited Area (3)	The loss of wetland areas may lead to reduced water to the immediate area.	

Intensity	Serious loss (4)	Construction will result in the complete loss of a very small area of wetland area, however, should mitigation be implemented the impact will be reduced.	
Probability	Likely (5)	Loss of wetland areas will likely occur even if mitigation measures are implemented.	
Nature	Negative		
5. Activity and Interaction: Installation of parking bays for the construction area and vehicles.			
Impact Description: • Erosion and sedimentation of wetland areas; • Water quality and quantity contamination and deterioration; and • Habitat and biodiversity loss.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium Term (3)	Impact should only occur during the Construction Phase but the impact may last for the medium term without mitigation.	Negligible (negative) - 21
Extent	Limited (2)	Impact will only occur outside the wetland area therefore spillage will be outside the wetlands.	
Intensity	Minor loss (2)	Due to the activities being outside the wetlands, the intensity will be minor.	
Probability	Unlikely (3)	Impacts are unlikely.	
Nature	Negative		
Mitigation Measures			

- Parking bays will be constructed outside wetland areas and will be contained to already disturbed areas;
- Construction shall be undertaken during the dry season where practically possible;
- Small equipment will be used to minimize the area of impact within the immediate wetland area;
- If the construction is going to take longer than 3 months, vegetate the areas to prevent erosion and loss of soil and sedimentation; and
- Movement and construction activities, such as mixing of cement will take place outside of the wetlands and no spillage will take place within the wetland area. If any spillage occurs, it will be dealt with immediately.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Short Term (3)	Impact should only occur during the Construction Phase. The impact will be short term should the mitigation be implemented.	Negligible (negative) - 14
Extent	Very limited (1)	Impact will only occur outside the wetland area therefore spillage will be outside the wetlands.	
Intensity	Moderate loss (3)	Due to the activities being outside the wetlands, the intensity will be moderate.	
Probability	Rare/improbable (2)	Impacts are improbable when mitigation is followed.	
Nature	Negative		

6. Activity and Interaction: Installation of temporary warning signage.

Impact Description:

- Wetland fragmentation; and
- Erosion and sedimentation of wetland areas.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Short Term (3)	Impact should only occur during the Construction Phase. The impact will be short term.	Negligible (negative) - 14
Extent	Very limited (1)	Impact will only occur outside the wetland area.	

Intensity	Moderate loss (3)	Due to the activities being outside the wetlands, the intensity will be moderate.	
Probability	Rare/improbable (2)	Impacts are improbable due to the small areas.	
Nature	Negative		
Mitigation Measures			
• Warning signage will be placed outside of wetland areas as far as possible; • Movement and construction activities, such as mixing of cement will take place outside of the wetlands and no spillage will take place within the wetland area; and • All movement must be contained to one road. Where practical possible, as little movement as possible within the wetlands and catchment will take place.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Impact should only occur during the Construction Phase. The impact will be short term.	Negligible (negative) - 10
Extent	Very limited (1)	Impact will only occur outside the wetland area.	
Intensity	Minor loss (2)	Due to the activities being outside the wetlands, the intensity will be moderate.	
Probability	Rare/improbable (2)	Impacts are improbable due to the small areas.	
Nature	Negative		
7. Activity and Interaction: Topsoil stripping and stockpiling.			
Impact Description: • Erosion and sedimentation of wetland areas; and • Water quality and quantity contamination and deterioration.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Project Life (5)	Site clearing should only take place during construction, but the impact may last for the Project life, such as erosion and sedimentation	Moderate (negative) - 91

Extent	Local Area (3)	The loss of wetland areas may lead to reduced water to the local area.	
Intensity	moderate (5)	Site clearing will result in the complete loss of some wetland area.	
Probability	Certain (7)	Loss of some wetland areas will definitely occur.	
Nature	Negative		
Mitigation Measures			
• During the excavation, the topsoil must be stockpiled separate from the underlying material (B-horizon) to place the soil profile back in the original horizon-sequence; • If the construction is going to take longer than 3 months, vegetate the stockpiles to prevent erosion and loss of soil and sedimentation; • AIPs shall be controlled during and after the construction of the trench is completed; and • No raw materials shall be stockpiled within the wetland, but shall be stockpiled in demarcated areas outside the wetland areas.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Project Life (5)	Site clearing should only take place during construction but the impact may last for the Project life.	Minor (negative) - 44
Extent	Limited (2)	The loss of wetland areas may lead to reduced water to the immediate area, however will be minimal after rehabilitation	
Intensity	Serious Medium Term (4)	Site clearing will result in complete loss of some wetland area, however will be rehabilitated	
Probability	Probable (4)	Loss of wetland areas will occur; mitigation measures will attempt to limit the impacts on other wetland areas within the surrounding areas.	
Nature	Negative		
8. Activity and Interaction: Provision of sanitation facilities during the construction phase.			
Impact Description: • Water quality and quantity contamination and deterioration.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**

Duration	Short Term (2)	Sanitation facilities should only be provided during the Construction Phase. The impact is likely to last for the short term.	Negligible (negative) - 10
Extent	Very limited (1)	Impact will occur outside of the wetland area and will have very limited impacts on the wetland.	
Intensity	Minor loss (2)	Due to the activities being outside the wetlands, the intensity will be moderate.	
Probability	Rare/improbable (2)	Impacts are improbable due to the small areas.	
Nature	Negative		
Mitigation Measures			
• Install portable toilets for the personnel and provide trash cans all over the site outside wetland areas; • Portable toilets shall not be placed within the wetlands; • An agreement with a service provider shall be in place to service the portable toilets weekly to prevent this from becoming a nuisance; and • All waste shall be removed from site at the end of each week once construction activities are completed for the day.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Very limited/isolated (1)	Provision of sanitation facilities should only take place during construction for limited time.	Negligible (negative) - 6
Extent	Very limited (1)	Impact will occur outside the wetland area and will have very limited impacts on the wetlands.	
Intensity	Minimal loss (1)	Due to the activities being outside the wetlands, the intensity will be minimal.	
Probability	Rare/improbable (2)	Impacts are improbable due to the small areas.	
Nature	Negative		
9. Activity and Interaction: Demarcation of the site using fencing and gates.			

Impact Description:

- Wetland fragmentation; and
- Erosion and sedimentation of wetland areas.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Short Term (3)	Impact should only occur during the Construction Phase. The impact will be short term.	Moderate (negative) - 14
Extent	Very limited (1)	Impact will occur outside the wetland area and have very limited impact on the wetlands.	
Intensity	Moderate loss (3)	Due to the activities being outside the wetlands, the intensity will be moderate.	
Probability	Rare/improbable (2)	Impacts are improbable due to the small areas.	
Nature	Negative		

Mitigation Measures

- Linear infrastructure will be placed outside of wetland areas as far as possible;
- Culverts and constructed trenches will be used to prevent fragmentation of wetlands;
- Movement and construction activities, such as mixing of cement will take place outside of the wetlands and no spillage will take place within the wetland area; and
- All movement must be contained to one road. Where practical possible, as little movement as possible within the wetlands and catchment will take place.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Short Term (2)	Impact should only occur during the Construction Phase. The impact will be short term.	Minor (negative) - 10
Extent	Very limited (1)	Impact will occur outside the wetland area and have very limited impact on the wetlands.	
Intensity	Minor loss (2)	Due to the activities being outside the wetlands, the intensity will be moderate with mitigation.	
Probability	Rare/improbable (2)	Impacts are improbable due to the small areas.	

Nature	Negative		
10. Activity and Interaction: Waste generation and removal of waste.			
Impact Description: • Water quality and quantity contamination and deterioration; • Habitat and biodiversity loss; • Erosion and sedimentation of wetland areas			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium Term (3)	Waste generation and removal should only take place during construction phase	Minor (negative) - 60
Extent	Project Area (3)	Impacts will be limited to the Project Area	
Intensity	Serious (6)	Impacts might result in the loss of wetland health and biodiversity.	
Probability	Certain (5)	Impacts will most certainly occur.	
Nature	Negative		
Mitigation Measures			
• All movement of construction equipment shall be contained to one road and small servitude; • Where practical possible, as little movement as possible within the wetlands will take place and the width of the servitude shall not be increased where the wetlands are located; • The footprint for the proposed activity shall be demarcated to prevent unauthorised entrance to the wetlands; • All construction equipment and personnel shall keep to designated areas; • Light vehicles should be used where possible.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (2)	Waste generation and removal should only take place during construction and will be removed from site	Negligible (negative) - 12
Extent	Limited Area (2)	Impacts will only be in limited areas where spills/dumping has occurred	
Intensity	Minor loss (2)	Impacts will be minor when mitigation is followed	

Probability	Improbable (2)	With mitigation measures, impacts are unlikely.	
Nature	Negative		

8.2. Operational Phase

Activities during the Operational Phase that may have potential impacts on the wetlands are described in Table 8-3 below.

Table 8-3: Interactions and Impacts of Activity

No.	Interaction	Impact	Description
1	Maintenance of the pumps will be undertaken as required	• Soil erosion due to increased surface water runoff; • Siltation due to erosion of surface water resources leading to deteriorated water quality and quantity; • Change in habitat and potential change in species composition.	Maintenance could result in exposed soil surfaces for prolonged periods and the generation of loose soil which may be washed into wetland areas and cause sedimentation of wetland areas. The exposed soil surfaces will have no ability to slow water flow and as such may cause an altered or elevated water flow to the wetland areas which may prompt the onset of erosion in wetland areas. Additionally, erosion of the roads will lead to sedimentation of wetlands.

8.2.1. Management Objectives

The aim during the Operational Phase is to:

- Implement measures to prevent desiccation of the surrounding wetland areas due to the loss of upstream wetland habitat and thus to prevent the loss of water supply to the lower-lying wetland areas; and
- Limit operational activities to the operational area and ensure that no areas outside of the operational area are disturbed.

8.2.2. Impact Ratings

The Operational Phase impacts are rated in Table 8-4 below.

Table 8-4: Operational Phase Interactions and Impacts of Activity Rating

1. **Activity and Interaction:** Maintenance of the pumps will be undertaken as required.			
Impacts: • Soil erosion due to increased surface water runoff; • Siltation of surface water resources leading to deteriorated water quality and quantity; • Siltation of wetlands due to erosion; and • Change in habitat and potential change in species composition.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Long Term (4)	Maintenance will take place for the duration of the project life.	Minor (negative) - 40
Extent	Local (3)	Impact will only be in a small section of the wetland.	
Intensity	Moderate loss (3)	Due to the area being very impacted already, the intensity will be moderate.	
Probability	Probable (4)	Impacts will probably occur without mitigation.	
Nature	Negative		
Mitigation Measures			
• Keep to designated areas. Movement must be restricted to development footprint; • Light vehicles should be used where possible; • All movement of personnel and light vehicles shall be contained to one road; and • Where practically possible, as little movement as possible within the wetlands will take place and access of vehicles to wetland areas will be denied.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Long Term (4)	Maintenance will take place for the duration of the project life.	Negligible (negative) - 16
Extent	Limited (2)	Impact will only be in a small section of the wetland and impacts will be minimal if mitigation is followed.	
Intensity	Minor loss (2)	Due to the area being very impacted already, the intensity will be minor if mitigation is followed.	
Probability	Rare/Improbable (2)	It is unlikely that impacts will occur if mitigation is followed.	

Nature	Negative		

8.3. Rehabilitation Phase

Activities during the Rehabilitation Phase that may have potential impacts on the wetlands are described in Table 8-5 below.

Table 8-5: Decommissioning Phase Interactions and Implications of Activity

No.	Interaction	Impact	Description
1	All rubble and redundant material shall be removed from site to an appropriate licensed facility.	• Soil erosion due to surface runoff/soil compaction; • Siltation of surface water resources leading to deteriorated water quality and quantity; and • Change in habitat and potential change in species composition.	Vehicle movement in the wetland may result in hardened surface which could lead to increased runoff, erosion and sedimentation. Wetlands will silt up and might change the natural vegetation and habitat.
2	Areas where compaction has occurred will be ripped to allow the growth of vegetation.	• Soil erosion due to wind and surface water runoff; • Siltation of surface water resources leading to deteriorated water quality and quantity; • Change in habitat and potential change in species composition; and • Increased AIPs.	The activities that will be performed during the final rehabilitation will entail the movement of material and shaping of the topography and will include the establishment of vegetation on exposed soil surfaces. The movement of material and large areas of exposed soil surfaces could result in erosion that may cause sedimentation of wetland areas. Newly ripped areas will have minimal vegetation cover and might lead to erosion and sedimentation in the wetlands.
3	Area shall be shaped and contoured, as far as practicably possible, to mimic its surrounding areas and to encourage the recovery and continuity of the wetland vegetation.	• Soil erosion due to wind and surface water runoff; • Change in habitat and potential change in species composition; and • Increased AIPs.	Vehicles might compact the soils, increasing runoff causing erosion and sedimentation. Vegetation will be disturbed and might increase AIPs. Areas not sloped correctly might cause water ponding or increased runoff.

8.3.1. Management Objectives

The aim during the Rehabilitation Phase is to:

- Rehabilitate the affected areas to pre-construction state as far as possible without resulting in additional impacts to the wetland ecology throughout the process.

Impacts to the Project Area will as far as practicable possible be rectified and reduced. Avoidance of impacts is not possible during the Rehabilitation Phase; however the Rehabilitation Phase will include the mitigation and monitoring of impacts which will in turn have a positive consequence for the impact assessment.

8.3.2. Impact Ratings

The impact rating associated with rehabilitation of potentially affected areas have been predicted in Table 8-6 below.

Table 8-6: Rehabilitation and Impacts of Activity Rating

1. **Activity and Interaction:** All rubble and redundant material shall be removed from site to an appropriate licensed facility.			
Impacts: • Soil erosion due to surface runoff/soil compaction; • Siltation of surface water resources leading to deteriorated water quality and quantity; and • Change in habitat and potential change in species composition.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Rehabilitation and removal of waste will only be for a short period.	Negligible (negative) - 30
Extent	Limited (2)	The activity will only be within the Project Area.	
Intensity	Minor Loss (2)	The activity will only cause minor losses to the wetlands.	
Probability	Unlikely (5)	It is unlikely that impacts will result from the activity.	
Nature	Negative		
Mitigation Measures			

- Keep to designated areas. Movement must be restricted to development footprint;
- Light vehicles should be used where possible;
- All movement of personnel and light vehicles shall be contained to one road;
- Where practically possible, as little movement as possible within the wetlands will take place and access of vehicles to wetland areas will be denied; and
- Waste will be stored outside the wetland and removed as soon as possible from the site.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Immediate (1)	The removal of waste will be less than one month and have limited effects.	Negligible (negative) - 9
Extent	Very Limited (1)	The activity will only be within the waste storage area.	
Intensity	Minimal to no Loss (1)	The activity will only cause minimal loss to wetlands.	
Probability	Unlikely (3)	It is unlikely that impacts will result from the activity.	
Nature	Negative		

2. Activity and Interaction: Areas where compaction has occurred will be ripped to allow the growth of vegetation.

Impacts:

- Soil erosion due to wind and surface water runoff;
- Siltation of surface water resources leading to deteriorated water quality and quantity;
- Change in habitat and potential change in species composition; and
- Increased AIPs.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Short Term (2)	Ripping of the areas will only occur for a short period.	Negligible (negative) - 20
Extent	Limited (2)	The activity will only be within the Project Area.	
Intensity	Minimal Loss (1)	Activity will help reduce the impacts.	
Probability	Probable (4)	It is probable that increases in AIPs will occur as well as erosion.	

Nature	Negative		
Mitigation Measures			
• Erection of sediment trapping berms around (100 m buffer) the wetland areas to prevent sedimentation of wetland areas during the rehabilitation of the site; • Shaping of landscape should be performed in a manner that will allow water to drain freely towards wetland areas, as far as practicable possible; • If self-vegetation has not occurred within 3 months of the work, seeding has to be done; • Implement a AIPs program to prevent proliferation of AIPs; • Avoiding creating narrow preferential flow paths as the this could lead to erosion; and • As far as possible, conduct work during the dry season.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Immediate (1)	Ripping of the areas will only occur for a very short period.	Negligible (negative) - 9
Extent	Very Limited (1)	The activity will only be within a small area when mitigation is followed.	
Intensity	Minimal Loss (1)	Activity will help reduce the impacts and therefore will have very limited impacts itself.	
Probability	Unlikely (3)	It is unlikely that impacts will occur when mitigation measures are followed.	
Nature	Negative		
3. Activity and Interaction: Area shall be shaped and contoured to mimic its surrounding areas and to encourage the recovery and continuity of the wetland vegetation.			
Impacts: • Soil erosion due to wind and surface water runoff; • Change in habitat and potential change in species composition; and • Increased AIPs.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Reshaping and revegetation of the areas will only occur for a short period.	Negligible (negative) - 20
Extent	Limited (2)	The activity will only be within the Project Area.	

Intensity	Minimal Loss (1)	Activity will help reduce the impacts and therefore will have very limited impacts itself.	
Probability	Probable (4)	It is probable that increases in AIPs will occur as well as erosion and loss of habitat.	
Nature	Negative		
Mitigation Measures			
• Shaping of landscape should be performed in a manner that will allow water to drain freely towards wetland areas; • If self-vegetation has not occurred within 3 months of the work, seeding has to be done; • Implement a AIPs program to prevent proliferation of AIPs; • Avoiding creating narrow preferential flow paths as the this could lead to erosion; and • As far as possible, conduct work during the dry season. Rehabilitation work should be performed during the dry season, unless it is highly urgent and could be detrimental to the health of wetland areas.			
Post to Mitigation/Management			
Dimension	**Rating**	**Motivation**	Negligible (negative) - 15
Duration	Short Term (2)	Reshaping and revegetation of the areas will only occur for a short period.	
Extent	Limited (2)	The activity will only be within the Project Area.	
Intensity	Minimal Loss (1)	Activity will help reduce the impacts and therefore will have very limited impacts itself.	
Probability	Unlikely (3)	It is probable that increases in AIPs will occur as well as erosion and loss of habitat.	
Nature	Negative		

8.4. Cumulative Impacts

The activities within the Project Area and catchment have led to losses in wetland areas that may have facilitated increased water flow and also have increased the number of pollutants flowing/seeping into the water resources. The alteration of vegetation and surface flow has led to the onset of erosion in the wetlands, and this may be perpetuated further by mining and related activities within the Project Area.

The area is heavily impacted and very limited natural areas occur within the Project Area.

8.5. Unplanned and Low Risk Events

There is a risk that wetlands associated with the infrastructure throughout the life of the proposed Project might be affected by the entry of hazardous substances, such as hydrocarbons, in the event of a spillage or unseen seepage from parking and storage facilities during the construction phase. Accidents during the construction of the pipeline might cause unplanned spillage of hydrocarbons, erosion and fragmentation of the wetland.

Table 8-7 outlines mitigation measures that must be adopted in the event of unplanned impacts throughout the life of the proposed Project.

Table 8-7: Unplanned Events and Associated Mitigation Measures

Unplanned Risk	Mitigation Measures
• Hazardous substances and (or) contaminant spills from construction operation, infrastructure and associated activities.	• Ensure correct storage of all hazardous substances at operations as per each chemical's specific storage requirements (e.g. sealed containers for hydrocarbons); • Ensure staff involved at the proposed Project have been trained to correctly work with hazardous substances at the sites; and • Ensure spill kits (e.g. Drizit) are readily available at areas where chemicals are known to be used. Staff must also receive appropriate training in the event of a spill, especially near wetlands, watercourses and/or drainage lines.
• Unplanned structural deterioration or accidents along the pipeline in the vicinity of wetlands.	• Maintenance of the pipeline should be considered an ongoing process where leakages or issues with the pipeline should be reported to the TEP Environmental Practitioner (EP) immediately after detection.

9. Environmental Management Plan

The Environmental Management Plan (EMP) is described in Table 9-1 below.

Table 9-1: Environmental Management Plan

Phase	Activities	Potential Impacts	Mitigation Measure	Mitigation Type	Period for Implementation
Construction	• Development and upgrading of a permanent access road to the site; • Clearing and grubbing of approximately 0.3 ha • Establishment of the laydown area and contractors camp; • Construction of the pump station and the pipeline from the pump station to the Discard Facility; • Installation of parking bays for the construction area and vehicles; • Installation of temporary warning signage; • Topsoil stripping and stockpiling; • Provision of sanitation facilities during the construction phase; • Demarcation of the site using fencing and gates; and • Waste generation and removal of waste.	• Wetland fragmentation; • Water quality and quantity contamination and deterioration; • Habitat and biodiversity loss; • Loss of wetland areas; • Erosion and sedimentation of wetland areas; and • Increased AIPs.	• The footprint shall be contained to the immediate servitude and demarcated to prevent the movement of unauthorised vehicles into the wetlands; • Keep to designated areas. Movement must be restricted to development footprint. Light vehicles should be used where possible; • All movement of construction equipment shall be contained to one road and small servitude, not larger than 4 m. Where practically possible, as little movement as possible within the wetlands will take place and the width of the servitude shall not be increased where the wetlands are located; • Vegetation clearance will be undertaken during the dry season where practically possible; • Small equipment shall be used to minimize the area of impact within the immediate wetland area; • All movement must be contained to one road. Where practical possible, as little movement as possible within the wetlands and catchment will take place; • Excavation of the pumpstation well and pipeline shall be undertaken during the dry season where practically possible; • Movement and construction activities, such as mixing of cement will take place outside of the wetlands and no spillage will take place within the wetland area. If any spillage occur, it will be dealt with immediately; • All soil removed from the trench shall be stockpiled separately, adjacent to the pit, within the 4 m servitude area. A new road will have to be constructed and vegetation cleared to connect the existing road to the new construction area. This shall be done to a maximum of 4 m servitude and vehicle movement restricted to the servitude; • Conserve the topsoil so that it can be used for the rehabilitation of the disturbed areas; • If the construction is going to take longer than 3 months, vegetate the stockpiles to prevent erosion and loss of soil and sedimentation; • Parking bays will be constructed outside wetland areas; • Warning signage will be placed outside of wetland areas as far as possible; • During the excavation, the topsoil must be stockpiled separate from the underlying material (B-horizon) to place the soil profile back in the original horizon-sequence; • AIPs shall be controlled during and after the construction of the trench is completed; • No raw materials shall be stockpiled within the wetland and shall be stockpiled in demarcated areas outside the wetland areas; • Linear infrastructure will be placed outside of wetland areas as far as possible; • Culverts and constructed trenches will be used to prevent fragmentation of wetlands; • All construction equipment and personnel shall keep to designated areas.	Concurrent rehabilitation through the life of the Project	Life of Construction Phase

Operational	• Maintenance will be undertaken of the pumps as and when required.	• Soil erosion due to increased surface water runoff; • Siltation of surface water resources leading to deteriorated water quality and quantity; • Siltation of wetlands due to erosion; and • Change in habitat and potential change in species composition.	• Keep to designated areas. Movement must be restricted to development footprint; • Light vehicles should be used where possible; • All movement of personnel and light vehicles shall be contained to one road; and • Where practically possible, as little movement as possible within the wetlands will take place and access of vehicles to wetland areas will be denied.	Concurrent rehabilitation through the life of the Project	Life of Operational Phase
Rehabilitation	• All rubble and redundant material shall be removed from site to an appropriate licensed facility; • Areas where compaction has occurred will be ripped to allow the growth of vegetation; and • Area shall be shaped and contoured to mimic its surrounding areas and to encourage the recovery and continuity of the wetland vegetation.	• Soil erosion due to surface runoff/soil compaction; • Siltation of surface water resources leading to deteriorated water quality and quantity; • Change in habitat and potential change in species composition; and • Increased AIPs.	• Keep to designated areas. Movement must be restricted to development footprint; • No movement shall be allowed in areas already rehabilitated; • All movement of personnel and light vehicles shall be contained to one road; • Where practically possible, as little movement as possible within the wetlands will take place and access of vehicles to wetland areas will be denied; • Waste will be stored outside the wetland and removed as quickly as possible from the site; • Creation of sediment trapping berms around (100 m buffer) the wetland areas to prevent sedimentation of wetland areas during the rehabilitation of the site; • Shaping of landscape should be performed in a manner the will water to drain freely towards wetland areas; • If self-vegetation has not occurred within 3 months of the work, seeding has to be done; • Implement a AIPs program to prevent proliferation of AIPs; • Avoiding creating narrow preferential flow paths as the this could lead to erosion; and • As far as possible, conduct work during the dry season. Rehabilitation work should be performed during the dry season, unless it is highly urgent and could be detrimental to health of wetland areas.	Concurrent rehabilitation through the life of the Project	Life of Decommissioning Rehabilitation and beyond

10. Monitoring Programme

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented together with ensuring effectiveness of the management measures in place.

Table 10-1 describes the monitoring plan which should be followed from the Construction Phase through to the Rehabilitation and Monitoring phase. Table 10-1 includes each element of monitoring together with the frequency of monitoring and person responsible.

The monitoring programme is based on the following points:

- Throughout the Construction Phase, monitoring should be done annually for wetlands and vegetation, preferable right after the rainy season (March to May);
- Throughout the Operational and Rehabilitation Phases, bi-annual (twice a year) external monitoring of wetlands, preferable one survey after the rainy season (March to May) and one after the dry season (July to September);
- Monitoring should be done in terms of:
  - EIA Regulations, 2014 (GN R 982 of 4 December 2014 as amended by GN R326 of 7 April 2017) promulgated under the NEMA;
  - NEMA, 1998 (Act No. 107 of 1998);
  - NEM:WA, 2008 (Act No. 59 of 2008); and
  - CARA, 1983 (Act No. 43 of 1983).
- The Environmental Practitioner (EP) are responsible to report on results of the monitoring program; and
- Internal monitoring reports should be required, reporting on the progress of the state of the monitoring and rehabilitation programme. This should be completed after each external monitoring report.

As the proposed Project Area is comprised largely of wetland habitat, it is recommended that the WET-Health and WET-EcoServices tools should be used to re-evaluate the PES and ES six months after the Construction Phase, and annually thereafter until the PES and ES are evaluated as to prior-construction.

Table 10-1: Monitoring Plan

Monitoring Element	Comment	Requirements	Frequency	Responsibility
• Wetland extent; • Wetland integrity; • Wetland functionality; • Soil disturbances; • Linear infrastructure; • Erosion status; • Surface water quality and quantity; • Vegetation basal cover; • Vegetation species diversity; and • Infrastructure has been fully rehabilitated.	• Impacts such as damming and infilling can result in a loss of wetland area; • The entrance point of the pipeline to the trench might results in erosion and head cut erosion; • A PES and ES assessment is necessary to detect changes to the health of vegetation (including alien invasion), hydrology, and geomorphology of the wetlands associated with the site. This allows for the determination of the PES; and • The EIS of the wetlands should be determined to detect any alteration to functionality.	• Control and remove AIPs where necessary; • Define and establish the long-term land management system (grass needs regular defoliation if it is to be sustainable); • There must be no planting of alien plants (e.g. black wattle, eucalyptus and pampas grass) anywhere within the Project Area; • Annual surveys, aimed at updating the AIPs list and establishing and updating the invasive status of each of the alien species, should be carried out (can be done by staff); • The transportation of soils or other substrates infested with AIPs should be strictly controlled; • Continuous erosion monitoring of rehabilitated areas should be undertaken and zones with excessive erosion should be identified. Erosion can either be quantified or the occurrence there-of simply recorded for the specific location.	• Six months after the Construction Phase, and annually thereafter until the PES and ES are evaluated as to prior-construction	• The EP should ensure wetland monitoring on-site; • EP to give training to sub-contractors and all workers on the operational procedures and mitigation measures; and • The EP should be responsible to determine the effectiveness of erosion control structures.

11. Stakeholder Engagement Comments Received

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

- To ensure that I&APs are informed about the Project;
- To provide 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 I&APs in identifying methods in which concerns can be addressed;
- To verify that stakeholder comments have been accurately recorded; and
- To comply with the legal requirements.

The Public Participation Process (PPP) has not been completed yet, and is a process separate to the Wetland Environmental Impact Assessment. No formal consultation was undertaken as part of this assessment. Should any I&AP comments be submitted in relevance to wetland resources during the SEP, these will be considered in the final BA report.

12. Recommendations

The following actions are recommended to reduce adverse effects on the wetland resources of the Project Area (Table 12-1):

Table 12-1: Possible Impacts and Recommendations

Possible Impacts	Recommendations
Loss of wetland vegetation and habitat.	Recreate wetland habitat after construction of the pipeline. Ensure proper landscaping, shaping and revegetation
Soil disturbance, and decreasing biodiversity resulting in increased sedimentation and increased erosion.	Improved vegetation cover and establish hydrophytic plants and facultative hydrophytes that are native to the area. Reduced risk of erosion and sedimentation. If self-vegetation has not occurred in 3 months, re-seeding should be done.
Linear infrastructures resulting in fragmentation of wetlands, the creation of preferential flow paths, and the onset of erosion.	Reduced risk of erosion, compaction, and the creation of preferential flow paths. Maintain linear infrastructure such as roads.
Water quality impacts.	Improved water quality and prevention of pollution. Prevent contaminated water entering the wetland. If spills or leakages from the pipe occur, it should be cleaned up immediately.

13. Reasoned Opinion Whether Project Should Proceed

Based on the aforementioned information and impact ratings, it is the opinion of the specialist that this project will have minor impacts on the wetlands. The proposed pipeline will help remediate the current pollution within the wetland. The Project Area is heavily disturbed, and the proposed pipeline might rather have a positive effect on the wetland in the long-term. It is however important to implement the mitigation measures provided to ensure minimal impacts to the wetland.

A Rehabilitation Audit Programme, one year after the Rehabilitation Phase is complete, is recommended to ensure successful rehabilitation and to achieve the committed land use and sustainability of the wetlands after mining activities have ceased.

As the proposed Project Area is comprised largely of wetland habitat, it is recommended that the WET-Health and WET-EcoServices tools should be used to re-evaluate the PES and ES six months after the Construction Phase, and annually thereafter until the PES and ES are evaluated as to prior-construction.

14. Conclusion

The wetlands were previously assessed by Digby Wells (Digby Wells Environmental, 2019) where the PES was rated as seriously modified (**E**) and the EIS as **Moderate.** The 2021 assessment included a desktop assessment of the previously conducted assessment as well as re-assessing the wetland health and sensitivities (PES and EIS) during a rapid site survey. In conclusion, no significant changes were observed from the previous findings and was re-assessed as PES **E** and EIS **Moderate**.

The ES was previously not determined; however, it was determined during this assessment as **Moderate**, with the main ecological services provided being flood attenuation, phosphate assimilation, nitrate assimilation, toxicant assimilation and education and research.

The impact assessment did not indicate that the proposed listed activities will have a large effect on the wetland. The Project Area is currently heavily impacted by other land use activities and the proposed pipeline will therefore not have a significant effect on the wetland, given the mitigation measures are implemented. It is in the opinion of the specialist that the pipeline will likely have a long-term positive effect on the wetland as the contaminated water will be extracted from the wetland and pumped into the Fine Coal and Discard facility cut-off trenched to the RWD and then reused in the TEP process. This will allow the wetland to possibly recover and increase the health and ecological services it currently provides.

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Appendix A: Methodology

Methodology

Literature Review and Desktop Assessment

Relevant literature was reviewed with respect to the historical wetlands associated with the Project Area, habitats and vegetation types as well as the wetland state prior to development. This was completed to obtain relevant information on the wetland ecology of the Project Area and its vicinity to acquire enough information to compile a Wetland Environmental Impact Assessment Report.

For the purpose of this assessment, wetland areas were identified, and preliminary wetland boundaries were delineated at the desktop level using detailed aerial imagery and wetland signatures, along with 5 m contours. Baseline and background information were researched and used to understand the area on a desktop level prior to fieldwork confirmation. This included but was not limited to:

- A practical field procedure for the identification and delineation of wetlands and riparian areas (Department of Water Affairs and Forestry, 2005);
- WET-RoadMap: A Guide to the Wetland Management Series (WRC, 2007);
- National Freshwater Ecological Priority Areas (NFEPA) (Driver, et al., 2011; Nel, et al., 2011);
- Mining and Biodiversity Guidelines, DEA et al. (2013);
- Mpumalanga Biodiversity Sector Plan (MTPA, 2014);
- Wetland Offsets: A Best Practice Guideline for South Africa (SANBI and DWS, 2016); and
- All relevant studies previously completed by Digby Wells within or nearby the Project Area, namely:
    - Wetland Impact Assessment Report (Digby Wells Environmental, 2019);
    - Wetland Assessment Report (Digby Wells Environmental, 2019); and
    - Integrated Water and Waste Management Plan (Digby Wells Environmental, 2021).

Relevant and available historical studies conducted within, or surrounding the Project Area, the South African National Biodiversity Institute (SANBI), Water Management Areas (WMA) and Quaternary Catchments, the National Spatial Biodiversity Assessment, Governmental reports such as the Mpumalanga State of the Environment Report (2003), Vegetation types of South Africa (Mucina & Rutherford, The Vegetation of South Africa, Lesotho and Swaziland., 2012), and Fauna distribution and identification books of South Africa (Friedman & Daly, 2004; Skinner & Chimimba, 2005) were some of the platforms used to identify and create a background study of the area.

National Freshwater Ecosystem Priority Areas

The NFEPA Project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel, et al., 2011). The spatial layers (FEPAs) include the nationally delineated wetland areas that are classified into Hydro-geomorphic (HGM) units and ranked in terms of their biodiversity importance. These layers were assessed to evaluate the importance of the wetlands.

The NFEPA Project represents a multi-partner Project between the CSIR, SANBI, WRC, DWS, DEA, WWF, SAIAB and SANParks. The NFEPA Project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel, et al., 2011).

More specifically, the NFEPA Project aims to:

1. Identify FEPAs to meet national biodiversity goals for freshwater ecosystems; and
2. Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers.

The first aim uses systematic biodiversity planning to identify priorities for conserving South Africa's freshwater biodiversity within the context of equitable social and economic development. The second aim is comprised of two separate components: the (i) national component aimed to align DWS and DEA policy mechanisms and tools for managing and conserving freshwater ecosystems, while the (ii) sub-national component is aimed to use three case studies to demonstrate how NFEPA products should be implemented to influence land and water resource decision-making processes. The Project further aimed to maximize synergies and alignment with other national level initiatives, including the National Biodiversity Assessment (NBA) and the Cross-Sector Policy Objectives for Inland Water Conservation (Driver, et al., 2011).

Based on a desktop-based modelled wetland condition and a combination of special features, including expert knowledge (e.g. intact peat wetlands, presence of rare plants and animals, etc.) and available spatial data on the occurrence of threatened frogs and wetland-dependent birds, each of the wetlands within the inventory were ranked in terms of their biodiversity importance and as such, Wetland FEPAs were identified in an effort to achieve biodiversity targets (Driver, et al., 2011). Table 1 below indicates the criteria that were considered for the ranking of each of these wetland areas. Whilst being a valuable tool, it is important to note that the FEPAs were delineated and studied at a desktop and relatively low-resolution level. Thus, the wetlands delineated via the desktop delineations and ground-truthing work done through this study may differ from the NFEPA data layers. The NFEPA assessment does, however, hold significance from a national perspective.

Table 1: NFEPA Wetland Classification Ranking Criteria (Nel et al., 2011)

Criteria	Rank
Wetlands that intersect with a Ramsar site.	1
• Wetlands within 500 m of an International Union for Conservation of Nature (IUCN) threatened frog point locality; • Wetlands within 500 m of a threatened water-bird point locality; • Wetlands (excluding dams) with most of their area within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes, Grey Crowned Cranes and Blue Cranes; • Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of exceptional Biodiversity importance, with valid reasons documented; and • Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands that are good, intact examples from which to choose.	2
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of biodiversity importance, but with no valid reasons documented.	3
Wetlands (excluding dams) in A or B condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion); and Wetlands in C condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion).	4
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing Impacted Working for Wetland sites.	5
Any other wetland (excluding dams).	6

Mining and Biodiversity Guideline

The Mining and Biodiversity Guideline was developed collaboratively by SANBI, the DEA, the Department of Mineral Resources (DMR), the Chamber of Mines and the South African Mining and Biodiversity Forum (2013). The purpose of the guideline was to provide the mining sector with a manual to integrate biodiversity into the planning process thereby encouraging informed decision-making around mining development and environmental authorisations. The aim of the guideline is to explain the value for mining companies to consider biodiversity management throughout the planning process. The guideline highlights the importance of biodiversity in managing the social, economic and environmental risk of the proposed mining Project. The country has been mapped into biodiversity priority areas including the four categories each with associated risks and implications (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute, 2013) (Table 2).

Table 2: Mining and Biodiversity Guideline Categories (DEA et al., 2013)

Category	Risk and Implications for Mining
Legally Protected	Mining prohibited; unless authorised by ministers of both the DEA and DMR.
Highest Biodiversity Importance	Highest Risk for Mining: the EIA process must confirm significance of the biodiversity features that may be a fatal flaw to the proposed Project. Specialists must provide site-specific recommendations for the application of the mitigation hierarchy that informs the decision-making processes of mining licences, water use licences and environmental authorisations. If granted, authorisations should set limits on allowed activities and specify biodiversity related management outcomes.
High Biodiversity Importance	High Risk for Mining: the EIA process must confirm the significance of the biodiversity features for the conservation of biodiversity priority areas. Significance of impacts must be discussed as mining options are possible but must be limited. Authorisations may set limits and specify biodiversity related management outcomes.
Moderate Biodiversity Importance	Moderate Risk for Mining: the EIA process must confirm the significance of the biodiversity features and the potential impacts as mining options must be limited but are possible. Authorisations may set limits and specify biodiversity related management outcomes.

Mpumalanga Biodiversity Sector Plan (MBSP)

The MBSP is a spatial tool that forms part of the national biodiversity planning tools and initiatives that are provided for national legislation and policy. The MBSP was published in 2014 by the Mpumalanga Tourism and Parks Agency (MTPA) and comprises a set of maps of biodiversity priority areas accompanied by contextual information and land-use guidelines for use in land-use and development planning, environmental assessment and regulation, and natural resource management (MTPA, 2014). Strategically the MBSP enables the province to:

- Implement the NEM:BA, 2004 provincially, and comply with requirements of the National Biodiversity Framework, 2009 (NBF) and certain international conventions;
- Identify those areas of highest biodiversity that need to be considered in provincial planning initiatives; and
- Address threat of climate change (ecosystem-based adaptation).

The publication includes terrestrial and freshwater biodiversity areas that are mapped and classified in Protected Areas (PAs), Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) or Other Natural Areas (ONAs) (Table 3).

Wetlands in Mpumalanga Province have been extensively degraded and, in many cases, irreversibly modified and lost through a combination of inappropriate land-use practices,

development, agriculture and mining. Wetlands represent ecosystems of high value for delivering, managing and storing good water quality for anthropological and animal use yet they are vulnerable to undesirable impacts. It is therefore in the interest of national water security that all wetlands are protected by law.

Table 3: Mpumalanga Biodiversity Sector Plan Categories

Map Category	Definition	Desired Management Objectives
PA	Those areas that are proclaimed as protected areas under national or provincial legislation, including gazette protected environments.	Areas that are meeting biodiversity targets and therefore must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity.
CBAs	Areas that are required to meet biodiversity targets, for species, ecosystems or ecological processes. CBA Wetlands are those that have been identified as FEPA wetlands that are important for meeting biodiversity targets for freshwater ecosystems.	Must be kept in a natural state, with no further loss of habitat. Only low-impact, biodiversity-sensitive land-uses are appropriate.
ESAs	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services. ESAs Wetlands are those that are non-FEPA and ESA Wetland Clusters are clusters of wetlands embedded within a largely natural landscape that function as a unit and allow for the migration of species such as frogs and insects between individual wetlands.	Maintain in a functional, near-natural state, but some habitat loss is acceptable. A greater range of land-uses over wider areas is appropriate, subject to an authorization process that ensures the underlying biodiversity objectives are not compromised.
ONAs	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions. Although they have not been prioritized for biodiversity, they are still an important part of the natural ecosystem.	An overall management objective should be to minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. These areas offer the greatest flexibility in terms of management objectives and permissible land-uses, but some authorisation may still be required for high-impact land-uses.

Map Category	Definition	Desired Management Objectives
Heavily or Moderately Modified Areas	Areas that have been modified by human activity to the extent that they are no longer natural, and do not contribute to biodiversity targets. These areas may still provide limited biodiversity and ecological infrastructural functions, even if they are never prioritized for conservation action.	Such areas offer the most flexibility regarding potential land-uses, but these should be managed in a biodiversity-sensitive manner, aiming to maximize ecological functionality and authorization is still required for high-impact land-uses. Moderately modified areas (old lands) should be stabilized and restored where possible, especially for soil carbon and water-related functionality.

National Biodiversity Assessment (NBA)

The National Biodiversity Assessment (NBA) presents the best available science on South Africa's biodiversity (SANBI, 2018). It aims to inform policy, planning and decision making in a range of sectors for the conservation and sustainable use of biodiversity. The NBA 2018 builds on the National Spatial Biodiversity Assessment 2004 and 2011 thus providing a comprehensive picture of South Africa's biodiversity threat status and protection level over time (SANBI, 2018).

The NBA has four indicators, providing information on the threat status and protection level of ecosystems and species. The threat status indicators use the established IUCN Red List of Species and Red List of Ecosystems assessment frameworks. The risk of extinction (species) or collapse (ecosystems) is evaluated across all realms and for taxonomic groups for which sufficient data exists. The protection level indicators reflect how well our species and ecosystem types are represented in the protected area network (SANBI, 2018).

Wetland Identification, Delineation and Classification

A detailed desktop delineation was done prior the field assessment. The site survey was therefore done for ground truthing purposes to verify the desktop delineations as well as compiling data and information to assess the wetland health, ecological state and importance and sensitivity.

The wetland delineations were verified according to the accepted methodology from the Department of Water and Sanitation 'A practical field procedure for identification and delineation of wetlands and riparian areas' (Department of Water Affairs and Forestry, 2005) as well as the "Updated manual for identification and delineation of wetlands and riparian areas" (Department of Water Affairs and Forestry, 2008). These methodologies use the:

- **Terrain Unit Indicator**: Identifies those parts of the landscape where wetlands are more likely to occur;

- **Soil Form Indicator**: Identifies the soil forms, which are associated with prolonged and frequent saturation;
- **Soil Wetness Indicator**: Identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- **Vegetation Indicator**: Identifies hydrophilic vegetation associated with frequently saturated soils.

Terrain Unit Indicator

Terrain Unit Indicator (TUI) areas include depressions and channels where water would be most likely to accumulate. These areas are determined with the aid of topographical maps, contour data, aerial photographs and engineering and town planning diagrams (Department of Water Affairs and Forestry, 2005). In accordance with the guidelines provided by the DWS (Department of Water Affairs and Forestry, 2005) wetlands are identified and classified into various HGM units based on their individual characteristics and setting within the landscape. The HGM unit classification system focuses on the hydro-geomorphic setting/position of wetlands in a landscape which incorporates geomorphology, water movement into, through and out of the wetland. The HGM unit is dependent on various aspects, including whether the drainage is open or close, water is dominating the system or is sub-surface water, how the water flows from and into the wetlands and how water is contained within the wetland. Once wetlands have been identified, they are categorised into HGM units as shown in Table 4.

Table 4: Description of the Various HGM Units for Wetland Classification

Hydromorphic Wetland Type	Diagram	Description
Floodplain		Valley bottom areas with a well-defined stream channel stream channel, gently sloped and characterised by floodplain features such as oxbow depression and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom with a channel		Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.

Hydromorphic Wetland Type	Diagram	Description
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel usually gently sloped and characterised by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from the channel entering the wetland and also from adjacent slopes.
Hillslope seepage linked to a stream channel		Slopes on hillsides, which are characterised by colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.
Isolated hillslope seepage		Slopes on hillsides that are characterised by colluvial transport (transported by gravity) movement of materials. Water inputs are from sub-surface flow and outflow either very limited or through diffuse sub-surface flow but with no direct link to a surface water channel.
Pan/Depression		A basin-shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. It is inward draining). It may also receive subsurface water. An outlet is usually absent and so this type of wetland is usually isolated from the stream network.

Soil Indicators

Soil Form Indicators

Hydromorphic soils are characterized as soils that has undergone redox reactions because of the fluctuation of water and oxygen within the soil profile, creating segregations of iron (Fe) and manganese (Mn) particles. This fluctuation of water and oxygen in the soils can be attributed to the fluctuating ground water table, creating seasonal, temporary and permanent wet zones. Hydromorphic soils are thus Soil Form Indicators (SFI) which will display unique characteristics resulting from prolonged and repeated water saturation (Department of Water Affairs and Forestry, 2005). The permanent, as well as occasional saturation of soil results in anaerobic conditions of the soils causing a chemical, physical and biological change to the soil.

Hydromorphic soils are often identified by the colours of various soil components. The frequency and duration of the soil saturation periods strongly influences the colours of these components. Grey colours become more prominent in the soil matrix the higher the duration and frequency of saturation in a soil profile (Department of Water Affairs and Forestry, 2005). A feature of hydromorphic soils are coloured mottles (iron and manganese accumulation)

which are usually absent in permanently saturated soils and are most prominent in seasonally saturated soils and are less abundant in temporarily saturated soils (Department of Water Affairs and Forestry, 2005). The hydromorphic soils must display signs of wetness within 50 cm of the soil surface, as this is necessary to support hydrophytic vegetation.

Soils that are commonly associated with wetlands are: Champagne, Rensburg, Arcadia, Katspruit, Kroonstad, Longlands, Fernwood and Westley soil forms. These soil forms are associated with high clay content and accumulation of clay, promoting water logging and creating low drainage, thus water logging conditions. These soils are commonly associated with low-laying landscapes such as valley bottoms, foot-slopes and mid-slopes.

Soil Wetness Indicators

In practice, the Soil Wetness Indictor (SWI) is used as the primary indicator (Department of Water Affairs and Forestry, 2005). Iron and manganese accumulation in a soil profile, termed mottles, are some of the recognized 'wet-indicators'. These two elements are insoluble under aerobic (unsaturated) conditions and become soluble when the soil becomes anaerobic (saturated). The fluctuating water table creates these conditions by increasing and reducing the oxygen levels in the soil profile by increased and reduced water levels. Iron is one of the most abundant elements in soils and is responsible for the red and brown chroma of many soils.

During anaerobic (saturated) conditions, the iron and manganese in the soils are mobile and thus begin to leach out of the soil profile. Where oxidation takes place around for example roots, aggregate surfaces and pores, relatively insoluble ferric oxides is deposited leading to formation of red/green mottles and concretions. These soil profiles are commonly known as leached soils, gleysol, E-horizons or Albic horizons. Resulting from the prolonged anaerobic conditions, the soil matrix is left a grey, greenish or bluish colour, and is said to be "gleyed". Recurrence of the cycle of wetting and drying over many decades concentrates these insoluble iron compounds. Thus, soil that is gleyed and has mottles within the first 0.5 m of the surface are indicating a zone that is seasonally or temporarily saturated, interpreted and classified as a wetland (Department of Water Affairs and Forestry, 2005).

Vegetation Indicator

Plant communities undergo distinct changes in species composition along the wetness gradient from the centre of the wetland to the edge, and into adjacent terrestrial areas. Valuable information for determining the wetland boundary and wetness zone is derived from the change in species composition. A supplementary method for employing vegetation as an indicator is to use the broad classification of the wetland plants according to their occurrence in the wetlands and wetness zones (Kotze & Marneweck, Guidelnes for delineating the wetland boundary and zones within a wetland under the South African Water Act, 1999; Department of Water Affairs and Forestry, 2005). This is summarised in Table below.

When using vegetation indicators for delineation, emphasis is placed on the group of species that dominate the plant community, rather than on individual indicator species (Department of Water Affairs and Forestry, 2005). Areas where soils are a poor indicator (black clay, vertic

soils), vegetation (as well as topographical setting) is relied on to a greater extent and the use of the wetland species classification as per Table 5 becomes more important. If vegetation was to be used as a primary indicator, undisturbed conditions and expert knowledge are required (Department of Water Affairs and Forestry, 2005). Due to this uncertainty, greater emphasis is often placed on the SWI to delineate wetland areas.

Table 5: Classification of Plant Species According to Occurrence in Wetlands

Type	Description
Obligate Wetland Species (OW)	Almost always grow in wetlands: > 99% of occurrences.
Facultative Wetland Species (FW)	Usually grow in wetlands but occasionally are found in non-wetland areas: 67-99% of occurrences.
Facultative Species (F)	Are equally likely to grow in wetlands and non-wetland areas: 34-66% of occurrences.
Facultative Dry-land Species (FD)	Usually grow in non-wetland areas but sometimes grow in wetlands: 1-34% of occurrences.

(Source: (Department of Water Affairs and Forestry, 2005))

Wetland Ecological Health Assessment (WET-Health)

According to Macfarlane et al. (2009), the health of a wetland can be defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. A level 1 WET-Health assessment was done on the wetlands in accordance with the method described by Macfarlane et al., (2009) to determine the integrity (health) of the characterised HGM units for the wetlands associated with the Project Area. A Present Ecological State (PES) analysis was conducted to establish baseline integrity (health) for the associated wetlands. The health assessment attempts to evaluate the hydrological, geomorphological and vegetation health in three separate modules to attempt to estimate similarity to or deviation from natural conditions. The overall health score of the wetland is calculated using Equation, which provides a score ranging from 0 (pristine) to 10 (critically impacted in all respects).

Central to WET-Health is the characterisation of HGM units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated, or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described above.

The overall approach is to quantify the impacts on wetland health and then to convert the impact scores to a PES score. This takes the form of assessing the spatial extent of the impact of individual activities and then separately assessing the intensity of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The impact scores and PES categories are provided in Table 6 (Macfarlane, Kotze, & Ellery, 2009).

$$Wetland\ Health = \frac{3(Hydology) + 2(Geomorphology) + 2(Vegetation)}{7}$$

Equation 1: Overall Wetland Ecological Health Score

Table 6: Impact Scores and Present Ecological State Categories (WET-Health; Macfarlane et al., 2009)

Impact Category	Description	Combined Impact Score	PES Score (%)	PES Category
None	Unmodified, natural.	0-0.9	90-00	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota has taken place.	1-1.9	80-89	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	60-79	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	40-59	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	20-39	E
Critical	Modifications have reached a critical level and ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	0-19	F

As is the case with the PES, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit, within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (Table 7) (Macfarlane, Kotze, & Ellery, 2009).

Wetland Ecological Services (WET-EcoServices)

The importance of a water resource in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class (Department of Water Affairs and Forestry, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described Kotze et al. (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

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

The characteristics were used to quantitatively determine the value and, by extension, sensitivity of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland (Table 8).

Table 8: Classes for Determining the Likely Extent to Which a Benefit is Being Supplied

Score	Rating of the Likely Extent to Which the Benefit is Being Supplied
<0.5	Low
0.6-1.2	Moderately Low
1.3-2	Intermediate
2.1-3	Moderately High
>3	High

Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) tool was derived to assess the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present

to ensure the continued provision of ecosystem benefits in the long term. The methodology outlined by DWAF (1999) and updated in Kotze and Rountree (Kotze, Ellery, Macfarlane, & Jewitt, 2012; Rountree, Malan, & Weston, 2013), was used for this study.

In this method there are three suites of importance criteria; namely:

- **Ecological Importance and Sensitivity:** incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWS and thus enabling consistent assessment approaches across water resource types;
- **Hydro-functional Importance:** which considers water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- **Importance in Terms of Basic Human Benefits:** this suite of criteria considers the subsistence uses and cultural benefits of the wetland system.

These determinants are assessed for the wetlands on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. It is recommended that the highest of these three suites of scores be used to determine the overall Importance and Sensitivity category of the wetland system, as defined in Table 9.

Table 9: Interpretation of Overall EIS Scores for Biotic and Habitat Determinants

Ecological Importance and Sensitivity Category (EIS)	Range of Median
Very High Systems that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4
High Systems that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3
Moderate Systems that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2
Low/Marginal Systems that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1

Impact Assessment

The wetland impacts were assessed based on the impact's magnitude as well as the receiving environment's sensitivity, resulting in an impact significance rating which identified the most important impacts that require management. Based on international guidelines and legislation, the following criteria were taken into consideration when potentially significant impacts were examined relating to wetlands:

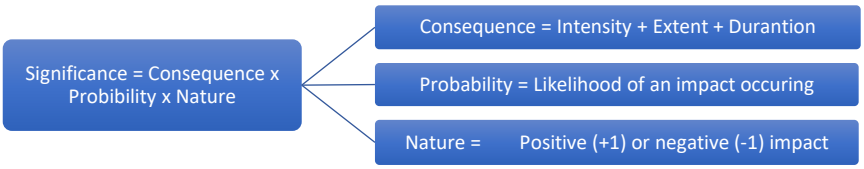
- Nature of impacts (direct/indirect and positive/negative);
- Duration (short/medium/long-term; permanent (irreversible)/temporary (reversible) and frequent/seldom);
- Extent (geographical area and size of affected population/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Measures to mitigate avoid or offset significant adverse impacts.

Significance Rating

Impacts and risks have been identified based on the description of the activities to be undertaken. Once the impacts were identified, a numerical environmental significance rating process was undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of a specific environmental impact.

The severity of an impact was determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact was then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances.

Following the identification and significance ratings of potential impacts, mitigation and management measures were incorporated into the EMP. Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below. The significance rating process follows the established impact/risk assessment formula:



Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

The matrix calculated the rating out of 147, whereby intensity, extent, duration and probability were each rated out of seven as indicated in Table 11. The weight assigned to the various parameters was then multiplied by +1 for positive and -1 for negative impacts.

Parameter Rating

Impacts are rated prior to mitigation and again after consideration of the mitigation proposed in this report. The significance of an impact is then determined and categorised into one of seven categories, as indicated in Table 11, which is extracted from Table 12. The description of the significance ratings is discussed in Table 13.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Mitigation Hierarchy

The aim of the Impact Assessment is to strive to avoid damage to or loss of ecosystems and services that they provide, and where they cannot be avoided, to reduce and mitigate these impacts (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute, 2013). Offsets to compensate for loss of habitat are regarded as a last resort, after all efforts have been made to avoid, reduce and mitigate. The mitigation hierarchy is represented in Table 10.

Table 10: Mitigation Hierarchy

	Avoid or Prevent	Refers to considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services and people. This is the best option but is not always possible. Where environmental and social factors give rise to unacceptable negative impacts, mining should not take place. In such cases, it is unlikely to be possible or appropriate to rely on the other steps in the mitigation.
	Minimize	Refers to considering alternatives in the Project location, sitting, scale, layout, technology and phasing that would minimize impacts on biodiversity, associated ecosystem services. In cases where there are environmental constraints, every effort should be made to minimize impacts.
	Rehabilitate	Refers to rehabilitation of areas where impacts are unavoidable, and measures are provided to return impacted areas to near natural state or an agreed land use after mine closure. Rehabilitation can, however, fall short of replicating the diversity and complexity of natural systems.
	Offset	Refers to measures over and above rehabilitation to compensate for the residual negative impacts on biodiversity after every effort has been made

		to minimize and then rehabilitate the impacts. Biodiversity offsets can provide a mechanism to compensate for significant residual impacts on biodiversity.

Table 11: Impact Assessment Parameter Ratings

Rating	Intensity/Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
7	**Irreplaceable loss** or damage to biological or physical resources or **highly sensitive** environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and/or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the Project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	**Irreplaceable loss** or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond Project Life: The impact will remain for some time after the life of the Project and is potentially irreversible even with management.	Almost Certain/Highly Probable: It is most likely that the impact will occur. > 65 but < 80% probability.
5	**Serious loss** and/or damage to physical or biological resources or **highly sensitive** environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/Region Will affect the entire province or region.	Project Life (> 15 years): The impact will cease after the operational life span of the Project and can be reversed with sufficient management.	Likely: The impact may occur. < 65% probability.
4	**Serious loss** and/or damage to physical or biological resources or **moderately sensitive** environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures/items of cultural significance.	Average to intense natural and/or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long Term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. < 50% probability.
3	**Moderate loss** and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local including the site and its immediate surrounding area.	Medium Term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur. < 25% probability.
2	**Minor loss and/or effects** to biological or physical resources or **low sensitive** environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited extending only as far as the development site area.	Short Term: Less than 1 year and is reversible.	Rare/Improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. < 10% probability.
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and/or social benefits felt by a very small percentage of the baseline.	Very Limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly Unlikely/None: Expected never to happen. < 1% probability.

Table 12: Probability/Consequence Matrix

Probability	Significance																																							
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Consequence

Table 13: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the Project. The impact may result in permanent positive change.	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and/or social) environment.	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and/or social environment.	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and/or social environment.	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and/or social environment.	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the Project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and/or social environment.	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the Project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the Project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

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