Wetland Functional and Impact Assessment for the Savuka 5a, 5b, 7a & 7b Tailings Storage Facilities Height Extension

Merafong Local Municipality, West Rand District Municipality, Gauteng West Province, South Africa

16/05/2025

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

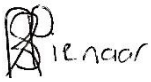
Report Name	**Wetland Functional and Impact Assessment for the Savuka 5a, 5b, 7a & 7b Tailings Storage Facilities Height Extension**	
Specialist Theme	Aquatic Biodiversity Theme	
Project Reference	Savuka 5a, 5b, 7a & 7b TSF	
Report Version	16/05/2025	Draft 2
Environmental Assessment Practitioner	EIMS ENVIRONMENTAL IMPACT MANAGEMENT SERVICES	
Fieldwork and Delineations	Divan van Rooyen (SACNASP Pr. Sci. Nat .151272)	
Report Writer	Divan van Rooyen (SACNASP Pr. Sci. Nat .151272)	
Reviewer	Rian Pienaar (SACNASP Pr. Sci. Nat. 135544)	
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, Amended. We have no conflicting interests in the undertaking of this activity and have no interest in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.	

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Background

The Biodiversity Company was commissioned to conduct a wetland baseline and impact assessment in support of the environmental authorisation and amendment of water use license processes for the proposed Savuka 7a & 7b Tailings Storage Facility (TSF) height extension and to include the Savuka 5a and 5b TSF compartments in the Water Use Licence (WUL) for c) and i) water uses. The proposed project indicates that the Savuka 5a, 5b, 7a & 7b TSF are nearing their final approved height, and the current planned life of the mine in the West Wits region surpasses the available deposition capacity of these Tailings Storage Facilities (TSFs). The Savuka TSF is situated in close proximity to Carletonville, Merafong Local Municipality, West Rand District Municipality, Gauteng Province (Figure 1-1). A 500 m radius has been demarcated for the project to facilitate the identification of wetlands; this area is referred to as the Project Area of Influence (PAOI).

This assessment has been completed in accordance with the requirements of the published Government Notice (GN) 4167 by the Department of Water and Sanitation (DWS) (previously GN 509 of 2016 and GN 3139 of 2023). The said notice was published in the Government Gazette (no. 49833) under Section 39 of the National Water Act (Act no. 36 of 1998) in December 2023, for a Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses. The GN 4167 process provides an allowance to apply for a WUL for Section 21(c) & (i) under a General Authorisation (GA), as opposed to a full Water Use Licence Application (WULA). A water use (or potential) qualifies for a GA under GN 4167 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM), provided the identified risks are all considered a low risk, and the applicant is listed under Appendix D1 or Appendix D2 of the same notice. This assessment will implement the RAM and provide a specialist opinion on the favourability for a water use authorisation.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations (2014) (amended by GNR 326, 7 April 2017 and GNR. 517, 11 June 2021) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices (GN) 320 (20 March 2020) and GN 1150 (30 October 2020) in terms of NEMA, dated 20 March and 30 October 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation” (Reporting Criteria).

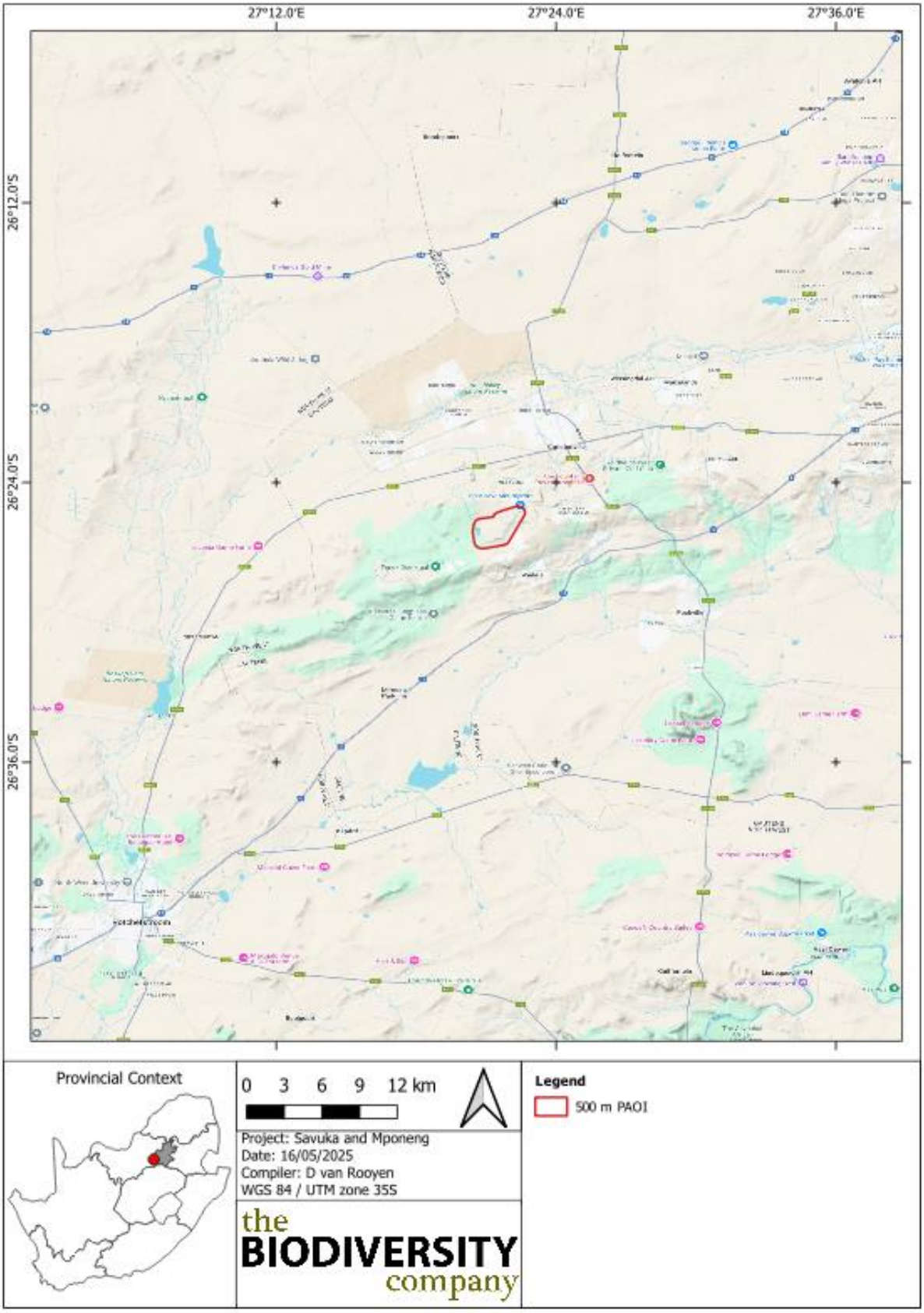


Figure 1-1 Location of the proposed project

1.2 Scope of Work

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- A desktop assessment of available and related datasets to provide context of the freshwater biodiversity of the project area and to indicate potential wetland areas;
- The delineation, classification and assessment of wetlands within 500 m of the project area;
- An assessment of the related impacts through the use of the Risk Assessment (DWS, 2023);
- The provision of recommendations relevant to associated impacts; and
- Report compilation detailing the baseline findings.

1.3 Project Description and Technical Information

The applicant possesses an approved Mining Right (MR) and Environmental Management Programme (EMPr) under the Minerals and Petroleum Resources Development Act (Act 28 of 2002, as amended) (MPRDA) for gold mining operations in the West Wits region of Gauteng Province. Currently, the Savuka Plant deposits tailings onto the Savuka 5a, 5b, 7a & 7b TSFs (Figure 1-2). However, these facilities are nearing their maximum approved height, and the projected Life of Mine (LOM) for the West Wits region surpasses the available deposition capacity of these TSFs. Consequently, the applicant is conducting a feasibility study to increase the height of the Savuka 7a & 7b TSFs. Slurry deposition is ongoing at these TSFs, and Harmony proposes to raise their height by an additional 5 to 10 meters.

The scope of work involves undertaking the necessary environmental authorization processes as mandated by the National Environmental Management Act (No. 107 of 1998) (NEMA), National Water Act (Act 36 of 1998) (NWA), National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA), National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA), National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA), National Heritage Resources Act (Act No. 25 of 1999) (NHRA), Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA), and any other applicable acts and/or guidelines relevant to the proposed activities.

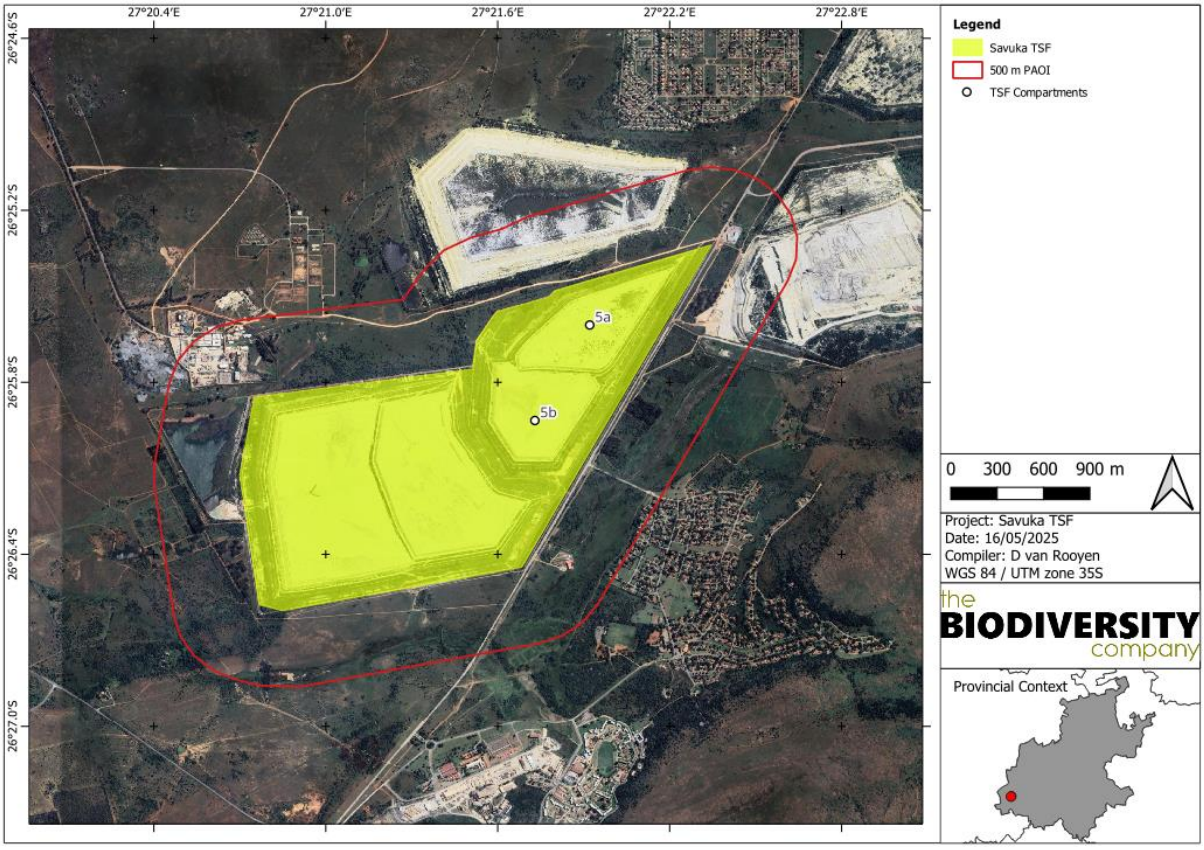


Figure 1-2 Proposed Savuka TSF site and Project Area of Influence

1.4 Assumptions and Limitations

The following aspects were considered as limitations:

- It has been assumed that the spatial files provided to the specialist is accurate;
- Apart from the "features" as indicated in Figure 1-2, no other relevant spatial information in terms of the structure design was provided in relation to the proposed development at the time of survey and report preparation;
- The original assessment was conducted for TSF compartments 7a and 7b. Subsequent to this, the Department of Water and Sanitation (DWS) has requested that compartments 5a and 5b also be considered. Information from the assessment completed for the Kusasalethu Mine Pipeline Project (2023) has been considered to supplement the requirements for the 5a and 5b project components;
- The delineations presented herein were derived from previous assessments undertaken for the area and, are considered to be representative and sufficient for the purpose of this assessment;
- The seasonality of the above-mentioned surveys is not considered to be a limiting factor of the assessment, for which the results are conclusive in the opinion of the specialist;
- Only natural features were considered for the ecological components of this assessment; and
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by a maximum of five meters to either side.

1.5 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 1-1 are applicable to the current project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 1-1 A list of key legislative requirements

Region	Legislation / Guideline	Comment
National	National Environmental Management Act (Act No. 107 of 1998) (NEMA)	To provide for the effective protection and controlled utilisation of the environment and for matters incidental thereto.
	NEMA: Environmental Impact Assessment Regulations (2014) (GNR 326, 7 April 2017), Appendix 6 requirements	Minimum content for specialist reports.
	NEMA: Government Notices (GN) 320 (20 March 2020) and GN 1150 (30 October 2020)	The minimum criteria for reporting. Protocol for the specialist assessment and minimum report content requirements.
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA), Threatened or Protected Species Regulations	The protection of species and ecosystems that warrant protection.
	National Environmental Management: Waste Act (Act No. 59 of 2008)	The regulation of waste management to protect the environment.
	National Water Act (Act No. 36 of 1998) (NWA)	To provide for the regulation of water uses.
	NWA: Government Notice (GN) 4167 (previously GN 509 of 2016 and GN 3139 of 2023)	Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses and the provision to apply for a General Authorisation subject to usage and outcome of the Risk Assessment Matrix.
	NEMBA: Alien and Invasive Species Regulations (2014) (GNR R598, 1 August 2014)	The regulation and management of alien invasive species.
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)	To provide for control over the utilisation of the natural agricultural resources, including the vegetation and the combating of weeds and invader plants.
Provincial	Transvaal Nature Conservation Ordinance (Act No. 12 of 1998)	To consolidate and amend the laws relating to nature conservation and to provide matters incidental thereto.
	Gauteng Conservation Plan (2022)	The spatial designation of conservation areas and targets within the province.

1.6 National Water Act (NWA, 1998)

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

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

A watercourse means:

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

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

The NWA recognises that the entire ecosystem, not just the water itself, constitutes a water resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

1.7 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

1.8 Legislative Framework

In line with the protocol for the specialist assessment and minimum report content requirements for environmental impacts on freshwater biodiversity, as per Government Notice 320 published in terms of NEMA, dated 20 March 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation” – the following has been assumed:

- An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of:
- “very high sensitivity” for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment;
- “low sensitivity” for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement;
- Where the information gathered from the site sensitivity verification differs from the screening tool designation of “very high” aquatic biodiversity sensitivity, and it is found to be of a “low” sensitivity, an Aquatic Biodiversity Compliance Statement must be submitted;
- Similarly, where the information gathered from the site sensitivity verification differs from the screening tool designation of “low” aquatic biodiversity sensitivity, and it is found to be of a “very high” sensitivity, an Aquatic Biodiversity Specialist Assessment must be submitted.

An Aquatic / Freshwater Biodiversity Specialist Assessment Report must contain the information as presented in Table 1-2 below.

Table 1-2 Aquatic Biodiversity Specialist Assessment information requirements as per the relevant protocol, including the location of the information within this report

Information to be Included (as per GN 320, 20 March 2020)	Report Section
The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of aquatic sciences	8.3
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae	8.4
A signed statement of independence by the specialist(s)	8.3

The assessment must be undertaken on the preferred site and within the proposed development footprint	1.3
A baseline description of the aquatic biodiversity and ecosystems on the site, including: aquatic ecosystem types; presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns.	3.2
The threat status of the ecosystem and species as identified by the screening tool	3.6
An indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub-catchment, a strategic water source area, a priority estuary, whether or not they are free-flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area)	3.1.4
A description of the ecological importance and sensitivity of the aquatic ecosystem including: (a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g., movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and (b) the historic ecological condition (reference) as well as the present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater)	3.1.4 & 3.4.3
The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate	3.6
Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal? Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present? How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include: (a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); (b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub-catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns); (c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and (d) to what extent will the risks associated with water use and related activities change.	4.2
How will the proposed development impact on the functioning of the aquatic feature? This must include: (a) base flows (e.g., too little or too much water in terms of characteristics and requirements of the system); (b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g., seasonal to temporary or permanent; impact of over-abstraction or instream or offstream impoundment of a wetland or river); (c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g., change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); (d) quality of water (e.g., due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); (e) fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and (f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g., waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.)	4.2
How will the proposed development impact on key ecosystems regulating and supporting services especially: i. flood attenuation; ii. streamflow regulation; ii. sediment trapping; v. phosphate assimilation; v. nitrate assimilation; ii. toxicant assimilation; ii. erosion control; and ii. carbon storage?	4.2

How will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	-
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment	2
The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant	8.1
A description of the assumptions made, any uncertainties or gaps in knowledge or data	1.4
The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant	3.5
Additional environmental impacts expected from the proposed development	-
Any direct, indirect and cumulative impacts of the proposed development on-site	4
The degree to which impacts and risks can be mitigated	4
The degree to which the impacts and risks can be reversed	4
The degree to which the impacts and risks can cause loss of irreplaceable resources	4
A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies	3.5
Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr)	5
A motivation must be provided if there were development footprints identified as having a “low” aquatic biodiversity sensitivity and that were not considered appropriate	3.6.2
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	6.2
Any conditions to which this statement is subjected	6.2

2 Fieldwork

An initial field survey for a small section of the Savuka TSF was undertaken on the 12th of January 2023, constituting a wet season survey.

The field survey for the remainder of the Savuka TSF area was undertaken on the 11th of December 2024 which constitutes a wet season survey. The seasonality is not considered to be a limiting factor to the assessment and the results of this assessment are considered to be conclusive in the opinion of the specialist.

3 Results & Discussion

3.1 Desktop Dataset Assessment

3.1.1 Climate

The climate for the Gauteng Shale Mountain bushveld is characterised by a summer rainfall with very dry winters. Mean Annual Precipitation (MAP) ranges between 600–750 mm, increasing from west to east as well as with higher elevation. Frost frequent, higher in the west and south. For the purpose of this report, Figure 3-1 below summarises the different climatic conditions experienced within these vegetation units at the bioregion level (Mucina & Rutherford, 2006).

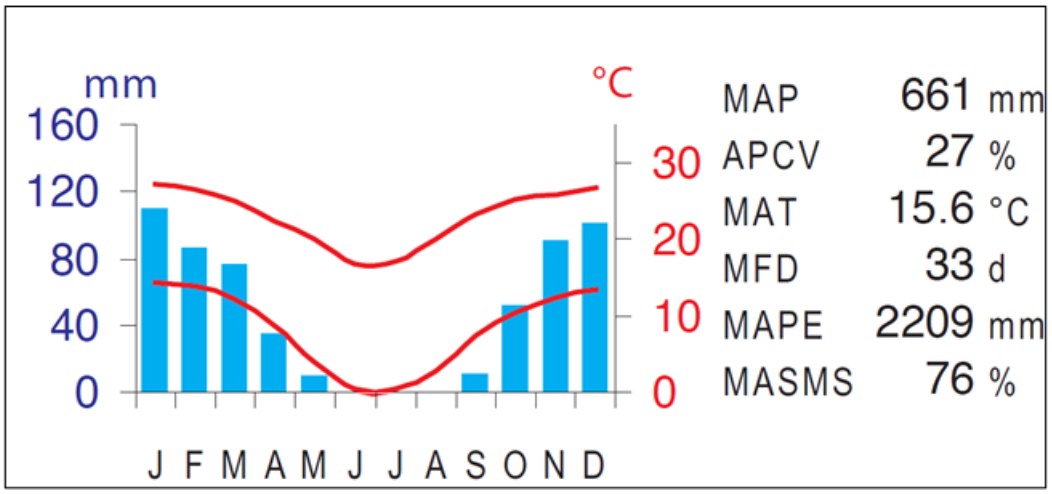


Figure 3-1 Summarised climatic condition expected to within the proposed study area (Mucina & Rutherford, 2006)

3.1.2 Soils and Geology

The geology of this vegetation type is dominated by shale and some coarser clastic sediments and andesite from the Pretoria Group. Some of the area has Malmani dolomites of the Chuniespoort Group. The soils are mostly shallow Mispah but are deeper at the foot of the slopes. Land types within this vegetation type is mostly Fb, however, land type Ib do occur in some areas within this vegetation type (Mucina & Rutherford, 2006).

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is categorised by the Fb 15 land type. The Fb land type predominantly features Glenrosa and/or Mispah soil forms, with the potential presence of other soil types interspersed throughout the landscape. These soils are typically calcareous, indicating the widespread presence of lime across the terrain.

3.1.3 Hydrological Characteristics

The PAOI falls within the Highveld Ecoregion, within the Vaal-Orange Water Management Area (WMA). At a finer scale, the Savuka 7a & 7b TSF falls within the C23E quaternary catchment. The fine scale hydrological features are presented in the following section (Figure 3-2).

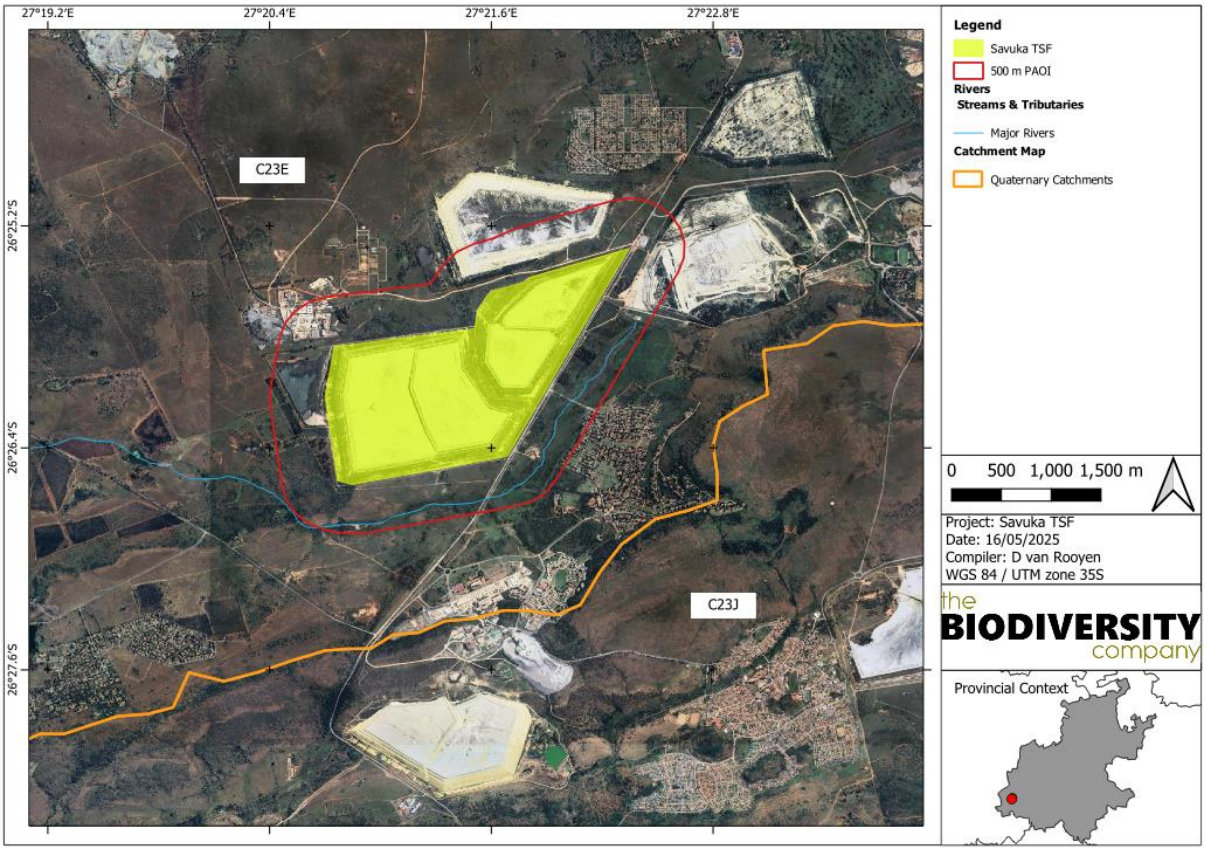


Figure 3-2 Catchments that overlap with the Project Area of Influence

3.1.3.1 Topographical River Lines and Inland Water Areas

The topographical inland and river line data for the "2627" dataset indicated several inland water areas, which was classified as numerous dams, one marsh vlei and two large reservoirs (Figure 3-3). Furthermore, two topographic non-perennial drainage features were identified within the PAOI as shown in Figure 3-2.

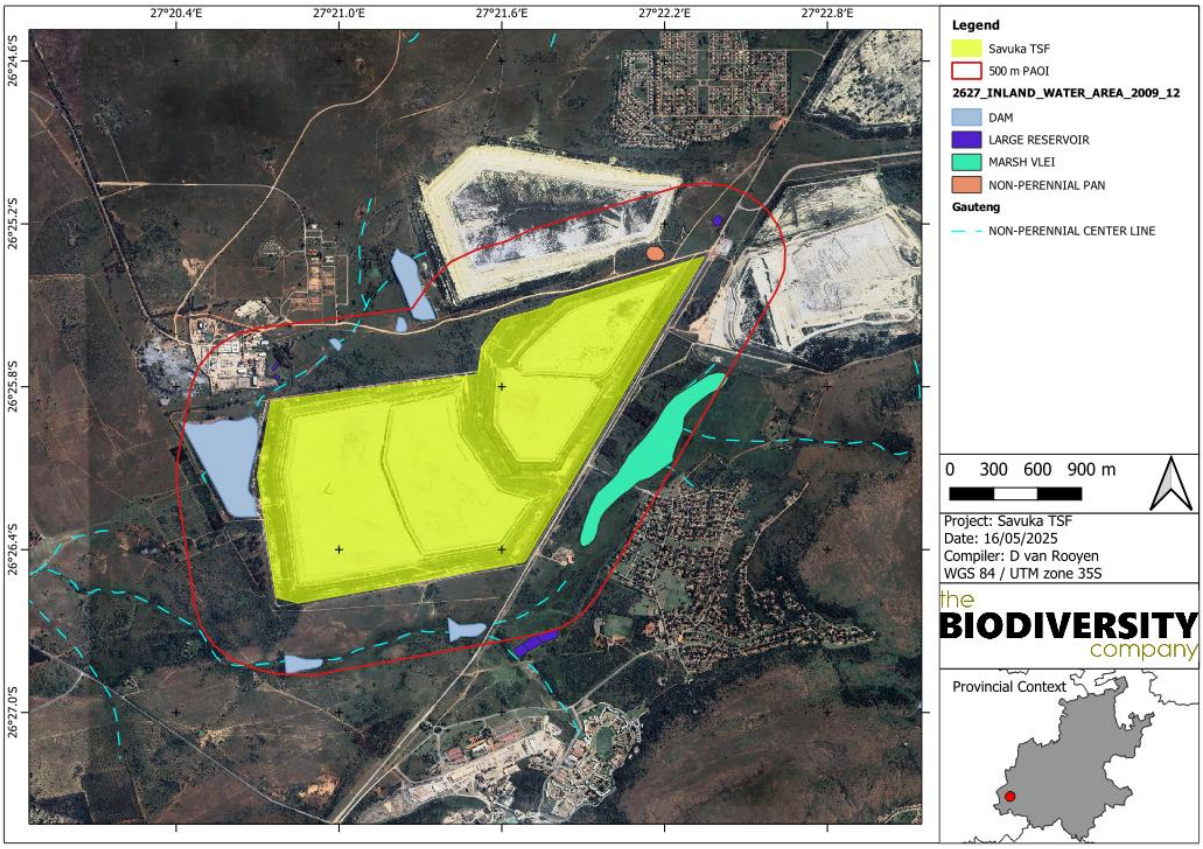


Figure 3-3 Topographical Inland Water Areas and River Lines that intersect the Project Area of Influence

3.1.4 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features is summarised in Table 3-1. Only features that were identified to be relevant to the proposed project were further discussed.

Table 3-1 Summary of relevance of the proposed project to ecologically important landscape features

Desktop Information Considered	Relevant/Irrelevant	Section
National Freshwater Priority Area	Relevant – PAOI overlaps with NFEPA wetlands and rivers.	3.1.4.1
South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	Relevant – PAOI overlaps with overlap with SAIIAE wetlands and rivers.	3.1.4.2
Provincial Conservation Plan	Relevant – PAOI overlaps with CBA's and ESA's.	3.1.4.3
Strategic Water Source Areas	Irrelevant – PAOI does not overlap with SWSA's.	-

3.1.4.1 National Freshwater Ecosystem Priority Ecosystems

Two wetland types have been identified within the PAOI, namely a seep wetland which are classified as artificial, and a wetland flat (Figure 3-4). According to the dataset, the seep/artificial wetlands have been classified to have a "Z3 - Heavily to Critically Modified" condition and are classified as "non-priority" systems. The wetland flat is classed as Moderately Modified. Furthermore, one river was identified within the PAOI, a non-perennial tributary of the Mooiriver.

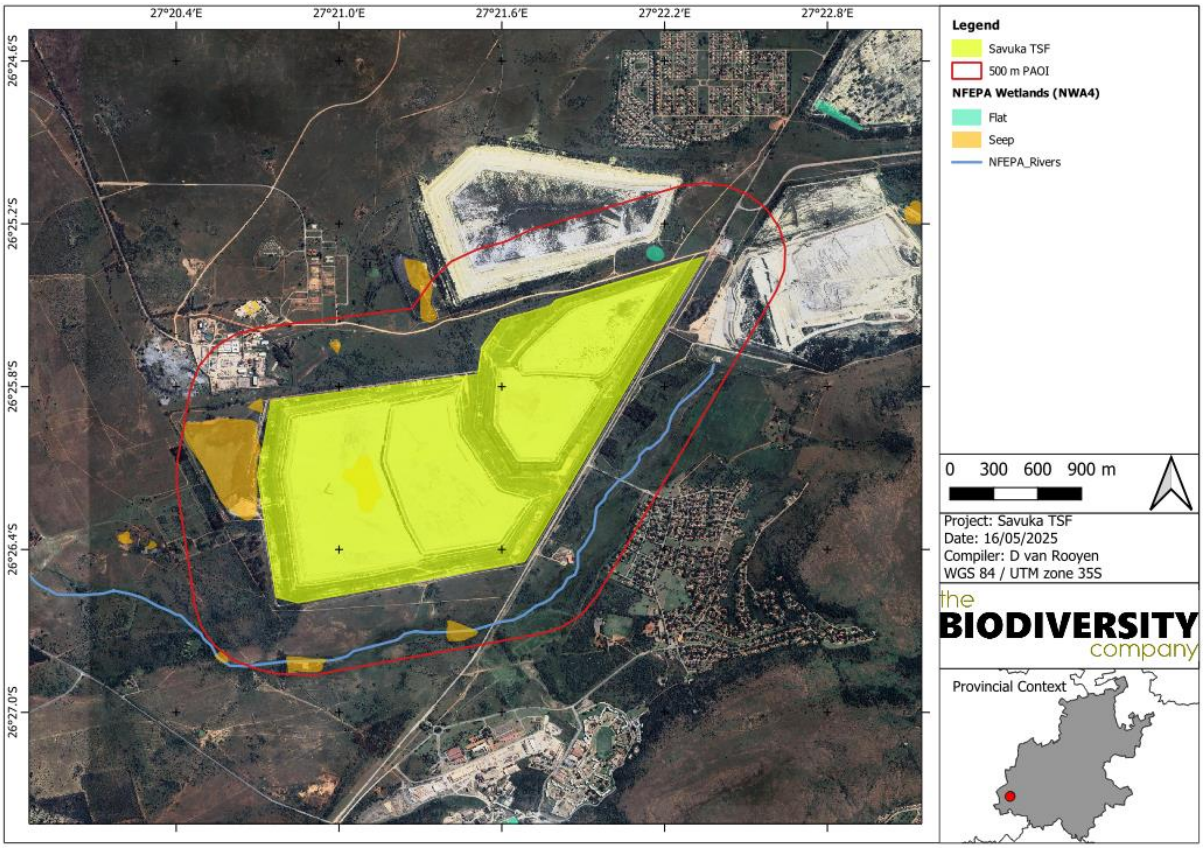


Figure 3-4 Wetland features identified within the Project Area of Influence according to the National Freshwater Ecosystem Priority Ecosystems dataset

3.1.4.2 South African Inland Inventory of Aquatic Systems

Two wetlands were identified within the PAOI according to the dataset, these were classified as a channelled valley-bottoms and unchanneled valley-bottom wetlands (Figure 3-5). The wetlands have been classified according to the dataset to either have a “C – Moderately Modified” condition or a “D/E/F – Heavy or Critically Modified” condition. Furthermore, all wetlands are considered to be “Critically Endangered” and “Not Protected” with regard to Ecosystem Threat and Protection Status.

The river identified through the dataset is “Critically Endangered” and “Not Protected” ecosystems with regard to Ecosystem Threat and Protection Status, respectively.

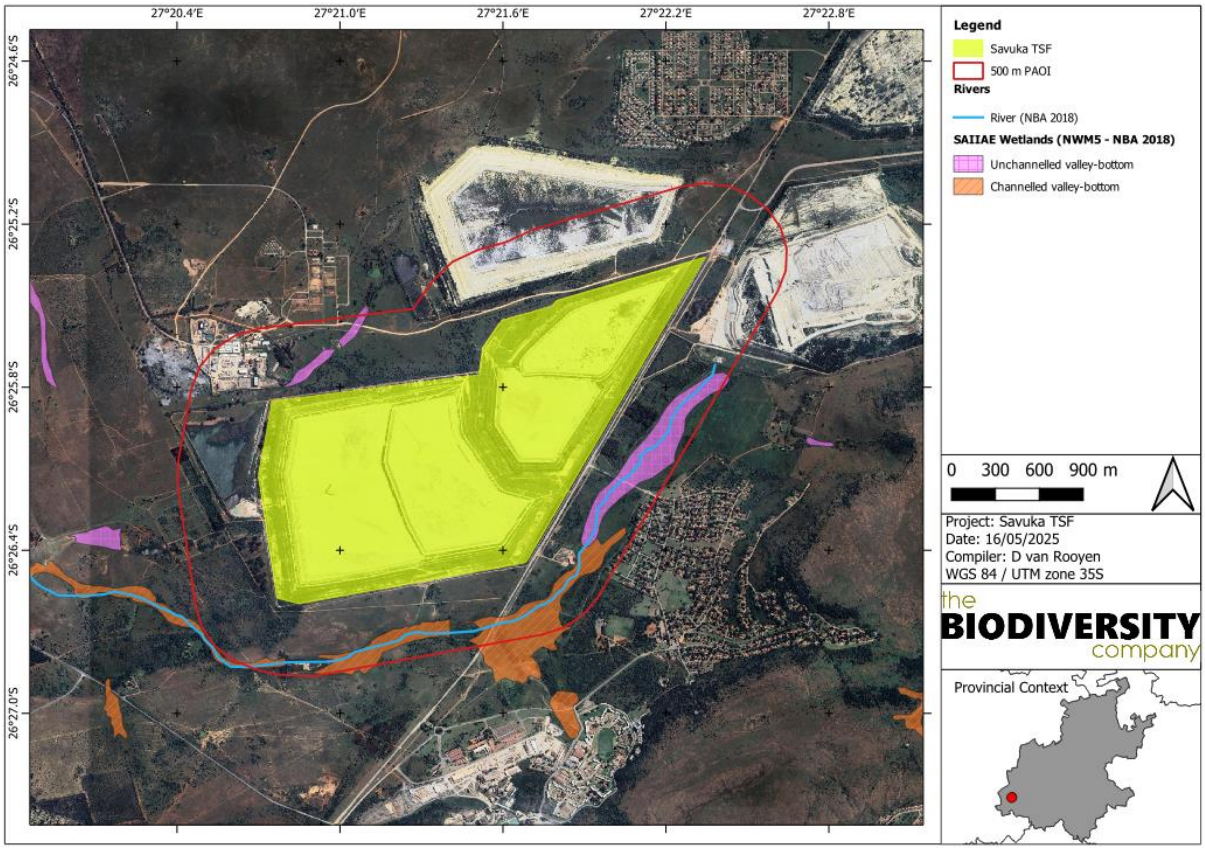


Figure 3-5 Wetland features identified within the Project Area of Influence according to the South African Inland Inventory of Aquatic Systems dataset

3.1.4.3 Gauteng Conservation Plan

According to the Gauteng Conservation Plan for biodiversity (Figure 3-6), the Savuka PAOI intersects only with Ecological Support Area's.

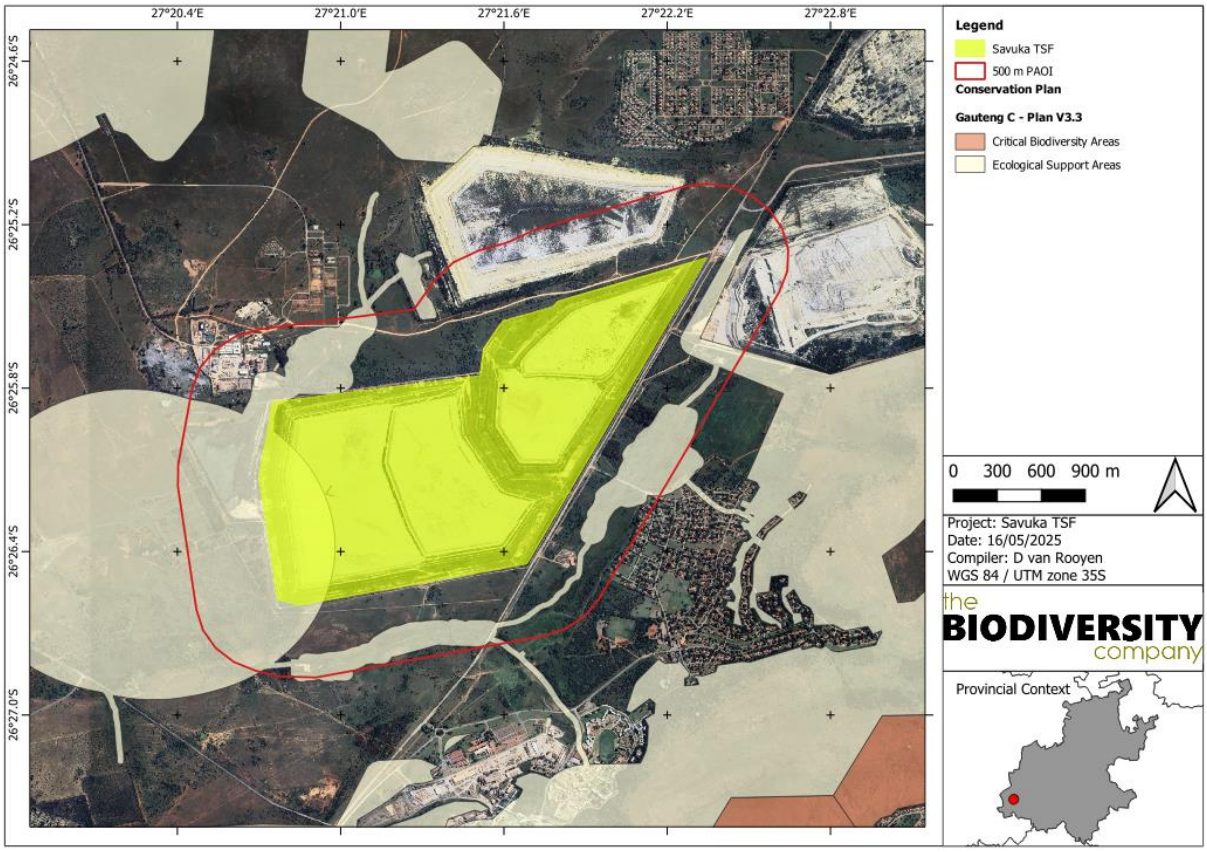


Figure 3-6 Gauteng Conservation Plan overlayed with the Project Area of Influence

3.2 Wetland Field Survey

3.2.1 Delineation

Four (4) Hydrogeomorphic (HGM) units were identified within the encompassing 500 m Savuka TSF PAOI. These were classified as; one (1) channelled valley-bottom, two (2) unchannelled valley-bottoms and one (1) artificial wetland (Figure 3-7 & Figure 3-8). Several dams were identified within the PAOI, most of which were off-channel features. Furthermore, the one HGM unit has been identified as an artificial depression. In addition, two non-perennial drainage features were identified where one has connectivity to the larger perennial river, namely the Mooiriver. A summary of the wetland features is provided in the table below.

Table 3-2 Summary of the identified Savuka 7a & 7b TSF watercourses

Wetland Type	Wetland Name
Channelled valley-bottom	HGM 1
Unchannelled valley-bottom	HGM 2 HGM 4
Artificial Wetland	HGM 3
Artificial watercourses	Artificial
Dams	Artificial Dams

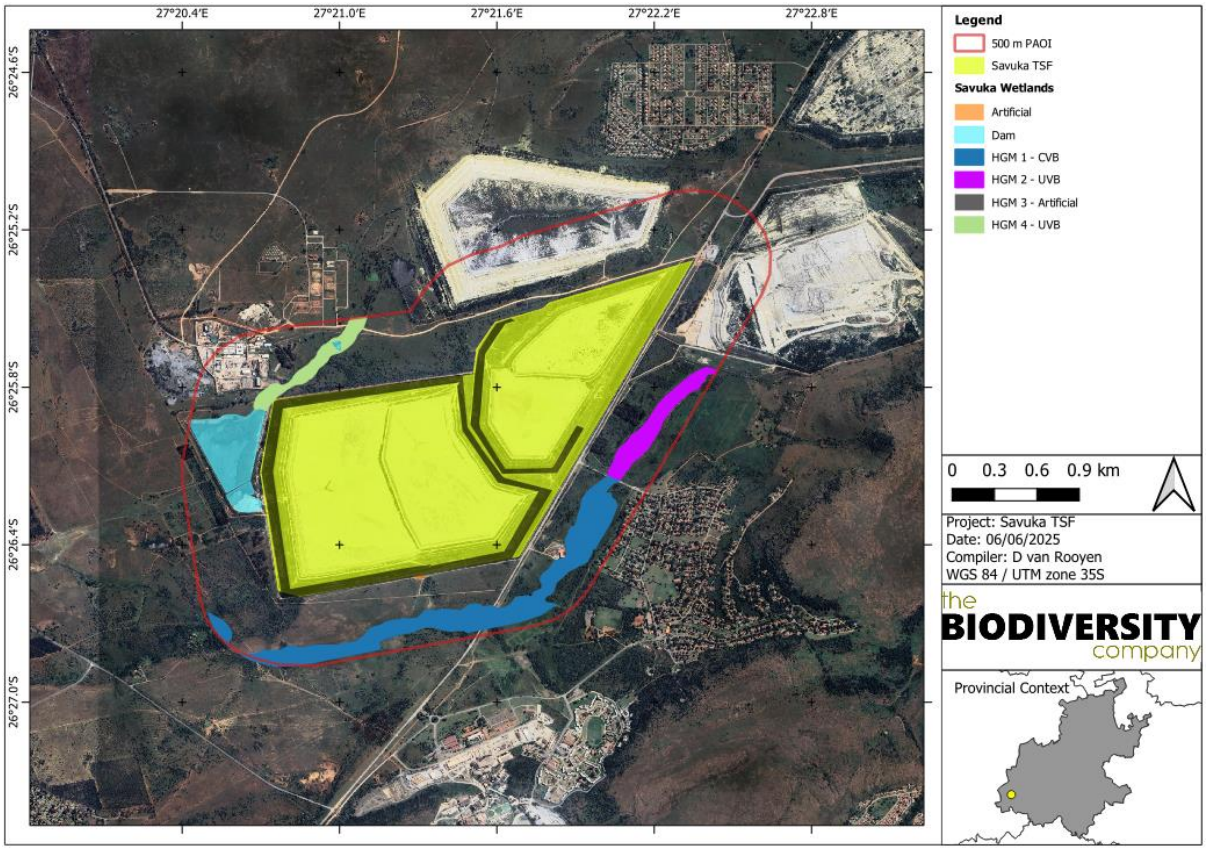


Figure 3-7 Delineation of watercourses within the Savuka Project Area of Influence

3.2.2 Area of Wetlands

The table below summarises the individual wetland areas and the percentage that each HGM unit comprises of the total wetland area within the Savuka PAOI, which amounts to 107.98 ha (Table 3-3).

Table 3-3 Summary of wetland area within the Savuka project area of influence

HGM Units	Area (Ha)	Size (%)
HGM 1	40.06	37.1
HGM 2	0.50	0.46
HGM 3	40.42	37.43
HGM 4	7.44	6.89
Artificial Dam	19,43	17.99
Artificial	0.13	0.12
Total	**107.98**	**100**

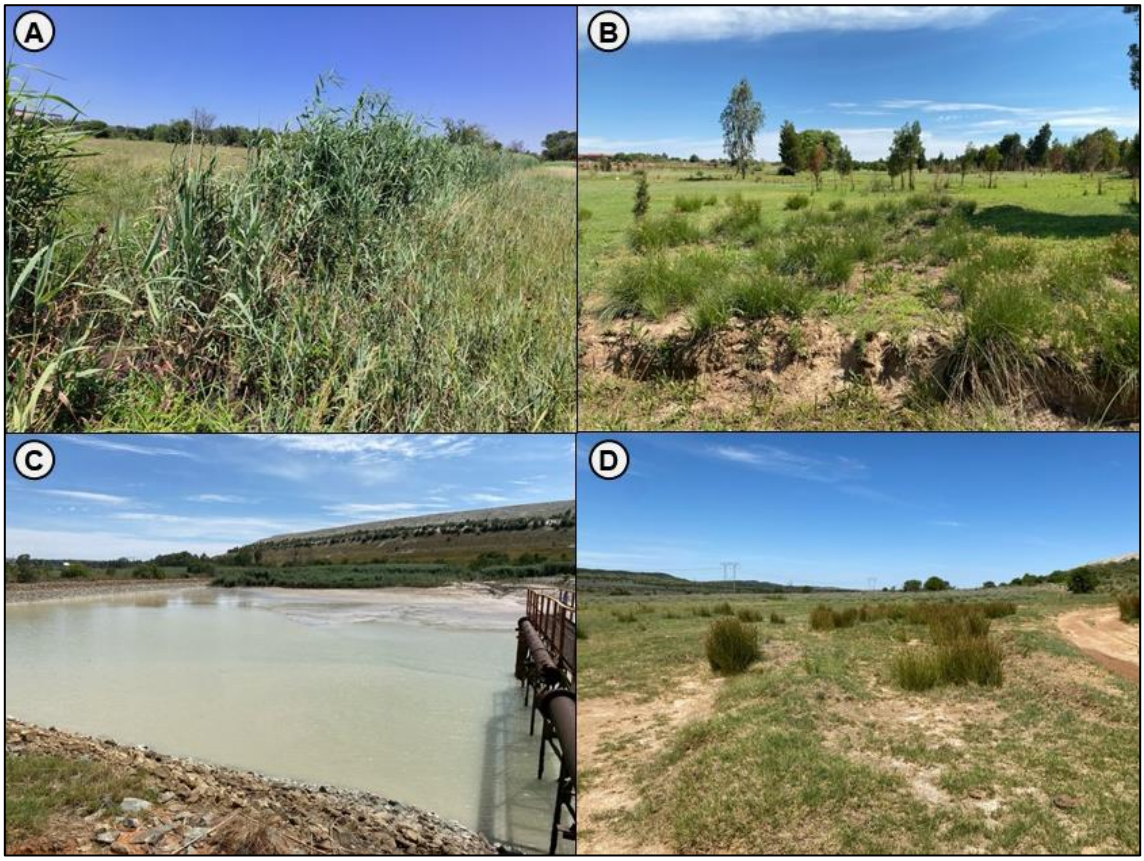


Figure 3-8 Representative photographs of the various freshwater features within the Savuka project area. A) Channelled valley-bottom (HGM 1); B) Unchannelled valley-bottom (HGM 4); C) Dam and D) Artificial Depression

3.2.3 Classification and Description

The wetland classification as per SANBI guidelines (Ollis *et al.,* 2013) is presented in Table 3-4.

Table 3-4 Wetland classification as per SANBI guideline (Ollis et al., 2013)

Wetland Unit	Level 1	Level 2		Level 3	Level 4		
	System	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	4A (HGM)	4B	4C
HGM 1	Inland	Highveld	Central Bushveld Group 1	Valley floor	Channelled valley-bottom	N/A	N/A
HGM 2					Unchannelled valley-bottom		
HGM 4							

A channelled valley-bottom wetland, is a wetland ecosystem located along a valley floor, characterized by the presence of a river channel running through it (Ollis *et al.,* 2013). These wetlands are distinct from floodplain wetlands due to the absence of characteristic floodplain features and the presence of a defined river channel. The landscape setting of a channelled valley-bottom wetland typically involves a valley floor where the wetland receives water inputs from the river channel, either as surface flow during flooding or as subsurface flow, and from adjacent valley side-slopes through overland flow or interflow. The hydrodynamics of these wetlands are influenced by the river channel, which provides a concentrated flow of water, contributing to the wetland's ecological functions such as sediment trapping,

nutrient cycling, and habitat provision. This setting makes channelled valley-bottom wetlands crucial for maintaining the ecological integrity of riverine systems and supporting biodiversity. Figure 3-9 presents a diagram of a typical channelled valley bottom, showing the dominant movement of water into, through and out of the system.

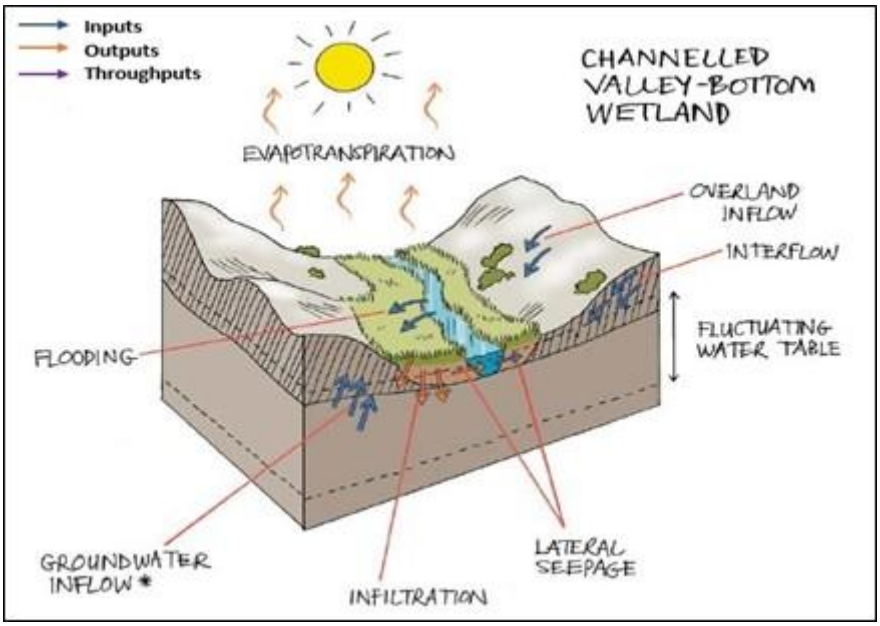


Figure 3-9 Amalgamated diagram of a typical channelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

An unchannelled valley-bottom wetland, is a wetland located on a valley floor, characterized by the absence of a distinct river channel (Ollis *et al.,* 2013). These wetlands are defined by their diffuse water flows, which are not confined within channel banks, allowing water to spread across the valley floor. The primary water inputs for unchannelled valley-bottom wetlands include diffuse surface and subsurface flows from upstream channels that lose confinement, as well as seepage from adjacent valley side-slopes. The hydrodynamics of these wetlands are dominated by horizontal, unidirectional, diffuse surface flow, although infiltration and evapotranspiration can also be significant. This setting allows unchannelled valley-bottom wetlands to function as important sites for sediment deposition, water filtration, and habitat provision, supporting a diverse range of plant and animal species. Their unique hydrological and geomorphological characteristics make them vital components of the landscape, contributing to the overall ecological health of the valley systems in which they occur. Figure 3-10 presents a diagram of a typical unchannelled valley-bottom wetland, showing the dominant movement of water into, through and out of the system.

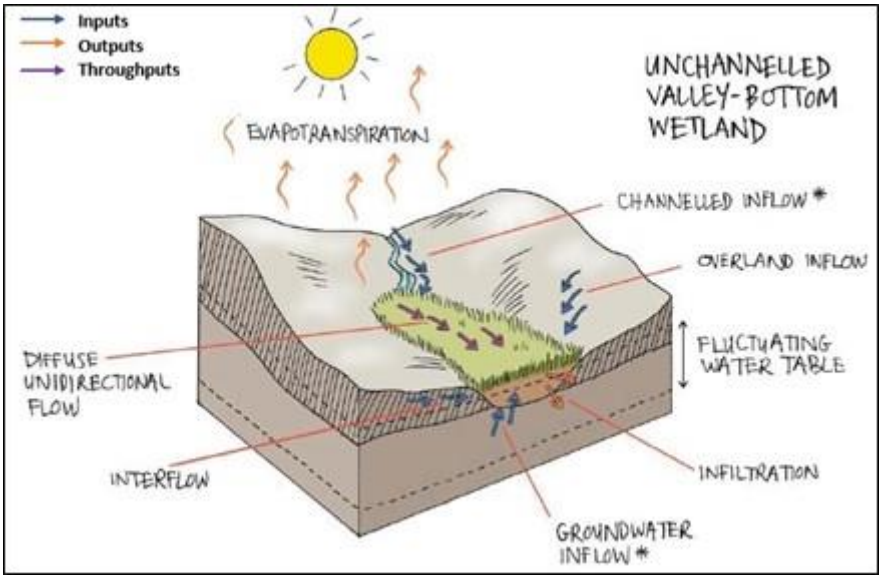


Figure 3-10 Amalgamated diagram of a typical unchannelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

The DWAF (2005) manual separates the classification of watercourses into three (3) separate types of channels or sections defined by their position relative to the zone of saturation in the riparian area (Figure 3-11). The classification system separates channels into:

- those that do not have baseflow ('A' Sections);
- those that sometimes have baseflow ('B' Sections) or non-perennial; or
- those that always have baseflow ('C' Sections) or perennial.

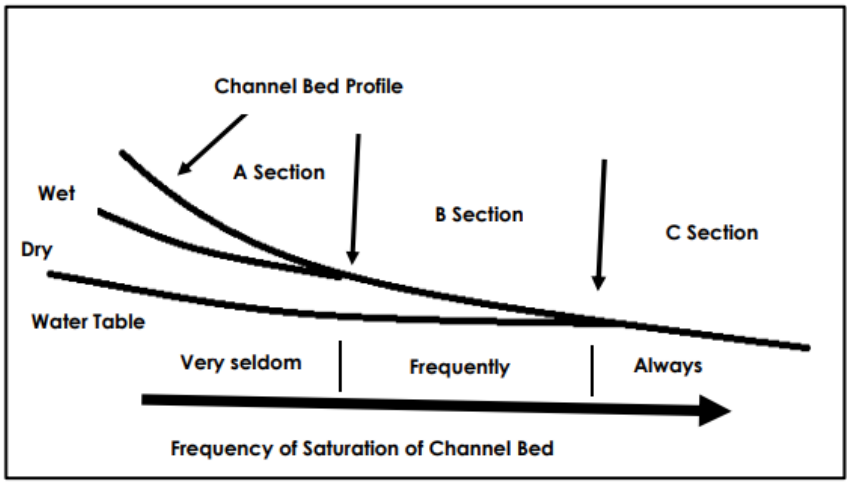


Figure 3-11 The watercourse classifications (DWAF, 2005)

3.3 Risk Screening

Table 3-5 provides the results of risk screening for the delineated wetlands and provides motivation for each of the determined categories. All the identified wetlands are perceived to be "Note at Risk" from the proposed activities resulting from the proximity of the activities to the watercourses. Furthermore, the riparian zones and rivers are perceived to be "At Risk" from the proposed activities resulting from the proximity of the activities to the watercourses.

Table 3-5 Risk status of the delineated wetlands

HGM unit	Risk Status	Rationale
HGM 4 HGM 2	At Risk (Direct or Indirect)	These watercourses are located either within the proposed project area or in close proximity to the project area and, have therefore been determined as "At Risk". It is anticipated that indirect impacts to HGM 2 & 4 - UVB is likely as the proposed TSF boundary is in close proximity to this watercourse.
HGM 1 HGM 3 Artificial Dam	Not at Risk	These features are isolated and are located within the larger 500m PAOI of the proposed activities, however, impact to these systems is therefore unlikely hence the "Not at Risk" status. Furthermore, the dams, HGM 3 and artificial watercourses around the TSF are artificial features which are not representative of natural ecological sensitivities.

3.4 Wetland Functional and Ecological Assessment

Artificial features and off-stream dams were not considered for the ecological and functional assessments as they do not represent natural ecological sensitivities. Instream dams were assessed as part of the HGM Unit they occur within.

3.4.1 Functional Assessment

3.4.1.1 General Functional Description

Channelled valley-bottom wetlands are characterized by their location in valley bottoms with a well-defined stream channel. These wetlands play a crucial role in hydrological processes, particularly in flood attenuation and sediment trapping. The presence of a channel allows for the movement of water, which can contribute to the regulation of streamflow, especially during periods of low flow. The vegetation in these wetlands provides resistance to water flow, thereby slowing down the movement of water and allowing for the deposition of sediments. This process not only helps in maintaining water quality by trapping sediments and associated nutrients but also supports the wetland's role in flood attenuation by spreading out and slowing down floodwaters. Additionally, channelled valley-bottom wetlands can contribute to the removal of nitrates and toxicants from the water, enhancing the overall water quality in the catchment area. These wetlands are integral to maintaining the ecological balance and providing essential ecosystem services, such as water purification and habitat provision for various species (Kotze *et al.,* 2009).

Unchannelled valley-bottom wetlands are characterized by their location in valley bottoms without a distinct stream channel, resulting in diffuse water flow across the wetland. These wetlands are highly effective in sediment trapping due to their gentle gradients and the extensive areas that remain permanently saturated, which promote the deposition of sediments carried by runoff waters. The high levels of soil organic matter in these wetlands enhance their capacity for nitrate and toxicant removal, as the prolonged contact with runoff waters facilitates these processes. However, phosphate retention may be lower compared to other wetland types due to potential remobilization under prolonged anaerobic conditions. Unchannelled valley-bottom wetlands also contribute to streamflow regulation to some extent, although this is influenced by factors such as vegetation transpiration and soil characteristics. These wetlands play a crucial role in maintaining water quality and providing habitat for diverse species, making them vital components of the landscape (Kotze *et al.,* 2009).

Hillslope seep wetlands are typically found on hillsides where water emerges from subsurface flows, creating a diffuse downslope movement. These wetlands are primarily fed by groundwater discharges, although surface water contributions can also supplement flows. Hillslope seeps are particularly effective in water quality enhancement, notably in the removal of excess nutrients and pollutants such as nitrates, through processes like denitrification. This is facilitated by the wetland's vegetation, which provides organic carbon necessary for microbial processes that assimilate these nutrients. The vegetation also plays a critical role in stabilizing the soil, thereby reducing erosion risks, although the

generally steep slopes of hillslope seeps can increase erosion susceptibility if vegetation cover is compromised. Additionally, these wetlands contribute to streamflow regulation by slowing down subsurface water movement, which prolongs water contribution to stream systems during low flow periods, although their flood attenuation capacity is limited once the soils are saturated (Kotze *et al.,* 2009).

It should be noted that these characteristics are representative of ideal wetland features and may not necessarily represent the characteristics of all wetlands. The functionality of wetlands and the provision of benefits is largely dependent on wetland size and influence from abiotic drivers.

3.4.1.2 Ecosystem Services

The ecosystem services provided by the relevant wetland units on site were assessed and rated using the WET-EcoServices method (Kotze *et al.,* 2009). The results of the assessment are presented in Table 3-6. For Savuka 7a & 7b TSF, the average ecosystem scores ranged from “Moderately High” to “Intermediate”. Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, provisioning of water for human use, erosion control, and the maintenance of biodiversity.

Table 3-6 Summary of the average ecosystem scores for the assessed systems

Moderately High	Intermediate
HGM 1	HGM 2
-	HGM 4

3.4.2 Present Ecological State

The wetlands exhibited different degrees of modification resulting from natural physical changes as well as anthropogenically induced impacts at both the local and catchment level. Resultingly, the wetlands have scored an average Present Ecological State (PES) score of either “D – Largely Modified” or “E – Seriously Modified” PES class. Impacts to the wetland is further discussed in Section 4.1. The summative results of the wetland health and integrity assessment is provided in the table below.

Table 3-7 Average Present Ecological State scores for the assessed wetlands

D - Largely Modified	E - Seriously Modified
HGM 4	HGM 1
-	HGM 2

3.4.3 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) assessment was applied to the HGM units in conjunction with the ecosystem service scores in the preceding section, to assess the levels of sensitivity and ecological importance of the wetland. Various components pertaining to the protection status of a wetland is considered for the EIS, including Strategic Water Source Areas (SWSA), the NFEPA wet veg protection and threat status and the protection and threat status of the wetland type itself considering the NBA wetland dataset (Table 3-8). It should be noted that where the dataset did not identify a wetland and one was identified on site, the closest wetland of the same type within the dataset was used to extrapolate findings for the purpose of this assessment. The results of the assessment are shown in the table below. The wetlands average EIS scores were in the “B – High” EIS class.

Table 3-8 Aspects considered in the Ecological Importance and Sensitivity assessment

HGM	NFEPA Wet Veg			NBA Wetlands			SWSA (Y/N)	CBA / ESA (Y/N)	EIS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level			
HGM 1 - CVB	Central Bushveld Group 1	Critically Endangered	Not Protected	E Seriously Modified (Field Visit)	Critically Endangered	Not Protected	N	Y	B - High
HGM 2 – UVB				E Seriously Modified (Field Visit)				Y	B – High
HGM 3 – Artificial depression		-	-	-	-	-		N	-
HGM 4 - UVB		Critically Endangered	Not Protected	D Largely Modified (Field Visit)	Critically Endangered	Not Protected		Y	B - High

3.4.4 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) for the wetland areas was determined from the results of the PES and EIS assessments. These assessments indicated that the wetland feature within the site, had underwent transformation as a result of historical and current impacts. Nevertheless, despite the altered ecological integrity of the systems, they are considered to provide ecological services.

The results of the assessment are presented in the table below. The REC for the wetland is to improve the current PES.

Table 3-9 Recommended Ecological Category and Management Objective

HGM No.	Recommended Ecological Category	Recommended Management Objective
HGM 1	E/F	Improve
HGM 2		
HGM 4	C/D	Improve

3.5 Buffer Requirements

The buffer requirements for the wetlands were calculated using the Site-Based Tool: Determination of buffer zone requirements for wetland ecosystems (Macfarlane *et al.,* 2014). The recommended buffer zones are presented in Table 3-10 and Figure 3-12.

The advised pre-mitigation buffer zone for all wetlands within the Savuka 7a & 7b TSF PAOI is 32 m, which is reduced to 15 m following mitigation measures. The buffers considered the sensitivity of the wetlands and the level of modification to the wetland's periphery (buffer intactness) in relation to the type of development or proposed activities.

Table 3-10 Buffer requirements for the relevant wetland feature

Watercourse	Type	Buffer Distance
HGM 1	Pre-mitigation	32 m
	Post-mitigation	15 m
HGM 2	Pre-mitigation	32 m
	Post-mitigation	15 m
HGM 4	Pre-mitigation	32 m
	Post-mitigation	15 m

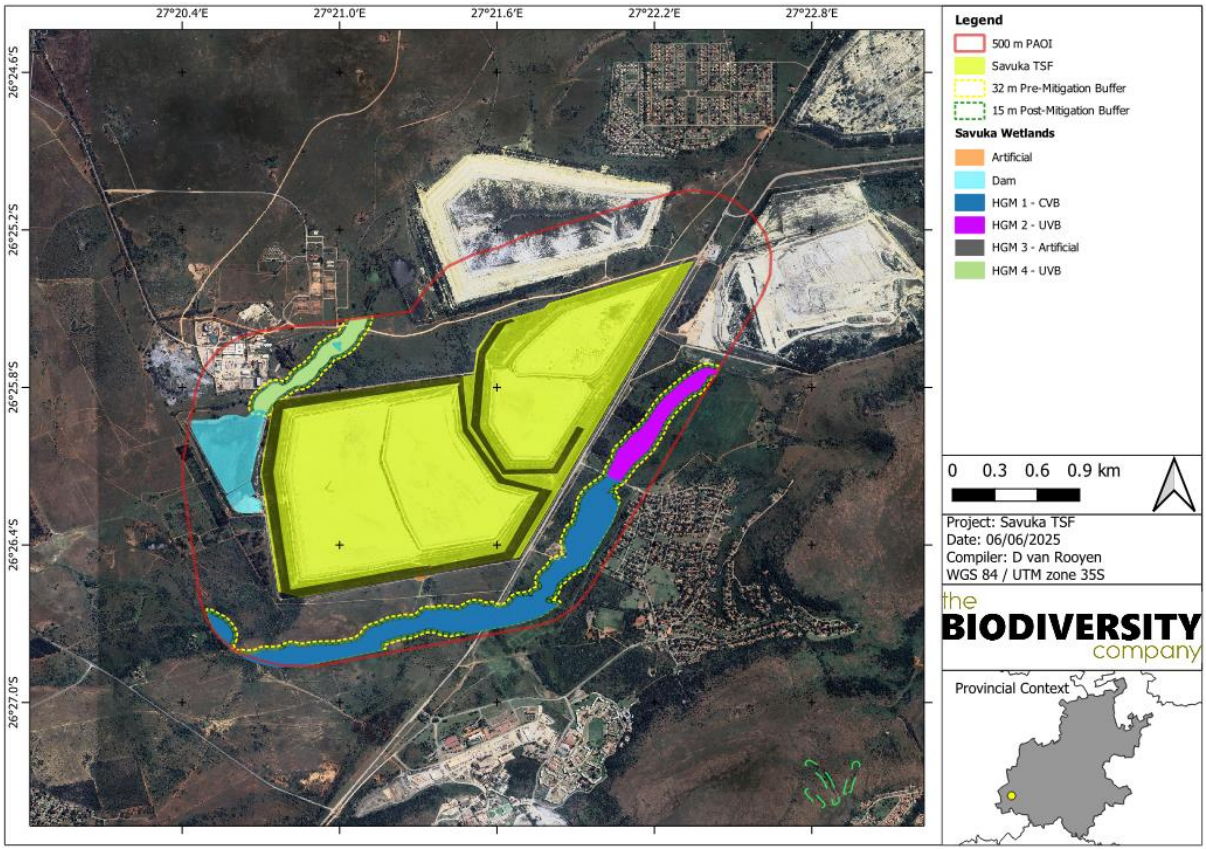


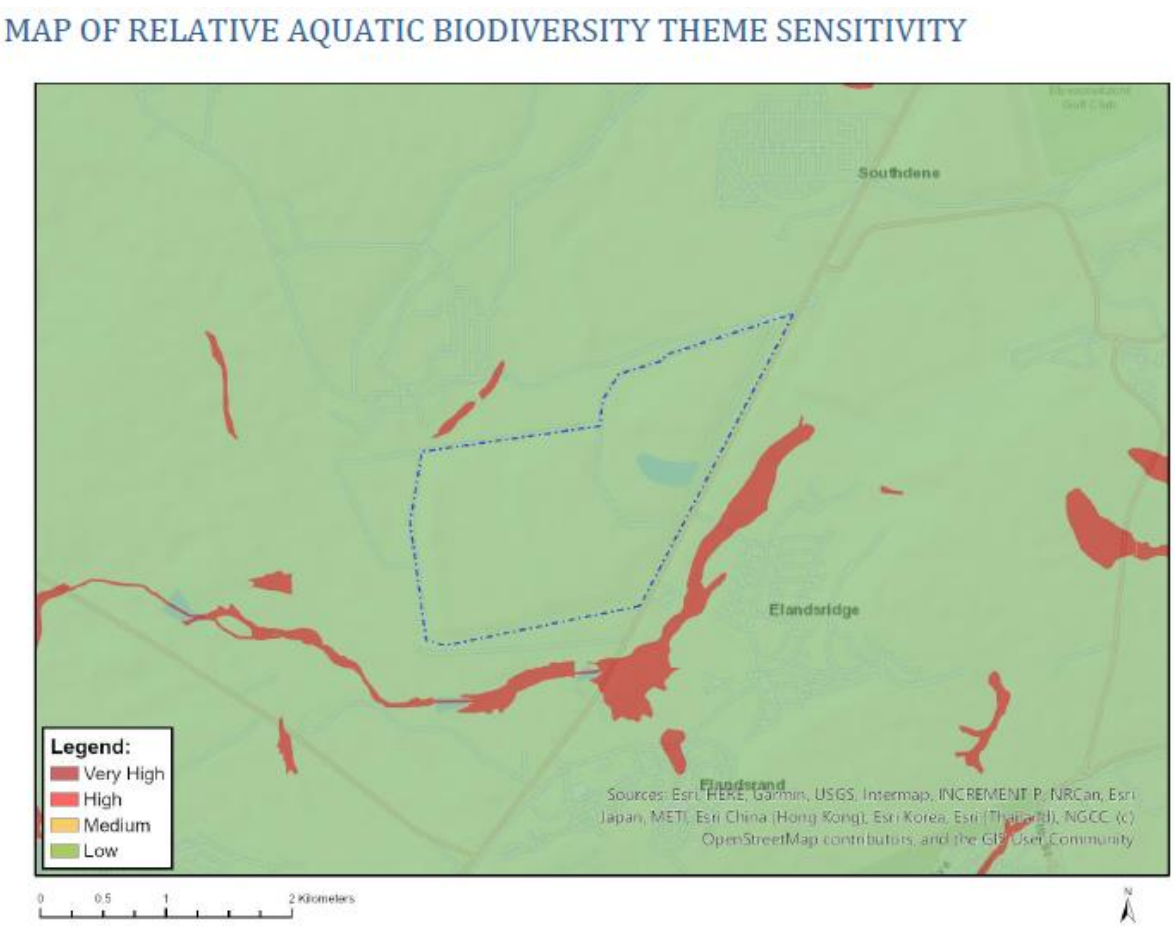
Figure 3-12 Recommended buffers for the assessed wetlands within the Savuka PAOI

3.6 Site Sensitivity Verification

3.6.1 Desktop Ecological Sensitivity

The following is deduced from the National Web-based Environmental Screening Tool Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended):

- Aquatic Biodiversity Theme Sensitivity as “Low” for the Savuka 7a & 7b TSF attributed to the no wetland and river features within the Savuka 7a & 7b TSF (Figure 3-13).



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

Figure 3-13 Aquatic Biodiversity Theme Sensitivity for the Savuka 7a & 7b TSF, according to the National Web-based Environmental Screening Tool

3.6.2 Screening Tool Comparison

The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas as presented in Table 3-11 below. A summative explanation for each result is provided as relevant. It should be noted that the National Web-based Environmental Screening Tool allocates sensitivities to freshwater resources identified through the available national freshwater datasets based on their presence (very high) or absence (low). The specialist-assigned sensitivity ratings presented herein consider the presence of features in conjunction with the ecological characteristics of the wetlands as discussed in Section 3.4. Figure 3-14 presents the delineated systems within the Savuka 7a & 7b TSF PAOI and the assigned sensitivities.

Table 3-11 Summary of the screening tool vs specialist assigned sensitivities

Feature	Screening Tool Theme	Screening Tool	Specialist Finding	Tool Validated or Disputed by Specialist - Reasoning
HGM 1 HGM 2 HGM 4	Aquatic Biodiversity Theme	**Very High**	**High**	Disputed – This is a channelled valley-bottom system that has been Seriously modified, however, the wetland offers a variety of moderately high ecological benefits to fauna and flora.
HGM 3		**Low**	**Low**	Validated – This is an artificial watercourse that offers no to limited ecological benefits. This watercourse was created as a result of the Savuka TSF. As such, these systems have been classified to have "Low" sensitivities.
Artificial watercourse Dam		**Low**	**Low**	Validated – These are all modified features and therefore these systems provide limited ecological benefits. As such, these systems have been classified to have "Low" sensitivities.
Freshwater Buffers		**Low**	**Low / Moderate / High**	Validated / Disputed – Whilst the buffer areas do not necessarily represent freshwater features, their conservation is imperative to limiting impact to the wetlands as they form the periphery of the wetlands thereby having spatial connectivity to the wetlands. The sensitivity of the buffers is therefore determined by the landscape and the sensitivity of the features they encompass.
Remaining Area		**Low**	**Low**	Validated – No natural surface water features were identified within these areas.

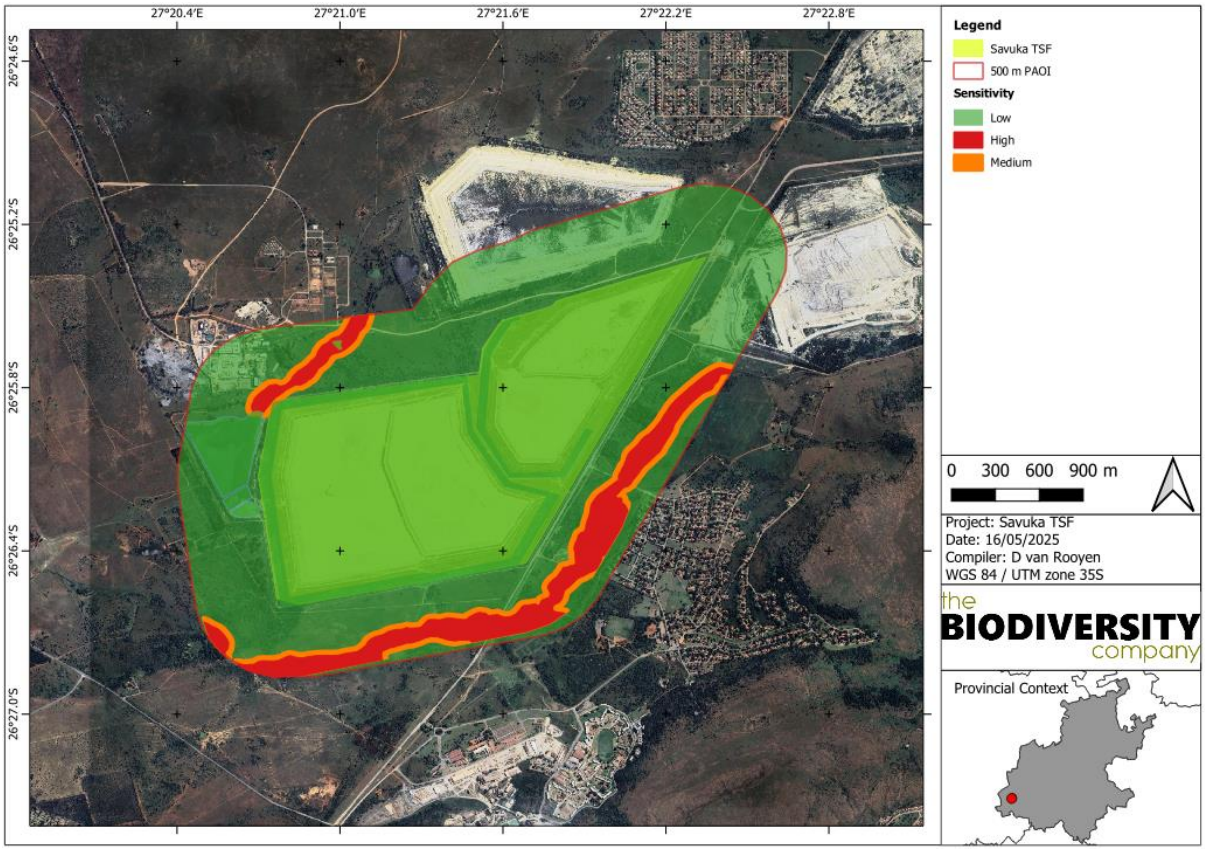


Figure 3-14 Map illustrating the freshwater sensitivity for the Savuka 7a & 7b TSF Project Area of Influence

4 Risk and Impact Assessment

The Risk / Impact Assessment considered the direct and indirect impacts to the wetland systems. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the assessment (Figure 4-1). In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts. The table below presents the water uses being considered for the application.

Table 4-1 Savuka TSF in the WULA c)&i) water uses

Water use	Description	Property Description	Coordinates	Volumes discharged per tonnes per annum / Storage capacity m3 and area m2 OR Length in m
Current Water Use				
Section 21(g)	Savuka TSF	Portions 5, 6, 7, 8, 9 & 25 of the Farm Doornfontein 118 IQ and Portion 16, 17, 48 & 93 of the Farm Blyvooruitzicht 116 IQ.	Lat: S 26°25'18.213" Long: E 27°22'20.511"	Deposition rate: 3 600 000 t/a
Proposed Amendment				
Section 21(g)	Savuka TSF	Portions 5, 6, 7, 8, 9 & 25 of the Farm Doornfontein 118 IQ and Portion 16, 17, 48 & 93 of the Farm Blyvooruitzicht 116 IQ.	Lat: S 26°25' 18.21" Long: E 27°22' 20.51"	Deposition rate: 2 880 000 t/a Capacity: m3 Area: m2 Height: 70 magl
Proposed Addition to the WUL				
Section 21 (c) & (i) Proximity of the Savuka TSF Compartments 7A, 7B and associated infrastructure to the Unchanneled Valley Bottom Wetland (HGM4)	CI 1: Savuka TSF 7A, 7B and associated infrastructure	Portions 5, 6, 7, 8, 9 & 25 of the Farm Doornfontein 118 IQ and Portion 16, 17, 48 & 93 of the Farm Blyvooruitzicht 116 IQ.	**Start:** Lat: S 26°25' 46.08" Long: E 27°21' 18.74" **End:** Lat: S 26°25' 53.14" Long: E 27°20' 22.15"	1.591 km
Section 21 (c) & (i) Proximity of the Savuka TSF Compartments 5A, 5B, 7A and associated infrastructure to the Unchanneled Valley Bottom Wetland (HGM2)	CI 2: Savuka TSF 5A, 5B, 7A and associated infrastructure	Portions 5, 6, 7, 8, 9 & 25 of the Farm Doornfontein 118 IQ and Portion 16, 17, 48 & 93 of the Farm Blyvooruitzicht 116 IQ.	**Start:** Lat: S 26°25' 47.86" Long: E 27°22' 04.13" **End:** Lat: S 26°26' 18.82" Long: E 27°21' 48.04"	1.04 km
Section 21 (c) & (i) Proximity of the Savuka TSF Compartments 5A, 5B, 7A, 7B and associated infrastructure to the Channelled Valley	CI 3: Savuka TSF 5A, 5B, 7A, 7B and associated infrastructure	Portions 5, 6, 7, 8, 9 & 25 of the Farm Doornfontein 118 IQ and Portion 16, 17, 48 & 93 of the Farm Blyvooruitzicht 116 IQ.	**Start:** Lat: S 26°25' 51.93" Long: E 27°22' 01.40" **End:** Lat: S 26°26' 25.00" Long: E 27°20' 37.75"	2.54 km

Bottom (HGM1)	Wetland

A risk assessment (Table 4-3) and an impact assessment (Table 4-4) was conducted for the proposed activities. For this assessment, only the operational phase of the development was focused on. It is anticipated that the proposed activities for the Savuka 7a & 7b TSF would not significantly impact the watercourses within the PAOI as the TSF avoids all wetlands except for HGM 4 which travers a small section of the wetland. However, it is anticipated that the proposed works would only cause indirect impacts. Furthermore, it is assumed that existing access roads will be used during the operational phase and thereby minimising the risks.

A decommissioning phase for the project was not considered given the expected longevity of the infrastructure.

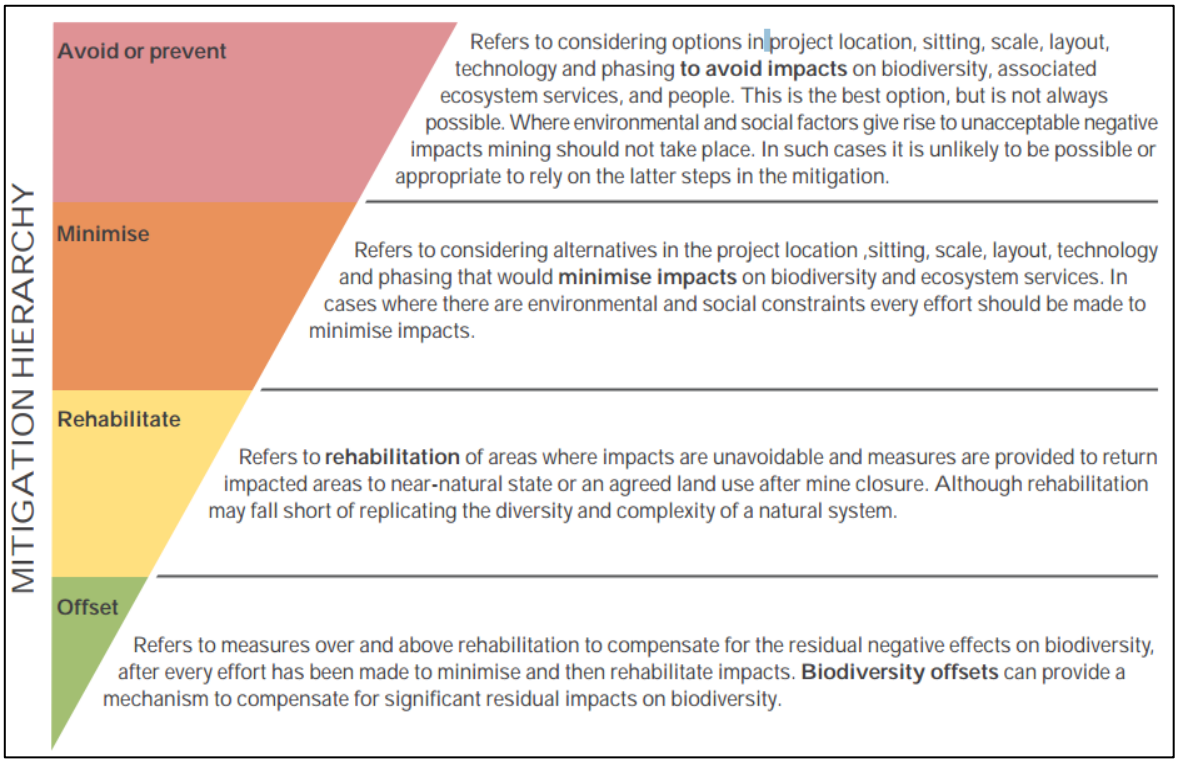


Figure 4-1 The mitigation hierarchy as described by the DEA (2013)

4.1 Current Impacts to Freshwater Biodiversity

The list below refers to the present-day local impacts observed within the assessed wetland areas:

- Historical alterations to the natural hydrological regime due to the presence of access roads through wetlands;
- Alterations to hydrology and geomorphology through the development of dams within wetlands and the local catchment;
- Loss of vegetation and wetland area through infrastructure infringement;
- Impaired water quality from mining runoff;
- Impeding flow within watercourse from informal and formal road crossings;
- Proliferation of alien invasive vegetation; and
- Erosion of watercourse from altered hydrology and geomorphology.

4.2 Potential Anticipated Impacts

It should be noted that the TSF has already been established and is currently in use, and the height of the facility is now being increased. Therefore, the majority of the impact has already occurred. The project entails continuing with deposition using the cyclone method for another 2 to 3 years which is an added impact of low significance.

Table 4-2 illustrates the potential aspects expected to threaten the integrity of sensitive receptors during the proposed activities.

Table 4-2 Activities and impacts relevant to the proposed activity

Phase	Activity	Impact
Operation	Operation of TSF relating to consistent stockpiling of tailings material	Siltation of water resources
		Erosion of water resources
		Altering of hydrological regime
		Proliferation of alien vegetation
		Impaired Water Quality
		Wetland disturbance and decrease in functionality
		Phytoremediation for groundwater pollution

4.3 Risk Assessment

Provided that the suggested mitigations are implemented, the project is anticipated to result in “Low” post-mitigation risks to the watercourses. This is attributed to the nature of the project which is a lower risk activity to freshwater resources given the proximity to watercourses.

Table 4-3 Summary of the DWS Risk Assessment conducted for the proposed activities at Savuka 7a & 7b TSF

Phase	Activity	Impact	Significance (max = 100)	Risk Rating	Confidence level

OPERATIONAL	Operation of TSF relating to consistent stockpiling of tailings material	Siltation of water resources	**21,6**	**L**	High
		Erosion of water resources	**21,6**	**L**	High
		Altering of hydrological regime	**21,6**	**L**	High
		Proliferation of alien vegetation	**14,4**	**L**	High
		Impaired Water Quality	**26,4**	**L**	High
		Wetland disturbance and decrease in functionality	**14,4**	**L**	High
		Phytoremediation for groundwater pollution	**28,8**	**L**	High

4.4 Impact Assessment

The Environmental Impact Management Services impact assessment methodology was used for this assessment and considers the same impacts as mentioned in Section 4.2. The construction phase for the project was not considered for the assessment as no construction would be undertaken while a decommissioning phase for the project was also not considered given the expected longevity of the infrastructure. Unlike the DWS Risk Assessment, which is activity specific, this impact assessment provides a cumulative assessment of significance per impact. As such, the pre- and post-mitigation impact ratings present within the “Low” class. The proposed activities being assessed in this impact assessment refer to TSF height extension/operation of TSF. The following serves as a description for each of these listed impacts:

- Siltation - The extension of the TSF increases the risk of fine tailings material being mobilized via surface runoff, wind erosion, and stormwater discharge. If erosion control measures are inadequate, these sediments can enter nearby wetlands, altering substrate composition and smothering aquatic vegetation.

- Erosion - Altered drainage patterns associated with increasing the height of the TSF can accelerate erosion along nearby watercourses.

- Hydrological regime - The additional height of the TSF may alter natural surface and subsurface flow paths, leading to increased runoff, reduced infiltration, and localized water table changes. This can disrupt wetland recharge and modify seasonal water availability, impacting wetland-dependent species.

- Invasive plant species - Disturbance from altered water flow can create favourable conditions for invasive species to establish. Poor rehabilitation practices may further encourage the spread of aggressive alien vegetation within wetland buffer zones.

- Water quality - The extension of the TSF increases the potential for contaminants such as heavy metals, sulphates, and fine sediments to leach into surface and groundwater. Stormwater runoff from tailings areas, accidental spills, and seepage from storage facilities can introduce harmful substances into adjacent wetland habitats.

- Phytoremediation – According to the Geohydrological Impact Assessment (van Biljon, 2025), applying Phytoremediation to counter groundwater pollution, will result in lowering the water table. Certain plant species used in phytoremediation, particularly those with high transpiration rates, can significantly draw down the water table as they uptake large volumes of water to support their growth and contaminant uptake processes. However, channelled valley-bottom wetlands are characterised by their location on valley floors, the presence of a river channel running through them, and the absence of characteristic floodplain features. Therefore, these wetlands are typically influenced by water inputs from the river channel and adjacent valley-side slopes, which contribute to their hydrological and ecological dynamics (Ollis *et al*., 2013).

Table 4-4 Summary of the Impact Assessment conducted for the proposed activities

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Confidence	Cumulative Impact	Irreplaceable loss	Final score
Siltation of water resources.	Operational	-6,75	-3,5	High	2	1	-3,9375
Erosion of water resources	Operational	-6,75	-3,5	High	2	1	-3,9375
Altering of hydrological regime	Operational	-5	-4	High	2	1	-4,5
Proliferation of alien vegetation	Operational	-7,5	-4	High	2	1	-4,5
Impaired Water Quality	Operational	-5	-2	High	2	1	-2,25
Wetland disturbance and decrease in functionality	Operational	-5	-3,5	High	2	1	-3,9375
Phytoremediation for groundwater pollution	Operational	-6.5	-4.5	High	2	1	-5.0625

4.5 Cumulative Impact Assessment

The quantitative impact of the proposed project in isolation on freshwater biodiversity is anticipated to be “Low” due to the proposed activities that will avoid wetland features and their buffers wherever possible and given that mitigation measures will be in place during the operational phase where impacts will be more likely to occur (Table 4-5). The cumulative impact of the proposed project on freshwater biodiversity is anticipated to be “Low” given the nature of the activities and expected low magnitude of impact once the height of the TSF is established.

Therefore, a slight and short-term deterioration to the wetland’s integrity and functionality conditions are expected but will likely remain within the recommended ecological category as a result of the proposed development activities. An irreplaceable loss of freshwater biodiversity is not anticipated.

Table 4-5 Cumulative Impacts to freshwater resources associated with the proposed project

Status	Cumulative Effect	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Impact in isolation	1	11	Low (6-28)	Yes	Yes
Cumulative impact	2	26	Low (6-28)		

5 Mitigation Measures

In light of the expected impacts from proposed activities the following mitigation measures have been proposed to lower the intensity of the impacts on the ecological integrity of the wetland catchment and its downslope wetland features.

The focus of mitigation measures should be to reduce the significance of potential environmental impacts associated with the proposed activities and thereby to:

- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community of the wetland areas.

Table 5-1 Mitigation measures for potential impacts

Activity	Impact	Mitigation
	Operation	
Operation of TSF relating to consistent stockpiling of tailings material	Siltation of water resources	• Update and implement the stormwater management plan. • Implement and maintain silt traps and sediment basins at strategic stormwater discharge points. • Establish and maintain vegetated buffer zones (using indigenous grass species) between the TSF and nearby wetlands, within 15 m from the TSF. • Regularly inspect and clear sediment traps and drains to ensure continued functionality. • Apply dust suppression measures (e.g., water spraying or biodegradable binders) on exposed tailings to reduce wind-blown silt deposition where required.
	Erosion of water resources	• Install energy dissipation structures (e.g., riprap, gabions, or concrete stilling basins) at stormwater outflows to reduce flow velocity, if required. • Stabilize slopes and embankments where required. • Implement a controlled release of stormwater through designed drainage channels to prevent concentrated flows from reaching wetland areas. • Conduct regular inspections of stormwater management infrastructure and repair erosion-prone areas immediately. • No machinery or vehicles should be allowed to parked in any wetlands. All activities to be restricted to authorized areas only.
	Proliferation of alien vegetation	• Remove alien vegetation manually or mechanically rather than using herbicides, to avoid contamination risks. This should be conducted annually. • Implement a maintenance program to ensure that previously cleared areas do not become re-infested with alien vegetation.
	Altering of hydrological regime	• Implement stormwater management, to be informed by the hydrological report. • Use permeable berms or check dams in water diversion channels to slow down and evenly distribute water flow. • Monitor groundwater levels.
	Impaired Water Quality	• Conduct routine water quality monitoring at key points downstream of the TSF to detect contamination early. • Conduct groundwater quality monitoring.
	Wetland disturbance and decrease in functionality	• Establish a 15 m wetland buffer zone with clear demarcation to prevent accidental encroachment. This can include signage. • Restrict heavy vehicle access to designated and authorized roads. • Implement a long-term wetland monitoring program to track ecological changes and implement adaptive management strategies.
	Phytoremediation for pollution plume control	• Use indigenous plant species that are well-adapted to local conditions. This helps maintain the ecological balance and supports local biodiversity. • Monitor water levels by means of the current groundwater monitoring programme to detect any significant changes in the water table. The geohydrologist is to advise on the suitability of the programme, and to recommend any changes. • The geohydrologist is to also advise on 'allowable' changes to the groundwater levels, and to prescribe remedial actions if levels are exceeded. • Manage the density of phytoremediation plants to prevent excessive water uptake and potential lowering of the water table. This can be achieved by spacing plants appropriately and using mixed planting strategies.

5.1 Recommendations

The following recommendations are important in manging the potential impacts to the watercourses:

- Strict adherence to the wetland buffers should be practiced, unless for activities that have been authorised;
- Update and implement a stormwater management plan for the operational phase of the development. The plan must address the movement of water on site and include measures to reduce erosion and sedimentation of the watercourses. Furthermore, the plan must ensure that only clean water is released into the environment;
- Ensure that waste generated on site during the operational phase is appropriately contained, categorised and disposed of; and
- Review and update the surface, groundwater and also aquatic biomonitoring programmes for the operation. In the event no monitoring programmes are available, these must be informed by the relevant specialists. It is recommended that an annual wetland monitoring programme be considered for the necessary authorisation, for this project.

6 Conclusion

Four (4) Hydrogeomorphic (HGM) units were identified within the encompassing 500 m Savuka TSF PAOI. These were classified as; one (1) channelled valley-bottom, two (2) unchannelled valley-bottoms and one (1) artificial wetland. Several earth dams were identified within the PAOI, most of which were instream features. Several dams were identified within the PAOI, most of which were off-channel features. Furthermore, the one HGM unit has been identified as an artificial depression. In addition, two non-perennial drainage features were identified where one has connectivity to the larger perennial river such as the Mooiriver.

The ecological characteristics of the wetlands are presented in Table 6-1.

Table 6-1 Ecological characteristics and buffer requirements of the freshwater resources within the Savuka 7a & 7b TSF PAOI

HGM Unit / Feature	PES	EIS	Ecosystem Services	REC - RMO	Buffer Requirement
HGM 1 – Channelled valley-bottom	E - Seriously Modified	High	Moderately High	E/F - Improve	15 m
HGM 2 – Unchannelled valley-bottom	E - Seriously Modified	High	Intermediate	E/F - Improve	
HGM 3 – Artificial wetland			N/A		
HGM 4 – Unchannelled valley-bottom	D - Largely Modified	High	Intermediate	C/D - Improve	15 m

6.1 Risk and Impact Statement

A risk assessment was conducted for the proposed project. The post-mitigation risks for the project presented within the “Low” significance categories. Additionally, a second impact assessment was undertaken for the project and the pre- and post-mitigation impact ratings present within the “Low” class.

The cumulative impact of the proposed project on freshwater biodiversity is anticipated to be “Low” given the nature of the activities and expected low magnitude of impact once the height of the TSF is established. Therefore, a negligible deterioration to the wetland’s integrity and functionality conditions are expected, for the duration of the operational phase of the project. However, the recommended ecological category of the systems is expected to be unaffected.

An irreplaceable loss of freshwater biodiversity is not anticipated.

6.2 Specialist Opinion

No fatal flaws were identified for the project. It is the opinion of the specialists that the project may be favourably considered for approval, and the Competent Authority must consider the prescribed mitigation measures and recommendations for the authorisation.

7 References

Department of Water Affairs and Forestry (DWAF). 2005a. A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas.

Department of Water and Sanitation (DWS). 2005b. River Ecoclassification: Manual for Ecostatus Determination. First Draft for Training Purposes. Department of Water Affairs and Forestry.

Department of Water Affairs and Forestry (DWAF). 1999a. Appendix W4 of the DWAF Resource Directed Measures for Water Resources: Wetland Ecosystems. Department of Water Affairs and Forestry, Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2016. General Authorisation in Terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for water uses as defined in Section 21(c) or section 21(i). Government Gazette Notice: 509 in Government Gazette 40229 of 26 August 2016.

Department of Water and Sanitation (DWS). 2023. General Authorisation in Terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for water uses as defined in Section 21(c) or section 21(i). Government Gazette Notice: 4167 in Government Gazette 49833 of 08 December 2023.

GDARD, 2014. Technical Report for the Gauteng Conservation Plan (Gauteng C-Plan v3.3). Gauteng Department of Agriculture and Rural Development: Nature Conservation Directorate.

Kotze, D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.C., and Collins, N.B. 2009. A Technique for rapidly assessing ecosystem services supplied by wetlands, Mondi Wetland Project.

Land Type Survey Staff. 1972 - 2006. Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases. Pretoria: ARC-Institute for Soil, Climate, and Water.

Le Maitre, D.C., Seyler, H., Holland, M., Smith-Adao, L., Nel, J.L., Maherry, A. and Witthüser, K. (2018) Identification, Delineation and Importance of the Strategic Water Source Areas of South Africa, Lesotho and Swaziland for Surface Water and Groundwater. Report No. TT 743/1/18, Water Research Commission, Pretoria.

Lotter, M.C., Le Maitre, D. 2021. Fine-scale delineation of Strategic Water Source Areas for surface water in South Africa using Empirical Bayesian Kriging Regression Prediction: Technical report. Prepared for the South African National Biodiversity Institute (SANBI), Pretoria. 33p.

Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2014. Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries. Final Consolidated Report. WRC Report No TT 610/14, Water Research Commission, Pretoria.

Macfarlane, D.M., Kotze, D.C., Ellery, W.N., Walters, D., Koopman, V., Goodman, P. and Goge, C. 2007. A technique for rapidly assessing wetland health: WET-Health. WRC Report TT 340/08.

Mucina, L., and Rutherford, M.C., 2010. The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria South African.

Nel, J. L., Driver, A., Strydom, W. F., Maherry, A. M., Petersen, C. P., Hill, L., Roux, D. J., Nienaber, S., van Deventer, H., Swartz, E. R. & Smith-Adao, L. B. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources, WRC Report No. TT 500/11. Water Research Commission, Pretoria.

Nel J.L., Murray K.M., Maherry A.M., Petersen C.P., Roux D.J., Driver A., Hill L., Van Deventer H., Funke N., Swartz E.R., Smith-Adao L.B., Mbona N., Downsborough L. and Nienaber S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Ollis D.J., Snaddon C.D., Job N.M., and Mbona N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

Rountree, M. & Kotze, D. 2013. Ecological Importance and Sensitivity Assessment. In: Rountree, M., Malan, H. & Weston. ed., Manual for the Rapid Ecological Reserve Determination of Inland Wetlands. Report to the Water Research Commission and Department of Water Affairs. WRC Report No. 1788/1/12. Pretoria. p. 42-46.

Soil Classification Working Group. 2018. Soil Classification A Taxonomic system for South Africa. Pretoria: The Department of Agricultural Development.

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E., Snaddon, K. 2018. South African Inventory of Inland Aquatic Ecosystems. South African National Biodiversity Institute, Pretoria. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number http://hdl.handle.net/20.500.12143/5847.

8 Appendix Items

8.1 Appendix A – Methodology

8.1.1 Desktop Dataset Assessment

The desktop assessment was undertaken using Geographic Information System (GIS) to access, view and overlay the latest available related datasets with the project area. The information represented within the datasets was used to develop the relevant digital maps used to identify potentially environmentally sensitive areas. These datasets and their respective dates of publishing are provided below:

- Vegetation Types - Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018 & Mucina and Rutherford 2006);
- Soils and Geology - Land Types Database (Land Type Survey Staff, 1972 - 2006); and
- Topographical Inland Water Areas and River Lines (based on the 1994 1:500 000 topographic maps as per the Chief Directorate of the National Geo-spatial Information).

8.1.1.1 Vegetation Types - Vegetation Map of South Africa, Lesotho and Swaziland

The Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018) is the latest and updated version of the maps published in earlier time such as those presented by Mucina and Rutherford (2006) and those presented in the National Biodiversity Assessment (2011). The map provides spatial details on the representative vegetation of South Africa and is complemented in this report using information from Strelitzia (Mucina & Rutherford, 2006) to provide insight on the landscape features, biogeography, climate, geology, and soils of the project area.

8.1.1.2 Soils and Geology - Land Type Database

The Land Type Survey provides information on the soils, terrain, climate, and geology of areas within South Africa. The data includes the pedological classification of soils and is used in this report to provide insight on the common soil forms associated with aquatic or freshwater systems of a particular area.

8.1.1.3 Topographical River Lines and Inland Water Areas

Topographical Inland Water Areas and River Lines for South Africa are based on the topographic maps dated 1994 as per the National Geo-spatial Information. These datasets are used in this report to provide insight on potential wetland areas and serves to highlight the location and extent of drainage features, dams, wetlands, reservoirs and other relevant inland waterbodies.

8.1.1.4 Ecologically Important Landscape Features

The datasets listed below were incorporated to establish the relation between the project and ecologically important or sensitive freshwater entities. Emphasis was placed around the following spatial datasets:

- South African Inventory of Inland Aquatic Ecosystems (SAIIAE), NBA 2018 Rivers and Wetlands (Van Deventer *et al.,* 2019);
- National Freshwater Priority Areas, Rivers and Wetlands, 2011 (Nel *et al.,* 2011); and
- Gauteng C-Plan v3.3 (GDARD, 2014).

8.1.1.4.1 The South African Inventory of Inland Aquatic Ecosystems

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the 2018 NBA, the SAIIAE is a collection of spatial data layers that represent the extent of river and inland wetland ecosystem types as well as the pressures on these systems. The same two headline indicators, and their associated categorisations, are applied as with the terrestrial ecosystem NBA, namely Ecosystem Threat Status and Ecosystem Protection Level. The Ecosystem Threat Status of river and wetland ecosystem types are based on the extent to which each ecosystem type had been altered from its natural condition.

8.1.1.4.2 National Freshwater Ecosystem Priority Areas, Rivers and Wetlands

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its inland aquatic systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs). The FEPAs are intended to be conservation support tools and it is envisioned that they will guide the effective implementation of measures to achieve the National Environment Management: Biodiversity Act's biodiversity conservation goals (Nel *et al.,* 2011).

8.1.1.4.3 Gauteng C-Plan v3.3

The final spatial outcome of the systematic conservation planning process (ie. The Gauteng C-Plan) is a map that delineates biodiversity priority areas for conservation and sustainable land use management. The map, which is commonly referred to as a Critical Biodiversity Areas or CBA Map, identifies biodiversity priority areas in a number of major categories (GDARD, 2014):

- Protected Areas;
- Critical Biodiversity Areas; and
- Ecological Support Areas

8.1.2 Wetland Field Survey

8.1.2.1 Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 8-1. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
- The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

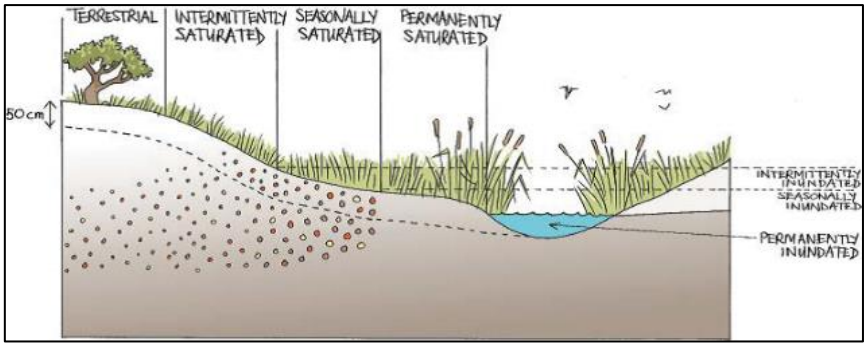


Figure 8-1 Cross section of a wetland, indicating how the soil wetness and vegetation indicators respond to changes in topography (Ollis et al. 2013)

8.1.2.2 Delineation

The wetland indicators described above are used to determine the boundaries of the wetlands within the project area. These delineations are then illustrated by means of maps accompanied by descriptions.

8.1.2.3 Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and then also includes structural features at the lower levels of classification (Ollis *et al.,* 2013).

8.1.3 Risk Screening

A risk screening procedure which considers the general topography of the proposed area in conjunction with the spatial proximity of the natural wetlands to the proposed areas of development was used to determine the 'Risk Status' of the delineated wetlands. Two broad categories are included in the screening process which classify wetlands to be 'At Risk' or 'Not at Risk'.

8.1.4 Wetland Functional and Ecological Assessment

8.1.4.1 Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Ecosystem services serve as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (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 services are provided (Table 8-1).

Table 8-1 Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate

2.1 - 3.0	Moderately High
> 3.0	High

8.1.4.2 Present Ecological Status

The overall approach as described by Macfarlane *et al.,* 2009, is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 8-2.

Table 8-2 The Present Ecological Status categories (Macfarlane et al., 2007)

Impact Category	Description	Impact Score Range	PES Score (%)	PES
None	Unmodified, natural	0 to 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 may have taken place.	1.0 to 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.	2.0 to 3.9	60-79	C
Large	Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.0 to 5.9	40-59	D
Serious	Seriously Modified. The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	6.0 to 7.9	20-39	E
Critical	Critically Modified. The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.0 to 10	0-19	F

8.1.4.3 Ecological Importance and Sensitivity

The importance and sensitivity of water resources is determined in order establish resources that provide higher than average ecosystem services, biodiversity support functions or are particularly sensitive to impacts. The mean of the determinants as described by Rountree *et al.,* 2013, is used to assign the Ecological Importance and Sensitivity (EIS) category as listed in Table 8-3.

Table 8-3 Description of Ecological Importance and Sensitivity categories

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	A
High	2.1 to 3.0	B
Moderate	1.1 to 2.0	C
Low Marginal	< 1.0	D

8.1.4.4 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) (Table 8-4) was determined based on the results obtained from the PES and EIS of the assessed wetlands, with the objective of recommending how a water resource should be managed. This is achieved by either maintaining or improving the ecological integrity of the wetland in order to ensure continued ecological functionality (DWA, 1999).

Table 8-4 Recommended Ecological Category and Recommended Management Objectives for water resources based on Present Ecological State and Ecological Importance and Sensitivity scores

PES		Ecological Importance and Sensitivity			
		Very High	*High*	*Moderate*	*Low*
	A (Pristine)	A Maintain	A Maintain	A Maintain	A Maintain
	B (Natural)	A Improve	A/B Improve	B Maintain	B Maintain
	C (Good)	A Improve	B/C Improve	C Maintain	C Maintain
	D (Fair)	C Improve	C/D Improve	D Maintain	D Maintain
	E/F (Poor)	D Improve	E/F Improve	E/F Maintain	E/F Maintain

8.1.5 Buffer Requirements

The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane *et al.,* 2014) was used to determine the appropriate buffer zone for the proposed activity.

8.2 Appendix B – Risk Assessment

The Department of Water and Sanitation (DWS) risk matrix assesses impacts in terms of consequence and likelihood. The significance of the impact is rated according to the classes presented in Table 8-5.

Table 8-5 Significance ratings matrix

Rating	Class	Management Description
1 – 29	(L) Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
61 – 100	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

8.3 Appendix C – Specialist Declaration of Independence

Declaration

I, Divan van Rooyen, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Divan van Rooyen

Freshwater Ecologist

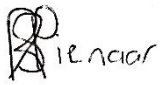
The Biodiversity Company

January 2025

Declaration

I, Rian Pienaar, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Rian Pienaar

Ecologist

The Biodiversity Company

January 2025

8.4 Appendix D – Specialist CVs

Divan van Rooyen

Ph.D. Environmental Science

Pri Sci Nat (151272)

Cell: +27 83 265 8776
Email: divan@thebiodiversitycompany.com
Identity Number: 9312205072085
Date of birth: 20 December 1993

Profile Summary

Working experience throughout Southern Africa

Specialist experience with mining, WWTW's and construction.

Specialist expertise include wetlands resources, aquatic ecology and ecotoxicology.

Areas of Interest

Mining, Seismic Surveys, Renewable Energy, Bulk Services Infrastructure Development & WWTW's.

Key Experience

- Environmental Impact Assessments (EIA)
- Environmental Management Programmes (EMP)
- Wetland delineations and ecological assessments
- Rehabilitation Plans and Monitoring
- Aquatic biomonitoring

Country Experience

South Africa

Nationality

South African

Languages

English – Proficient

Afrikaans – Proficient

Qualifications

- PhD (North-West University of Potchefstroom) – Environmental Science with Aquatic Ecosystem Health
- MSc (North-West University of Potchefstroom) – Environmental Science (Ecological Remediation and Sustainable Management)
- BSc Honours (North-West University of Potchefstroom) – Environmental Science with Ecological Remediation and Sustainable Management
- BSc Environmental sciences
- Pri Sci Nat (151272)

Rian Pienaar

M.Sc. Environmental Science

Pri Sci Nat (135544)

Cell: +27 78 0505 0201
Email: rian@thebiodiversitycompany.com
Identity Number: 9405235011089
Date of birth: 23 May 1994

Profile Summary

Working experience throughout Southern Africa

Specialist experience with mining, construction and agriculture.

Specialist expertise include wetlands resources, aquatic ecology, parasitology and ecotoxicology.

Areas of Interest

Mining, Oil & Gas, Renewable Energy & Bulk Services Infrastructure Development, Farming, Land Contamination, Sustainability and Conservation.

Key Experience

- Environmental Impact Assessments (EIA)
- Environmental Management Programmes (EMP)
- Wetland delineations and ecological assessments
- Rehabilitation Plans and Monitoring
- Soil classification
- Agriculture potential assessments
- Land contamination assessments

Country Experience

South Africa

Mozambique

Botswana

Nationality

South African

Languages

English – Proficient

Afrikaans – Proficient

Qualifications

- MSc (North-West University of Potchefstroom) – Environmental Science (Cum Lauda)
- BSc Honours (North-West University of Potchefstroom) – Environmental Science with Aquatic ecosystem heath.
- BSc Environmental sciences
- Pri Sci Nat (135544)

8.5 Appendix E – Impact Assessment Methodology