FRESHWATER ECOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED RHENOSTERKOP SAND MINING RIGHT APPLICATION

Beaufort West, Western Cape Province, South Africa

24/06/2025

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Report Name	**FRESHWATER ECOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED RHENOSTERKOP SAND MINING RIGHT APPLICATION**	
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Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science.	

Abbreviations

Abbreviation	Definition
ASPT	Average Score per Recorded Taxon
CBA	Critical Biodiversity Area
DO	Dissolved Oxygen
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
ECO	Environmental Control Officer
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EN	Endangered
ESA	Ecological Support Area
ETS	Ecosystem threat status
IHI	Index of Habitat Integrity
IUCN	International Union for Conservation of Nature
LC	Least Concerned
MASL	Meters Above Sea Level
NEMA	The National Environmental Management Act
NFEPA (FEPA)	National Freshwater Ecosystem Priority Areas
NT	Near Threatened
NWA	National Water Act
NWBEST	National Web-Based Environmental Screening Tool
PAOI	Project Area Of Influence
PES	Present Ecological State
RQO's	Resource Quality Objectives
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SASS5	South African Scoring System version 5
SCC	Species of Conservation Concern
SQR	Sub Quaternary Reach
TBC	The Biodiversity Company
TWQR	Target Water Quality Range
VU	Vulnerable
WMA	Water Management Area

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1 Introduction

1.1 Background

The Biodiversity Company was appointed to conduct a freshwater ecological assessment for Environmental Authorisation (EA) and a mining permit to mine sand on a portion of the remaining portion of the Farm Rhenosterkop no 155, Registration Division of Beaufort West, Western Cape Province (hereafter referred to as the "*Project Area*") (Figure 1-1).

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).

This assessment has been completed in accordance with the requirements of the published General 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 low risk and/or 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 appropriate water use authorisation.

The purpose of the specialist assessment is to provide relevant input into the EA process and provide a report for the activities associated with the project. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision-making with regard to the ecological viability of the proposed development and related activities.

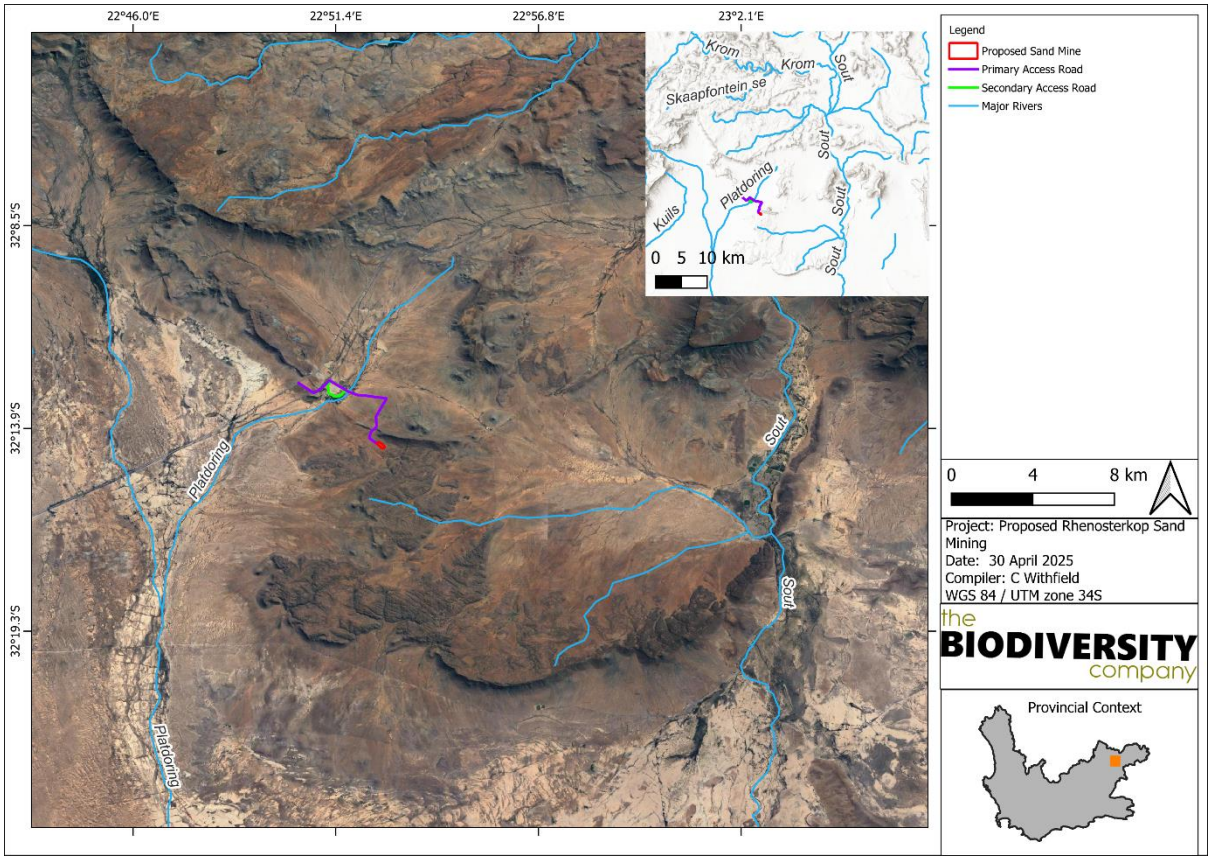

Figure 1-1 Locality map illustrating the project area in relation to the general setting.

1.2 Project Description

The Applicant, Sand Mine (Pty) Ltd, applied for environmental authorisation (EA) and a mining permit to mine sand on a portion of the remaining portion of the Farm Rhenosterkop no 155, Registration Division of Beaufort West, Western Cape province.

The proposed mining area is approximately 5 ha in extent and will be developed over an undisturbed and inactive area of the farm. The applicant, intents to obtain material from the area for at least 2 years with a possible 3-year extension. The proposed sand mine will appoint ±6 employees, and due to the small scale of the operation no infrastructure, other than a chemical toilet, must be established within the mining footprint. The proposed mining area will be reached via an existing farm road that will be upgraded and maintained for the duration of the operational phase.

The sand extracted from the sand mine will be used for the construction industry in the surrounding area. The proposed sand mine will contribute to the upgrading / maintenance of road infrastructure, renewable energy projects and building contracts in and around the Beaufort West area.

The proposed operation is representative of the small-scale mining industry where the mineral (sand) is loaded with a Front-End-Loader (FEL) directly from the mining footprint area to the stockpile area, following standard practices in the small-scale mining sector. If necessary, the sand will be screened before being stockpiled. Once ready for distribution, a front-end loader will load the sand onto trucks for delivery to customers. No washing of sand will be required. All mining related activities will be contained within the limits of the authorized mining permit.

The proposed project triggers listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and the Environmental Impact Assessment Regulations 2014 (as amended 2017) and therefore requires an environmental impact assessment (basic assessment process) that assess project specific environmental impacts and alternatives, consider public input, and propose

mitigation measures, to ultimately culminate in an environmental management programme that informs the competent authority (Department of Mineral Resources and Energy) when considering the environmental authorisation.

1.3 Assessment Scope of Work

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

- A desktop assessment of all available and related datasets;
- GIS processing to preliminary identify water accumulation areas;
- The delineation of water resources in accordance with the DWAF (2005) guidelines, whereby the outer edges will be identified; and
- A functional and integrity assessment of the water resources.

1.4 Assumptions and Limitations

The following aspects were considered as limitations:

- It is assumed that the client has provided the specialist with all available data and information surrounding the project at the time of writing and it is assumed that all this information is relevant and accurate, including the extent of the project area;
- No alternatives were provided at the time of the survey and compilation of this report;
- All watercourses associated with the project area were dry at the time of the survey. Therefore, no Macroinvertebrate, Ichthyofauna, water quality, IHAS assessment were conducted. The assessment was only limited to only an IHI assessment of the habitat present on site;
- A single-season survey was conducted for the respective study, which would constitute a wet season/low flow survey. Thus, temporal trends were not investigated. Despite this it is the specialist's opinion that the findings are conclusive, and no further fieldwork would be required; and
- The GPS used for water resource delineations is accurate to five meters. Therefore, the 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 applies 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	NEMA	Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017), Appendix 6 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
	Assessment Protocol (March 2020)	The minimum criteria for reporting.
	Assessment Protocol (October 2020)	Protocol for the specialist assessment and minimum report content requirements.

	NEMWA;	The regulation of waste management to protect the environment.
	NWA	The regulation of water use.
	GN 1003 of GG 43726 of 18 Sept 2020	The regulation and management of alien invasive species.
	GN4167 of GG 49833 of 8th Dec 2023	General Authorisations in term of Section 39 of the National Water Act 36 of 1998 for Water Uses as defined in Section 21 (c) and (i)
	GN704 of GG 20119 of 4th June 1999	Regulations on use of water for mining and related activities aimed at the protection of water resources
	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	Western Cape Environmental Management Framework (EMF) (2013)	This framework guides sustainable development and environmental protection in sensitive areas like the Cape Winelands, coastlines, and wetlands by setting out requirements for environmental impact assessments (EIAs) and zoning.
	Western Cape Nature Conservation Ordinance (1974 as amended)	To manage the protection of fauna and flora within the province, regulate activities like hunting, fishing, and camping, and ensure the conservation of protected areas and nature reserves.
	Western Cape Biodiversity Act (Act 6 of 2021)	The Western Cape Biodiversity Act was signed into law in 2021. It marks a key milestone in the rationalisation and modernisation of the regulatory framework for biodiversity governance in the Western Cape Province and supports alignment with national and international policy and strategic frameworks.

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.
- 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.
- 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 and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the 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, state 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.

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	9.3
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae	9.4
A signed statement of independence by the specialist(s)	9.3
The assessment must be undertaken on the preferred site and within the proposed development footprint	3.2.1
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
The threat status of the ecosystem and species as identified by the screening tool	3.4.1
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
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)	3.2.6
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	-
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:	4

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.	
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 off stream 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
How will the proposed development impact on key ecosystems regulating and supporting services especially: (a) flood attenuation; (b) streamflow regulation; (c) sediment trapping; (d) phosphate assimilation; (e) nitrate assimilation; (f) toxicant assimilation; (g) erosion control; and (h) carbon storage?	4
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	9.1
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	
Additional environmental impacts expected from the proposed development	-
Any direct, indirect, and cumulative impacts of the proposed development on-site	-
The degree to which impacts and risks can be mitigated	-
The degree to which the impacts and risks can be reversed	-
The degree to which the impacts and risks can cause loss of irreplaceable resources	-
A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies	0
Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr)	4 and 4.6
A motivation must be provided if there were development footprints identified as having a “low” aquatic biodiversity sensitivity and that were not considered appropriate	-
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	7.3
Any conditions to which this statement is subjected	7.3

A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

2 Fieldwork

In line with the minimum requirements for aquatic biodiversity surveys a single field survey for the project area was undertaken on the 7th of March 2023 (Autumn) to identify the presence and condition of freshwater resources and to delineate their spatial extents. The survey constituted a wet season/high flow assessment. Seasonality is not considered to be a limiting factor to the assessment of which the results are conclusive. After consulting the desktop data and visiting the site, it was noted that no wetlands were indicated by the desktop data nor found within the 500 m PAOI. Therefore, efforts were afforded to a riverine assessment rather than a wetland assessment for this project.

3 Results & Discussion

3.1 Desktop Dataset Assessment - Ecologically Important Landscape Features

The following spatial features describe the general area and associated freshwater resources (ecologically important landscape features). This assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and the South African National Biodiversity Institute (SANBI). The desktop analysis and their relevance to this project are summarised in Table 3-1.

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

Desktop Information Considered	Relevance	Reasoning	Section
Strategic Water Source Areas	No	The project area is not located within any SWSAs for groundwater or surface water.	3.1.1
Conservation Plan	Yes	The project area overlaps with Ecological Support Area (ESAs) – ESA 1 and Other Natural Areas (ONA)	3.1.2
National Biodiversity Assessment (NBA)	Yes	The proposed mining area does not traverse any NBA wetlands or rivers, however the access road will cross an NBA river (Platdoring River)	3.1.3
Aquatic Ecosystem Threat Status	Yes	The project area is located along a 'Least Threatened' watercourse.	3.1.4
Aquatic Ecosystem Protection Level	Yes	The project area is located along a 'Poorly Protected' watercourse.	3.1.5
Protected Areas	Yes	No protected areas detected within the project area or immediate downstream reaches. The Steenbokkie Private Nature Reserve is approximately 15 km downstream of the project area.	3.1.6
National Freshwater Ecosystem Priority Areas (NFEPA)	Yes	The project area (primary and secondary access road) is in proximity to a non-priority NFEPA wetland and NFEPA river.	3.1.7

3.1.1 Strategic Water Source Areas

Strategic Water Source Areas (SWSAs) are areas that supply a disproportionate amount of mean annual runoff to a geographical region of interest. The areas supplying ≥ 50% of South Africa's water supply (which were represented by areas with a mean annual runoff of ≥ 135 mm/year) represent national Strategic Water Source Areas (Lotter & Le Maitre, 2021). According to the SWSAs of South Africa, Lesotho and Swaziland, the southern portion project area is not located within a SWSA for surface water (Figure 3-1).

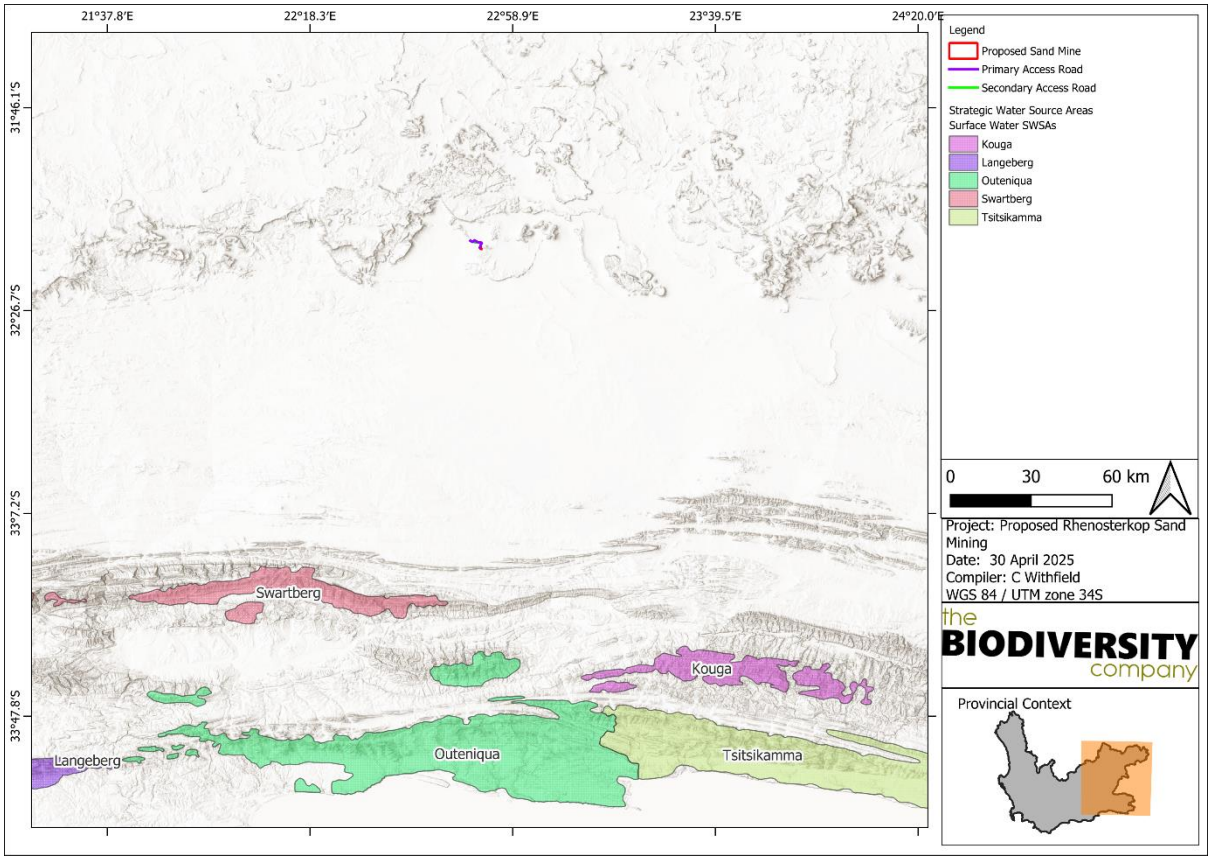

Figure 3-1 Map illustrating the Strategic Water Source Areas in relation to the project area.

3.1.2 Conservation Plan

The Western Cape Biodiversity Spatial Plan (WCBSP) 2023 is the most recent, systematic biodiversity planning product for the Western Cape Province. Developed by CapeNature, it identifies spatial biodiversity priorities critical for sustaining ecosystems and associated services. The WCBSP delineates Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Other Natural Areas (ONAs), Protected Areas (PAs), and Marine Protected Areas (MPAs), to guide sustainable development and inform land use, environmental assessments, and conservation planning.

CBAs are split into CBA1 (likely natural) and CBA2 (potentially degraded or secondary vegetation), while ESAs are divided into ESA1 (likely functional) and ESA2 (likely severely degraded, requiring restoration). The plan was developed using the Marxan decision-support tool within a QGIS environment, using biodiversity features, ecological infrastructure, and land cover data to identify areas of highest conservation value.

The WCBSP aligns with the Western Cape Biodiversity Act (2021) and provides clear land-use guidelines for each biodiversity category, promoting integration into planning and regulatory processes across the province.

The primary access road will traverse a CBA 1 river, with ONA's and ESA 1 watercourses being traversed by the road options and sand mine.

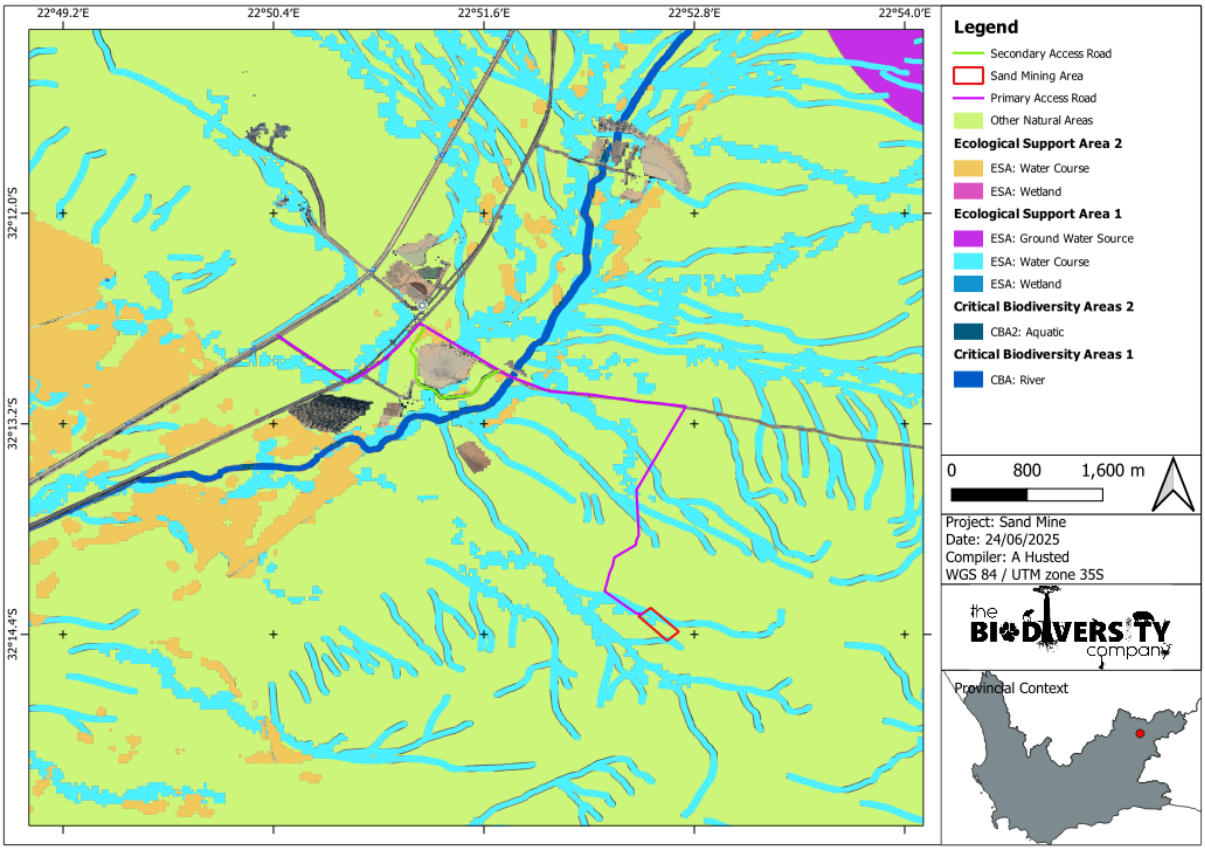

Figure 3-2 Map illustrating the conservation plan in relation to the project area.

3.1.3 The National Biodiversity Assessment

The National Biodiversity Assessment (NBA) was completed as a collaboration between the SANBI, the DEA and other stakeholders, including scientists and biodiversity management experts throughout the country over a three-year period (Van Deventer *et al*., 2019). The purpose of the NBA is to assess the state of South Africa's biodiversity to understand trends over time and inform policy and decision-making across a range of sectors (Van Deventer *et al*., 2019).

This spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the NBA (2018). National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (2018).

This database does not recognise the presence of any wetlands within the extent of the project area. Only the access road will traverse and NBA river (Platdoring River) (Figure 3-3).

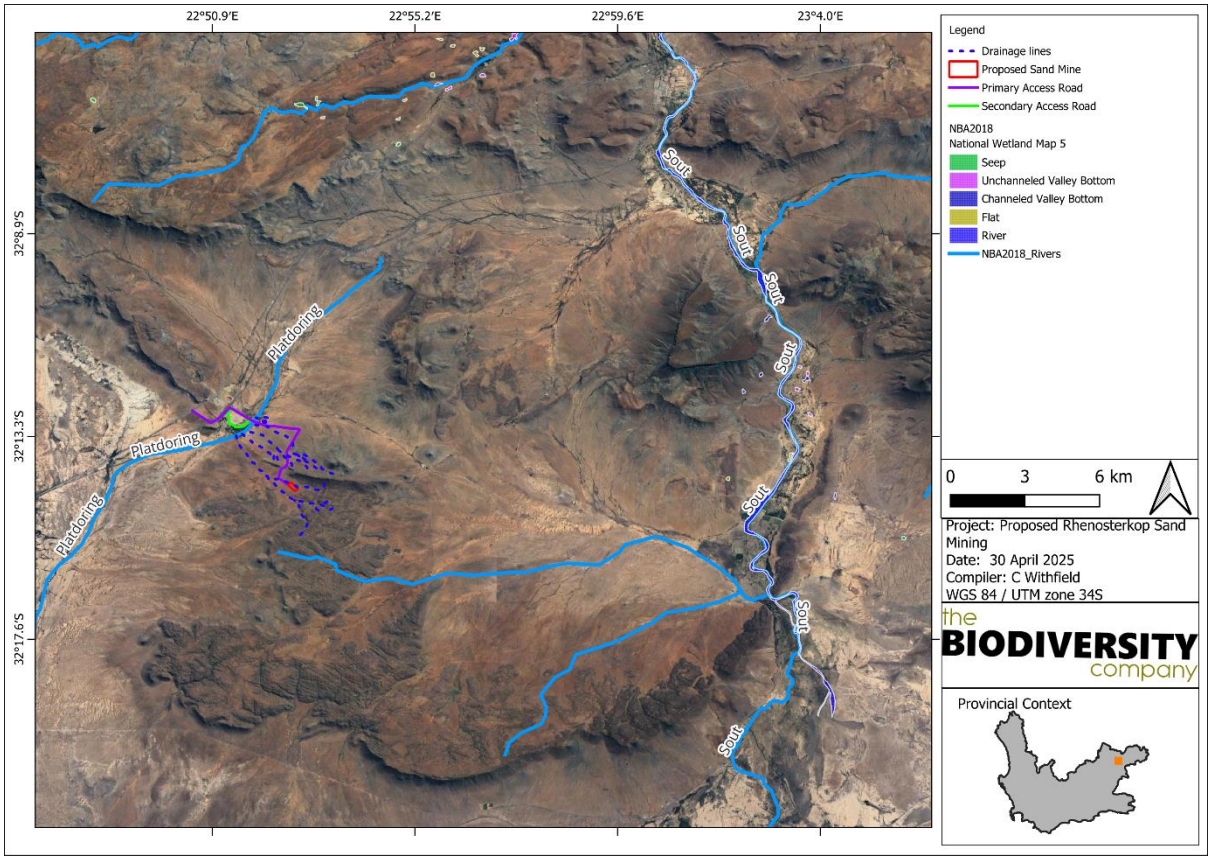

Figure 3-3 Illustration of wetlands and rivers within the project area(NBA, 2018)

3.1.4 Aquatic Ecosystem Threat Status

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the NBA in 2018. The Ecosystem threat status of river and wetland ecosystem outlines the degree to which the ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Van Deventer *et al*., 2019; Skowno *et al*., 2019). Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in a good ecological condition (Skowno *et al*., 2019).

The Ecosystem Threat Status (ETS) of each river assessed was based on the extent to which the system had been modified from its natural condition (SANBI, 2017). According to the SAIIAE dataset, the project area and surrounding/proximal watercourses are drained by an LT river (Figure 3-4).

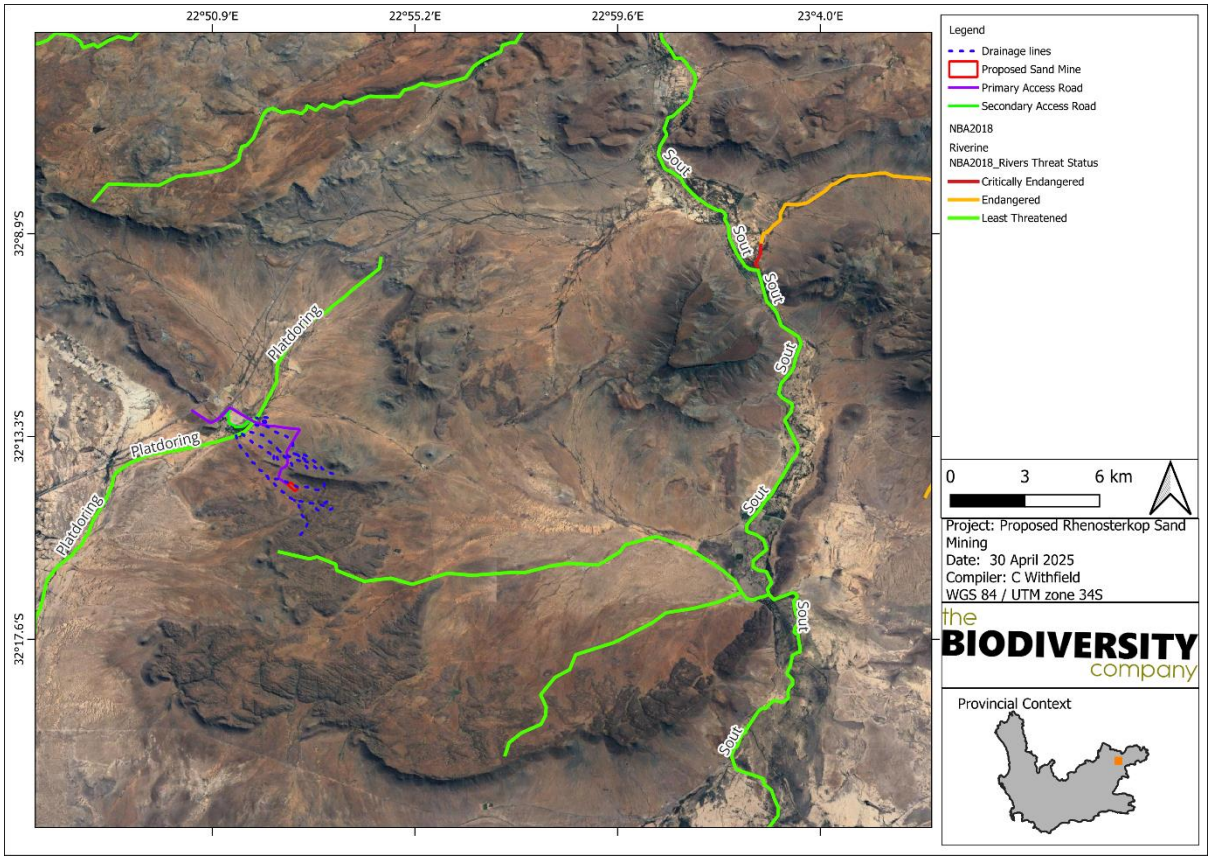

Figure 3-4 The project area in relation to the threat status of aquatic ecosystems, SAIIAE dataset (NBA, 2018).

3.1.5 Aquatic Ecosystem Protection Level

Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Skowno *et al*., 2019). The Ecosystem Protection Level (EPL) of each river assessed was based on the extent (expressed as a percentage) to which the system has their biodiversity target located within protected areas and are in a natural or near-natural ecological condition. Rivers in protected areas need to be in good condition (A or B ecological category) to be considered as protected. Well protected rivers have 100% of their extent located within protected areas, while moderately protected and poorly protected river ecosystem types have at least 50% and 5% of their biodiversity target in protected areas, respectively. Not protected rivers are characterised by less than 5% (SANBI, 2022).

The project area was superimposed on the ecosystem protection level map to assess the protection status of aquatic ecosystems associated with the development (Figure 3-5). According to the SAIIAE dataset, the project area and surrounding/proximal watercourses are drained by Poorly Protected system.

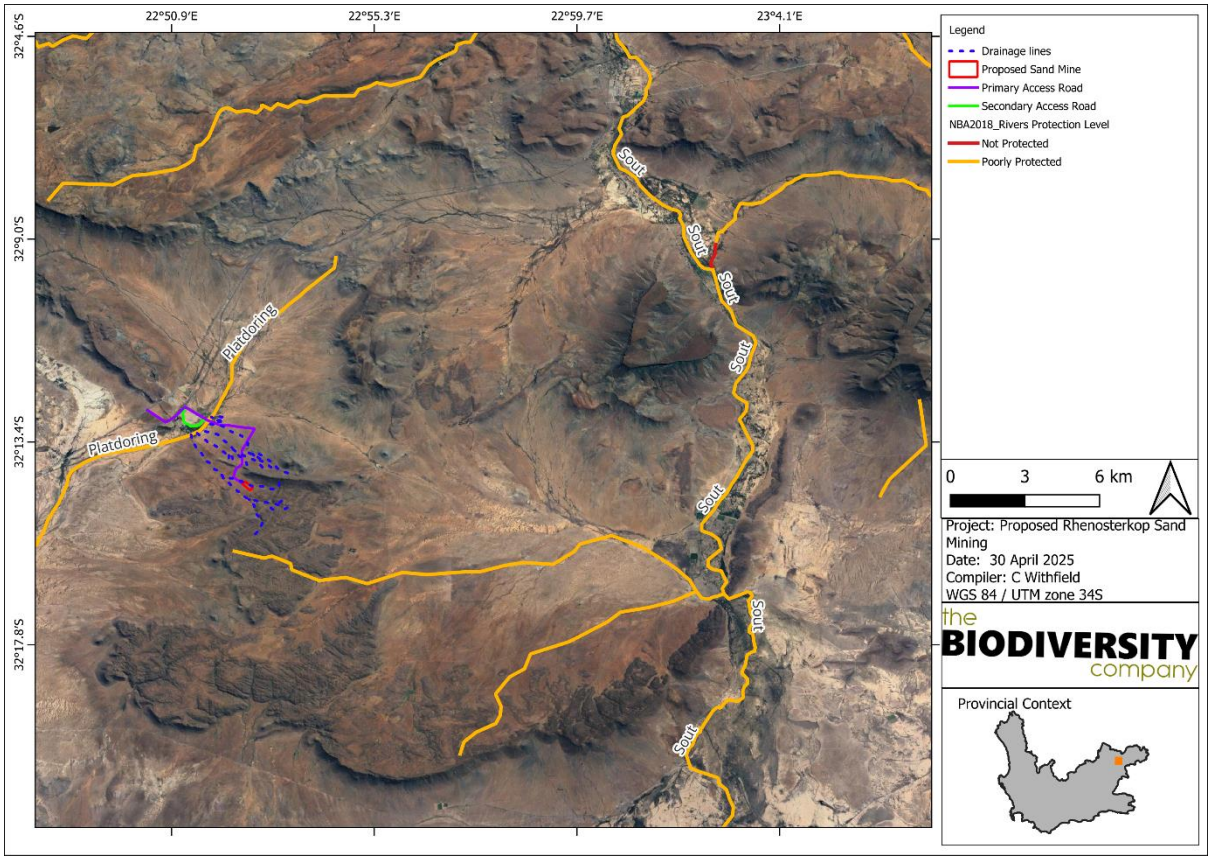

Figure 3-5 ***The project area in relation to the protection level of aquatic ecosystems, SAIIAE dataset (NBA, 2018). The project area in relation to Protected Areas in South Africa.***

3.1.6 Protected Areas

The Department of Environmental Affairs maintains a spatial database of Protected Areas and Conservation Areas. The Protected Areas and Conservation Areas (PACA) Database scheme is used for classifying protected areas (South Africa Protected Areas Database-SAPAD) and conservation areas (South Africa Conservation Areas Database-SACAD) into types and sub-types in South Africa. The definition of protected areas used in these documents follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the “System of Protected Areas”, which consists of the following kinds of protected areas: Special nature reserves, National parks, Nature reserves, Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003), World heritage sites declared in terms of the World Heritage Convention Act, Marine protected areas declared in terms of the Marine Living Resources Act, Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998), and Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970). The types of conservation areas that are currently included in the database include: Biosphere reserves, Ramsar sites, Stewardship agreements (other than nature reserves and protected environments), Botanical gardens, Transfrontier conservation areas, Transfrontier parks, Military conservation areas, and Conservancies.

The National Biodiversity Assessment of 2011 Protected Areas layer was also consulted. The project area is not within, adjacent or proximal to any Protected or Conserved areas. However, the Steenbokkie Private Nature Reserve is approximately 15 km downstream of the project area (Figure 3-6).

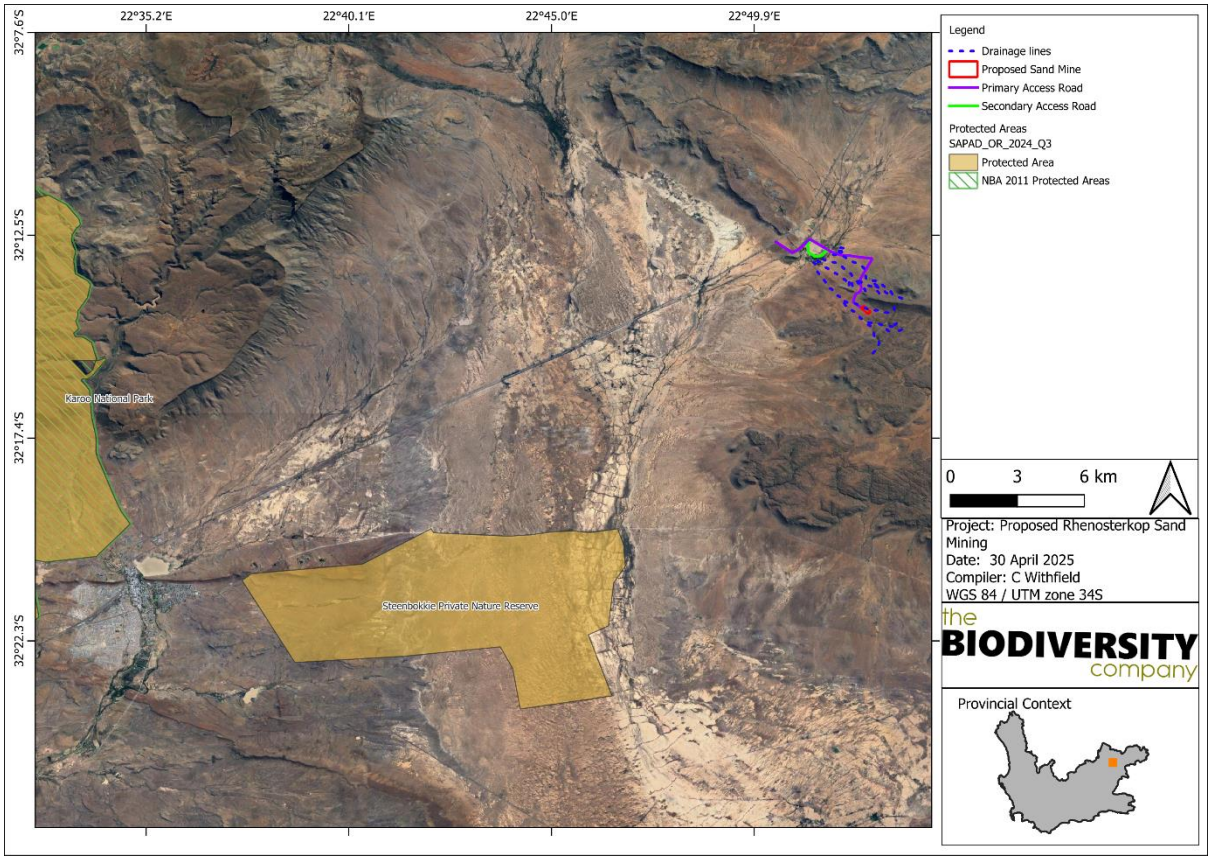

Figure 3-6 The project area in relation to Protected Areas in South Africa.

3.1.7 National Freshwater Ecosystem Priority Area Status

The National Freshwater Ecosystem Priority Areas (NFEPA) database forms part of a comprehensive approach to the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act 36 of 1998). This directly applies to the National Water Act, which feeds into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel *et al*., 2011). The NFEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's biodiversity goals (NEM: BA) (Act 10 of 2004), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel *et al*., 2011).

According to the NFEPA dataset (Figure 3-7), the project area (primary and secondary access road) is in proximity to an unclassified (non-priority) NFEPA wetland and NFEPA river. Therefore, conserving the water quality, riverine and wetland habitat and associated ecological functioning within the project area and associated catchments, will aid in the protection of riverine habitat supporting fish species occurring within the entire catchment and water quality for the aquatic and terrestrial biota downstream of the project area. The catchments in which human activities occur need to be managed to maintain water quality and prevent further degradation of local and downstream water resources in order to contribute to national biodiversity goals and support sustainable use of water resources. According to the NFEPA datasets, there is no FEPA river or FEPA area within the project area (Nel *et al.,* 2011).

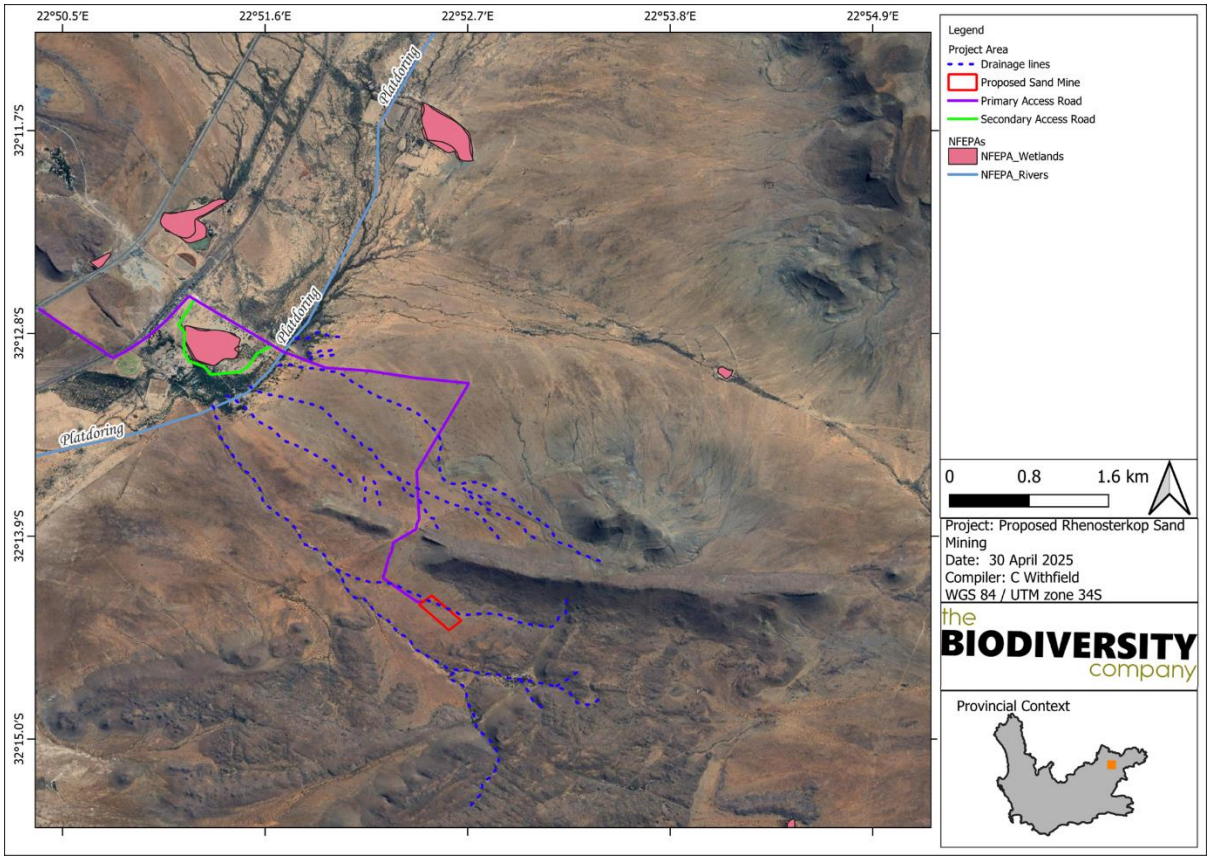

Figure 3-7 Illustration of NFEPAs and SAIIAE wetlands in relation to the project area.

3.1.8 Freshwater Ecology

The project area falls within the L11F quaternary catchment (Figure 3-8), the Great Karoo Ecoregion (Figure 3-9), and the Mzimvubu-Tsitsikamma Water Management Area (WMA)(Figure 3-10) (DWS, 2023).Desktop information for the Sub-Quaternary Reaches (SQRs) associated with the project area was obtained from the DWS (2014). The project area falls within L11F-07164 SQR, associated with the Platdoring River. The Present Ecological State (PES), Ecological Importance (EI), and Ecological Sensitivity (ES) for the SQRs are summarised in Table 3-2. The SQR impacts and activities include instream impoundments, sand mining, grazing, erosion and bush encroachment.

Table 3-2 PES of systems and the SQR associated with the project (DWS, 2014)

SQR Importance and Sensitivity	Score
L11F-07164 (Platdoring River)	
Present Ecological Status	Moderately Modified (category C)
Ecological Importance (EI)	High
Ecological Sensitivity (ES)	Moderate

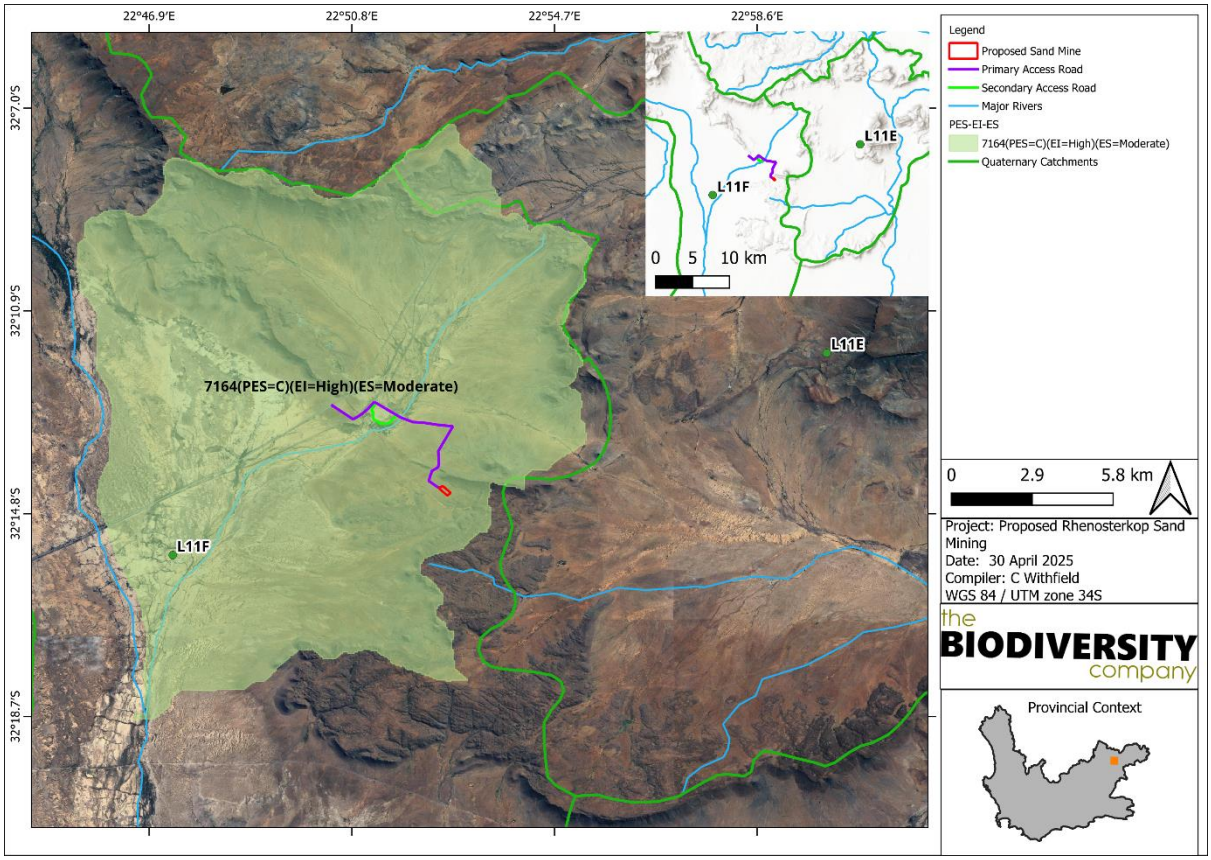

Figure 3-8 Catchment map illustrating the project area in relation to the quaternary catchment.

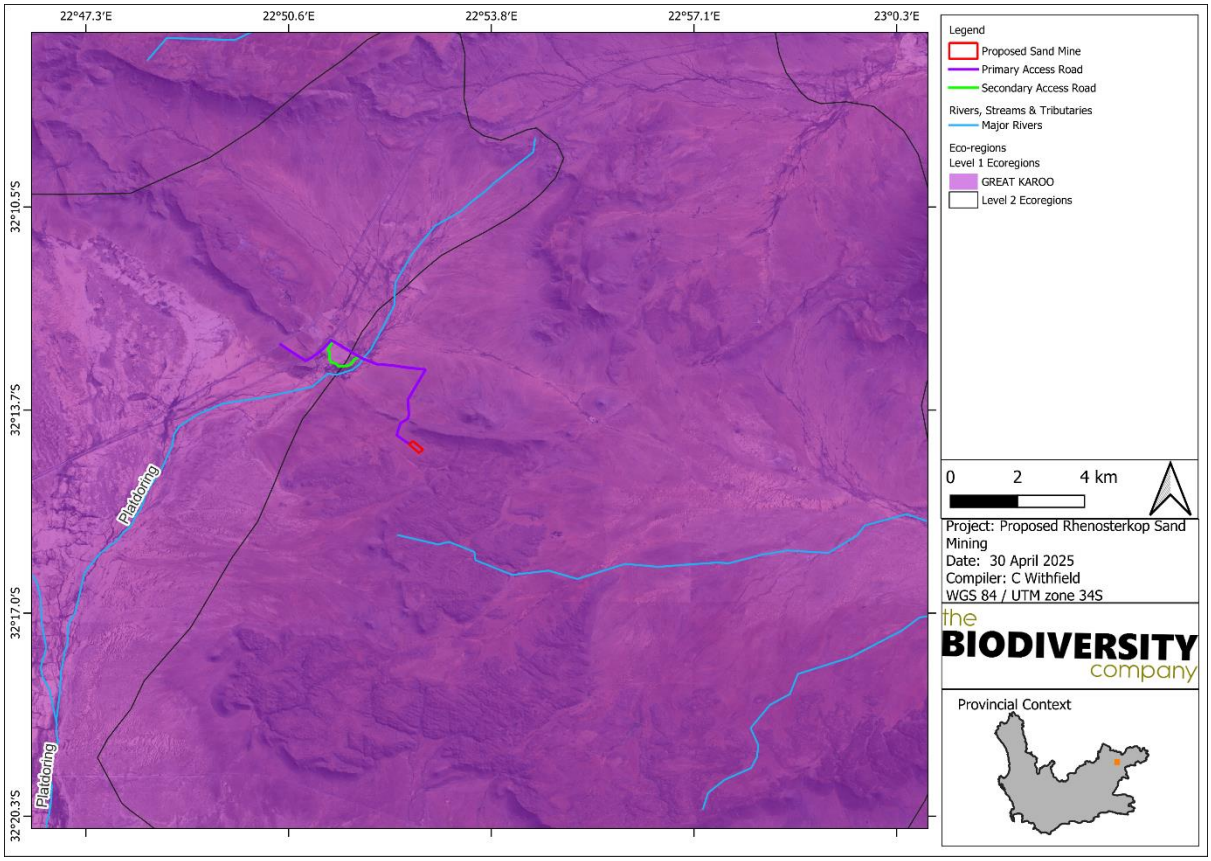

Figure 3-9 Project area in relation to the Level 1 and Level 2 Ecoregions.

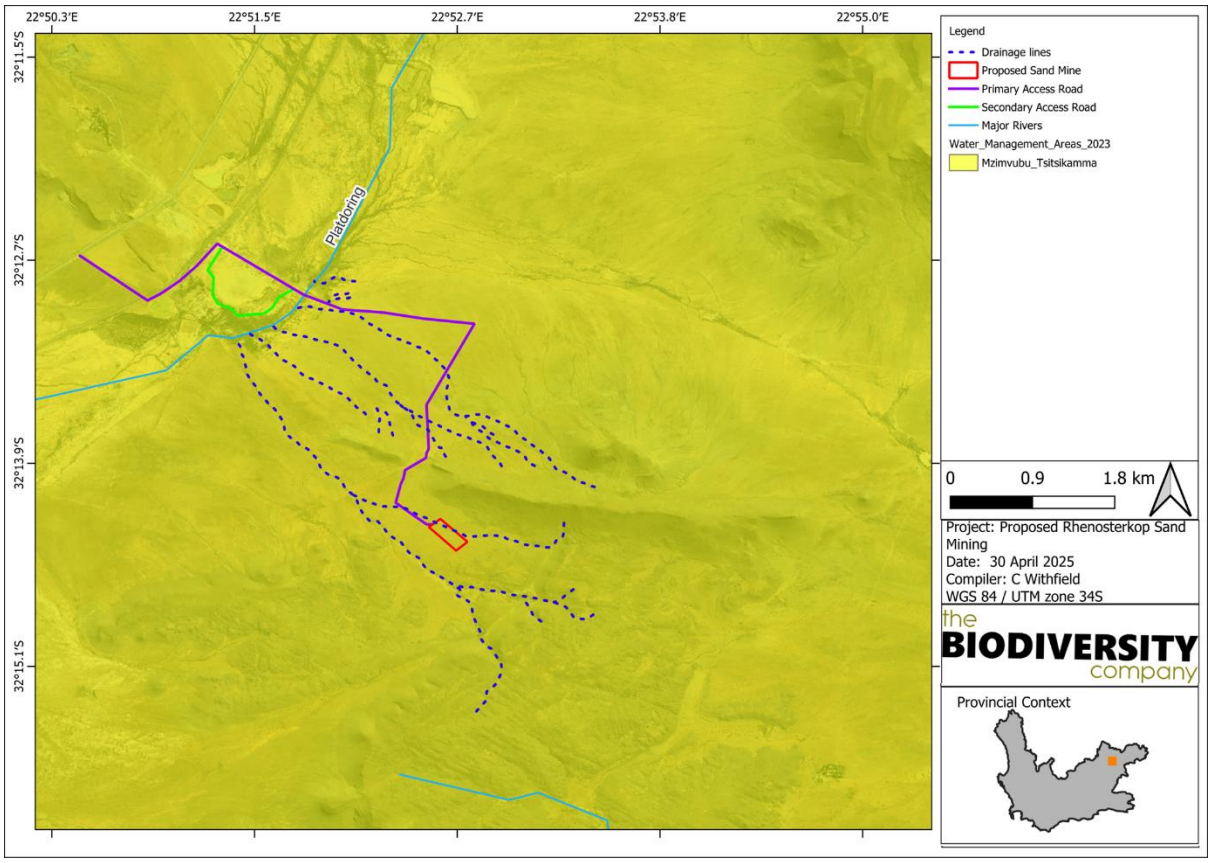

Figure 3-10 Project area in relation to the Water Management Areas (WMA)

3.2 Survey Results

3.2.1 Investigation Sites

Data obtained from a single wet season survey conducted on the 07th of March 2023 in the project area was used. Sampling points (Figure 3-11 - Figure 3-12) were selected for the study area to assess the current state of the associated watercourses. Only watercourses at an appreciable level of risk in relation to the proposed project and related activities were considered for assessment. Site investigations were conducted on systems presenting adequate surface water to conduct biological assessments, and if safe to do so. Photographs and Global Positioning System (GPS) coordinates pertaining to the sites are presented in Table 3-3.

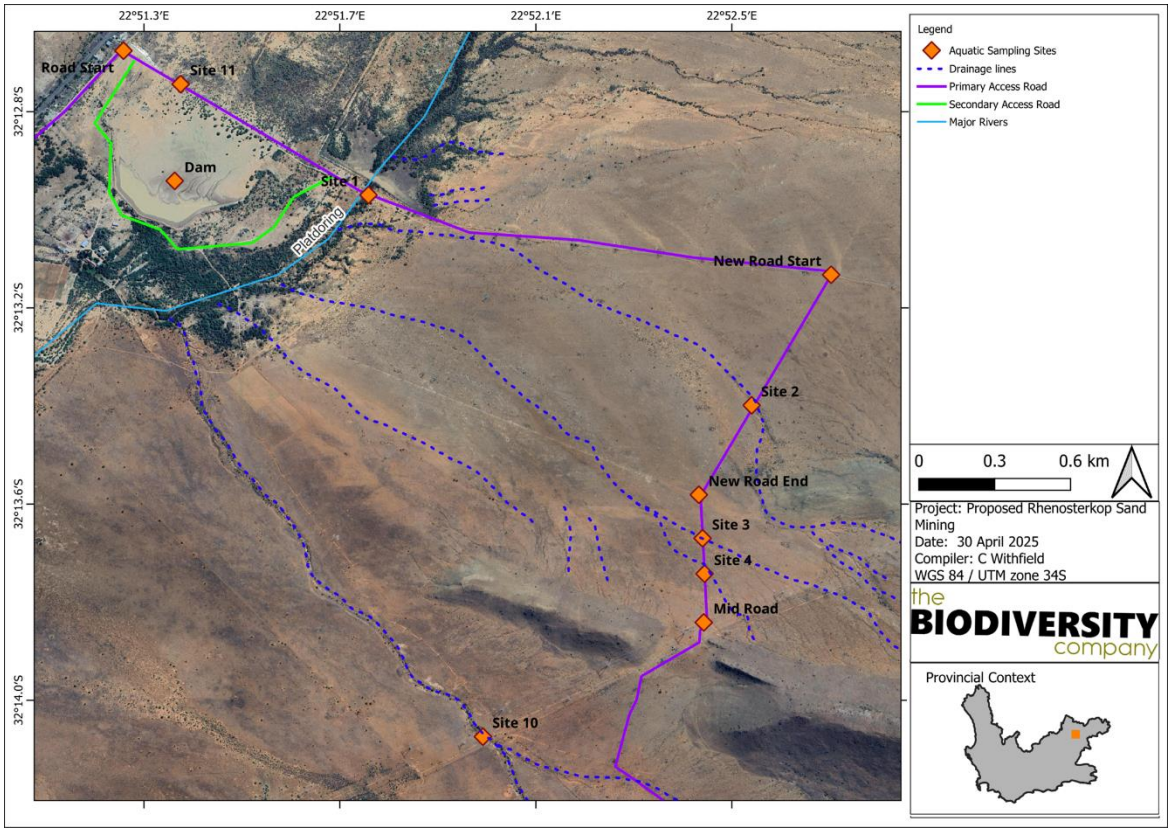

Figure 3-11 Location of the North-western aquatic sampling sites.

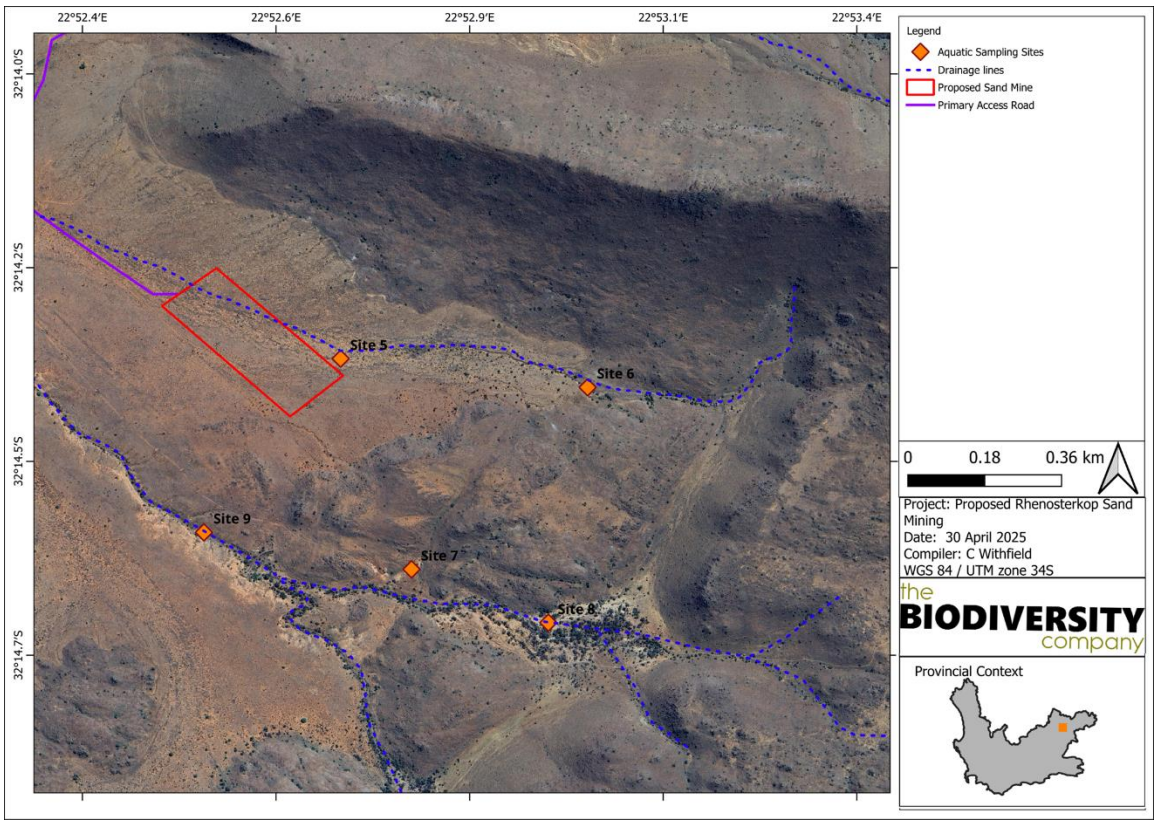

Figure 3-12 Location of the South-eastern aquatic sampling sites.

Table 3-3 Photos and coordinates for the sites sampled (March 2023)

Site	Upstream View	Downstream View
Platdoring River		
Site 1		
GPS	32°12'55.94"S 22°51'45.65"E	
Platdoring River tributaries		
Site 2		
GPS	32°13'22.57"S 22°52'34.97"E	
Site 3		
GPS	32°13'39.82"S 22°52'28.42"E	
Site 4		
GPS	32°13'44.36"S 22°52'28.67"E	

Site	Upstream View	Downstream View
Site 5		
GPS	32°14'21.55"S 22°52'42.49"E	
Site 6		
GPS	32°14'24.39"S 22°53'3.90"E	
Site 7		
GPS	32°14'38.23"S 22°52'46.43"E	
Site 8		
GPS	32°14'40.16"S 22°52'51.31"E	

Site	Upstream View	Downstream View
Site 9		
GPS	32°14'33.06"S 22°52'29.53"E	
Site 10		
GPS	32°14'5.19"S 22°52'0.30"E	
Site 11		
GPS	32°12'41.70"S 22°51'21.63"E	
Other Sites		
Dam		
GPS	32°12'54.12"S 22°51'20.85"E	

Site	Upstream View	Downstream View
Road Start		
GPS	32°12'37.65"S 22°51'14.45"E	
New Road Start		
GPS	32°13'6.14"S 22°52'44.80"E	
New Road End		
GPS	32°13'34.41"S 22°52'27.97"E	
Mid-Road		
GPS	32°13'50.86"S 22°52'28.44"E	

3.2.2 Water Quality

The *in-situ* results are important to assist in the interpretation of biological results due to the direct influence water quality has on aquatic life forms. No surface water resources were observed at the time of the survey. Thus, *in-situ* water quality measurements could not be done.

3.2.3 Index of Habitat Integrity

The condition of the watercourses and associated aquatic biodiversity are largely dependent on the condition and degree of modification of the surrounding catchment. The more intact and natural the catchment is, the greater the watercourse condition and ecosystem functioning, and the more services there will be with an associated high aquatic and terrestrial biodiversity presence. An altered catchment compromises the watercourse condition, ecosystem functioning, and services offered, with deleterious effects depending on the degree and type of catchment modification. The more modified catchment will ultimately have a low ecological value watercourse offering limited services with an absence of key services such as phytoremediation (cleaning of water by vegetation) with the cumulative loss of its original biodiversity with only the most tolerant biota remaining in the most negatively modified catchments. The IHI was completed for selected reaches of the Platdoring River and its tributaries.

The results for the instream and riparian Index of Habitat Integrity (IHI) assessment for the associated watercourse reaches are presented in Table 3-4. IHI was conducted to determine the PES of the system. According to the IHI results, the instream and riparian habitat integrity of the Platdoring River reach was rated as 'Moderately modified' (Class C).

Instream habitat was considered largely intact, however, several impacts were observed on site and from aerial imagery. Modifications to instream habitat are attributed to erosion and channel and banks modification due to low water crossings and livestock activities, resulting in instream sedimentation. Further, over grazing and livestock activities within the terrestrial areas have contributed to instream sedimentation. Small impoundments occur within the upper reaches of the system, resulting in flow modifications.

Table 3-4 Results for the Instream Habitat Integrity assessment for the associated reaches of the watercourses (March 2023)

Instream Criteria	Impact Score
Water abstraction	5
Flow modification	12
Bed modification	13
Channel modification	10
Phys-chem modification	5
Inundation	5
Alien macrophytes	0
Introduced aquatic fauna	0
Rubbish dumping	5
Instream Habitat Integrity Score	**70**
Instream Habitat Integrity Category	**C**
Riparian Criteria	**Impact Score**
Vegetation removal	10
Exotic vegetation	5
Bank erosion	5
Channel modification	7

Water abstraction	5
Inundation	5
Flow modification	5
Phys-chem	0
Riparian Zone Integrity Score	**79**
Riparian Zone Integrity Category	**C**

Figure 3-13 Illustration of instream impoundment within the Platdoring River (GoogleEarth, 2024)

3.2.4 Aquatic Macroinvertrebrates

3.2.4.1 Macroinvertebrates Habitat

The sites were dry during the survey. Therefore, SASS5 could not be done and the macroinvertebrate community was not assessed at the time of the survey.

3.2.5 Fish Community Structure

The sites were dry during the survey. Therefore, no ichthyofauna assessment could be done at the time of the survey. An expected fish species list was composed for the system based on habitat preferences and distribution, this list along with the observed species are presented in Table 3-6. The expected fish species list was developed from a literature survey and included sources such as DWS (2014), Kleynhans *et al.* (2007) and Skelton (2001; 2016; 2024). One (1) indigenous fish species was expected to occur in the Platdoring River.

Fish species have different sensitivities to physiochemical and flow modification (Table 3-5) and therefore this was considered for the expected fish species assemblage. This indicated that the expected assemblage is moderately tolerant to changes in flow and physiochemical modification.

Table 3-5 Intolerance rating and sensitivity of fish species

Sensitivity Score	Tolerance/Sensitivity Level
0-1	Highly tolerant = Very low sensitivity
1-2	Tolerant = Low sensitivity
2-3	Moderately tolerant = Moderate sensitivity
3-4	Moderately intolerant = High sensitivity
4-5	Intolerant = Very high sensitivity

Table 3-6 Summary of the expected fish species and sensitivity for the project area (March 2024)

Species	Common name	Sensitivity - Flow	Sensitivity – Phys-Chem	IUCN Status* (IUCN, 2025)
Expected Species				
Enteromius oraniensis	Karoo Chubbyhead Barb	2.30	2.60	LC

LC - Least Concern

3.2.6 Present Ecological Status

The PES assessment for the sampled watercourse is based on the collective data collected during the March 2023 survey and the results are provided in Table 3-7. The PES assessment indicated that the Platdoring River was in a class C 'Moderately Modified' state. It should be noted that the PES results represent a single high flow survey. Therefore, these results should be interpreted accordingly.

Table 3-7 Present Ecological Status

Aspect Assessed	Platdoring River Reach
Present Ecological State	C
REC	B
	Improve
DWS Ecostatus (DWS, 2014)	C

3.3 Riparian Delineations and Buffer Requirements

The study area is situated within two biomes: Azonal Vegetation and Nama Karoo Biome and (SANBI, 2018). The Azonal vegetation is formed in and around flowing and stagnant freshwater bodies. Habitats with high levels of salt concentration form a highly stressed environment for most plants and often markedly affect the composition of plant communities. Invariably, both waterlogged and salt-laden habitats appear as 'special', deviating strongly from the typical surrounding zonal vegetation. They are of azonal character.

The Nama Karoo Biome is found in the central plateau of the western half of South Africa. The geology underlying the biome is varied, as the distribution of this biome is determined primarily by rainfall. The rain falls in summer and varies between 100 and 520 mm per year. This also determines the predominant soil type - over 80% of the area is covered by a lime-rich, weakly developed soil over rock. Although less than 5% of rain reaches the rivers, the high erodibility of soils poses a major problem where overgrazing occurs (SANBI, 2019).

The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils. Grazing rapidly increases the relative abundance of shrubs. Most of the grasses are of the C4 type and, like the shrubs, are deciduous in response to rainfall events (SANBI, 2019). The project area watercourses including the development are both situated in the Gamka Karoo and the Southern Karoo Riviere vegetation types according to SANBI (2018)(Figure 3-14).

3.3.1 Southern Karoo Riviere

The Southern Karoo Riviere vegetation type is found in the Western and Eastern Cape Provinces. This vegetation type occurs along narrow riverine flats supporting a complex of *Vachellia karroo* or *Tamarix usneoides* thickets (up to 5 m tall) and fringed by tall *Gamka*-dominated shrubland (up to 1.5 m high), especially on heavier (and salt-laden) soils on very broad alluvia. (Mucina & Rutherford, 2006).

Important Plant Taxa

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006). The following species are important in the Southern Karoo Riviere (d=dominant):

Riparian thickets

- Small Trees: *Vachellia (d), Searsia lancea (d).*
- Tall Shrubs: *Diospyros lycioides (d), Tamarix usneoides (d), Cadaba aphylla, Euclea undulata, Grewia robusta, Gymnosporia buxifolia, Melianthus comosus.*
- Low Shrub: *Asparagus striatus.*
- Succulent Shrubs: *Lycium cinereum (d), Amphiglossa callunoides, Lycium hirsutum, L. oxycarpum.*

Rocky slopes of river canals

- Graminoid: *Stipagrostis namaquensis (d).*

Alluvial shrublands & herblands

- Low Shrubs: *Ballota africana, Bassia salsoloides, Carissa haematocarpa, Pentzia incana.*
- Succulent Shrubs: *Malephora uitenhagensis (d), Gamka aphylla (d), S. arborea (d), Drosanthemum lique, Gamka geminiflora, S. gemmifera.*
- Graminoids: *Cynodon incompletus (d), Cenchrus ciliaris, Cyperus marginatus.*

Reed beds

- *Megagraminoid: Phragmites australis (d).*

3.3.2 Gamka Karoo

Gamka Karoo vegetation type is found in the Western Cape, Eastern Cape and marginally in the Northern Cape. This vegetation type occurs on extremely irregular to slightly undulating plains covered with dwarf spiny shrubland dominated by Karoo dwarf shrubs (e.g., *Chrysocoma ciliata, Eriocephalus ericoides*) with rare low trees (e.g., *Euclea undulata*). It occurs at an altitude of 500-1100m.

Important Taxa

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006). The following species are important in the Gamka Karoo (d=dominant):

- Tall Shrubs: *Lycium cinereum* (d), *L. oxycarpum* (d), *Rhigozum obovatum* (d), *Acacia karroo*, *Cadaba aphylla*, *Lycium schizocalyx*, *Rhus burchellii*, *Sisyndite spartea*.
- Low Shrubs: *Chrysocoma ciliata* (d), *Eriocephalus ericoides* subsp. *ericoides* (d), *E. spinescens* (d), *Felicia muricata* (d), *Galenia fruticosa* (d), *Limeum aethiopicum* (d), *Pentzia incana* (d), *Pteronia adenocarpa* (d), *Rosenia humilis* (d), *Aptosimum indivisum*, *Asparagus burchellii*, *Blepharis mitrata*, *Eriocephalus microphyllus* var. *pubescens*, *Felicia filifolia* subsp. *filifolia*, *F. muricata* subsp. *cinerascens*, *Galenia secunda*, *Garuleum bipinnatum*, *G. latifolium*, *Gomphocarpus filiformis*, *Helichrysum lucilioides*, *Hermannia desertorum*, *H. grandiflora*, *H. spinosa*, *Melolobium candicans*, *Microloma armatum*, *Monechma spartioides*, *Pentzia pinnatisecta*, *Plinthus karooicus*, *Polygala seminuda*, *Pteronia glauca*, *P. sordida*, *P. viscosa*, *Selago geniculata*, *Sericocoma avolans*, *Zygophyllum microcarpum*, *Z. microphyllum*.
- Succulent Shrubs: *Ruschia intricata* (d), *Aridaria noctiflora* subsp. *straminea*, *Crassula muscosa*, *Drosanthemum lique*, *Galenia sarcophylla*, *Kleinia longiflora*, *Ruschia spinosa*, *Gamka tuberculata*, *Sarcocaulon patersonii*, *Trichodiadema barbatum*, *Tripteris sinuata* var. *linearis*.
- Semi parasitic Shrub: *Thesium lineatum*.
- Herbs: *Gazania lichtensteinii* (d), *Chamaesyce inaequilatera*, *Dicoma capensis*, *Galenia glandulifera*, *Lepidium africanum* subsp. *africanum*, *L. desertorum*, *Lessertia pauciflora* var. *pauciflora*, *Leysera tenella*, *Osteospermum microphyllum*, *Sesamum capense*, *Tetragonia microptera*, *Tribulus terrestris*, *Ursinia nana*.
- Geophytic Herbs: *Drimia intricata*, *Moraea polystachya*.
- Graminoids: *Aristida congesta* (d), *A. diffusa* (d), *Fingerhuthia africana* (d), *Stipagrostis ciliata* (d), *S. obtusa* (d), *Aristida adscensionis*, *Cenchrus ciliaris*, *Digitaria argyrograpta*, *Enneapogon desvauxii*, *Enneapogon scaber*, *Eragrostis homomalla*, *E. lehmanniana*, *E. obtusa*, *Tragus berteronianus*, *T. koelerioides*.

Biogeographically Important Taxa (*Endemic to Great Karoo Basin)

- Succulent Shrubs: *Hereroa latipetala** (also found in Prince Albert Succulent Karoo), *H. odorata** (also found in Koedoesberge-Moordenaars Karoo), *Pleiospilos compactus* (southern and western limits of distribution), *Rhinephyllum luteum**, *Stapelia engleriana**.
- Geophytic Herb: *Tritonia tugwelliae**.
- Low Shrub: *Felicia lasiocarpa**.
- Succulent Herbs: *Piaranthus comptus**, *Tridentea parvipuncta* subsp. *parvipuncta**.
- Graminoid: *Oropetium capense* (westernmost limit of distribution).

Endemic Taxa

- Succulent Shrubs: *Chasmatophyllum stanleyi*, *Hereroa incurva*, *Gamka dregei, Ruschia beaufortensis*.
- Low Shrubs: *Jamesbrittenia tenuifolia*.
- Herb: *Manulea karrooica*.
- Succulent Herb: *Piaranthus comptus*.

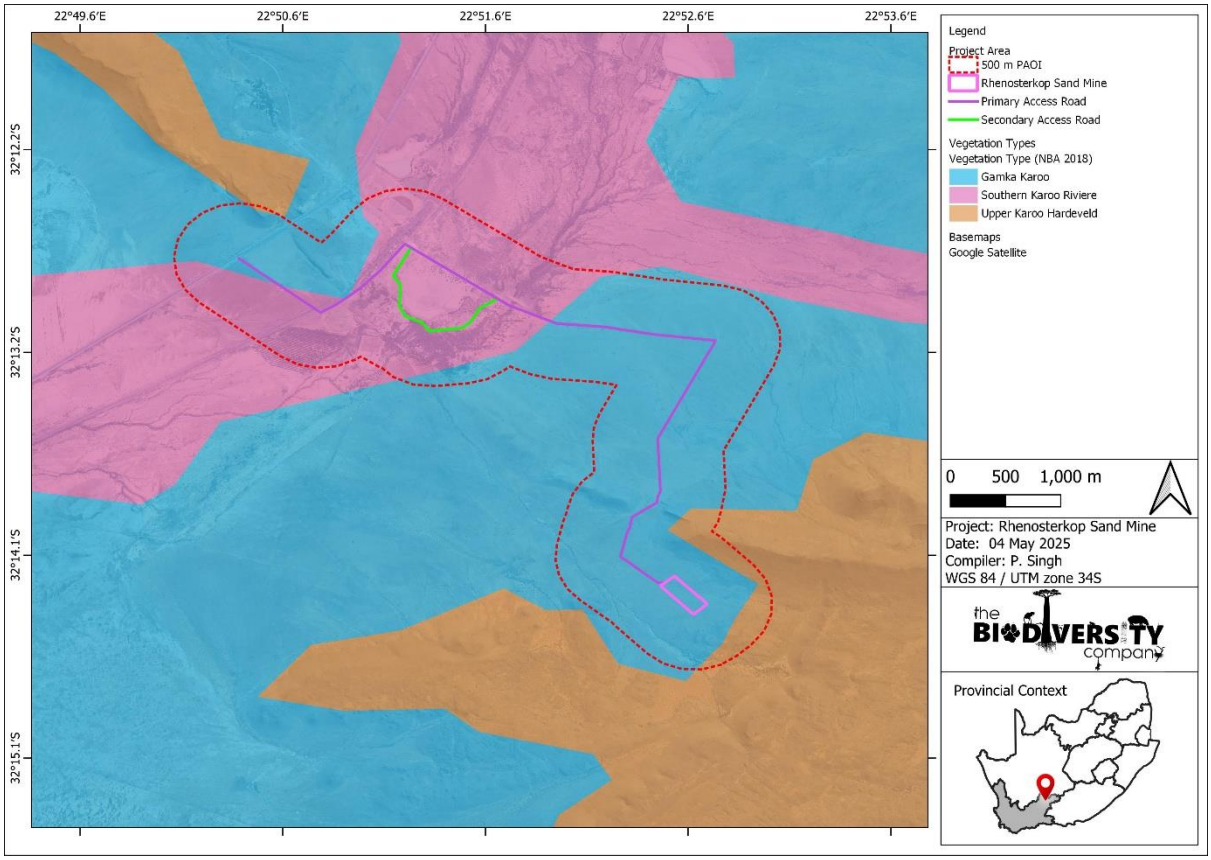

Figure 3-14 The study area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2018).

3.3.3 Buffer Requirements and Development Setbacks

According to the buffer guidelines the maximum required buffer should be applied to a system (Macfarlane, *et al*., 2014). Riparian areas have high conservation value and can be considered the most important part of a watershed for a wide range of values and resources. They provide important habitat for a large volume of wildlife and often forage for domestic animals (livestock). The vegetation they contain are an important part of the water balance for the hydrological cycle through evapotranspiration. They are crucial for riverbank stability and in preventing erosion within the channel (Elmore and Beschta, 1987). The implementation of a buffer zone ensures the ecological requirements needed to maintain both the ecosystem functioning and services offered by the watercourses are maintained. Additionally, the watercourses potentially influenced by the project have sensitivity to further disturbance, requiring protection from the project activities.

Therefore, buffer areas are considered high priority areas and should be avoided at all costs. A minimum buffer zone strip of at least 32 meters wide is required for rivers as per NEMA (Act no. 107 of 1998). The buffer zone tool was used to calculate the appropriate buffer required for the project, which would be applicable to the drainage lines and Platdoring River. The model shows that the largest risk posed by the project during the construction phase is that of “increased sediment inputs and turbidity”. During the operational phase the flow patterns being altered (increase flood peaks), increased sediment inputs and altered water quality are high risks. These risks are based on what could threaten the systems and what buffer would be required at a desktop level. A conservation buffer zone of 15 m and 30 m was determined (Table 3-8) for the drainage lines and Platdoring River respectively. This buffer is calculated assuming mitigation measures are applied. According to the buffer guideline (Macfarlane, *et al.* 2014) a high-risk activity, such as mining, would require a buffer that is 95% effective to reduce the risk of the impact to a low level threat.

Table 3-8 Post-mitigation buffer requirement

Required Buffer after mitigation measures have been applied	
Drainage line	**15 m**
Platdoring River	**30 m**

3.3.4 Regulation Zones

Table 3-9 presents the legislated zones of regulation that would be applicable to the PAOI. In accordance with General Notice (GN) 4167 of 2023 as it relates to the NWA (1998), a regulated area of a watercourse for Section 21 (c) and 21 (i) of the NWA, 1998 means the outer edge of the 1 in 100 year flood or where no flood line has been determined it means **100 m** from the edge of a watercourse or a 500 m radius from the delineated boundary (extent) of any wetland or pan. Listed activities in terms of the NEMA (1998), (Act 107 of 1998) EIA Regulations as amended in April 2017 must be taken into consideration if any infrastructure is to be placed within the applicable zone of regulation, which in this case is a **32 m** zone of regulation. The proposed activities traverse ephemeral drainage lines , and therefore the project falls within the NEMA Act 107 and DWS GN 4167 regulated zones. The regulated areas have been applied to the delineations within the PAOI and presented in Figure 3-15).

Table 3-9 The legislated zones of regulation

Regulatory authorisation	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). **Department of Water and Sanitation (DWS)**	Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the National Water Act, 1998 (Act No.36 of 1998) as amended. In accordance with GN4167, a regulated area of a watercourse in terms of water uses as listed in Section 21(c) and 21(i) is defined as: • the outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam; • in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or • In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended. **Department of Environmental Affairs and Development Planning (DEA&DP)**	**Activities of Listing Notice 1 (GN 983) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended):** **Activity 12:** The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres;or (j) infrastructure or structures with a physical footprint of 100 square metres or more. where such development occurs: a) within a watercourse; b) in front of a development setback; or c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse. Excluding – …(dd) where such development occurs within an urban area… **Activity 19:** The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from (i) a watercourse; (ii) the seashore; or

	(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or estuary, whichever distance is the greater— but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies. **Activities of Listing Notice 3 (GN 985) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended)** **Activity 14** *The development of—* *(xii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse,*

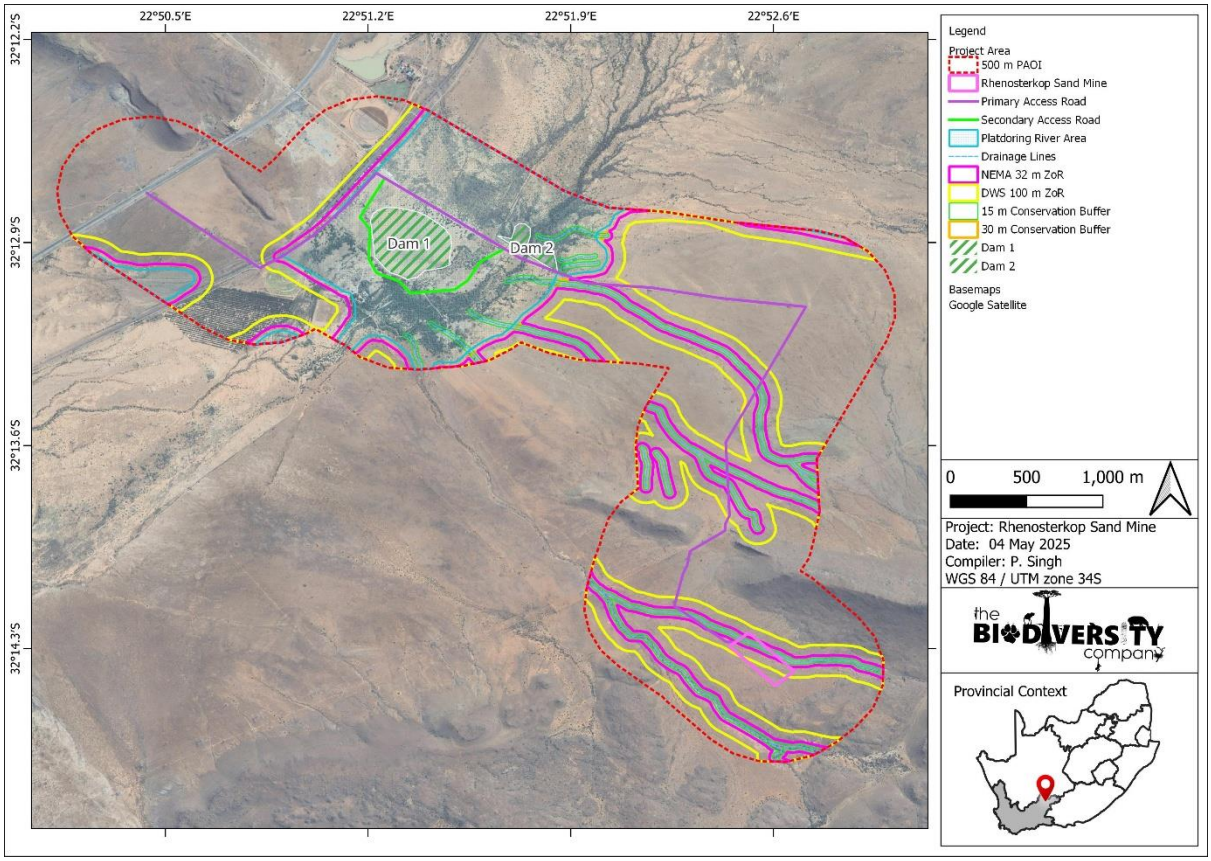

Figure 3-15 Watercourses and their assigned ecological protection buffers and ZoR with the PAOI

3.4 Site Sensitivity Verification

3.4.1 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) and the current assessment:

- The National Web-Based Environmental Screening Tool has characterised the aquatic theme sensitivity of the project area and the PAOI and footprint development as “Very High” (Figure 3-16).

- The desktop assessment and site visit agreed with both of these ratings. The reaches (Platdoring River and Drainage lines) are susceptible to further impacts, particularly on water quality and physical disturbances to instream and riparian habitat. The freshwater ecology of the immediate project area and further downstream areas is considered sensitive to disturbance from a hydrological and biological perspective. This will include the Platdoring River and its tributaries (drainage lines) adjacent to the project area and within the proposed sand mining area, which is considered sensitive due to the ecosystem services that these watercourse features provide. The construction and operational activities must take cognizance of this and avoid any unnecessary disturbance of the watercourse and adjacent habitat.

- ‘High’ freshwater sensitivities were assigned to all delineated watercourses (No-go areas). ‘Medium’ sensitivities were assigned to the buffer areas, and ‘Low’ sensitivities were assigned to the remainder of the area within the POAI which would be deemed developable areas in terms of aquatic sensitivity and subject to suitable mitigation. The freshwater sensitivity map is provided below in Figure 3-17.

Development-related activities can have significant impacts on biodiversity and ecosystem services, often causing irreversible and large-scale habitat loss across large areas or areas important for the provision of important ecosystem services. According to the riparian delineation, the project area (the proposed access road) is encroaching into the riparian zone of the Platdoring river. It is noted that the section of the access road to cross the Platdoring River is already modified by the existing farm dirt road. However, it is highly recommended that project activities avoid the riparian and buffer zones and make use of the existing farm dirt road. However, due to increased traffic associated with mining the farm roads would need to be regularly inspected and maintained, so as to prevent erosion and run-off into the watercourse. The proposed sand mining area overlaps with a drainage line watercourse which should be avoided by mining activities. These mitigations will reduce the potential impacts on the watercourse significantly.

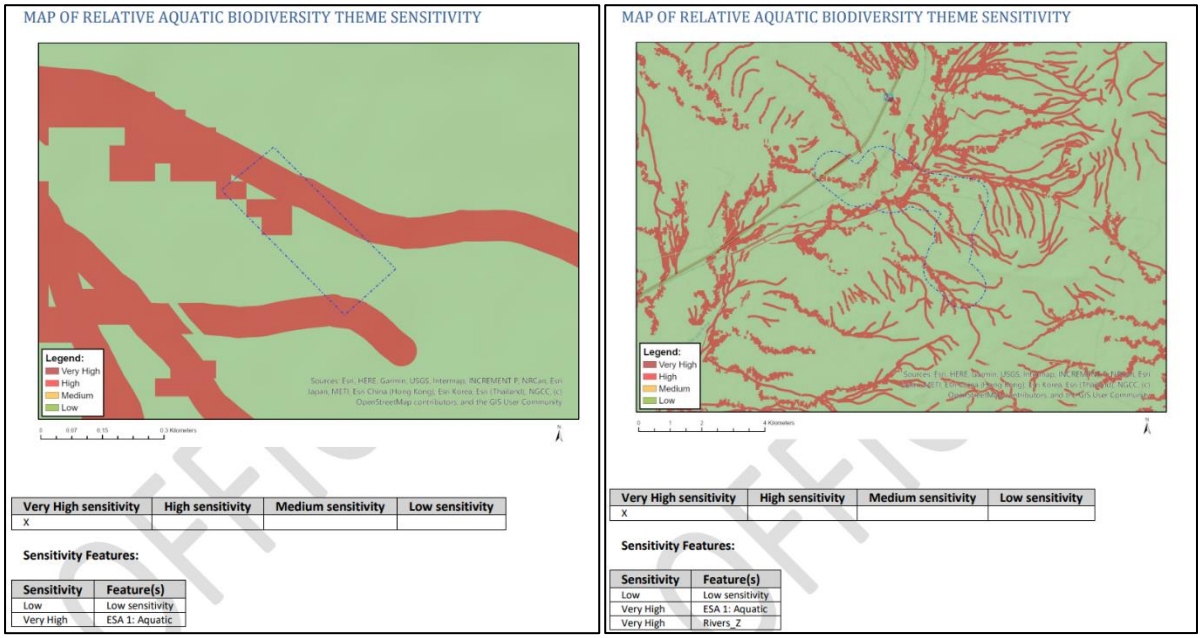

Figure 3-16 Aquatic Biodiversity Theme Sensitivity for the PAOI

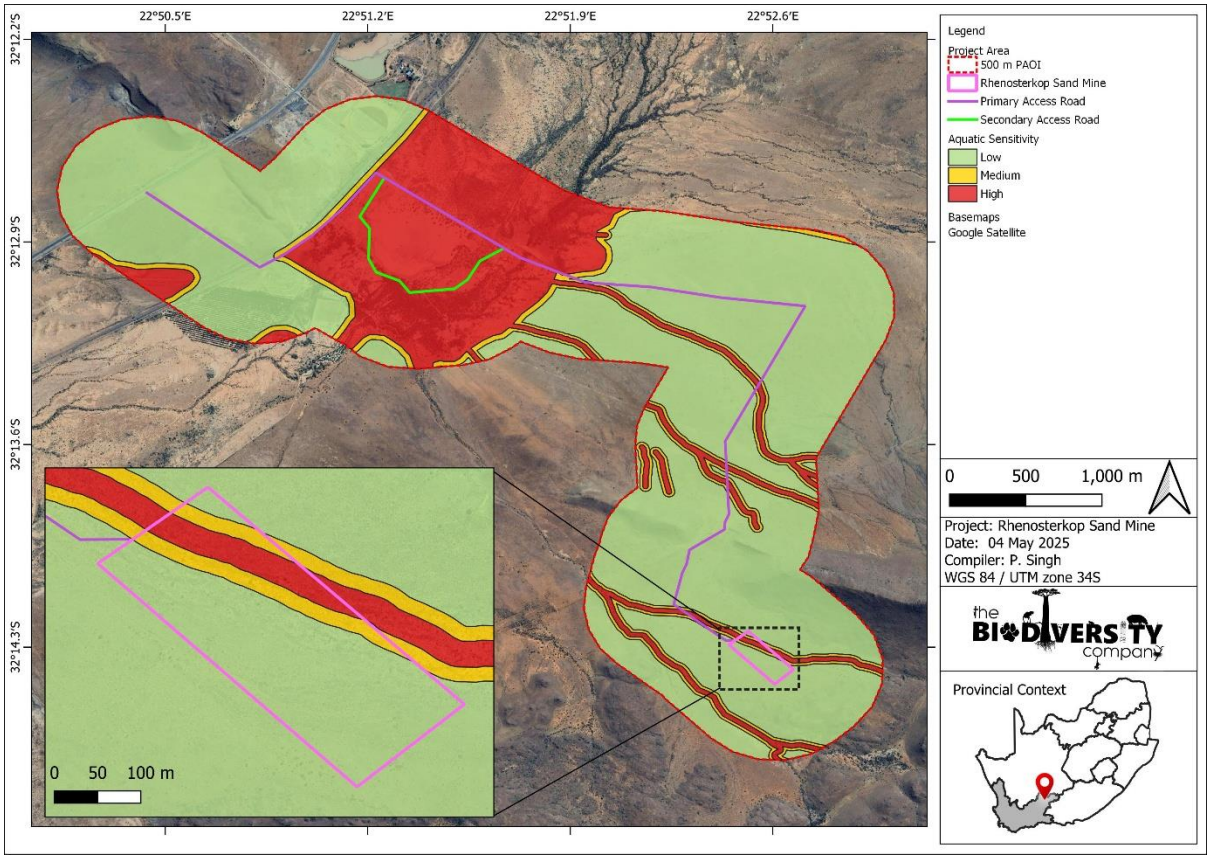

Figure 3-17 Specialist aquatic delineated sensitivity for the PAOI

4 Risk and Impact Assessment

4.1 Current Impacts on Freshwater Biodiversity

The assessed watercourse exhibits impacts on both the catchment and local scale. These impacts result from present and historical land use relating to transport infrastructure development and agricultural practices in proximity to water resources which have transformed their habitats and altered their natural hydrological regime as well as species composition. The list below refers to the present-day local impacts associated with the assessed freshwater areas:

- Urbanisation and associated run-offs;
- Water abstraction;
- Settlements and roads;
- Instream sedimentation;
- Instream impoundments;
- Indigenous vegetation clearing;
- Encroachment of alien vegetation into the riparian habitat;
- Erosion induced by altered hydrodynamics due to hardened surfaces and sand mining on the riverbanks and bed; and
- Grazing.

4.2 Alternatives Considered

The Applicant applied for a 5 ha mining permit to mine sand on a portion of the remaining portion of the Farm Rhenosterkop no 155, Registration Division of Beaufort West in the Western Cape Province. The proposed mining area is over an undisturbed and inactive area of the farm.

4.2.1 Site Alternative 1:

Site Alternative 1 (assessed in this report) is the preferred and only Site Alternative, as it is considered the most practical and feasible option. The proposed area is adjacent to an existing quarry, allowing for the use of the same access route, which reduces additional infrastructure requirements. Furthermore, rehabilitation efforts are simplified due to the site's location and characteristics. Based on the preliminary assessments, the anticipated environmental impacts are deemed acceptable.

The proposed area (Site Alternative 1) was deemed as the preferred area due to the location of the sand reserve which is situated over an undisturbed and inactive area of the farm. The site has a medium agricultural production potential. The mining area is situated between the koppies on a flat sandy area with low visual impact and is approximately 5 km from the N1, the site is situated to avoid interfering with nearby drainage lines.

An alternative layout for the sand mine, has been assessed in the pre application phase – Site Alternative 2 but not found viable as explained below.

4.2.2 Site Alternative 2:

Site Alternative 2 was considered by the EAP for the proposed mining activities but was found to be neither environmentally nor practically suitable. The earmarked area is situated between two drainage lines, and mining in this location would result in the complete destruction of these watercourses. In addition, this site would require the use of an alternative access route, increasing the need for additional infrastructure and associated impacts.

Rehabilitation at this location would also be more complex due to the site's terrain and ecological sensitivity. Preliminary assessments indicate that, while Site Alternative 2 could technically accommodate sand mining the associated environmental impacts are of significantly higher concern. It is believed that the impact associated with this site alternative is of higher significance without the need or motivation justifying it.

Therefore only Site Alternative 1 was considered for this assessment.

4.3 Loss of Irreplaceable Resources

The freshwater ecology of the project area is considered moderately sensitive to disturbance from a hydrological, biological and conservational perspective. This includes the Platdoring River and associated riparian area and tributaries, and construction and operation activities must take cognisance of this and avoid any unnecessary disturbance of these areas. Activities within these sensitive areas will lead to modifications to the present ecological state and therefore ecosystem degradation.

4.4 Quantitative Risk and Impact Assessment

The Risk/Impact Assessment considered the direct and indirect impacts of the activity(ies) on the freshwater systems associated with the project area. 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 the project location, setting, scale, layout, technology, and phasing to avoid impacts. For this assessment, the specialist was provided with the location of the proposed activity and the study focussed on the water resources within and close to the project area. Mitigation measures should be implemented to negate potential impacts on the water resources associated with the project area.

A single risk assessment was compiled for the project, which relates to sand mining and associated activities post-mitigation. The DWS Risk Assessment Matrix (GN 4167) was used to assess both risks and impacts anticipated from the proposed activities.

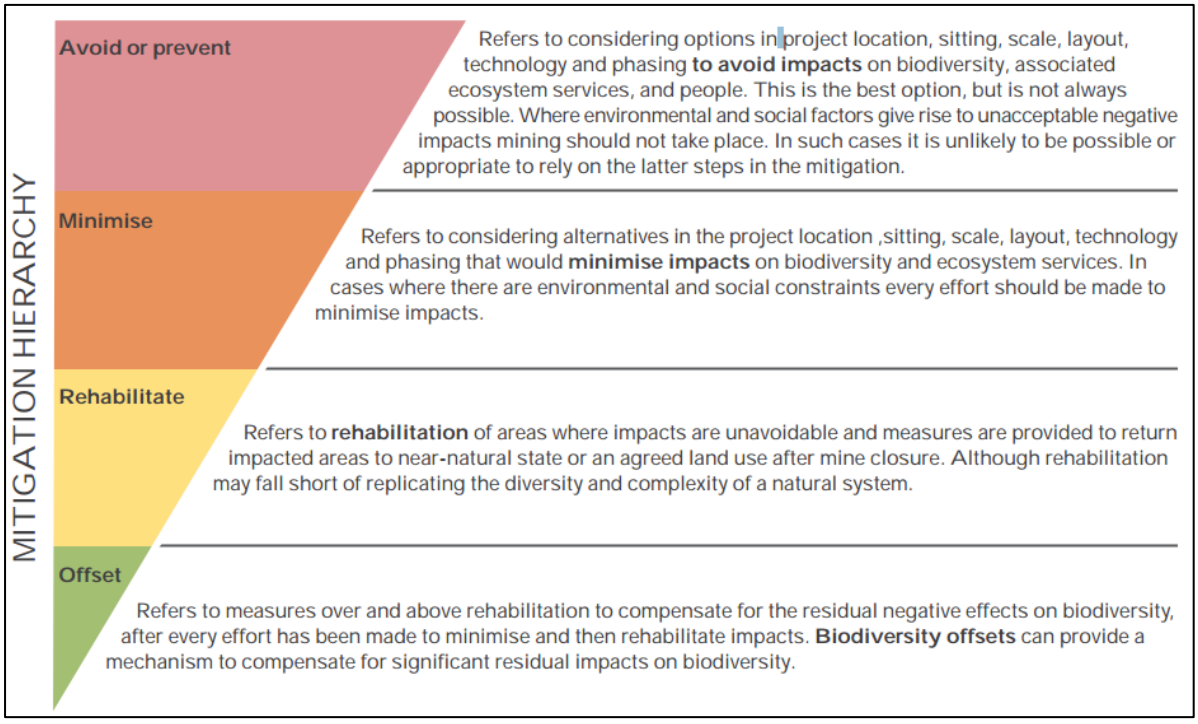

Figure 4-1 The mitigation hierarchy as described by the DEA (2013)

4.4.1 Potential Anticipated Impacts

Table 4-1 illustrates the DWS risk ratings associated with the project. The potential direct and indirect impacts are expected to threaten the integrity of sensitive receptors during the project activities if unmitigated. The post-mitigation significance ratings have been calculated considering various parameters, these results are presented in the subsequent tables.

Table 4-1 Summative results of the DWS Risk Assessment Matrix compiled by Prasheen Singh (Pr. Sci. Nat. 116822)

Phase	Activity	Impact	Significance (max = 100)	Risk Rating
CONSTRUCTION	<1> Construction of road levels, mining laydown yards and stormwater management systems.	<1a> Increase in sediment inputs & turbidity and associated smothering and loss of instream habitat.	10.8	L
		<1b> Inputs of toxic organic contaminants.	6	L
		<1c> Loss of aquatic biota and habitat	6	L
		<1d> Excess rubble and construction material in channel and riparian areas.	5.4	L
	<2> Excavating and levelling of existing road to surveyed levels, new access roads and laydown yards.	<2a> Increased sedimentation	10.8	L
		<2b> Increased erosion from exposed surfaces	12	L
		<2c> Erosion in key areas (steep and/or exposed areas)	5.4	L
		<2d> Alteration of hydro-dynamics and reduced dispersal/ migration of fauna	5.4	L
OPERATIONAL	<1> Mining (Deep excavations, drilling, crushing and stockpiling). Operation and maintenance of roads.	<1a> Increased sedimentation.	28.8	L
		<1b> Alteration of hydro-dynamics and reduced dispersal/ migration of fauna.	28.8	L
		<1c> Increased erosion from exposed surfaces.	28.8	L
DECOMMISSIONING	<1> Backfilling of the excavations.	<1a> Increased erosion from exposed surfaces.	26.4	L
		<1b> Increased sedimentation. Alteration of patterns of flows (increased flood peaks).	26.4	L
	<2> Re-shaping and contouring.	<2a> Increased erosion from exposed surfaces.	19.8	L
		<2b> Increased sedimentation. Alteration of patterns of flows (increased flood peaks).	26.4	L

The proposed activities pose low to moderate pre-mitigation risks during the construction, operational and decommissioning phases. Moderate risks are associated with the activities proximate to the watercourse, including the drainage patterns change due to road extent and crossings, clearing of riparian (and terrestrial) vegetation, stormwater management, excavation of riparian area, bed and/or banks, operation of heavy machinery adjacent/within the watercourse, alien vegetation encroachment, conducting road and crossings maintenance, sedimentation and erosion, and hydrocarbon contamination. Due to the presence of existing roads and crossings, the implementation of mitigation measures as well as the avoidance of watercourse areas for any mining activities will reduce the risks/impacts of Moderate-risk activities to Low if done effectively. If not done effectively, the activities will not reduce the risks of aspects/activities such as clearing riparian areas, deep excavation when mining, drilling and crushing, excavations, the drainage patterns change due to road extent and crossings, dust precipitation (from backfilling), change in topography (from backfilling), dust precipitation (from shaping/contouring), change in topography (from shaping/contouring) and surface structures as

well as stormwater, as these activities will result in direct loss of riparian vegetation, channel-, bed- and bank modification, and have a direct impact on the rivers and riparian areas.

The disturbance of land poses a risk for alien invasive plants (AIP) proliferation. AIPs were observed on site, and these species would likely spread post construction. Therefore, a site management plan is required, including an AIP control plan. Furthermore, the increase in surface runoff from the activities can be expected due to altered topographies and mining activities, posing a risk to the watercourse through bank erosion, water quality contamination, and instream sedimentation. A stormwater management plan should be implemented during construction and during the operational phase. Sensitive areas should be clearly demarcated by an appropriately qualified person, and these areas should be avoided by all unauthorised activities. Should this be adequately implemented, the risks to the system may be considered low.

4.5 Unplanned Events

The planned activities will have known impacts as discussed above; however, unplanned events may occur on any project and may have potential impacts which will need mitigation and management. Table 4-2 is a summary of the findings from a watercourse ecology perspective. Please note not all potential unplanned events may be captured herein and this must therefore be managed throughout all phases of the project.

Table 4-2 Unplanned Events, Risks and their Management Measures

Unplanned Event	Potential Impact	Mitigation
Uncontrolled erosion during high rainfall events	Sedimentation of downstream watercourse	Erosion control measures must be put in place. These should be adaptive to on site conditions.

4.6 Cumulative Impact

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for terrestrial fauna and flora.

Localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers. These include dust deposition, noise and vibration, disruption of wildlife corridors or habitat, groundwater drawdown, groundwater and surface water quality, and transport. The overall cumulative impact is expected to be moderate (Table 4-3).

Table 4-3 Cumulative impact assessment for the development

Impact Nature: Loss / Degradation to Local Ecology		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Low	Moderate
Duration	Long term	Long term
Magnitude	Moderate	Moderate
Probability	Probable	Highly probable
Significance	**Moderate**	**Moderate**

Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

5 Mitigation Measures

Sand mining can have significant adverse effects on riverine systems in terms of surface water depletion and subsequent losses of inundated riparian and instream habitat, physical destruction of instream and riparian habitat, water quality degradation, alterations to channel morphology and increased flood risks, and loss of aquatic biota (Choudhary 2023).

Sand mining mitigation measures are aimed at promoting responsible mining practices through sustainable extraction rate, volume and area-controlled methods, protection and rehabilitation of instream and riparian habitats, and proactive monitoring of the receiving abiotic and biotic environment.

Mitigation measures must aim to avoid or reduce potential negative impacts to air, water, land, ecology, and humans, or to introduce positive aspects to the development/activity that would otherwise not be felt in the absence of the proposed development.

Considering that the mitigation measures can only practically focus on the minimisation of impacts from the proposed sand mine operational activities, due to instream mining (wet pit) proposed, the following mitigation measures have been proposed to lower the intensity of the impacts on the ecological integrity of the associated water resources:

5.1.1 General

- An Ecological Compliance Officer (ECO) that is a competent freshwater ecologist must be appointed to ensure compliance to the mitigation measures listed below;
- The ECO must clarify the sensitive areas with all operational staff, notwithstanding providing overall environmental awareness training of the catchment and general high importance of estuarine environments, as is particularly relevant to this project;
- Sand mining activities must be limited to the proposed sand mine amendment area, with the 12 bounding coordinates demarcated on the ground using wooden poles. The areas outside of the demarcated sand mine amendment area are to be treated as a no-go area for all aspects of the sand mine operation. The non-definitive list, comprises the operation of machinery, vehicles and equipment, construction camps/laydown yards and staff pedestrian movement to name some;
- Sand mining activities must avoid the riparian zones and instream stoney habitat (runs and riffles) as far as possible, considering these habitats provide the greatest refugia (support) to aquatic biota;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- All domestic and general waste that is produced daily must be contained and may not be buried of burned on site. Waste containers must be emptied regularly and removed from site to the nearest official waste disposal site to prevent littering on site;
- Access routes and other infrastructure areas must be rehabilitated;

- Measures must be implemented where environmental alterations are made (including at existing structures or activities) to 1) prevent detrimental changes to the breeding, nesting or feeding patterns of aquatic biota, including migratory species (if present), 2) allow for the free up and downstream movement of aquatic biota, including migratory species (if present), and 3) prevent a decline in the composition and diversity of the indigenous and endemic aquatic biota;

- All link roads from the mining area to the main road must be continuously sprayed to suppress dust and prevent the potential smothering of aquatic vegetation in the form of wind-blown dust. Regular compaction and grading of the haul roads to clear accumulation of loose material will further assist to suppress dust.

5.1.2 Operation of Vehicles, Heavy Machinery and Equipment

- Vehicles, heavy machinery and equipment are only permitted within the no-go areas when being actively operated, and otherwise must be stored outside of the no-go areas on level impervious ground. The same applies to the servicing thereof. This is best practice as it limits their duration within sensitive freshwater areas and thereby minimising impacts. Any activity within an unauthorised area must first seek the prior approval of the ECO, except under emergency procedures;

- The operation activities must be subjected to seasonal restrictions to support aquatic wildlife breeding periods;

- Existing access roads/jeep tracks/haul roads must be used as far as possible to prevent additional disturbance to the riparian zone and overall upgradient catchment. New routes must be carefully planned and advised by the ECO so as to avoid freshwater and generally sensitive habitats as far as feasibly possible. In the event of a new access route traversing a riparian zone, the proponent must look into using machinery with low ground pressure to minimise soil compaction and damage to riparian vegetation. Tracked vehicles or specialised low-ground-pressure tyres can be used if feasible/available;

- Non mobile machinery must be equipped with attachments like swamp mats or bog mats to distribute weight and minimise disturbance to the watercourse areas;

- Vehicle and heavy machinery must be equipped with drip trays to prevent the spill of hydrocarbons and other contaminants into the environment. An emergency spill remediation response plan must be in place in the event of an unforeseen spill, as affected through the training of operational staff and the acquisition of spill contaminant materials that must be readily available on-site. It is the responsibility of the contractor to immediately action spill cleanups and remove hazardous material off site;

- Operators must be trained in operating machinery in wetland/sensitive environments and be aware of the sensitivity of the area;

- Sensitive areas must be demarcated so as to guide operators, labourers and contractors;

- Use machinery with low ground pressure to minimise soil compaction and damage to wetland/riparian vegetation. Tracked vehicles or specialised low-ground-pressure tyres can be used if feasible/available;

- Implement sediment and erosion control measures such as silt fences, erosion control blankets, or sediment traps to prevent soil runoff into water bodies associated with vehicular movements and disturbed/hardened surfaces;

- Servicing, washing and refuelling of vehicles may not take place within the no-go areas;
- All Hazardous Chemical Substances (HCS) should be stored within suitable secondary containment structure and may not be stored within the watercourses or their buffer zones;
- Develop spill prevention and response plans to address potential leaks or spills of fuels, oils, or other hazardous substances;
- Have spill containment materials readily available on-site and train personnel in proper spill response procedures;
- The contractor is responsible for cleaning up any spillages (e.g. concrete, oil, fuel), immediately;
- Leaking equipment shall be removed from site immediately to facilitate repair;
- Contaminated soils and waste materials must be removed and disposed of in accordance with local regulations and guidelines;
- Properly manage waste generated during operations, including fuel, lubricants, and construction debris, to prevent contamination of the wetland/riparian areas;
- Implement an Incident Register to report any incidents or deviations from the planned operations to the ECO;
- Tarpaulins must be used to cover the loaded material to prevent the spill and spread of sand during transport; and
- Develop a restoration and rehabilitation plan to mitigate any long-term impacts of operating heavy machinery in wetlands and/or riparian areas

5.1.3 Water Quality Impairment

- All contractors and employees must undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Vehicle washing and refuelling must take place outside of the no-go area to avoid the runoff of hydrocarbons and other contaminants into watercourses;
- All chemicals and toxicants must be stored in bunded areas; and
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly.

5.1.4 Erosion and Sedimentation

- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the water resources. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Install sandbags around soil stockpiles to prevent soils washing into the system;

- Document the soil profile on removal and ensure the soil is backfilled in the same horizon order in which it was removed;
- Ensure that topsoil is appropriately stored and re-applied; and
- Make sure that the soil is backfilled and compacted to appropriate geotechnical specifications for the project area.
- Signs of erosion must be addressed immediately to prevent further erosion of the infrastructure;
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil; and
- Landscape and re-vegetate all cleared areas as soon as possible to limit erosion potential.
- Erosion control such as gabions must be established at the access point through the vegetation;
- Temporary storm water management systems must be in place and preferential runoff channels be filled with aggregate and/or logs (branches included) to dissipate flows, limiting erosion and sedimentation; and
- Silt traps and sediment trapping berms must be in place in drainage lines around the stockpile area.

5.1.5 Vegetation

- An alien invasive plant management plan needs to be compiled and implemented by the ECO prior to the authorisation of the amended sand mine area to control and prevent the spread of invasive alien vegetation due to disturbance of the riparian zone;
- Vegetation must be removed sparingly and must be overseen by an ECO, who must prioritise the removal of alien invasive species over indigenous vegetation; and
- Alien vegetation must be removed to a registered facility as soon as possible and must not be stockpiled, burned or mulched on site, ultimately to prevent the spread of alien invasive vegetation.

5.1.6 Construction of quarrying

The following mitigation measures are aimed to conserve watercourses during the construction of the quarry:

- The extent of the quarry should not differ from the extent of the shapefile shared with the consultants responsible for this assessment;
- All infrastructure components (i.e., stockpiles, haul roads, buildings etc) associated with the quarry activities must be located within the extent of the quarry area shared with the consultant; and
- Basic rock cladding must be applied to areas characterised by signs of erosion within and around the relevant watercourses and drainage lines.

5.1.7 Decommissioning of Quarry

To ensure that overland flow is not increased during the proposed decommissioning phase of the quarry, the following mitigation measures have been recommended:

- An annual monitoring must be completed for the first three years upon the completion of the decommissioning phase. This must be followed up by a thorough rehabilitation strategy as per the recommendations of these reports; and

- Water quality samples must be taken downstream of the relevant quarry, within the Platdoring River to the east of the quarry and its tributary south of the quarry, to determine potential salinity and heavy metal contamination. Contamination remediation strategies must be recommended if contamination is identified.

6 Recommendations

The following recommendations are pertinent to ensure the adequate protection of the freshwater resource:

- A stormwater management plan must be incorporated for the quarry operation (including pollution control facilities, attenuation ponds, separation of clean and dirty water etc.);

- An infrastructure monitoring and service plan must be compiled and implemented during the operational phase. This will include the monitoring all stormwater discharge points, energy dissipation structures, and stability of watercourse banks in the project footprint which must include the river reach below any discharge points.

- It is critical that a competent ECO in the freshwater ecological discipline is appointed to ensure that the mitigation measures as listed in this report, including the sand mining operational conditions that are drafted by the authorities are adequately exercised on the ground;

- An alien invasive plant management plan must be drafted and implemented to prevent the establishment and spread of alien invasive vegetation as a result of site disturbance;

- A rehabilitation plan must be implemented in parallel with the operation of the sand mine, and look to rehabilitate areas in a phased approach as the mining operation moves along the riverbed;

- Water quality in terms of total suspended solids, turbidity, nutrient loading, temperature, dissolved oxygen and Electrical Conductivity must be monitored as part of a monitoring programme to ensure that water quality conditions do not deteriorate during the operation of the sand mine; and

- A sediment flow study must be undertaken to establish sustainable extraction rates that allow natural systems to replenish sand resources over time,

7 Conclusion

7.1 Baseline Ecology

The National Web-based Environmental Screening Tool has characterised the aquatic sensitivity of the project area (mining area and access route) as “Low” and “Very High”. The reach (Platdoring River) is susceptible to further impacts, particularly on water quality and physical disturbances to instream and riparian habitat.

A single wet season survey was conducted on the 7th of March 2023 for the proposed project. The drainage lines and Platdoring River was dry albeit a wet season survey. The project area is situated in the L11F quaternary catchment and is in proximity of the Platdoring River and its unnamed tributary. The Platdoring River flows in a southerly direction into the Sout River. The project area falls within the L11F-07164-Platdoring Sub-Quaternary Reach (SQR) and the Great Karoo Level 1 Ecoregion. The project area is located within the Mzimvubu-Tsitsikama WMA. Temperature for the region ranges from average lows of 4°C during winter periods (April – August) and average highs of 29°C during the summer periods (September-March). Rainfall patterns indicate a mean annual precipitation of 210 mm, with summer and winter rainfall, and peak rainfall periods occurring between December and March. The study area is situated within two biomes: Azonal Vegetation and Nama Karoo Biome and situated in both the Gamka Karoo and the Southern Karoo Riviere vegetation types. The L11F-07164 SQR is derived to be moderately modified, category C. The moderately modified state of the reach was due to small impacts on riparian and wetland zone continuity and modification, moderate impacts on instream habitat continuity, potential impacts on physico-chemical conditions (water quality), and flow modification. The results of the IHI for the Platdoring River and its tributaries (drainage lines) indicated moderately modified instream and riparian conditions. Instream habitat was considered largely intact, however, several impacts were observed on site and from aerial imagery.

7.2 Impact Statement

An impact statement is required as per the NEMA regulations with regards to the proposed development. Based on desktop and survey findings in this report the specialist disputes the “Low” rating for the mining area and agrees with the “Very High” aquatic theme sensitivity as per the National Web based Environmental Screening Tool. The specialist revised the ratings to a maximum of ‘High’ aquatic sensitivity. This is attributed to:

- The project area is not located within a SWSA for surface water;
- The project footprint overlaps only with a Western Cape ESA1 and Other Natural Areas;
- The project area (proposed sand mine and access road) is in proximity of an NFEPA river (Platdoring River) as well as several drainage lines which are tributaries of same;
- The project area is located along a Least Threatened and Poorly Protected watercourse (Platdoring River); and
- No protected areas detected within the project area or immediate downstream reaches. The Steenbokkie Private Nature Reserve is approximately 15 km downstream of the project area.

The proposed activities pose low to moderate pre-mitigation risks during the construction, operational and decommissioning phases. Moderate risks are associated with the activities proximate to the watercourse, including the drainage patterns change due to road extent and crossings, clearing of riparian (and terrestrial) vegetation, stormwater management, excavation of riparian area, bed and/or banks, operation of heavy machinery adjacent/within the watercourse, alien vegetation encroachment, conducting road and crossings maintenance, sedimentation and erosion, and hydrocarbon

contamination. Due to the presence of existing roads and crossings, the implementation of mitigation measures as well as the avoidance of watercourse areas for any mining activities will reduce the risks/impacts of Moderate-risk activities to Low if done effectively. If not done effectively, the activities will not reduce the risks of aspects/activities such as clearing riparian areas, deep excavation when mining, drilling and crushing, excavations, the drainage patterns change due to road extent and crossings, dust precipitation (from backfilling), change in topography (from backfilling), dust precipitation (from shaping/contouring), change in topography (from shaping/contouring) and surface structures as well as stormwater, as these activities will result in direct loss of riparian vegetation, channel-, bed- and bank modification, and have a direct impact on the rivers and riparian areas.

7.3 Specialist Opinion

Considering the assessment findings, it is the opinion of the specialist that the project may be considered for authorisation. This is on condition that all prescribed mitigation measures and recommendations are implemented. This includes the avoidance of sensitive freshwater habitats and their buffer zones (as far as is feasible), methods that prevent the introduction of contaminants into watercourses, rehabilitation of disturbed watercourses, as well as the minimisation of development/disturbances within these areas.

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9 Appendices

9.1 Appendix A: Methodology

9.1.1 Desktop Spatial Assessment

The following information sources were considered for the desktop assessment;

- Aerial imagery (Google Earth Pro);
- The inland water dataset;
- Topographical river line data;
- Present Ecological State (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) per Sub Quaternary Reaches (SQR) for Secondary Catchments in South Africa (DWS, 2014);
- The National Freshwater Ecosystem Priority Areas (NFEPA) (Nel *et al*., 2011);
- Provincial Conservation Plans;
- South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al*., 2019);
- National Biodiversity Assessment (NBA) (Van Deventer *et al*., 2019);
- The SANBI National Wetland Map 5 (Van Deventer *et al*., 2019); and
- Contour data (5 m).

9.1.2 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:

9.1.2.1 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 into potential wetland areas and serve to highlight the location and extent of rivers, drainage features, dams, wetlands, reservoirs, and other relevant inland waterbodies.

9.1.2.2 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 on 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 (Nel *et al.,* 2011).
- Strategic Water Source Areas, 2021 (Lötter & Le Maitre, 2021); and

9.1.2.2.1 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 has been altered from its natural condition.

9.1.2.2.2 National Freshwater Ecosystem Priority Areas, Rivers, and Wetlands

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).

9.1.3 Water Quality

Water quality was measured *in-situ* using a handheld calibrated multi-parameter water quality meter. The constituents considered that were measured included: pH, electrical conductivity (µS/cm), water temperature (°C) and Dissolved Oxygen (DO) in mg/l.

9.1.4 Habitat Assessments

Habitat availability and diversity are major attributes of the biota found in a specific ecosystem, and thus knowledge of the quality of habitats is important in an overall assessment of ecosystem health. Habitat assessment can be defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour *et al*., 1996). Both the quality and quantity of available habitat affect the structure and composition of resident biological communities (USEPA, 1998). Habitat quality and availability play a critical role in the occurrence of aquatic biota. For this reason, habitat evaluation is conducted simultaneously with biological evaluations to facilitate the interpretation of results.

9.1.4.1 Index of Habitat Integrity

The Index of Habitat Integrity (IHI) model was used to assess the integrity of the habitats from a riparian and instream perspective as described in Kleynhans (1996) v1. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale which are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

This model compares current conditions with reference conditions that are expected to have been present. Specification of the reference condition follows an impact-based approach where the intensity and extent of anthropogenic changes are used to interpret the impact on the habitat integrity of the system. To accomplish this, information on abiotic changes that can potentially influence river habitat integrity is obtained from surveys or available data sources. These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology and physicochemical conditions and how these changes would impact the natural riverine habitats.

The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table 9-1 and Table 9-2 respectively. The spatial framework for each IHI was 5 km upstream and downstream of the respective sampling points within the watercourse(s).

Table 9-1 Criteria used in the assessment of habitat integrity (Kleynhans, 1996)

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance, and size. Also implicated in flow, bed, channel, and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in the duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering, or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment (Gordon *et al*., 1993). Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation (Hilden & Rapport, 1993) is also included.
Channel modification	may be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Phys-chem modification	Originates from point and diffuse point sources. Measured directly or agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments (Gordon *et al*., 1992).
Alien macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Introduced aquatic fauna	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
Rubbish dumping	A direct anthropogenic impact which may alter habitat structurally. Also a general indication of the misuse and mismanagement of the river.
Vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river (Gordon *et al*., 1992). Refers to physical removal for farming, firewood, and overgrazing.
Exotic vegetation	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochthonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the riverbank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

Table 9-2 Descriptions used for the Ratings of the Various Habitat Criteria

Impact Category	Description	Impact Score
None	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size, and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size, and variability are also very small.	1-5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size, and variability are also limited.	6-10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size, and variability. Large areas are, however, not influenced.	11-15
Serious	The modification is frequently present and the habitat quality, diversity, size, and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	16-20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size, and variability in almost the whole of the defined section are influenced detrimentally.	21-25

The habitat integrity assessment takes into account the riparian zone and the instream channel of the river. Assessments are made separately for both aspects, but data for the riparian zone are primarily interpreted in terms of the potential impact on the instream component (Table 9-3). The relative weighting of criteria remains the same as for the assessment of habitat integrity (DWS, 1999).

Table 9-3 Criteria and weights used for the assessment of habitat integrity and habitat integrity (from Kleynhans, 1996)

Instream Criteria	Weight	Riparian Zone Criteria	Weight
Water abstraction	14	Vegetation removal	13
Flow modification	13	Exotic vegetation	12
Bed modification	13	Bank erosion	14
Channel modification	13	Channel modification	12
Phys-chem modification	14	Water abstraction	13
Inundation	10	Inundation	11
Alien macrophytes	9	Flow modification	12
Introduced aquatic fauna	8	Phys-chem	13
Rubbish dumping	6		
Total	100	Total	100

The negative weights are added for the instream and riparian facets respectively and the total additional negative weight subtracted from the provisionally determined integrity to arrive at a final habitat integrity estimate. The eventual total scores for the instream and riparian zone components are then used to place the habitat integrity in a specific habitat integrity category (DWS, 1999). These categories are indicated in Table 9-4.

Table 9-4 Intermediate habitat integrity categories (From Kleynhans, 1996)

Category	Description	Score (% of Total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level, and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0

9.1.5 Riparian Delineation

The riparian delineation was completed according to DWAF (2005). Typical riparian cross-sections and structures are provided in Figure 9-1. Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. Elevation data obtained from topography spatial data was also utilised to support the infield assessment.

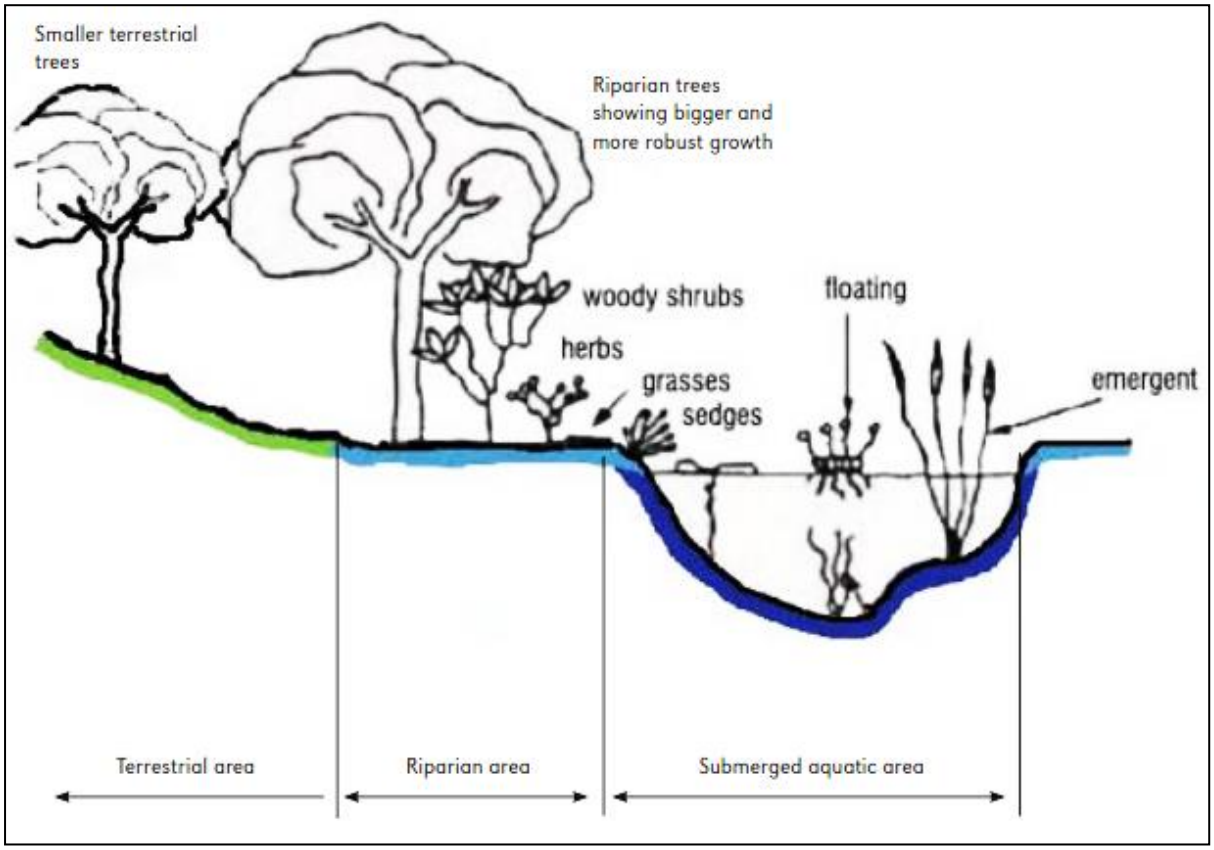

Figure 9-1 Riparian Habitat Delineations (DWAF, 2005)

9.1.6 Aquatic Macroinvertebrate Assessment

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al.,* 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour *et al.,* 1999). The assessment and monitoring of benthic macroinvertebrate communities form an integral part of the monitoring of the health of an aquatic ecosystem.

9.1.6.1.1 South African Scoring System

The South African Scoring System version 5 (SASS5) is the current index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g. Chironomidae) to highly sensitive families (e.g. Perlidae). SASS results are expressed both as an index score (SASS score) and the Average Score Per recorded Taxon (ASPT value).

Sampled invertebrates were identified using the “Aquatic Invertebrates of South African Rivers” Illustrations book, by Gerber and Gabriel (2002). Identification of organisms was made at the family level (Thirion *et al.,* 1995; Dickens and Graham, 2002; Gerber and Gabriel, 2002, Fry, 2022).

Reference conditions reflect the best conditions that can be expected in rivers and streams within a specific area and reflect natural variation over time. These reference conditions are used as a benchmark against which field data can be compared. All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007). This method seeks to develop biological

bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database. Ecological categories for the project area are based on biological banding presented in Table 9-5.

Table 9-5 Biological Bands / Ecological categories for interpreting SASS data (adapted from Dallas, 2007)

Class	Ecological Category	Description
A	Natural	Unimpaired. High diversity of taxa with numerous sensitive taxa.
B	Largely natural	Slightly impaired. High diversity of taxa, but with fewer sensitive taxa.
C	Moderately modified	Moderately impaired. Moderate diversity of taxa.
D	Largely modified	Considerably impaired. Mostly tolerant taxa present.
E/F	Seriously Modified	Severely impaired. Only tolerant taxa present.

9.1.7 Fish Community Assessment

Fish species information can be used to develop the Fish Response Assessment Index (FRAI), which gives an indication of the PES of the river based on the fish assemblage structures observed. Ideally, fish would be captured through electroshocking techniques. Approximately, 50 m up and 50 m downstream of each sampling point would be assessed by sampling representative habitat. All fish would be identified in the field and released at the point of capture. Fish species would be identified using the guide Freshwater Fishes of Southern Africa (Skelton, 2001; 2016). The identified fish species would be compared to those expected to be present for the quaternary catchment. The expected fish species list was developed from a literature survey and included sources such as DWS (2014), (Kleynhans *et al.,* 2007) and Skelton (2001; 2016). Fish have different sensitivities or levels of tolerance to various aspects that they are subjected to within the aquatic environment. These tolerance levels are rated with a sensitivity score as presented in Table 9-6. These tolerance levels are scored to show each fish species' sensitivity to flow and physicochemical modifications.

Table 9-6 Intolerance rating and sensitivity of fish species.

Sensitivity Score	Tolerance/Sensitivity Level
0-1	Highly tolerant = Very low sensitivity
1-2	Tolerant = Low sensitivity
2-3	Moderately tolerant = Moderate sensitivity
3-4	Moderately intolerant = High sensitivity
4-5	Intolerant = Very high sensitivity

9.1.8 Present Ecological Status

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions (Kleynhans and Louw, 2007) (Table 9-7) . For this study ecological classifications have been determined for biophysical attributes for the associated water course. This was completed using the river Ecoclassification manual by Kleynhans and Louw (2007). The areas considered in the PES assessment are outlined in the description of the project area section. The combined categories were assessed to determine the reach-based PES.

Table 9-7 Present Ecological State (PES) Categories

Category	Descriptions (Modifications)	Descriptions (Taxa)
A	**Natural**	
	Unmodified, natural.	Unimpaired. High diversity of taxa with numerous sensitive taxa.
B	**Largely Natural**	
	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Slightly impaired. High diversity of taxa, but with fewer sensitive taxa.
C	**Moderately Modified**	
	A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	Moderately impaired. Moderate diversity of taxa.
D	**Largely Modified**	
	A large loss of natural habitat, biota and basic ecosystem functions has occurred.	Considerably impaired. Mostly tolerant taxa present.
E	**Seriously Modified**	
	The loss of natural habitat, biota and basic ecosystem functions is extensive.	Severely impaired. Only tolerant taxa present.
F	**Critically Modified**	
	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	Severely impaired. Only tolerant taxa present.

9.1.9 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.

9.1.10 Site Sensitivity Verification

The baseline aquatic / freshwater sensitivity of the project area was obtained using the National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended). The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas based on the specialist-assigned Ecological Importance and Sensitivity of the different systems (where applicable), with consideration being given to the presence of observed or likely sensitive fauna and flora.

9.2 Appendix B: Risk and Impact 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 9-8.

Table 9-8 Significance ratings matrix

Rating	Class	Management Description
1 – 29	(L) Low Risk OR (+) Positive (+ +) Highly positive	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. License 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. License required.

9.3 Appendix C – Specialist Declaration of Independence

DECLARATION

I, Charles de Beer, declare that:

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. “the Protocols”) and in Government Notice No. 1150 of 30 October 2020.
- 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 and is punishable in terms of the NEMA Act.

Charles de Beer

Aquatic Ecologist

The Biodiversity Company

29/04/2025

DECLARATION

I, Prasheen Singh, declare that:

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. “the Protocols”) and in Government Notice No. 1150 of 30 October 2020.
- 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 and is punishable in terms of the NEMA Act.

Prasheen Singh

Aquatic Ecologist

The Biodiversity Company

04/05/2025

9.4 Appendix D – Specialist CVs

Charles de Beer

BSc Honours in Environmental Sciences with Aquatic Ecosystem Health (Candidate Natural Scientist 168416)

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Identity Number: 0112205269080
Date of birth: 20 December 2001

Profile Summary

Aquatic Ecologist at The Biodiversity Company.

Specialist experience in various projects including Estuarine Health Assessments, Freshwater Ecological Assessments, Ecological Impact Assessments and Biomonitoring.

Specialist expertise includes Environmental Management, Aquatic Ecology and Water Quality.

Areas of Interest

Aquatic Ecology
Aquatic Ecosystem Health
Ecosystem Rehabilitation
Estuarine Health
Habitat and Biodiversity Conservation
Sustainable Development
Environmental Management
Water Quality

Key Experience

- Aquatic Impacts and Risk Assessments
- Water resource baseline monitoring and impact assessments
- The use of biological indicators such as fish, macroinvertebrates and diatoms
- Aquatic Ecological Assessments
- Biomonitoring Programmes
- Ecological Flow Requirements
- Ecological Impact Assessment
- Basic Assessments

International Experience

Botswana
Lesotho
Mozambique
Namibia
South Africa
Zimbabwe

Nationality

South African

Languages

Afrikaans – Proficient
English – Proficient

Qualifications

- National Senior Certificate (Oakdale Agricultural High School, 2019)
- BSc in Biological Science with Zoology and Botany (North-West University, 2022)
- BSc Honours in Environmental Science with Aquatic Ecosystem Health (North-West University, 2023)

Prasheen Singh

M.Sc Aquatic Health (*Pr. Sci. Nat.*)

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Identity Number: 8904255091089
Date of birth: 25 April 1989

Profile Summary

Prasheen Singh is a SACNASP registered Professional Scientist in the field of Aquatic Science.

He is an Aquatic Ecologist and Water Quality Specialist whose 11 years' experience comprises numerous Aquatic Scientific Studies, Peer Reviews, Research, and served as a SANAS accredited Technical Signatory at an Ecotoxicology Laboratory. He is also a Steering Committee Member for the Water Research Commission

Prasheen attained his MSc in Aquatic Health at the University of Johannesburg, and completed training courses for wetlands, river eco-status monitoring, hydropedology, and ecosystem restoration. He is also an accredited SASS5 Practitioner with the Department of Water and Sanitation.

He has working experience throughout South Africa, specialising in water quality studies, aquatic biomonitoring, compliance audits, rehabilitation plans, monitoring plans and risk assessments. Prasheen is experienced in project management and strives to achieve and maintain scientific excellence in all specialist work.

Areas of Interest

Terrestrial and Aquatic Biodiversity.

Ecosystem Restoration, Protection and Conservation.

Environmental Awareness.

Key Experience

- Freshwater Ecological Studies
- SASS5 Macroinvertebrate Assessments, IHAS & MIRAI
- FRAI & Fish Population Structure Assessments
- Instream and Riparian Integrity Assessments
- Aquatic Impact and Risk Assessments
- DWS Risk Assessments
- Environmental Impact Assessments
- Surface water Quality
- Groundwater Quality
- Wastewater Quality
- SANS241 Drinking Water Quality
- Compliance Monitoring
- Water Use License Audits
- Aquatic Resources Rehabilitation Plans
- Aquatic Resources Monitoring Programs
- Ecotoxicity Testing
- GIS and Sensitivity Mapping (ArcGIS, QGIS)

Provincial Experience

Gauteng, Mpumalanga, Eastern Cape, Western Cape, Northern Cape, North West Province, Free State Province, Limpopo, KwaZulu-Natal

Nationality

South African

Languages

English – Proficient

Afrikaans – Basic

Qualifications

- MSc (University of Johannesburg) – Aquatic Health (*Cum Laude*).
- BSc Honours (University of Johannesburg) – Biodiversity and Conservation
- BSc (University of Johannesburg) – Life and Environmental Sciences
- Pr. Sci. Nat. (116822) – Aqua Science
- SASS 5 (2017-2024) – Department of Water Affairs and Sanitation River Health Programme
- River Ecostatus Monitoring Programme Training
- Wetland Management: Introduction and Delineation · University of Free State
- Official DWS Section 21(c) a (i) Water Use Authorisation Training Course – Departme of Water and Sanitation
- Hydropedology and Wetland Functioning – Water Busines Academy
- Ecosystem Restoration (Part and 2) – Learning for Nature

Chelsea Withfield

MSc Environmental Sciences

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Profile Summary

Aquatic Ecologist Intern at The Biodiversity Company.

Specialist expertise includes Environmental Management, Aquatic Ecology and Water Quality.

Areas of Interest

Aquatic Ecology
Water quality
Aquatic Ecosystem Health
Ecosystem Rehabilitation
Habitat and Biodiversity Conservation
Sustainable Development

Key Experience

- Water quality analyses
- Metal detection
- DNA extraction, Polymerase Chain Reaction
- Microscopy
- Biomarker analyses
- The use of biological indicators such as fish and macroinvertebrates
- GIS with training in QGIS
- Statistical analyses

Provincial Experience

Limpopo
Mpumalanga
Gauteng
North West
Free State

Nationality

South African

Languages

Afrikaans – Proficient
English – Proficient

Qualifications

- BSc in Environmental Science with Zoology and Tourism (North-West University, 2021)
- BSc Honours in Environmental Science with Biodiversity and Conservation Ecology (North-West University, 2022)
- MSc in Environmental Sciences with Aquatic Ecosystem Health (North-West University, 2025)

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