Aquatic Biodiversity Specialist Assessment

Aquatic Ecological and Impact Assessment for the proposed Dolerite Mining Permit

Beaufort West, Western Cape Province, South Africa

Report Date: March 2023

Client

Prepared by:

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Executive Summary

The Biodiversity Company (TBC) was appointed by Greenmined Environmental on behalf of Otter Mist Trading 1057 (Pty) Ltd to conduct an Aquatic Ecological and Impact Assessment as part of the Environmental Authorisation and/or Water Use Authorisation process for the proposed dolerite mining permit. The proposed project entails the mining of 5 hectares of land as well as an access road on a portion of the remaining extent of the Farm Rhenosterkop 155, Beaufort West District, Western Cape Province, South Africa.

The purpose of the specialist study is to provide relevant input into the environmental and water use authorisation process and provide a report for the proposed 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, as to the ecological viability of the proposed project.

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 although this was 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 IHIA for the Platdoring River and its tributaries indicated moderately modified instream and riparian conditions. Instream habitat was considered largely intact, however, several impacts were observed on site and from aerial imagery.

The National Web-based Environmental Screening Tool has characterised the aquatic sensitivity of the project area (mining area) as "**Low**", whilst "**Very High**" for the access route to the mining area. The desktop assessment and site visit agreed with both of these ratings. The reach (Platdoring River) is susceptible to further impacts, particularly on water quality and physical disturbances to instream and riparian habitat. The proposed activities pose low to moderate 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 will reduce the risks/impacts of Moderate-risk activities to Low if done effectively. If not done effectively, the construction will not reduce the risks of aspects/activities such as clearing riparian areas, deep excavation when mining, 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.

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 agrees with the "**Low**" rating for the mining area and the "**Very High**" for the access route to the mining area aquatic theme sensitivity as per the National Web based Environmental Screening Tool. 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.
- There is no FEPA river and FEPA area within to the project area. However, the project area (proposed access road) is in proximity to an unclassified NFEPA wetland.
- The project area is located along a Least Threatened and Poorly Protected watercourse (Platdoring River).
- 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 risks during the construction, operational and decommissioning phases. However, all moderate risks can be reduced to low with the application of adequate mitigation measures and recommendations ascribed in this report. It is therefore the specialist's opinion that the project may continue as proposed and as the proposed access road will cross the Platdoring River and several drainage lines, a full water use authorisation application process is required and must adhere to the stipulations or directives that may arise consequently.

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
IHIA	Intermediate Habitat Integrity Assessment
IUCN	International Union for Conservation of Nature
KZNDT	KwaZulu-Natal Department of Transport
LC	Least Concerned
NEMA	The National Environmental Management Act
NFEPA (FEPA)	National Freshwater Ecosystem Priority Areas
NT	Near threatened
NWA	National Water Act
PES	Present ecological state
RQO's	Resource Quality Objectives
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
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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Document Guide

The table below provides the minimum requirements for aquatic specialist assessments, and the relevant sections in the reports where these requirements are addressed. These are as per the "Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity" gazetted 20 March 2020, published in Government Notice No. 320.

Item	Section	Comment
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.	2	
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	2	CV available on request
A signed statement of independence by the specialist(s).	10	
The assessment must be undertaken on the preferred site and within the proposed development footprint.	4	
A baseline description of the aquatic biodiversity and ecosystems on the site, including: (a) aquatic ecosystem types; (b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns.	4 & 6	
The threat status of the ecosystem and species as identified by the screening tool;	4	
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 (NFEPA) or sub catchment, a strategic water source area (SWSA), a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area);	4.2	
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 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).	4	
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	1 & 5	
A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant.	5	
A description of the assumptions made and any uncertainties or gaps in knowledge or data.	5.4	
The assessment must identify any 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.	7.4	Recommendation have been included to avoid sensitive areas
Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal? Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present? How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include: (a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g., suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); (b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub -catchment (e.g., sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);	7	

(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 I seasonal I 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 uses 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.);	7	
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?	7	
A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant).	6.2	
Additional environmental impacts expected from the proposed development.	7	
Any direct, indirect and cumulative impacts of the proposed development.	7	
The degree to which impacts and risks can be mitigated.	7	
The degree to which the impacts and risks can be reversed.	7	
The degree to which the impacts and risks can cause loss of irreplaceable resources.	7	
A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	5.2	
Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr).	7	
A motivation must be provided if there were development footprints identified as per above that were identified as having a “low” aquatic biodiversity sensitivity and that were not considered appropriate.	7	N/A
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not;	8	
Any conditions to which this above statement is subjected	8	

1. Introduction

The modification of land use within a river catchment has the potential to degrade local water resources (Wepener *et al*., 2005). Landuse such as mining, and its associated infrastructure thus have the potential to negatively impact on local water resources and ecosystem services. In order to holistically manage water resources in South Africa, the use of standard water quality sampling methods is considered in-effective. Non-point and point source pollutants are dynamic and can fluctuate according to several factors such as rainfall, industrial discharges, and extensive pollutant seepage. Aquatic ecology is permanently exposed to the dynamic conditions within water bodies and can therefore be an effective reflection of the environmental conditions within a management area. Considering this, the monitoring of aquatic ecology is regarded as an effective tool in water management strategies, with all sensitive areas required to be delineated in order to preserve ecosystem services for future generations. Further the hydrology of the catchment must be understood as a driving factor of the aquatic and ecosystem health with appropriate consideration given during construction to accommodate for this.

The Biodiversity Company (TBC) was appointed by Greenmined Environmental on behalf of Otter Mist Trading 1057 (Pty) Ltd to conduct an Aquatic Ecological and Impact Assessment as part of the Environmental Authorisation and/or Water Use Authorisation process for the proposed dolerite mining permit. The proposed project entails the mining of 5 hectares of land as well as an access road on a portion of the remaining extent of the Farm Rhenosterkop 155, Beaufort West District, Western Cape Province, South Africa.

The proposed mining footprint will be 5 ha and will be developed over an undisturbed area of the farm. The mining method will make use of drilling and blasting in order to loosen the hard rock; the material will then be loaded and hauled to the crushing plant where it will be screened to various sized stockpiles. The dolerite will be stockpiled until it is transported from site using tipper trucks. All mining related activities will be contained within the approved mining permit boundaries. An access road to the mining area would need to be constructed. A single site visit was conducted on the 7th of March 2023. The survey constituted a wet season/high flow assessment.

Otter Mist Trading 1057 (Pty) Ltd intends to mine material (dolerite) from the area for at least 2 years with a possible extension of another 3 years. The dolerite to be removed from the quarry will be used for local construction and building projects in the vicinity. The proposed quarry will therefore contribute to the upgrading/maintenance of road infrastructure and building contracts in and around the Beaufort West area. The mining activities will consist of the following:

- Stripping and stockpiling of topsoil;
- Drilling
- Blasting;
- Excavating;
- Crushing;
- Stockpiling and transporting;
- Sloping and landscaping upon closure of the site; and
- Replacing the topsoil and vegetation to the disturbed area.

The mining site will contain the following:

- Drilling equipment;
- Excavating equipment;
- Earth moving equipment;
- Static crushing and screening plants.
- Access Roads;
- Site Office (Containers);
- Site vehicles;
- Parking area for visitors and site vehicles;

- Vehicle service area;
- Wash bay;
- Workshop (Containers);
- Salvage Yard;
- Bunded diesel and oil storage facilities;
- Generator on bunded area;
- Ablution Facilities (Chemical Toilets);
- Weigh Bridge; and
- Demarcated general and hazardous waste area.

The proposed project will not require any additional electricity connections, as power will be supplied, when needed, by generators. All diesel storage will be below the threshold as mentioned in the EIA regulations of the National Environmental Management Act, 1998 (Act No 107 of 1998) as amended 2017.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) 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): “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) 509 by the Department of Water and Sanitation (DWS). The said notice was published in the Government Gazette (no. 40229) under Section 39 of the National Water Act (Act no. 36 of 1998) in August 2016, for a Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses. The GN 509 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 509 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM), provided the identified risks are all considered a low risk. This assessment will implement the RAM and provide a specialist opinion on the appropriate water use authorisation.

The purpose of the specialist study is to provide relevant input into the environmental authorisation and water use application process and provide a report for the proposed 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, as to the ecological viability of the proposed project.

1.1 Objectives

The aim of the assessment was to provide information to guide the proposed infrastructure upgrade with respect to the current state of the associated water resources in the project area. This was achieved through the following:

- A desktop assessment of all available datasets;
- Geographic Information Systems (GIS) processing to preliminarily identify water accumulation areas; and
- The delineation of water resources in accordance with the DWAF (2005) guidelines, whereby the outer edges will be identified.
- A functional and integrity assessment of the water resources.
- The determination of the watercourses Present Ecological State (PES) using appropriate inputs.
- A GN509 Risk Assessment in terms of the Section 21(c) and (i) General Authorisation (GA) Regulations to assess the impacts of the proposed activities within the watercourses of the project area.
- Description of the baseline receiving environment specific to the field of expertise (general surrounding area as well as site specific environment);
- Identification and description of any sensitive receptors in terms of relevant specialist discipline (aquatic biodiversity) that occur in the project area, and the manner in which these sensitive receptors may be affected by the activity; and
- Impact assessment, mitigation and rehabilitation measures to prevent or reduce the possible impacts.

2. Specialist Details

Report Name	**Aquatic Ecological and Impact Assessment for the Proposed Dolerite Mining Permit**
Submitted to	
Report Writer	**Khethokuhle Hlatshwayo**  Khethokuhle Hlatshwayo is a Pr. Sci. Nat. registered (124579) in the fields of Aquatic Science. Khethokuhle has obtained his Hons. degree in Zoology from the University of Johannesburg with 4 years' experience in aquatic ecology and has operated in various sectors, including mining, civil engineering, research and EIAs following IFC standards. Khethokuhle is SASS5 accredited with the Department of Water and Sanitation (DWS).
Fieldwork & Reviewer	**Prasheen Singh**  Prasheen Singh is a registered Professional Scientist in the field of Aquatic Science (Pr. Sci. Nat. 116822). He is an Aquatic Ecologist whose 10 years' experience comprises numerous Aquatic Scientific Studies, Peer Reviews, Research, and having served as a SANAS accredited Technical Signatory at an Ecotoxicology Laboratory. 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 an accredited SASS5 Practitioner with the Department of Water and Sanitation since 2017.
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, 2014 (as amended). 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.

3. Legislation

3.1 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (Act No. 107 of 1998) (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations, as amended in April 2017, state that prior to certain listed activities taking place, an environmental authorisation application (EA) process needs to be followed. This could follow either the BA process or the Scoping and EIA process, depending on the scale of the impact. A BA process is being undertaken for the project.

GN 350 was gazetted on the 20 March 2020, which has replaced the requirements of Appendix 6 of the EIA Regulations in respect of certain specialist reports. These regulations provide the criteria and minimum requirements for specialist's assessments, in order to consider the impacts on aquatic resources for activities which require EA.

3.2 National Water Act (NWA, 1998)

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

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

A watercourse is defined in the NWA as:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem and not just the water in isolation, 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) of the NWA.

4. Description of the Project Area

The proposed Dolerite mining area is located on 5 ha on a portion of the remaining extent of the Farm Rhenosterkop 155, approximately 30 km northeast of the Beaufort West Town within the Beaufort West District, Western Cape Province, South Africa (Figure 4-3). The project area is situated in the L11F quaternary catchment (Figure 4-4) 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 (Figure 4-5). There are currently nine (9) Water Management Area (WMA) which were formed by joining the old nineteen WMAs, with the project area located within the Mzimvubu-Tsitsikama WMA. A number of rivers drain the Mzimvubu-Tsitsikama WMA.

Temperatures for the region range from average lows of 4°C during winter periods (April – August) and average highs of 29°C during the summer periods (September-March) (Figure 4-1). Rainfall patterns indicate a mean annual precipitation of 210 mm (weatherbase.com), with summer and winter rainfall and peak rainfall periods occurring between December and March (Figure 4-2).

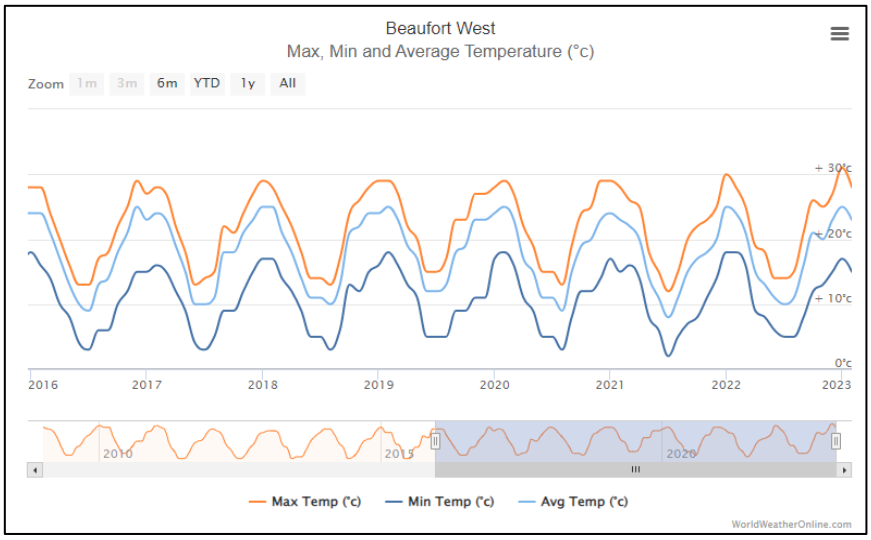


Figure 4-1: Illustration of historical average temperatures (obtained from Worldweather.com)

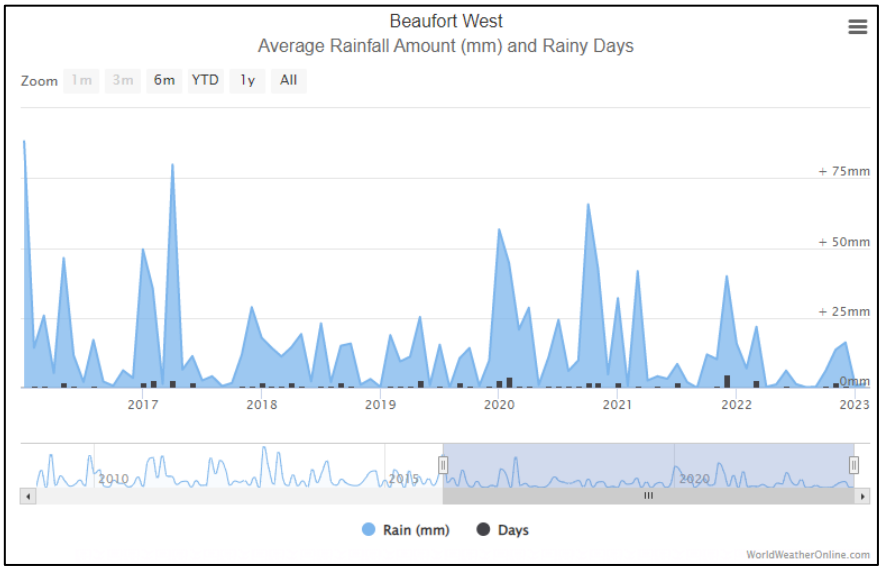


Figure 4-2: Illustration of average precipitation and rainy days (obtained from Worldweather.com)

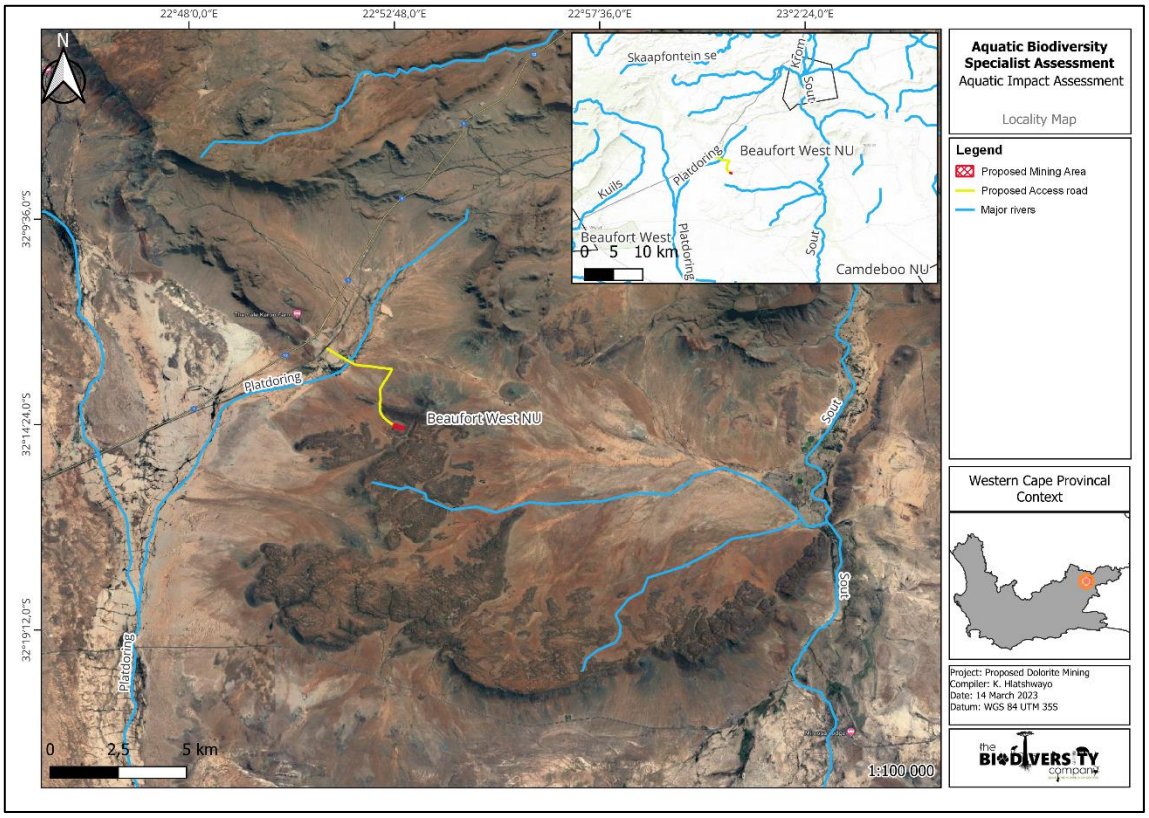


Figure 4-3 Locality map illustrating the project area in relation to the general setting.

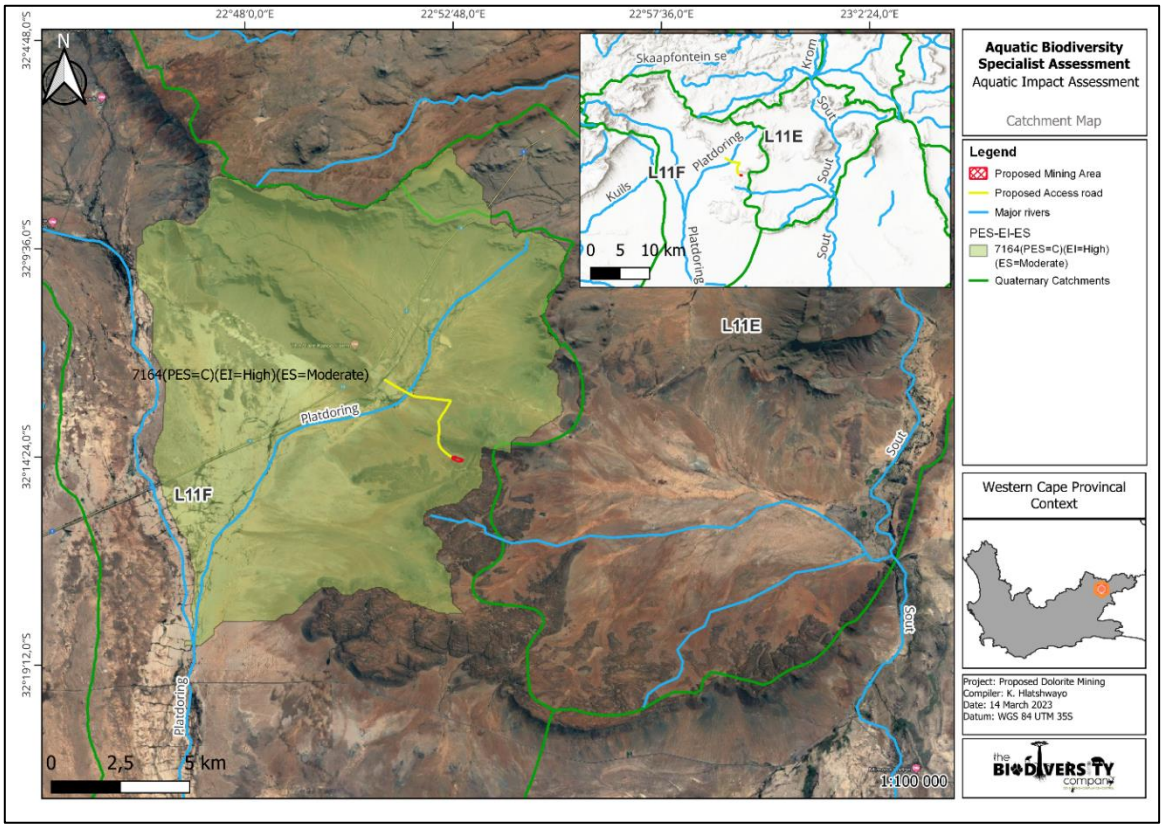


Figure 4-4 Catchment map illustrating the project area in relation to the quaternary catchment.

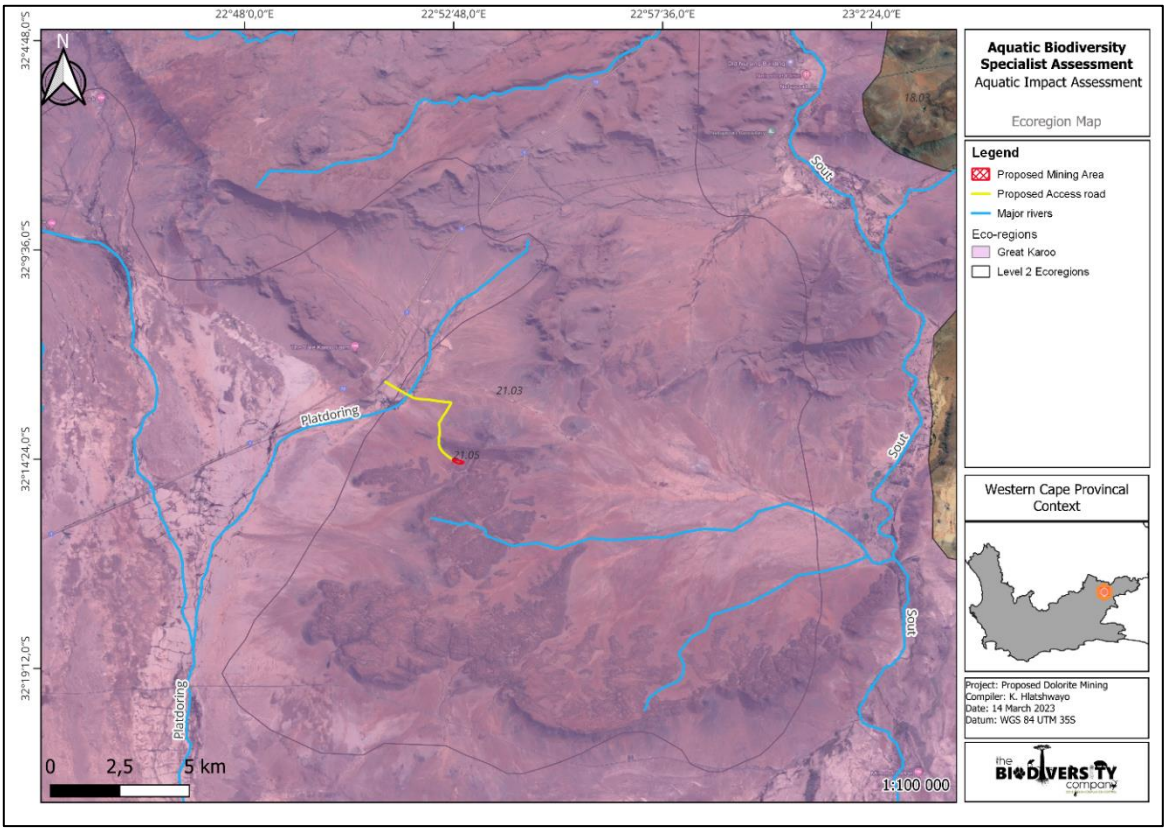


Figure 4-5 Project area in relation to the Level 1 and Level 2 Ecoregions.

4.1 Desktop Present Ecological Status of Watercourse

Desktop information for the L11F-07164 SQR's was obtained from DWS (2014) and represented in Table 4-1. 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), flow modification.

Table 4-1 Summary of the Present Ecological State of the SQRs associated with the Mooi River reaches (DWS, 2014).

Component/Catchment	L11F-07164
River Name	Platdoring River
Reach Length	22.84 km
Present Ecological Status (PES)	Moderately Modified (class C)
Ecological Importance Class	High
Ecological Sensitivity	Moderate
Default Ecological Category	Largely Natural (class B)

4.2 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features are summarised in Table 4-2.

Table 4-2 Summary of relevance of the proposed project to ecologically important landscape features.

Desktop Information Considered	Relevance	Section
Strategic Water Source Areas	Not applicable - The project area is not located within a SWSA for surface water.	4.2.1
Critical Biodiversity Area	Relevant – The project footprint overlaps only with a Western Cape ESA1 and Other Natural Areas	4.2.2
National Freshwater Ecosystem Priority Areas	Not applicable - There is no FEPA river and FEPA area within to the project area. However, the project area (proposed access road) is in proximity to an unclassified NFEPA wetland.	4.2.3
National Wetland Map 5	Not applicable – The project area does not overlaps with any wetlands.	4.2.4
Ecosystem Threat Status	Relevant - The project area is located along a Least Threated watercourse.	4.2.5
Ecosystem Protection Level	Relevant - The project area is located along a Poorly Protected watercourse.	4.2.6
Protected Areas	Not applicable – 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.	4.2.7

4.2.1 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 4-6).

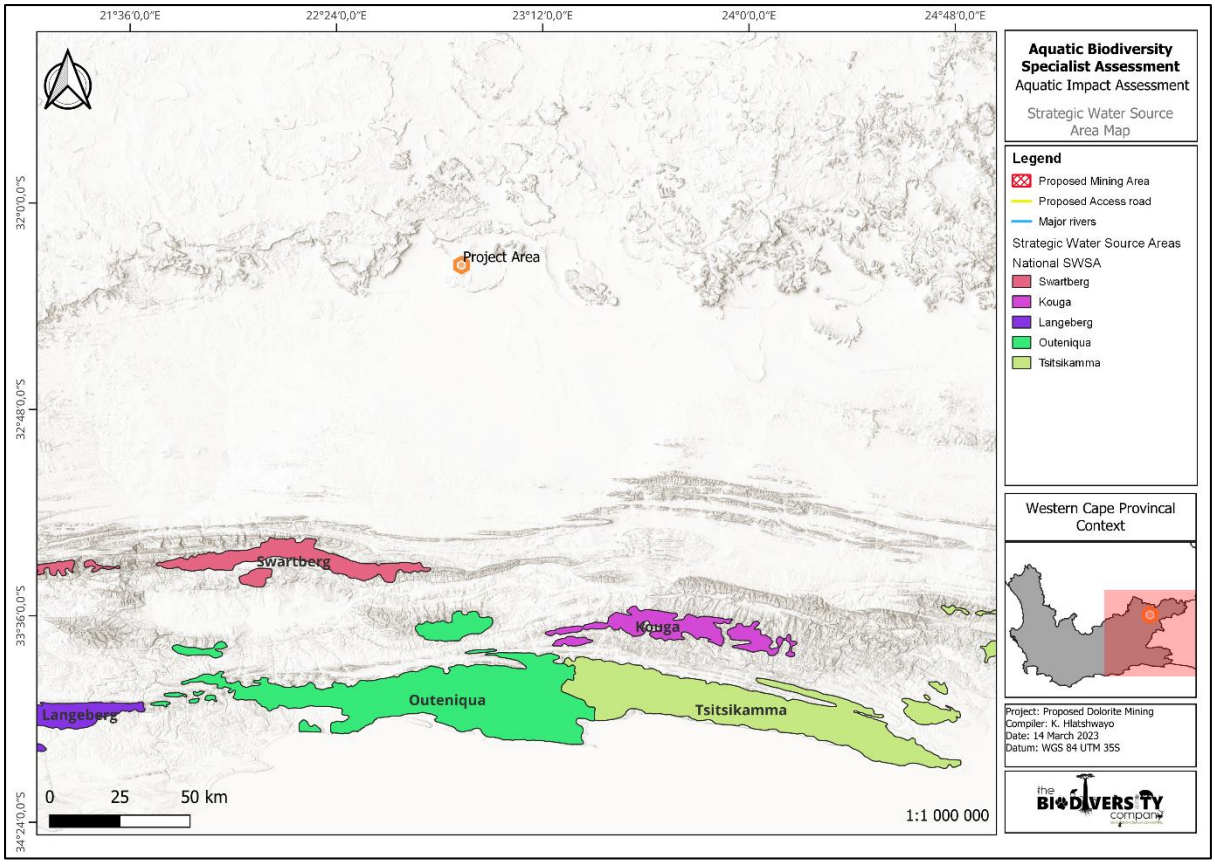


Figure 4-6 Map illustrating the Strategic Water Source Areas in relation to the project area.

4.2.2 Critical Biodiversity Areas and Ecological Support Areas

The Western Cape Biodiversity Spatial Plan (WCBSP) was updated in 2017. It classifies areas into Critical Biodiversity Area (CBA1), CBA2, Ecological Support Area (ESA1), ESA2, Other Natural Areas (ONA) and Protected Areas (PA). Figure 4-7 shows the various categories and what their main features are. Figure 4-8 shows that the development area overlaps with areas classified as:

- CBA1;
- CBA2 degraded;
- ESA1; and
- ONA.

MAP CATEGORY	DEFINITION	DESIRED MANAGEMENT OBJECTIVE	SUB-CATEGORY
Protected Area	Areas that are proclaimed as protected areas under national or provincial legislation.	Must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity. A benchmark for biodiversity.	n/a
Critical Biodiversity Area 1	Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.	Maintain in a natural or near-natural state, with no further loss of habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.	CBA: River CBA: Estuary CBA: Wetland CBA: Forest CBA: Terrestrial
Critical Biodiversity Area 2	Areas in a degraded or secondary condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.	Maintain in a functional, natural or near-natural state, with no further loss of natural habitat. These areas should be rehabilitated.	CBA: Degraded
Ecological Support Area 1	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services.	Maintain in a functional, near-natural state. Some habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.	ESA: Foredune ESA: Forest ESA: Climate Adaptation Corridor ESA: Coastal Resource Protection ESA: Endangered Ecosystem ESA: River ESA: Estuary ESA: Wetland ESA: Watercourse Protection ESA: Water Source Protection ESA: Water Recharge Protection
Ecological Support Area 2	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services.	Restore and/or manage to minimise impact on ecological infrastructure functioning, especially soil and water-related services.	ESA: Restore from NN
ONA: Natural to Near-Natural	Areas that have not been identified as a priority in the current systematic biodiversity plan, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.	Minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. Offers flexibility in permissible land uses, but some authorisation may still be required for high-impact land uses.	ONA: Natural to Near-Natural ONA: Degraded
No Natural Remaining	Areas that have been modified by human activity to the extent that they are no longer natural, and do not contribute to biodiversity targets. These areas may still provide limited biodiversity and ecological infrastructure functions, even if they are never prioritised for conservation action.	Manage in a biodiversity-sensitive manner, aiming to maximise ecological functionality. Offers the most flexibility regarding potential land uses, but some authorisation may still be required for high-impact land uses.	No Natural Remaining

Figure 4-7 Western Cape Biodiversity Spatial Plan categories (WCBSP, 2017)

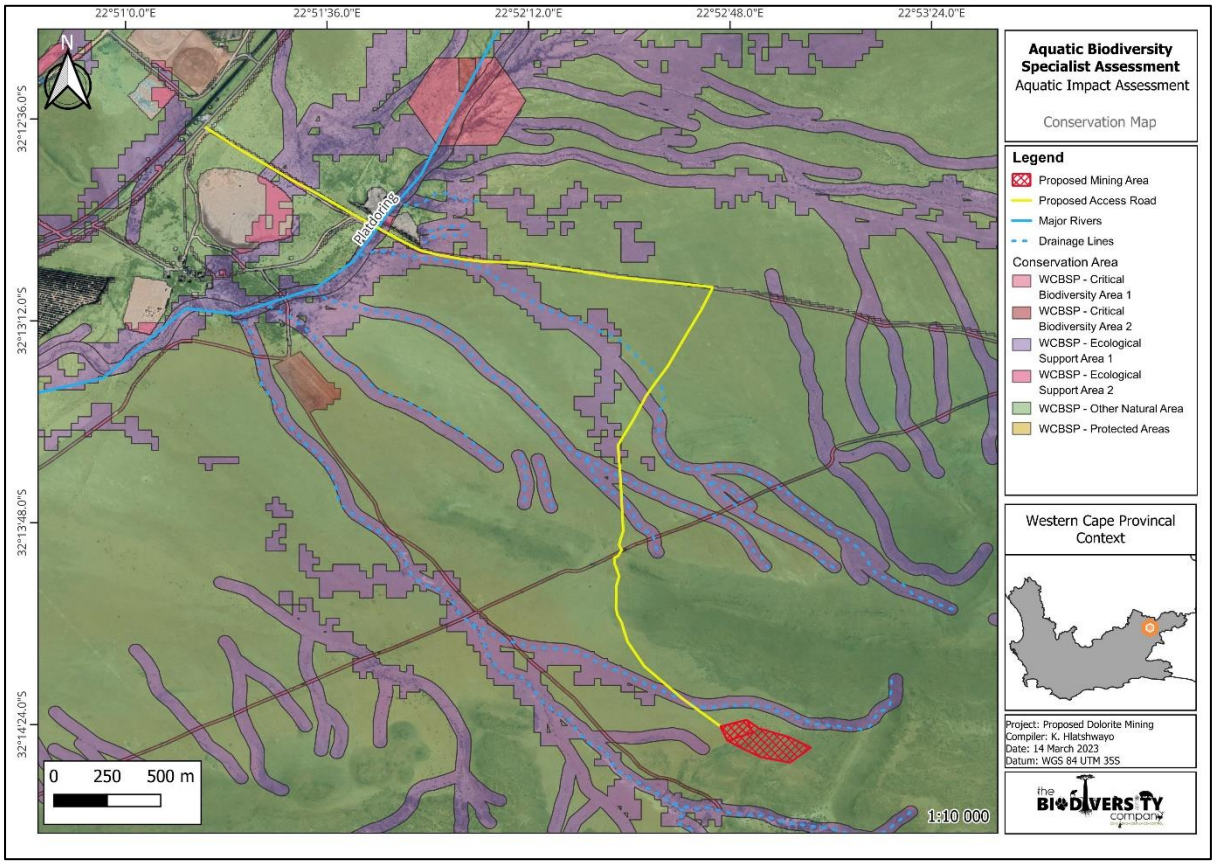


Figure 4-8 Map illustrating the conservation plan in relation to the project area.

4.2.3 National Freshwater Ecosystem Priority Areas

The layout of project area and National Freshwater Ecological Priority Area (NFEPA) are provided in Figure 4-9. The NFEPA database forms part of a comprehensive approach of the sustainable and equitable development of South Africa's scarce water resources. 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 Nel *et al.* (2011), the NFEPA status of the project area (proposed access road) is in proximity to an unclassified NFEPA wetland. 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).

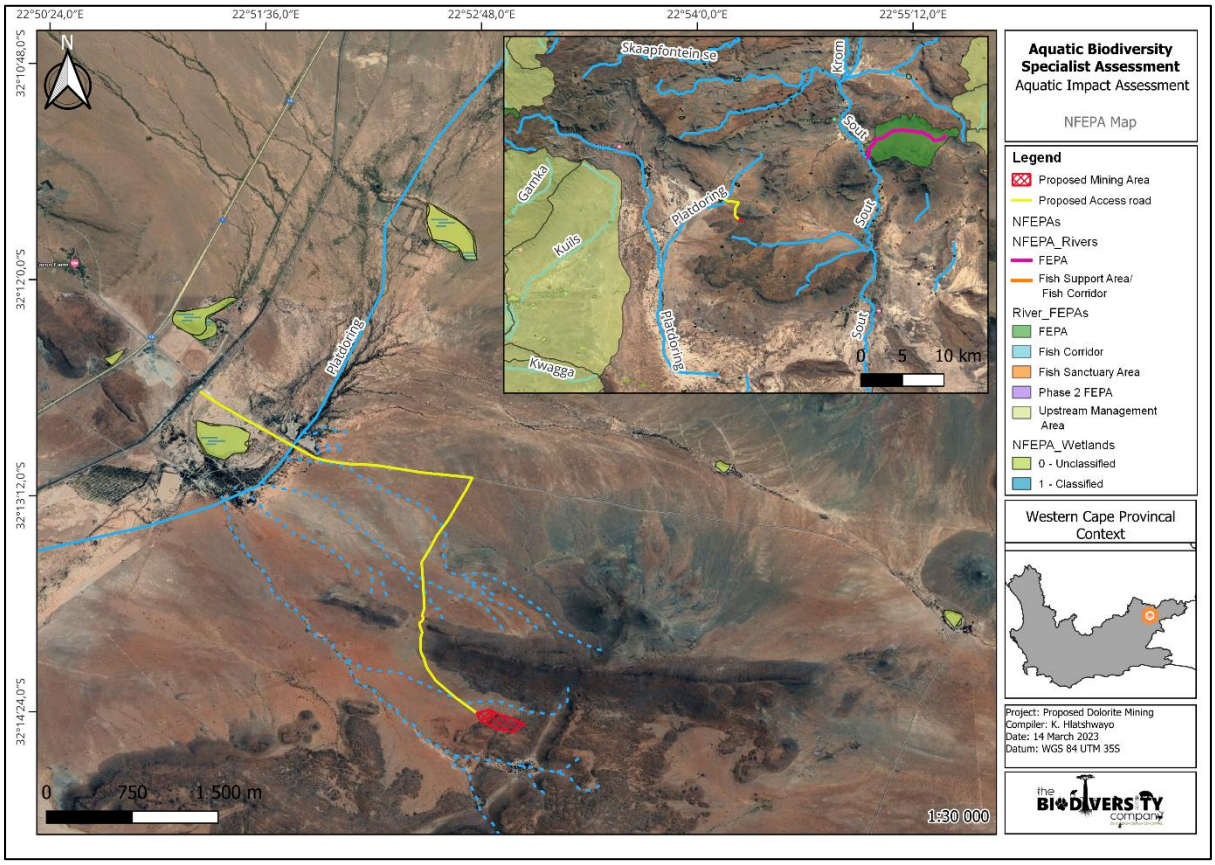


Figure 4-9 Illustration of NFEPAs and SAIIAE wetlands in relation to the project area.

4.2.4 National Wetland Map 5

The National Wetland Map 5 (NWM5) spatial data was published in October 2019 (Deventer *et al.* 2019), in collaboration with the South African National Biodiversity Institute (SANBI), with the specific aim of spatially representing the location, type and extent of wetlands in South Africa. The data represents a synthesis of a wide number of official watercourse data, including rivers, inland wetlands and estuaries. This database does not recognise the presence of any wetlands within the extent of the project area (Figure 4-10).

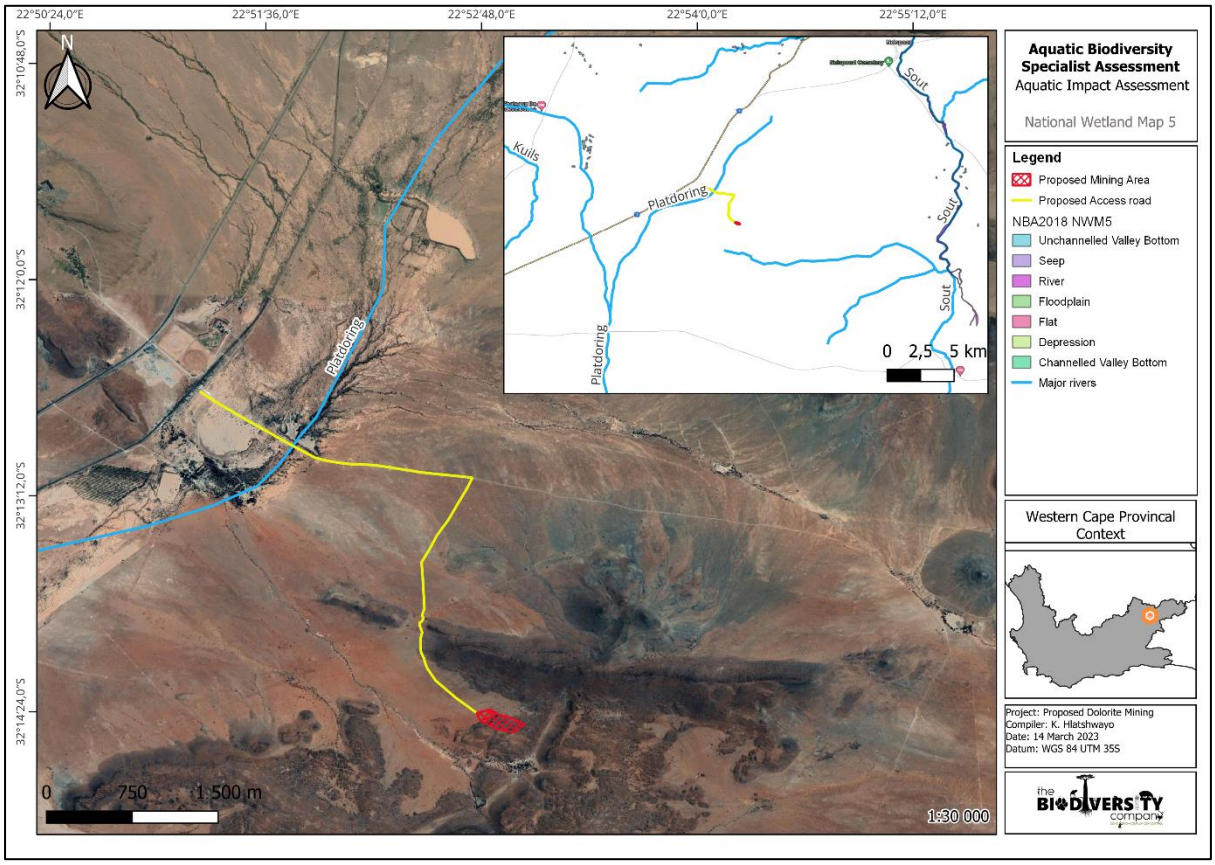


Figure 4-10 The project area in relation to the National Wetland Map version 5.

4.2.5 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 4-11).

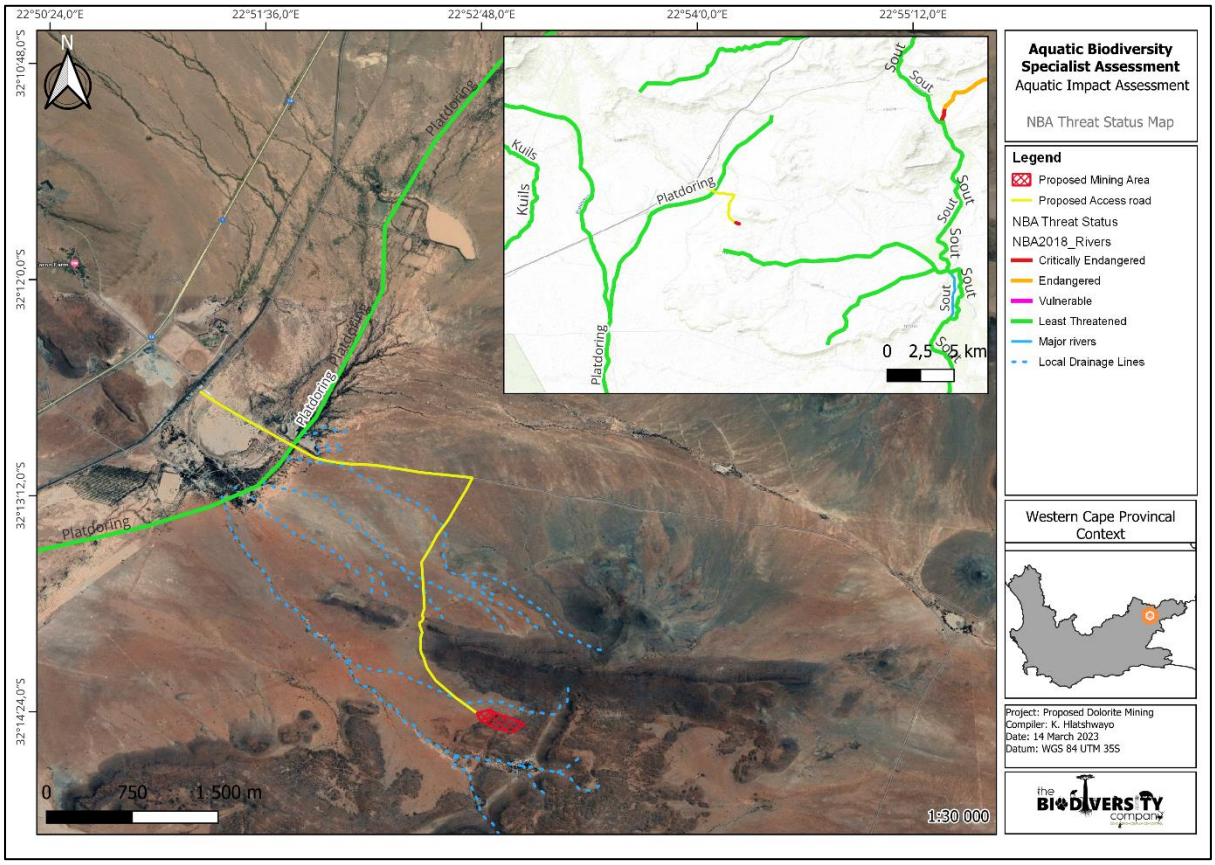


Figure 4-11 The project area in relation to the threat status of aquatic ecosystems, SAIIAE dataset (NBA, 2018).

4.2.6 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 4-12). According to the SAIIAE dataset, the project area and surrounding/proximal watercourses are drained by Poorly Protected system.

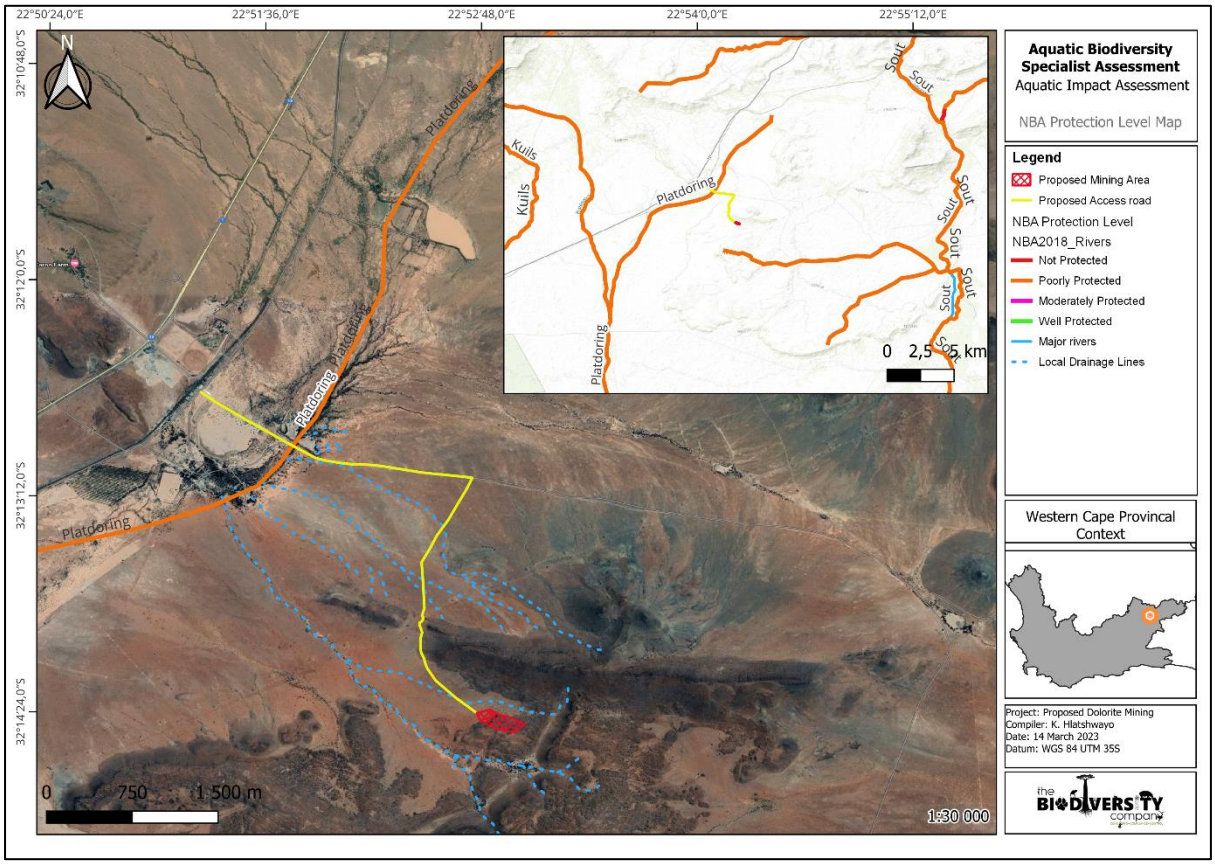


Figure 4-12 The project area in relation to the protection level of aquatic ecosystems, SAIIAE dataset (NBA, 2018). The project area in relation to Protected Areas in South Africa.

4.2.7 South African Protected and Conservation Areas

The South African Protected Areas Database (SAPAD) and the South Africa Conservation Areas Database (SACAD) contains spatial data critical for the conservation of South Africa's natural resources. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection, such as conservation areas. These databases are updated regularly and form the basis for the Register of Protected Areas, which is a legislative requirement under the National Environmental Management: Protected Areas Act (Act 57 of 2003). Formally protected areas are categorised according to several different types, and each type is subject to specific legislative restrictions and management guidelines, many of which restrict development to some degree. Generally, these areas are assigned a buffer of influence of between 5 and 10 km (the latter pertaining to National Parks and World Heritage Sites), within which certain laws and management actions may apply. Many of the protected area types are further classified into sub-types as well. Formally protected area types include National Parks, Nature Reserves, Special Nature Reserves, Mountain Catchment Areas, World Heritage Sites, Protected Environments, Forest Nature Reserves and Forest Wilderness Areas, Specially Protected Forest Areas and Marine Protected Areas. 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 4-13).

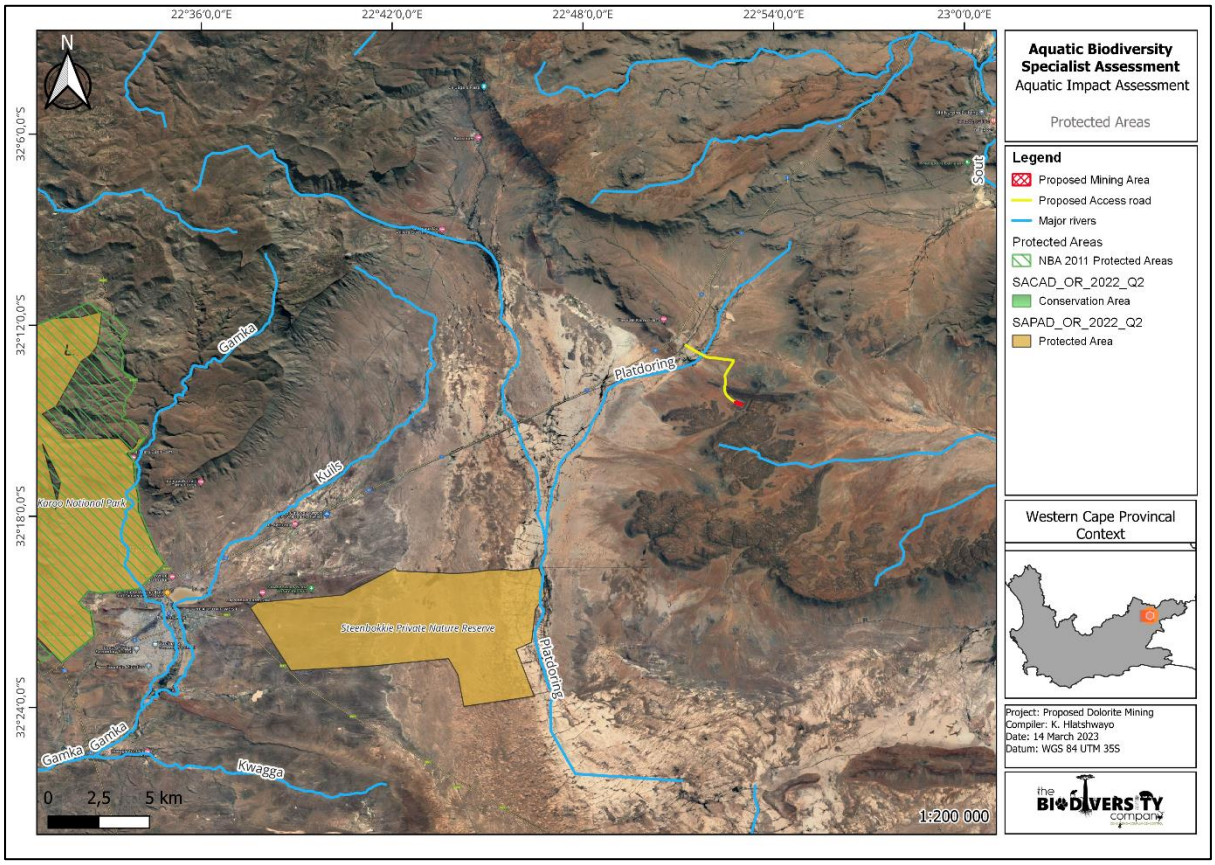


Figure 4-13 The project area in relation to Protected Areas in South Africa.

4.3 Investigation Sites

The aquatic sampling points, Global Positioning System (GPS) coordinates, and photographs are provided in Table 4-3 and Figure 4-14 below.

Table 4-3 Investigation site photographs and coordinates

Site	Upstream View	Downstream view
Platdoring River		
Site 1		
GPS- coordinates	32°12'55.94"S, 22°51'45.65"E	
Platdoring River tributaries		

Site	Upstream View	Downstream view
Site 2		
GPS- coordinates	32°13'22.57"S, 22°52'34.97"E	
Site 3		
GPS- coordinates	32°13'39.82"S, 22°52'28.42"E	
Site 4		
GPS- coordinates	32°13'44.36"S, 22°52'28.67"E	
Site 5		
GPS- coordinates	32°14'21.55"S, 22°52'42.49"E	
Site 6		
GPS- coordinates	32°14'24.39"S, 22°53'3.90"E	

Site	Upstream View	Downstream view
Site 7		
GPS- coordinates	32°14'38.23"S, 22°52'46.43"E	
Site 8		
GPS- coordinates	32°14'40.16"S, 22°52'51.31"E	
Site 9		
GPS- coordinates	32°14'33.06"S, 22°52'29.53"E	
Site 10		
GPS- coordinates	32°14'5.19"S, 22°52'0.30"E	
Site 11		
GPS- coordinates	32°12'41.70"S, 22°51'21.63"E	
Other Sites		

Site	Upstream View	Downstream view
Dam		
GPS- coordinates	32°12'54.12"S, 22°51'20.85"E	
Road Start		
GPS- coordinates	32°12'37.65"S, 22°51'14.45"E	
New Road Start		
GPS- coordinates	32°13'6.14"S, 22°52'44.80"E	
New Road End		
GPS- coordinates	32°13'34.41"S, 22°52'27.97"E	
Mid-Road		
GPS- coordinates	32°13'50.86"S, 22°52'28.44"E	

Site	Upstream View	Downstream view
Site Area		
		
GPS- coordinates	32°14'25.02"S, 22°52'49.37"E	

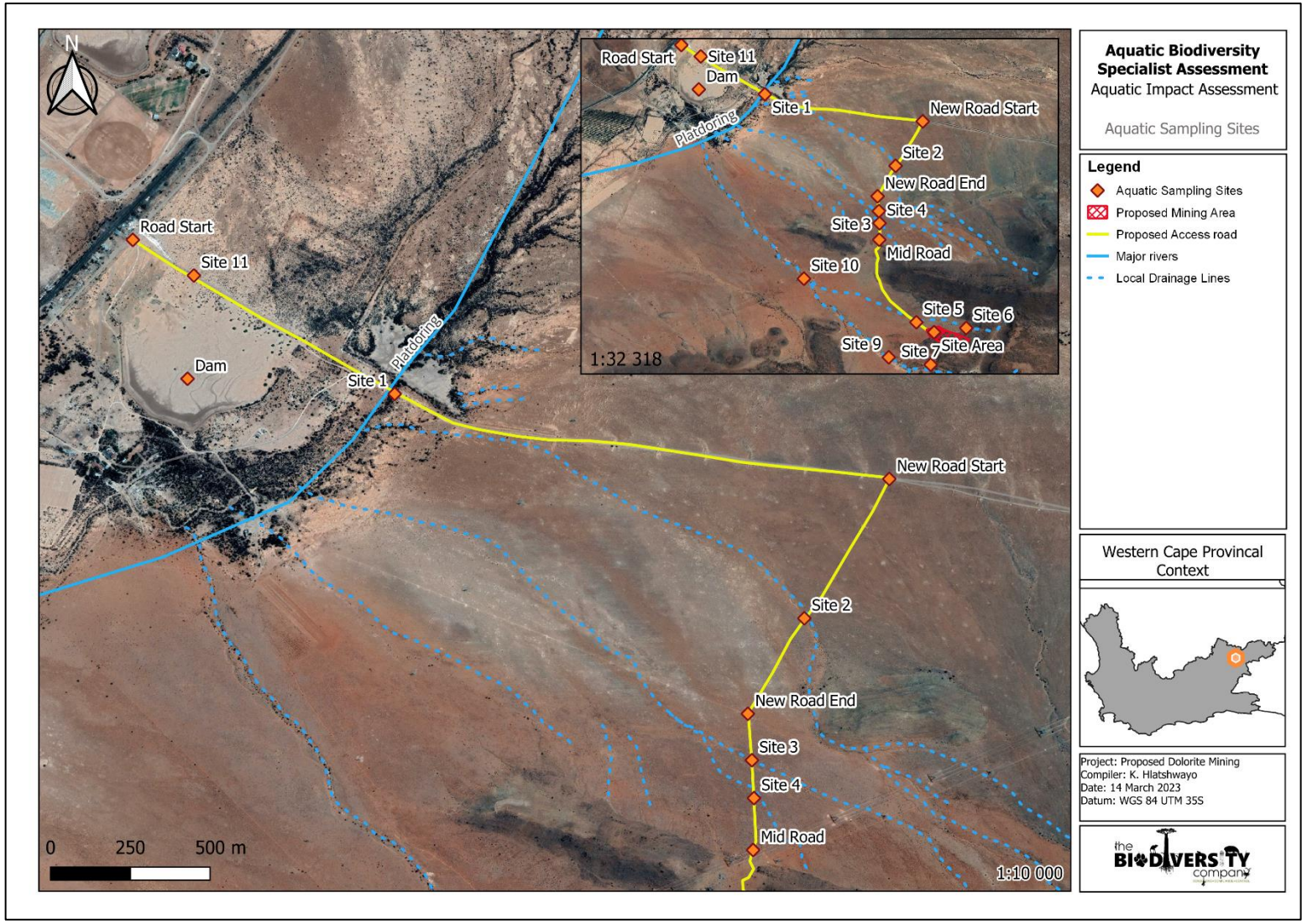


Figure 4-14 Location of the North-western aquatic sampling sites.

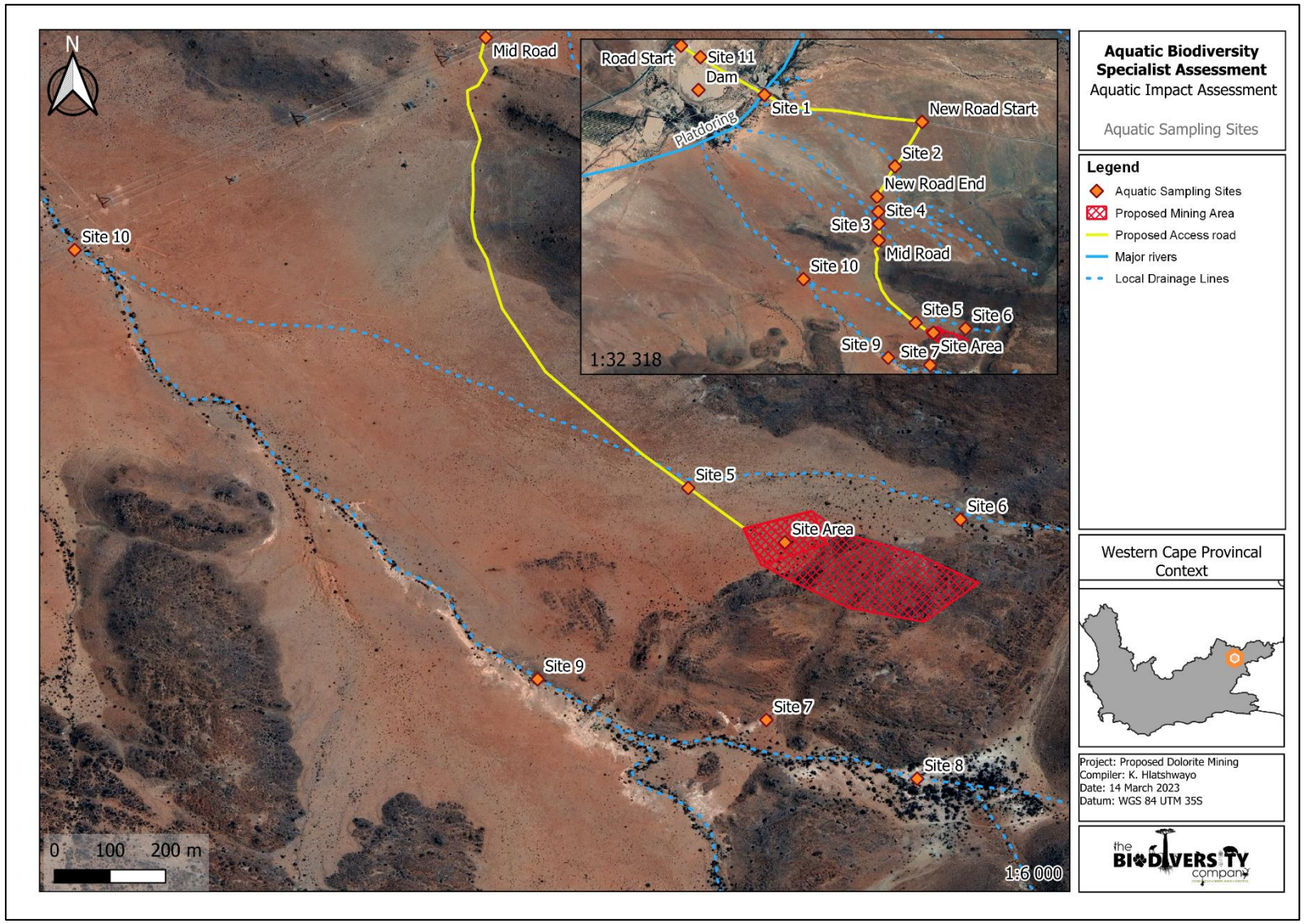


Figure 4-15 Location of the South-eastern aquatic sampling sites.

5. Methods

5.1 Aquatic Assessment and Survey

In line with the minimum requirements for aquatic biodiversity surveys a single aquatic sampling survey was conducted on the 7th of March 2023. The survey constituted a wet season/ high flow assessment.

5.1.1 *In-situ* 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), total dissolved solids (mg/l), temperature (°C) and Dissolved Oxygen (DO) in mg/l.

5.1.2 Aquatic Habitat Integrity

The Intermediate Habitat Assessment Index (IHIA) as described in the Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), 1999 were used to define the ecological status of the river reach. The IHIA makes use of data obtained at each site to compile a reach-based PES.

The IHIA model was used to assess the integrity of the habitats from a riparian and instream perspective. 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 that are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996). The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table 5-1 and Table 5-2

Table 5-1 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 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. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation 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.
Water quality modification	Originates from point and diffuse point sources. Measured directly or alternatively 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.
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic 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.
Solid waste disposal	A direct anthropogenic impact which may alter habitat structurally. Also, a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river. Refers to physical removal for farming, firewood and overgrazing.

Criterion	Relevance
Exotic vegetation encroachment	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 5-2 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

5.1.3 Integrated Habitat Assessment System

The quality of the instream and riparian habitat influences the structure and function of the aquatic community in a stream; therefore, the assessment of the habitat is critical to any assessment of ecological integrity. The Integrated Habitat Assessment System (IHAS, version 2) was applied at selected sampling sites in order to assess the availability of habitat biotopes for macroinvertebrates. The IHAS was developed specifically for use with the SASS5 index and rapid biological assessment protocols in South Africa (McMillan, 1998). The index considers sampling habitat and stream characteristics. The sampling habitat is broken down into three sub-sections namely Stones-In-Current (SIC), Vegetation (VEG), Gravel Sand & Mud (GSM) and other habitat/ general. It is presently thought that a total IHAS score of over 65% represents good habitat conditions, a score over 55% indicates adequate/fair habitat conditions and a score below 55% indicates poor habitat (McMillan, 1998) (Table 5-3).

Table 5-3 Integrated Habitat Assessment System Scoring Guidelines

IHAS Score	Description
> 65%	**Good (Diverse)**
55-65%	**Adequate (Moderately diverse)**
< 55%	**Poor (Low diversity)**

5.1.4 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 forms an integral part of the monitoring of the health of an aquatic ecosystem.

5.1.4.1 Macroinvertebrate Habitat

The macroinvertebrate habitat at each sampled site was assessed using the South African Scoring System version 5 (SASS5) biotope rating assessment. A rating system of 0 to 5 was applied, 0 being not available or absent, while 5 was abundant and diverse. The weightings for upper foothill rivers (slope class D) were used to categorize biotope ratings (Rowntree & Ziervogel, 1999; Rowntree *et al.,* 2000).

5.1.4.2 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 to family level (Fry, 2022; Thirion *et al.,* 1995; Dickens and Graham, 2002; Gerber and Gabriel, 2002). All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the Great Karoo – Lower Ecoregion (Table 5-4). 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. Where data was deficient, the Freshwater Biodiversity Information System (FBIS) was consulted (FBIS, 2022).

Table 5-4 The Great Karoo (Lower) Ecoregion, calculated using percentiles (Dallas, 2007).

Ecoregion 1	Combined Zone	RHP Site Code	n	Ref Site	Score	Min	Max	ASPT	Min	Max	No of Taxa	Min	Max
Great Karoo	Lower	E2GROO-DEMOD	2		125	108	142	6.3	6.2	6.4	20	17	23
Great Karoo	Lower	E2TANK-ELAND	3	Yes	38	13	75	4.7	3.6	6.5	9	2	18
Great Karoo	Lower	J1BUFF-LAINS	1		62			4.4			14		
Great Karoo	Lower	J2LEEU-N1ROA	1		90			4.5			20		
Great Karoo	Lower Total		7		74	13	142	5.1	3.6	6.5	14	2	23

5.1.5 Macroinvertebrate Response Assessment Index

Aquatic macroinvertebrate data collected during the high flow survey was applied to the Macroinvertebrate Response Assessment Index (MIRAI). Aquatic macroinvertebrate assemblages and communities offer a good understanding of the flow regime and water quality in a river. In addition, they form an essential component of the riverine ecosystem. Macroinvertebrates are important processors of transported organic matter in aquatic systems, perform vital functions in purifying the water and furthermore provide a food source for aquatic and terrestrial biota. Aquatic macroinvertebrate assemblages are guided by the physical-chemical tolerance of the individuals in the population to an array of environmental influences. The distribution pattern resulting from habitat selection by a given aquatic macroinvertebrate species reflects the optimal overlap between habit (mode of existence) and physical environmental conditions such as habitat and flows. Therefore, the often discontinuous distribution of aquatic macroinvertebrate populations is a result of interplay between habitat, habit and the availability of food resources.

The major components (drivers) of a stream system that determine productivity for aquatic organisms include:

- Flow regime,

- Physical habitat structure (e.g. channel form and substrate distribution), and
- Water quality (e.g. temperature, dissolved oxygen).

According to Thirion (2007), the determination of aquatic invertebrate EC is done by integrating the ecological requirements of the invertebrate taxa in a community or assemblage and their response to modified habitat conditions. These are based on:

- An interpretation of the environmental requirements, preferences and intolerances of invertebrate taxa constituting the natural assemblage in a particular river delineation, and their responses to changes in habitat conditions as brought about by changes in driver components.

Ecological categories for MIRAI are based on those presented in Table 5-5 .

5.1.6 Ichthyofauna Community

Fish may be sampled through electroshocking (Figure 5-1). Sampled fish were identified in the field and released at the point of capture, in order not to cross fish populations between sites and watercourses. Fish species were identified using the guide Freshwater Fishes of Southern Africa (Skelton, 2001). The identified fish species were compared to those expected to be present for the quaternary catchment. The expected fish species list for the project area was developed from a literature survey to compare to the sampled species at site. Different fish species represent different sensitivities to water chemistry, habitat and flow which considered as part of the Fish Response Assessment Index (FRAI) (Kleynhans *et al*., 2007 and Skelton 2001).

Figure 5-1 Example of electroshocking used to catch fish species.

5.1.7 Present Ecology Status Classification

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 5-5). For the purpose of this study, ecological classifications have been determined for biophysical attributes for the associated watercourses. 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 5-5 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.

5.2 Riparian Habitat Delineation

The riparian delineation was completed according to DWAF (2005; Figure 5-2). Typical riparian cross sections and structures are provided in Figure 5-2. Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. Contour data obtained from topography spatial data was also utilised to support the infield assessment.

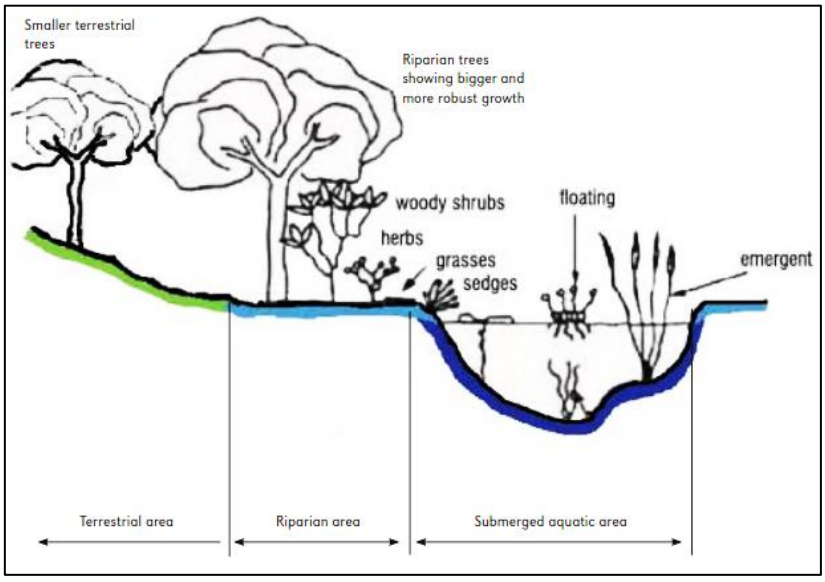


Figure 5-2 Riparian Habitat Delineations (DWAF, 2005).

5.3 Risk Assessment

The risk assessment will be completed in accordance with the requirements of the DWS General Authorisation in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 509 of 2016). The significance of the impact is calculated according to Table 5-6.

Table 5-6 Significance ratings matrix

Rating	Class	Management Description
1 – 55	Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	High Risk	Always involves wetlands. Watercourse(s)impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

5.4 Limitations and Assumptions

The following limitations are applicable for this project:

- It is assumed that all information received from the client is relevant and correct;
- The results of this study are largely based on the outcomes of a standardised rapid assessment and historic information for the catchment; and
- A single wet season aquatic ecological survey was completed for this assessment. Thus, temporal trends were not investigated.
- 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 IHIA assessment of the habitat present on site.
- There were no project area alternatives provided for this project when this document was completed.

6. Results

6.1 Intermediate Habitat Integrity Assessment

The condition of the watercourse 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 IHIA was completed for the assessed watercourse(s) and is presented below (Table 6-1).

Table 6-1 Results for the watercourse and catchment habitat integrity assessment.

Criterion	Impact Score	Weighted Score
Instream		
Water abstraction	5	2.8
Flow modification	12	6.2
Bed modification	13	6.8
Channel modification	10	5.2
Water quality	5	2.8
Inundation	5	2.0
Exotic macrophytes	0	0.0
Exotic fauna	0	0.0
Solid waste disposal	5	1.2
Total Instream Score		**73**
Instream Category		**C**
Riparian		
Indigenous vegetation removal	10	5.2
Exotic vegetation encroachment	5	2.4
Bank erosion	5	2.8
Channel modification	7	3.4
Water abstraction	5	2.6
Inundation	5	2.2
Flow modification	5	2.4
Water quality	0	0.0
Total Riparian Score		**79**
Riparian Category		**C**

The results of the IHIA for the Platdoring River and its tributaries indicates moderately modified instream and riparian conditions. 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 (Figure 6-1).

Figure 6-1 Illustration of instream impoundment within the Platdoring River (GoogleEarth, 2019)

6.2 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)

6.2.1 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).*

6.2.2 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*.

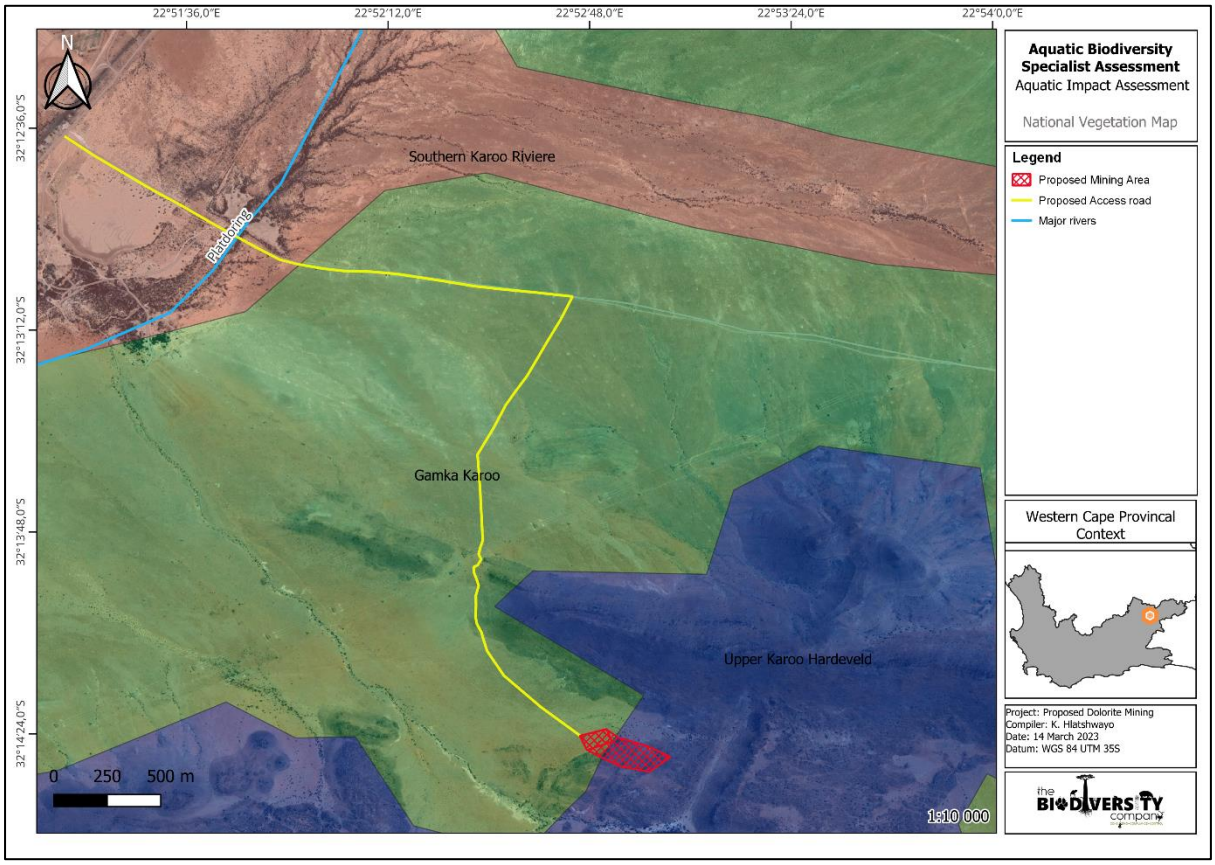


Figure 6-2 The study area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2018).

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 proposed grid connection, 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 buffer zone of 15 m and 30 m was determined (Table 6-2) 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 6-2 Post-mitigation buffer requirement

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

6.3 Environmental Screening Tool

The National Web-based Environmental Screening Tool has characterised the aquatic sensitivity of the project area (mining area) as "**Low**" (Figure 6-3), whilst "**Very High**" for the access route to the mining area. The desktop assessment and site visit agreed with both of these ratings. The reach (Platdoring River) is 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 adjacent to the project 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.

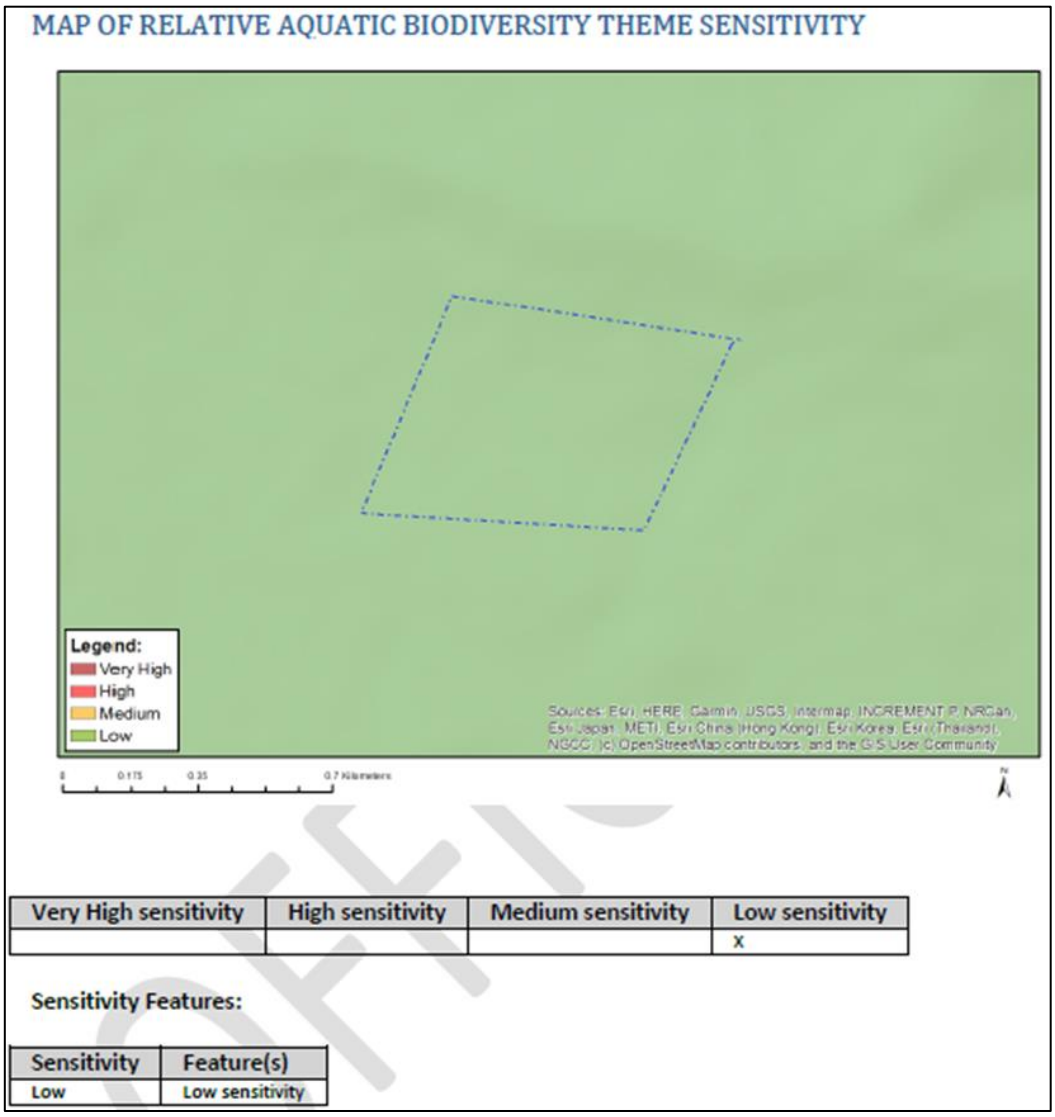
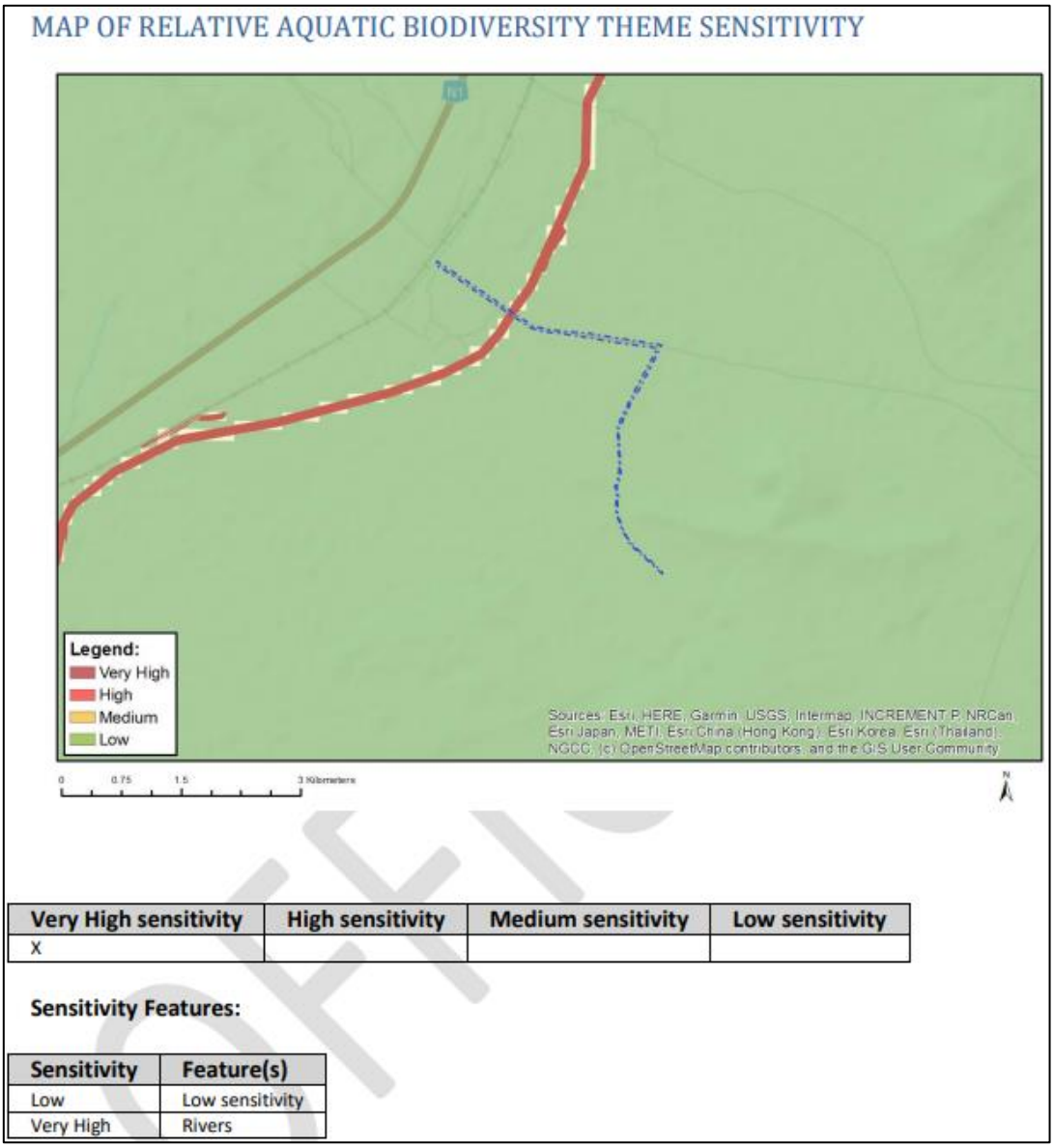


Figure 6-3 Sensitivity of aquatic biodiversity features for the project area.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Very High	Rivers

Figure 6-4 Sensitivity of aquatic biodiversity features for the project area.

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 road would need to be regularly inspected and maintained, so as to prevent erosion and run-off into the watercourse. This mitigation will reduce the potential impacts on the watercourse significantly. A DWS aspect and impact register/risk assessment was conducted as part of the Water Use authorisation and is presented in Section 7 below).

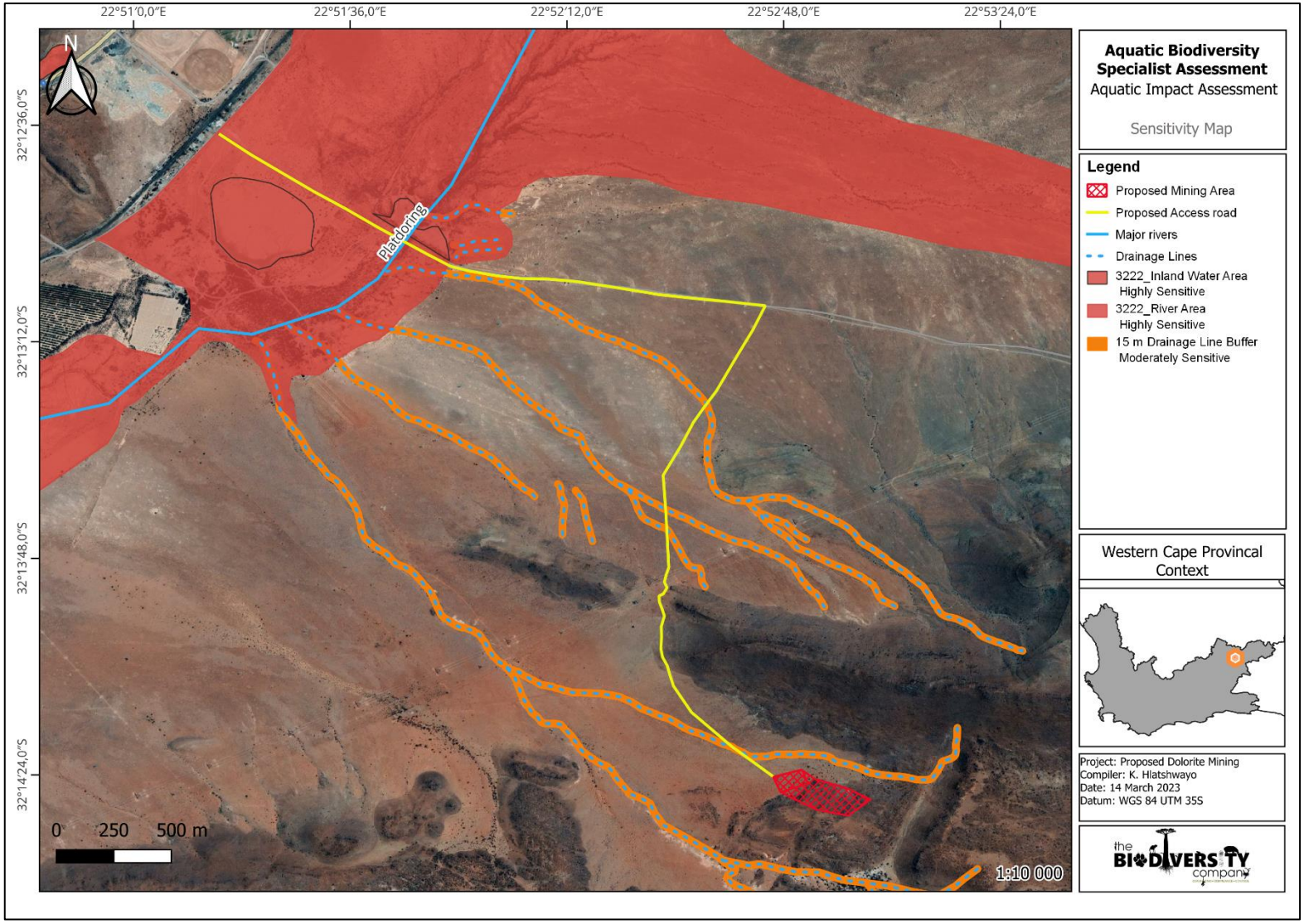


Figure 6-5 Map illustrating aquatic sensitivity areas associated with the project.

7. DWS Risk Assessment

The proposed access road intersects with more than 2 drainage lines and a river (albeit dry) which still necessitates a water use application in terms of Section 21 of the NWA, 1998. A Risk Matrix Assessment will be compiled for the access road and the mining area. The section below and associated tables serve to indicate and summarise the significance of perceived impacts on the aquatic ecology of the project area. Potential impacts were evaluated against the data captured during the desktop and field assessment to identify relevance to the project area. The relevant impacts associated with the proposed activity were then subjected to a prescribed impact assessment methodology to the DWS risk assessment methodology as presented in Table 5-6. Findings from the DWS aspect and impact register / risk assessment are provided in Table 7-1, Table 7-2 and Table 7-3.

7.1 Aquatic Impact Assessment

Anthropogenic activities drive habitat destruction causing displacement of aquatic and terrestrial fauna and flora and possibly direct mortality. Land clearing for development infrastructure (all inclusive) destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines and their associated riparian area, or other locally important features such as off channel wetlands. The removal of natural vegetation from these areas and their respective buffers will reduce the habitat available for fauna and may reduce ecological integrity and species diversity within the area depending on the intensity and footprint of clearing and destruction caused.

7.1.1 Anticipated Impacts

The impacts anticipated for the proposed project are considered in order to predict and quantify these impacts and assess and evaluate the magnitude on the identified aquatic biodiversity (Table 7-1). The following project related activities may have a negative effect on more sensitive biodiversity features, with most impacts involving the watercourses and their associated buffer areas.

As this project is for the access road (existing farm dirt roads were noted) and a new dolerite mining infrastructure, impacts associated with the area are potentially moderate to low. Modifications to the biotic integrity and instream and habitat of the watercourse are likely to occur during construction. The project will entail the cutting and reshaping of the riverbed and embankments for the proposed road upgrade. This has the potential to increase erosion and sedimentation of downstream habitats due to surface runoff during the wet season. Furthermore, due to the construction taking place within the watercourse, direct impacts to the instream, marginal and embankments are inevitable. These construction and operational phase disturbances could also result in further spread of alien vegetation which in turn would affect the functioning of the aquatic ecosystems.

Table 7-1 Potential risks posed by the Mining operations and access route.

Risk Assessment Completed by Khethokuhle Hlatshwayo (Pr.Sci.Nat. 124579)		
Activity	**Aspect**	**Combined Impact**
Construction Phase	Drainage patterns change due to road extent and crossings	• Loss of aquatic habitat • Erosion of watercourse. • Loss of indigenous vegetation • Exotic vegetation proliferation • Sedimentation of the watercourse.
	Clearing vegetation (outside riparian zone)	
	Clearing riparian vegetation	
	Construction of laydown yard	
	Stormwater management	
	Operation of machinery & equipment	
	Excavation of bed and banks	

	Installation of concrete base and low-level crossings	• Flow sediment equilibrium change
	Ablution and eating areas	• Water quality impairment
	Shaping & surfacing of road	• Flow modifications
	Establishment of alien vegetation	• Loss of biodiversity
	Soil and building material management and soil wash from working areas.	• Alteration of bed and banks
Operational Phase	Sedimentation and erosion	• Flow modifications
	Stormwater	• Water quality modifications/impairments
	Alien vegetation encroachment and proliferation	• Erosion
	Deep excavation, drilling and crushing	• Habitat modifications
	Hydrocarbon contamination	• Alteration of bed and banks
	Conducting road and crossings maintenance	
Decommissioning Phase	Dust Precipitation (From Backfilling)	
	Change in topography (From Backfilling)	
	Dust Precipitation (From Shaping/Contouring)	
	Change in topography (From Shaping/Contouring)	

7.1.1 Assessment of Risk Significance

The assessment of risk significance considers pre-mitigation as well as implemented post-mitigation scenarios. Mitigation measures must be implemented to negate potential impacts to water resources. This section represents the risk / impact assessment for the proposed activity.

The various risks anticipated for the different aspects and activities associated with the project were previously detailed above and the associated risk ratings are provided on the next page in Table 7-2 and Table 7-3. As per the Department of Environmental Affairs (2013) mitigation hierarchy (Figure 7-1), these risks should be minimised through the implementation of the various mitigation measures as outlined below. The mitigation actions required to lower the risk of the project related impacts are provided after the impact ratings section of this report.

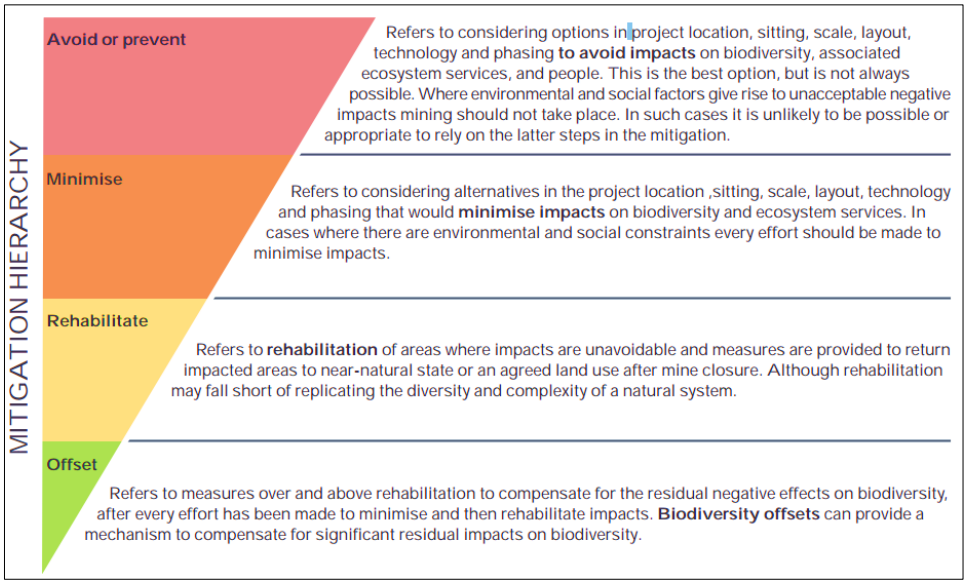


Figure 7-1 The mitigation hierarchy as described by the DEA (2013).

Table 7-2 DWS Risk Impact Matrix for the proposed project

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction phase								
Drainage patterns change due to road extent and crossings	1	3	3	4	2,8	1	2	5,8
Clearing vegetation (outside riparian zone)	2	2	4	3	2,8	2	2	6,8
Clearing riparian vegetation	4	4	5	5	4,5	1	4	9,5
Construction and mining of laydown yard	2	2	4	3	2,8	2	2	6,8
Stormwater management	3	3	3	2	2,8	2	2	6,8
Operation of machinery & equipment	2	3	3	3	2,8	3	2	7,8
Excavations in riparian area, bed and/or banks	5	5	5	5	5,0	1	2	8,0
Soil management and soil wash from working areas	2	3	3	3	2,8	1	2	5,8
Ablution and eating areas	1	2	1	1	1.25	2	2	5.25
Shaping & surfacing of road	2	1	3	2	2	2	2	6
Establishment of alien vegetation	3	3	4	3	3,3	3	3	9,3
Operation Phase								
Sedimentation and erosion	2	3	2	2	2,3	3	1	6,3
Stormwater	2	3	3	2	2,5	3	1	6,5
Deep Excavation, drilling and crushing	2	3	3	2	2,5	2	3	7,5
Alien vegetation encroachment and proliferation	3	3	4	3	3,3	3	3	9,3
Hydrocarbon contamination	1	5	2	4	3,0	3	1	7,0
Conducting road and crossings maintenance	1	2	2	1	1,5	1	4	6,5
Decommissioning Phase								
Dust Precipitation (From Backfilling)	3	3	2	3	2.75	3	2	7.75
Change in topography (From Backfilling)	3	2	2	2	2.25	2	2	6.25
Dust Precipitation (From Shaping/Contouring)	3	2	3	3	2.75	3	2	7.75
Change in topography (From Shaping/Contouring)	3	2	2	2	2.25	2	2	6.25

Table 7-3 DWS Risk Impact Matrix for the proposed project continued

Aspect	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Sig.	Without mitigation	With mitigation
Construction Phase								
Drainage patterns change due to road extent and crossings	4	4	1	2	11	63,25	Moderate	Low
Clearing vegetation (outside riparian zone)	3	3	1	2	9	60,75	Moderate	Low
Clearing riparian vegetation	4	4	5	2	15	142,5	Moderate	Low
Construction and mining of laydown yard	1	3	1	1	6	40,5	Low	Low
Stormwater management	3	4	1	1	9	60,75	Moderate	Low
Operation of machinery & equipment	5	4	1	1	11	85,25	Moderate	Low
Excavations in riparian area, bed and/or banks	5	4	5	1	15	120	Moderate	Low
Soil management and soil wash from working areas	3	3	1	1	8	46	Low	Low
Ablution and eating areas	3	2	1	2	8	42	Low	Low
Shaping & surfacing of road	1	2	1	1	5	30	Low	Low
Establishment of alien vegetation	4	3	5	1	13	120,25	Moderate	Low
Operation Phase								
Sedimentation and erosion	2	4	1	2	9	56,25	Moderate	Low
Stormwater	3	3	1	2	9	58,5	Moderate	Low
Deep Excavation, drilling and crushing	5	4	5	1	15	112,5	Moderate	Low
Alien vegetation encroachment and proliferation	4	3	5	1	13	120,25	Moderate	Low
Hydrocarbon contamination	1	2	5	2	10	70	Moderate	Low
Conducting road and crossings maintenance	3	2	5	1	11	71,5	Moderate	Low
Decommissioning Phase								
Dust Precipitation (From Backfilling)	2	2	1	3	8	62	Moderate*	Low
Change in topography (From Backfilling)	2	4	1	3	10	62,5	Moderate*	Low
Dust Precipitation (From Shaping/Contouring)	2	2	1	3	8	62	Moderate*	Low
Change in topography (From Shaping/Contouring)	2	4	1	3	10	62,5	Moderate*	Low

(*) denotes - In accordance with General Notice 509 "Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.

The proposed activities pose low to moderate 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 an existing roads and crossings, the implementation of mitigation measures will reduce the risks/impacts of Moderate-risk activities to Low if done effectively. If not done effectively, the construction 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.

Further impacts to the watercourse include sedimentation due to surface runoff from the surrounding area and compacted project area, which can be mitigated through implementation of a stormwater management plan prior to construction (e.g., the installation of berms and silt traps). Sensitive areas should be clearly demarcated by an appropriately qualified person, and these areas should be avoided by all unauthorised activities.

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 development can be expected due to hard surfaces, 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. Should this be adequately implemented, the risks to the system may be considered low.

7.1.2 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 7-4 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 7-4 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.

7.1.3 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 7-5).

Table 7-5 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	

7.2 Mitigation Measures

In light of the expected impacts associated with the project the following mitigation measures have been proposed to lower the intensity of the impacts on the ecological integrity of the watercourse catchment and its downslope watercourses features.

7.3 Mitigation Measure Objectives

Mitigation measures should aim to avoid or reduce potential negative impacts to air, water, land, ecology and humans, or to introduce positive aspects to the development/activity. The focus of mitigation measures should be to reduce the significance of potential impacts associated with the proposed activities, and thereby to:

- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community (including the riparian area);
- Prevent the loss of the faunal community (including potentially occurring species of conservation concern) associated with these vegetation communities; and
- Limiting the construction area to the defined project areas and only impacting those areas where it is unavoidable to do so otherwise.

7.3.1 Construction of the 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.

7.3.2 Access Road Mitigation

- To minimise the impact on both surface water flow and interflow, portions of the road must include a coarse rock layer that has been specifically incorporated to increase the porosity and permeability of the sub-layers of the road;
- The footprint area of the road should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
- All construction activities and access must make use of the existing dirt road;
- Exposed road surfaces awaiting resurfacing must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion of the road;
- Silt traps and fences must be placed in the preferential flow paths along the road to prevent sedimentation of the watercourse;
- Temporary storm water channels should be filled with aggregate and/or logs (branches included) to dissipate flows;
- 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; and
- The design of the road must make allowances for stormwater management.

7.3.3 Erosion & Sedimentation

The following water quality specific mitigation measures are provided:

- 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.

7.3.4 Alien Vegetation Establishment

The following alien vegetation establishment specific mitigation measures are provided:

- Quarterly vegetation rehabilitation surveys need to be conducted of the vegetation within the project footprint; and
- An alien invasive plant management plan needs to be compiled and implemented prior to construction to control and prevent the spread of invasive aliens. This is particularly applicable for the area beyond the perimeter fence at the discharge area, as access through the access gate was limited by dense alien vegetation that has not been maintained. Subsequently the monitoring of the discharge point and associated infrastructure cannot be conducted.

7.3.5 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.

7.4 Recommendations

The following are recommendations made in support of the water resource assessment:

- A stormwater management plan must be incorporated for the quarry operation (including pollution control facilities, attenuation ponds, separation of clean and dirty water etc.);
- A competent Environmental Control Officer (ECO) must oversee the construction, operational and rehabilitation phase of the project, with watercourse areas as a priority; and
- 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.

8. Conclusion

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 although this was 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 IHIA for the Platdoring River and its tributaries indicated moderately modified instream and riparian conditions. Instream habitat was considered largely intact, however, several impacts were observed on site and from aerial imagery.

The National Web-based Environmental Screening Tool has characterised the aquatic sensitivity of the project area (mining area) as "**Low**", whilst "**Very High**" for the access route to the mining area. The desktop assessment and site visit agreed with both of these ratings. The reach (Platdoring River) is susceptible to further impacts, particularly on water quality and physical disturbances to instream and riparian habitat. The proposed activities pose low to moderate 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 will reduce the risks/impacts of Moderate-risk activities to Low if done effectively. If not done effectively, the construction will not reduce the risks of aspects/activities such as clearing riparian areas, deep excavation when mining, 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.

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 agrees with the "**Low**" rating for the mining area and the "**Very High**" for the access route to the mining area aquatic theme sensitivity as per the National Web based Environmental Screening Tool. 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.
- There is no FEPA river and FEPA area within to the project area. However, the project area (proposed access road) is in proximity to an unclassified NFEPA wetland.

- The project area is located along a Least Threatened and Poorly Protected watercourse (Platdoring River).
- 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 risks during the construction, operational and decommissioning phases. However, all moderate risks can be reduced to low with the application of adequate mitigation measures and recommendations ascribed in this report. It is therefore the specialist's opinion that the project may continue as proposed and as the proposed access road will cross the Platdoring River and several drainage lines, a full water use authorisation application process is required and must adhere to the stipulations or directives that may arise consequently.

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10. Declaration

I, Khethokuhle Hlatshwayo, declare that:

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

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Khethokuhle Hlatshwayo

Aquatic Ecologist

The Biodiversity Company

17 March 2023

- End of report -