AQUATIC BIODIVERSITY AND IMPACT ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF PORTION 243 ROODEKRANS

October 2024

Report – Final

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ENVIRONMENTAL SUSTAINABILITY

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EXECUTIVE SUMMARY

BioBlue Environmental Sustainability (Pty) Ltd (BioBlue) an independent ecological specialist company based in Pretoria, Gauteng, was appointed by Tutam Properties 143 CC (hereafter refer to as client) to conduct an aquatic biodiversity assessment and to evaluate the impacts that the proposed township development might have on the Muldersdrift se loop a tributary of the Crocodile River. This study intends to support the EIA Application and Water Use Licence Application (WULA).

The objective is to summarise the findings of the survey that was conducted at the sampling sites, adjacent to the proposed residential development, near the tributary of the Muldersdrift se loop.

The study area is located within Roodepoort approximately 1 km to the Southeast of the Cradle stone mall, Mogale City local municipality. The study area is situated in the quaternary catchment A21E and falls within the Limpopo Water Management Area (WMA 3), and the Highveld Ecoregion.

Table 0-1-1: Summary of the Desktop Results

Quaternary Catchment Area	A21E
Water Management Area (WMA)	Limpopo (WMA 3)
Ecoregion	Highveld – 11.03
Applicable River(s)/Stream	Muldersdrift ser Loop
Impacts observed at the study area	The stream is situated in an urbanised area, surrounded by industrial zones and informal settlements

The Present Ecological State (PES) of the Muldersdrift se loop was determined, by assessing the conditions in terms of the instream and riparian habitat, water quality and macro-invertebrate community, adjacent to the proposed township development. FRAI indices are exclusive to riverine systems, and it is not applicable in wetlands, impoundments, estuaries, and other lentic habitats. Therefore, these indices could not be used during the current aquatic assessment. The objectives are to evaluate any possible impacts that proposed township development may have on this aquatic ecosystem. A site visit was conducted on the 5th of August 2024.

The main findings of this report have been summarised below:

- The Index of Habitat Integrity Assessment (IHIA) results indicate that both the sites on Muldersdrift se loop is **Largely Modified (D Category)**.
- Most of the water quality constituents did not meet the recommended guidelines. However, the site on the Muldersdrift se loop have high concentrations of nitrites.

- The SASS 5 results indicated that the site had seriously modified ecological Conditions **(E Category)** due to low species diversity and was classed as a **poor-quality**, indicative of eutrophic condition.

Table 0-1-2: Summary of the Aquatic Biodiversity Results

Sites Assessed	Variables	Units of Measure	Roodekrans	TWQR
Water Quality Results	pH	pH Units	8.13	6.5 – 9.0[A]
	Electrical Conductivity	mS/m	19.5	<70[D]
	Total Suspended Solids	mg/ℓ	74	<15[RQO]
	Nitrate	mg/ℓ	1.8	<0.5[A]
	Total oxidised nitrogen	mg/ℓ	1,8	<2[R]
	Orthophosphate	mg/ℓ	0.345	<0.058[R]
	COD	mg/ℓ	56	<20[D]
	Turbidity	NTU	24.3	1,69 [R]
	E.coli	CFU/100ml	50	<100[I]
	Faecal Coliforms	CFU/100ml	55	<110
	Total Coliforms	CFU/100ml	450	<120
Biomonitoring Results	IHIA		**D**	
	IHAS		**Very Good**	
	SASS Score		**94**	
	No of Taxa		**19**	
	ASPT		**5,0**	
	SASS EC		**E**	
Overall	PES		**E**	

*Results in red is higher than the TWQR

The overall Ecostatus of the Muldersdrift se loop is **Seriously Modified (Category E)** and indicates that a loss and change of natural habitat and biota have occurred.

Based on the results of the Department of Water Affaires (DWS) Risk Assessment, a General Authorization (GA) is allowed with the correct mitigation for the proposed township development in line with Notice 4167 of December 2024, which was drafted in accordance with Section 21 of the National Water Act No. 36 of 1998.

The following recommendations are based on the findings:

- Maintain a 32m buffer along the tributary of the Muldersdrift se loop and riparian vegetation. No construction activities should occur within these buffers except where there is already existing infrastructure.
    - The establishment of stormwater infrastructure and the proposed attenuation pond is allowed within the 32m buffer zone.

- The exceeding nutrient levels should continue to be monitored over time to see if it increases and it must be managed accordingly.
- Conduct aquatic monitoring in this system (specifically in the wet season), during and after construction. Water quality sampling and diatoms sampling should be included during the watercourse monitoring. This will lead to good management and intervention practices when and where required.
- An Extensive alien invasive management plan should be compiled and implemented.
- An Extensive stormwater management plan should be compiled and implemented.
- Access to the riparian area should be restricted except to managing alien invasive species.
- Construction run off, and sediment controls should be implemented
- All mitigation measures should be followed.

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Abbreviations	
ASPT	Average Score Per Taxon
BSP	Biodiversity Sector Plan
CBA	Critical Biodiversity Area
COD	Chemical Oxygen Demand
DS	Downstream
DWS	Department of Water and Sanitation
EC	Ecological Category
EI	Ecological Importance
ES	Ecological Sensitivity
ESA	Ecological Support Area
GSM	Gravel, Sand and Mud
IHAS	Integrated Habitat Assessment System
IHIA	Index of Habitat Integrity Assessment
EMPr	Environmental Management Programme
EPL	Ecosystem Protection level
mamsl	metres above mean sea level
MIRAI	Macroinvertebrate Response Assessment Index
mg/l	Milligrams/Litre
MP	Moderately Protected
mS/m	Millisiemens/meter
NBA	National Biodiversity Assessment
NWA	National Water Act, 1998 (Act 36 of 1998)
ONA	Other Natural Areas
PA	Protected Areas
PES	Present Ecological State
PP	Poorly Protected
PSDF	Provincial Special Development Framework
QDS	Quarter Degree Square
REC	Recommended Ecological Class
RHP	River Health Programme
RQO	Resource Quality Objectives
SASS5	South African Scoring System Version 5
SQR	Sub Quaternary Reaches
SCC	Species of Conservation Concern
TWQR	Target Water Quality Range
TDS	Total Dissolved Solids
WMA	Water Management Area
WULA	Water Use License Application
WUL	Water Use License

Definitions	
Anthropogenic	Human activities with the potential to disrupt and modify associated aquatic conditions
Alluvial System	An alluvial system is a landform produced when a stream or river, that is, some channelised flow slows down and deposits sediment that was transported either as bedload or in suspension.
Aquatic Ecosystems	Aquatic ecosystems are defined as the abiotic (physical and chemical) and biotic components, habitats and ecological processes contained within rivers and their riparian zones, reservoirs, lakes, and wetlands and their fringing vegetation.
Aquatic Biomonitoring	Aquatic biomonitoring is the science of inferring the ecological condition of rivers and streams by examining the types of organisms that live there, such as invertebrates, algae, aquatic and non-aquatic vegetation, fish, or amphibians. The method is based on the principle that different aquatic organisms have different tolerances to pollutants, and that certain organisms will appear under conditions of pollution, while others will disappear. The assessment of biota in freshwater ecosystems is a widely recognised means of determining the condition, or 'health' of the ecosystem.
Benthic	Relating to or characteristic of the bottom of a water body, or the animals and plants that live there.
Biota	The animal and plant life of a particular region, habitat, or geological period.
Critical Biodiversity Areas	CBAs are areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and healthy functioning of important species and ecosystems and the delivery of ecosystem services. Thus, if these areas are not maintained in a natural or near natural state then provincial biodiversity targets cannot be met.
Ecological Support Areas	ESAs are areas that are not essential for meeting biodiversity representation targets but play an important role in supporting the ecological functioning of ecosystems as well as adjacent Critical Biodiversity Areas, and/or in delivering ecosystem services that support socio-economic development.
Ecoregions	Regions that share similar ecological characteristics and are based on the understanding that ecosystems and their biota display regional patterns that mirror causal factors such as climate, soils, geology, physical land surface, and vegetation.
Ecostatus	The totality of the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. Therefore, the Ecostatus represents an ecologically integrated state representing the drivers (hydrology, geomorphology, physico-chemical) and responses (fish, aquatic invertebrates, and riparian vegetation).
Macro-invertebrates	The Invertebrates include all animals without backbones. In rivers, this includes aquatic insects, larvae of insects with terrestrial (often flying) adult forms, as well as mussels, clams, snails, and worms that are aquatic throughout their life cycle.
Macrophytic vegetation	Vegetation that grows in or near water and is either emergent, submergent, or floating. Macrophytes provide cover for fish, substrate for aquatic invertebrates, produce oxygen and act as food for some fish and wildlife.
River	A linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water
Riparian	Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with composition and physical structure distinct from those of adjacent land areas.
Spruit	A small tributary stream or watercourse that is usually nonperennial.

Definitions	
Species of Conservation Concern (SCC)	Species that has a high conservation importance in terms of preserving South Africa's rich biodiversity.
Vegetation	Plants of an area or region.
Wetlands	The land, which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils.

DOCUMENT GUIDE

The Table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice ("GN") 320, as promulgated in Government Gazette 43110 of 20 March 2020, in line with the Department of Water and Sanitation ("DWS") screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"). This protocol replaces the requirements of Appendix 6 of the Environmental Impact Assessment Regulations.

No.	Requirements	Report Section
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Cover page ii and Appendix F.
2.2	Description of the preferred development site, including the following aspects -	
2.2.1	a) Aquatic ecosystem type b) Presence of aquatic species and composition of aquatic species communities, their habitat, distribution, and movement patterns	Section 3 & 5
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified.	Section 3 & 5
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e., is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status.	Section 3
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g., movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian, and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater).	Section 3
2.3	Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification.	N/A
2.4	Assessment of impacts – a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 6
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 6
2.4.2	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: 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. Change in the sediment regime (e.g., sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment;	Section 6

No.	Requirements	Report Section
	c. The extent of the modification in relation to the overall aquatic ecosystem (i.e., at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.) and d. Assessment of the risks associated with water use/s and related activities	
2.4.3	How will the 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?	Section 6
2.4.4	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems)	N/A
3	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Cover Page, ii & Annexure F
3.2	A signed statement of independence by the specialist.	Annexure E
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 3 & 5
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant	Section 4 & Annexure A
3.5	A description of the assumptions made any uncertainties or gaps in knowledge or data.	Section 1
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 3
3.7	Additional environmental impacts expected from the proposed development.	Section 6
3.8	Any direct, indirect, and cumulative impacts of the proposed development on site.	Section 6
3.9	The degree to which impacts and risks can be mitigated.	Section 6
3.10	The degree to which impacts and risks can be reversed.	Section 6
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 6
3.12	Suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	N/A
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 6
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a "low" aquatic biodiversity and sensitivity and that were not considered appropriate.	N/A
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	N/A
3.16	Any conditions to which this statement is subjected.	Section 1

1 INTRODUCTION

1.1 PROJECT BACKGROUND

BioBlue Environmental Sustainability (Pty) Ltd (BioBlue) was appointed by Tutam Properties 143 CC (hereafter referred to as Client) to undertake an aquatic biodiversity assessment and to evaluate the impacts that the proposed Township development might have on the Muldersdrift se Loop, a tributary of the Crocodile River.

The study area is located within Roodepoort approximately 1 km to the Southeast of the Cradle stone mall, Mogale City local municipality, in Gauteng (Figure 1-1). The study area is situated in the quaternary catchment A21E and falls within the Limpopo Water Management Area (WMA 1), and the Highveld Ecoregion.

A desktop and field survey assessment were conducted during August 2024. The survey period therefore reflects a dry, winter season survey. Furthermore, the desktop assessment and field survey both involved the detection, identification and description of any locally relevant sensitive receptors and habitats, and the manner in which these sensitive features may be affected by the proposed residential development.

The desktop and baseline aquatic biodiversity 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) and GN 1150 (30 October 2020) in terms of NEMA, dated 20 March and 30 October 2020: "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation" (Reporting Criteria). This assessment intends to support the Basic Assessment (BA) and General Authorisation Application (GA).

1.2 TERMS OF REFERENCE

The aim of the assessment was to assess the current aquatic biodiversity of the freshwater systems and to evaluate the impacts that the proposed Township Development might have on the Muldersdrift se loop a tributary of the Crocodile River (SQR A21E 01162).

In order to achieve this the following will be conducted:

- Determine the Present Ecological State (PES) of the watercourses;
- DWS Risk assessment, mitigation, and recommendations to prevent and/or reduce the current impacts.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- It is assumed that all information received from the client is accurate and up to date;
- All datasets accessed and utilised for this assessment are considered to be representative of the most recent and suitable data for the intended purposes;
- The assessment area was based on the footprint areas as provided by the client, and any alterations to the area and/or missing GIS information pertaining to the assessment area would have affected the area surveyed and hence the results of this assessment;
- Only a single winter season survey was conducted, and thus this assessment does not consider temporal trends. However, the data collected is considered sufficient to derive a meaningful baseline assessment;
- The site visit was conducted during the late dry season, and this means that certain flora and fauna would not have been present or observable due to seasonal constraints;
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features may be offset by up to 5 m.
- The PES of the tributary of the tributary of Muldersdrift se loop a tributary of the Crocodile River (SQR A21E 01162) was determined by assessing the instream and riparian habitat, water quality and the macro-invertebrate community integrities. The sampling site occurs within a perennial stream.

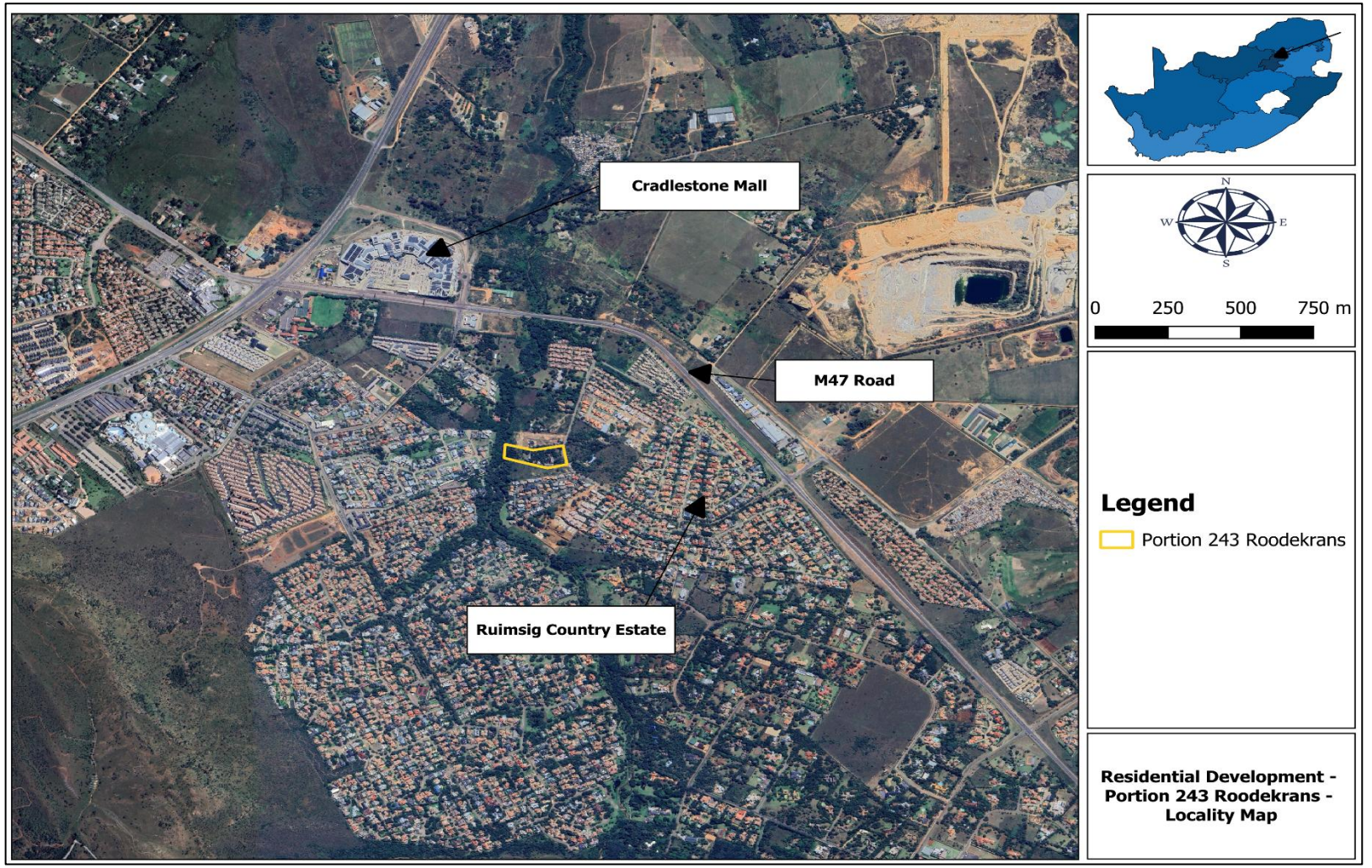


Figure 1-1: General Locality Map of the Study Area

2 LEGISLATIVE REQUIREMENTS

The legislation, policies and guidelines listed below are applicable to the current assessment in terms of biodiversity and ecological support systems. The list below, although extensive, is not exhaustive and other legislation, policies and guidelines may apply in addition to those listed below (Table 2-1).

Table 2-1: A list of the key legislative requirements relevant to this study in KwaZulu-Natal

Region	**Site**
National	Constitution of the Republic of South Africa (Act No. 108 of 2006)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
	The National Environmental Management Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management Biodiversity Act (Act No. 10 of 2004)
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989) and associated EIA Regulations
	National Water Act (NWA, 1998)
	National Protected Areas Expansion Strategy (NPAES)
	Environmental Conservation Act (Act No. 73 of 1983)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Strategy and Action Plan (NBSAP, 2015)
	National Biodiversity Framework (NBF, 2009)
	National Water Resource Strategy (NWRS2), 2013
	Policy for the Preservation and Development of Agricultural Land (2016)
	Municipal Systems Act (Act No. 32 of 2000)
Provincial	Gauteng Provincial Spatial Development Framework
	Gauteng Conservational Plan (C-Plan) Version 3.3

3 STUDY AREA

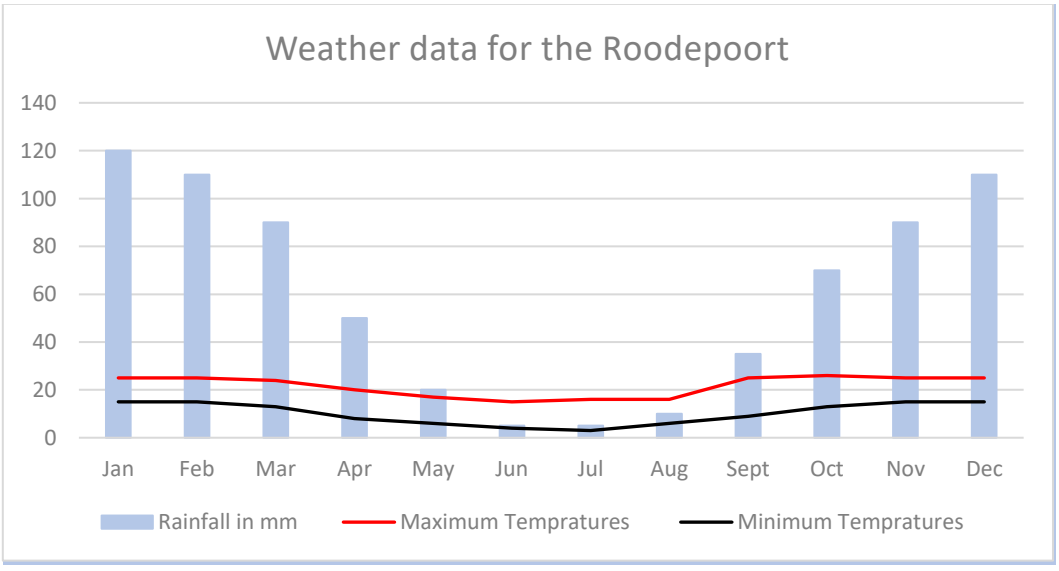
A brief description of the location and biophysical characteristics of the study area, that are relevant to the current assessment, are provided below.

3.1 ECOREGION AND TOPOGRAPHY

The study area is located within Quarter Degree Square (QDS) 2627BB and Highveld Ecoregion 11.03. The Highveld ecoregion is primarily defined by its expansive plateau landscape, characterized by rolling plains and gentle undulations, with altitudes ranging from 1,200 to 1,800 meters above mean sea level (mamsl). The region is less mountainous compared to surrounding areas, though small hills and ridges punctuate the landscape. This ecoregion features a predominance of temperate grassland, with dominant vegetation types including Dry Highveld Grassland and Moist Highveld Grassland. Major rivers, such as the Vaal and Crocodile, traverse the Highveld, playing a vital role in the hydrological dynamics of the region (Mucina & Rutherford, 2006; NBA, 2018).

3.2 CLIMATE AND RAINFALL

The study area is located in summer rainfall region with a warm and temperate climate. The Mean Annual Precipitation (MAP) ranges from 600mm to 800mm, with the highest rainfall typically occurring in January (around 125 mm). June is generally the driest month, with precipitation levels averaging around 5 mm. The warmest months are December, January, and February, where average high temperatures reach 28°C. June and July are the coldest months, with average minimum temperatures dropping to around 4°C.



Source: www.worldweather.com

Figure 3-1: Weather Data for the town of Roodepoort

3.3 VEGETATION

The Egoli Granite Grassland, a vegetation type within the Grassland Biome and specifically the Mesic Highveld Grassland Bioregion, is classified as **Critical Endangered** (CR) due to its limited distribution and high levels of transformation. This grassland is characterized by medium-tall tufted grasses, such as Hyparrhenia hirta (red grass) and Cymbopogon pospischilii (narrow-leaved turpentine grass), which dominate the flat to gently rolling plains. Scattered shrubs and trees, such as Vachellia karroo (sweet thorn), can be found in disturbed areas or along watercourses. The Egoli Granite Grassland is under severe threat from urbanization, agriculture, and industrial activities, with less than 1% formally protected. Overgrazing, mining, invasive species like Acacia mearnsii and Eucalyptus, and changes in fire regimes have further contributed to its degradation. Its conservation is crucial for maintaining the unique biodiversity of the region (Mucina & Rutherford, 2012).

The conservation targets, extents, ecosystem status and level of protection and protected area (PA) for the Egoli Granite Grassland (Gm 10) vegetation type are indicated in Table 3-1 below.

Table 3-1: Soweto Highveld Grassland

Gauteng Vegetation Type Name	Gauteng Biome	Conservation Target (%)	Original Extent (ha)	Remaining Natural (ha)	Remaining Natural Less Fragments (ha)	Ecosystem Status	Total PA (ha)	Level of Protection
Soweto Highveld Grassland	Grassland	24*	161,329	66,018	61,529	**Critical Endangered** (CR)	2,985	Poorly Protected (PP
* Conservation targets were based on the Government of South Africa (2009)								

Source: Jewitt (2016)

3.4 AQUATIC ECOSYSTEMS, HYDROLOGY AND DRAINAGE

In terms of hydrology, the study area is situated within the Limpopo Water Management Area (WMA 1), and Quaternary Catchment A21E (DWS, 2016).

A study completed by the DWS (2014) included aspects such as water quality, riparian vegetation, invertebrates, fish, and hydrology at a sub quaternary catchment level (SQ River 10359). Based on the available information, the expected PES of the Crocodile River **Largely Modified (E Category)** which extensive loss and change of natural habitat and biota have occurred, and the basic ecosystem functions are still predominantly changed. A summary of

Ecostatus and the impacts of the Crocodile River is indicated in Table 3-2. No Ecostatus data of the Muldersdrift se loop was available of we use the Crocodile River as reference of wich the Muldersdrift se loop is a tributary of.

Table 3-2: Summary of the Ecostatus and impacts of the Crocodile River

Quaternary Catchment	Water Resource	Present Ecological State (PES)	Ecological Importance (EI)	Ecological Sensitivity (ES)
A21E	Crocodile River	**E Seriously Modified**	**Moderate**	**High**
Current Impacts				
The following impacts/activities were identified: Channelization of the stream upstream of the sampling sites, large urbanisation and industrial areas near the stream, informal settlements, residential areas, and roads.				

Source: DWS (2014)

3.5 Land Use

The main forms of land-use in the larger study area include:

- industrial areas;
- Residential areas;
- Urban areas; and
- Informal settlements.

3.6 Areas of Conservation Importance

3.6.1 Gauteng Spatial Development Framework

Gauteng Special Development Framework (PSDF, 2022) addresses the urgent need to identify and map critical biodiversity areas and priorities for conservation in the province. It also provides land use planning guidelines, recommending biodiversity-friendly activities in priority areas. The PSDF is intended for use by technical users and decision-makers in the spheres of planning, development, and environment. Spatial mapping information can be used both reactively and strategically to guide future development away from sensitive and priority biodiversity areas. The key output of a systematic biodiversity plan is a map of biodiversity priority areas. The CBA map delineates Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Other Natural Areas (ONAs), Protected Areas (PAs), and areas that have been irreversibly modified from their natural state (PSDF, 2021). The PSDF uses the following terms to categorise the various land used types according to their biodiversity and environmental importance:

- CBA – 1; CBA –2; CBA – 3;

- ESA 1; ESA 2;
- NNR (No Natural Areas); ONA; and PA.

The sampling sites are located within a CBA and ESA (**Error! Reference source not found.**).

3.6.2 National Freshwater Ecosystem Priority Areas

The project related to the delineation and characterisation of the National Freshwater Ecosystem Priority Areas ("NFEPA") prioritised freshwater systems in the country with an aim to incorporate conservation into Catchment Management Strategies (Driver et al. 2011). The NFEPAs provide guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition. It supports the implementation of the National Water Act (Act 36 of 1998), National Environmental Management: Biodiversity Act (Act 10 of 2004), and the National Environmental Management: Protected Areas Act (Act 57 of 2003).

The objectives set for the FEPA project included:

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

The NFEPA was completed, and the goal of the project was to determine strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources. FEPA maps show rivers, wetlands and estuaries that need to stay in a good condition to conserve freshwater ecosystems and protect water resources for human use. River FEPAs are often tributaries that support hard-working mainstem rivers and are an essential part of an equitable and sustainable water resource strategy. This does not mean that FEPAs need to be fenced off from human use, but rather that they should be supported by good planning, decision-making and management to ensure that human use does not impact on the condition of the ecosystem (Driver et al. 2011).

According to SANBI (2023), the systems are located within a sub-quaternary catchment considered important as a Freshwater Ecosystem Priority Area (FEPACODE = 2) . River FEPAs are important for achieving biodiversity targets for river ecosystems and threatened fish species and should therefore remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.

3.6.3 National Biodiversity Assessment

The National Biodiversity Assessment (NBA) was completed as a collaboration between the SANBI, the DEA and other stakeholders, including scientists and biodiversity management experts throughout the country over a three-year period (Deventer et al., 2019). The purpose of the NBA is to assess the state of South Africa's biodiversity with a view to understanding trends over time and informing policy and decision-making across a range of sectors (Deventer et al., 2019). This spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the NBA, (2018). National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE, 2018). The two headline indicators assessed in the NBA data are ecosystem threat status and ecosystem protection level (Deventer et al. 2019).

- Ecosystem Threat Status (ETS) outlines the degree to which 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. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Concern (LC), based on the proportion of each ecosystem type that remains in a good or healthy ecological condition (Skowno et al., 2019). CR, EN, or VU ecosystem types are collectively referred to as threatened ecosystems.
- Ecosystem Protection level (EPL) informs on whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Not Protected (NP), Poorly Protected (PP), Moderately Protected (MP) or Well Protected (WP), based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Skowno et al., 2019). NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems.

According to the SAIIAE (2018), no wetland seeps or valley bottoms were identified within the study area.

4 METHODOLOGY

In line with the minimum requirements for aquatic biodiversity surveys, a single survey was completed for this assessment. A site visit was undertaken on the 5th of August 2024. The survey period therefore reflects a dry, winter season survey.

4.1 DESKTOP ASSESSMENT

A number of information sources were considered for the desktop assessment. This is described in detail above in Section 3 and Annexure A of this report.

4.2 SAMPLING SITES

The selection of the aquatic sampling sites was based on the location of the proposed Township development. The location of the sampling site is indicated in Table 4-1 and Figure 4-1

Table 4-1: Sampling sites for the aquatic biodiversity assessment

Watercourse	Site	GPS Coordinates		Location description
		Latitude	Longitude	
Muldersdrift se loop	**Roodekrans**	26° 4'5.94"S	27°50'25.96"E	The site is located adjacent to the Study Area.

The sampling point is located adjacent to the study area only one water resource was evaluated.

4.3 PRESENT ECOLOGICAL STATE

The PES of the tributary of the Muldersdrift se loop was determined by assessing the instream and riparian habitat, water quality and the macro-invertebrate community integrities. The Ecological Categories were used to assist in defining the current ecological condition of the watercourse in terms of the deviation of biophysical components from the natural reference condition (Kleynhans & Louw, 2007). These categories range over a continuum of impacts, from Natural (Category A) to Critically Modified (Category F) and are represented by characteristic colours defined by Kleynhans & Louw (2007) in Table 4-2.

Table 4-2: Ecological Category Codes and Description with standardises colour coding

Ecological Category (EC)	Score	SASS5	ASPT	Description
A	90-100	>=240	>=6,8	**Natural** – Unmodified state with no impacts, conditions natural.
B	80-89	190-240	6.3-6,8	**Largely Natural** with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	60-79	155-190	5,8-6,3	**Moderately Modified** – loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	40-59	120-155	5.3-5.8	**Largely Modified** – a large loss of natural habitat, biota and basic ecosystem functions has occurred.
E/F	20-39	0-120	<5.3	**Seriously Modified** – the loss of natural habitat, biota and basic ecosystem functions are extensive.

Source: Adapted from Kleynhans & Louw (2007) and Dallas (2007)

4.4 Risk Assessment

The risk assessment was completed in accordance with the requirements of the DWS General Authorisation (GA) 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 4-3.

Table 4-3: Significance Rating Matrix

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

The methodology is described in detail in **Annexure A**.

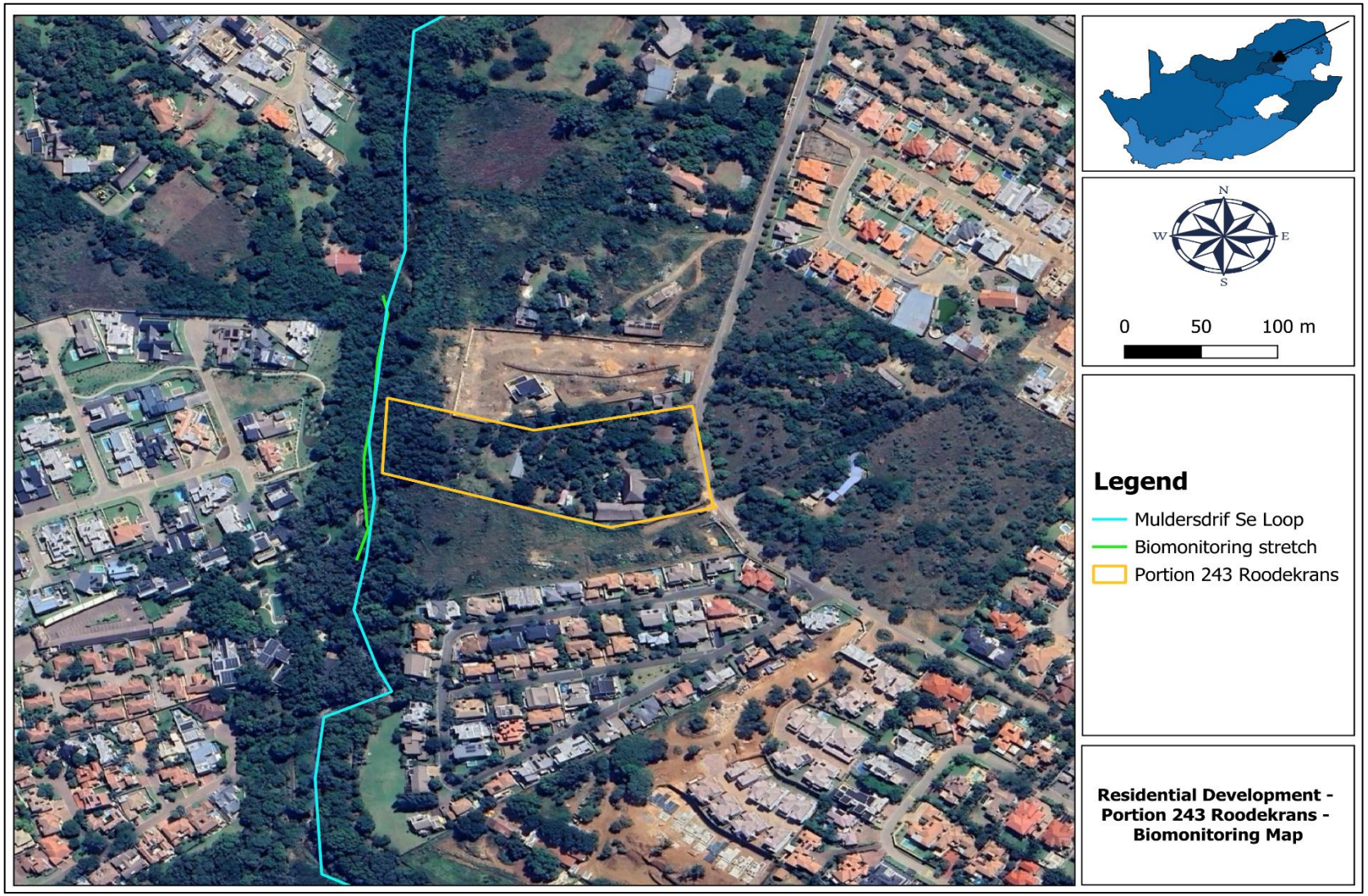


Figure 4-1: Map of the Aquatic Sampling Sites

5 RESULTS AND DISCUSSION

A site visit was undertaken on the 5th of August 2024. The survey period therefore reflects a dry, winter season survey.

5.1 SAMPLING SITES AND VISUAL ASSESSMENT

Descriptions of the sampling site, as well as photographs from an upstream and downstream view, are indicated in Table 5-1 below.

Table 5-1: Description and visual assessment of the upstream sampling site Roodekrans

Roodekrans							
Upstream View				**Downstream View**			
						
Watercourse							
Site Description	The site Roodekrans is in a the Muldersdrift se loop a tributary of the Crocodile River and is located adjacent to the proposed township development.						
GPS co-ordinates	26° 4'5.94"S ;27°50'25.96"E						
Habitat	The flow of the stream was reduced by a couple of historical weirs within the stream, all the habitats were available to conduct an SASS 5 evaluation although stones in current and vegetation were limited.						
In Situ water Quality	The water was clear, and brown algae were observed on substrates which is common in lotic systems. The majority of the in situ chemical parameters fall outside the accepted range.						
Quaternary Catchment	A21E						
Water Management Area	Limpopo (WMA 1)						
Ecoregion	Highveld –11.01						
Watercourse Type	Lotic order 1 stream						
Surface Water Dimensions	Width: 2-5m; Depth: 0.5						
Velocity-depth Classes	Shallow and moderate flow of water.						
DATE	**SAMPLER**	**IHAS**	**IHI**	**WQ**	**Diatoms**	**SASS5**	**FRAI**
31/07/2024	Z. Liebenberg M. Du Preez	**Adequate**	**D**	**Poor**	**N/A**	**N/A**	**N/A**
Existing Treats	The area is surrounded by industrial areas, residential areas, informal settlements and urban infrastructures -roads, footpaths etc.						

5.2 HABITAT ASSESSMENT

5.2.1 Index Of Habitat Integrity Assessment (IHIA)

The habitat integrities of all the sites have been assessed using the IHIA methodology of Kleynhans (1996) and Kemper (1999). The defined Ecological Categories are described in Table 4-2 and the results of the assessment are presented in Table 5-2 below

Table 5-2: The IHI results for the sampling sites during the August 2024 low flow survey

Site	**Roodekrans**
River	Muldersdrift se loop
Position	Adjacent to the proposed township development.
Condition	Monotone
Instream Habitat	
IHI %	**50**
IHI Class	**D**
Impacts	Flow-, channel- and bed modifications. Bad water quality exotic macrophytes and inundation effects.
Riparian Habitat	
RHI %	**40**
RHI Class	**D**
Impacts	Flow-, channel- and bed modifications. Bad water quality exotic macrophytes and inundation.
Final IHIA Score	**45**
Ecological Category (EC)	**D**
Total Ecological Class	**Largely Modified**

The site on the Muldersdrift se loop is classed as **Largely modified (D Category)** with severe flow -and bed modification with a concession of weirs. There is an abundance of exotic macrophytes on the riverbank and erosion are starting to occur. The water quality is poor and inundation effects are eminent with developments occurring on the riverbank and water abstraction.

5.2.2 Integrated Habitat Assessment System (IHAS)

Drivers in the ecosystem (physico-chemical, geomorphology, hydrology) provide a specific habitat template that is required by biota. Habitat quality is an important part of an ecosystem as it forms the basis for the ecosystem. If the habitat quality is affected, it will have an effect on the whole systems integrity (Uys et al. 1996). Habitat quality is directly proportional to the quality of the system and the functioning of the different components. The habitat provides a substrate for aquatic life and diversity to provide a holistic environment. Habitat is very important as it drives the functioning of aquatic systems and determines the suitability for all organisms within the system. Any impact on any element of the habitat could be detrimental to aquatic organisms and may be fatal to some of them.To assess the current state of habitat

integrity, IHAS was applied to the one sampling site. The IHAS results for the sampling sites are indicated in Table 5-2.

Table 5-3: The IHAS results for the sampling site during the July 2024 low-flow survey

Watercourse	Sites	IHAS Score	Description
Muldersdrift se loop	Roodekrans	78%	**Very Good**

The IHAS results indicate that the site on the Muldersdrift se loop i.e., Roodekrans have **very good** habitats to support a variety of macro-invertebrates and fish. There was sufficient bedrock, stones in current (SIC), together with gravel, sand, and mud (GSM) present at the sites. Instream vegetation was sampled, but the vegetation out of current and aquatic vegetation were limited. The river makeup included rifles, runs, and pools.

5.3 WATER QUALITY

It is important to assess water quality (WQ) variables to determine the impacts within an ecosystem that may contribute toward changes within the biotic integrity. The water quality results are provided in Table 5-4. The WQ results are compared to the Target Water Quality Range (TWQR) for aquatic ecosystems (DWAF, 1996) and Resource Quality Objectives (RQO) for the Upper Vaal Sub-catchment in the Vaal WMA (DWS, 2014). The water quality analyses indicated that the general water variables for the sites fall within these guidelines.

Table 5-4: The in-situ water quality results for the sampling sites during the August 2024 low flow survey

Sites Assessed	Variables	Units of Measure	Roodekrans	TWQR & RQO
Water Quality Results	pH	pH Units	8.13	6.5 – 9.0[A]
	Electrical Conductivity	mS/m	19.5	<70[D]
	Total Suspended Solids	mg/ℓ	74	<15[RQO]
	Nitrate	mg/ℓ	1.8	<0.5[A]
	Total oxidised nitrogen	mg/ℓ	1,8	<2[R]
	Orthophosphate	mg/ℓ	0.345	<0.058[R]
	COD	mg/ℓ	56	<20[D]
	Turbidity	NTU	24.3	1,69 [R]
	E.coli	CFU/100ml	50	<100[I]
	Faecal Coliforms	CFU/100ml	55	<110
	Total Coliforms	CFU/100ml	450	<120

RQO = Resource Quality Objectives (DWS, 2022)
TWQR = Target Water Quality Range
A = TWQR for aquatic ecosystems (DWAF, 1996)
D = TWQR for domestic use (DWAF, 1996a)
R = TWQR for recreational use (DWAF, 1996b)

The nitrite, total oxidised nitrogen (TON), orthophosphate and turbidity concentrations exceeded the recommended TWQR and RQO limits at the sampling site. Increased COD, nitrate, TON, orthophosphates and turbidity are indications of industrial influences on the water system. Increased COD is commonly associated with mining wastewater, sewage, and urban run-off. An increase in Nitrates, phosphates and Nitrogen are an indication of an increase in industrial waste and nutrients associated with eutrophication. The increase in nutrients causes algae blooms and could mining wastewater, sewage, and urban run-off origins. Overall, the current WQ results indicate **bad** water quality conditions at the Roodekrans monitoring site.

5.4 South African Scoring System (SASS5)

Macro-invertebrates are well known to have different sensitivities to pollution and habitat transformation and are therefore very useful indicators of pollution. Different taxa of macro-invertebrates also exhibit differing tolerances to individual water quality variables (Dallas & Day, 1993). Therefore, water of suitable quality is essential to maintain healthy populations of aquatic organisms.

The SASS5 index is exclusive to riverine systems, and it is not applicable wetlands, impoundments, estuaries, and other lentic habitats (Dickens & Graham, 2002).

The SASS5 score is determined by the combination of sensitivity scores of the sampled macro-invertebrates. This information is important, as it indicates whether the type of macro-invertebrate community is tolerant or sensitive to organic pollution and environmental changes. However, the SASS5 score will be lower, where habitat diversity is poor, due to less biotic diversity. The ASPT will be less affected because the few organisms present may have the appropriate sensitivity. Therefore, the ASPT score provides a more reliable measure of the overall health of a good-quality river (Dicken & Graham, 2002).

The SASS5 results for the monitoring sites, during the August 2024 low-flow survey, are indicated in

Table 5-5

Table 5-5. The complete SASS5 results are available in Annexure D.

Table 5-5: The SASS5 results for August 2024 low flow survey

Site	Roodekrans
River	Muldersdrift se loop
SASS5 Score	94
No. of Taxa	19
ASPT	5.0
Ecological Category	**E** **Seriously Modified**

The site on the Muldersdrift se loop i.e., Roodekrans was classified as **Seriously Modified (E Category)**. The SASS5 score is 94, with an ASPT score of 5.0. Nineteen families were sampled, and the sensitive species sampled include more than two species *of Baetidae* and Dixidae . Moderately sensitive species like *Aeshnidae* were also sampled. The presence of sensitive species indicates that the WQ and available habitat are bad and not good enough to support a diversity of sensitive macro-invertebrates

5.5 Present Ecological State (PES)

The Ecostatus is all the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora, and fauna and its capacity to provide a variety of goods and services (Kleynhans, 2007). In essence the Ecostatus represents an ecologically integrated state representing the drivers (hydrology, geomorphology, physico-chemical) and responses (aquatic invertebrates, and riparian vegetation).

The overall Ecostatus of the Muldersdrift se loop is **Seriously Modified (D)** which indicates a large loss of natural habitat, biota and basic ecosystem functions have occurred. This is in agreement with the desktop Ecostatus for this river.

Table 5-6: Overall Ecostatus results for the Muldersdrift se Loop

	Indices	Roodekrans
Sites Assessed	Watercourse	Muldersdrift se loop
	IHIA	**D**
	IHAS	Verry Good
	SASS Score	94
	No of Taxa	19
	ASPT	5.0
	SASS EC	E
Overall	PES	**E**

6 IMPACT ASSESSMENT

6.1 DWS Risk Assessment

The results of the risk assessment are indicated in Table 6-1. All components scored a low to moderate impact significance. Borderline risk scores were manually adapted and reduced all components to a low impact significance with the application of various mitigation measures.

Based on the results of the DWS risk assessment, a GA is required for the proposed residential development in line with GNR 4167, of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as Defined in Section 21(C) or Section 21(I), 2023).

6.2 Construction Phase

6.2.1 Construction Phase- Impacts

The potential impacts that may occur during the operational phase of the residential development are grouped into the following impact categories:

- Impacts on riparian habitat due to construction; and
- Water quality impacts.

6.2.2 Construction Phase- Mitigation Measures

The mitigation measures proposed for the management and use of the construction of the residential development are set out below. This will aid in improving their surrounding and receiving environment and help contribute to an improved health class for the aquatic ecosystem.

Some of these mitigations include the following aspects:

- No construction should occur within the riparian area and 32m buffer, except the attenuation pond;
- Ablution facilities must be provided at a rate of 1:10
- No chemical toilets should be located within the buffer zone.
- All orange listed plants should be relocated out of the construction zone.
- No taking or harvesting of any fauna or flora out of the area;
- Waste bins should be provided, and litter should be monitored and regularly picked up;

- No littering should be allowed;
- Proper stormwater management application.
- Sediment and erosion control.
- Proper chemical substance handling and spill handling education
- The construction area should be continuously monitored for rubbish dumping and chemical spills.
- Care should be taken to avoid run-off from the construction, flowing into the rivers and oil traps should be administered.
- Stay in the allocated construction footprint.
- Immediate rehabilitation of disturbed areas after completion with indigenous material.
- Immediately revegetate servitude with indigenous vegetation after completion of works in section.
- An allocated batching facility should be constructed, or batching should be done on an imperative service and bunded
- Compile an Alien Invasive Management Plan and adhere to the plan.
- Compile a Stormwater management plan and adhere to the plan.
- Water quality testing should be conducted before, during and after construction and records should be kept of reports.
- Biomonitoring including Diatom assessment should be conducted during and after construction and records should be kept of reports.
- Continual nutrient monitoring

6.3 Operational Phase

6.3.1 Operational Phase - Impacts

The potential impacts that may occur during the operational phase of the residential development are grouped into the following impact categories:

- Inundation associated with the humans utilizing the township; and
- Water quality impacts.

6.3.2 Operational Phase – Mitigation Measures

The mitigation measures proposed for the management and use of the residential development is set out below. This will aid in improving their surrounding and receiving environment and help contribute to an improved health class for the aquatic ecosystem.

Some of these mitigations include the following aspects:

- Proper stormwater management system.
- Installation of oil traps and sediment traps before water enters the stream.
- Sediment -and erosion control.
- Proper rehabilitation and continual monitoring and removal of alien invasive plant species.
- The area should be continuously monitored for rubbish dumping and chemical spills.
- Care should be taken to avoid run-off from the township, to flow into the rivers.
- Clear and manage alien invasive plants from riparian zones according to the Alien Invasive Management Plan.
- Stormwater systems should be constructed to be able to withstand storm events.
- Surface water monitoring needs to be conducted bi-annually for the first year of operation.

6.4 RECOMMENDATIONS

The following recommendations are based on the findings:

Please take note of the following guidelines during the construction phase:

- It is essential to clearly demarcate the construction area and keep it as small as possible to minimize any potential impact on the surrounding system.
- No construction should be allowed in the riparian area and within the 32m buffer zone except the proposed stormwater infrastructure and the attenuation pond.
- No accesses should be allowed into riparian area except to remove alien invasive plants.
- All construction materials such as gravel, sand, and cement must be contained within the construction site and should not enter the streams and riparian areas.
- Proper management of stormwater is necessary to reduce runoff from the residential development into the aquatic environment and mitigate erosion potential.
- It is recommended to conduct monitoring during and after construction to ensure that all guidelines are being followed.
- To prevent further spread and establishment, all invasive alien plants (IAPs) along the stream banks within 100m of the crossings should be removed. The use of herbicides should be minimized due to the risk of contaminating aquatic environments and surface water resources. If chemical application is necessary, it should be done carefully under the supervision of an environmental control officer (ECO).
- When controlling alien vegetation, it is advised to only apply herbicide during the active growing season, avoid spraying during unfavourable weather conditions, ensure correct

herbicide mixing ratios, use dyes to identify treated areas, and refrain from spraying near surface water.

- Bare or exposed soils should be revegetated using suitable indigenous grass species. In more degraded areas, the use of silt fences and other biodegradable measures may be necessary.
- It is important to monitor head cuts and erosion gullies within the channel and introduce appropriate structures if needed.

Table 6-1: Significant rating matrix for the impacts associated with the proposed residential development before mitigation measures

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
CONSTRUCTION	Constructing a township near a stream	Potential water contamination	Muldersdrift se loop	E	Moderate	1	4	2	3	3	**8**	3	2	**13**	**3**	**39**	80%	**31,2**	M	Medium
		Increase in alien invasive vegetation	Muldersdrift se loop	E	Moderate	1	4	2	3	3	**8**	1	2	**11**	**3**	**33**	80%	**26,4**	L	Medium
		Water quality impact and human health	Muldersdrift se loop	E	Moderate	1	4	2	3	3	**8**	3	1	**12**	**3**	**36**	80%	**28,8**	L	Medium
	Construction workers	Water quality impact and human health	Muldersdrift se loop	E	Moderate	1	4	2	3	3	**8**	3	3	**14**	**3**	**42**	80%	**33,6**	M	Medium
		Increase in Litter	Muldersdrift se loop	E	Moderate	1	4	2	3	3	**8**	2	3	**13**	**3**	**39**	80%	**31,2**	M	Medium
		Increase in poaching and loss of biodiversity	Muldersdrift se loop	E	Moderate	1	4	2	3	3	**8**	2	3	**13**	**3**	**39**	80%	**31,2**	M	Medium
	Stormwater runoff due to vegetation clearing	Sediment load in the river system	Muldersdrift se loop	E	Moderate	2	3	2	2	2	**6**	2	1	**9**	**3**	**27**	100%	**27**	L	Medium
		Hydrocarbon run off from residential development	Muldersdrift se loop	E	Moderate	1	4	3	2	2	**8**	2	2	**12**	**3**	**36**	100%	**36**	M	Medium
		erosion	Muldersdrift se loop	E	Moderate	1	2	3	2	2	**6**	2	3	**11**	**3**	**33**	100%	**33**	M	Medium
OPERATIONAL	Humans living near a stream	Increase in littering	Muldersdrift se loop	E	Moderate	1	3	2	2	2	**6**	2	4	**12**	**3**	**36**	100%	**36**	M	Medium
		Increase in alien invasive vegetation	Muldersdrift se loop	E	Moderate	2	2	2	4	4	**8**	2	4	**14**	**3**	**42**	100%	**42**	M	Medium
		loss of riparian habitat	Muldersdrift se loop	E	Moderate	2	1	2	3	3	**6**	1	4	**11**	**3**	**33**	80%	**26,4**	L	Medium
	Stormwater run off	sedimentation	Muldersdrift se loop	E	Moderate	2	3	2	2	2	**6**	2	2	**10**	**3**	**30**	80%	**24**	L	Medium
		erosion	Muldersdrift se loop	E	Moderate	2	3	2	2	2	**6**	2	2	**10**	**3**	**30**	80%	**24**	L	Medium
		decrease in water quality	Muldersdrift se loop	E	Moderate	1	3	2	2	2	**6**	3	3	**12**	**3**	**36**	60%	**21,6**	L	Medium
	increase in pets	loss of biota	Muldersdrift se loop	E	Moderate	1	1	1	3	3	**6**	1	3	**10**	**3**	**30**	60%	**18**	L	Medium
		spread of pathogens	Muldersdrift se loop	E	Moderate	1	1	1	2	3	**6**	1	2	**9**	**3**	**27**	60%	**16,2**	L	Medium

Table 6-2: Significant rating matrix for the impacts associated with the proposed residential development After mitigation

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Overall Watercourse Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
CONSTRUCTION	Constructing a township near a stream	Potential water contamination	Muldersdrift se loop	E	Moderate	1	2	2	3	3	**6**	3	2	**11**	**3**	**33**	80%	**26,4**	L	Medium
		Increase in alien invasive vegetation	Muldersdrift se loop	E	Moderate	1	2	2	2	2	**4**	1	2	**7**	**3**	**21**	80%	**16,8**	L	Medium
		Water quality impact and human health	Muldersdrift se loop	E	Moderate	1	2	2	3	3	**6**	3	1	**10**	**3**	**30**	80%	**24**	L	Medium
	Construction workers	Water quality impact and human health	Muldersdrift se loop	E	Moderate	1	2	2	3	3	**6**	3	3	**12**	**3**	**36**	80%	**28,8**	L	Medium
		Increase in Litter	Muldersdrift se loop	E	Moderate	1	2	2	3	3	**6**	2	3	**11**	**3**	**33**	80%	**26,4**	L	Medium
		Increase in poaching and loss of biodiversity	Muldersdrift se loop	E	Moderate	1	2	2	3	3	**6**	2	3	**11**	**3**	**33**	80%	**26,4**	L	Medium
	Stormwater runoff due to vegetation clearing	Sediment load in the river system	Muldersdrift se loop	E	Moderate	2	3	2	2	2	**6**	2	1	**9**	**3**	**27**	100%	**27**	L	Medium
		Hydrocarbon run off from residential development	Muldersdrift se loop	E	Moderate	1	1	2	2	2	**4**	2	2	**8**	**3**	**24**	100%	**24**	L	Medium
		erosion	Muldersdrift se loop	E	Moderate	1	1	2	2	2	**4**	2	3	**9**	**3**	**27**	100%	**27**	L	Medium
OPERATIONAL	Humans living near a stream	Increase in littering	Muldersdrift se loop	E	Moderate	1	3	2	2	2	**6**	2	1	**9**	**3**	**27**	100%	**27**	L	Medium
		Increase in alien invasive vegetation	Muldersdrift se loop	E	Moderate	2	2	2	2	2	**4**	2	1	**7**	**3**	**21**	100%	**21**	L	Medium
		loss of riparian habitat	Muldersdrift se loop	E	Moderate	2	1	2	3	3	**6**	1	4	**11**	**3**	**33**	80%	**26,4**	L	Medium
	Stormwater run off	sedimentation	Muldersdrift se loop	E	Moderate	2	3	2	2	2	**6**	2	2	**10**	**3**	**30**	80%	**24**	L	Medium
		erosion	Muldersdrift se loop	E	Moderate	2	3	2	2	2	**6**	2	2	**10**	**3**	**30**	80%	**24**	L	Medium
		decrease in water quality	Muldersdrift se loop	E	Moderate	1	3	2	2	2	**6**	3	3	**12**	**3**	**36**	60%	**21,6**	L	Medium
	increase in pets	loss of biota	Muldersdrift se loop	E	Moderate	1	1	1	3	3	**6**	1	3	**10**	**3**	**30**	60%	**18**	L	Medium
		spread of pathogens	Muldersdrift se loop	E	Moderate	1	1	1	2	3	**6**	1	2	**9**	**3**	**27**	60%	**16,2**	L	Medium

7 CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

Tutam Properties 143 CC Proposed do a township development near the Muldersdrift se loop the aquatic biodiversity assessment was conducted on the 5th of August 2025 to determine the PES of these systems and to evaluate the potential impact of the proposed township development on the aquatic ecosystems. This assessment intends to support the Basic Assessment Report (BAR) and Water Use Licence (WUL).

The overall PES of the tributary of the Muldersdrift se loop is Seriusly Modified (E) which indicates that a loss and change of natural habitat and biota have occurred. This is in agreement with the desktop Ecostatus for this river.

7.2 RECOMMENDATIONS

Specific recommendations are based on the findings:

- No construction activities should occur within the riparian area or 32m buffer except to construct stormwater infrastructure and the proposed attenuation pond.
- It is essential to clearly demarcate the construction area and keep it as small as possible to minimize any potential impact on the surrounding system.
- All construction materials such sand, and cement must be contained within the construction site and should not enter the streams and riparian areas.
- Proper management of stormwater is necessary to reduce runoff from residential development into the aquatic environment and mitigate erosion potential.
- It is recommended to conduct monitoring during and after construction to ensure that all guidelines are being followed.
- To prevent further spread and establishment, all invasive alien plants (IAPs) along the stream banks within the area near the residential development. The use of herbicides should be minimized due to the risk of contaminating aquatic environments and surface water resources. If chemical application is necessary, it should be done carefully under the supervision of an environmental control officer (ECO).
- When controlling alien vegetation, it is advised to only apply herbicide during the active growing season, avoid spraying during unfavourable weather conditions, ensure correct herbicide mixing ratios, use dyes to identify treated areas, and refrain from spraying near surface water.

- Bare or exposed soils should be revegetated using suitable indigenous grass species. In more degraded areas, the use of silt fences and other biodegradable measures may be necessary.

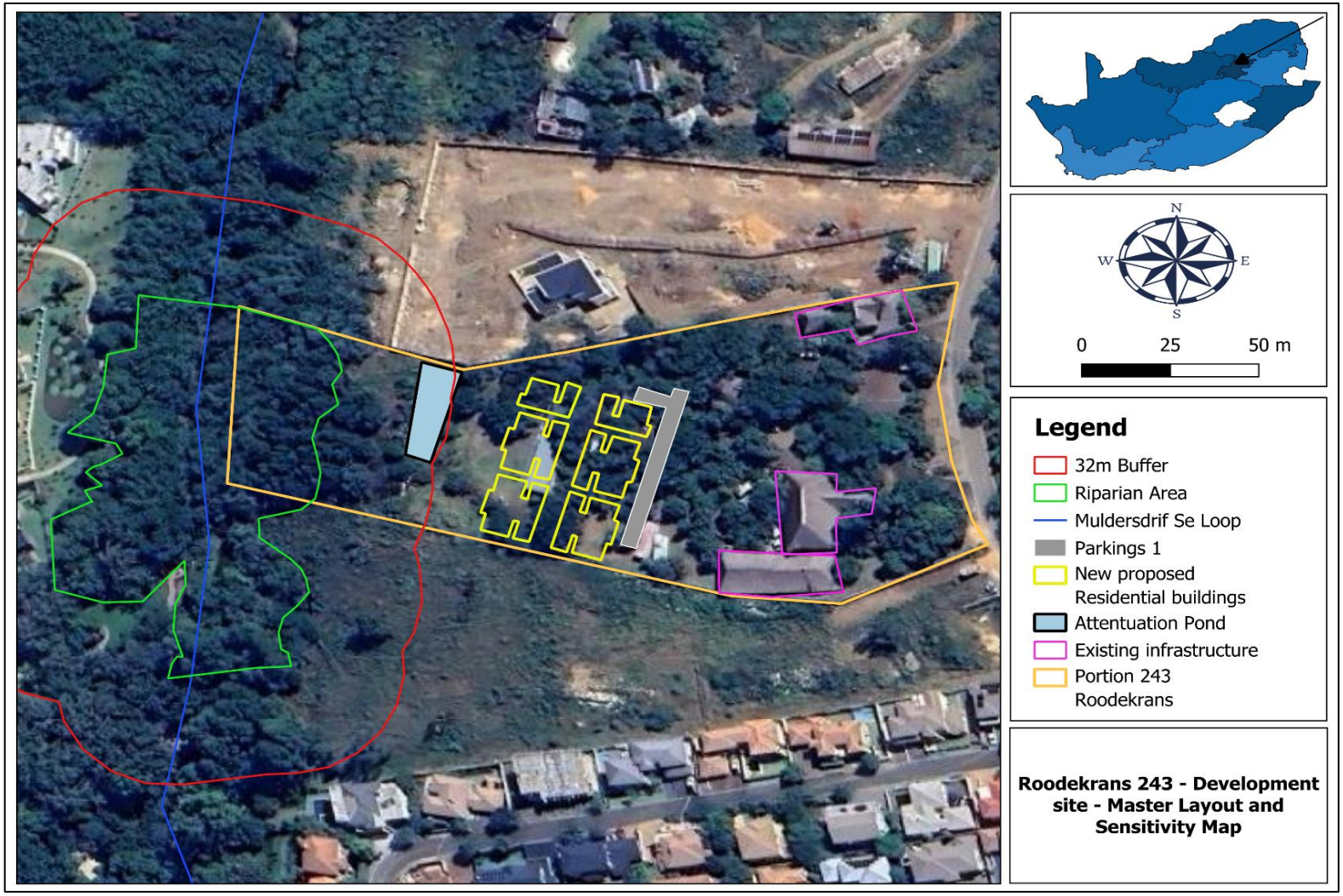


Figure 7-1: Buffer area Map

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9 ANNEXURE A: METHODOLOGY

9.1 DESKTOP ASSESSMENT

A number of information sources were considered for the desktop assessment.

- Aerial imagery (Google Earth Pro);
- Vegetation and climate information (Mucina & Rutherford, 2006);
- Land Type Data (Land Type Survey Staff, 1972 - 2006).
- The inland water dataset;
- Topographical river line data;
- Present Ecological State (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) per Sub Quaternary Reaches (SQR) for Secondary Catchments in South Africa (DWS, 2014);
- The National Freshwater Ecosystem Priority Areas (NFEPA) (Nel et al., 2011); Mpumalanga Conservation Plan (MBSP, 2022);
- South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Deventer et al. 2019). National Biodiversity Assessment (NBA) (Deventer et al. 2019);
- The SANBI National Wetland Map 5 (Deventer et al. 2019); and
- Contour data (5 m).

9.2 SAMPLING SITES

The selection of the aquatic sampling sites was based on location of the constructed earth dams. The locations of the sampling sites are indicated in Table 9-1 and depicted in Table 4-1.

Table 9-1: Sampling site for the aquatic biodiversity assessment

Watercourse	Site	GPS Coordinates		Location description
		Latitude	Longitude	
Muldersdrift se loop	**Roodekrans**	26° 4'5.94"S	27°50'25.96"E	The site is located adjacent to the Study Area.

The sampling point is located adjacent to the study area only one water resource was evaluated.

9.3 HABITAT ASSESSMENT

9.3.1 Index of Habitat Assessment Systems (IHAS)

Habitat availability and diversity are the major determining factors in the overall community structure of macro-invertebrates. It is therefore very important to evaluate habitat quality when applying biomonitoring methodologies to assess river health. The habitat quality and diversity were assessed using the Integrated Habitat Assessment System Version 2 (IHASv.2) (McMillan, 1998).

The IHAS was used to assess the integrity of the in-stream habitat on which macro-invertebrates depend. The scoring system is split into two sections: Sampling Habitat (55 points) and Stream Condition/Characteristics (45 points), resulting in a total score of 100 points. The Sampling Habitat section is further divided into three sub-sections: Stones-in-Current (20 points), Vegetation (15 points), and Other Habitat (20 points). The Stream Condition section provides an evaluation of the physical characteristics of a site and the degree of disturbance present at the site. The Total IHAS scores are interpreted in accordance with the descriptions provided in Table 9-2.

Table 9-2: The IHAS score interpretation guidelines

Percentage		Description
>75%	Very good	Highly suitable for supporting a diverse macro-invertebrate community
65%-75%	Good	Good for supporting a diverse aquatic macro-invertebrate community
55-64%	Adequate	Adequate for supporting a diverse aquatic macro-invertebrate community
<55%	Poor	Inadequate for supporting a diverse aquatic macro-invertebrate community

Source: McMillan (1998)

9.3.2 Index of Habitat Integrity (IHI)

The protocol Index of Habitat Integrity (IHI), described by Kleynhans et al. (2008), was used to assess the impacts on the aquatic and surrounding habitats of all the sites sampled. Respectively, the instream (IH) and riparian (RH) habitats were analysed based on a set of 12 weighted disturbances in the index. These disturbances represent some of the important and easily quantifiable anthropogenically induced impacts including bank erosion, bed-, channel- and flow modification; alien aquatic fauna, -macrophytes and -vegetation encroachment;

indigenous vegetation removal; inundation; solid waste disposal and water abstraction. The respective impacts for the IH and RH habitats were calculated. Each disturbance was assigned an impact class (Table 9-3) and a confidence score. These values were used to calculate an impact score using the formula: (impact rating/25) x (the weight of that impact) defined in (Table 9-4). The estimated impacts of all criteria were summed, expressed as a percentage, and subtracted from 100, respectively. The habitat integrity value for the instream and riparian components were then obtained. The final IHI was calculated and characterised into one of the six categories defined by Kleynhans & Louw (2007).

Table 9-3: Summary of the scoring procedures used to determine the Index of Habitat Integrity

IMPACT CLASS	DESCRIPTION	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 is limited.	1-5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size, and variability is fairly 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 affected	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

Table 9-4: Criteria and weightings used for the assessment of Instream and Riparian Habitat Integrity

INSTREAM CRITERIA	WEIGHT		RIPARIAN CRITERIA	WEIGHT
Water abstraction	14		Vegetation removal	13
Water quality	13		Alien vegetation	12
Flow modification	13		Bank erosion	14
Bed modification	13		Channel modification	12
Channel modification	14		Water abstraction	13
Inundation	10		Inundation	11
Exotic macrophytes	9		Flow modification	12
Alien fauna	8		Water quality	13
Rubbish dumping	6			

9.4 WATER QUALITY ASSESSMENT

9.4.1 In Situ Water Quality Assessment

Water quality is used to describe the physical, chemical, biological, and aesthetic properties of water that determine its fitness for a variety of uses and for the protection of the health and integrity of aquatic ecosystems. The quality of water, results from the combined effect of the physical and chemical attributes of an aquatic ecosystem (DWAF, 1996).

The surface water samples were collected in 1 litre polyethylene water bottles, labelled with the site name, the date and time that the sample was taken. The samples were kept cool and transported to Aquatico (Pty) Ltd (an SANAS accredited laboratory) for analysis.

Table 9-5: Resource Water Quality Objectives and Target Water Quality Range for aquatic ecosystems

Variables	Units of Measure	TWQR	RQO
pH	pH Units	6.5 – 9.0[A]	-
Electrical Conductivity	mS/m	<70[D]	-
Total Suspended Solids	mg/ℓ	<15[RQO]	<350
Nitrate	mg/ℓ	<0.5[A]	-
Total oxidised nitrogen	mg/ℓ	<2[R]	<2
Orthophosphate	mg/ℓ	<0.058[R]	<0.058
COD	mg/ℓ	<20[D]	-
Turbidity	NTU	1,69 [R]	-
E.coli	CFU/100ml	<100[I]	<130

RQO = Resource Quality Objectives (DWS, 2022)
TWQR = Target Water Quality Range
A = TWQR for aquatic ecosystems (DWAF, 1996)
D = TWQR for domestic use (DWAF, 1996a)
R = TWQR for recreational use (DWAF, 1996b)
I = TWQR for irrigation (DWAF, 1996c)

9.5 MACRO-INVERTEBRATE ASSESSMENT

9.5.1 South African River Scoring System (SASS5)

Macro-invertebrates are adapted to live within certain environmental conditions, and changes within this environment may adversely affect their community composition. Resident aquatic macro-invertebrates are good short-term indicators of ecological integrity, as they integrate (respond to) the effects of physical and chemical changes. The ecological health for the macro-invertebrate community was assessed by implementing the South African River Scoring System version 5 (SASS5) protocol (Dickens & Graham, 2002; DWAF, 2008) at selected sites. This included the sampling of three main biotopes (where available), namely:

- Stones: refers to free/loose stones (2-25cm) in and out of the current as well as bedrock (>25cm);
- Vegetation: refers to aquatic and marginal vegetation in and out of current; and
- Gravel, sand, and mud refers to small stones (<2cm); sand grains (<2mm); and mud, silt or and clay (<0.06mm), respectively.

Results are expressed as an index score (SASS5 score), an average score per taxon (ASPT) as well as the number of taxa. Each taxon is allocated a sensitivity value between 1 and 15, in accordance with its perceived sensitivity to changes in water quality. A score of 1-5 is allocated for taxa highly tolerant to pollution, 6-10 for those moderately tolerant to pollution and 11-15 for those taxa with a very low tolerance to pollution (Gerber & Gabriel, 2002). The abundance of individuals per taxon was estimated and recorded using the following intervals:

- 1 = Single individual;
- A = 2 – 10 individuals;
- B = 10 – 100 individuals;
- C = 100 – 1000 individuals;
- D > 1000 individuals.

The sampled macro-invertebrates were identified using the Aquatic Invertebrates of South African Rivers Illustrations book (Gerber & Gabriel, 2002) by a SASS5 accredited practitioner. The macro-invertebrates were identified to family level (Dickens & Graham 2002; Gerber et al. 2002). The SASS5 score was calculated by the sum of the sensitivity scores of the present families. The average score per taxon (ASPT) was calculated by dividing the total SASS5 score by the total number of taxa (Dickens & Graham 2002). Interpretation of the SASS5 outcomes involves considering the habitat availability and state at the sampled sites. The SASS5 results were analysed based on the biological bands method developed by Dallas (2007). The selected sites fall within the North Eastern Uplands – Upper Zone, and the biological bands, as seen in Figure 9-1 were used to determine the Ecological Category of the macroinvertebrate communities. The ecological integrity state of macro-invertebrate communities was interpreted in accordance with the descriptions provided in Table 4-2 (Kleynhans & Louw, 2008).

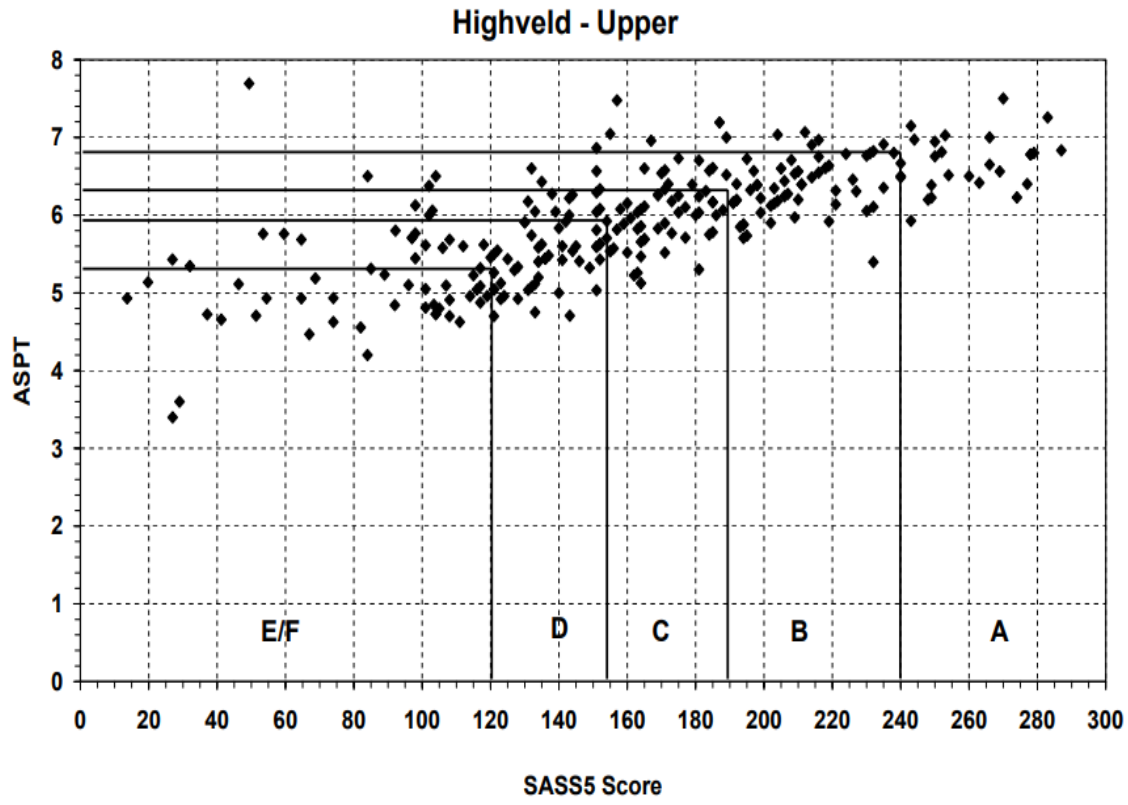


Figure 9-1 Biological Bands for the Highveld – Upper Zone (Dallas, 2007)

9.6 DWS RISK ASSESSMENT

The impacts of the nine constructed earth dams on associated watercourses were assessed, in accordance with the DWS risk-based water use authorisation approach and delegation guidelines. The matrix assesses impacts in terms of consequence and likelihood. Consequence is calculated based on the following formula:

Consequence = Severity + Spatial Scale + Duration

Whereas likelihood is calculated as:

Likelihood=Frequency of Activity + Frequency of Incident +Legal Issues + Detection

Significance is calculated as:

Significance\Risk= Consequence x Likelihood

Each metric of the severity (flow regime, water quality, geomorphology, biota, and habitat) and spatial scale, duration, frequency of the activity, frequency of the incident/impact and detection are rated to a 1 to 5 scale. The score is then placed into one of the three classes as indicated in Table 9-6 below, where low risks to the watercourse will qualify for a General Authorisation (GA). Medium and high-risk activities will require a Section 21(c) and (i) water use licence as per the National Water Act of 1998.

Table 9-6: Rating Classes

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

Annexure B: IHAS Sheet

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)

version 2.0e
peter mac 1/99

River Name: Muldersdrift se loop
Site Name:Roodekrans
Date: 31/07/2024

SAMPLING HABITAT	0	1	2	3	4	5
Stones In Current (SIC)						
Total length of white water rapids (ie: bubbling water) (in metres)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in metres)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone sizes kicked (in cm's) (<2 or >20 = <2 >20) (gravel <2: bedrock >20)	none	<2>20	2-20	11-20	2-20	
Amount of stone surface **clear** (of algae, sediment etc.) (in percent) *	N/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking SIC's (in minutes) (gravel/bedrock=0min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
(E=SIC boxes total; F=adjustment to equal 20; G=final total) **SIC Scores:**	actual 26 E		adj. ± +6 F		Max. 20 20 G	
Vegetation						
Length of fringing vegetation sampled (banks) (in metres)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation/algae sampled (underwater) (in square metres)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: (none, pool or still only, run only, mixture of both)	none		run	pool		mix
Type of veg. (percent leafy veg. as opposed to stems/shoots) (aq. veg. only=49)	none	0	1-25	26-50	51-75	>75
(H=Veg. boxes total: I=adjustment to equal 15: J=final total) **Veg. Scores:**	actual H		adj. ± + I		max. 15 11 J	
Other Habitat / General						
Stones Out Of Current (SOOC) sampled: (PROTOCOL - in square metres)	None	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) (present, but only below stones)	None	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) (present, but only below stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all, SIC stone size=<2) **	None	0-½	½	>½**		
Bedrock sampled: (all=no SIC, sand, gravel) (if all, SIC stone size=>20) **	None	some			all**	
Algal presence: (1-2m²=algal bed, rocks=on rocks, isol.=isolated clumps)	>2m²	rocks	1-2m²	<1m²	Isol.	none
Tray identification: (PROTOCOL - using time: corr=correct times)		Under		corr		over
(** NOTE: you must still fill in SIC section)						
(K=O.H./G boxes total: L=adjustment to equal 20: M=final total) **O.H.Scores:**	actual K		adj. ± + L		Max. 20 20 M	
(S=total adjustment (P+I+L): N= total habitat (G+J+M)) **Habitat Totals:**			adj. ± + S		Max. 55 51 N	

STREAM CONDITION

Physical

River make-up: (pool=pool/still/dam only: run only: rapid only: 2 mix=2 types etc.)	pool		Run	rapid	2 mix	3 mix
Average width of stream: (metres)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (metres)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: (slow=<½m/s, fast=>1m/s)	still	slow	Fast	med		mix
Water colour: (disc.=discoloured with visible colour but still clearish)	silty	opaqu		discol		clear
Recent disturbances due to: (constr.=construction) ***	flood	fire	constr	other		none
Bank / riparian vegetation is: (grass=includes reeds, shrubs=includes trees)	none		Grass	shrub	Mix	
Surrounding impacts: (erosn=erosion/shear banks, farm=farmland/settlements) ***	erosn	farm	Trees	other		Open
Left bank cover (rocks and vegetation): (in percent)	0-50	51-80	81-95	>95		
Right bank cover (rocks and vegetation): (in percent)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose lowest)						
(P=Physical boxes final total) **Stream Conditions**					max. 45 27 P	

Total IHAS Score: (N+P) 78 % T

Annexure C: Water Quality Results

aquatico Laboratories (Pty) Ltd

ilac-MRA sanas T0685

Test Report Page 1 of 1

Client:	BioBlue Environmental Sustainability	**Date of report:**	13 August 2024
Address:	829 Cronstedt street, Moreleta Park, Pretoria 0181	**Date accepted:**	05 August 2024
Report no:	192595	**Date completed:**	13 August 2024
Project:	Roodekrans	**Date received:**	05 August 2024

Lab no:					114591
Date sampled:					02-Aug-24
Aquatico sampled:					No
Sample type:					Water
Locality description:					Roodekrans
		Analyses	**Unit**	**Method**	
A	AQL	pH @ 25°C	pH	ALM 20	8.11
A	AQL	Electrical conductivity (EC) @ 25°C	mS/m	ALM 20	19.6
A	AQL	Nitrate (NO_3) as N	mg/l	ALM 06	1.80
A	AQL	Total oxidised nitrogen as N	mg/l	ALM 06	1.80
A	AQL	Orthophosphate (PO_4) as P	mg/l	ALM 12	0.345
A	AQL	E.coli	CFU/100ml	ALM 40	60
N	AQL	Faecal coliform	CFU/100ml	ALM 42	66
A	AQL	Total coliform	CFU/100ml	ALM 40	450
A	AQL	Turbidity	NTU	ALM 21	23.4
A	AQL	Total suspended solids (TSS)	mg/l	ALM 25	74

A = Accredited N = Non accredited Sub = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine ATR = Alternative test report ; Results relate only to the items received and tested ; Results reported against the limit of detection; Results marked 'Non SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory; Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation; The report shall not be reproduced except in full without approval of the laboratory

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Annexure D: SASS Sheets

Date (dd:mm:yr):	31:07:2024
Site Code:	Roodekrans
Collector/Sampler:	BioBlue
River:	Muldersdrift se loop
Level 1 Ecoregion:	1: LIMPOPO PLAIN
Quaternary Catchment:	A21E
Site Description:	**Roodekrans**
Temp (°C):	
pH:	
DO (mg/L):	
Cond (mS/m):	
Riparian Disturbance:	Exotic Vegetation, Vgetation removal
Instream Disturbance:	Flow modifications

			(dd.ddddd)
Grid reference (dd mm ss.s) Lat:	S	26° 4'5.94"	#VALUE!
Long:	E	27°50'25.96"	#VALUE!
Datum (WGS84/Cape):		31/07/2024	
Altitude (m):		1457	
Zonation:		C: Transitional	

Routine or Project? (circle one)
Project

Flow:	Medium
Clarity (cm):	45
Turbidity:	Low
Colour:	Normal Transparent
Algae (%)	Dark Brown

Biotopes Sampled (tick & rate)	Rating	Weight		Category
Stones In Current (SIC)	3	100,0		
Stones Out Of Current (SOOC)	2	100,0		
Bedrock	2	100		
Aquatic Veg	0	100,0		
MargVeg In Current	2	100,0		
MargVeg Out Of Current	1	100,0		
Gravel	3	100,0		
Sand	2	100,0		
Mud	2	100,0		
Hand picking/Visual observation	1			
OVERALL BIOTOPE SUITABILITY			38%	E

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5	A			A
COELENTERATA (Cnidaria)	1				
TURBELLARIA (Flatworms)	3	1			1
ANNELIDA					
Oligochaeta (Earthworms)	1			1	1
Hirudinea (Leeches)	3	A			A
CRUSTACEA					
Amphipoda (Scuds)	13				
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
Palaemonidae (Freshwater Prawns)	10				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Notonemouridae	14				
Perlidae	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4				
Baetidae 2 sp	6				
Baetidae > 2 sp	12	B	B	B	C
Caenidae (Squaregills/Cainfles)	6		B		B
Ephemeridae	15				
Heptageniidae (Flatheaded mayflies)	13				
Leptophlebiidae (Prongills)	9				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale Burrowers)	10				
Prosopistomatidae (Water specs)	15				
Teloganodidae SWC (Spiny Crawlers)	12				
Tricorythidae (Stout Crawlers)	9				
ODONATA (Dragonflies & Damselflies)					
Calopterygidae ST,T (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Synlestidae (Chlorolestidae)(Sylphs)	8				
Coenagrionidae (Sprites and blues)	4		A		A
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8	A		A	B
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6			A	A
Libellulidae (Darters/Skimmers)	4				
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Belostomatidae* (Giant water bugs)	3				
Corixidae* (Water boatmen)	3	1			1
Gerridae* (Pond skaters/Water striders)	5	B			B
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7				
Nepidae* (Water scorpions)	3				
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4				
Veliidae/M...veliidae* (Ripple bugs)	5				
MEGALOPTERA (Fishflies, Dobsonflies & Alderflies)					
Corydalidae (Fishflies & Dobsonflies)	8				
Sialidae (Alderflies)	6				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae	8				
Hydropsychidae 1 sp	4	A			A
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae	10				
Polycentropodidae	12				
Psychomyiidae/Xiphocentronidae	8				
Cased caddis:					
Barbarochthonidae SWC	13				
Calamoceratidae ST	11				
Glossosomatidae SWC	11				
Hydroptilidae	6				
Hydrosalpingidae SWC	15				
Lepidostomatidae	10				
Leptoceridae	6				
Petrothrincidae SWC	11				
Pisuliidae	10				
Sericostomatidae SWC	13				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5	A			A
Elmidae/Dryopidae* (Riffle beetles)	8				
Gyrinidae* (Whirligig beetles)	5	B	B		B
Haliplidae* (Crawling water beetles)	5				
Helodidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving Beetles)	10				
Psephenidae (Water Pennies)	10				

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Blepharoceridae (Mountain midges)	15				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2	A	A		A
Culicidae* (Mosquitoes)	1	1			1
Dixidae* (Dixid midge)	10	1			1
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5	B			B
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ancylidae (Limpets)	6	1			1
Bulininae*	3				
Hydrobiidae*	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails)	3				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* ST	5				
PELECYPODA (Bivalvles)					
Corbiculidae (Clams)	5				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
SASS Score					94
No. of Taxa					19
ASPT					5,0
Present Ecological State (A-F)					E/F
Other biota:					
Comments/Observations:					

Annexure E: Specialist Declaration

I, **Marinus du Preez**, in my capacity as a specialist consultant, hereby declare that I -

- act as an independent consultant;
- 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;
- declare that there are no circumstances that may compromise my objectivity in performing such work;
- do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- based on information provided to me by the project proponent and in addition to information obtained during this study, have presented the results and conclusion within the associated document to the best of my professional ability;
- undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered; and
- as a registered candidate of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member.



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Marinus du Preez (MSc Zoology)

Date: 13 October 2024

SSACNASP (134755)

Annexure E: CV of the Specialist