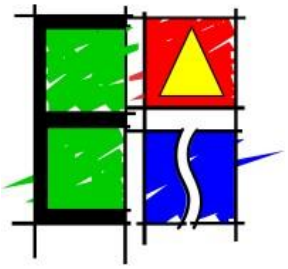
REPORT SPECIALIST	PERSPECTIVE Consulting
REPORT	**Aquatic Biodiversity Impact Assessment for the proposed Low Cost Housing Development, Grabouw, Farm Oudebrug (RE 9 of 313), Theewaterskloof Municipality, Western Cape**
REPORT VERSION	Version 2/Draft/16.07.2025
EAP/ CLIENT	
PROPONENT	Theewaterskloof Municipality
PREPARED BY	Cole Grainger (Pr. Sci. Nat.) 084 397 6753 | cole@fwpc.co.za

REPORT CONTEXT

SPECIALIST THEME	**Aquatic Biodiversity Theme**							
REPORT TYPE	Impact Assessment	☒	Scoping Report	☐	Site Sensitivity Verification	☐		
	Compliance Statement	☐	Screening Report	☐	Letter	☐		
	Biomonitoring Report	☐	Rehabilitation Report	☐				
INDUSTRY	Civil Engineering Transport Infrastructure	☐	Civil Engineering Housing Development	☒	Renewable Energy	☐		
	Agriculture	☐						

PROVINCE	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu Natal	Gaut eng	North West	Limpopo	Mpumal anga
	☒	☐	☐	☐	☐	☐	☐	☐	☐

DISTRICT MUNICIPALITY	Overberg
LOCAL MUNICIPALITY	Theewaterskloof
CATCHMENT MANAGEMENT AGENCY	BREEDE-OLIFANTS CATCHMENT MANAGEMENT AGENCY
WATER MANAGEMENT AREA	Breede Olifants
SUB WATER MANAGEMENT AREA	Overberg West
QUARTERNARY CATCHMENT	G40C
SUB QUARTERNARY CATCHMENT	9305

ENVIRONMENTAL PROCESSES TO BE INFORMED	Process	Act	Director	Applicable
	Environmental Authorisation	NEMA[1] (Act 107 of 1998)	DEADP[2]/ DFFE[3]	☒
	Water Use Authorisation	NWA[4] (Act 36 of 1998)	DWS[5]	☒

1 NEMA: National Environmental Management Act (Act 107 of 1998), as amended
2 DEADP: Department of Environmental Affairs and Development Planning
3 DFFE: Department of Forestry, Fisheries and the Environment
4 National Water Act (Act 36 of 1998), as amended
5 Department of Water and Sanitation

ABBREVIATIONS AND DEFINITIONS

ABIAr	**Aquatic Biodiversity Impact Assessment Report**
Alien Vegetation	Non-native vegetation that have been introduced to an area, either intentionally or non-intentionally.
ASPT	Average Score per Taxon
BAR	Basic Assessment Report
BAS	Best Attainable State
BGIS	Biodiversity Geographic Information System
Biodiversity	Overarchingly, the number and variety of living organisms, including genetic diversification, evolutionary history and the ecological processes they form a part of it.
Buffer	A strip of land surrounding a wetland or riparian area in which activities are controlled, restricted or prohibited, to reduce or prevent impacts to these systems.
Catchment	The topographical boundary/area of land of rainwater, surface runoff and subsurface flow (groundwater) collection which predicts the hydrological nature of rivers and wetlands.
°C	Degrees Celsius
CBA 1	**Critical Biodiversity Area (undegraded)** 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 2	**Critical Biodiversity Area (degraded)** 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.
DFFE	Department of Forestry, Fisheries and the Environment
DO	Dissolved Oxygen
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Ecological Class/Electrical Conductivity
ECO	Environmental Control Officer
Ecoregion	A "recurring pattern of ecosystems associated with characteristic contributions of soil and landform that characterises the region"
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class

EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EN	Endangered
EPL	Ecosystem Protection Level
ESA 1	**Ecological Support Area (undegraded)** 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 2	**Ecological Support Area (degraded)** 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.
ETS	Ecosystem threat status
EWR	Ecological Water Requirements
Facultative Wetland Vegetation Species	Specially with 76-99% occurrence in wetlands, but occasionally found in terrestrial areas
FEPA	Freshwater Ecosystem Priority Areas
FRAI	Fish Response Assessment Index
GA	General Authorisation
GIS	Geographic Information System
Gleying	A soil process resulting from prolonged soil saturation, and thereby long term reduction of metals such as Iron and Manganese which is reflected by the presence of neutral grey, bluish or greenish colours in the soil matrix
GN	Government Notice
GN509	Government Notice 509 published in Government Gazette (no. 40229) on the 26th August 2016 by the DWS under Section 39 of the National Water Act (Act no. 36 of 1998) (NWA) for Section 21 (c) and (i) water uses.
GN3139	**Government Notice 3139 published in Government Gazette (no. 48187) on the 10th March 2023 by the DWS under Section 39 of the National Water Act (Act no. 36 of 1998) (NWA) for Section 21 (c) and (i) water uses.** GN4167 replaces GN 509 of 2016 and outlines the process of a GA, which replaces the need to apply for a full Water Use Licence Application (WULA) in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA, including the applicant being listed under Appendix D1 or Appendix D2 of this notice.
GN4167	**Government Notice 4167 published in Government Gazette (no. 49833) on the 8th December 2023 by the DWS under Section 39 of the National Water Act (Act no. 36 of 1998) (NWA) for Section 21 (c) and (i) water uses.** GN4167 replaces GN 509 of 2016 and GN 3139 of 2023 and outlines the process of a GA, which replaces the need to apply for a full Water Use Licence Application (WULA) in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA, including the applicant being listed under Appendix D1 or Appendix D2 of this notice.

GPS	Global Positioning System
HGM	Hydrogeomorphic
Hydromorphic Soil	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation.
Hydromorphy	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile
Hydrophytic Vegetation	Vegetation that are adapted to living in anaerobic soil conditions
IHI	Index of Habitat Integrity
Invasive Species	A species that causes substantial ecological, environmental and/or economic damage
IUCN	International Union for Conservation of Nature
LC	Least Concerned
m	Meter
MAP	Mean Annual Precipitation
MASL	Meters Above Sea Level
MIRAI	Macroinvertebrate Response Assessment Index
Mottles	The oxidation and subsequent precipitation of Iron and Manganese out of aqueous solution when a once saturated/partially saturated soils becomes oxygenated when the soil matrix loses its water. Display as clusters of yellow or orange "mottles" in the soil matrix
NATIVE, INDIGENOUS AND ENDEMIC SPECIES	**Native:** Species occurs naturally in a biogeographic region as a result of natural evolution and distribution (no human intervention). The distribution of the species is not necessarily limited and it may be native to other regions too. These species are generalists and are at the lowest risk of extinction **Indigenous:** A native species that is found in a particular location and surrounding areas, with a distribution range that is comparatively more restricted than for native species. This species could be found with a specific mountain range as well as the surrounding areas. These species are semi-specialised and may face moderate risks of extinction **Endemic:** A native species with a highly restricted biogeographical range, large or small. A species can be endemic to an entire continent or to a much smaller area. For instance, a species might be found only in a particular mountain range at a certain elevation and nowhere else, or only in a particular lake, single river or small island. These species are highly specialised and face high risks of extinction
NBA	National Biodiversity Assessment
NEMA	The National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity (Act 10 of 2004) **Category 1a:** • Species which must be combatted or eradicated immediately • Authorised officials must be permitted to enter properties to monitor, assist with or implement the combatting or eradication which if available must be in accordance with an Invasive Species Management Programme **Category 1b:** • Species which must be controlled by property owners and organs of state with their properties, and if available, must be in accordance with an Invasive Species Management Programme • Authorised officials must be permitted to enter properties to monitor, assist with or implement the combatting or eradication

	• Category 2 listed species (where permits are applicable) which fall outside of containment and control revert to Category 1b and must be controlled • Category 3 listed species which occur with a Protected Area or watercourse revert to Category 1b and must be controlled • The Minister may require any person to develop a Category 1b Control Plan for one or more category 1b species occurring on a property **Category 2:** • Species listed under Category 2 requires a permit issued by the DFFE to carry out a restricted activity • No person may carry out a restricted activity in respect of a Category 2 listed invasive species without a permit • A person in control of a Category 2 listed species must take all necessary measures to ensure that specimens of the species do not spread outside of the land or area specified in the permit **Category 3:** • Category 3 listed invasive species are subject to certain exemptions in terms of Section 70 (i) (a) of the NEMBA Act, which applied to the listing of alien invasive species • Any Category 3 listed plant species that occurs in riparian areas must be considered as a Category 1b and the appropriate control measures instituted
NFEPA (FEPA)	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Area Expansion Strategy
NT	Near Threatened
NWA	National Water Act (Act 36 of 1998)
Obligate Wetland Vegetation Species	Wetland vegetation species that are always only found in wetland conditions (99% of occurrence is in a wetland)
ONA	**Other Natural Area** 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.
PAOI	**Project Area Of Influence:** A 500 m radius around the proposed culvert, as stipulated in GN4167 was screened for freshwater sensitivities, and watercourses occurring within this radius were delineated for this report. This 500 m radius will be referred to as the Project Area of Influence (PAOI).
pers. obs.	Personal observation
PES	**Present Ecological State:** Class A: Pristine Ecological Condition Class B: Largely Natural Ecological Condition Class C: Moderately Modified Ecological Condition Class D: Largely Modified Ecological Condition Class E: Seriously Modified Ecological Condition Class F: Critically Modified Ecological Condition
RDL	**Red Data Listed Species**

	Organisms that fall into the Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status. Species that classify as Least Concern (LC) are not considered RDLs.
REC	Recommended Ecological Condition
REMP	River Ecostatus Monitoring Programme
RMO	Recommended Management Objective
RQIS	Resource Quality Information Services
RQO's	Resource Quality Objectives
SACAD	South African Conservation Areas Database
SACNASP	South African Council for Scientific Professions
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Database
SASS5	South African Scoring System version 5
Seasonal Zone of Wetness	The zone of wetland that lies between the Temporary and Permanent Zones and is characterised by saturation between 3-10 months of the year, within 50 cm of the surface
Temporary Zone of Wetness	The outer zone of the wetland which is saturated within 50 cm of the surface for less than 3 months of the year.
SCC	Species of Conservation Concern
SQR	Sub Quaternary Catchment Reach
subWMA	Sub-Water Management Area
VEGRAI	Riparian Vegetation Response Assessment Index
TEC	Target Ecological Category
TWQR	Target Water Quality Range
VU	Vulnerable
Watercourse	*"A river or spring.* *A natural channel in which water flows regularly or intermittently.* *A wetland, lake or dam into which, or from which, water flows.* *Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks."*
Water Resource	The NWA defines water resources as watercourses, surface water areas, estuaries and aquifers. This report focuses only on watercourses, i.e. the presence of freshwater riverine and wetland systems.
WMA	Water Management Area
WULA	Water Use License Application

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LEGISLATIVE FRAMEWORK REPORTING REQUIREMENTS

In line with the protocol for the specialist assessment and minimum report content requirements for environmental impacts on freshwater biodiversity, the following has been determined:

- An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of: "**very high sensitivity**" for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Impact Assessment (**as has been determined for this project**)

An Aquatic / Freshwater Biodiversity Specialist Impact Assessment Report must contain the information as presented in Table 0.1 below.

Table 0.1 Aquatic Biodiversity Specialist Assessment information requirements as per the relevant protocol, including the location of the information within this report

Information to be Included (as per GN 320, 20 March 2020)	Report Section
The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of aquatic sciences	APPENDIX I
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae	APPENDIX I
A signed statement of independence by the specialist(s)	APPENDIX H
The assessment must be undertaken on the preferred site and within the proposed development footprint	6
A baseline description of the aquatic biodiversity and ecosystems on the site, including: aquatic ecosystem types; presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns.	B-1.1
The threat status of the ecosystem and species as identified by the screening tool	B-1.10
An indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub-catchment, a strategic water source area, a priority estuary, whether or not they are free-flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area)	B-1.7 B-1.8 B-1.9
A description of the ecological importance and sensitivity of the aquatic ecosystem including: 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 the historic ecological condition (reference) as well as the present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater)	C-4.2
The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate	E-3
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: 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); 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); what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and to what extent will the risks associated with water use and related activities change.	APPENDIX E
How will the proposed development impact on the functioning of the aquatic feature? This must include: base flows (e.g., too little or too much water in terms of characteristics and requirements of the system);	Table E-5.1

Information to be Included (as per GN 320, 20 March 2020)	Report Section
quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g., seasonal to temporary or permanent; impact of over-abstraction or instream or offstream impoundment of a wetland or river); change in the hydrogeomorphic typing of the aquatic ecosystem (e.g., change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); quality of water (e.g., due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and 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.)	
How will the proposed development impact on key ecosystems regulating and supporting services especially: flood attenuation; streamflow regulation; sediment trapping; phosphate assimilation; nitrate assimilation; toxicant assimilation; erosion control; and carbon storage?	Table E-5.1
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?	APPENDIX E
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment	APPENDIX A
The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant	APPENDIX C
A description of the assumptions made, any uncertainties or gaps in knowledge or data	APPENDIX A
The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant	D-4
Additional environmental impacts expected from the proposed development	E-5
Any direct, indirect and cumulative impacts of the proposed development on-site	E-5
The degree to which impacts and risks can be mitigated	E-5
The degree to which the impacts and risks can be reversed	E-5
The degree to which the impacts and risks can cause loss of irreplaceable resources	E-5
A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies	D-4
Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr)	9 APPENDIX F
A motivation must be provided if there were development footprints identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate	-
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	10
Any conditions to which this statement is subjected	10

REPORT SYNOPSIS

1. Appointment

Freshwater Perspective Consulting was appointed to conduct a specialist freshwater assessment as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed mixed-use development on Farm Re 9/313 (Oude Brug), Grabouw, Theewaterskloof Local Municipality, Overberg West District Municipality. The proposed development is located immediately north of the N2 National Highway, immediately east of the Grabouw Township (Figure 1.1 and Figure 2.1).

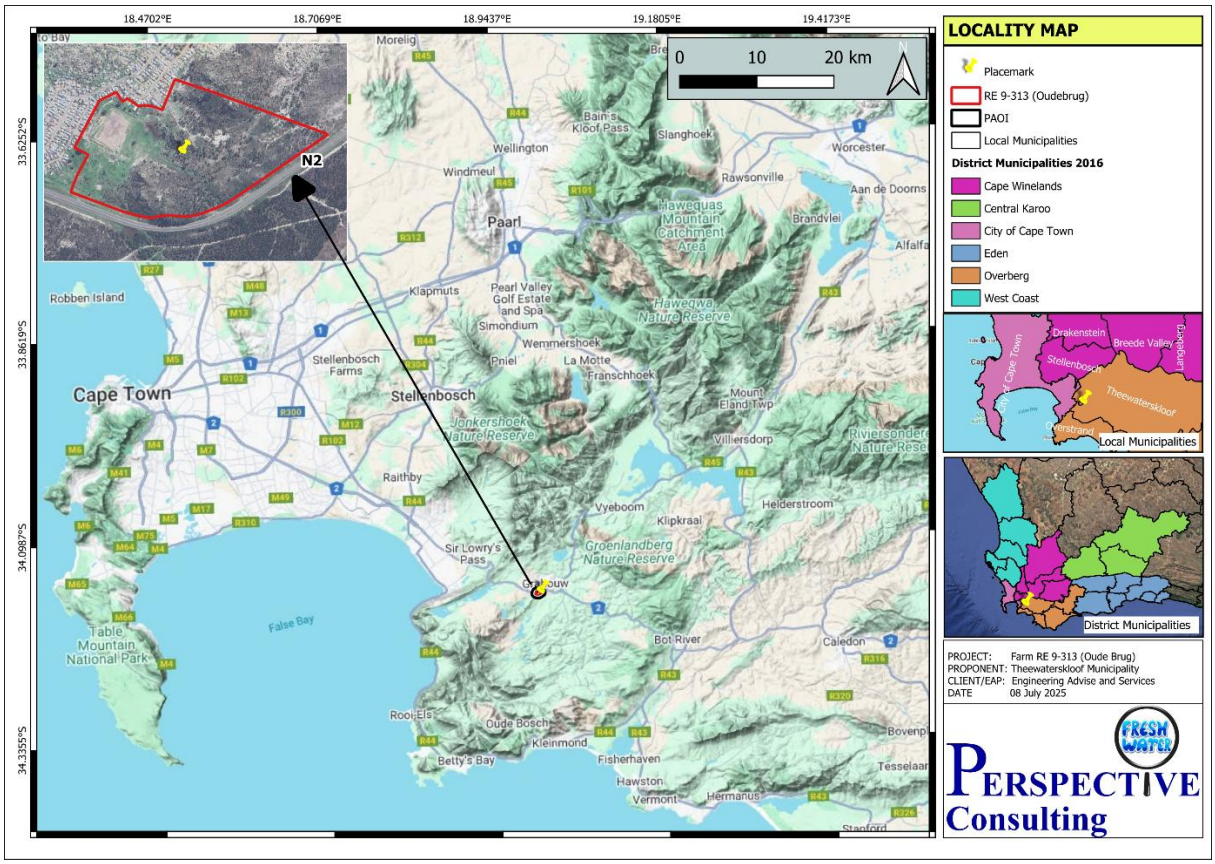

Figure 1.1 Location of the Project Area of Influence (PAOI) in relation to municipalities and the surrounding areas

2. Project

The proposed development comprises subsidy, emergency and financially linked individual subsidy programme (FLISP) housing which will require stormwater, domestic and sewerage services, and infilling, due to slope constraints. New internal stormwater, domestic and sewerage services will be required and linked to existing bulk services, which in turn will need to be upgraded to accommodate the increased service demand. Stormwater will be attenuated for flows up to 1:50 year intervals, unpurified domestic water will be treated at the Grabouw Water Treatment Works, and raw sewerage will be treated at the Grabouw Waste Water Treatment Works.

No services layouts or strategic development plans were available at the time of the previous report compiled by Freshwater Ecologist Network in November 2023, which have subsequently been made available and communicated in the updated report (this report). This report must proactively inform the proponent of development possibilities with respect to these layouts and services within the property.

The master plan is provided below in

.

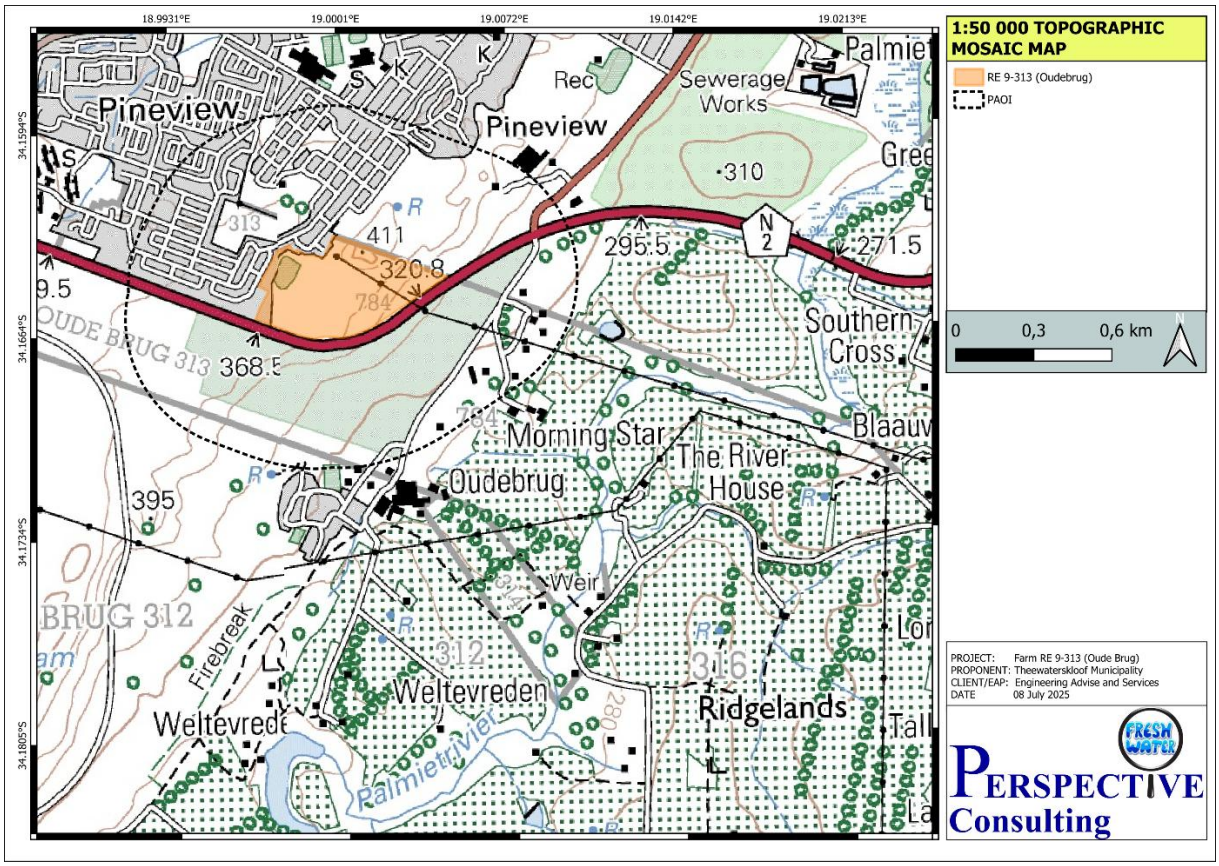

Figure 2.1 Location of the POAI overlayed on a 1:50 000 topographic map

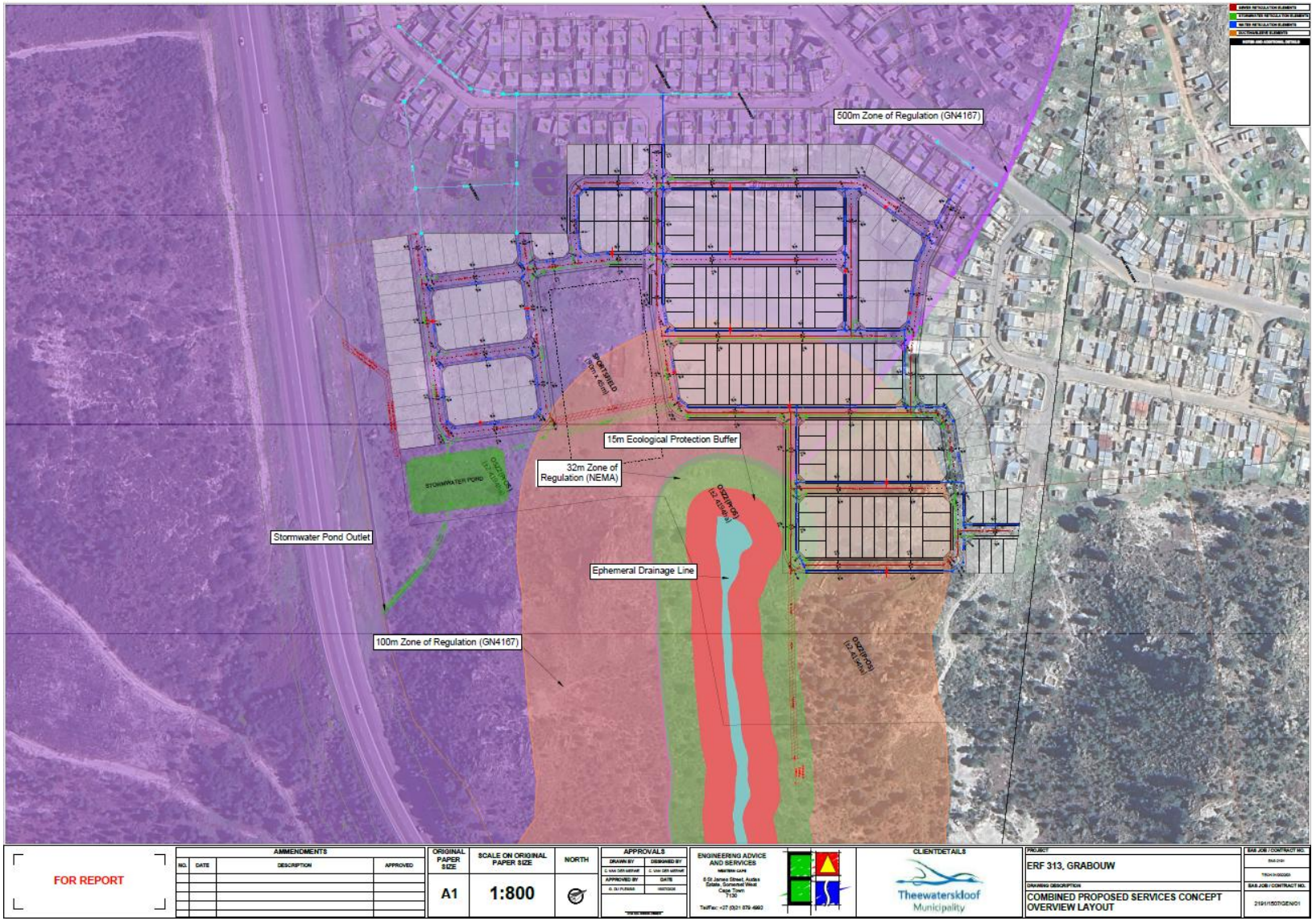

Figure 2.2 Proposed masterplan (as provided by EAS)

3. Scope of Works

This report was conducted in accordance with the "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). Refer to Table 0.1 above for a list of the reporting criteria.

This report is also in support of the Water Use Authorisation (WUA) process with the DWS, to enable the department to make an informed decision on the nature of the water use, i.e. General Authorisation (GA) versus Water Use License Application (WULA).

The initial report compiled by Freshwater Ecologist Network in November 2023 saw to the following Scope of Works for Erven 1314, RE/793 and 563 of 8078 and the farm RE 9 of 313 as described below:

- A desktop assessment of local, provincial and nationally relevant datasets within the PAOI;
- Field-based watercourse assessment and delineation within the PAOI; as per GN4167 and in accordance with the DWAF (2005) guidelines, whereby the outer watercourse edges (as defined in the NWA) will be defined;
- A functional and integrity assessment of the water resources, whereby the Present Ecological Status (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) is determined;
- The legal implications of the proposed culvert upgrades, as per the NWA and NEMA;
- Application of the DWS GN4167 Risk Assessment Matrix to determine the risk of the proposed culvert upgrades on the associated watercourses; and
- A statement on the suitability of the development given the environmental sensitivities and any conditions that the awarding of the WUA and EA must be subjected to.

The masterplan, i.e., the Strategic Development Plan (SDP) and services for the farm RE 9 of 313 (Oude Brug) had since been made available to Freshwater Perspective Consulting (FWPC) in May 2025. This requires the following report upgrades to the initial report compiled by Freshwater Ecologist Network:

- Updating all maps to reflect the latest GIS spatial information;
- Application of the GN4167 Risk Assessment Matrix, now considering the SDP and services. Previously the GN509 Risk Assessment Matrix was applied, which is superseded by GN4167; and
- Report conversion from a FEN- FWPC template.

4. Need for this report

The need for an Aquatic Biodiversity Impact Assessment was determined by the **"Very High"** Aquatic Biodiversity Sensitivity classification of the National Web-Based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended), which was developed by the Department of Forestry, Fisheries and The Environment (DFFE) under the governance of the National Environmental Management Act (Act 107 of 1998) (NEMA).

The Very High Aquatic Biodiversity Sensitivity rating is based on nationally recognised seep wetlands and the PAOI falling within the Boland Surface Water Strategic Water Source Area (SWSA).

Although no wetlands or highly sensitive watercourses were identified within the immediate vicinity of the proposed development (within RE 9-313), the general south-west sloping terrain would create water accumulation areas on the southern side of the N2 national highway in which several wetland systems are expected. This is notwithstanding the southwards flowing Palmiet River, which is the master recipient of all freshwater in the area which is a Moderately Modified, Endangered, Poorly Protected, Critical Biodiversity Area that has been designated as a Phase 2 FEPA, meaning that this river must not be further degraded, as it may in future be considered for rehabilitation once more ecologically intact river systems have been rehabilitated and well managed.

The Freshwater Specialist therefore supports the Very High Aquatic Biodiversity Classification of the Screening Tool of the PAOI, based on the field survey conducted on the 16th November 2023 and the above reasoning.

5. Desktop Assessment

The various spatial layers do not indicate any watercourses to fall within the subject property. An EDL was subsequently field verified, as illustrated in Figure 6.1. Therefore, the desktop assessment for this report focuses on the broader ecological and catchment context of the downstream watercourses that could potentially be recipients of disturbance within the subject property, either via discharge into the EDL, or via other stormwater pathways, both which eventually drain into the Palmiet River system.

The PAOI falls within the Kogelberg Biosphere Reserve conservation area and falls within a Phase 2 FEPA catchment which are identified in moderately modified rivers (C ecological category), only in cases where it was not possible to meet biodiversity targets for river ecosystems in rivers that were still in good condition (A or B ecological category). The condition of these Phase 2 FEPAs should not be degraded further, as they may in future be considered for rehabilitation once FEPAs in good condition (A or B ecological category) are considered fully rehabilitated and well managed.

The southwest sandstone fynbos wetland vegetation type which occurs on site is designated as Endangered but Well Protected.

According to the NBA database Ecosystem Threat Status (2018), the seep wetland is designated as Vulnerable, the wetlands associated with the Palmiet River as **Critically Endangered,** and the Palmiet River itself as **Endangered**.

According to the NBA database Ecosystem Protection Level (2018), the seep wetland is designated as Well Protected, the wetlands associated with the Palmiet River as **Not Protected,** and the Palmiet River itself as Moderately Protected, and **Poorly Protected** further downstream.

The RQO's PESEIS [6]Database (2014) designates the upstream reaches of the Palmiet River, to be of a Class B/C Present Ecological Status (PES) – Largely Natural to Moderately Modified Ecological Condition and the downstream reaches to be a Class B (Largely Natural) PES. A High Ecological Importance and High Ecological Sensitivity at the G40C-09305 PESEIS inspection point, downstream of the proposed development is designated (refer to Section 6.3 below).

The Proposed Water Resource Classes and Resource Quality Objectives (RQOs) for the Breede-Gouritz Water Management Area (DWS 2018), which now falls within the Breede-Olifants Water Management Area (DWS 2023) for a Class II[7] and Class III[8] water resource (as applicable, depending on the availability and location of the RQO data) are summarised below in Table 5.1.

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[6] PESEIS: Present Ecological Status, Ecological Importance and Ecological Sensitivity
7 Class II: An Integrated Resource Unit (IRU) indicating moderate protection and modern utilisation of the water resource
8 Class III: An IRU indicating sustainable minimal protection and high utilisation

Table 5.1 Breede-Olifants WMA Proposed Resource Quality Objectives for the most proximate watercourses to those within the PAOI

Integrated Units of Analyses	River	IUA Class	Biophysical Node	Quaternary Catchment	Resource Unit	Target Ecological Category	pH	EC (mS/m)	DO (mg/l)	VEGRAI (level 3)	FRAI	MIRAI	SASS5
B5 Overberg West	Palmiet	II	Piii2	G40D	B5-R12	B/C (Largely Natural to Moderately Modified Ecological Condition)	≥ 6.5 ≤ 8.5	≤ 55	≥ 6	B/C Category (77-82%)	E Category (22-37%)	B/C Category (77-82%)	SASS Score > 110 ASPT > 6.5 Families that must be present: *Corydalidae, Elmidae, Hydropsychidae,* and *Cordulidae*
	Palmiet	II	Piii3	G40D	B5-R13	B (Largely Natural Ecological Condition)	≥ 5 ≤ 7.5	≤ 30	≥ 8	Category B (82-87%)	Category D (42-57%)	Category B (82-87%)	SASS Score >100 ASPT > 7.0 Families that must be present: *Athericidae, Leptophlebiidae, Heptageniidae, Tricorythidae, Elmidae, Corydalidae, Hydropsychidae* (≥ 2sp)

Table 5.1 above describes the Palmiet River (which ultimately would receive water from the proposed development) in its downstream reaches as being in a Class B/C – Class B PES – Largely Natural to Moderately Modified ecological condition. The improvement in the PES Class between upstream Piii2 and its Piii3 downstream site is also reflected in the River Ecostatus Monitoring Programme Tools, whereby, VEGRAI, FRAI, MIRAI and SASS5 all increase by one Ecological Class. The proposed development must further take cognisance of the physico chemistry limits of pH, Electrical Conductivity (EC) and Dissolved Oxygen (DO), both during the construction phase and services operations during the operational phase. Although the Palmiet River is more degraded in the vicinity of the proposed development, Table 5.1 suggests that the PES of the Palmiet River must ultimately improve on route to the coast. This can only be made possible if all upstream activities are carefully managed and risk adequately mitigated.

6. Field-Based Assessment

In line with the minimum requirements for aquatic biodiversity surveys, a single field survey within the project area was undertaken on the 16th November 2023 (late spring declining base flow season) to delineate the spatial extent of the study reach of the subject watercourse and assess its Present Ecological Status (PES), Ecological Importance (EI) and Ecological Sensitivity (ES), collectively (PESEIS).

6.1. Watercourse Delineation

An ephemeral drainage line (EDL) was identified to the west of the proposed development which flows in a south westerly direction out of the farm boundary, underneath the N2 National Highway after which this feature drains through a forested area of Pines (*Pinus pinaster*), eventually confluencing with the southwards-flowing Palmiet River, presumably after release from agricultural impoundments downgradient.

The watercourse delineation map is indicated below in Figure 6.1 and indicates the EDL and an unchanneled valley bottom wetland and several seep wetlands, south of the N2 national highway along the southern portion of the PAOI.

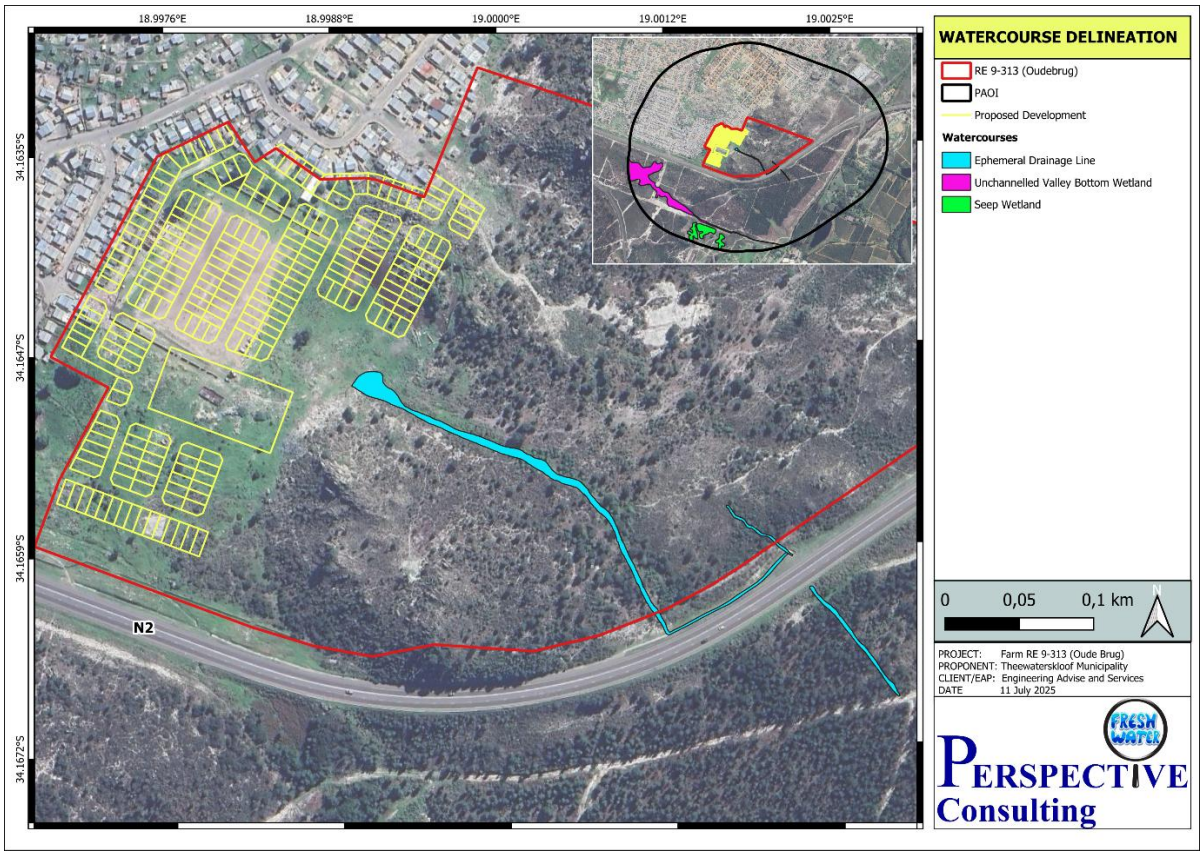

Figure 6.1 Watercourse delineation map of watercourses falling within the PAOI

6.2. Present Ecological Status and Ecological Importance and Sensitivity

A summary of the PESEIS, including the Recommended Ecological Category, Recommended Management Objective and Best Attainable State is provided below in Table 6.1 for the EDL and Palmiet River. The activities of the proposed development must ensure that the PES Category D of the EDL is maintained, and not further deteriorated, as general best practice, but moreover, because the EDL in question delivers freshwater to the Palmiet River (presumably) which is to be managed for a PES Class B/C category in its downstream reaches. In this regard the water quality emanating from surface runoff and stormwater releases of the proposed development must be sufficiently managed prior to discharge into the environment. Refer to Section 9 and APPENDIX F for a list of site specific and general best practice mitigation measures respectively.

Table 6.1 PESEIS summary of the Ephemeral Drainage Line

Present Ecological Status	Primary Ecoservices	Ecological Importance and Sensitivity	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
Category E (Seriously Modified)	• Food for Livestock • Cultivation Potential • Harvestable resources	Low	REC Category D (Largely Modified) BAS: Category D (Largely Modified) RMO: Category D (Improve)
Extent of Modification Anticipated	**Low Modification Extent Envisaged** An extent of modification is envisaged on the ecological integrity of the EDL due to this system being downgradient of the proposed development which may potentially impact on the water quality component of the EDL. The Low extent of modification was assigned based on components of the proposed development being within the 32m Zone of Regulation (NEMA), and thus the probability of impact, despite mitigation measures being in place can not be entirely disregarded on the EDL.		
Impact Significance and Business Class	**Low** No fatal flaws are envisaged in terms of impacts to these EDLs, especially considering the ongoing disturbances that have pressurised these systems into being little more than freshwater conduits that regulate the flows of downstream systems (i.e the Palmiet River). The cumulative impacts on the downstream freshwater ecosystems must be considered in terms of water quality impacts, by ensuring that these EDLs do not become pathways of pollution during the construction, and especially during the operational phase.		

Table 6.2 PESEIS summary of the receiving Palmiet River (downstream of the proposed development)

Present Ecological Status	Primary Ecoservices	Ecological Importance and Sensitivity	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
Category D (Moderately Modified)	• Biodiversity Maintenance	Very High	REC Category C (Moderately Modified) BAS: Category C (Largely Modified) RMO: Category C (Improve)
Extent of Modification Anticipated	**Low to No Extent of Modification Extent Envisaged** Modification to the downstream reach of the Palmiet River may take place in the form of alien and invasive vegetation encroachment on the proposed development site and thereafter migrating along the flow path of the Ephemeral Drainage Line, and eventually into the Palmiet River system itself. The Palmiet River is approximately 1.3 km south-west of the proposed development site, and so migration this way is plausible. Other potential impacts include potential degradation of the water quality of the Palmiet River from stormwater releases and, in unlikely cases, ingress of sewerage into the Ephemeral Drainage Line channel, and eventually finding its way into the Palmiet River. Water quality related impacts to this system are however highly unlikely.		
Impact Significance and Business Class	**Low** No fatal flaws are envisaged on this system. The cumulative impacts on the Palmiet River must be considered in terms of water quality impacts (considering the largely agricultural catchment), by ensuring that the proposed development does not contribute to water quality pollution during the construction, and especially during the operational phase.		

6.3. Ecological Importance and Sensitivity

Ephemeral Drainage Line

The Ephemeral Drainage Line was determined to have a very low Ecological Importance and Sensitivity due to already being Seriously Modified, being ephemeral in nature and therefore not supporting an aquatic ecosystem year round, fragmentation of its course by the N2 national highway, and therefore preventing this system from being an aquatic corridor (atleast in terms of biota movement) to larger systems such as the Palmiet River, and this EDL not being recognised Nationally, or in provincial conservation planning. Furthermore, this Ephemeral Drainage Line is not envisaged to support rare and endangered aquatic communities.

Palmiet River

The Palmiet River was determined to have a Very High Ecological Importance and Sensitivity due to being an Endangered, Poorly Protected, Critical Biodiversity Area that has been designated as a Phase 2 FEPA, meaning that this river must not be further degraded, as it may in future be considered for rehabilitation once more ecologically intact river systems have been rehabilitated and well managed.

The DWS PESEIS G40C-09305 inspection point further indicates a very high invertebrate rarity and representivity per secondary class, high riparian wetland instream vertebrate presence (excluding fish), high riparian-wetland natural vegetation importance, very high habitat size, high habitat diversity class and instream migration link class, very high macroinvertebrate velocity sensitivity, very high riparian-wetland instream vertebrates (excluding fish) intolerance to water level/flow changes and very high macroinvertebrate physico-chemistry sensitivity.

7. GN4167 Risk Assessment Matrix

The GN4167 Risk Assessment Matrix determined that all activities would pose a Low-risk significance impact on the ecological integrity of the EDL and the potentially receiving Palmiet River. This is due to a combination of 1) the already Seriously Modified PES of the EDL, in terms of alien invasive vegetation, existing physical (litter) and chemical pollution (substances) of the EDL, meaning this system is no longer considered ecologically sensitive, the ephemeral hydroperiodicity of this EDL, meaning that its course is dry for the majority of time(September (year 1) – June (year 2) and for this reason is also not ecologically sensitive outside of the wet season; and 3) the proposed development footprint is proposed outside of the footprint of the EDL, and therefore direct impacts are avoided, meaning that no loss in the footprint of the EDL is expected. The proposed development therefore needs to focus its mitigation largely on not cumulatively impacting on the EDL in terms of alien and invasive vegetation species encroachment and water quality impacts on the EDL, and downstream receiving Palmiet River system. Concrete in particular is highly toxic for aquatic biota and furthermore has a very high alkaline pH, unlike the naturally acidic pH of the majority of river systems in the Western Cape (Day and Davies (2023).

The Low risk impact significance on the Palmiet River, especially in terms of further water quality perturbation is due to the unlikely event of sewerage pipeline failure and subsequent ingress into the EDL and eventually the Palmiet River system. Stormwater entry into the Palmiet River by comparison is much more likely, but assuming that the stormwater attenuation facility will be operated in such a manner that erosion is prevented and water quality releases are within the specification of the Resource Quality Objectives of the B5 Overberg West reach of the Palmiet River (Table 5.1), the impacts are envisaged to be Low. Alien and invasive vegetation encroachment into the Palmiet River system due to disturbance on site is of the most concern, but was determined to be Low on condition that an alien and invasive management plan is in place for this project.

It is imperative that sediment and the continued spread of alien invasive vegetation be managed during the construction phase, and as required during the operation phase, including monitoring thereof. The low risks associated with the DWS Risk Assessment Matrix are based on the assumption that sources of water quality impairment and mobilisation of alien and invasive vegetation species and sediment can be contained.

The rehabilitation of the EDL would see a positive ecological return during the operational phase in terms of increased ecosystem provision in the long term via improved habitat of the downstream reach of the drainage line once the initial rehabilitation disturbance during the construction phase has ceased.

A decommissioning phase for the proposed development was not considered due to the longevity of proposed activity.

Table E-5.1 summarises the DWS GN4167 Risk Assessment Matrix ratings associated with the project in terms of the listed activities that would likely result in the above impacts. The risks are calculated based on the assumption that the mitigation measures, as described in Section 9 and APPENDIX F are diligently applied.

The determination of only Low risk significances would afford the applicant eligibility to register for the Water Use Authorisation process in terms of a General Authorisation. This decision is however ultimately the sole discretion of the DWS, the freshwater custodians of South Africa.

8. Legislative Requirements

The initial report compiled by Freshwater Ecologist Network stated that the EDLs do not meet the definition of a watercourse due to lacking riparian vegetation, but may be considered a watercourse that would be subjected to regulation under the NWA, should a 1:100 year floodline associated with them be delineated by a qualified professional.

This report as compiled by Freshwater Perspective Consulting is of the opinion that riverine systems do not need to express riparian areas along their banks to be considered watercourses. GN 4167, in terms of the regulation area of watercourses states that "*in the absence of a determined 1 in 100-year flood line or riparian area, the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench*"; and furthermore, the definition of a watercourse makes provision for "*a natural channel in which water flows regularly or*

intermittently, or 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."

Construction within a watercourse will therefore require EA and WUA with the respective departments.

In terms of Water Use Authorisation (WUA), development within the 100 m ZOR of riverine systems requires that the WUA process be followed with the Department of Water and Sanitation (DWS). The Freshwater Specialist is of the opinion that the WUA process would qualify to follow the General Authorisation registration protocol with the DWS, given that all risk significance impacts were determined to be Low. The WUA process is however ultimately to be determined by the DWS, the freshwater resource custodians of the freshwater resource in South Africa.

In terms of Environmental Authorisation (EA), the development within the NEMA 32 m ZOR of the EDL may trigger Activity 12 of GN327 – Listing Notice 1 of the 2014 Environmental Impact Assessment (EIA) regulations (**GN 983 of 04 December 2014 - as amended**) and Activity 14 of GN324 – Listing Notice 3 (**GN 985 of 04 December 2014 - as amended)** of the 2014 EIA regulations **GN 982 of 04 December 2014 (as amended)**, to be determined by the Environmental Assessment Practitioner (EAP).

9. Site Specific Mitigation Measures

The site-specific mitigation measures are largely concerned with the protection of the downstream receiving Palmiet River, considering its conservation importance in rehabilitation plans and for meeting biodiversity targets. Therefore, the following site mitigation measures are pertinent to this project:

9.1. Construction Phase

- Silt traps must be installed prior to the commencement of any activities;
- Invasive vegetation with the proposed construction footprint must be removed, including problematic species and efficiently restocked with endemic plant species;
- Development must coincide with the summer to autumn dry season (December (year 1) – April (year 2) as far as possible to avoid or maximise control of polluted surface runoff related complications to the receiving EDL and ultimately, the Palmiet River;
- During this dry period it is strongly suggested that all concrete works be completed and batching may not take place on the ground. Batching of concrete within the building is supported on condition that concreate is contained with walls; and
- An alien and invasive management plan must be in place for the vegetation clearing on site, to ensure that vegetation is cleared in a strategic, controlled and phased manner, to prevent the spread of alien vegetation on site.

9.2. Operational Phase

- The site must be rehabilitated with indigenous vegetation and monitoring for the potential encroachment of alien vegetation with the proposed development area, on a quarter-annual basis for the first year of operation, and then bi-annually during the second year of operation must be conducted. Once the site is stabilised in terms of indigenous vegetation then monitoring and associated rehabilitation may cease. This mitigation necessitates that an alien and invasive management plan is drafted for the project, for consideration by the Breede Gouritiz Catchment Management Agency;
- Siltation of the EDL must also be monitored during both the construction and operational phase of the proposed development;
- The internal sewer pipelines must be monitored every 5 years for leaks, and an emergency repair plan must be in place, in case of the detection of a leak; and
- Stormwater infrastructure must be designed and operated in accordance with the principles of Sustainable Urban Design Principles (SUDs), by discharging adequate quantities and qualities of stormwater to receiving freshwater ecosystems, also ensuring that adequate energy dissipation structures are in place to prevent erosion of receiving watercourses. Water quality releases must

be within the specification of the Resource Quality Objectives of the B5 Overberg West reach of the Palmiet River.

10. Specialist Opinion

Considering the assessment findings, it is the opinion of the specialist that the project may be considered for authorisation, on condition that all prescribed construction and operation phase mitigation measures and recommendations are implemented as described in this report.

11. Report Appendices

For further technical support of the synopsis and general reporting requirements, please refer to the Appendices, as described in the Table of Appendices (Table 11.1) below:

Table 11.1 Overview of report Appendices

APPENDIX A	Assumptions and Limitations
APPENDIX B	Desktop Methodology and Results
APPENDIX C	Field-Based Methodology and Assessments
APPENDIX D	Environmental Legislation and Requirements
APPENDIX E	GN4167 Risk Assessment
APPENDIX F	General Mitigation Measures
APPENDIX G	References
APPENDIX H	Specialist Declaration of Independence
APPENDIX I	Specialist CV

APPENDIX A ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are relevant to this project:

- The National Water Act (Act 36 of 1998) (NWA) defines water resources as watercourses, surface water areas, estuaries and aquifers. This report focuses only on watercourses, i.e. the presence of freshwater riverine and wetland systems, as defined in the NWA;
- It is assumed that the client has provided the specialist with all available relevant and accurate data and information surrounding the project at the time of writing, including the extent of the project area provided to the specialist;
- A single aquatic survey was conducted on the 16th of November 2023 for the respective study, which would constitute a late spring semi-wet season **declining base flow survey.** Thus, temporal trends were not investigated and it must be acknowledged that ecological processes are dynamic and complex, with certain aspects thereof potentially being overlooked. The freshwater ecosystem delineation as presented in this report is, however, regarded as the best estimate of the boundaries based on the site conditions present at the time of the site visit and are deemed appropriately accurate to guide any future development plans;
- Site surveys are recommended to take place during a seasonal period where the probability of detecting seasonally limited freshwater features such as facultative or obligate wetland vegetation are highest, and/or when aquatic faunal communities are most diverse – i.e. in a state of early succession prior to top-down control by factors such as predation. In terms of wetland "greenness" and plant vigour and riverine aquatic biodiversity, this period occurs in spring between September and November in the Western cape Province. Thus, the site conditions at the time of the assessment are reasonably ideal for the purposes of the study;
- The Grabouw area in which the proposed development is located has undergone decades of transformation, primarily due to afforestation and deforestation, and recent development and expansion of the Grabouw residential suburbs and township. This has altered the hydrological and geomorphic characteristics and vegetation composition associated with the watercourses. The watercourse delineations as presented in this report however do occur outside of developed areas, but nevertheless are regarded as a best estimate of the boundaries based on the present-day site conditions;
- It fell outside the scope of works to field-verify the presence of any watercourses that are not directly associated with the site on which development is proposed. This potentially includes the Palmiet River which receives the subject watercourse some 1.3 km downstream. Watercourse delineations adjacent to the subject watercourse are therefore based on professional opinion, using Google Earth Digital Satellite Imagery and are deemed sufficiently accurate for the purposes of this study for the reasons stated above;
- Instream ecological response models pertaining to the River Ecostatus Monitoring Programme (REMP) such as the Fish Response Assessment Index (FRAI) (Kleynhans 2008) and the Macroinvertebrate Response Assessment Index (MIRAI) (Thirion 2007) where not run for this project considering that these models are best informed by multiple aquatic surveys which are typically conducted during biomonitoring programs, and more importantly, on perennial riverine systems on which they have been tested. Completion of the river Index of Habitat Integrity (IHI) models is deemed sufficient for the purposes of this project;
- Even though the River Ecostatus Monitoring Tools could not be computed for this project, the RQOs for the downstream receiving Palmiet River must be still be considered, in terms of how water quality emanating from the proposed development area could impact on these RQOs (Table 5.1); and
- The GPS used for water resource delineations is inherently accurate to five meters. Therefore, the delineation plotted digitally may be offset by a maximum of five meters to either side. However, the delineations are deemed sufficiently accurate to adequately protect the freshwater resource.

APPENDIX B DESKTOP ASSESSMENT AND METHODOLOGY

B-1 Freshwater coverage and catchment, ecological and conservation context

The desktop spatial layers as listed and summarised below in Table B-1.1 below were used to indicate the likely presence of water accumulation areas in terms of rivers and wetlands with respect to the PAOI and to provide hydrological, ecological and conservation context of the surrounding areas within which these watercourses fall.

The desktop assessment was undertaken using Geographic Information System (GIS) software to query spatially relevant spatial layers pertaining to the PAOI and surrounding areas. These spatial layers were subsequently mapped to identify potential freshwater sensitive areas, to be groundtruthed in the field.

The baseline aquatic / freshwater sensitivity of the project area was obtained using the National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended). The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas based on specialist opinion in terms of watercourse presence, PESEIS and observations of sensitive fauna and flora.

Table B-1.1 Summary of the freshwater coverage, catchment, ecological and conservation context of the PAOI

Desktop Information	Relevance	Reasoning	Section
Aquatic Biodiversity Sensitivity Theme	Yes	PAOI falls within a Very High Aquatic Biodiversity Sensitivity Area	B-1.1
Catchment Drainage Context	Yes	Refer to description	B-1.2
Level 1 Ecoregion and DWS PESEIS monitoring point	Yes	Refer to description	B-1.2
Strategic Water Source Areas (SWSA)	Yes	PAOI falls within surface and groundwater SWSAs	B-1.3
River Freshwater Ecosystem Priority Areas (FEPAs)	Yes	PAOI falls within a Phase 2 FEPA	B-1.4
National Freshwater Ecosystem Priority Areas (Wetland Vegetation Types)	Yes	PAOI falls within the Southwest Sandstone Fynbos wetland vegetation type which is **Endangered** but Well Protected	B-1.5
South African Conservation Areas Database	Yes	PAOI falls within the Kogelberg Biosphere Reserve conservation area	B-1.6
South African Protected Areas Database	No	PAOI does not overlay any protected areas	B-1.6
Western Cape Biodiversity Spatial Plan (version 2)	No	No conservation areas fall within the CBA	B-1.7
National Freshwater Ecosystem Priority Areas (NFEPA) – National Wetland Map 4	No	No wetlands are indicated within the subject property	B-1.11
NFEPA Rivers	No	No rivers are indicated within the subject property	B-1.8
National Biodiversity Assessment (NBA) – National Wetland Map 5	Yes	No wetlands are indicated within the subject property	B-1.9
NBA Rivers	Yes	No wetlands are indicated within the subject property	B-1.9
Aquatic Ecosystem Threat Status	Yes	According to the NBA database Ecosystem Threat Status (2018), the seep wetland is designated as Vulnerable, the wetlands associated with the Palmiet River as **Critically Endangered,** and the Palmiet River itself as **Endangered**.	B-1.10
Aquatic Ecosystem Protection Level	Yes	According to the NBA database Ecosystem Protection Level (2018), the seep wetland is designated as Well Protected, the wetlands associated with the Palmiet River as **Not Protected,** and the Palmiet River itself as Moderately Protected, and Poorly Protected further downstream.	B-1.11

B-1.1. National Web-Based Environmental Screening Tool

The National Web-Based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended) was developed by the Department of Forestry, Fisheries and The Environment (DFFE) under the directorship of the National Environmental Management Act (Act 107 of 1998) (NEMA).

The Screening Tool (Figure B-1.1.1); has characterised the aquatic biodiversity sensitivity theme of the PAOI as "**Very High**" due to the presence of seep wetlands and the PAOI falling within the Boland surface water Strategic Water Source Area (SWSA).

Although no wetlands or highly sensitive watercourses were identified within the immediate vicinity of the proposed development (within RE 9-313), the general south-west sloping terrain would create water accumulation areas on the southern side of the N2 national highway in which several wetland systems are expected. This is notwithstanding the southwards flowing Palmiet River, which is the master recipient of all freshwater in the area which is a Moderately Modified, Endangered, Poorly Protected, Critical Biodiversity Area that has been designated as a Phase 2 FEPA, meaning that this river must not be further degraded, as it may in future be considered for rehabilitation once more ecologically intact river systems have been rehabilitated and well managed.

The Freshwater Specialist therefore supports the Very High Aquatic Biodiversity Classification of the Screening Tool of the PAOI, based on the field survey conducted on the 16th of November 2023 and the above reasoning.

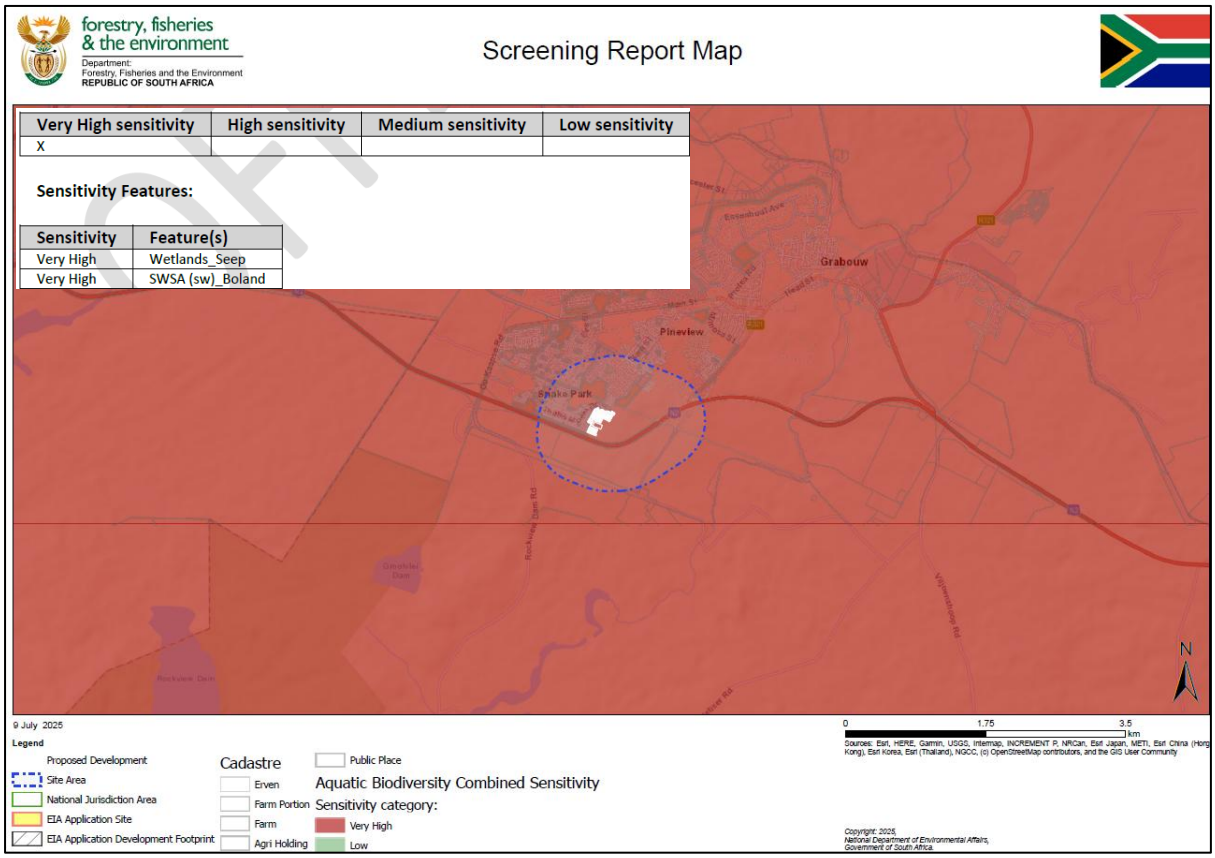

Figure B-1.1.1 Aquatic Biodiversity Theme outcome of the Environmental Screening Tool

B-1.2. Catchment Drainage and Ecoregion Context

The PAOI falls within the Southern Folded Mountains Level 1 Ecoregion in the Overberg West Sub Water Management Area (WMA), within the Breede Olifants WMA (DWS 2023), previously the Breede Gouritz WMA, within the G40C quaternary catchment (Figure B-1.2.1 and Figure B-1.2.2). The watercourse (EDL) flows south-east then south through the PAOI before crossing the N2 national highway and eventually reaches the Palmiet River system some ~ 1.3 km south east of the proposed development.

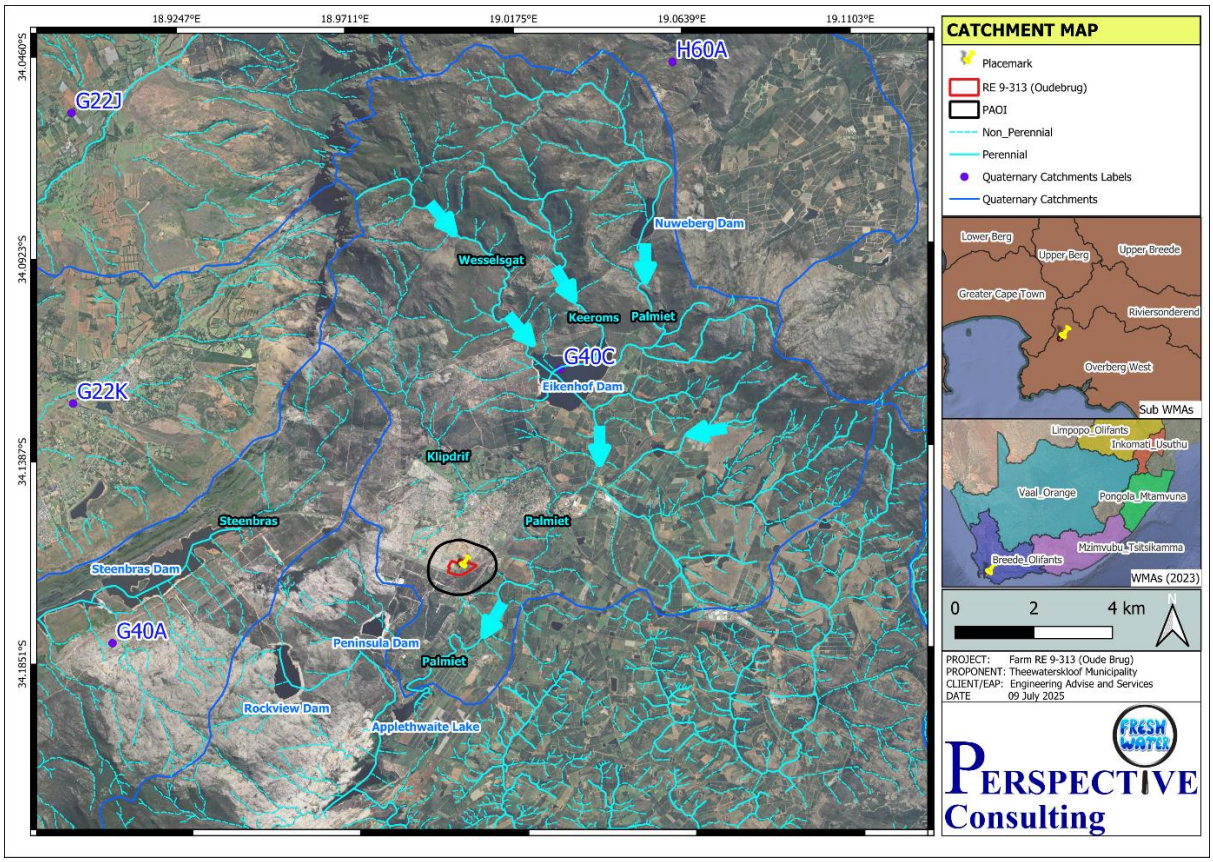

Figure B-1.2.1 Catchment drainage context in relation to the PAOI and surrounding areas

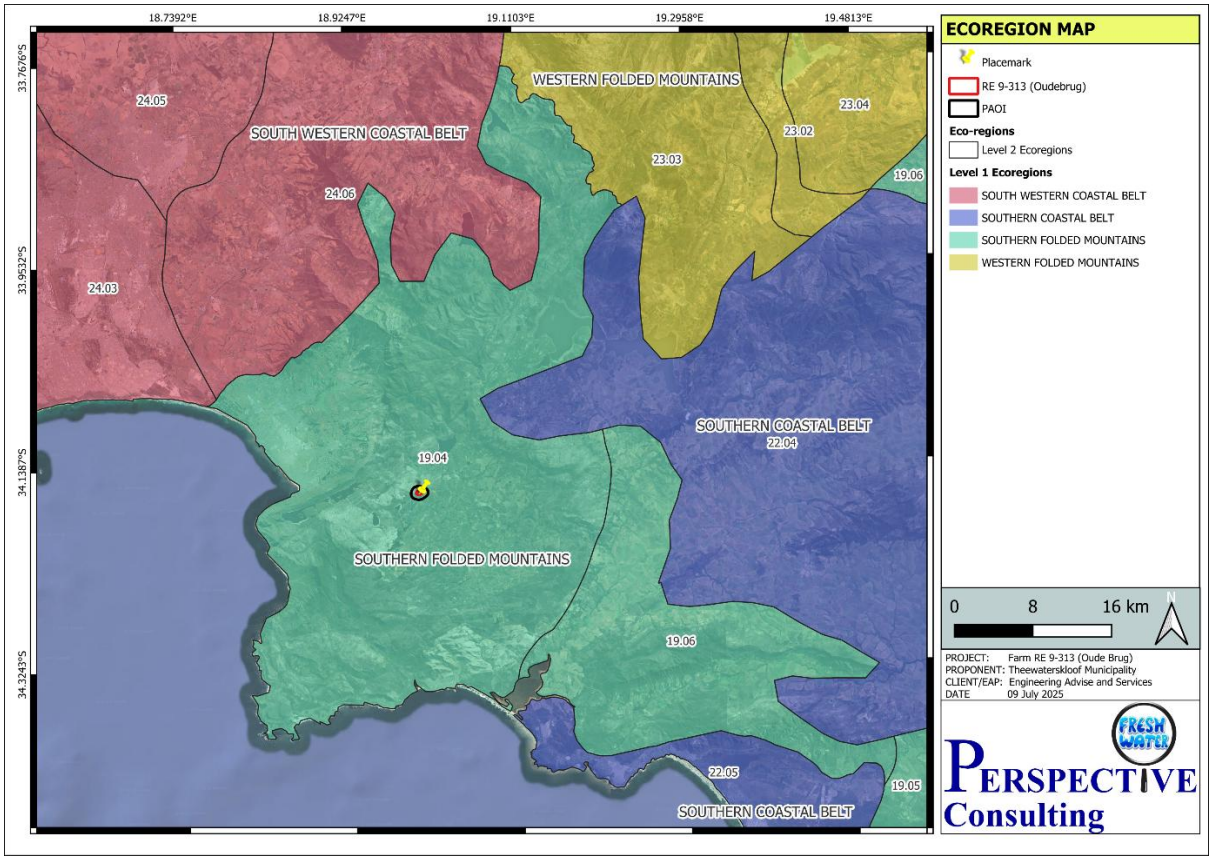

Figure B-1.2.2 Level 1 ecoregion context in relation to the PAOI and surrounding areas

B-1.3. 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 (SANBI, 2013). According to Le Maitre (2018), ''SWSAs are defined as areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important, or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b). They include transboundary Water Source Areas that extend into Lesotho and Swaziland. According to Lötter and Le Maitre (2021), the 2018 SWSAs data set for surface water was identified based on a generalised 1.7 x 1.7 km resolution Mean Annual Runoff dataset, while the 2021 data set was delineated at a finer resolution of 90 x 90 m. The purpose of the update was to refine the spatial resolution such that SWSAs can be reliably integrated into a range of catchment- and local-level planning, management, and regulatory processes.

According to the SWSAs of South Africa, Lesotho and Swaziland, the PAOI falls within the Boland surface water SWSA and the Southwestern Cape Ranges groundwater SWSA (Figure B-1.3.1).

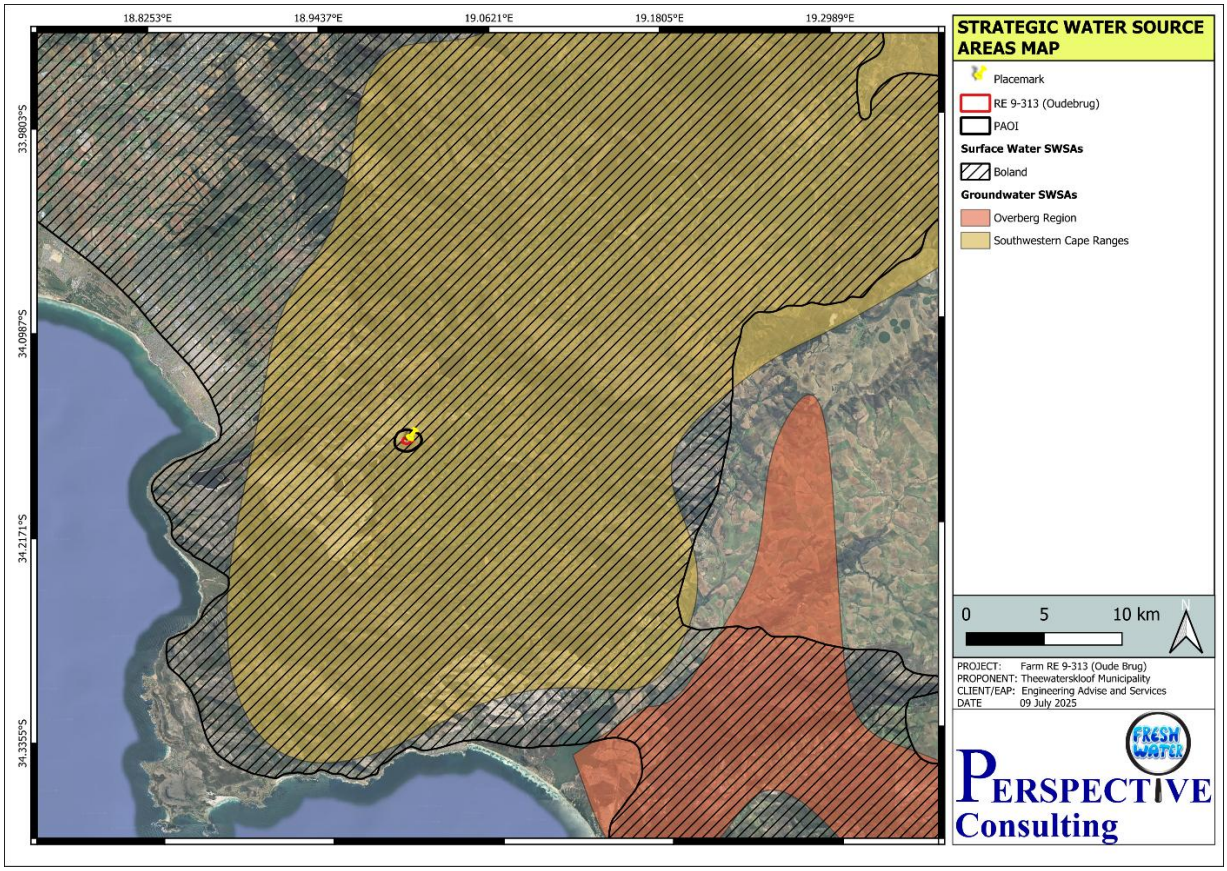

Figure B-1.3.1 Strategic Water Source Areas in relation to the PAOI and surrounding areas

B-1.4. River Freshwater Ecosystem Priority Areas

River FEPAs are derived from the National Freshwater Ecosystem Priority Areas (NFEPA) 2011 database and achieve national biodiversity targets for river ecosystems and fish species, and are identified in rivers that are currently in a good condition (A or B ecological category). 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 through sustainable use of water resources. 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.

According to the River FEPA spatial layer, the PAOI falls within a Phase 2 FEPA which are identified in moderately modified rivers (C ecological category), only in cases where it was not possible to meet biodiversity targets for river ecosystems in rivers that were still in good condition (A or B ecological category). The condition of these Phase 2 FEPAs should not be degraded further, as they may in future be considered for rehabilitation once FEPAs in good condition (A or B ecological category) are considered fully rehabilitated and well managed. (Figure B-1.4.2).

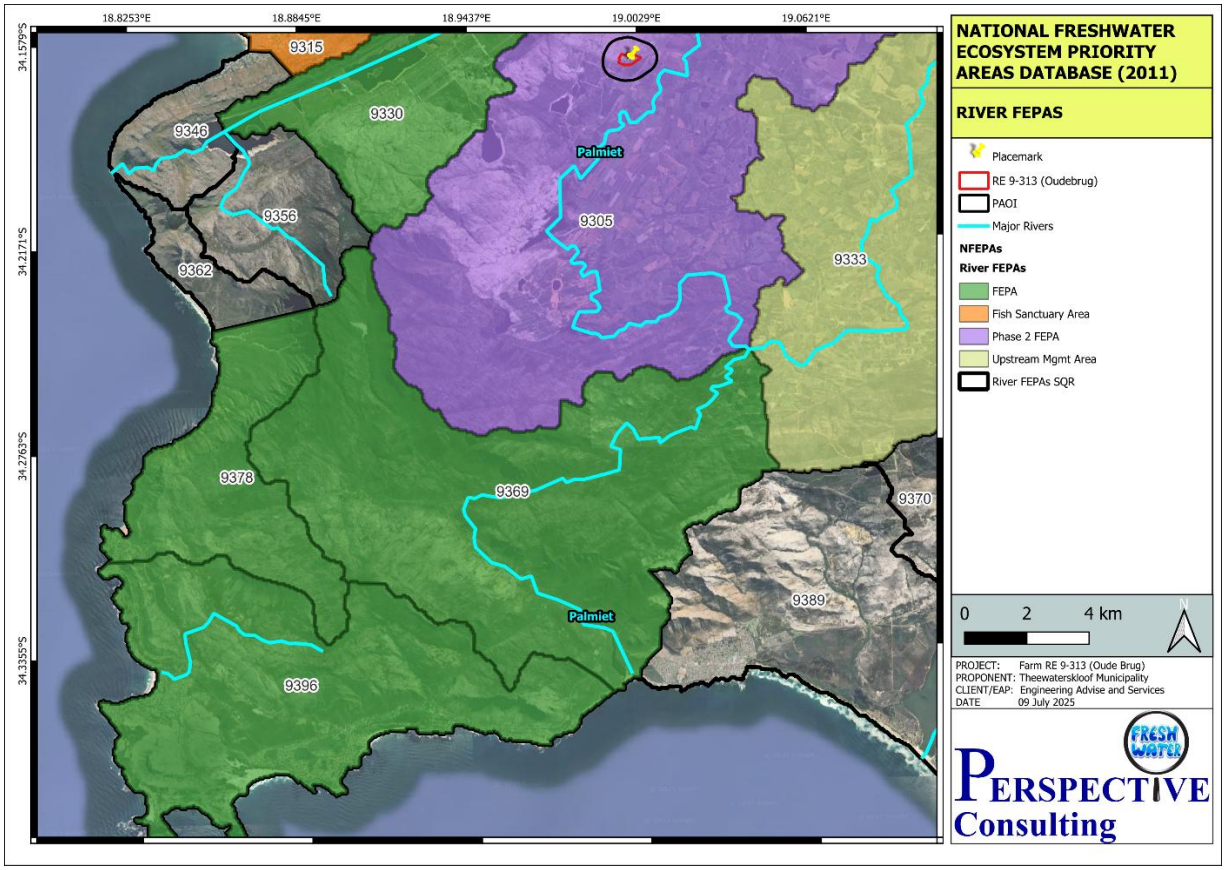

Figure B-1.4.2 River FEPAs in relation to the PAOI and surrounding areas

B-1.5. NFEPA Wetland Vegetation

Wetland vegetation groups were used to characterise the regional context within which wetlands occur based on the premise that wetlands in a particular vegetation group are likely to be more similar to one another than to wetlands in other vegetation groups. Broad vegetation groupings reflect differences in geology, soils and climate, which in turn affect the ecological characteristics and functionality of wetlands. Wetland vegetation groups were derived by grouping the 438 national vegetation types of South Africa, Lesotho and Swaziland (Muccina and Rutherford 2004) into groups thought to reflect the turnover of wetland biodiversity at a national level. The expert knowledge of regional wetland ecologists was used to do the grouping, deriving a map of 133 wetland vegetation types.

According to Mbona *et al*. (2015), the PAOI overlays the Southwest Sandstone Fynbos wetland vegetation type which is designated as **Endangered** but Well Protected according to the National Biodiversity Assessment's Ecosystem Threat Status and Ecosystem Protection Level Respectively (Figure B-1.5.1).

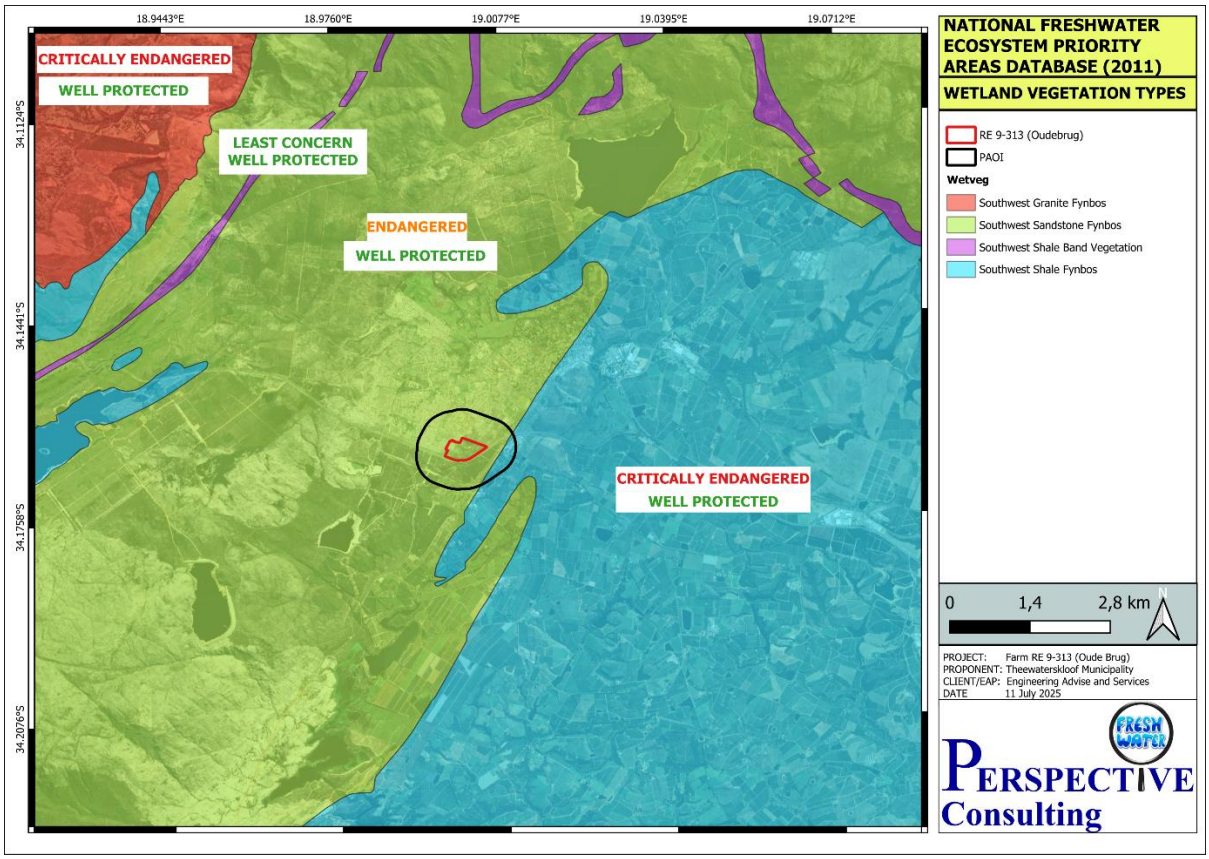

Figure B-1.5.1 NFEPA wetland vegetation types associated with the PAOI – NFEPA (2011) database

B-1.6. Protected Areas

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

According to the protected area NPAES spatial datasets, the PAOI fall within the Kogelberg Biosphere Reserve conservation areas (Figure B-1.6.1).

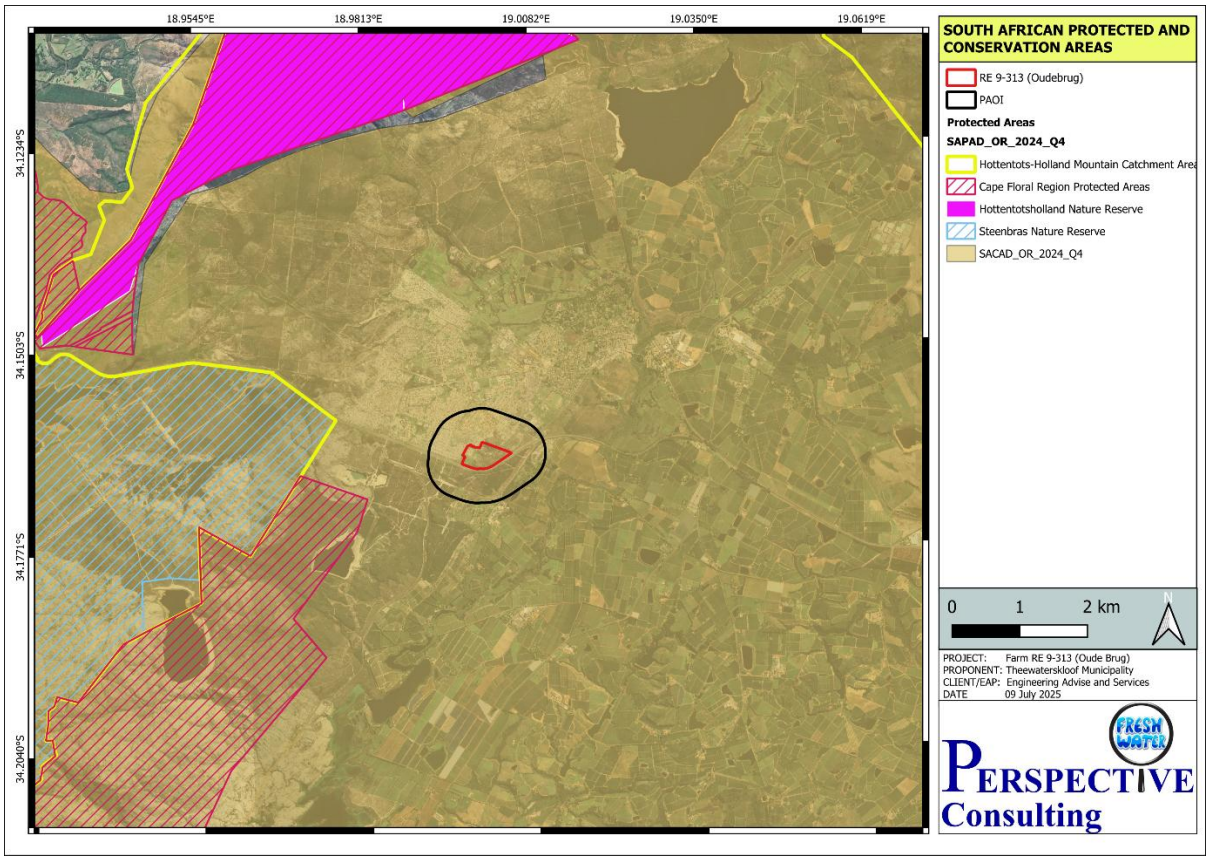

Figure B-1.6.1 Protected areas associated with the PAOI

B-1.7. Western Cape Biodiversity Spatial Plan (2023) (v2)

The Western Cape Biodiversity Spatial Plan (WCBSP) is the product of a systematic biodiversity planning assessment that delineates Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) which require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and freshwater realms. These spatial priorities are used to inform sustainable development in the Western Cape Province. This product replaces all previous systematic biodiversity planning products and sector plans with updated layers and features.

According to the WCBSP, no aquatic CBAs or ESAs fall within the PAOI (Figure B-1.7.1).

CBAs are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (SANBI, 2017). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI, 2017).

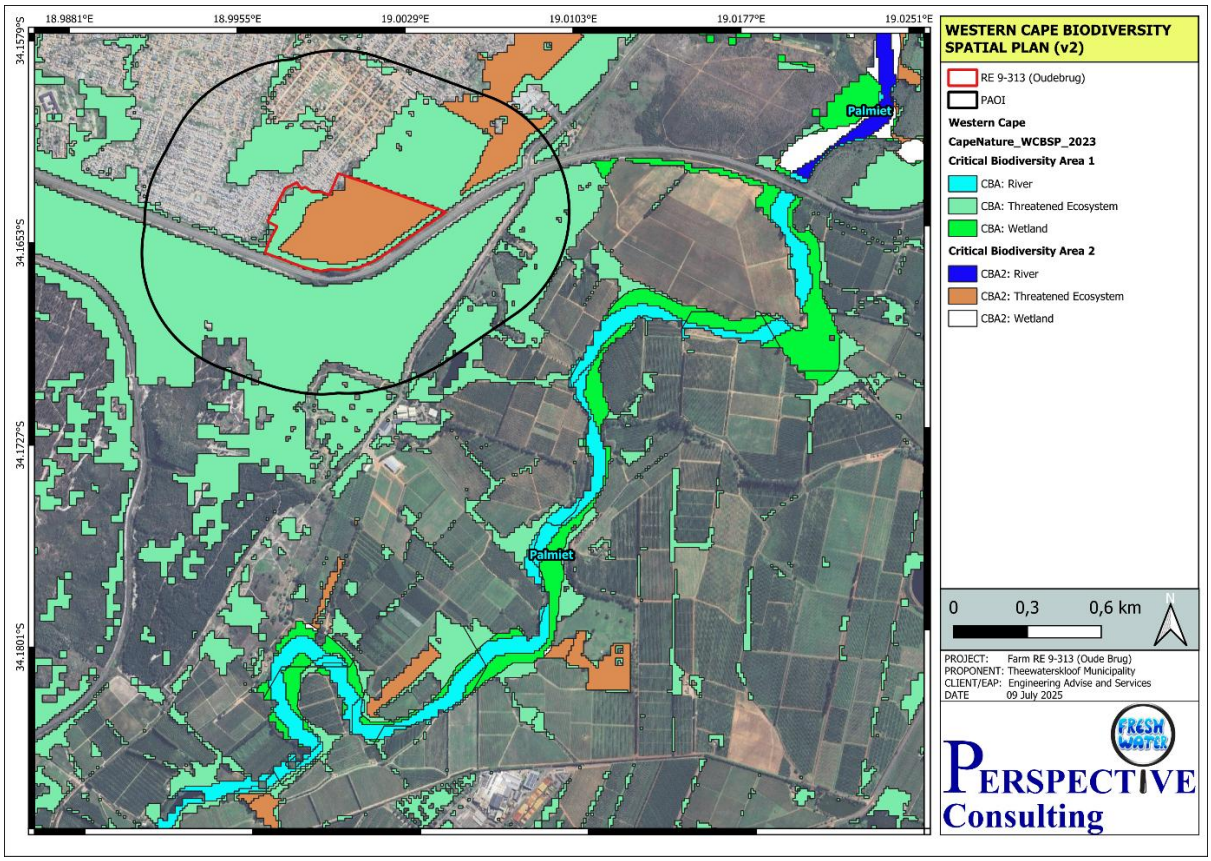

Figure B-1.7.1 The PAOI superimposed on the Western Cape Biodiversity Spatial Plan

B-1.8. National Freshwater Ecosystem Priority Area Database (2011)

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

According to the NFEPA (2011) National Wetland Map 4, no watercourses are mapped within the property (RE9-313). Natural wetlands that either feed to, or are associated with the Palmiet River are mapped along the southern boundary of the PAOI. These wetlands are designated as being in a Heavily to Critically Modified PES, with less than 25% natural landcover remaining (Class Z3), none of which are a conservation priority. The Palmiet River flows in a south westerly direction to the south of the PAOI and is considered to be in a Class C (Moderately Modified) ecological condition (Figure B-1.8.1).

The natural wetlands are considered by the NFEPA database to be channelled valley bottom wetlands (Figure B-1.11.2).

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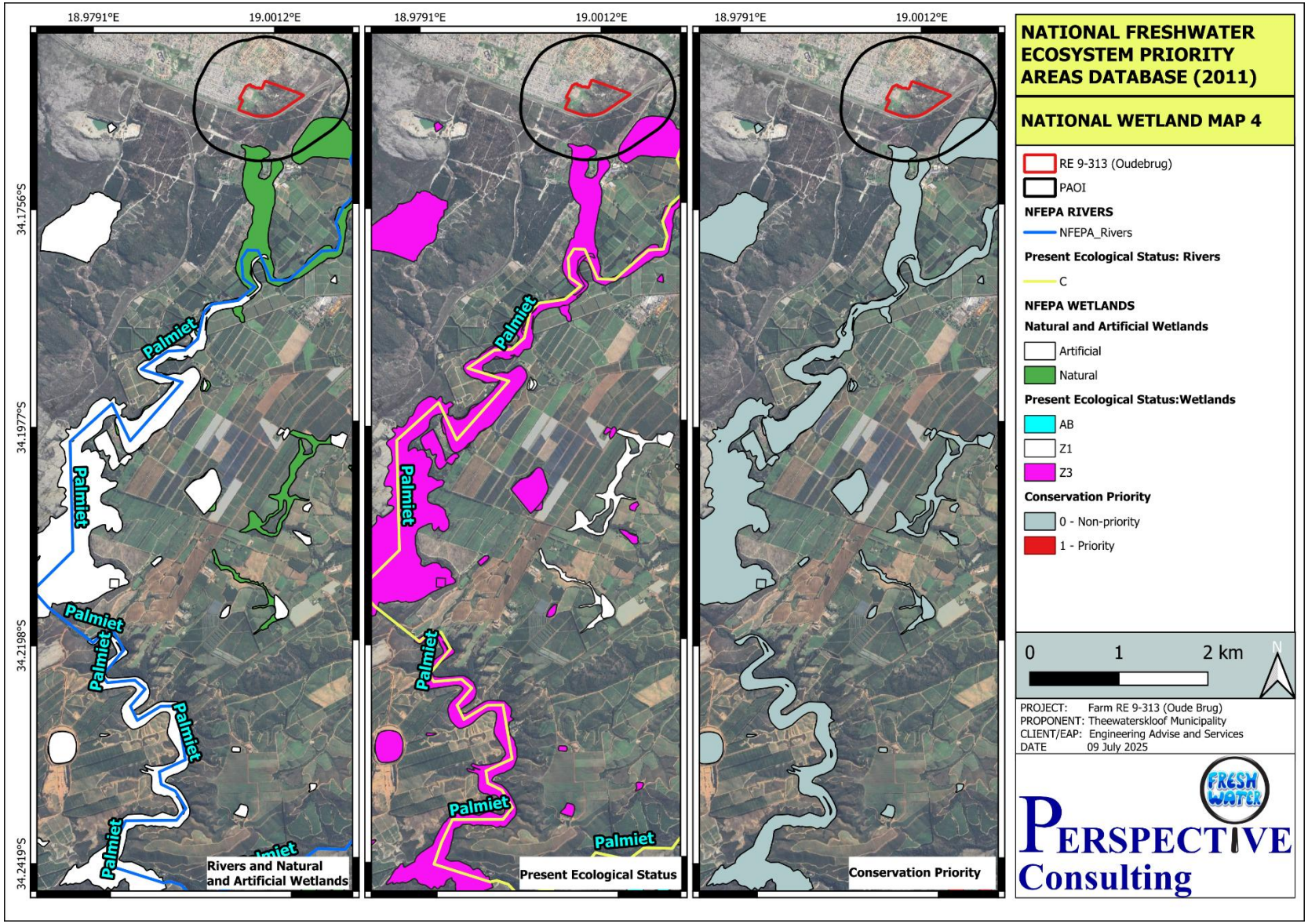

Figure B-1.8.1 National Freshwater Ecosystem priority areas (NFEPA) associated with the PAOI

B-1.9. The National Biodiversity Assessment Database (2018)

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

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

According to the NBA database – National Wetland Map 5, a seep wetland is indicated in the southwestern portion of the POAI (Figure B-1.11.2) which drains to the Palmiet River that is also indicated by the NBA database (Figure B-1.11.1).

The seep wetland and wetlands associated with the receiving Palmiet River are designated as being in a PES Class D/E/F (Largely to Critically Modified ecological condition), while the Palmiet River is designated as being in a PES Class C (Moderately Modified) ecological condition (Figure B-1.11.1).

B-1.10. 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). 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 (Van Deventer *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 NBA database Ecosystem Threat Status (2018), the seep wetland is designated as Vulnerable, the wetlands associated with the Palmiet River as **Critically Endangered,** and the Palmiet River itself as Endangered (Figure B-1.11.1).

B-1.11. 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 (Van Deventer *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).

According to the NBA database Ecosystem Protection Level (2018), the seep wetland is designated as Well Protected, the wetlands associated with the Palmiet River as **Not Protected,** and the Palmiet River itself as Moderately Protected, and Poorly Protected further downstream (Figure B-1.11.1).

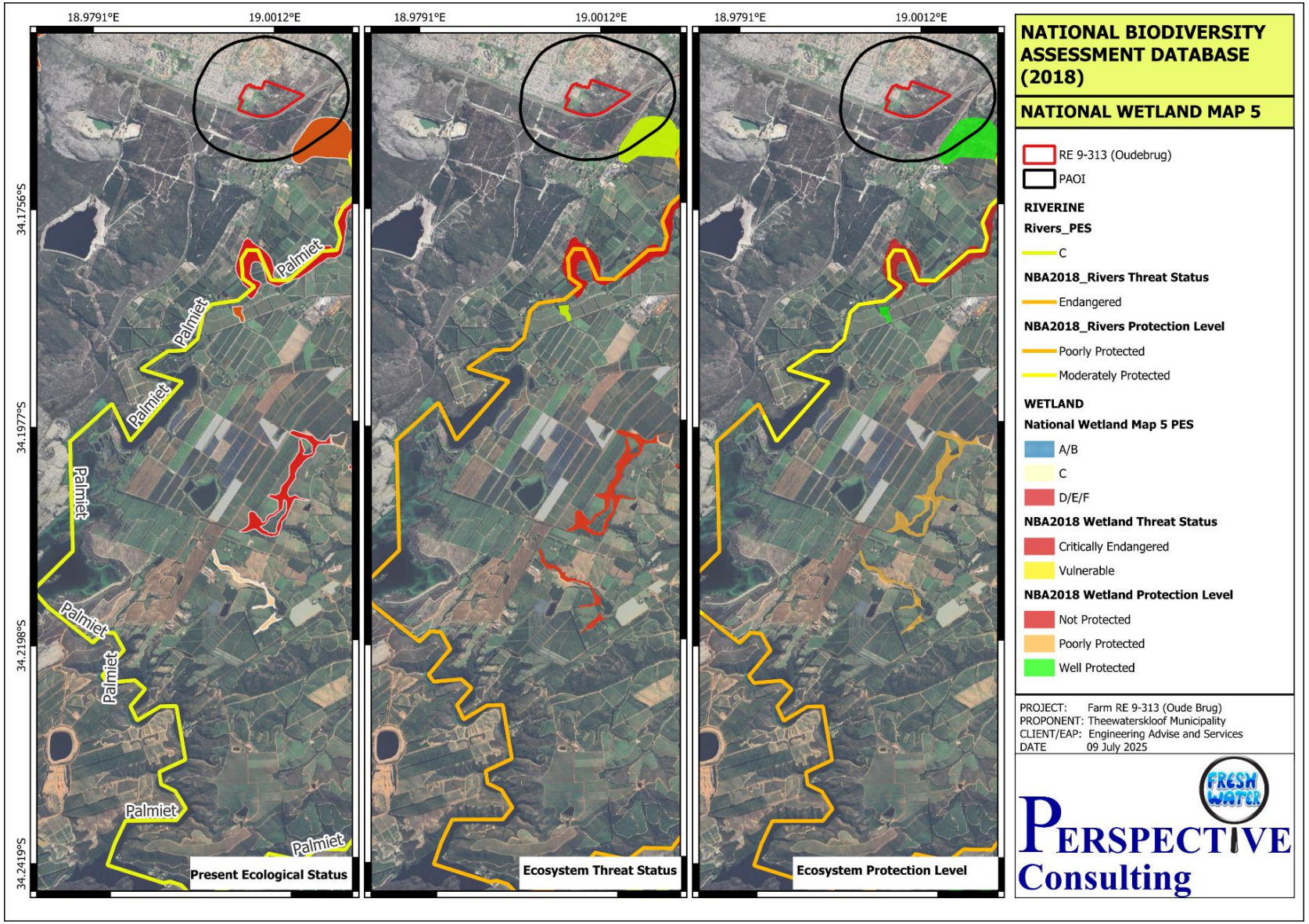

Figure B-1.11.1 Watercourses, ecosystem threat status and ecosystem protection level as per the National Biodiversity Assessment (2018)

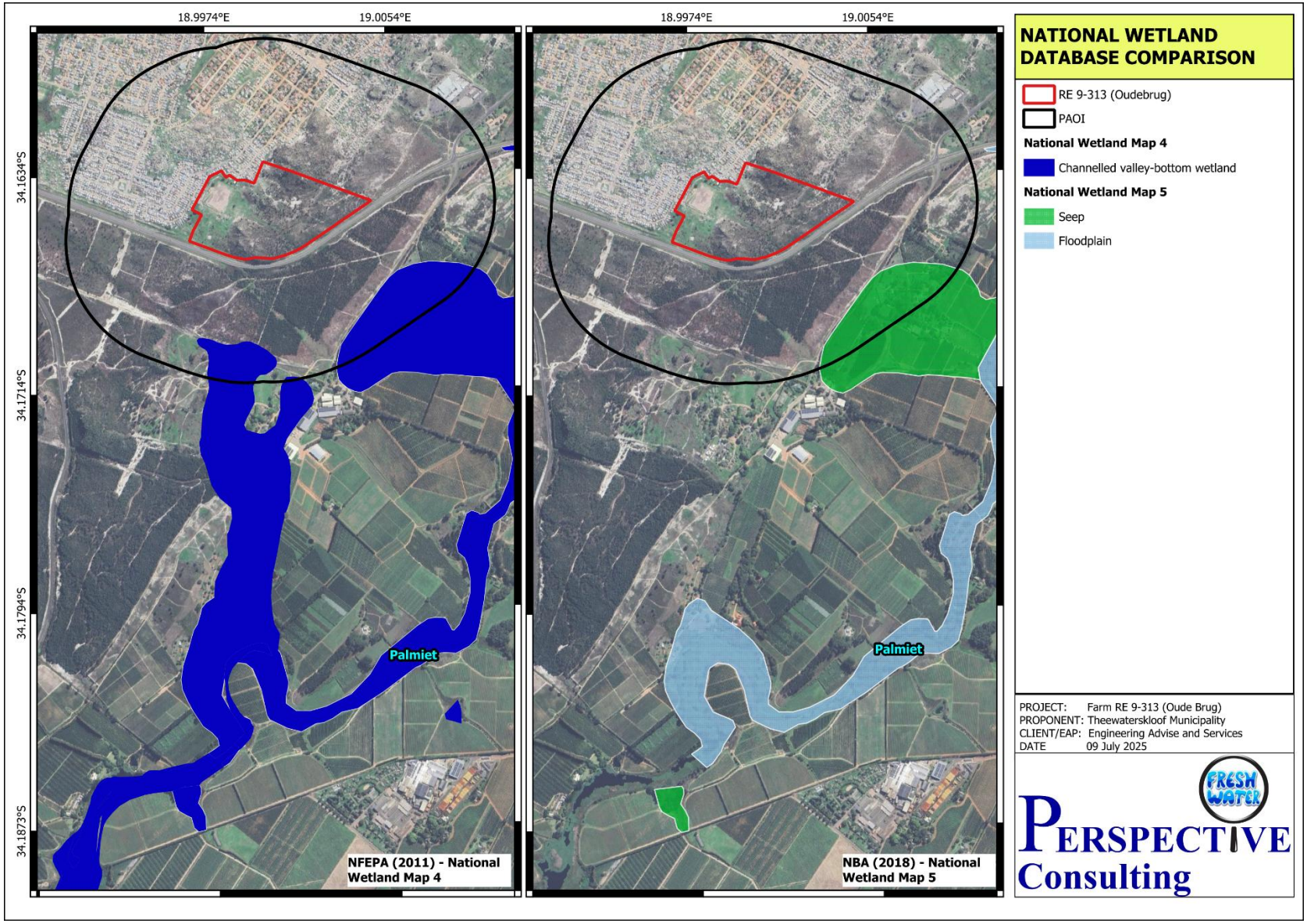

Figure B-1.11.2 Comparison of NWM4 and NWM5 wetland hydrogeomorphic types

B-1.12. DWS RQO PESEIS Database (2014)

Desktop information for the Sub-Quaternary Reaches (SQRs) associated with the PAOI was obtained from the DWS RQO PESEIS Database (2014). The DWS' Resource Quality Objective's (RQO) 2014 database inspection point (G40C-09305) is located on the Palmiet River, downstream of the PAOI (Figure B-1.12.1).

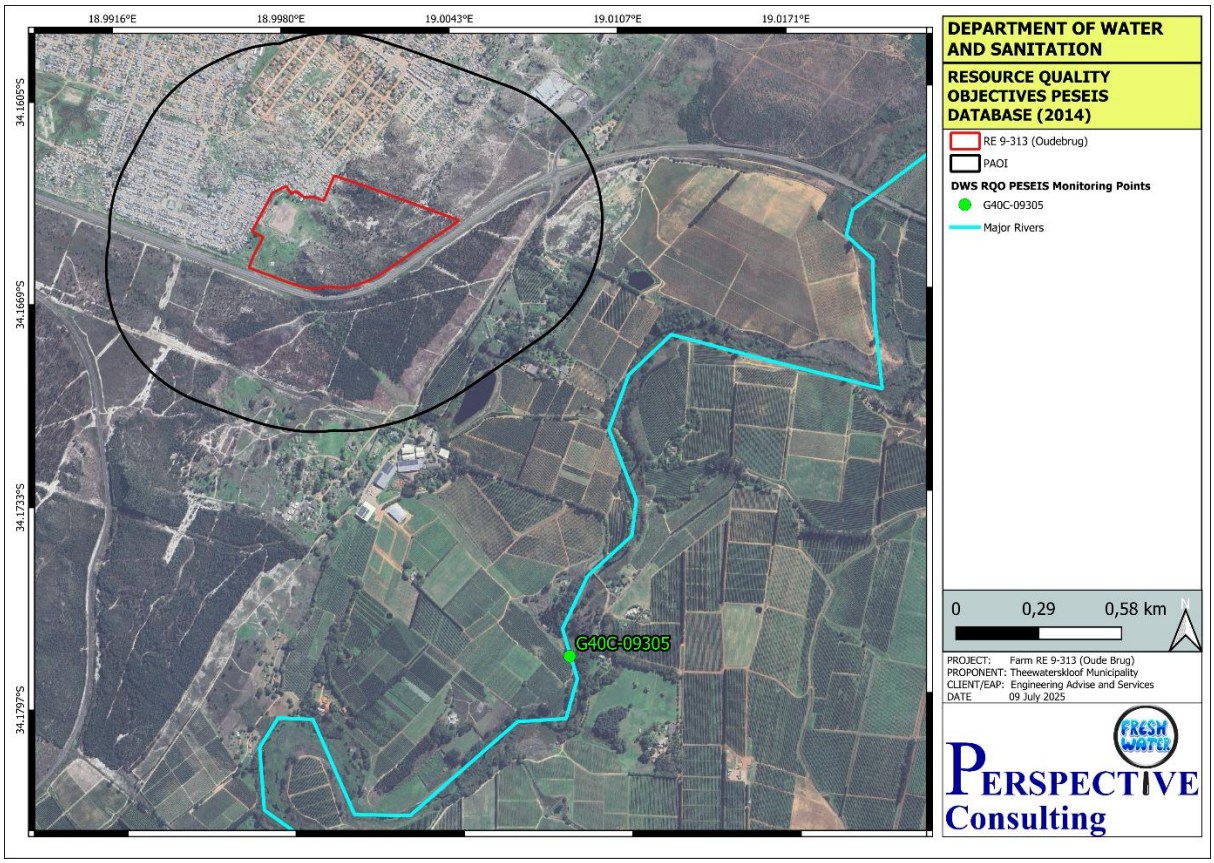

Figure B-1.12.1 DWS RQOS PESEIS monitoring points on the Palmiet River

The Present Ecological Status (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) for the inspection points is summarised below in Table B-1.12.1

Table B-1.12.1 PES of systems and the SQR associated with the project (DWS, 2014)

SQR Importance and Sensitivity	G40C-09305 Palmiet River (Upstream)
Present Ecological Status (PES)	Class D – Largely Modified
Ecological Importance (EI)	High
Ecological Sensitivity (ES)	High

Justification of the PES, Ecological Importance and Ecological Sensitivity is listed below in Table B-1.12.2.

Table B-1.12.2 DWS RQO PESEIS summary of SQR G40C-09305

PES Details
Large potential physico-chemical modification activities
Large potential flow modification activities
Moderate Instream Habitat Continuity Modification
Large Potential Instream Habitat Modification Activities
Large riparian-wetland zone modification

Ecological Importance Details
Very High invertebrate rarity per secondary class
High riparian-wetland instream vertebrates (excluding fish) rating
High riparian-wetland natural vegetation importance based on expert rating
Low fish representivity per secondary class
Very High habitat size (length) class
Moderate fish rarity per secondary class
Very High invertebrate representivity per secondary class
Low riparian-wetland natural vegetation rating based on % natural vegetation within 500 m
High habitat diversity class
High instream migration link class
Moderate riparian-wetland zone migration link
Moderate instream habitat integrity class
Moderate riparian-wetland zone habitat integrity class
Ecological Sensitivity Details
Very High macroinvertebrate velocity sensitivity
Very High riparian-wetland instream vertebrates (excluding fish) intolerance to water level/flow changes
High stream size sensitivity to modified flow/water level changes
High riparian-wetland vegetation intolerance to water level changes
Moderate fish physico-chemistry sensitivity
Moderate fish no flow sensitivity
Very High macroinvertebrate physico-chemistry sensitivity

The expected fish species list was composed for the system based on habitat preferences and distribution and was developed from a literature survey that included sources such as DWS (2014), Kleynhans *et al.* (2007) and Skelton (2001; 2016).

Fish have different sensitivities or levels of tolerance to flow and physio-chemical modifications which is included in Table B-1.12.3 below.

Two (2) fish species are expected to occur in the Palmiet River within the listed SQR, namely *Galaxius zebratus* and *Sandelia capensis*. Table B-1.12.4 below lists these species and their associated IUCN Conservation statuses.

Table B-1.12.3 Importance rating and sensitivity of fish species

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

Table B-1.12.4 Fish species expected within the Palmiet River

Fish species	Common Name	Habitat	Flow Sensitivity	Physico-Chemistry Sensitivity	SA IUCN Status (IUCN 2024)	GLOBAL IUCN Status (IUCN 2024)
Galaxius zebratus	Cape Galaxius	Some taxa display preference for clear oligotrophic mountain streams with low dissolved minerals, while others prefer turbid lowland streams with high dissolved mineral content	2.50	2.50	Data Deficient	Data Deficient
Sandelia capensis	Cape Kurper	A hardy species that can survive in a variety of habitat, but preferring quiet or slow-flowing waters with an abundance of plant and root cover. Preys on small insects and other invertebrates and small fish.	2.00	2.00	Data Deficient	Data Deficient

According to the DWS PESEIS database, the following invertebrate species are expected to occur within the Palmiet River (Table B-1.12.5), many of which have a very high intolerance to water quality modifications.

Table B-1.12.5 Invertebrate families associated with the most proximate inspection points to the PAOI (DWS, 2014)

Invertebrate family	Quality Value	Physico-Chemistry Intolerance Category	Invertebrate family	Quality Venue	Physico-Chemistry Intolerance Category
Oligochaeta			Caenidae		
Hirudinea			Heptageniidae		
Amphipoda			Leptophlebiidae		
Potamonautidae			Teloganodidae		
Hydracarina			Tricorythidae		
Notonemouridae			Synlestidae		
Baetidae 1sp			Ceonogrionidae		
Baetidae 2sp			Lestidae		

Invertebrate family	Quality Value	Physico-Chemistry Intolerance Category	Invertebrate family	Quality Venue	Physico-Chemistry Intolerance Category
Platycnemidae	10	Moderate Intolerance	Lepidostomatidae	10	Moderate Intolerance
Aeshnidae	8	Moderate Intolerance	Leptoceridae	6	Low Intolerance
Cordulidae	8	Moderate Intolerance	Petrothrincidae	11	Moderate Intolerance
Gomphidae	6	Low Intolerance	Sericostomatidae	13	High Intolerance
Libellulidae	4	Low Intolerance	Dytiscidae	5	Low Intolerance
Crambidae	12	High Intolerance	Elmidae	8	Moderate Intolerance
Belostomatidae	3	Very Low Intolerance	Gyrinidae	5	Low Intolerance
Corixidae	3	Very Low Intolerance	Helodidae	12	High Intolerance
Gerridae	5	Low Intolerance	Hydraenidae	8	Moderate Intolerance
Naucoridae	7	Moderate Intolerance	Hydrophilidae	5	Low Intolerance
Notonenectidae	3	Very Low Intolerance	Athericidae	10	Moderate Intolerance
Veliidae/Mesoveliidae	5	Low Intolerance	Blephariceridae	15	High Intolerance
Corydalidae	8	Moderate Intolerance	Ceratopogonidae	5	Low Intolerance
Ecnomidae	8	Moderate Intolerance	Chironomidae	2	Very Low Intolerance
Hydropsychidae 1sp	4	Low Intolerance	Culicidae	1	Very Low Intolerance
Hydropsychidae 2sp	6	Low Intolerance	Muscidae	1	Very Low Intolerance
Philopotamidae	10	Moderate Intolerance	Simuliidae	5	Low Intolerance
Psychomyiidae	8	Moderate Intolerance	Tipulidae	5	Low Intolerance
Barbarochthonidae	13	High Intolerance	Ancylidae	6	Low Intolerance
Glossosomatidae	11	Moderate Intolerance	Lymnaeidae	3	Very Low Intolerance
Hydroptilidae	6	Low Intolerance	Physidae	3	Very Low Intolerance
1-3: Very Low Intolerance | 4-6: Low Intolerance | 7-11: Moderate Intolerance | 12-15 High Intolerance (based on Thirion 2007)					

APPENDIX C FIELD-BASED ASSESSMENT AND METHODOLOGY

C-1 Watercourse Classification

The watercourses identified within the PAOI are described in terms of the Level 3 (landscape)and Level 4 (hydrogeomorphic type) definitions as per the Ollis *et al*. (2013) classification system in Table C-1.1 below.

Table C-1.1 Watercourses identified within the PAOI, as defined by Ollis et al. (2013)

Watercourse	Level 3: Landscape Unit	Level 4: Hydrogeomorphic Type
River **(Ephemeral Drainage Line)**	Slope: an inclined stretch of ground typically located on the side of a mountains, hill or valley floor. Includes scarp slopes, mid-slopes and foot slopes	A linear fluvial landform feature with non-clearly discernible bed and banks, which periodically carries a unidirectional concentrated flow of water.
Seep Wetland		A wetland area located on gently to steeply sloping land (excluding the valley floor) and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope. Water input through the wetland is primarily via subsurface flows (interflow or groundwater discharge at surface) from an up-slope direction and water movement through the seep is mainly in the form of interflow, with diffuse overland flow (known as sheetwash) often being significant during and after rainfall events. Outflows at surface may be channelled or diffuse or as subsurface interflow.
Unchanneled Valley Bottom Wetland	Valley Floor: the base of a valley, situated between two distinct side slopes, where alluvial or fluvial processes typically dominate	A valley-bottom wetland located on the valley floor without a river channel running through it. Water inputs are dominated by diffuse flows which are formed when a river channel loses confinement and spreads out over a wider area, causing the concentrated flow associated with the river channel to change to diffuse flow (i.e. the river becomes an unchannelled valley-bottom wetland). This is typically due to a change in gradient brought about by a change in base level at the downstream edge of the wetland and the resulting accumulation of sediment or an unchannelled valley-bottom wetland could occur at the downstream end of a seep, where a slope grades into a valley near the head of a drainage line. There may also be groundwater input into the wetland. Water characteristically moves through the wetland in the form of diffuse surface or subsurface flow, but the outflow may be in the form of either diffuse or concentrated surface flow.

C-2 Watercourse Delineation

The following DWAF (2005 and 2008) delineation indicators were typically used to identify watercourses.

Riparian and non-riparian areas (rivers, streams and smaller drainage lines)

- Terrain units in terms of topography and elevation are used to determine which parts of the landscape a riparian/non-riparian area is most likely to occur (typically sloping plains and valley bottom topographies). In the absence of a riparian area in smaller seasonal, ephemeral and episodic fluvial systems, a distinct and often subtle change in the microtopography is used to define the channel edge;
- Flowing surface water can be used to determine the active instream zone of the fluvial feature;
- The presence of a riparian zone which represents a vegetation community that is neither purely aquatic nor terrestrial and is distinct from the river active channel and upland terrestrial areas; and

- The presence of alluvial soil, which is an indication of periodic/constant flows in which smaller substrates are taken into suspension or rolled and deposited in similar areas when the carrying capacity of flows has been exceeded.

Wetlands

- Terrain units in terms of topography and elevation are used to determine in which parts of the landscape a wetland is most likely to occur. This can range from flat terrains to sloping valley bottoms;
- Obligate and facultative vegetation species are used to separate freshwater from terrestrial areas and are presented by a range of hydrophytic (water loving plants) that differ in their degree of tolerance to root system saturation. Typically wetland obligate species occur in wetlands > 99% of the time and include species that are tolerant of root saturation, while facultative species occur in wetlands 67-99% of the time but can also on occasion be found in terrestrial habitats. Some facultative species are stronger wetland indicators than others and this is based on the degree of root saturation tolerance across hydrophytic species; and
- Soil redoximorphic features such as mottling, gleying and streaking to a depth of 50 cm below the ground can be used to identify soils which regularly experience fluctuations in the water table, are well drained or remain waterlogged for extended periods of time.

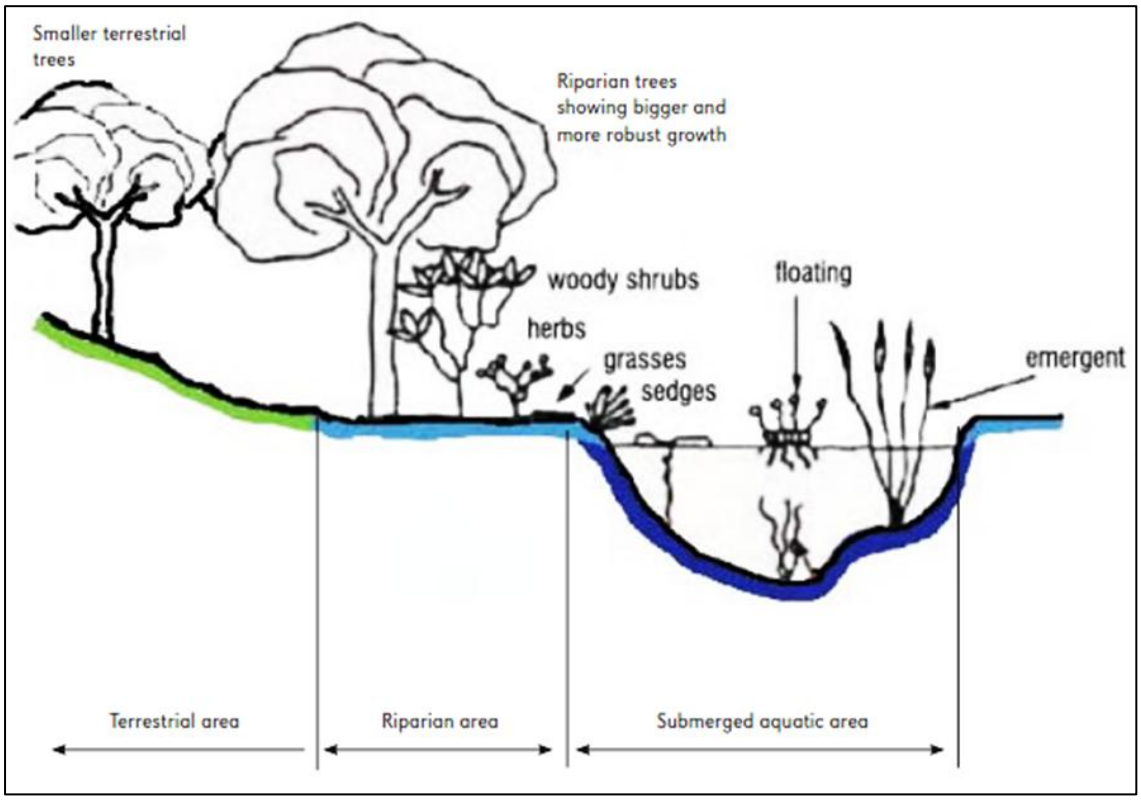

Figure C-2.1 Riparian habitat delineation (DWAF, 2005)

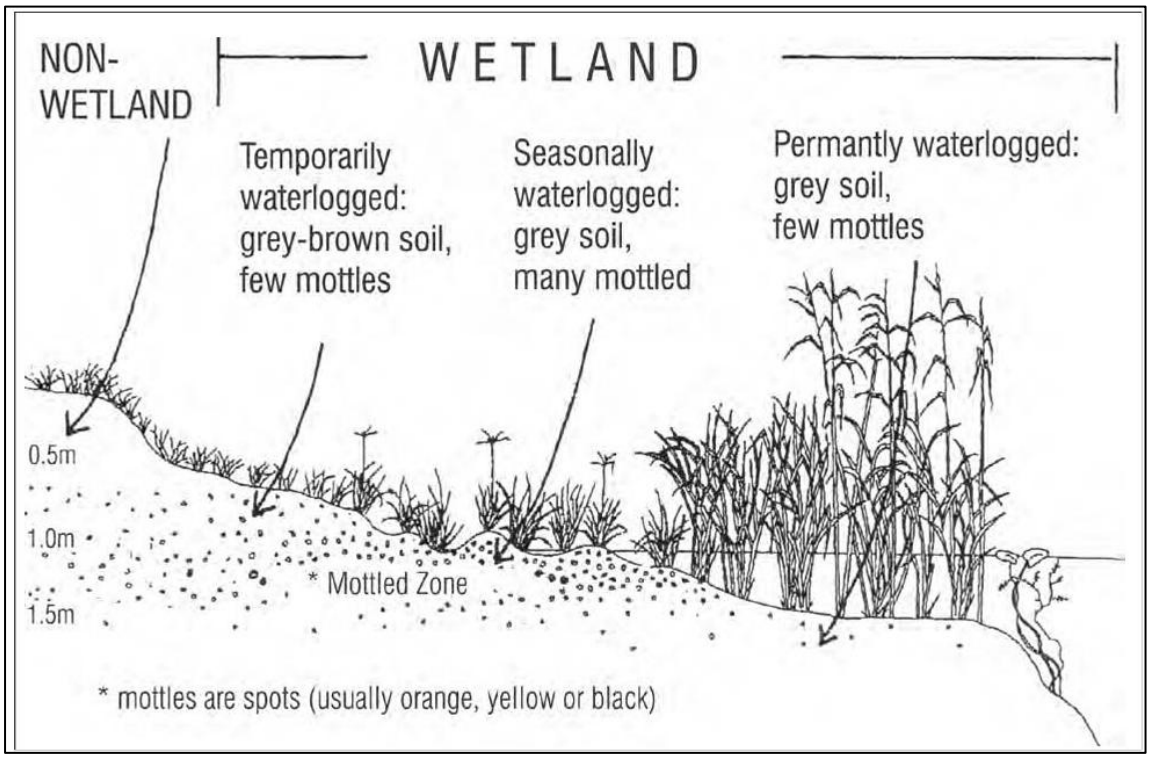

Figure C-2.2 Wetland habitat delineation (DWAF, 2005)

The watercourse delineation map is provided in Figure 6.1 in the Report Synopis.

C-3 Ecological Assessment Tools Utilised

The following field-based ecological assessments were used to assess PESEIS as listed in Table C-3.1

Table C-3.1 Ecological Assessment tools used in this report

Ecological Assessment	Tool	Applicable
PES	Riverine Index of Habitat Integrity (v2) – Kleynhans et al. (2012)	☒
	Riverine Index of Habitat Integrity – Kleynhans and Louw (2008)	☐
	WET-Health (v2) – Macfarlane et al (2020)	☐
EIS	DWAF (1999)	☒
	Rountree and Kotze (2013)	☐
Ecosystem Services	Rountree and Kotze (2013)	☐
	WET-Ecoservices (v2) – Kotze et al. (2020)	☐

C-4 Survey Results

The outcomes of the aquatic survey in terms of PESEIS are summarised below:

C-4.1. Present Ecological Status – Index of Habitat Integrity

The Present Ecological Status of the EDL was determined using the river Index of Habitat Integrity (IHI) which was used to assess the integrity of the habitats from a riparian and instream perspective as described in Kleynhans (1996) v2. The riparian component was not assessed due to an absence of an accompany riparian area to the instream habitat of the EDL. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale which are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

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

The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table C-4.1 and Table C-4.2 below respectively. The IHI was informed by a combination of desktop analyses of the catchment using Google Earth imagery as well as historic aerial imagery to understand the trajectory of change of the watercourse in question, typically as a result of landuse changes. The desktop analysis was confirmed by subsequent groundtruthing of the site.

Table C-4.1 Criteria used in the assessment of habitat integrity (from Kleynhans, 1996)

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in the duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.

Criterion	Relevance
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment (Gordon *et al.*, 1993 in: DWS, 1999). Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation (Hilden & Rapport, 1993 in DWS, 1999) 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 agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments (Gordon *et al.*, 1992 in DWS, 1999)).
Exotic macrophytes	Alteration of habitat by obstruction of flow may influence water quality. Dependent upon the species involved and the 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 the 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 (Gordon *et al.*, 1992). Refers to physical removal for farming, firewood, and overgrazing.
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	A 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.

The assessment of the severity of the impact of modifications is based on six descriptive categories which are described in Table C-4.2 below

Table C-4.2 Descriptive classes for the assessment of modifications to habitat integrity (Kleynhans, 1996)

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 is 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 is also limited.	**6 - 10**
Large	The modification is generally present with a detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	**11 - 15**
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	**16 - 20**
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	**21 - 25**

The habitat integrity assessment takes into account the riparian zone and the instream channel of the river. Assessments are made separately for both aspects, but data for the riparian zone are primarily interpreted in terms of the potential impact on the instream component (Table C-4.3). The relative weighting of criteria remains the same as for the assessment of habitat integrity (DWS, 1999).

Table C-4.3 Criteria and weights used for the assessment of habitat integrity (from Kleynhans, 1996)

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

The negative weights are added for the instream and riparian facets respectively and the total additional negative weight is subtracted from the provisionally determined integrity to arrive at a final habitat integrity estimate. The eventual total scores for the instream and riparian zone components are then used to place the habitat integrity in a specific habitat integrity category. Thus, the result of the assessment is primarily descriptive and not quantitative. These categories are indicated in Table C-4.4.

Table C-4.4 Habitat integrity categories (from Kleynhans, 1996)

Category	Description	Score (% of Total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

Ephemeral Drainage Line

Hydrological Regime

Current instream impacts to the **EDL** include dysregulation in terms of the pattern and timing of the hydrological regime due to stormwater inputs and catchment hardening. The magnitude and frequency of flows have both increased, while the duration (residence time) of flows have conversely decreased due to increased stormwater input as a result of catchment hardening from development and the loss of flow-regulating vegetation. This has resulted in an increase in the flashiness of the system, and thereby a decrease in its hydroperiodicity, ultimately meaning that the subject EDL experiences more zero flow days per hydrological year compared to under natural conditions.

Geomorphology and Sediment Balance

Increases in the magnitude and frequency of flows have encouraged erosion in these systems, with fluvial-derived sediments being lost to the footslopes and valley bottom terrain units of these areas.

Habitat and Biota

Indigenous flora have been largely lost to alien invasive encroachment by *Pinus pinaster* (Pines), *Acacia saligna* (Port Jackson), *Acacia mearnsii* (Black Wattle) and *Pennisetum clandestinum* (Kikuyu Grass) as a result of historic afforestation, disturbance through subsequent deforestation and more recent cattle grazing practices.

Water Quality

Water quality was not measured, but is expected to contain elevated sediment loads, organic pollution and toxicants when flowing, due to the upgradient catchment being largely developed as a township and observation of leaking sewer pipelines.

The instream habitat was calculated to be in a Class E (Seriously Modified) Present Ecological State (PES).

Palmiet River

Hydrological Regime

The hydrological regime of the Palmiet River is impaired due to impoundment upstream in the Nuweberg and Eikenhof impoundments which would remove temporal variability in the pattern and timing of flows, especially high flow events that are required to reset river ecosystems. Abstraction from the Palmiet River for agricultural activities would further decrease the discharge of this river system, especially during the low base flow season.

Geomorphology and Sediment Balance

The decrease in discharge due to impoundment would decrease the ability of the Palmiet River to transport sediments and maintain the erosion/deposition balance along its downstream course. An increase in sediment is however expected downstream of these impoundments due to the largely agricultural catchment which is accompanied by sediment-laden runoff.

Habitat and Biota

Agricultural activities along the Palmiet River have caused disturbance of the riparian area which would likely be associated with an increase in alien and invasive vegetation and thereby the decreased ability to support endemic fauna.

Water Quality

Water quality was not tested, but elevated salts and nutrients (phosphorous and nitrogen) are expected due to the agricultural catchment through which the Palmiet River flows, notwithstanding releases from the Grabouw Waste Water Treatment Plant upstream. Refer to the impact scores in Table C-4.5.

The instream habitat was calculated to be in a Class C (Moderately Modified) Present Ecological State (PES), and the riparian habitat to be in a Class D (Largely Modified) PES.

Table C-4.5 IHI assessment of the EDL and downstream receiving Palmiet River

River Habitat	Criteria	EDL	Palmiet River
Instream Criteria	Water abstraction	0	15
	Flow modification	20	15
	Bed modification	18	8
	Channel modification	12	5
	Phys-chem modification	18	10
	Inundation	0	10

River Habitat	Criteria	EDL	Palmiet River
	Alien macrophytes	20	10
	Introduced aquatic fauna	0	15
	Rubbish dumping	15	5
	Instream Habitat Integrity Score	**37**	**55**
	Instream Habitat Integrity Category	**E**	**D**
Riparian Criteria	Vegetation removal	**NA – EDL not fringed by a riparian area**	5
	Exotic vegetation		15
	Bank erosion		10
	Channel modification		10
	Water abstraction		15
	Inundation		5
	Flow modification		10
	Phys-chem		0
	Riparian Habitat Integrity Score		50
	Riparian Habitat Integrity Category		**D**
Overall PES Category		**E**	**D**

C-4.2. Ecological Importance and Sensitivity

The assessment of the importance and sensitivity of watercourses is to be able to identify those freshwater systems that provide above average ecosystem services, biodiversity support functions or are highly sensitive to impacts. Watercourses with higher ecological importance must be managed for better conditions than the present to preserve long term sustainable provision of ecosystem services.

The Department of Water Affairs and Forestry (1999) Ecological Importance and Sensitivity (EIS) Tool for riverine systems was used to determine the EIS of the study reach of the EDL and receiving Palmiet River.

The overall Importance and Sensitivity category (Table C-4.6) is based on the overall median obtained between the biotic and habitat subcomponents. The EIS results are presented below in

Table C-4.7.

Table C-4.6 Ecological Importance and Sensitivity categories and median scores for biota and habitat

Ecological Importance and Sensitivity Category*	Range Of Median
Very high	>3 and ≤4
Quaternaries/delineations that are considered unique on a national or even international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	
High	>2 and ≤3
Quaternaries/delineations that are considered to be unique on a national scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but may have a substantial capacity for use.	
Moderate	>1 and ≤2
Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually not very sensitive to flow modifications and often have a substantial capacity for use.	
Low/marginal	>0 and ≤1
Quaternaries/delineations that are not unique at any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have a substantial capacity for use.	

Table C-4.7 Ecological Importance and Sensitivity Results

	EDL	Palmiet River
EIS CRITERIA		
BIOLOGICAL DETERMINANTS		
Rare and Endangered Biota	0	3
Unique Biota	0	3
Intolerant Biota	0	3
Species Richness	1	3
Median Score (Biotic Criteria)	**0**	3
Overall Median Interpretation	**(Low EIS)**	**(High EIS)**
HABITAT DETERMINANTS		
Diversity of aquatic habitat features	1	4
Refuge value of habitat	1	4
Sensitivity of Habitat to flow related changes	0	3
Sensitivity to flow related water quality changes	1	3
Migration route or corridor for instream and riparian biota	1	4
National Parks, wilderness areas, Nature reserves, Natural Areas, Heritage sites, Protected Areas	2	4
Median Score (Habitat Criteria)	**1.0**	**4.0**
Overall Median Interpretation	**(Low EIS)**	**(Very High)**
Ecological Importance and Sensitivity (This Report)	**0.5 (Low)**	**3.5 (Very High)**
Desktop Ecological Importance (EI) (DWS, 2014)	**NA**	**High[9]**
Desktop Ecological Sensitivity (ES) (DWS, 2014)	**NA**	**High**

The Ephemeral Drainage Line was determined to have a very low Ecological Importance and Sensitivity due to already being Seriously Modified, being ephemeral in nature and therefore not supporting an aquatic ecosystem year round, fragmentation of its course by the N2 national highway, and therefore preventing this system from being an aquatic corridor (atleast in terms of biota movement) to larger systems such as the Palmiet River, and this EDL not being recognised Nationally, or in provincial conservation planning. Furthermore, this Ephemeral Drainage Line is not envisaged to support rare and endangered aquatic communities. This EDL should however be considered in terms of its support role to downstream watercourses such as the Palmiet River. Therefore, although the ecological integrity of the EDL itself is impaired, further degradation of this system must be prevented to prevent deterioration of downstream watercourse that have a comparatively higher EIS, i.e. the Palmiet River.

The Palmiet River was determined to have a Very High Ecological Importance and Sensitivity due to being an Endangered, Poorly Protected, Critical Biodiversity Area that has been designated as a Phase 2 FEPA, meaning that this river must not be further degraded, as it may in future be considered for rehabilitation once more ecologically intact river systems have been rehabilitated and well managed.

The DWS PESEIS G40C-09305 inspection point further indicates a very high invertebrate rarity and representivity per secondary class, high riparian wetland instream vertebrate presence (excluding fish), high riparian-wetland natural vegetation importance, very high habitat size, high habitat diversity class and instream migration link class, very high macroinvertebrate velocity sensitivity, very high riparian-wetland instream vertebrates (excluding fish) intolerance to water level/flow changes and very high macroinvertebrate physico-chemistry sensitivity.

[9] Based on G40C-09305 PESEIS inspection point

APPENDIX D LEGISLATIVE REQUIREMENTS

The following legislative requirements were considered during the assessment and are described below in Table D.1.

- The Constitution of the Republic of South Africa, 1996;
- The National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA); and
- The National Environmental Management Act, 1998 (Act 107 of 1998), as amended (NEMA); and
- Government Notice 4167 (GN4167) as published in the Government Gazette 49833 of 08 December 2023 as it relates to the National Water Act, 1998 as amended (Act No. 36 of 1998).

Table D.1 Legislative requirements used in this report

The Constitution of the Republic of South Africa, 1996	States that: "Everyone has the right to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development."
National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, state that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.
National Water Act , 1998 (Act No. 36 of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) recognises that the entire ecosystem and not just the water itself in 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 Department of Water and Sanitation (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) & (i). A watercourse is defined 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 a watercourse.
Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the NWA (Act No. 36 of 1998) as amended	GN 4167 outlines the process of a General Authorisation (GA), which replaces the need to apply for a full Water Use Licence in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA. The notice replaces GN 509 of 2016. The GA sets out the requirement to determine the regulated area of a watercourse, which are defined as: the outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam; in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans. The GA also requires a determination of the degree of risk posed by an activity/ies related to a particular water use only applies to the use of water in terms of Section 21(c) and (i) of the NWA where the risk class is LOW as determined through the application of the Risk Matrix as prescribed in the Notice.

The legislation, policies and guidelines listed below in Table D.2 apply to the current project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table D.2 A list of key legislative requirements informing this report

Region	Legislation / Guideline	Comment
National	NEMA - National Environmental Management Act (Act 107 of 1998), as amended	Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017), Appendix 6 requirements
	NEMBA- The National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Threatened or Protected Species Regulations	The protection of species and ecosystems that warrant protection
	NEMA –Assessment Protocol (March 2020)	The minimum criteria for reporting.
National	NEMA - Assessment Protocol (October 2020)	Protocol for the specialist assessment and minimum report content requirements.
	NEMWA – National Environmental Management: Waste Act (Act 59 of 2008)	The regulation of waste management to protect the environment.
	NWA – National Water Act (Act 36 of 1998), as amended	The regulation of water use.
	GN 1003 of GG 43726 of 18 Sept 2020	The regulation and management of alien invasive species.
	NWA - GN4167 of GG 49833 of 8th Dec 2023	General Authorisations in term of Section 39 of the National Water Act 36 of 1998 for Water Uses as defined in Section 21 (c) and (i)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)	To provide for control over the utilisation of the natural agricultural resources, including the vegetation and the combating of weeds and invader plants.
Provincial	Western Cape Biodiversity Act (Act 6 of 2021)	The Western Cape Biodiversity Act was signed into law in 2021. It marks a key milestone in the rationalisation and modernisation of the regulatory framework for biodiversity governance in the Western Cape Province and supports alignment with national and international policy and strategic frameworks.

D-1 National Environmental Management Act (Act 107 of 1998) – NEMA

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

D-1.1. Environmental Authorisation

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

(h) and 44 of the National Environmental Management Act, 1998, when applying for EA" (Reporting Criteria).

The NEMA Environmental Screening Tool, as drafted by the Department of Forestry, Fisheries and the Environment (DFFE), as published in Government Notice No. 320 in Government Gazette 43110 determined that the proposed development must follow the reporting guidelines of an Aquatic Biodiversity Specialist Impact Assessment due to falling within a Very High Sensitivity Aquatic Biodiversity Sensitivity Area. The NEMA desktop screening and reporting requirements are subjected to subsequent freshwater sensitivity verification in the field – this was already conducted on the 16th November 2023.

The Environmental Authorisation (EA) process is determined by confirmation or rejection of the environmental sensitivity outcomes of the NEMA Environmental Screening Tool. If environmental sensitivity is disputed, or if it is confirmed but no quantum of impact from the proposed activities can be motivated and no Environmental Impact Assessment (EIA) listing notices are triggered (in terms of watercourses[10]) then the proponent may opt for EA exemption, usually in the form of an Aquatic Biodiversity Compliance Statement. If the proposed activities are deemed however to exert an impact on the environment (this report), then an Aquatic Biodiversity Specialist Impact Assessment must be submitted, which will subsequently inform whether a Basic Assessment, or a Scoping and EIA process must be followed. The EA process is to be determined by an Environmental Assessment Practitioner.

D-2 National Water Act (Act 36 of 1998) - NWA

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

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

A watercourse means:

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

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

D-2.1. Water Use Authorisation

This assessment has also been completed in accordance with the requirements of the published General Notice (GN) 4167 in Government Gazette (no. 49833) on the 8th December 2023 by the Department of Water and Sanitation (DWS) under Section 39 of the National Water Act (Act no. 36 of 1998) (NWA) for Section 21 (c) and (i) water uses.GN4167 replaces GN 509 of 2016 and GN 3139 of 2023) and outlines the process of a General Authorisation (GA), which replaces the need to apply for a full Water Use Licence

[10] The National Water Act (Act 36 of 1998) (NWA) defines water resources as watercourses, surface water areas, estuaries and aquifers. This report focuses only on watercourses, i.e. the presence of freshwater riverine and wetland systems.

Application (WULA) in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA, including the applicant being listed under Appendix D1 or Appendix D2 of the same notice.

The conditions for GA eligibility include the following:

- when all proposed water use activities fall within a LOW risk significance impact in the GN 4167 DWS Risk Assessment Matrix (RAM) and if the applicant is listed under Appendix D1 or Appendix D2 of this notice;
- when the application does not include other NWA Section 21 water uses, and
- when the application does not involve sewage infrastructure, water and wastewater treatment works, pipelines and other water uses associated with hazardous materials and for most-mining related water uses.

It must be noted that the DWS as the freshwater resource custodians of South Africa ultimately determine the nature of the WUA process (GA or WULA).

D-3 Legislative Zones of Regulation

Zones of Regulation (ZoR) are not necessarily development exclusion zones, but areas within which Environmental Authorisation (EA) or Water Use Authorisation (WUA) is required with NEMA or the NWA respectively. ZoRs are deemed to be areas surrounding the watercourse within which development activities might pose a quantum of risk to the watercourse. Therefore, the authorisation of the proposed activities within these ZoR is typically subjected to certain development related conditions being met, to inform sustainable use of the freshwater resource.

Within the context of sustainable freshwater use, this pertains to certain types of activities that fall either within the watercourse or within a defined distance from the watercourse.

Further to this, this aquatic impact assessment report speaks to WUA in terms of the NWA Section 21 (c) and (i) water uses, as described below:

- Section 21 (c): Impeding or diverting the flow of water in watercourse; and
- Section 21 (i): The alteration of the bed, banks, course and characteristics of a watercourse

The specific conditions triggering the need for WUA in terms of NWA Section 21 (c) and (i) water uses, as promulgated in General Notice (GN) 4167 of 2023 are described below in Table D-3.1.

Table D-3.1 Legislated ZoR in terms of NWA Section 21 (c) and (i) water uses

Regulatory authorisation	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). **Department of Water and Sanitation (DWS)**	Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the National Water Act, 1998 (Act No.36 of 1998) as amended. In accordance with GN4167, a regulated area of a watercourse in terms of water uses as listed in Section 21(c) and 21(i) is defined as: the outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam; **in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or** **In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans.**

Regulatory authorisation	Zone of applicability
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) **EIA Regulations (2014), as amended.** **Department of Environmental Affairs and Development Planning (DEA&DP)**	**Activities of Listing Notice 1 (GN 983) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended):** **Activity 12:** The development of— dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; o**r** infrastructure or structures with a physical footprint of 100 square metres or more. where such development occurs: a) within a watercourse; b) in front of a development setback; or c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse. **Excluding:** dd) where such development occurs within an urban area ee) where such development occurs within existing roads, road or railway line reserves **Activity 19:** The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from (i) a watercourse; (ii) the seashore; or (iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or estuary, whichever distance is the greater— but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies. Activities of Listing Notice 3 (GN 985) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) **Activity 14** The development of— dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a) within a watercourse; (b) in front of a development setback; or

Regulatory authorisation	Zone of applicability
	(c) if no development setback has been adopted, within 32 metres of a watercourse, **Western Cape:** aa) A protected area identified in terms of NEMPAA, excluding conservancies; bb) National Protected Area Expansion Strategy Focus Areas; cc) World Heritage Sites; dd) Sensitive areas identified in an environmental management framework adopted by relevant environmental authority; ee) Sites or areas identified in terms of an International Convention ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; gg) Core areas in biosphere reserves; or hh) Areas within 10 km from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve

The following ZoR were assigned to the watercourses associated with the PAOI (Figure D-4.1):

- A 32m ZoR was assigned to all watercourses falling within the PAOI in terms of NEMA;
- A 100m ZoR was assigned to the EDL falling within the PAOI in terms of GN4167; and
- A 500m ZoR was assigned to all wetlands falling within the PAOI in terms of GN4167.

D-4 Ecological Protection Buffer Requirements

Riparian areas and wetlands 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 complement of wildlife and forage for domestic animals. The vegetation they contain is 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). Additionally, the watercourses potentially influenced by the project have sensitivity to further disturbance, requiring protection from the project activities. Therefore, they are considered as high priority areas and should be avoided at all costs.

An ecological protection buffer differs from a ZoR in that it is a determined strip of land (a no-go area) of high priority that protects one area of land against the potentially negative impacts of another, ultimately to afford protection of riverine and wetland ecosystem processes from construction and operation phase impacts. This is notwithstanding these buffer areas being intentionally designed to in additionally (as required) polish water quality from upstream activities, preserve ecological corridors for both aquatic and terrestrial biota, and even make provision for societal benefits (Macfarlane *et. al*, 2015).

Buffers are however not intended to be effective mitigation measures against impacts such as hydrological (stream flow reduction, impoundments or abstraction) and cannot safeguard against the impacts of point-source discharges or groundwater contamination. These impacts require site specific mitigation measures to be followed (Macfarlane *et. al*, 2015). In this regard, refer to Section 9 of this report.

A 15m buffer is recommended for this project for non-operational activities such as the placement of contractor laydown areas and for equipment/material/vehicular storage (Figure D-4.1).

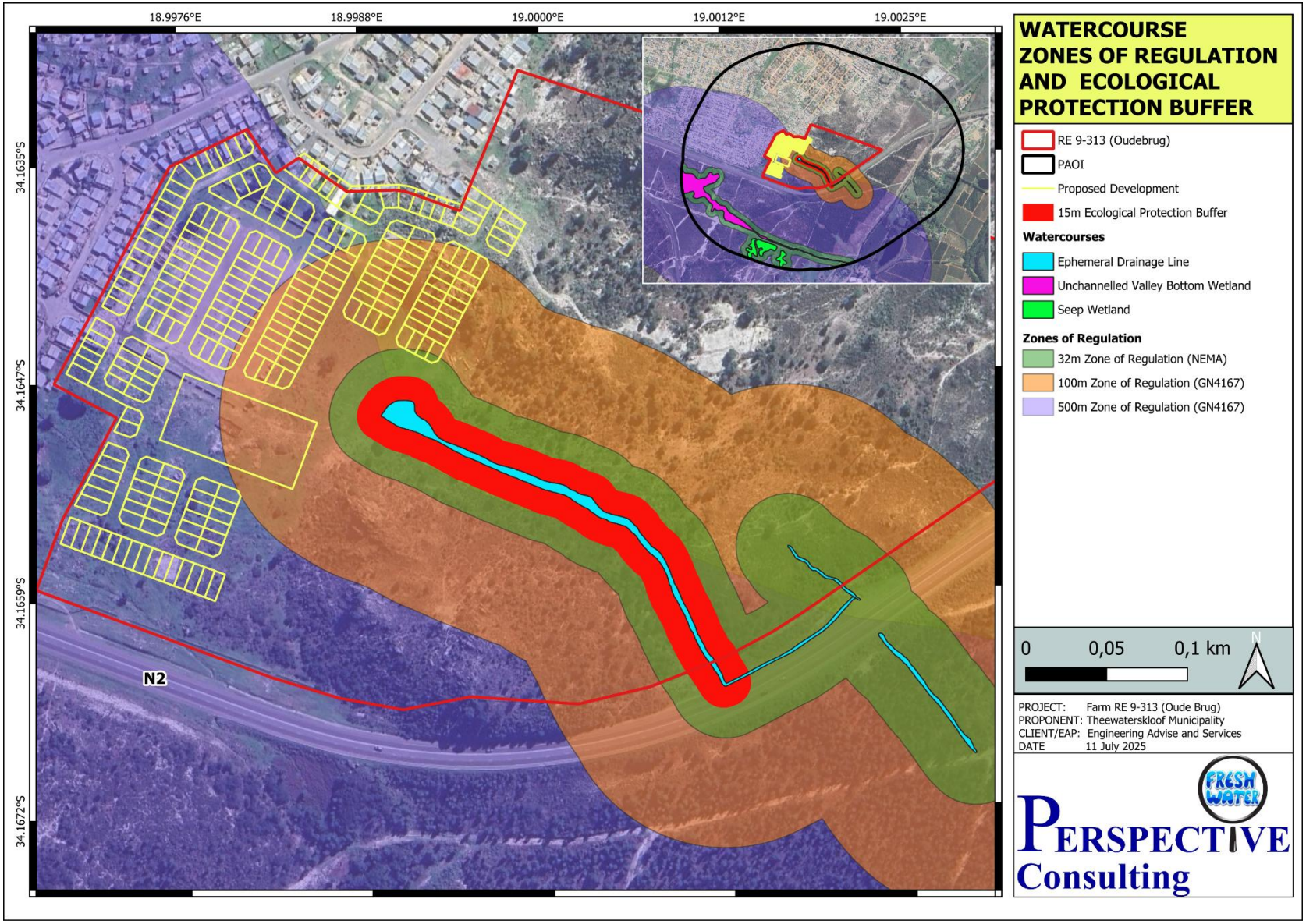

Figure D-4.1 Watercourse zones of regulation within the PAOI according to the NWA and NEMA

APPENDIX E RISK ASSESSMENT

E-1 Current Impacts on Freshwater Biodiversity – Present Ecological Status

The reader is referred to Section 6.2.

E-2 Ecological Importance and Sensitivity

The reader is referred to Section 0.

E-3 Alternative Considered

No alternative location has been considered for the proposed development.

E-4 Quantitative Risk and Impact Assessment

The mitigation hierarchy as developed by the Department of Environmental Affairs (2013) will be considered for this component of the assessment (Figure F.1). In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in the project location, setting, scale, layout, technology, and phasing to avoid impacts. For this assessment, the specialist was provided with the location of the proposed activity and the study focussed on the water resources within and downstream of the project area. Mitigation measures must be implemented to negate potential impacts on the water resources associated with the project area.

It must be noted that the proposed development is proposed outside of the footprint of the subject EDL, outside of the 15 m ecological protection buffer. Provided that all mitigation measures have successfully applied, the Freshwater Specialist is of the opinion that impacts to the EDL, and the potentially receiving Palmiet can be avoided.

E-5 Risk Assessment Discussion

The GN4167 Risk Assessment Matrix determined that all activities would pose a Low-risk significance impact on the ecological integrity of the EDL and the potentially receiving Palmiet River. This is due to a combination of 1) the already Seriously Modified PES of the EDL, in terms of alien invasive vegetation, existing physical (litter) and chemical pollution (substances) of the EDL, meaning this system is no longer considered ecologically sensitive, the ephemeral hydroperiodicity of this EDL, meaning that its course is dry for the majority of time(September (year 1) – June (year 2) and for this reason is also not ecologically sensitive outside of the wet season; and 3) the proposed development footprint is proposed outside of the footprint of the EDL, and therefore direct impacts are avoided, meaning that no loss in the footprint of the EDL is expected. The proposed development therefore needs to focus its mitigation largely on not cumulatively impacting on the EDL in terms of alien and invasive vegetation species encroachment and water quality impacts on the EDL, and downstream receiving Palmiet River system. Concrete in particular is highly toxic for aquatic biota and furthermore has a very high alkaline pH, unlike the naturally acidic pH of the majority of river systems in the Western Cape (Day and Davies (2023).

The Low risk impact significance on the Palmiet River, especially in terms of further water quality perturbation is due to the unlikely event of sewerage pipeline failure and subsequent ingress into the EDL and eventually the Palmiet River system. Stormwater entry into the Palmiet River by comparison is much more likely, but assuming that the stormwater attenuation facility will be operated in such a manner that erosion is prevented and water quality releases are within the specification of the Resource Quality Objectives of the B5 Overberg West reach of the Palmiet River (Table 5.1), the impacts are envisaged to be Low. Alien and invasive vegetation encroachment into the Palmiet River system due to disturbance on site is of the most concern, but was determined to be Low on condition that an alien and invasive management plan is in place for this project.

It is imperative that sediment and the continued spread of alien invasive vegetation be managed during the construction phase, and as required during the operation phase, including monitoring thereof. The low risks associated with the DWS Risk Assessment Matrix are based on the assumption that sources of

water quality impairment and mobilisation of alien and invasive vegetation species and sediment can be contained.

The rehabilitation of the EDL would see a positive ecological return during the operational phase in terms of increased ecosystem provision in the long term via improved habitat of the downstream reach of the drainage line once the initial rehabilitation disturbance during the construction phase has ceased.

A decommissioning phase for the proposed development was not considered due to the longevity of proposed activity.

Table E-5.1 summarises the DWS GN4167 Risk Assessment Matrix ratings associated with the project in terms of the listed activities that would likely result in the above impacts. The risks are calculated based on the assumption that the mitigation measures, as described in Section 9 and APPENDIX F are diligently applied.

The determination of only Low risk significances would afford the applicant eligibility to register for the Water Use Authorisation process in terms of a General Authorisation. This decision is however ultimately the sole discretion of the DWS, the freshwater custodians of South Africa.

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Table E-5.1 The DWS Risk Assessment Matrix applied to the associated watercourses, compiled by Cole Grainger (Pr. Sci. Nat. 119870)

Phase	Step	Activity	Impact	Potentially affected watercourses			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
				Name/s	PES	Overall Watercourse Importance										
CONSTRUCTION	1	SITE PREPARATION FOR CIVIL WORKS	Encroachment of fast colonising terrestrial alien invasive vegetation into watercourses after vegetation clearing, thereby decreasing the reestablishment success and extent of indigenous vegetation species which would ultimately see increased ecological pressure on freshwater ecosystems in the area	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	3	5	12	**2**	24	60%	**14,4**	**L**	Medium
				PALMIET RIVER	D	Very high	**6**	1	5	12	**5**	60	20%	**12**	**L**	Medium
			Potential sedimentation of the receiving watercourses from the generated sediment laden surface runoff during rainfall events as a result of devegetated, destabilised bare soils	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	2	2	8	**2**	16	20%	**3,2**	**L**	Medium
			Increased surface water runoff rates over destabilised soils due to decreased flow resistance by previously rooted vegetation. Increased surface runoff rates would increase the hydrological flashiness of an already flashy hydrological signature and would cause dysregulation of the receiving EDL and increase the probability of erosion of the receiving watercourse/s	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**6**	3	1	10	**2**	20	40%	**8**	**L**	Medium

Phase	Step	Activity	Impact	Potentially affected watercourses			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
				Name/s	PES	Overall Watercourse Importance										
CONSTRUCTION	2	LAYDOWN OF CONSTRUCTION MATERIALS	Laydown areas can become areas of disturbance which promotes the encroachment and establishment of alien and invasive vegetation which could spread into watercourses. Laydown areas can also impede and/or divert surface water away from its intended downstream reaches	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	3	5	12	**2**	24	20%	**4,8**	**L**	Medium
	3	EARTHWORKS FOR THE PREPARATION OF THE FOUNDATION OF THE PROPOSED STRUCTURES	Operation of machinery may cause potential contamination of the receiving watercourses downgradient as a result of hydrocarbon contaminant spills during vehicular and machinery operation	**EPHEMERAL DRAINAGE LINE**	D	Very high	**2**	3	2	7	**5**	35	40%	**14**	**L**	Medium
			Imported and stockpiled foundation material may be a source of an alien vegetation seedbank which may establish in stockpiled material and spread into watercourses	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	3	5	12	**2**	24	40%	**9,6**	**L**	Medium
				PALMIET RIVER	D	Very high	**6**	1	5	12	**5**	60	20%	**12**	**L**	Medium
			Potential sedimentation of the receiving watercourses from the generated sediment laden surface runoff during rainfall events as a result of the earthworks activities	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	2	2	8	**2**	16	20%	**3,2**	**L**	Medium
			Increased sedimentation of the watercourses may provide areas of substrate which encourages the encroachment and establishment of alien and invasive vegetation, which may then spread to other areas in this watercourse	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	3	5	12	**2**	24	20%	**4,8**	**L**	Medium

Phase	Step	Activity	Impact	Potentially affected watercourses			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
				Name/s	PES	Overall Watercourse Importance										
CONSTRUCTION	4	TRENCHING FOR THE INSTALLATION OF THE BULK AND INTERNAL DOMESTIC AND	Open trenching will lead to the impedance and diversion of freshwater from the upstream catchment which would result in the temporary dewatering of the downstream reach of watercourses	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**6**	2	1	9	**2**	18	20%	**3,6**	**L**	Medium
			Operation of machinery may cause potential contamination of the associated watercourses as a result of hydrocarbon contaminant spills during vehicular and machinery operation	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**2**	3	2	7	**2**	14	40%	**5,6**	**L**	Medium
	5	STOCKPILING OF EXCAVATED SOIL FROM THE GENERAL EARTHWORKS ACTIVITIES	Operation of machinery may cause potential contamination of the associated watercourses as a result of hydrocarbon contaminant spills during vehicular and machinery operation	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**2**	3	2	7	**2**	14	40%	**5,6**	**L**	Medium
			Stockpiles are substrates on which alien and invasive vegetation inhabit and spread to other terrestrial and watercourse areas	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	3	5	12	**2**	24	60%	**14,4**	**L**	Medium
				PALMIET RIVER	D	Very high	**6**	1	5	12	**5**	60	20%	**12**	**L**	Medium
			Increased sedimentation of the downstream reach of the watercourses due to sediment-laden surface runoff from the soil stockpiles.	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	2	2	8	**2**	16	20%	**3,2**	**L**	Medium

Phase	Step	Activity	Impact	Potentially affected watercourses			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
				Name/s	PES	Overall Watercourse Importance										
CONSTRUCTION	6	BACKFILLING OF TRENCHES	Over compacted soils would inhibit the germination of most seeds and favour the establishment of hardly pioneer alien and invasive plants that can spread into watercourses	EPHEMERAL DRAINAGE LINE	E	Low / Very low	4	3	5	12	2	24	60%	14,4	L	Medium
				PALMIET RIVER	D	Very high	6	1	5	12	5	60	20%	12	L	
	7	CONCRETE WORKS FOR THE CONSTRUCTION OF THE PROPOSED DEVELOPMENT	Concrete is highly toxic to aquatic life and has an alkaline pH which is above the natural signature of river systems in the region	EPHEMERAL DRAINAGE LINE	E	Low / Very low	4	3	2	9	2	18	40%	7,2	L	Medium
			Operation of machinery may cause potential contamination of the associated watercourses as a result of hydrocarbon contaminant spills during vehicular and machinery operation	EPHEMERAL DRAINAGE LINE	E	Low / Very low	2	3	2	7	2	14	40%	5,6	L	Medium
	8	IMPORTING INFILL FOR ROAD LAYERWORKS	Imported infill material can contain alien invasive seeds that could germinate and introduce alien vegetation to the watercourses	EPHEMERAL DRAINAGE LINE	E	Low / Very low	4	3	5	12	2	24	40%	9,6	L	Medium
				PALMIET RIVER	D	Very high	6	1	5	12	5	60	20%	12	L	Medium
			Stockpiled infill material can be a substrate on which alien and invasive vegetation establishes and spreads through the watercourse	EPHEMERAL DRAINAGE LINE	E	Low / Very low	4	3	5	12	2	24	40%	9,6	L	Medium
				PALMIET RIVER	D	Very high	6	1	5	12	5	60	20%	12	L	Medium
			Stockpiled infill material can be a source of sedimentation into the watercourse during surface runoff events	EPHEMERAL DRAINAGE LINE	E	Low / Very low	4	3	5	12	2	24	20%	4,8	L	Medium

Phase	Step	Activity	Impact	Potentially affected watercourses			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
				Name/s	PES	Overall Watercourse Importance										
CONSTRUCTION	9	LAYERWORKS FOR THE CONSTRUCTION OF THE ROAD	Overuse of herbicide that is used to prohibit regrowth and penetration of vegetation through the overlying imported foreign material which could contaminate the watercourse and negatively impact indigenous vegetation and aquatic biota	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**8**	3	2	13	**2**	26	40%	**10,4**	**L**	Medium
			Compaction of foreign material that could contain alien seeds and introduce alien invasive vegetation to the watercourses	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	3	5	12	**2**	24	60%	**14,4**	**L**	Medium
				PALMIET RIVER	D	Very high	**6**	1	5	12	**5**	60	20%	**12**	**L**	Medium
			Pouring of asphalt and spraying of the road sealant which is highly toxic to aquatic life should this enter into the watercourse	**EPHEMERAL DRAINAGE LINE**	E	Moderate	**6**	3	2	11	**3**	33	40%	**13,2**	**L**	Medium
	10	REHABILITATION OF THE WATERCOURSE	Removal of alien and invasive vegetation from the watercourse. The rehabilitation activity would temporarily cause destruction of existing habitat and expose the watercourse to sediment from surface runoff events, or erosion from river flow itself. This would cause water quality perturbations for the downstream reach of the river.	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	2	2	8	**2**	16	60%	**9,6**	**L**	Medium

Phase	Step	Activity	Impact	Potentially affected watercourses			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
				Name/s	PES	Overall Watercourse Importance										
CONSTRUCTION	10	REHABILITATION OF THE WATERCOURSE	A resurgence in alien and invasive vegetation is expected within the watercourse if all uprooted alien and invasive vegetation is not effectively and promptly removed from the watercourse. This resurgence could lead to spread of vegetation into other watercourses	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	3	5	12	**2**	24	80%	**19,2**	**L**	Medium
				PALMIET RIVER	D	Very high	**6**	1	5	12	**5**	60	40%	**24**	**L**	Medium
OPERATION	11	OPERATION OF THE PROPOSED DEVELOPMENT	Alien invasive encroachment as a result of general disturbance in the area since the construction phase, with re-establishment and spreading during the operational phase	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**4**	3	5	12	**2**	24	60%	**14,4**	**L**	Medium
				PALMIET RIVER	D	Very high	**6**	1	5	12	**5**	60	40%	**24**	**L**	Medium
			Increased catchment hardening as a result of an increase in the footprint area of developed surfaces. Increased surface runoff rates would increase the hydrological flashiness of an already flashy hydrological signature and firstly would cause dysregulation of the receiving episodic systems and secondly would increase the probability of erosion in these systems	**EPHEMERAL DRAINAGE LINE**	E	Low / Very low	**6**	2	5	13	**2**	26	40%	**10,4**	**L**	Medium

Phase	Step	Activity	Impact	Potentially affected watercourses			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
				Name/s	PES	Overall Watercourse Importance										
OPERATION	11	OPERATION OF THE PROPOSED DEVELOPMENT	Increased surface runoff from the proposed development may cause increased erosion and sedimentation of the receiving watercourses and thereby increase the risks of alien invasion establishment and spread throughout the watercourses	EPHEMERAL DRAINAGE LINE	E	Low / Very low	4	3	5	12	2	24	40%	9,6	L	Medium
	12	OPERATION OF THE STORMWATER	Potential degradation to the water quality of the watercourse through discharge of stormwater containing hydrocarbons, sediments and litter	PALMIET RIVER	D	Very high	2	2	4	8	5	40	40%	16	L	Medium
	13	OPERATION OF THE SEWAGE INFRASTRUCTURE	A sewerage pipeline burst could result in: • Proliferation of alien and invasive vegetation within the watercourse due to eutrophication; • Potential organic pollution of the watercourse through introduction of faecal coliforms which is considered a serious form of pollution	EPHEMERAL DRAINAGE LINE	E	Low / Very low	6	3	4	13	2	26	40%	10,4	L	Medium
				PALMIET RIVER	D	Very high	8	1	4	13	5	65	20%	13	L	Medium
	14	REHABILITATION OF THE	Improved PES of the watercourse and associated increases in ecosystem service provisioning	EPHEMERAL DRAINAGE LINE	E	Low / Very low	-6	3	3	-12	2	-24	80%	-19,2	+	Medium

The Department of Water and Sanitation (DWS) risk matrix assesses impacts in terms of consequence and likelihood. The significance of the impact is rated according to the classes presented in Table E-5.2.

Table E-5.2 Significance ratings matrix

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

E-6 Cumulative Impact Assessment

The following aspects as presented in Table E-6.1 were considered in the cumulative impact assessment which refers to quantifying the significance (Table E-6.2) of impacts in relation to the proposed development.

Table E-6.1 Aspects and ratings considered in the cumulative impact assessment

Duration of Impact	**Rating**
One day to one month: Temporary	1
One month to one year: Short Term	2
One year to five years: Medium Term	3
Life of operation or less than 20 years: Long-Term	4
Permanent	5
Spatial Scope of Impact	**Rating**
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear features affected > 3000m	5
Severity of Impact	Rating
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great/harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Sensitivity of Receiving Environment	**Rating**
Ecology is not sensitive/important	1
Ecology with limited sensitivity/importance	2

Ecology moderately sensitive/ /important	3
Ecology is highly sensitive /important	4
Ecology is critically sensitive /important	5
Probability of impact	**Rating**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Consequence (Severity+Spatial Scope+Duration)	
Likelihood (Sensitivity of Receiving Environment X Probability of Impact)	
Significance (Consequence X Likelihood)	

Table E-6.2 Significance ratings for the cumulative impact assessment

Significance	**Class**
0 - 15	Absent
16 -30	Low
31 - 45	
46 - 60	Moderate
61 - 75	
76 - 90	Moderately High
91 - 105	High
106 - 120	
120 - 135	Critical
136 - 150	

APPENDIX F MITIGATION MEASURES

As per the DEA (2013) Mitigation Hierarchy (see Figure F.1), development impacts must first be avoided, else mitigated to bring down the risk significance. When mitigation strategies can not be effectively applied to avoid/prevent impacts by considering options in the project location, setting, scale, layout, technology, and phasing to avoid impacts then rehabilitation of the environment is necessary post construction to redress these impacts. If however the environmental footprint is permanently lost to the proposed development, or if the ecological integrity and its associated ecoservices are permanently impaired, then offsetting is required to protect land elsewhere of a similar ecological value and integrity against future loss.

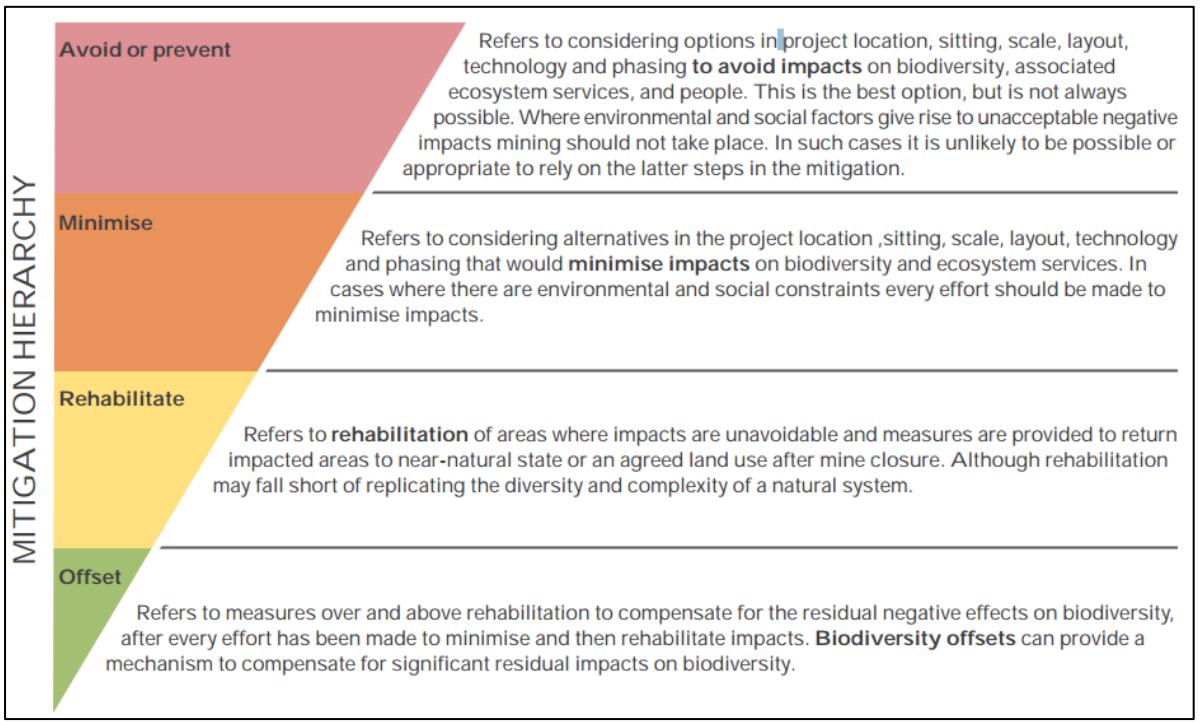

Figure F.1 The mitigation hierarchy as described by the DEA (2013)

In particular, mitigation measures aim to:

- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community;
- 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 impact those areas where it is unavoidable to do so otherwise.

It must be noted that avoidance of certain impacts such as vegetation removal and alterations to the watercourse are not deemed practical due to the requirement to work directly within this system.

Therefore, the proposed culvert works mitigation measures are focused largely on, avoidance of cumulative impacts as far as feasibly possible, and rehabilitation activities within the watercourse during the construction phase, followed by monitoring during the operation phase.

The mitigation measures are specifically targeted for the construction and operational nature of the proposed works with respect to the associated watercourses to ensure avoidance/prevention of cumulative impacts from further imposing on the PES of these freshwater systems.

The mitigation measures as described below are split into the abiotic drivers (hydrology, water quality, geomorphology) and biotic responders (vegetation and biota), as together these comprise the overarching functioning of any freshwater ecosystem.

F-1 General

- Contractor laydown areas and equipment/material/vehicular storage must remain outside of the prescribed watercourse ecological protection buffers (15 m development setback) which must be enforced by a suitably qualified Environmental Control Officer who has a good understanding of the watercourses on site and the quality and flow of surface water and can limit impacts to all watercourses as far as possible. Site specific mitigation measures in Section 9 must be applied to minimise the risk significance impact when working within a watercourse;
- Manual labour must be implemented as far as practically possible to limit the use of machinery in watercourses (considered much more environmentally invasive) and can hamper rehabilitation success due to additional time and cost constraints, which may not be operationally feasible;
- Solid waste and litter that is generated during construction must be contained and disposed of at a registered landfill facility and may not be stored on site. Separation and recycling of different waste materials must be supported. Similarly, construction material may not be left at site post-construction;
- All chemicals, construction materials and toxicants to be used for the construction must be stored within bunded areas;
- All contractors and employees must undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced to avoid unnecessary trampling through the environment (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- Stockpiling of removed soil/construction material must take place outside of the prescribed watercourse ecological protection buffers. Stockpiles must be protected using hessian sheeting or similar and surrounded by bunds to prevent them from becoming a source of windborne dust, sediment laden surface runoff, or habitat for the infestation of alien and invasive vegetation. Stockpile storage on a level ground and not exceeding 2 m in height is critical to their successful management and containment. Stockpiles must be safeguarded from all forms of contamination;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil from moisture and subsequent carbon loss, or from becoming infested by alien invasive plants;
- An **alien invasive plant (AIP) management plan** needs to be compiled and implemented post construction to control current invaded areas and prevent the growth of AIPs on cleared areas. Alien vegetation must not be allowed to encroach onto the sites and must be continually removed during construction. Construction must not promote further alien plant disturbances in the surrounding area;
- Erosion prevention and sediment control measures must be implemented. Temporary and permanent erosion control methods may include silt fences, interceptor ditches, seeding and sodding, riprap of exposed embankments, and mulching;
- Areas exposed to erosion must be protected through the use of sandbags, berms and efficient construction processes i.e., limiting the extent (footprint) and duration period that areas are exposed;
- Rehabilitation of the watercourses must be budgeted for **within the worked areas** and should be incorporated into the project life cycle and must be completed as soon as construction is

completed. Rehabilitation must be done following an approved Rehabilitation Plan and in consultation with a suitably qualified SACNASP professional who is familiar with the ecological importance of the local area. Rehabilitation in the Western Cape in terms of revegetation is most successful when planting is conducted immediately before the cold wet winter season. This will ensure that vegetation is not exposed to drought stress and this permits plants sufficient time to anchor and adapt to their new environment. The onset of spring, which brings increased sunlight intensity and sunlight hours will then encourage growth of the newly planted vegetation;

- All permanently created hardened surfaces that are associated with any project area must be structurally stable, must not induce sedimentation, erosion or flooding, must not cause a detrimental change in the quantity, velocity, pattern, timing, water level and assurance of flow in a watercourse, must not cause a detrimental change in the quality of water in the watercourse, must not cause a detrimental change in the stability or geomorphological structure of the watercourse; and must not create nuisance conditions, or health or safety hazards;
- Measures must be implemented at alterations (including at existing structures or activities) to 1) prevent detrimental changes to the breeding, nesting or feeding patterns of aquatic biota, including migratory species (if present), 2) allow for the free up and downstream movement of aquatic biota, including migratory species (if present), and 3) prevent a decline in the composition and diversity of the indigenous and endemic aquatic biota.

F-2 Water Quality Impairment

- All construction activities must be undertaken during the low flow (dry summer season) period as much as possible to limit surface flow transporting contaminants to the downstream reach of watercourses. This period is between December – March in the Western Cape;
- During construction, contractors used for the project must have action plans for spills and leaks and be in possession of spill kits available to ensure that any fuel or oil spills are cleaned up and discarded correctly;
- Where feasible, as much material must be prefabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site. This is particularly applicable to the use of concrete which in its wet form is highly toxic to aquatic life, for which the following mitigation measures must be applied:
- Ready mix concrete is preferred over batching concrete on site as this minimising the handling of concrete on site, and thereby the potential for environmental spillage;
- Mixing of fresh concrete must be done within a construction camp, at least 30 m away from watercourses, on a batter board/platform mixing tray, else within a lined, bound or bunded portable mixer. No mixing on bare ground is permitted;
- Cement bags must be disposed of in demarcated hazardous waste receptacles;
- Spilled or excess concrete must be disposed of at a suitable landfill site; and
- A washout area must be designated outside of the delineated extent of watercourses and wash water must be treated on site or discharged to a suitable landfill site. Chain of custody documentation in this regard is required.
- No vehicle or machinery is allowed to be washed within a watercourse or its buffer area, and must take place off site;
- All chemicals and toxicants during construction must be stored in bunded areas;
- All machinery and equipment must be inspected regularly for faults and possible leaks; these must be serviced off-site;
- Vehicles must be equipped with drip trays to avoid the spillage of oils and hydrocarbons into watercourses;

- Sandbags, sediment drift fences or other appropriate structures as determined by the Environmental Control Officer (ECO) must be placed between the proposed works and any downgradient watercourses in case of sudden rainfall events that could potentially generate sediment-laden runoff into the receiving watercourse; and
- Watercourses must be continuously visually monitored by the ECO during the construction phase, especially in the unlikely event of rainfall to ensure that sedimentation of these watercourses is avoided.

F-3 Erosion, Sedimentation and Geomorphology

- All removed soil and material must not be stockpiled downstream of watercourses so as to limit sedimentation of these systems. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, may not exceed a height of 2 m and must be surrounded by bunds or protected from wind using hessian sheeting or similar;
- Stockpiles must be safeguarded from all forms of contamination;
- Install sandbags around soil stockpiles to prevent soils washing into watercourses;
- Document the soil profile on removal and ensure the soil is backfilled in the same horizon order in which it was removed (last out first in principle). This is ultimately to ensure the success of revegetation, by maintaining the most carbon-rich soil layer at surface;
- Excess soil that was generated during the construction phase must be disposed of at an appropriate registered waste facility;
- Ensure that topsoil is appropriately stored and protected from weathering and reused during the rehabilitation process;
- Make sure that the soil is backfilled and compacted to appropriate geotechnical specifications for the project area;
- Signs of erosion during the operation phase must be addressed immediately to prevent further erosion of the upgraded 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 must be rehabilitated promptly by planting suitable indigenous vegetation to protect the exposed soil from weathering and/or erosion;
- Landscape and re-vegetate all cleared areas as soon as possible to limit erosion potential; and
- The river banks must be reprofiled to a 1:3 ratio, to reinstate the natural wetting of banks., or atleast must be tied in with the surrounding landscape.

F-4 Alien Vegetation Establishment

- Vegetation must be cleared in a phased approach and be limited to essential clearing area under the directive of an alien invasive vegetation clearing management plan, to control and prevent the spread of invasive alien vegetation species;
- Stockpiled vegetation must be stored outside of the prescribed watercourse ecological protection buffer and for a limited time to prevent the reestablishment of alien and invasive vegetation in the landscape;
- Cleared vegetation must be disposed of at a licensed facility and may not be mulched or burned on site;
- Bare soil must be immediately restocked with indigenous vegetation in areas that will not be developed, else protected from erosion or from being swept away by covering the soil with hessian sheeting or similar;

- Imported material must be alien seed free and the stockpiled infill must be continuously monitored (together with soil stockpiles) for the encroachment of alien and invasive vegetation and managed timeously; and
- Quarterly vegetation rehabilitation surveys must be conducted of the vegetation within the project footprint to establish whether alien invasive vegetation encroachment is stable or has become problematic once more.

F-5 Operation of Vehicles and Heavy Machinery

- All machinery and equipment must be inspected regularly for faults and possible leaks, these must be serviced in a designated area, outside of the prescribed watercourse protection buffer;
- Heavy vehicles must be parked outside of the prescribed watercourse protection buffer, except when in use for the construction process;
- Re-fuelling of vehicles must take place off-site, outside of the prescribed watercourse ecological protection buffer, preferably within a construction camp where spill kits are available, or on a non-permeable surface in case of a leak. The contractor is to have these spill kits in their possession;
- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for the creation of new access routes. In the case of a new access route that must traverse a watercourse (if applicable to a project), a single route must be strategized which will best provide proximate access to the working area, without the need to consider additional access routes;
- Prevent uncontrolled access of vehicles through the watercourses that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas;
- Operating heavy machinery in watercourses require careful consideration to minimise environmental impact; and must be under the supervision of an ECO;
- Schedule operations during the dry season when ground conditions are more stable and less prone to damage;
- No heavy machinery shall be permitted within unauthorised water resource areas for any purpose, without the prior approval of the ECO (except emergency procedures, or when works are required within the watercourse);
- Operators must be trained in operating machinery in wetland/sensitive environments and be made aware of the sensitivity of the area which itself must be demarcated so as to guide operators, labourers and contractors;
- Use machinery with low ground pressure to minimise soil compaction and damage to wetland/riparian vegetation. Tracked vehicles or specialised low-ground-pressure tyres can be used if feasible/available;
- Machinery can be equipped with attachments like swamp mats or bog mats to distribute weight and minimise disturbance to the watercourse areas;
- Implement sediment and erosion control measures such as silt fences, erosion control blankets, or sediment traps to prevent soil runoff into water bodies associated with vehicular movements and disturbed/hardened surfaces;
- Develop spill prevention and response plans to address potential leaks or spills of fuels, oils, or other hazardous substances;
- The contractor is responsible for cleaning up any spillages (e.g. concrete, oil, fuel), immediately;
- Develop a restoration and rehabilitation plan to mitigate any long-term impacts of operating heavy machinery in wetlands and/or riparian areas; and

- Implement measures such as revegetation of disturbed areas or habitat enhancement to restore the ecological functions of the water resource(s).

The site-specific mitigation measures can be revisited in Section 9.

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APPENDIX H SPECIALIST DECLARATION OF INDEPENDENCE

I, Cole Grainger, 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.

Cole Grainger

Freshwater Specialist

Freshwater Perspective Consulting

11 July 2025

APPENDIX I SPECIALIST CV

PERSPECTIVE Consulting

Freshwater Impact Assessment & Biomonitoring

Cole Grainger (Pr.Sci.Nat.)
Freshwater Specialist
cole@fwpc.co.za|084 397 6753

INTRODUCTION

Cole Grainger is a SACNASP registered Professional Scientist in the field of Aquatic Science.

He is a Freshwater Specialist with 10 years' experience in wetland and river impact assessments and biomonitoring.

Cole's MSc aimed at broadening the understanding of benthic algal community shifts in winter and summer rainfall areas as part of the testing of the biomonitoring viability of various algal groups in South Africa to nutrient and flow regime mixed effects. Cole has since broadened his aquatic biomonitoring experience to both wetland and riverine disciplines.

Cole furthermore is a reasonably experienced River Ecostatus Monitoring Programme assessor and has applied the IHI, FRAI, MIRAI and VEGRAI models.

AREAS OF INTEREST

Research

Cole is passionate about freshwater conservation and multivariate ecological research and has a keen interest to contribute to the advancement of benthic algae and macroinvertebrate riverine biomonitoring protocols in South Africa, as these organisms play key foundational roles in the regulation of the trophic food web, and thus the overall health of aquatic ecosystems.

Consulting

Cole aims to provide holistic freshwater solutions that balance the needs of sustainable freshwater resources management and development goals.

KEY EXPERIENCE

Consulting Industries

- Research and Development
- Renewable Energy and mining
- Residential/Industrial/Commercial developments

Monitoring Disciplines

- Surface and groundwater quality
- River discharge
- Groundwater levels
- SASS5 and Benthic algae
- Wetland health
- Ecotoxicity

Assessment Tools

- WET-Health, WET-Ecoservices
- Buffer determination
- IHI, VEGRAI, MIRAI, FRAI

Reporting

- Wetland and Riverine Ecological Impact Assessments
- Biomonitoring Compliance
- Rehabilitation plans

Miscellaneous

- Aquatic Macroinvertebrate Species Identifications
- Water Use Licencing
- Software Programs
- Multivariate Ecological Research (PRIMER Software)
- GIS (ArcGIS, QGIS)

NATIONALITY

South African (ID:8807065007080)

LANGUAGES

- English – Proficient
- Afrikaans – Good

QUALIFICATIONS

- Pr. Sci. Nat. (119870) – Aquatic Science
- MSc (University of Stellenbosch) – Conservation Ecology (*Cum Laude*)
- DST-NRF Internship with the Freshwater Consulting Group – Department of Science and Technology
- BSc Honours (University of Stellenbosch) – Conservation Ecology

COURSES

- SASS 5 (2018-2028) – Department of Water Affairs and Sanitation River Health Programme
- Tools for Wetland Assessment – Rhodes University
- River Ecostatus Monitoring Programme – Department of Water and Sanitation (Pending)

PROVINCIAL EXPERIENCE

Western, Eastern and Northern Cape, Free State, Mpumalanga and Limpopo

End of Report