ANNEXURE B – FRESHWATER AND AQUATIC ASSESSMENT

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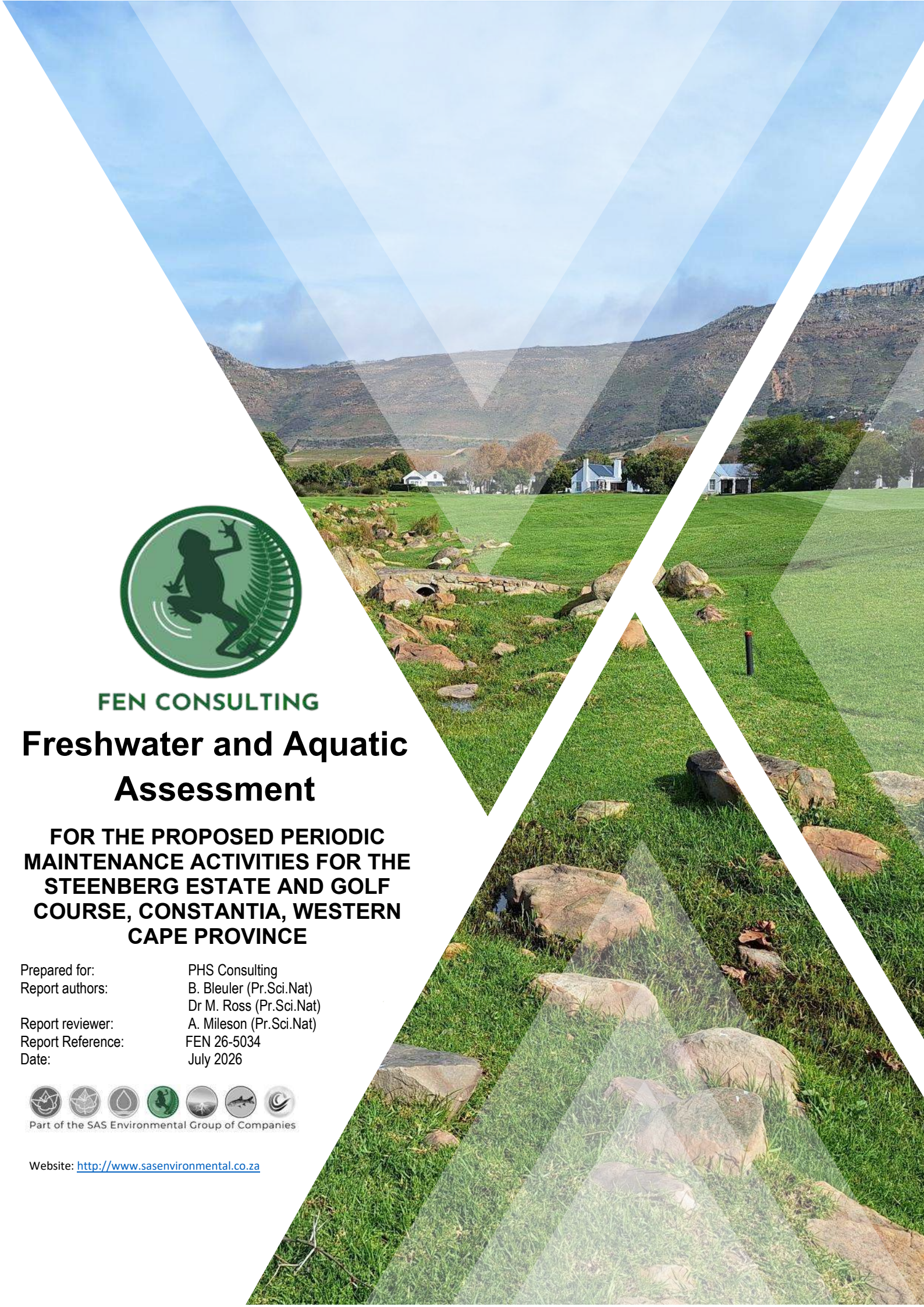

FEN CONSULTING

Freshwater and Aquatic Assessment

FOR THE PROPOSED PERIODIC MAINTENANCE ACTIVITIES FOR THE STEENBERG ESTATE AND GOLF COURSE, CONSTANTIA, WESTERN CAPE PROVINCE

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EXECUTIVE SUMMARY

The Proponent wishes to undertake general periodic maintenance activities of the watercourses on Steenberg Estate and Golf Course, located in Constantia, Cape Town, Western Cape Province, hereafter referred to as the 'study area'. Freshwater ecosystems were identified in association with the study area, namely an Ephemeral Drainage Line (EDL) which traverses the golf course as an artificial channel and transitions into a non-perennial river system (known as the Prinseskasteel Stream) and associated channelled valley bottom wetland. An additional EDL was identified on Erf 12910. Based on the findings of the freshwater ecosystem assessment and the results of the risk assessment, it is the opinion of the ecologists that the proposed periodic maintenance activities pose an overall Low risk to the identified freshwater ecosystems. Based on the outcome of the Impact Assessment, the proposed periodic maintenance activities pose an overall negative low impact on the ecological integrity of the freshwater ecosystems associated with the study area, as well as the non-perennial river downgradient of the study area within the investigation area. Provided that adherence to cogent, well-conceived and ecologically sensitive maintenance methodology are implemented and that the control measures provided in this report, as well as general good construction practice are adhered to, the proposed periodic maintenance activities can be considered environmentally acceptable and can be granted authorisation. Water Use Authorisation in terms of Section 21 (c) and (i) of the National Water Act 1998 (Act No. 36 of 1998) will be required from the relevant authorities prior to the commencement of any works. Although maintenance activities will be undertaken within the 32 m Zone of Regulation as it relates to the National Environmental Management Act, 1998 (Act No. 36 of 1998) as amended (NEMA) of the identified freshwater ecosystems, no Environmental Authorisation would need to be applied for should the Maintenance and Management Plan for the proposed maintenance activities be adopted by the Department of Environmental Affairs and Development Planning (DEA&DP).

The impoundments associated with the study area (especially the last of the impoundments at the northern boundary of the study area) was found to be an important breeding area for the Endangered Western Leopard Toad (*Sclerophrys pantherina*). Any maintenance procedures associated with this impoundment and any of the other impoundments should be limited to outside of the breeding period for this species (breeding period is known to be July to December).

Refer to the Management Summary for a more detailed summary.

MANAGEMENT SUMMARY

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Water Use Authorisation (WUA) process and Maintenance Management Plan (MMP) in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA) for the proposed general periodic maintenance of the watercourses on Steenberg Estate and Golf Course, located on Erven 11193, 12379, 11039, 11111, 11072 and 12910, Constantia, Western Cape Province (refer to Section 1.1 of this report for anticipated periodic maintenance activities proposed to be undertaken).

The purpose of this report is to define the ecology of the areas within which the proposed periodic maintenance activities will occur, in terms of the natural freshwater ecosystem characteristics, including mapping of all freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES) of the freshwater ecosystems associated with the proposed repairs. The Department of Water and Sanitation (DWS) Risk Assessment Matrix (RAM) (2023) and an Impact Assessment was applied to determine the significance of the impacts associated with the proposed periodic maintenance activities, and control measures were identified which aim to minimise the potential impacts.

The assessment took the following approach:

- A desktop study was conducted in which the freshwater ecosystems were identified for on-site investigation, and relevant national and provincial databases were consulted. The results of the desktop study are contained in Section 3 of this report. The study area falls within the Berg/Bot/Potberg catchment, within the quaternary catchment G22D;
- A field assessment took place on 18 May 2026 during which freshwater ecosystems were identified in association with the study and investigation areas (defined as a 500 m radius around the study area);
- Two freshwater ecosystems were identified in association with the study area, namely an Ephemeral Drainage Line (EDL) which traverses the golf course as an artificial channel and transitions into a non-perennial river system (known as the Prinseskasteel Stream) and associated channelled valley bottom wetland. An additional EDL was identified on Erf 12910;
- The identified freshwater ecosystems were classified according to the classification system (Ollis *et al.,* 2013);
- A fish assessment was undertaken for the impoundments where standard electrofishing techniques were used along the periphery and within deeper water areas that could be safely accessed;
- The detailed results of the field assessment for the freshwater ecosystems are contained in Section 3 of this report and summarised in the table below; and
- The results of the National Screening Tool (2022; accessed 2026) indicates that the entire study area and investigation area are within areas indicated as being of ‘Very High’ aquatic biodiversity sensitivity. The sensitivities of the freshwater ecosystems indicated by the Screening Tool are supported, based on the outcome of the site investigation. The exception is the artificial channel which is considered to be of ‘Moderate’ aquatic biodiversity sensitivity. Refer to Appendix G for the Site Sensitivity Verification Report.

Table A: Summary of the results of the assessed freshwater ecosystems.

Freshwater ecosystems	PES	Ecoservices	EIS	Recommended Ecological Category (REC) and Recommended Management Objectives (RMO)
EDL	Category C (Moderately modified)	Moderate	Moderate	REC: C RMO: Maintain
Extent of modification	**Low** The rehabilitation and maintenance of the in-stream dam is not anticipated to significantly modify the EDL if undertaken during the low flow season. Conversely, the rehabilitation of the dam is anticipated to improve the condition from a vegetation perspective, particularly through AIP management and control. With the implementation of appropriate control measures outlined in this report, further modification of the EDL is expected to remain low.			
Artificial channel	Category D/E (largely to seriously modified)[1]	Low	Low	-
Extent of modification	Low The anticipated extent of modification to the artificial channel network as a result of the proposed periodic maintenance activities is considered low. Significant impacts to the system are not expected, largely due to the artificial nature of the system. Nevertheless, minor alterations to the hydrological and geomorphological functioning of the system may occur as a consequence of proposed periodic maintenance activities.			
Non-perennial river (Prinseskasteel Stream) and associated CVB wetland	Category C (Moderately modified)	Moderate	Moderate to High	REC: C RMO: Maintain
Extent of modification	**Low** The anticipated extent of modification to the river system is considered low, based on the assumption that the outlet structure from the golf course to the river is not replaced. Significant impacts to the river and associated CVB wetland are not expected, largely due to the buffering and attenuation functions provided by the upstream artificial channel network and associated impoundments. Nevertheless, minor alterations to the hydrological and geomorphological functioning of the system may occur. These impacts may include slight changes to the timing, volume, and distribution of surface water inflows to the river system as well as potential water quality (through sedimentation) impacts.			

Following the assessment of the freshwater ecosystems, the DWS RAM (2023) and an Impact Assessment was applied to ascertain the significance of possible impacts which may occur because of the proposed periodic maintenance activities. Although it is highly recommended that the culverts associated with the outlet structure of the last in-stream dam (directly upgradient of the Prinseskasteel Stream) be upgraded to allow passage of fish and frogs, it is assumed that such upgrades will not be undertaken under the ambit of the MMP. Should it, however, be determined that those specific culverts are to be replaced/maintained, the RAM and Impact Assessment as presented in this report would need to be revised accordingly. The outcome of the risk assessment indicates that the proposed activities pose a 'Low' risk significance to the freshwater ecosystems. It is imperative that appropriate controls are implemented when undertaking the required periodic maintenance activities, with specific mention that works must be undertaken outside of the active breeding period of the Western Leopard Toad (July to December). Based on the outcome of the Impact Assessment, the proposed periodic maintenance activities pose an overall negative low impact on the ecological integrity of the freshwater ecosystems associated with the study area, as well as the non-perennial river downgradient of the study area within the investigation area. The long-term benefits of continued periodic maintenance of infrastructure associated with the golf course, including improvements to hydraulic connectivity and geomorphological processes, outweighs the short-term negative risk/ impact and is therefore supported by the specialist.

The results of the DWS RAM (2023) assessment are presented in Section 5 of this report, of which a summary is provided in the table overleaf.

With strict enforcement of the control measures as provided in this document, specifically control measures for the anticipated temporary instream diversion and concrete works, the significance of impacts arising from the various phases of the proposed periodic maintenance activities can be effectively reduced and managed. Furthermore, it is imperative that targeted rehabilitation of the freshwater ecosystems and associated ecological buffers (particularly of the in-stream dam associated with the EDL), is undertaken to maintain and prevent a reduction of the PES of these systems as a result of the proposed periodic maintenance activities. Rehabilitation of the ecological buffer within the golf course (where feasible) would entail reinstatement of indigenous vegetation suitable for occasional inundation.

Authorisation in terms of Sections 21 (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA) must be obtained from the DWS for the proposed periodic maintenance activities prior to the commencement of any works. With guidance from the freshwater specialist and the relevant authorisation obtained from the competent authority, the proposed periodic maintenance activities within the freshwater ecosystems can be deemed acceptable, on the strict condition that preventative and rehabilitative measures are planned and implemented as part of the authorisation of the proposed periodic maintenance activities. Although maintenance activities will be undertaken within 32 m of the identified freshwater ecosystems, should the MMP for the proposed maintenance activities be adopted by the Department of Environmental Affairs and Development Planning (DEA&DP), Environmental Authorisation would not need to be applied for. It is the reasoned opinion of the freshwater specialist that the development can be considered environmentally acceptable and can be granted authorisation, provided that the control measures as detailed in this report are adhered to.

Table B: Summary of the DWS Risk Assessment outcomes.

Phase	No.	Activity	Impact	Potentially affected watercourses	Significance	Risk Rating
MAINTENANCE	1	Site preparation (where applicable) for maintenance activities within the delineated extent of the applicable freshwater hydrogeomorphic unit and associated ecological buffers (e.g. culvert replacement where required, upkeep of in-stream dams), including: • Removal of vegetation and associated disturbances to soil (although unlikely); • Stockpiling of maintenance equipment and storage of materials, vehicles and machinery; and • Possible indiscriminate vehicle movement.	• Dust generation from exposed soil potentially leading to the smothering of freshwater vegetation and biota, and altering surface water quality; • Potential soil destabilisation leading to sedimentation of the freshwater HGM units, or conversely, soil compaction leading to increased surface runoff into downstream / downgradient freshwater ecosystem; • Potential proliferation or spread of AIPs from disturbed soil; and • Contaminant spillage into the freshwater ecosystem from machinery and vehicle operation.	EDL	**14,4**	**L**
				Artificial channel	**14**	**L**
				Non-perennial River and associated CVB wetland	**9,6**	**L**
	2	Clearing of vegetation, debris, litter and sediment, and rectification of observed erosion within the proposed periodic maintenance site footprint area including stripping of topsoil within the freshwater habitat.	• Exposure of soil, leading to increased runoff and erosion, and thus increased likelihood for sedimentation of the freshwater ecosystems; • Loss of freshwater habitat and ecological structure resulting in impacts to biota; • Increased sedimentation of the freshwater HGM units, potentially leading to smothering of vegetation in the downstream reaches; • Proliferation or spread of alien and/or invasive vegetation as a result of disturbances; and • Potential changes to the ecoservice provision of the freshwater ecosystems.	EDL	**27**	**L**
				Artificial channel	**20**	**L**
				Non-perennial River and associated CVB wetland	**11,2**	**L**
	3	Groundbreaking and excavations within the freshwater HGM units as part of the activities to replace culverts, gabion retaining walls, and dam walls, and provide protection works, which may include infilling and cut and fill of side slopes, excavation of areas for the installation of erosion protection measures.	• Excess soil being removed within the road surface and falling into the freshwater habitat adjacent to the road, resulting in altered pattern flow and timing of water in the freshwater ecosystems; • Disturbances of soil leading to ponding of water as a result of over compaction of soil in some areas, increased AIP proliferation, and in turn altered freshwater habitat and runoff patterns; • Potential impacts on water quality and contamination of soil within the freshwater ecosystems; • Altered runoff patterns, leading to increased erosion and sedimentation of the downstream freshwater habitat; and • Potential erosion and formation of preferential flow paths as a result of disturbed soil and inappropriate slopes resulting in sedimentation of the freshwater ecosystems.	Artificial channel	**16**	**L**
				Non-perennial River and associated CVB wetland	**28,8**	**L**

Phase	No.	Activity	Impact	Potentially affected watercourses	Significance	Risk Rating
	4	Installation of culverts and gabions within the delineated extent of the freshwater ecosystems (if required), which may require temporary diversion of flow.	• Minor removal of instream and marginal vegetation within the artificial channel; • Movement of machinery within channel, leading to benthic disturbance including potential damage to aquatic biota egg banks, instream sediment disturbance, and compaction of bank and bed soil; • Disturbances of soil as a direct result of removal of damaged infrastructure and replacement with new crossing structures, leading to ponding of water as a result of earthworks, over-compaction of soil due to movement of machinery, damage to fish and macroinvertebrate egg banks, potential for increased AIP proliferation (instream and freshwater), and in turn altered instream and riparian/wetland habitat, flow patterns and sediment distribution; • Increased sedimentation of the freshwater HGM units, leading to smothering of vegetation in the downstream reaches of the freshwater ecosystems; • Potential erosion and formation of preferential flow paths as a result of disturbed soil, and inappropriate slopes (bank and stream bed) resulting in altered sediment distribution and altered benthic characteristics affecting aquatic fauna and flora; • Potential proliferation /further spread of AIPs as a result of disturbances; and • Potential changes to the ecoservice provision of the freshwater ecosystems.	Artificial channel	20	L
				Non-perennial River and associated CVB wetland	21,6	L
	5	Rehabilitation of the impacted reaches of the freshwater ecosystems, including: • Resloping, reprofiling and revegetation of the artificial channel banks to prevent future erosion; • Revegetation of the in-stream dam associated with the EDL; and • Revegetation of the artificial channel.	• Exposure of soils, leading to increased runoff and erosion which can lead to increased sedimentation of the freshwater ecosystems; • Potentially altering surface water quality through increased turbidity from increased suspension loads and contamination from oils and hydrocarbons; • Soil compaction of the embankment; • Potential temporary disruption to the hydrological processes of the freshwater ecosystems; and • Damage and or removal of indigenous vegetation.	EDL	16,8	L
				Artificial channel	16	L
				Non-perennial River and associated CVB wetland	14,4	L
OPERATIONAL/	6	Monitoring of structural integrity of the culverts, crossings and in-stream dams including: • Proactive monitoring to ensure structural integrity is maintained and to identify early signs of erosion due to potential blockage or breakages.	• No direct negative impacts perceived.	All freshwater ecosystems	9,6	L
	7	Ongoing AIP removal (where required).	• Compaction of soil and loss of habitat as a result of ongoing disturbance from vehicles and equipment;	All freshwater ecosystems	22,4	L

Phase	No.	Activity	Impact	Potentially affected watercourses	Significance	Risk Rating
			• Impacts to water quality as a result of the application of herbicides; and • Disturbance of soil which could lead to erosion.			
	8	Functioning of the freshwater ecosystems post-maintenance.	• No direct negative impacts perceived.	EDL	-24	+
				Artificial channel	-9,6	+
				Non-perennial River and associated CVB wetland	-24	+

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (as amended) (NEMA).

No.	Requirements	Section in report/Notes
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Cover Page and Appendix I.
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution and movement patterns	Section 3
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 3 and Appendix C
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 3 and Appendix C
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 3 and Appendix C
2.3	Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	None.
2.4	Assessment of impacts – a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 5: Table 6, 11 and 12
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Yes, with implementation of the proposed control measures.
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.) and d. Assessment of the risks associated with water use/s and related activities.	Section 5: Table 6, 11 and 12
2.4.4	How will the development impact on the functionality of the aquatic feature including:	Section 5: Table 6, 11 and 12

No.	Requirements	Section in report/Notes
	a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system); b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over abstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f. 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).	
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 5: Table 6, 11 and 12
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 5: Table 6, 11 and 12
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	N/A
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Appendix I
3.2	A signed statement of independence by the specialist.	Appendix I
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 2.1
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Section 2, Appendix D and Appendix E
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	Section 1.4
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 4
3.7	Additional environmental impacts expected from the proposed development.	Section 5
3.8	Any direct, indirect and cumulative impacts of the proposed development on site.	Sections 5.3 and 5.4
3.9	The degree to which impacts and risks can be mitigated.	Section 5.3
3.10	The degree to which impacts and risks can be reversed.	Section 5.3
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 5.3
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 4, although it is noted that the buffers cannot be avoided
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 5: Table 6
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a “low” aquatic biodiversity and sensitivity and that were not considered appropriate.	None. The development area falls within a high aquatic biodiversity sensitivity.
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 6
3.16	Any conditions to which this statement is subjected.	Section 6

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome - usually international in origin.
Aquatic, riverine and wetland systems	***Aquatic systems*** are water-dependent ecosystems, including rivers, streams, lakes, estuaries, and wetlands. ***Riverine systems*** are flowing water ecosystems (e.g. rivers and streams) characterised by a defined channel and predominantly unidirectional flow. ***Wetland systems*** are ecosystems where land is permanently or seasonally saturated, resulting in hydric soils and wetland-adapted vegetation, with or without standing water.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
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 (vegetation adapted to living in anaerobic soils).
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perennial:	Flows all year round.
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.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface.
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act No. 36 of 1998) a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks.
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

%PTV	Percentage of Pollution-Tolerant Valves
AIP	Alien and/or Invasive Plant species
°C	Degrees Celsius
BAS	Best Attainable State
CBA	Critical Biodiversity Area
CESA	Critical Ecological Support Area
CR	Critically Endangered
CVB wetland	Channelled valley-bottom wetland
DEA	Department of Environmental Affairs
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry, Fisheries and Environment
DO	Dissolved Oxygen
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
ECO	Environmental Control Officer
EDL	Ephemeral Drainage Line
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Program
EN	Endangered
ESA	Ecological Support Area
FEN	Freshwater Ecologist Network Consulting (Pty) Ltd
FEPA	Freshwater Ecosystem Priority Areas
GDI	Generic Diatom Index
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
km	kilometre
m	metre
mm	millimetre
MMP	Maintenance Management Plan
NBA	National Biodiversity Assessment
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NWM6	National Wetland Map 6
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
RAM	Risk Assessment Matrix
REC	Recommended Ecological Category
RMO	Recommended Management Objectives
RoW	Right of Way
RWQO	Resource Water Quality Objectives

subWMA	Sub-Water Management Area
UCVB wetland	Unchannelled valley bottom wetland
SPI	Specific Pollution Sensitivity Index
SWSA	Strategic Water Source Area
TDI	Trophic Diatom Index
TWQR	Target Water Quality Objectives
VEGRAI	Riparian Vegetation Response Assessment Index
WetVeg	Wetland Vegetation
WMA	Water Management Areas
WUA	Water Use Authorisation
ZoR	Zone of Regulation

1 INTRODUCTION

1.1 *Background*

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Water Use Authorisation (WUA) process and Maintenance Management Plan (MMP) in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA) for the proposed periodic general maintenance of the watercourses associated with the Steenberg Estate and Golf Course, located on Erven 11193, 12379, 11039, 11111, and 11072, Constantia, Western Cape Province (Figure 1 to Figure 3), collectively referred to as 'the study area'. The abovementioned erven are associated with the Steenberg Golf Course ('the golf course'). The periodic general maintenance activities include, inter alia:

- Routine removal and maintenance of excess vegetation within and along the watercourses;
- Removal of alien invasive vegetation within and along the watercourses;
- Basic upkeep of in-stream dams and associated structures;
- General infrastructure maintenance within the regulated area of the watercourses;
- Ad-hoc repair of localised bank erosion;
- General removal of litter, debris, and excess silt build-up within the systems; and
- Periodic visual inspections to identify maintenance requirements.

The proponent further proposes to rehabilitate the small in-stream dam located on Erf 12910, which, in addition to the abovementioned periodic maintenance activities, will entail revegetating the dam banks with indigenous vegetation. The abovementioned periodic maintenance activities may also be undertaken from time to time within and surrounding the small in-stream dam. Unless otherwise stated, 'periodic maintenance activities' refers to activities on all erven.

This report presents the findings of a freshwater ecological assessment undertaken for the periodic maintenance activities proposed within the study area.

1.2 *Aims and Objectives*

The purpose of this report is to define the ecological baselines and characteristics of the freshwater ecosystems associated with the study area. This includes the mapping of the freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES) of the freshwater ecosystems associated with the study area, utilising current industry "best practice" assessment methods. Additionally, this report will define the Recommended Management Objectives (RMO) and Recommended Ecological Category (REC) for the freshwater ecosystems. In alignment with applicable environmental legislation and guideline requirements, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (RAM) as promulgated in Government Notice (GN) 4167 published in the Government Gazette 49833 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA), and the Environmental Assessment Practitioner's (EAP) Impact Assessment methodology, were applied to determine the significance of the impacts associated with the periodic maintenance activities. Mitigatory measures were subsequently identified which aim to minimise the potential impacts in line with the requirements of the mitigation hierarchy as advocated by the Department of Forestry, Fisheries and the Environment (DFFE) (previously the Department of Environmental Affairs (DEA)) and the DWS.

This study further aims to provide detailed information to guide the proposed activities in the vicinity of the freshwater ecosystems, to ensure the ongoing functioning of the ecosystems, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development. This report, after

consideration of the above, must guide the EAP as well as the proponent and the relevant authorities, by means of a reasoned opinion and recommendations, as to the viability of the periodic maintenance activities from a freshwater ecosystem management perspective.

1.3 *Scope of Work*

Specific outcomes in terms of this report are outlined below:

- A background study of relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas (NFEPA) 2011 database; the Department of Water and Sanitation (DWS) Research Quality Information Services (RQIS) PES/EIS 2014 database, National Biodiversity Assessment (NBA) 2023 database, and the Western Cape Biodiversity Spatial Plan (WCBSP) 2023 database), was undertaken to aid in defining the PES and EIS of the freshwater ecosystems;
- Freshwater ecosystems were field verified according to the "Department of Water Affairs and Forestry (DWAF, 2008): A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Aspects such as soil, morphological characteristics, vegetation types and wetness were used to verify the freshwater ecosystems;
- The classification of the freshwater ecosystems was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa: User Manual: Inland systems (Ollis *et al*., 2013);
- The PES of the freshwater ecosystems were determined according to the most appropriate industry best practice indices such as the WET-Health tool (Macfarlane *et al.,* 2008);
- The EIS of the freshwater ecosystems were determined according to the method described by Rountree and Kotze (2013);
- The Ecoservices of the freshwater ecosystems were assessed according to "A technique for rapidly assessing ecosystem services supplied by wetlands" (Kotze *et al.,* 2020) (Version 2);
- Allocation of a suitable RMO, REC and Best Attainable State (BAS) to the freshwater ecosystems based on the results obtained from the PES and EIS assessments;
- The freshwater ecosystem boundaries, and legislated zones of regulation were depicted for the freshwater ecosystems, where applicable;
- The DWS Risk Assessment Matrix (RAM) (2023) and an impact assessment using the methodology provided by the EAP were applied to assess the potential and existing ecological impacts associated with the project as a result of the planned project components;
- In line with the Terms of Reference provided to the specialist, freshwater habitat within the study area was assessed to determine the suitability thereof as breeding habitat for the Endangered Western Leopard Toad (Sclerophrys pantherinus). The in-stream dams and watercourses associated with the Steenberg Estate and Golf Course were confirmed as an important area for supporting a viable population of this species; therefore a management strategy to enhance the support of this species is included in this report; and
- To present management and control measures which should be implemented during the construction and operational phases of the development to assist in minimising the impact of the proposed activities on the receiving environment.

1.4 *Assumptions and Limitations*

- The ground-truthing and delineation of the freshwater ecosystem boundaries and the assessment thereof, are confined to a single site visit undertaken on 18 May 2026 (i.e. late autumn/early winter, with significant rainfall received in the area prior to the assessment). Freshwater ecosystems identified within the investigation area were delineated in fulfilment of GN 4167 of the NWA using various desktop methods including use of topographic maps, historical and current digital satellite imagery and aerial photographs, with limited site verification;

- The delineation of the freshwater ecosystems indicated in this report is considered accurate, taking into consideration the conditions at the time of assessment (i.e., disturbances to soil and vegetation, induced changes to the flow patterns, flow volumes and timing of water within the freshwater ecosystems). The watercourses within the study area, particularly within the golf course, have been significantly modified and although currently functioning as artificially developed channels, these channels connect upstream and downstream watercourses and therefore are subject to the provisions of the NWA;
- Ecostatus determinations of the channelled valley bottom (CVB) wetland associated with the non-perennial river downstream of the golf course was not formally undertaken; as the CVB wetland occurs approximately 180 m downgradient of the study area (more particularly, the golf course), the assessed river reach was considered a suitable proxy for the ecological assessment of the wetland. Field observations confirmed that the river reach and associated CVB wetland exhibit similar ecological characteristics and levels of modification, supporting the use of this approach;
- Considering the artificial nature of the channels associated with the golf course, the WET-Health tool (Macfarlane et al., 2008) could not be utilised. As such, for the purposes of undertaking the DWS RAM (2023) inference of the ecological condition was made from an ecosystem goods and services point of view;
- To ensure that the turnaround time meets expectations, diatom analysis and identification is undertaken using “live” diatom samples. There are no limitations through the use of “live” samples with accurate analysis and identification of samples and as such results for the report are considered accurate. There is no substantial impact on the validity of the final conclusions drawn in this report;
- Fish surveys were undertaken using standard electrofishing techniques. The assessment was undertaken over a single survey period and therefore the results obtained cannot be considered an unequivocal representation of the species that could occur within the system. Historical records associated with the site and immediate surrounds concur with the results that were obtained and therefore the data obtained during the assessment are deemed accurate;
- Although it is highly recommended that the culverts associated with the outlet structure of the last in-stream dam (directly upgradient of the Prinseskasteel Stream) be upgraded to allow passage of fish and frogs, it is assumed that such upgrades will not be undertaken under the ambit of the MMP. Should it, however, be determined that those specific culverts are to be replaced/maintained, the RAM and Impact Assessment as presented in this report would need to be revised accordingly;
- Some inaccuracies due to the use of a handheld Global Positioning System (GPS) unit to mark the outer boundaries of the freshwater ecosystems may occur as handheld units tend to have an accuracy limit of between 2 m and 5 m. The delineations provided in this report are, however, deemed adequate to fulfil the authorisation requirements as well as implementation of the control measures provided;
- Wetlands and/or riparian zones and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative wetland or riparian species. Within this transition zone, some variation of opinion on the freshwater feature boundaries may occur. However, if the Department of Water Affairs and Forestry (DWAF) (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been 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.

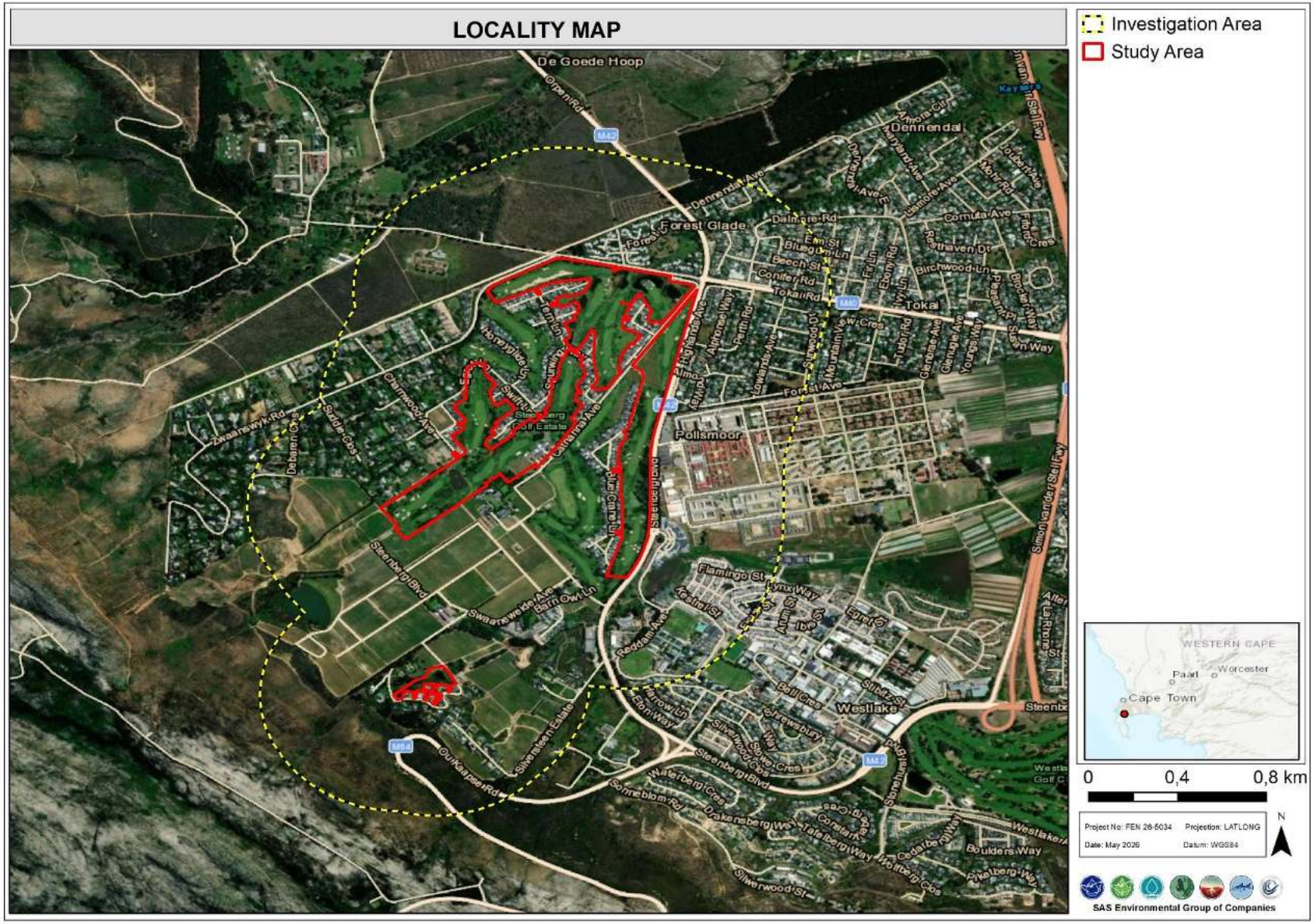


Figure 1: Digital satellite image depicting the location of the study area and associated investigation area in relation to the surrounding area.

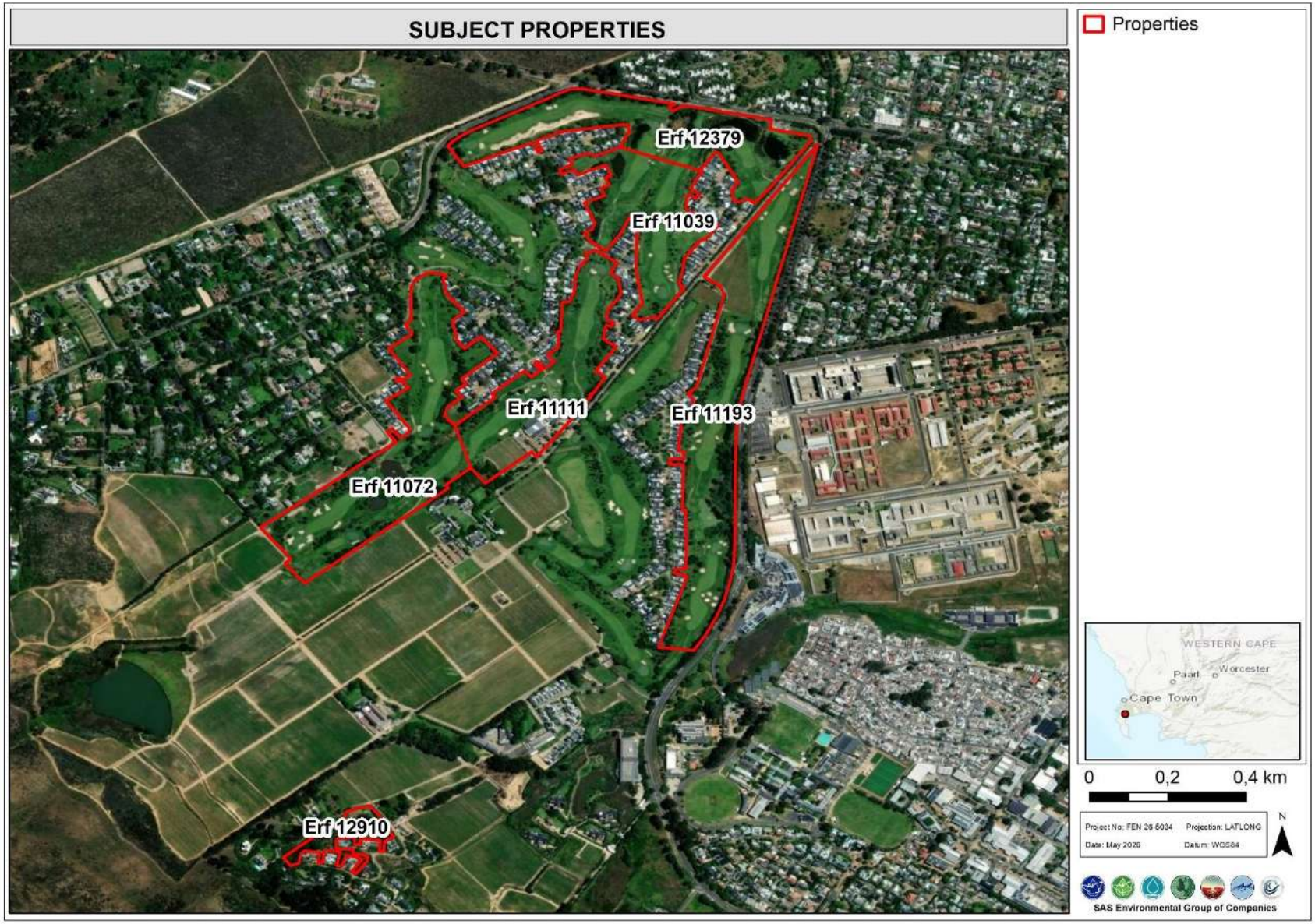


Figure 2: Digital satellite image depicting the erven comprising the study area in relation to the surrounding area.

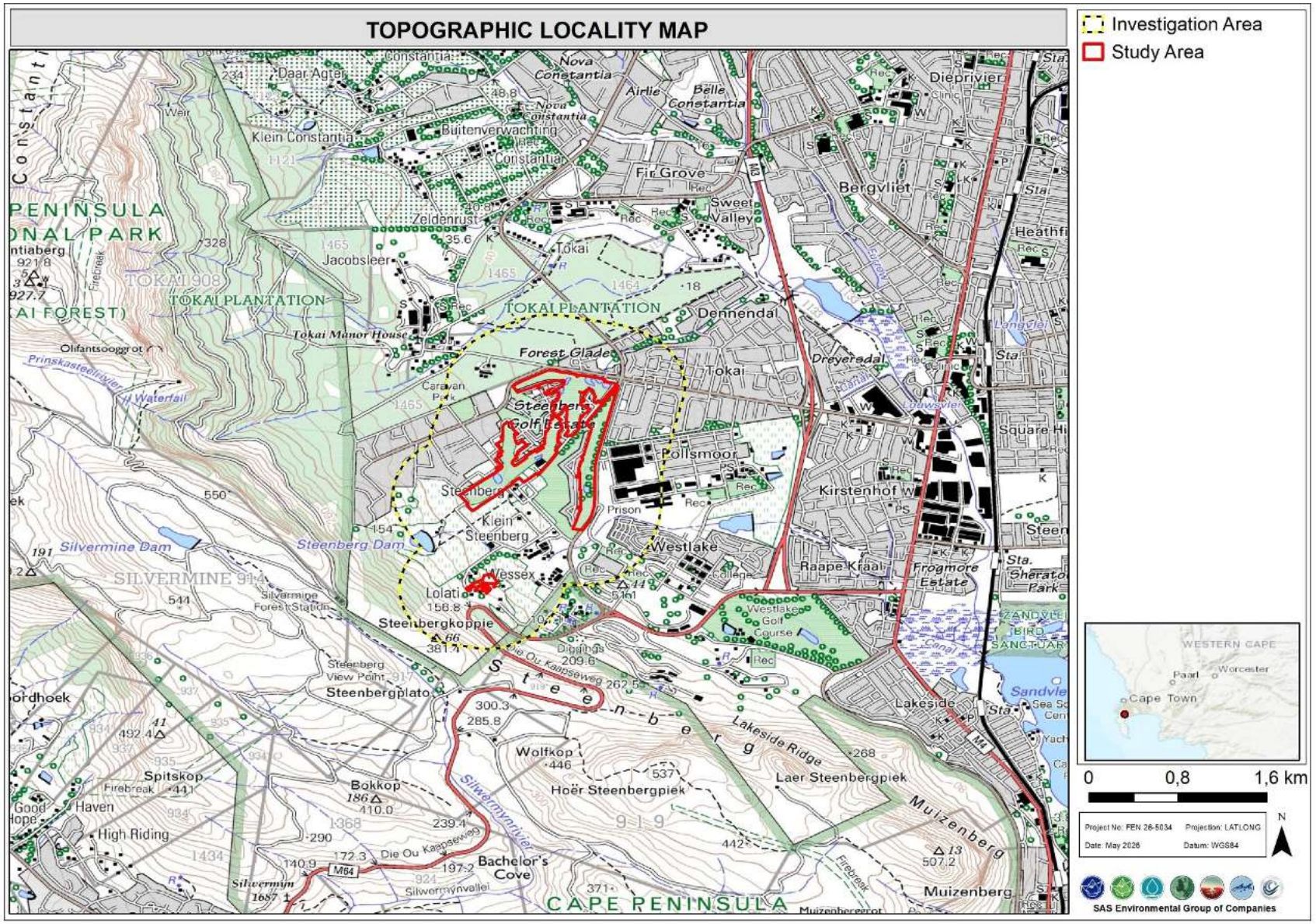


Figure 3: Location of the study area and associated investigation area depicted on a topographic map, in relation to surrounding area.

2 ASSESSMENT APPROACH

In order to identify all freshwater ecosystems associated with the study area which may potentially be impacted by the proposed activities, a 500 m "zone of investigation" in accordance with GN 4167 of 2023 as it relates to the NWA, was generated in order to assess possible sensitivities of the receiving freshwater environment. This area – i.e., the 500 m zone of investigation around the study area – will henceforth be referred to as the "investigation area".

2.1 *Freshwater Ecosystem Definitions*

As part of this assessment, the following definitions, as per the NWA are of relevance:

According to the NWA a **watercourse** means:

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

It should be noted that in this report "freshwater ecosystem" is used and carries the same meaning as "watercourse" as defined by the NWA.

Wetland habitat is "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

Another widely used definition of wetlands is the one used under the Convention on Wetlands (Ramsar, 1971) '**wetlands**' are defined by Articles 1.1 and 2.1 as:

> Article 1.1: 'For the purpose of this Convention wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.'
>
> Article 2.1 provides that wetlands: 'may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands'.

This determining factor has been utilised in this assessment. Wetland soils can be termed hydric or hydromorphic soils. **Hydric soils** are defined by the United States Department of Agriculture's Natural Resources Conservation Service as being:

> *"soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part".*

These anaerobic conditions would typically support the growth of hydrophytic vegetation (vegetation adapted to grow in soils that are saturated and starved of oxygen) and are typified by the presence of redoximorphic features.

2.2 *Freshwater Ecosystem Field Verification*

The freshwater ecosystem delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that freshwater ecosystems have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems, where applicable.

In preparation for the field verification, aerial photographs, digital satellite imagery and provincial and national freshwater ecosystem databases (as outlined in Appendix D of this report) were used to identify points of interest in the surrounding area at a desktop level. A diversity of signatures corresponding with freshwater ecosystems can be identified. In this regard, specific mention is made of the following:

- Linear features: since water flows/moves through the landscape, freshwater ecosystems often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with freshwater ecosystems: a distinct increase in density as well as shrub size near flow paths;
- Hue: water flow paths often show as white/grey or black and outcrops or bare soils displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with freshwater ecosystem vegetation are often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

The desktop databases, aerial photographs and digital satellite imagery were then utilised to identify points of interest for the site assessment. A site assessment was undertaken on 18 May 2026, during which the presence of any riparian or wetland characteristics as defined by DWAF (2008) and by the NWA was investigated (refer to Section 3.3 and 3.4 of this report). In addition to the delineation process, a detailed assessment of some of the delineated freshwater ecosystems was undertaken, at which time factors affecting the integrity of the freshwater ecosystems were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the freshwater ecosystems. A detailed explanation of the methods of assessment undertaken is provided in Appendix D of this report.

2.3 *Aquatic Assessments*

2.3.1 Fish Surveys

An aquatic assessment was undertaken using a standard SUM 1200V electrofisher unit within the various in-stream dams within the Steenberg Estate and Golf Course that were identified to support fish. Marginal vegetation along the periphery of the in-stream dams, features within the in-stream dams that would provide habitat cover for fish, and deeper water areas that could be safely accessed using electrofishing (up to depth of approximately 1.2 m) were surveyed. The surveys were undertaken as comprehensive searches and therefore not subject to time limitations. All available habitat types were assessed.

Species collected were identified and evaluated for general health condition before being returned to the water. The electrofishing method is regarded as a non-invasive collection method, and no fish were harmed nor killed during the assessment.

2.3.2 Herpetofauna Surveys

A desktop assessment for the Western Leopard Toad was undertaken that included an evaluation of known distribution records within the localised area, life history and habitat requirements of the species, and the relevance of the habitat type that features within the study area for supporting viable populations of this species. Thorough searches were undertaken within areas and habitat types that would most likely support individuals.

2.4 *Sensitivity Mapping*

The freshwater ecosystems associated with the investigation area were initially delineated on a desktop basis using digital satellite imagery. Geographic Information System (GIS) software was used to project these features so that they could be depicted on digital satellite imagery and topographic maps. The sensitivity map is presented in Section 4 of this report.

2.5 *Risk and Impact Assessment and Recommendations*

Following the completion of the freshwater ecosystem assessment, the DWS RAM (2023) and impact assessment using the methodology provided by the EAP were conducted (refer to Appendix E for the method of approach) and recommendations were developed to address and mitigate any negative ecological impacts associated with the project. These recommendations also include general management measures, which apply to the proposed maintenance and operational activities. Control measures have been developed to address issues in all phases throughout the life of the project. The detailed control measures are outlined in Section 5 of this report, while the general good practice control measures are outlined in Appendix H.

3 ASSESSMENT RESULTS

3.1 *Ecological Importance and Sensitivity of the Study Area Based on National and Provincial Datasets*

A summary of the desktop assessment as provided in Appendix C1 is provided below. It is important to note that although all data sources used to provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics at the scale required to inform the applicant of any potential environmental authorisation and/or water use authorisation processes that may be needed. Given these limitations, this information is considered useful as background information to the study and is important in legislative contextualisation of the risks and impacts and was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the field survey. It must, however, be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site-verified information must carry more weight in the decision-making process. Actual site conditions at the time of the assessment may differ to the background information provided by various datasets, primarily due to issues of scale of data capture. This potential discrepancy does not lower the confidence of this assessment, as the background data are used as supporting information and the results of the site assessment are based on more accurate site analysis.

The study area:

- Falls within the Southern Folded Mountains Ecoregion, within the Berg/Bot/Potberg catchment and the G22D quaternary catchment and is situated within the Berg Water Management Area (WMA) and Greater Cape Town subWMA.
- Is predominantly associated with the Southwest Sand Fynbos Wetland Vegetation (WetVeg) type, classified as Critically Endangered (CR), while portions of the surrounding investigation area fall within the Southwest Granite Fynbos WetVeg type (CR) and Southwest Sandstone Fynbos WetVeg type (Endangered; EN).
- According to the National Freshwater Ecosystem Priority Area (NFEPA) database, no natural wetlands occur within the study or investigation areas. However, several artificial unchannelled valley-bottom (UCVB) wetlands and an artificial channelled valley-bottom (CVB) wetland are mapped and are identified as dams in the National Biodiversity Assessment (NBA) artificial wetlands dataset.
- According to the National Wetland Map 6 (NWM6), no natural wetlands occur within the study area; however, multiple CVB and seep wetlands occur within the surrounding investigation area. These wetlands are generally indicated to be in moderately to largely modified ecological condition (Present Ecological State (PES) Categories C/D).
- No rivers are mapped within the study area or investigation area by either the NFEPA or NBA river datasets. The Silvermine River is located south of the investigation area within a neighbouring quaternary catchment.
- Falls entirely within the Table Mountain Strategic Water Source Area (SWSA) for surface water and the Cape Peninsula and Cape Flats Strategic Water Source Areas for groundwater, highlighting the importance of the area for regional water security.
- The City of Cape Town Biodiversity Network identifies numerous Other Ecological Support Areas, Critical Ecological Support Areas and Sand Fynbos depression wetlands within and surrounding the study area. A Sand River Catchment watercourse is also indicated to traverse the site (according to the City of Cape Town database (CityMaps, 2026), the Sand River Catchment watercourse is referred to as the ‘Prinseskasteel Stream’).
- Is underlain by Ga6, Bc58 and Ib93 land types, which are associated with podzolic soils, eutrophic red soils and rocky terrain with shallow soils and steep slopes, respectively.
- The National Environmental Screening Tool classifies the study area and surrounding investigation area as having Very High aquatic biodiversity sensitivity due to its location within the Table Mountain SWSA and the presence of mapped wetlands, including CVB, depression and seep wetlands.

3.2 *Ecological Status of Sub-Quaternary Catchments*

This section provides a summary of the ecological status of the sub-quaternary catchment as described in Appendix C2. The Department of Water and Sanitation Resource Quality Services Present Ecological State and Ecological Importance and Sensitivity database indicates that the nearest assessed sub-quaternary catchment reach, the Keysers River (G22D-09294), is in a largely modified ecological condition (Present Ecological State Category D) and supports a diverse aquatic community. A total of 37 macroinvertebrate taxa has been recorded or are expected to occur within the system, indicating relatively high aquatic biodiversity despite the modified condition of the catchment. The system is also expected to support several indigenous fish species, including Cape galaxias (*Galaxias zebratus*), Cape kurper (*Sandelia capensis*) and Mozambique tilapia (*Oreochromis mossambicus*). Ecological Importance is rated as Moderate overall, while Ecological Sensitivity is rated as High, reflecting the presence of diverse aquatic habitats, species of conservation significance and the sensitivity of aquatic biota to changes in flow, water quality and habitat conditions. Invertebrates and aquatic vertebrates associated with the system exhibit particularly high sensitivity to alterations in hydrological and physico-chemical conditions, while habitat diversity is considered very high. Although the riparian zone has been substantially transformed in places, the reach retains ecological value and contributes to biodiversity

conservation within the catchment, supporting the need for careful management of aquatic habitats and hydrological processes within the broader study area.

The surface water ecosystems within the study area are generally ecologically isolated from the greater catchment area for fish due to various migratory barriers that are in place between the greater catchment and the outfall of the watercourse from the study area. Fish were introduced into the in-stream dams within the study area after they were constructed. The fish community structure within the study area is therefore not representative of the fish populations within the greater catchment area.

The occurrence of any particular aquatic macroinvertebrate taxa within the aquatic environment is dependent on the availability of suitable habitat (substrates and flow-depth profiles) and appropriate levels of water quality. If suitable habitat conditions are present, then various invertebrate taxa from the catchment will recruit as the adult life stages can freely migrate and colonise alternative river reached. The reference aquatic macroinvertebrate data provided for the site SQR G22D-09294 were sampled within a riverine (flowing water) system. This habitat type was not strongly featured within the study area, which was predominantly in-stream dams with interconnected channels within limited flow and natural habitat. Many of the flow-dependent invertebrate taxa would therefore not be expected to occur within the auspice of the study area.

3.3 *Site Verification Results*

A site assessment was undertaken during which the presence of any areas presenting with freshwater ecosystem characteristics as identified in Section 2.2 were identified. The following systems were identified during the site assessment:

- The primary freshwater ecosystem associated with the golf course comprises an ephemeral drainage line (EDL) that has been extensively modified through channelisation, impoundment and diversion within the golf course. The system originates from an in-stream dam and associated seep wetland in the western portion of the investigation area and flows eastwards through a network of artificial channels and several in-stream dams within the golf course. The original alignment of the EDL has largely been replaced by underground pipelines, with surface stormwater infrastructure directing runoff into the piped system and associated artificial channels. The artificial channels provide hydraulic connectivity between the upstream EDL and the downstream river system, forming a continuous freshwater corridor through the golf course. Although the artificial channels cannot be classified into a particular hydrogeomorphic unit (HGM) type, due to the hydrological connectivity between the aforementioned upgradient and downgradient freshwater ecosystems, these channels are still considered a ‘watercourse’ as defined by the NWA and enjoys protection thereunder.
- The artificial channels transition into a non-perennial river system (known as Prinseskasteel Stream, and hereafter interchangeably referred to as the ‘non-perennial river’, ‘river’ or ‘Prinseskasteel Stream’), with reaches classified as CVB wetlands.
- An additional EDL and associated in-stream dam were identified on Erf 12910 in the southern portion of the investigation area. This system extends downgradient beyond the study area, where it transitions into a seep wetland and subsequently a CVB wetland.
- In addition to the freshwater systems identified during the field assessment, mapped freshwater features within the broader investigation area include seep wetlands, depression wetlands, CVB wetlands, rivers, artificial channels, in-stream dams and off-stream dams, all of which contribute to the hydrological connectivity of the catchment.

The freshwater ecosystems assessed in detail as part of this report comprise the EDL associated with Erf 12910, the artificial channel network within the golf course, and the downgradient river system (refer to Section 3.4). The following freshwater features were excluded from detailed assessment as they are not anticipated to be impacted by the proposed periodic maintenance activities:

- The EDL and associated depression wetland located in the northern portion of the investigation area occur within a separate local catchment and are hydrologically disconnected from the proposed periodic maintenance activities.
- The seep wetland and channelised reach of the EDL situated upstream of the golf course are located upgradient of the proposed maintenance areas and are therefore not expected to be influenced by the activities.
- The wetlands located downstream of Erf 12910 occur more than 500 m from the study area and are sufficiently removed from the activity footprint to preclude any measurable risk or impact.

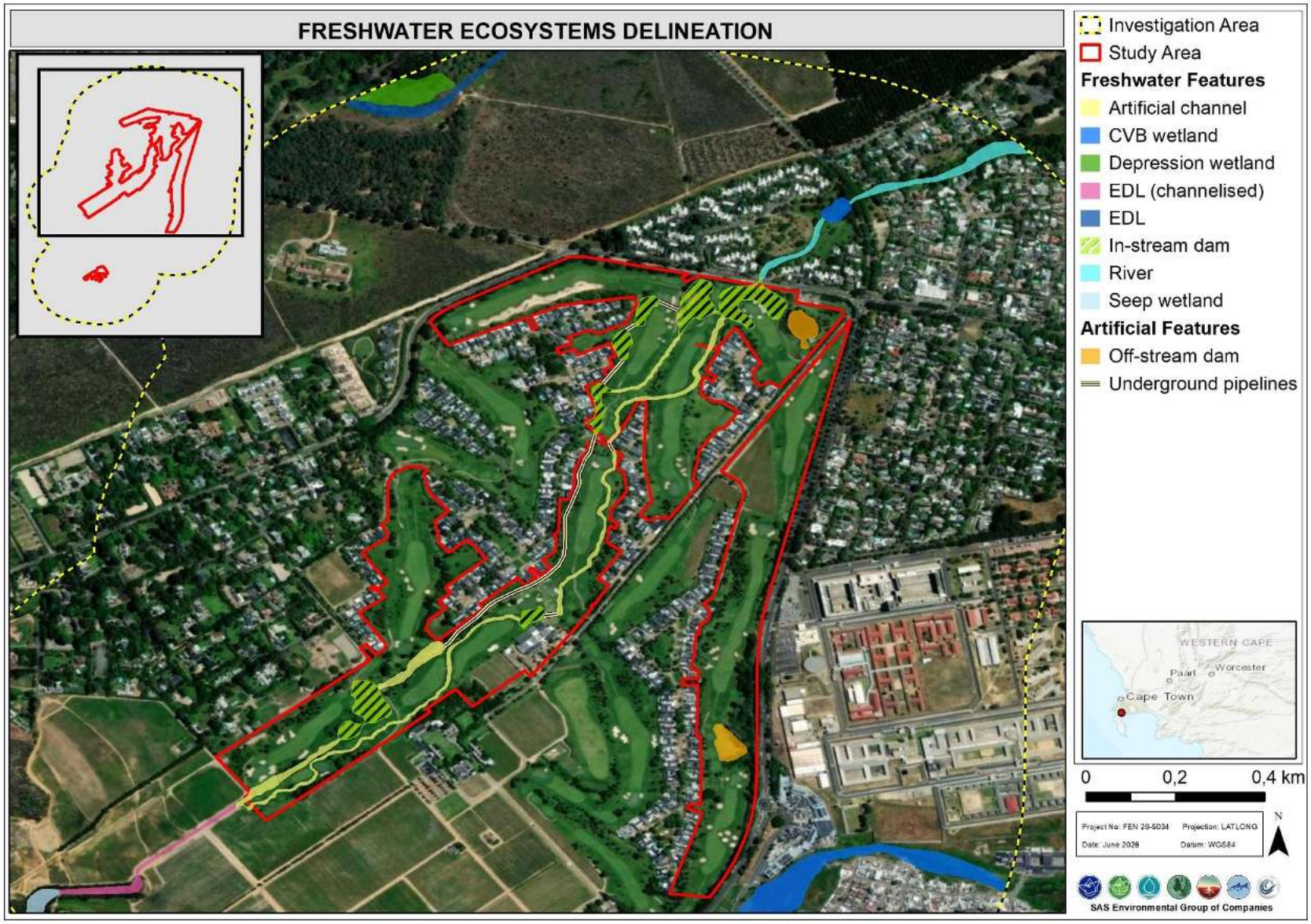


Figure 4: Map (1 of 2) depicting the delineated extent of the freshwater ecosystems associated with the study and investigation areas.

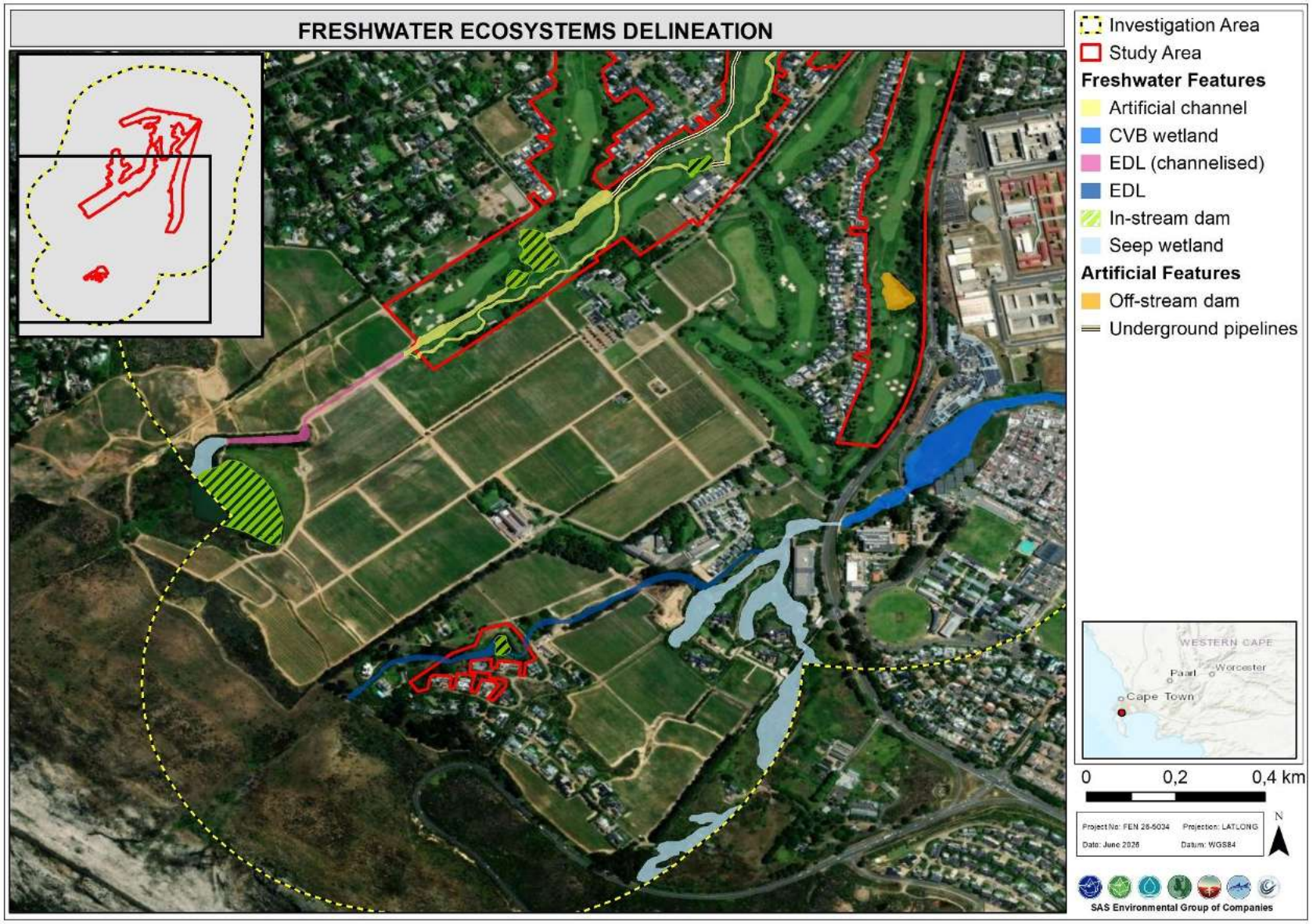


Figure 5: Map (2 of 2) depicting the delineated extent of the freshwater ecosystems associated with the study and investigation areas .

3.4 *Freshwater Ecosystem Classification and Assessment*

Classification of the freshwater ecosystems associated with the study area was undertaken at Levels 1 - 4 of the Classification System (Ollis *et al.*, 2013) as outlined in Appendix C of this report. The systems were classified as Inland Systems, located within the Southern Folded Mountains Aquatic Ecoregion. Table 1 below presents the classification from level 3 to 4 of the Classification System (Ollis *et al.*, 2013).

Table 1: Classification of the freshwater ecosystems associated with the study area.

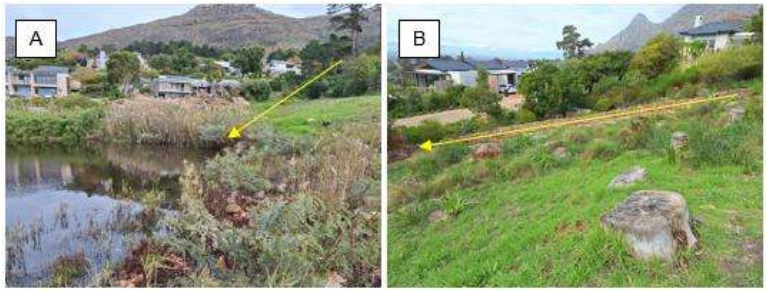
Freshwater ecosystems	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) Type
Non-perennial river (Prinseskasteel Stream)	**Slope:** An inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.	**River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.
CVB wetland associated with Prinseskasteel Stream		**Channelled valley bottom wetland:** A valley-bottom wetland, with a river channel running through it.
Ephemeral drainage line (EDL)		A linear fluvial landform comprising of a discernible bed (active channel) and banks (riparian zone), which permanently or periodically carries a unidirectional concentrated flow of water.

The dashboard style reports (Table 2 to Table 4) following Figure 4 and Figure 5 above provide a summary of the field verification findings in terms of relevant aspects (hydrology, geomorphology and vegetation components) associated with the assessed freshwater ecosystems. The artificial channel and river were assessed separately, but for the purposes of presenting a concise discussion, the results thereof are presented in a single dashboard report. Figure 6 provides a spatial representation of the location of the diatom community sampling points.

It should be noted that the river (Prinseskasteel Stream) and the associated CVB wetland was assessed collectively using the appropriate aquatic assessment matrices, i.e., the Integrated Habitat Integrity (IHI), Vegetation Response Assessment Index (VEGRAI) and WET-EcoServices assessments. This approach was adopted because the reach of the Prinseskasteel Stream immediately downgradient of the study area is more appropriately classified as an aquatic (riverine) system rather than a wetland system. Furthermore, given that the CVB wetland occurs approximately 180 m downgradient of the study area (more particularly, the golf course), the assessed river reach was considered a suitable proxy for the ecological assessment of the wetland. Field observations confirmed that the river reach and associated CVB wetland exhibit similar ecological characteristics and levels of modification, supporting this approach.

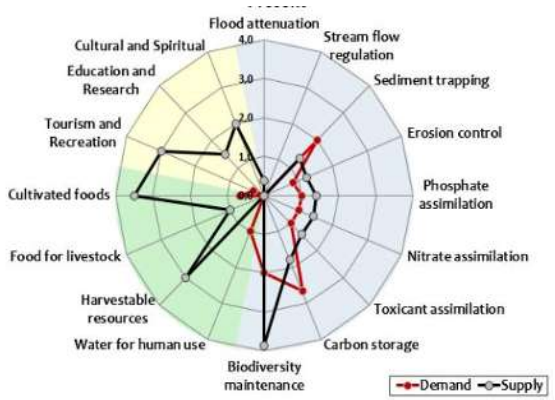
The details pertaining to the methodology used to assess the freshwater ecosystems are contained in Appendix D. All comprehensive results calculated are available in Appendix F.

Table 2: Summary of the results of the assessment of the EDL associated with Erf 12910.

<table>
<tr><th colspan="3">AQUATIC HABITAT FEATURES</th><th colspan="3">Physical features</th></tr>
<tr><td colspan="3" rowspan="2"> 

Representative photograph of (A) the in-stream dam to be rehabilitated and (B) the canalised dam outlet within the EDL. Yellow arrows indicate direction of flow. Indigenous fynbos, ornamental plants and alien and invasive plants (AIPs) are present on the dam embankments and in the terrestrial zone below the dam.</td><td>Flow condition</td><td colspan="2">The EDL associated with Erf 12910 is a seasonal drainage feature characterised by slow flows when present. Hydrological functioning has been modified by the presence of an in-stream dam and associated concrete- and rock-lined outlet structure. Despite these modifications, the EDL maintains hydrological connectivity with downstream freshwater ecosystems and continues to convey seasonal runoff through the catchment.</td></tr>
<tr><td>Substrate</td><td colspan="2">The substrate is dominated by sandy soils and organic material typical of drainage features within the region. Localised erosion was observed within the marginal zone, resulting in minor bank instability and sediment mobilisation.</td></tr>
<tr><td colspan="3" rowspan="4">Ecological Importance and Sensitivity (EIS)

The EDL attained an overall Moderate EIS rating. This rating is largely attributable to the role of the system in providing habitat diversity, supporting remnant indigenous fynbos vegetation communities within the study area, and providing ecological connectivity within the catchment. The system continues to contribute to downstream freshwater ecosystem functioning and remains sensitive to further changes in hydrology, habitat structure and vegetation composition.</td><td>Algal proliferation</td><td colspan="2">No significant algal growth or proliferation was observed during the assessment.</td></tr>
<tr><td>Water clarity & odour</td><td colspan="2">No obvious water quality concerns, pollution-related odours or excessive turbidity were observed during the assessment.</td></tr>
<tr><td>Water quality</td><td colspan="2">No water quality sampling was undertaken for the EDL. However, field observations did not indicate significant water quality impairment. The system is primarily influenced by natural runoff processes and adjacent land-use activities.</td></tr>
<tr><td colspan="3">Riparian zone features</td></tr>
<tr><td colspan="6">The VEGRAI assessment indicates a moderately modified riparian vegetation community. Indigenous fynbos vegetation remains dominant throughout much of the system; however, the ecological condition of the riparian zone has been reduced by alien invasive plant encroachment and localised disturbance associated with erosion and historical modifications. Within the non-marginal zone of the EDL and along the in-stream dam edges, ornamental plants were present. Dominant vegetation within and surrounding the in-stream dam include Phragmites australis and Cyperus papyrus along with other ornamental and opportunistic weeds commonly found in disturbed areas.</td></tr>
<tr><td colspan="4">VEGRAI Score:</td><td colspan="2">66.7% (C)</td></tr>
<tr><td colspan="2">IHI</td><td>Instream IHI (%)</td><td colspan="3">Riparian IHI (%)</td></tr>
<tr><td>Overall (%)</td><td>74,7 % (C)</td><td>79.9% (B/C)</td><td colspan="3">69.4% (C)</td></tr>
<tr><td colspan="6">The IHI assessment indicates that the EDL is in a largely natural to moderately modified condition. The primary drivers of modification include the in-stream dam and associated concrete-lined outlet structure, localised erosion within the marginal zone and alien invasive plant encroachment. Despite these disturbances, the system retains much of its natural habitat structure and ecological functioning.</td></tr>
</table>

ECOSERVICES	
	The EDL provides a **moderate** level of ecosystem service provision, with biodiversity maintenance identified as the most important service and attaining a Very High importance rating due to the presence of indigenous fynbos vegetation and the role of the system in maintaining habitat connectivity. Carbon storage provide additional ecosystem service value, while most regulating services are of low importance. The supply-demand relationship is generally balanced for regulating and supporting services, with biodiversity and habitat-related services being supplied at levels that meet current demand. Comparatively, the supply of provisioning and cultural services such as harvestable resources and potential for cultivation far exceed the demand thereof. Historical modification, localised erosion and AIP encroachment constrain the system's ability to provide regulating services and reduce resilience to future disturbance.

MANAGEMENT CLASSES							
Overall PES	**C**	**Best Attainable State (BAS)**	**C**	**Recommended Ecological Category (REC)**	**C**	**Recommended Management Objective (RMO)**	**Maintain**

Extent of modification anticipated as a result of the rehabilitation of the in-stream dam
Low The rehabilitation and maintenance of the in-stream dam is not anticipated to significantly modify the EDL if undertaken during the low flow season. Conversely, the rehabilitation of the dam is anticipated to improve the condition from a vegetation perspective, particularly through AIP management and control. With the implementation of appropriate control measures outlined in this report, further modification of the EDL is expected to remain low.

Impact Significance & Business Case	
Low (with the implementation of control measures)	The activities associated with the rehabilitation of the in-stream dam poses a 'Low' direct risk to the overall integrity of the assessed reach of the EDL, assuming that the rehabilitation will be limited to the dry, summer season, where possible. The recommended control measures, as provided in Section 5.2.1 below, must be implemented. Rehabilitation of the in-stream dam, which would include bank reshaping, AIP removal and revegetation could potentially improve the ecological condition of the EDL in the long term. A rehabilitation plan (inclusive of a Landscape Management and associated Plant Species Plan component) and AIP management plan is therefore recommended to be compiled by a suitably qualified specialist.

Table 3: Summary of the results of the assessment of the artificial channel.

<table>
<tr><th>AQUATIC HABITAT FEATURES</th><th>In situ water quality</th><th>Water quality discussion</th><th>Water quality reference data & targets</th></tr>
<tr><td rowspan="11"> 

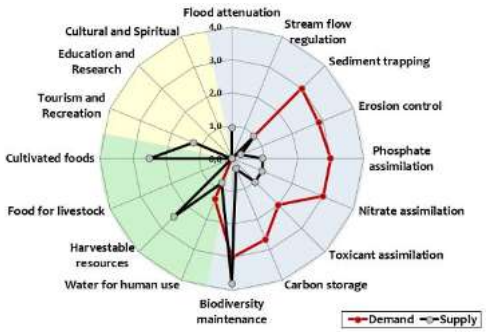
Representative photographs of (A-C) the artificial channel and (D) piped reach of the EDL. Yellow arrows indicate direction of flow and black arrow indicates position of surface water drain.</td><td>Middle reach</td><td rowspan="4">Water quality measurements collected within the middle and downstream reaches of the artificial channel indicate that measured parameters generally fall within applicable target ranges. Although treated effluent is incorporated into the broader golf course irrigation system, no evidence of significant water quality impairment was observed. This might be due to the recent flooding event that occurred prior to undertaking the site assessment. The slightly acidic conditions recorded are likely attributable to naturally occurring soil conditions and catchment influences. Overall, water quality is considered suitable for supporting the ecological functioning currently exhibited by the channel and downstream river system.</td><td>RWQO (DWS, 2020)</td></tr>
<tr><td>pH 7.30
EC (mS/m) 74.5
DO (mg/L) 8.51
Temp (°C) 19.0</td><td>pH >6.5 - <8.5
EC (mS/m) ≤ 85
DO (mg/L) > 6
Temp < 2°C Variation</td></tr>
<tr><td>Lower reach</td><td>TWQR (DWAF, 1996)</td></tr>
<tr><td>pH 8.39
EC (mS/m) 82.7
DO (mg-L) 7.97
Temp (°C) 19.7</td><td>DO (% sat) ≥80 - ≤120
Temp (°C) >10% Variation</td></tr>
<tr><td colspan="3">Physical features</td></tr>
<tr><td colspan="2">Flow condition</td><td colspan="2">The artificial channel network was constructed during development of the golf course in approximately 1996 when the original alignment of the ephemeral drainage line was diverted. The system is hydraulically connected to the upstream EDL and conveys flow through a series of artificial channels and impoundments before discharging into the downgradient river (the Prinseskasteel Stream). Hydrological functioning is influenced by the operation of the golf course dams and irrigation system, including the transfer of treated effluent from the nearby wastewater treatment works into an off-stream dam and, when required, into the uppermost golf course in-stream dam for irrigation purposes.</td></tr>
<tr><td rowspan="4">Present Ecological State (PES)

Although an IHI assessment was not undertaken for the artificial channel, based on the outcome of the EIS, EcoService provision and diatom community assessments for this system, the PES is analogous with a largely to seriously modified (PES D/E) system.</td><td colspan="2">Substrate</td><td colspan="2">The artificial channel substrate is dominated by deposited organic sediments and fine material associated with the impoundment network and managed golf course environment.</td></tr>
<tr><td colspan="2">Water clarity & odour</td><td colspan="2">Water clarity within the artificial channel was generally good, with no evidence of excessive turbidity, pollution or nuisance odours.</td></tr>
<tr><td colspan="2">Algal proliferation</td><td colspan="2">No significant algal proliferation was observed within the artificial channel network. Some of the in-stream dams however did contain algae.</td></tr>
<tr><td colspan="4">Riparian zone features</td></tr>
<tr><td colspan="4">Riparian vegetation associated with the artificial channel is largely managed as part of the golf course landscape and consists of a mixture of indigenous and ornamental species. The artificial channel was not assessed using VEGRAI due to its engineered nature and managed vegetation condition, although it was noted that some indigenous aquatic vegetation such as Kniphofia sp. have been planted. Vegetation composition within the artificial channel and in-stream dams include restios and shrubs synonymous with fynbos, Typha capensis, C. papyrus, Juncus sp. (including J. effusus), Cyperus polystachyos, C. rotundus, possibly C. prolifer, Commelina erecta, Persicaria decipiens, Schoenoplectus scirpoides, and possibly Aristida junciformis. Dominant instream vegetation includes Cynodon dactylon (Bermuda grass), while invasive woody vegetation includes Quercus sp. (oaks), Pinus sp. (pines) and possibly Dombeya sp. (wild pear).</td></tr>
</table>

EIS

The artificial channel attained a **Low EIS** rating, reflecting its engineered origin, limited habitat diversity and reduced ecological functionality. Although ecological importance is generally low, several of the in-stream dams provide habitat for indigenous fish and amphibian species and contribute to maintaining hydraulic connectivity between upstream and downstream freshwater ecosystems (see Section 3.5 for more information).

ECOSERVICES



The artificial channel provides a generally **low** level of ecosystem service provision, with biodiversity maintenance representing the primary ecological function. The supply of biodiversity maintenance services is mainly attributed to the presence of the Endangered Western Leopard Toad (from historical records) and viable habitat that would support breeding of this species in the downstream in-stream dams (Section 3.5), and the connectivity of the system with other aquatic habitats further downstream within the catchment area. Most regulating, supporting and cultural services are of Low to Very Low importance due to the engineered nature of the system, modified hydrology and limited habitat diversity. Consequently, ecosystem service supply is largely restricted to maintaining hydraulic connectivity and supporting localised biodiversity associated with the in-stream dams. The supply-demand relationship indicates that the system has a limited capacity to provide ecosystem services relative to potential demand, reflecting its highly managed condition.

Diatom community integrity

Diatom Index Scores			
Parameter	**Site 1**	**Site 2**	**Site 3**
Dominant Taxa	*Gomphonema* spp., *Tabularia* sp., *Cyclotella* sp.	*Cyclotella* sp., *Nitzschia* sp., *Gomphonema* sp., *Navicula* sp.	*Gomphonema* spp., *Fragilaria* sp.
Functional Groups	Pedunculate, colonial attached, and planktonic centric taxa	Mix of planktonic centric, benthic mobile, and pedunculate taxa	Pedunculate and colonial attached taxa dominant
Ecological Guilds	High-profile guild dominant with planktonic taxa present	Motile and planktonic guilds dominant with high-profile taxa present	High-profile guild dominant
Size Classes	Mostly medium to large-sized taxa (Size 3 & 4)	Mostly small to medium-sized taxa (Size 1 to 3)	Mostly medium to large-sized taxa (Size 3 & 4)
Specific Pollution Sensitivity Index (SPI)	11.2 – Moderate quality (Category C/D)	8.9 – Poor quality (Category D)	11.0 – Moderate quality (Category C/D)
Generic Diatom Index (GDI)	11.8	9.9	12.0
Trophic Diatom Index (TDI)	5.5	8.4	7.5
Percentage of Pollution-Tolerant Valves (%PTV)	20.7%	23.3%	23.5%
Diversity	2.6 – High	3.24 – High	3.12 – High
Evenness	0.93 – High	0.98 – High	0.94 – High

Site 1 represents the mid-to-upper portion of the artificial channel. The diatom assemblage is indicative of a **moderate** ecosystem condition (SPI 11.2; Category C/D) with a meso-eutrophic nutrient state. The calculated %PTV (20.7%) score indicates that the site has some evidence of organic contamination. The diatom community is dominated by the high-profile ecological guild, mostly consisting of large pedunculate *Gomphonema* species (Size Classes 3 and 4) and *Tabularia* species. The dominance of high-profile taxa indicates a stable benthic environment with low flow conditions and low physical disturbance, allowing the growth of erect, attached life-forms. Furthermore, the presence of *Tabularia* species indicates elevated

	electrolyte concentrations. The presence of the planktonic taxa *Cyclotella* further supports a stable, slow-flowing water column. The moderate ecological category is likely due to a combination of elevated dissolved minerals and localized organic contamination. Site 2 represents the most degraded section of the artificial channel network and recorded the poorest ecosystem condition (SPI 8.9; Category D). The SPI score and dominant diatom community indicate eutrophic nutrient enrichment. The calculated %PTV (23.3%) score indicates that the site has some evidence of organic contamination. The diatom community is dominated by motile and planktonic ecological guilds, together with the high-profile guild. The presence of the planktonic taxa *Cyclotella* indicates a slow-flowing or standing water column. The benthic group consists mainly of highly motile taxa such as *Nitzschia* and *Navicula*, which indicates an unstable, silted substrate, elevated electrolyte content, very heavily contaminated conditions, and physical disturbance (sedimentation, scouring, erosion, etc.). The well-developed raphe systems of motile taxa allow them to navigate and move through shifting fine sediments. Furthermore, the presence of *Nitzschia* sp. as dominant taxa supports nutrient enrichment and indicates very heavily contaminated conditions. The results thus indicate a stressed benthic habitat. The poor ecological category is likely due to physical habitat degradation (siltation), with organic contamination and elevated nutrients and salts, which could be attributed to the recent storms and flooding the study area experienced prior to the site assessment. Maintenance of the upstream dam (including vegetation removal) could also have contributed to the observed poor ecological condition. Site 3 shows a marked improvement relative to Site 2, returning to a moderate ecosystem condition (SPI 11.0; Category C/D) with meso-eutrophic nutrient enrichment. The calculated %PTV (23.5%) score indicates that there is some evidence of organic contamination. The re-establishment of high-profile taxa dominated by *Gomphonema* species and colonial *Fragilaria* species indicates a return to a more stable benthic habitat with lower physical disturbance. This suggests that the series of impoundments and channel reaches between Sites 2 and 3 may be acting as sediment traps, allowing suspended material mobilised in the middle reach to settle out before water reaches the downstream outlet. Although evidence of nutrient enrichment and organic contamination remains present, habitat stability appears to improve towards the outlet of the golf course system. From a management perspective, Site 2 appears to represent the primary area of concern within the artificial channel network and is likely where sediment accumulation, nutrient retention and physical disturbance are most pronounced. The downstream improvement observed at Site 3 suggests that the golf course dams and channel network are currently providing a degree of attenuation and settling prior to discharge into the Prinseskasteel Stream, thereby reducing the transfer of sediment-related impacts to the downstream river system.
Extent of modification anticipated as a result of the periodic maintenance activities associated with the study area	
Low The anticipated extent of modification to the artificial channel network as a result of the proposed periodic maintenance activities is considered low. Significant impacts to the system are not expected, largely due to the artificial nature of the system. Nevertheless, minor alterations to the hydrological and geomorphological functioning of the system may occur as a consequence of proposed periodic maintenance activities.	
Impact Significance & Business Case	
Low (with the implementation of control measures)	The activities associated with the periodic maintenance activities pose a 'Low' indirect risk to the overall integrity of the system, as it is assumed that the majority of the activities will be limited to the dry, summer season, where possible. The recommended control measures, as provided in Section 5.2.1 below, must be implemented, as well as regular maintenance checks. Despite the significantly modified condition of the system, the artificial channel remains ecologically functional and continues to provide important habitat connectivity and ecosystem service provision within the local landscape. Ongoing management interventions, particularly the removal and monitoring of alien invasive plant (AIP) species, are strongly recommended to prevent further degradation of riparian habitat condition.

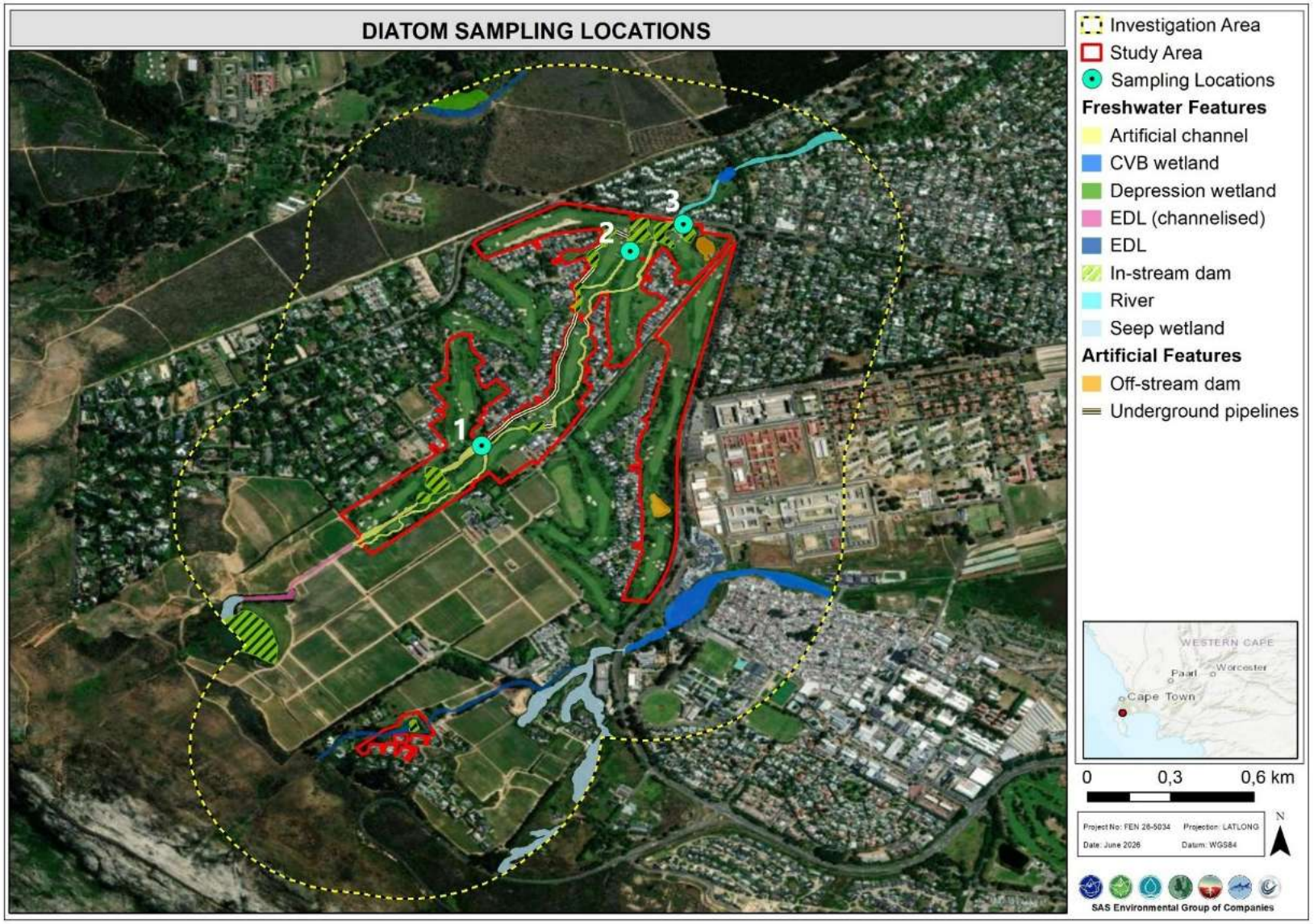
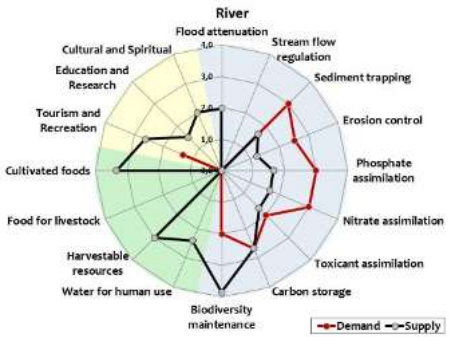


Figure 6: Map depicting the location of the diatom community samples in relation to the delineated extent of the freshwater ecosystems associated with the study and investigation areas.

Table 4: Summary of the results of the assessment of the non-perennial river (Prinseskasteel Stream) and associated CVB wetland.

<table>
<tr><th colspan="3">AQUATIC HABITAT FEATURES</th><th colspan="3">In-stream dam outlet structure below the artificial channel preventing faunal movement</th></tr>
<tr><td colspan="3"> 

Representative photographs of (A) the outlet from the upstream artificial channel to (B) the river and CVB wetland downgradient of the golf course. Yellow arrows indicate direction of flow. AIPs are evident in the delineated extent of the river and associated CVB wetland.</td><td colspan="3">  </td></tr>
<tr><th colspan="6">Physical features</th></tr>
<tr><td>Flow condition</td><td colspan="5">The downstream river retains a more natural flow regime, although flow patterns have been modified by upstream impoundments and channelisation (see Table 2 for further discussion).</td></tr>
<tr><td>Substrate</td><td colspan="5">The downgradient river and CVB comprises predominantly natural substrates including organic sediments, sands and alluvial material. Localised bank instability and minor erosion were observed in places, although the system generally remains stable.</td></tr>
<tr><td>Water quality, clarity & odour</td><td colspan="5">The river and CVB wetland similarly exhibited no obvious signs of water quality degradation during the assessment, although it is noted that water quality of the river is dependent on the operational activities associated with the golf course, and could therefore be impeded by treated effluent discharge and leached pesticide and herbicides.</td></tr>
<tr><td>Algal proliferation</td><td colspan="5">No significant algal proliferation was observed within either the river during the assessment.</td></tr>
<tr><th colspan="4">PES</th><th colspan="2">Riparian zone features</th></tr>
<tr><td colspan="2">RIVER-IHI (river reach level)</td><td>Instream IHI %</td><td>Riparian IHI %</td><td colspan="2" rowspan="2">The VEGRAI assessment of the river indicates that the riparian vegetation has been largely modified relative to reference conditions, largely as a result of invasive vegetation, historical disturbance from the upgradient catchment and altered riparian habitat structure. The Prinseskasteel Stream and associated CVB wetland supports a more developed riparian and wetland corridor comprising indigenous woody vegetation interspersed with alien invasive species. Common plant species found include Salix babylonica (Weeping Willow, invasive), S. mucronata (Cape Willow), Rapanea melanophloeos (Cape Beech), T. capensis (bulrush), possibly Monopsis lutea (Yellow Oneye), Cyperus textilis (Umbrella Sedge), rushes and the exotic grass Avena sp. (oats). The river corridor continues to provide an important ecological linkage through the surrounding urban landscape despite historical modification.</td></tr>
<tr><td>Overall (%)</td><td>70.6 % (C)</td><td>72.3 % (C)</td><td>68.9 % (C)</td></tr>
<tr><td colspan="4">The IHI assessment indicates a moderately modified ecological condition. Modifications are primarily associated with upstream flow regulation, historical catchment disturbance and AIPs within the riparian zone. Although a PES assessment was not undertaken for the CVB wetland, visual inspection of the wetland indicates that the overall PES is similar to that of the river (PES C).</td><td>VEGRAI Score:</td><td>45.3 % (D)</td></tr>
<tr><th colspan="6">EIS</th></tr>
<tr><td colspan="6">The river and CVB attained a Moderate to High EIS rating, reflecting their relatively diverse aquatic habitats, sensitivity to hydrological and water quality changes, and important role as an ecological corridor within the catchment. Ecological importance is driven by the riverine component, while the wetland contributes additional habitat diversity and ecological connectivity.</td></tr>
</table>

ECOSERVICES	
	The river and CVB wetland provide a **moderate** level of ecosystem service provision, with biodiversity maintenance attaining a Very High importance rating. Although not indicated in the spider diagram, flood attenuation and stream flow regulation services are also important regulating services provided by the system. Carbon storage, potential cultivated food support and recreational value contribute additional ecosystem service benefits. Although many hydrological regulation services are rated low to moderate, the river remains an important ecological corridor and contributes meaningfully to ecological functioning within the catchment. The river and CVB wetland exhibit a more favourable supply-demand relationship compared to the artificial channel network, with the river continuing to supply a range of ecosystem services that meet the ecological and social demands of the surrounding landscape. However, the river remains dependent on maintaining adequate water quality, hydrological connectivity and riparian / wetland habitat integrity. Further degradation of these attributes would likely reduce ecosystem service supply and increase the disparity between ecosystem service demand and delivery.

MANAGEMENT CLASSES							
Overall PES	**C**	**Best Attainable State (BAS)**	**C**	**Recommended Ecological Category (REC)**	**C**	**Recommended Management Objective (RMO)**	**Maintain**

Extent of modification anticipated as a result of the proposed maintenance activities

Low

The anticipated extent of modification to the river system is considered low, based on the assumption that the outlet structure from the golf course to the river is not replaced. Significant impacts to the river and associated CVB wetland are not expected, largely due to the buffering and attenuation functions provided by the upstream artificial channel network and associated impoundments. Nevertheless, minor alterations to the hydrological and geomorphological functioning of the system may occur. These impacts may include slight changes to the timing, volume, and distribution of surface water inflows to the river system as well as potential water quality (through sedimentation) impacts.

Impact Significance & Business Case

Low (with the implementation of control measures)	The activities associated with the proposed maintenance activities is anticipated to pose a 'Low' risk significance to the overall integrity of the river and CVB wetland, as it is assumed that the majority of the impacts will be absorbed by the artificial channel network and assuming that construction activities will be limited to the dry, summer season, where possible. The recommended control measures, as provided in Section 5.2.1 below, must be implemented, as well as regular maintenance checks. Despite the modified condition of portions of the system, the river remains ecologically functional and continues to provide important habitat connectivity and ecosystem service provision within the local landscape. Ongoing management interventions, particularly the removal and monitoring of alien invasive plant (AIP) species (although not required to be undertaken by the proponent), and appropriate design of the dam outlet structure to allow faunal movement are strongly recommended to prevent further degradation of riparian habitat condition and to serve to support the maintenance of the REC of the system.

3.5 *Aquatic and Herpetofauna Assessment*

Discussions with one of the Estate managers provided sufficient background data on the potential of fish occurring within the impoundments within the study area that then allowed for a confirmation of species occurrence during the assessment. Thorough assessments were undertaken along the shoreline of various impoundments using standard electrofishing and within the deeper water areas as far as safe work conditions would allow.

Cyprinus carpio (common carp) (exotic), *Gambusia affinis* (Mosquitofish) (exotic) and *Oreochromis mossambicus* (Mozambique tilapia) were noted to occur within the impoundments. These species were introduced to the impoundments once construction was completed. Common carp are introduced to impoundments for aesthetic value and to potentially support recreational fishing. This species is regarded as a habitat modifying species as it feeds by sucking up sediments and spitting it out again. A population of common carp within an impoundment therefore tends to increase the turbidity of the water. *Gambusia affinis* (Mosquitofish) are introduced to impoundments as a means of mosquito control. They impact on aquatic systems because they do not only feed on mosquitoes but on eggs and larvae of indigenous fish species as well. Both species are widespread throughout watercourses at the national level and are regarded as pest species within aquatic systems. *Oreochromis mossambicus* (Mozambique tilapia) is classified as conservationally Vulnerable. Although a geographically widespread species found throughout most of the major river basins of Africa, it is of conservational concern due to hybridisation with *Oreochromis niloticus* (Nile tilapia). It is, however, often regarded as a pest species within impoundments where they thrive under favourable conditions.

Figure 7: A selection of the fish species that were sampled within the various impoundments. *Gambusia affinis* (left) and *Oreochromis mossambicus* (right).

Figure 8: The Tokai Road crossing at the outfall of the main watercourse that leaves the study area (the golf estate). This structure does not allow for freedom of movement for fish from downstream within the catchment.

The impoundment which was reported to support the largest populations and breeding of the Western Leopard Toad is the most downgradient one in the series of the impoundments associated with the study area. Historical recordings of observations concentrate along the road (Tokai Road) that crosses the outfall of this impoundment as it leaves the study area. It is expected that observations would be recorded along the road as the toads are most easily observed there. The watercourse immediately downstream of the Tokai Road crossing is largely inaccessible, which would inevitably result in fewer observations being recorded within that area. The relatively high incidences of observations indicates that this species migrates *en masse* during the breeding season in search of favourable breeding habitat and the high observation rates within the most downstream in the series of impoundments associated with the study area indicates that breeding adults tend to recruit from lower down within the watercourses and not from above (i.e., upgradient). The toads therefore migrate in a generally upstream direction. When the froglets metamorphize and can migrate over land, it is assumed then that the majority move in a downstream direction rather than upstream. This is largely in agreement with the general and cyclic seasonal migratory patterns of other Bufonid toad species.

Figure 9: The most downstream impoundment within the study area where the majority of the breeding for the Western Leopard Toad is reported. It is also the impoundment that supports the population of *Oreochromis mossambicus*.

The occurrence of the active population of *Oreochromis mossambicus* in the same impoundment where the Western Leopard Toad breeds was also considered during the development of a management strategy to enhance the habitat suitability to support the positive breeding of the toads. The vast majority of the diet of *Oreochromis mossambicus* consists of detritus and algae, with a lesser inclusion of invertebrates, and a relatively minor inclusion of molluscs (snails), and smaller fish. It is largely assumed that if a fish preys on smaller fish that they would also prey on tadpoles, which would place the tadpoles of the toads at risk. This is not the case with *Oreochromis mossambicus* as fish do not form a usual part of their diet. There is the fortuitous risk of egg strings and tadpole stages that are still adhering to the substrates being taken up by the fish, but it is assumed that this would be a very small portion of the population being impacted by the fish. It is therefore not warranted that the fish be removed from the impoundment in favour of the toads. The marginal vegetation and the level of refuge that this provides is an advantage that supports the breeding success of the toads. The impoundments that fall within the Steenberg Estate and Golf Course are considered to be an important area that supports the breeding of the Western Leopard Toad and therefore should be managed appropriately with the features that benefit the support of the toads as one of the primary features.

4 LEGISLATIVE REQUIREMENTS

The following legislative requirements were considered during the assessment. A detailed description of these legislative requirements is presented in **Appendix B** of this report:

- The Constitution of the Republic of South Africa, 1996[1];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA); and
- Government Notice 4167 as published in the Government Gazette 49833 of 2023 as it relates to the NWA, as amended.

Certain articles of legislation related to the above Acts and legislation impose potential zones of regulation on freshwater ecosystems in both a national and provincial context. The ZoRs are not necessarily development exclusion zones, rather areas in which EIA and Water Use Authorisation legislative tools have been introduced for the protection and sustainable use of freshwater resources by requiring that certain types of activities within a freshwater ecosystem, or within a certain distance of a freshwater ecosystem require authorisation.

The definition and motivation for a regulated zone of activity for the protection of a watercourse can be summarised as per the table below. Confirmation of the applicability of the articles of legislation presented below must be obtained by the EAP in consultation with the relevant Competent Authority.

Table 5: Articles of legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use Authorisation Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) as amended. **Department of Water and Sanitation (DWS)**	**Government Notice 4167 as published in the Government Gazette 49833 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended** In accordance with GN 4167 of 2023 as it relates to the NWA, a regulated area of a watercourse in terms of water uses as listed in Section 21 (c) and 21 (i) is defined as: • the outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam; • **in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench;** or • **In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans.**
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended in 2017. **Department of Environmental Affairs and Development Planning (DEA&DP).**	Activities of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA regulations, 2014 (as amended) **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* … **excluding where** such infilling, depositing, dredging, excavation, removal or moving -

[1] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

Regulatory authorisation required	Zone of applicability
To be determined by the EAP in consultation with the applicable regulating authority.	**(b) is for maintenance purposes undertaken in accordance with a Maintenance Management Plan.**

In accordance with the above, the following ZoRs are applicable to the freshwater ecosystems (Figure 10 to Figure 13):

- A 32 m ZoR in accordance with the NEMA EIA Regulations of 2014, as amended;
- A 100 m ZoR in accordance with the GN4167, as amended, as it relates to the NWA (applicable to the aquatic systems – EDLs and rivers); and
- A 500 m ZoR in accordance with the GN4167, as amended, as it relates to the NWA (applicable to the wetlands).

4.1 *Freshwater Ecological Buffers*

To offer a measure of protection to freshwater ecosystems in the study and investigation areas, non-developable buffer areas are necessary to be designated around all freshwater ecosystems. According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on freshwater ecosystems arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et al.,* 2015). It should be noted however, that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific control measures (Macfarlane *et al.,* 2015).

An ecological buffer was calculated for the freshwater ecosystems associated with the study area, using the "*Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries*" as developed by Macfarlane *et al.* (2015). The results of the buffer tool indicate that a 10 m and 15 m ecological buffer is applicable for the proposed periodic maintenance activities associated with the in-stream dams and freshwater ecosystems, respectively (Figure 14 and Figure 15). It is however acknowledged that the implementation of a buffer is not fully practical considering that periodic maintenance activities is proposed to be undertaken within the delineated freshwater ecosystems and associated in-stream dams. As a result, a 5 m maintenance Right of Way (RoW) has been allowed for within which all activities must remain.

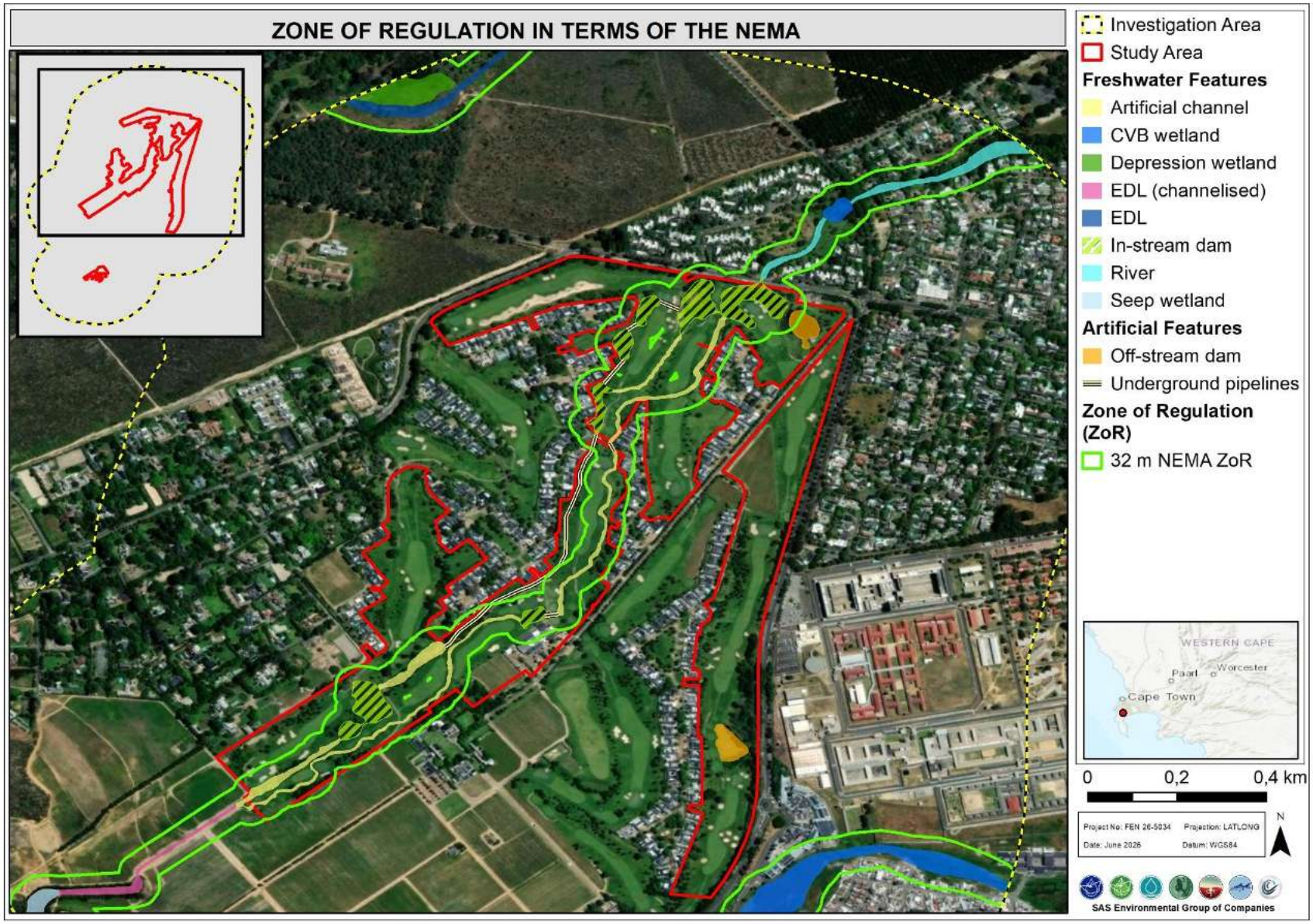


Figure 10: Freshwater ecosystems associated with the study and investigation areas, as well as the associated ZoR in terms of NEMA (Map 1 of 2).

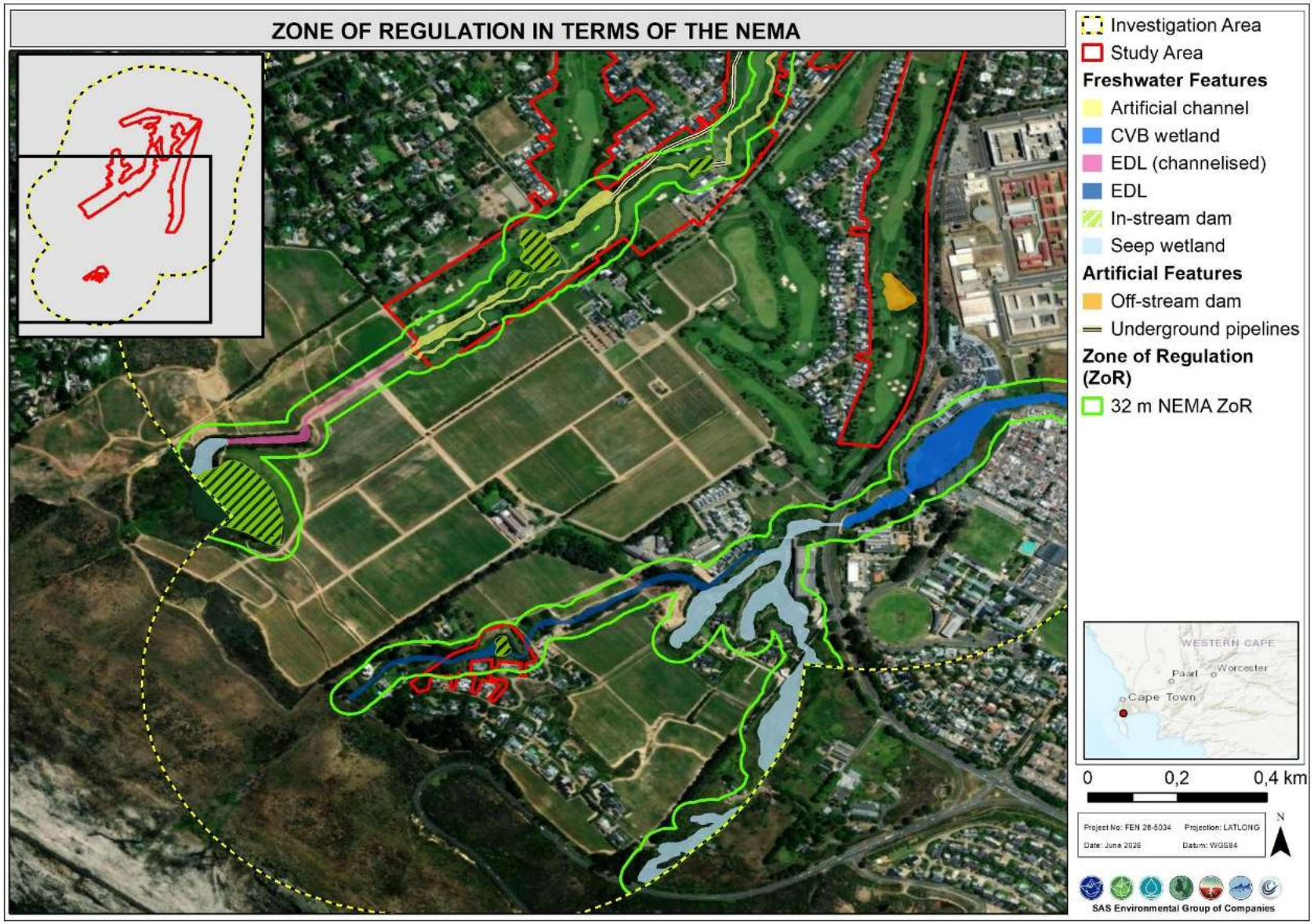


Figure 11: Freshwater ecosystems associated with the study and investigation areas, as well as the associated ZoR in terms of NEMA (Map 2 of 2).

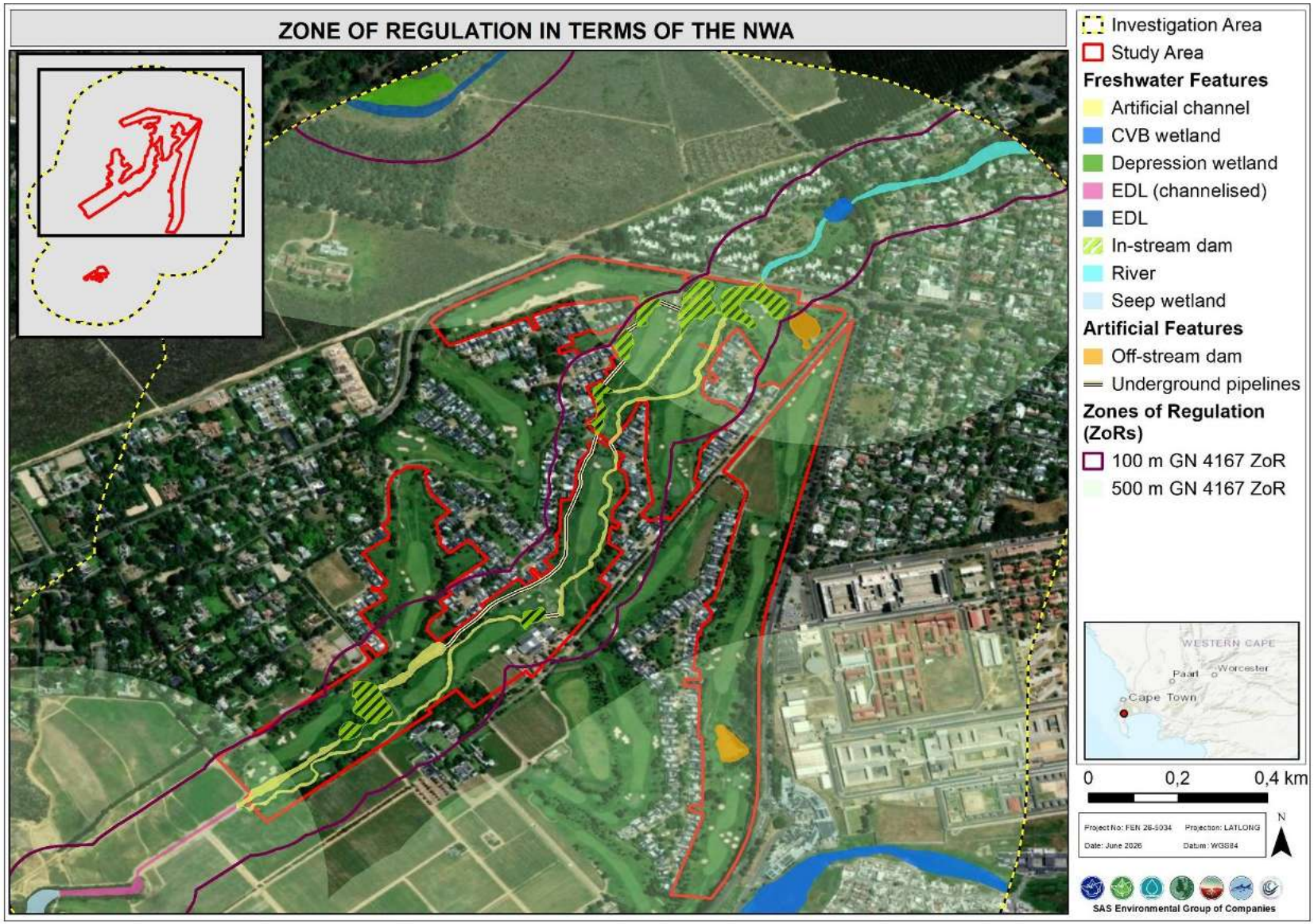


Figure 12: Freshwater ecosystems associated with the study and investigation areas, as well as the associated ZoR in terms of GN4167 as it relates to the NWA (Map 1 of 2).

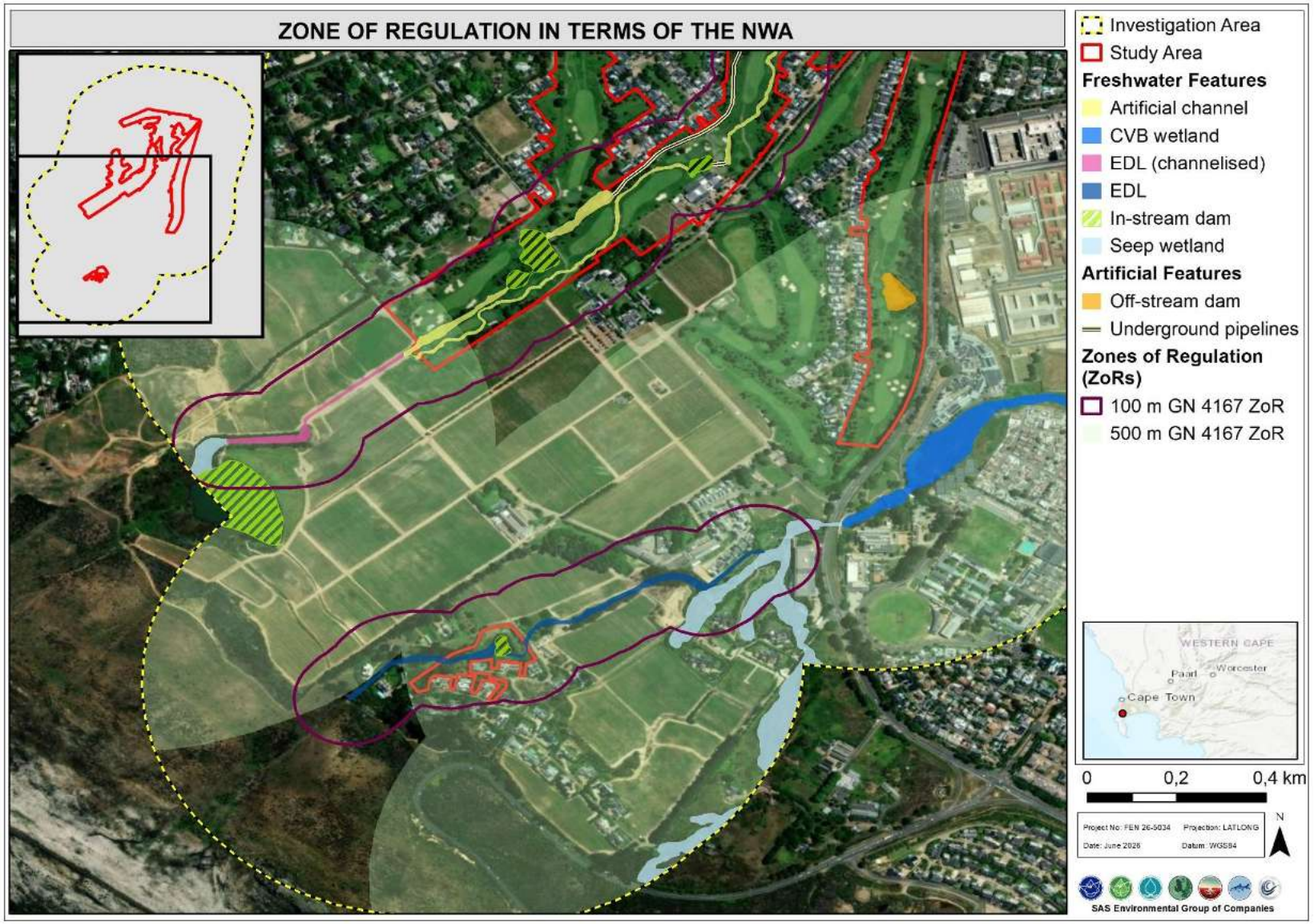


Figure 13: Freshwater ecosystems associated with the study and investigation areas, as well as the associated ZoR in terms of GN4167 as it relates to the NWA (Map 2 of 2).

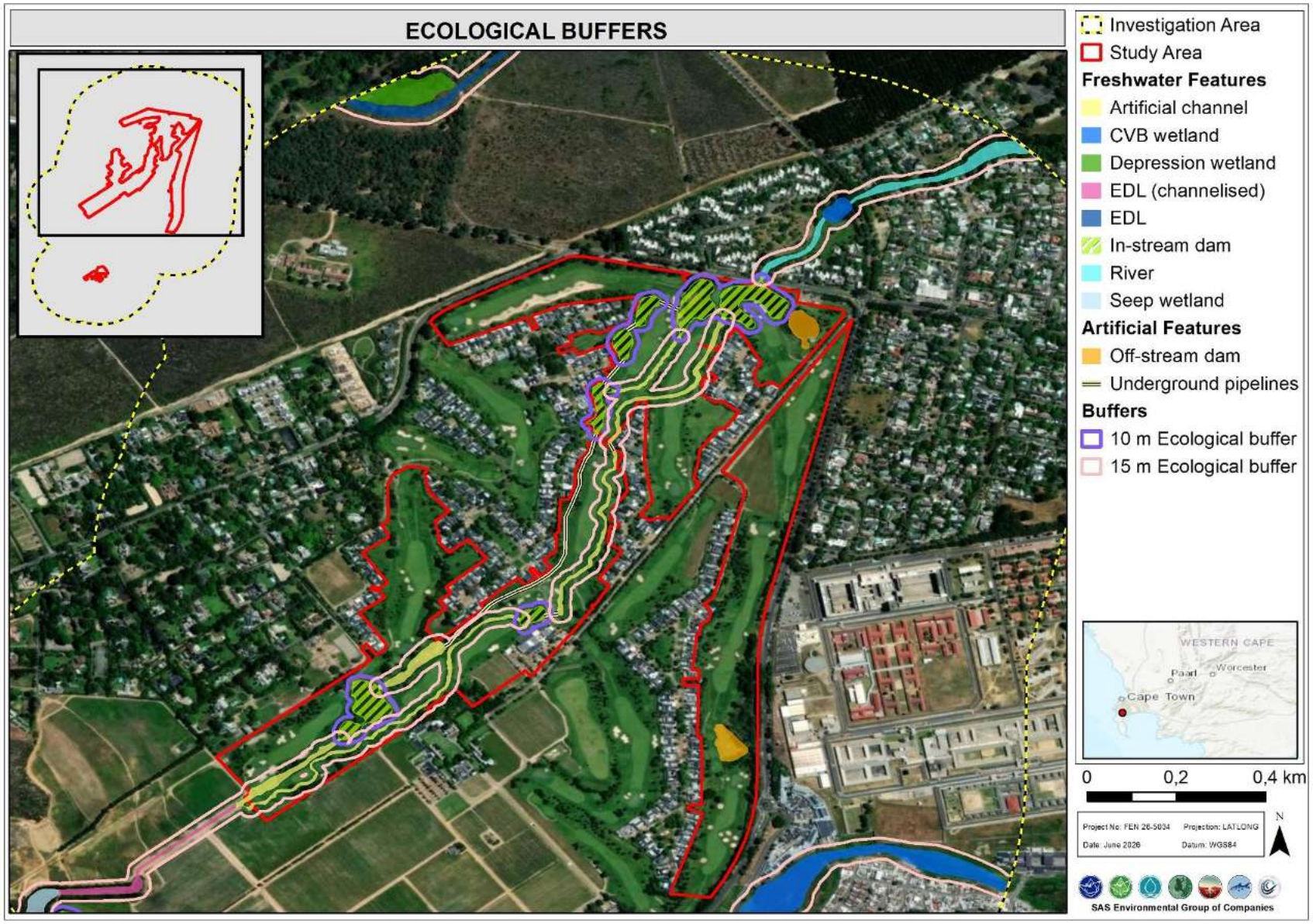


Figure 14: Freshwater ecosystems associated with the study and investigation areas, as well as the associated ecological buffer (Map 1 of 2).

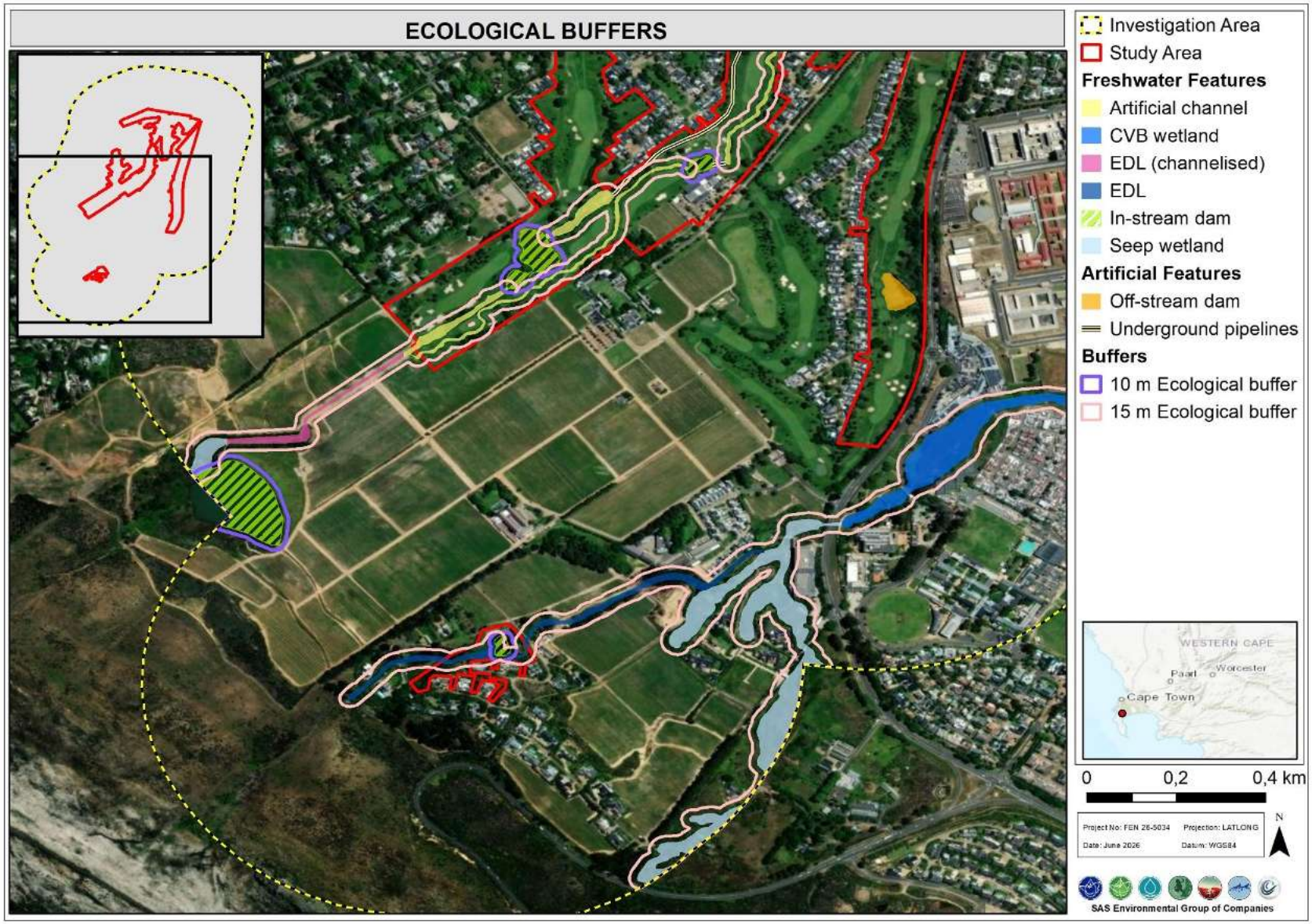


Figure 15: Freshwater ecosystems associated with the study and investigation areas, as well as the ecological buffer (Map 2 of 2).

5 DWS RISK AND IMPACT ASSESSMENT

This section presents the significance of the potential impacts on the ecological processes of the freshwater ecosystems associated with the proposed maintenance activities. In addition, it indicates the recommended control measures needed to minimise the perceived impacts of the proposed maintenance activities and presents an assessment of the significance of the impacts taking into consideration the proposed control measures. The DWS specified RAM (as promulgated in GN4167 of 2023 as it relates to the NWA) was undertaken to inform the Water Use Authorisation process, and an impact assessment was undertaken to inform the NEMA process, in this case, the application of the MMP.

Both the DWS RAM (2023) and the Impact Assessment method were applied to ascertain the significance of impacts on the receiving freshwater environment. It is crucial to note that although these two methods may present different scores and impact significance ratings for the same activity, this is due to differences in their methodologies (refer to Appendix E) and not due to inconsistencies in their application. Each should be judged individually for their specified purpose; i.e. the use of the Impact Assessment method for the purposes of the NEMA process, and the use of the DWS RAM (2023) to determine in consultation with the relevant competent authority whether there is a need to apply for a WUL.

5.1 *Considerations taken when applying the Risk and Impact Assessments*

Following the assessment of the freshwater ecosystems associated with the proposed periodic maintenance activities, the DWS specified RAM and Impact Assessment methodology as provided by the EAP was applied to ascertain the significance of risk associated with the proposed periodic maintenance activities on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the associated freshwater ecosystem. The points below summarise the considerations undertaken:

- The assessments were applied considering the risk significance of the proposed periodic maintenance activities as described in Section 1.1;
- With the exception of the rehabilitation of the in-stream dam associated with Erf 12970 and associated maintenance activities (for example, removal of excess and AIP vegetation and revegetation with appropriate indigenous plants, erosion control, etc.), no other activities are anticipated to be undertaken in the EDL. Therefore, only activities associated with the above-mentioned activities, rehabilitation and post-rehabilitation phases on the EDL were assessed. Should future maintenance activities require activity within the dam, assuming that they are similar in nature and extent as those assessed in this report, the control measures provided herein will suffice in the event of general maintenance activities in future;
- The RAM was applied assuming a high level of control measures is implemented, thus the results of the risk assessment provided in this report presents the perceived impact significance **post-mitigation**. The Impact Assessment was undertaken considering both pre- and post-mitigation scenarios;
- In applying the risk and impact assessments, it was assumed that the mitigation hierarchy as advocated by the DEA et al. (2013) would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- The activities and the associated risks they pose are all site-specific, not of a significant extent relative to the freshwater ecosystems and therefore have a limited spatial extent (i.e. within the investigation area). The exceptions are risks of water contamination during periodic maintenance activities (e.g. replacement of existing culverts) and ongoing functioning of the golf course in which the artificial channel is located. However, if the maintenance activities are

undertaken during low flow period (i.e. Western Cape summer season – November to March), these risks are considered low;

- As a precautionary approach, it was assumed that the periodic maintenance activities will not necessarily be undertaken during the drier months. The risk and impact assessments were applied assuming that works will be undertaken during the high-flow period in line with the precautionary principle;
- Although it is highly recommended that the culverts associated with the outlet structure of the last in-stream dam directly upgradient of the Prinseskasteel Stream be upgraded to allow passage of fish and frogs, it is assumed that such upgrades would not be undertaken under the ambit of the MMP. Should it however be determined that the culverts be replaced / maintained, the RAM and Impact Assessment would need to be revised;
- The proposed periodic maintenance activities are located within the delineated extent of a reach of an EDL and within the artificial channels, and the respective 10 m and 15 m ecological buffers, and therefore also within the 32 m NEMA ZoR and the 100 m and 500 m GN 4167 ZoR of the watercourses;
- The proposed individual periodic maintenance activities are envisioned to take no more than a few months, but may possibly be spanned over a long period (for the validity period of the MMP). However, the frequency of the activities' impacts may be daily during this time;
- For freshwater ecosystems assessed in unison in the RAM and impact assessment, the best (highest) ecological condition and EIS were utilised to assess worst-case scenario impacts;
- Most impacts are considered easily detectable, with the exception of contamination of surface and groundwater which will require some effort; and
- The considered control measures are easily practicable.

5.2 *DWS Risk Assessment Discussion of Anticipated Ecological Impacts*

The following potential ecological risks on the freshwater ecosystems were considered as part of this assessment:

- Impacts on the hydrology and sediment balance of the freshwater ecosystems;
- Impacts on water quality;
- Associated indirect impacts to biota (including endangered fish and herpetofauna); and
- Proliferation of AIP species.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The corrective and control measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

The results of the risk assessment are summarised in Table 6 below, including key control measures for each activity that must be implemented. A comprehensive outcome of the risk assessment is presented in Appendix H.

Table 6: Summary of the results of the DWS RAM applied to the freshwater ecosystems at potential risk from the proposed periodic maintenance activities.

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
MAINTENANCE	1	Site preparation (where applicable) for maintenance activities within the delineated extent of the applicable freshwater HGM unit and associated ecological buffers (e.g. culvert replacement, upkeep of in-stream dams), including: • Removal of vegetation and associated disturbances to soil (although unlikely); • Stockpiling of maintenance equipment and storage of materials, vehicles and machinery; and • Possible indiscriminate vehicle movement.	• Dust generation from exposed soil potentially leading to the smothering of freshwater vegetation and biota, and altering surface water quality; • Potential soil destabilisation leading to sedimentation of the freshwater HGM units, or conversely, soil compaction leading to increased surface runoff into downstream / downgradient freshwater ecosystem; • Potential proliferation or spread of AIPs from disturbed soil; and • Contaminant spillage into the	EDL		**6**	**3**	**18**	80%	**14,4**	**L**	1. The applicable ecological buffers (10 m and 15 m) must be implemented and demarcated on site where practical for the duration of the periodic maintenance activities in order to mitigate edge effects. The outer boundary of the 5 m maintenance RoW must be clearly demarcated using a suitable barrier or material (e.g. Figure A) by an Environmental Control Officer (ECO) and both the buffer area and the maintenance RoW are to be marked as 'no-go' areas to ensure that maintenance activities do not encroach into the freshwater environment and associated buffer area except where essential. Only authorised personnel may be permitted to enter these 'no-go' areas as part of the maintenance and subsequent rehabilitation activities, where required, to prevent excessive compaction of the soil within the freshwater ecosystems;  **Figure A: Example of a barrier fence used to demarcate the no-go area outside of the 10 m and 15 m ecological buffer of the**
				Artificial channel		**7**	**2**	**14**	100%	**14**	**L**	
				Non-perennial River and associated CVB wetland		**6**	**4**	**24**	40%	**9,6**	**L**	

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
			freshwater ecosystem from machinery and vehicle operation.									**freshwater ecosystems, where applicable and 5 m maintenance RoW.** 2. Maintenance staging areas (where applicable), vehicle re-fuelling areas, and equipment and material storage facilities to remain outside of the 10 m and 15 m ecological buffer of the freshwater ecosystems and preferably the 32 m NEMA ZoR, where possible. A designated maintenance staging area must be approved by an independent ECO prior to use; 3. Stockpiles must be placed outside the delineated freshwater ecosystems, the associated ecological buffer and preferably the 32 m NEMA ZoR (the latter where practical); 4. Although considered unlikely to be required, site clearing activities (including for maintenance staging areas, if required) are to remain within the authorised maintenance and management footprint, and vegetation clearing is to be limited to what is absolutely essential within that active footprint, with the exception of alien vegetation and excess vegetation such as dense *T. capensis* stands within in-stream dams which may be carefully removed; 5. Avoid unnecessary trampling of vegetation irrespective of the vegetation being associated with the freshwater ecosystems or the surrounding terrestrial area; 6. Retain as much indigenous vegetation as possible (wetland and terrestrial); 7. Dust suppression measures must be implemented (if required) throughout the maintenance phase to prevent excessive dust which may smother freshwater vegetation; and 8. In all events all machinery and vehicles used during maintenance must be maintained and equipped with drip trays to prevent oil, petrol or diesel leaks. If breakdowns occur these

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
												must be towed offsite site to the designated areas/workshops. The proposed control measures will ensure that incidental oil spills and leakage are minimised onsite and thus limit any opportunities of water contamination and water quality deterioration.
	2	Clearing of vegetation, debris, litter and sediment and rectification of observed erosion within the proposed periodic maintenance site footprint area including stripping of topsoil within the freshwater habitat.	• Exposure of soil, leading to increased runoff and erosion, and thus increased likelihood for sedimentation of the freshwater ecosystems; • Loss of freshwater habitat and ecological structure resulting in impacts to biota; • Increased sedimentation of the freshwater HGM units, potentially leading to smothering of vegetation in the downstream reaches; • Proliferation or spread of alien and/or	EDL		**9**	**3**	**27**	100%	**27**	**L**	1. No indiscriminate movement of vehicles through the freshwater ecosystems may be permitted. All vehicles must remain outside of the 10 m and 15 m ecological buffer, unless required as part of specific maintenance activities for a short period of time. This must also be limited to the drier summer season, where possible, to reduce risk significance; 2. Topsoil excavated (if any) must be stored separately and may not be contaminated. The topsoil is to be reused on completion of maintenance activities for rehabilitation; 3. All AIP species, debris and litter removed from the drainage structure must be removed from site (no stockpiling allowed); 4. Refer to Activity 1 for control measures related to stockpiling and trampling; 5. Schedule repair works outside peak breeding and metamorphosis periods (July to December) of the identified frog species where feasible; 6. Conduct pre- maintenance phase amphibian searches and relocation by a suitably qualified specialist if required; 7. Should erosion be noted within the freshwater ecosystems, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation. Use
				Artificial channel		**10**	**2**	**20**	100%	**20**	**L**	

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
			invasive vegetation as a result of disturbances; and • Potential changes to the ecoservice provision of the freshwater ecosystems.	Non-perennial River and associated CVB wetland		**7**	**4**	**28**	40%	**11,2**	**L**	can also be made of rocks sustainably obtained from the surrounding area to infill any area prone to erosion, as a natural dispersal mechanism; 8. Should erosion gullies be observed outside the freshwater ecosystems which could indirectly negatively affect the functioning of the freshwater ecosystems, such gullies must be rectified as soon as practically possible; 9. Control alien vegetation, specifically invasive and pioneer species and may find a niche to encroach disturbed areas towards the upper reaches. Ensure AIPs are managed post maintenance until suitable basal cover is achieved; and 10. Once all vegetation clearing is completed, all AIP and any removed excess material must be disposed of at a licensed refuse facility and may not be mulched or burned on site.
	3	Groundbreaking and excavations within the freshwater HGM units as part of the activities to replace culverts, gabion retaining walls, and dam walls, and provide protection works, which may include infilling and cut and fill of side slopes, excavation of areas for the installation of	• Excess soil being removed within the road surface and falling into the freshwater habitat adjacent to the road resulting in altered pattern flow and timing of water in the freshwater ecosystems; • Disturbances of soil leading to ponding of water as a result of over compaction of soil in some areas,	Artificial channel		**8**	**2**	**16**	100%	**16**	**L**	1. The maintenance footprint must be limited to the relevant proposed activity footprint and 5 m maintenance RoW (i.e. the authorised development footprint area) only; 2. Limit maintenance equipment within the freshwater ecosystems to what is essential; and 3. All proposed activities will potentially result in bank destabilisation and an increase in bank incision and sedimentation of the freshwater ecosystems. Therefore, sediment control devices must be constructed in-situ prior to maintenance activities. Refer to control measures of Activities 4 and 5 for additional information. Control measures specific to concrete works: Concrete and cement-related mortars can be toxic to aquatic life. Proper handling and disposal should minimise or eliminate discharges into the assessed freshwater ecosystems. High
				Non-perennial River and associated CVB wetland		**9**	**4**	**36**	80%	**28,8**	**L**	

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
		erosion protection measures.	increased AIP proliferation, and in turn altered freshwater habitat and runoff patterns; • Potential impacts on water quality and contamination of soil within the freshwater ecosystems; • Altered runoff patterns, leading to increased erosion and sedimentation of the downstream freshwater habitat; and • Potential erosion and formation of preferential flow paths as a result of disturbed soil and inappropriate slopes resulting in sedimentation of the freshwater ecosystems.									alkalinity associated with cement can dramatically affect and contaminate both soil and ground water. The following measures must be adhered to: o Fresh concrete and cement mortar should not be mixed near the freshwater ecosystems. Mixing of cement may be undertaken within a designated maintenance staging area, however it may not be mixed on bare soil, and must be within a lined, bound or bunded portable mixer. Consideration must be taken to use ready mix concrete; o No mixed concrete shall be deposited directly onto the ground or within the freshwater ecosystems. All concrete must be brought in via a cement mixing truck which must remain within the footprint of the proposed periodic maintenance activities and associated 5 m maintenance RoW, and cement must be piped down to the footprint area. Any areas that require manual application of cement require that a batter board or other suitable platform/mixing tray be used until it is deposited; o A washout area must be designated outside of the freshwater ecosystems, and wash water should be treated on-site or discharged to a suitable sanitation system; o At no point may batter boards/mixing trays or cement trucks be rinsed off on site and run-off water be allowed into the freshwater ecosystems; o Cement bags (if any) must be disposed of in the demarcated hazardous waste receptacles and the used bags must be disposed of through the hazardous substance waste stream; and o Spilled or excess concrete must be disposed of at a suitable landfill site. Chain of custody documentation must be provided.

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
	4	Installation of culverts and gabions within the delineated extent of the freshwater ecosystems (if required), which may require temporary diversion of flow.	• Minor removal of instream and marginal vegetation within the artificial channel; • Movement of machinery within channel, leading to benthic disturbance including potential damage to aquatic biota egg banks, instream sediment disturbance, and compaction of bank and bed soil; • Disturbances of soil as a direct result of removal of damaged infrastructure and replacement with new crossing structures, leading to ponding of water as a result of earthworks, over-compaction of soil due to movement of machinery, damage to fish and macroinvertebrate egg banks, potential	Artificial channel		**10**	**2**	**20**	100%	**20**	L	1. Refer to control measures applicable to Activity 3. Although a diversion of flow is not anticipated as the intention is to undertake the repair works to dams and culverts during the low flow season (when no water is present in the artificial channel), the following measures must be implemented during the disturbance period should water be present during the proposed repair works: 2. Water must be diverted into the downstream reaches, around the maintenance area (similar in concept to the use of a coffer dam, although a coffer dam may not be required or implemented). Water must be allowed to recharge the downstream reaches at all times, although sediment traps must be installed around any activities located upgradient of the river (e.g. maintenance staging areas, stockpiles etc) to ensure that volumes of sediment entering the river are minimised. Sediment traps are to be inspected daily and accumulated sediment to be removed by hand on a weekly basis; 3. Sediment traps must be installed either every 15 m downstream for any works for a length of 100 m, or, if this is not feasible (due to flow volumes, channel width, or spatial restriction of the authorised area within which work may occur), then sediment traps must be installed around the downgradient boundary of the maintenance work. The determination of appropriate placement of such sediment traps may be at the discretion of the ECO (see Figure B below); 4. Ensure that the creation of the diversion through existing structures or otherwise does not result in a significant water level difference upstream or downstream of the maintenance activities;
				Non-perennial River and associated CVB wetland		**9**	**4**	**36**	60%	**21,6**	L	

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
			for increased AIP proliferation (instream and freshwater), and in turn altered instream and riparian/wetland habitat, flow patterns and sediment distribution; • Increased sedimentation of the freshwater HGM units, leading to smothering of vegetation in the downstream reaches of the freshwater ecosystems; • Potential erosion and formation of preferential flow paths as a result of disturbed soil, and inappropriate slopes (bank and stream bed) resulting in altered sediment distribution and altered benthic characteristics affecting aquatic									5. It is recommended that a suitably qualified freshwater specialist and ECO monitor any flow diversions as well as sediment traps at least bi-monthly during maintenance work requiring flow diversion to monitor the conditions of the freshwater ecosystems during the maintenance period and after flows are re-directed through the new infrastructure;  **Figure B: Examples of silt traps to be used during the maintenance activities, to limit additional sediment from entering the downstream reaches of the freshwater ecosystems.** 6. Newly installed culverts and gabions (if required) must intersect the artificial channel at a right angle (perpendicular) to minimise disturbance to the freshwater ecosystems; 7. Ensure that culvert inlets are positioned at or below the natural bed level to preserve the natural flow regime and allow for sediment passage; 8. The area outside the 5 m maintenance RoW of the proposed periodic maintenance activities must be demarcated as a no-go area. No vehicles or personnel are permitted within this area; 9. Material to be used as part of the proposed periodic maintenance activities must be stockpiled outside the 32 m NEMA ZoR of the freshwater ecosystems to prevent additional

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
			fauna and flora; • Potential proliferation /further spread of AIPs as a result of disturbances; and • Potential changes to the ecoservice provision of the freshwater ecosystems.									sedimentation thereof and to avoid any other vegetation being impacted by the maintenance activities. These stockpiles may not exceed a height of 2 m and should be protected from wind and precipitation using tarpaulins or a suitable geotextile; and 10. Any remaining soil following the completion of the proposed periodic maintenance activities are to be spread out thinly in an area within the riparian zone to aid in the natural reclamation process.
	5	Rehabilitation of the impacted reaches of the freshwater ecosystems, including: • Re-sloping, reprofiling and revegetation of the artificial channel banks to prevent future erosion; • Revegetation of the in-stream dam associated with the	• Exposure of soils, leading to increased runoff and erosion which can lead to increased sedimentation of the freshwater ecosystems; • Potentially altering surface water quality through increased turbidity from increased suspension loads and	EDL		**7**	**3**	**21**	80%	**16,8**	**L**	1. Refer to control measures 1 to 3 of Activity 1 regarding movement in the delineated extent of the freshwater ecosystems. Careful planning of all maintenance equipment must be undertaken beforehand to ensure that the minimum impact on the freshwater ecosystems occur; 2. The preservation of cobble and gravel beds associated with flowing water habitats are important features for maintaining aquatic biodiversity. These features must be preserved during the proposed maintenance activities and reinstituted if maintenance activities have resulted in the loss of disturbance of such features; 3. Rehabilitation of the impacted reaches of the freshwater ecosystems and the associated ecological buffers must be undertaken. This must include clearing of all AIPs and
				Artificial channel		**8**	**2**	**16**	100%	**16**	**L**	

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
		EDL; and • Revegetation of the artificial channel.	contamination from oils and hydrocarbons; • Soil compaction of the embankment; • Potential temporary disruption to the hydrological processes of the freshwater ecosystems; and • Damage and or removal of indigenous vegetation.	Non-perennial River and associated CVB wetland		**6**	**4**	**24**	60%	**14,4**	**L**	reinstatement of indigenous freshwater vegetation within the disturbed footprint. Rehabilitation of the ecological buffer (where feasible considering the current operation of the golf course) would entail reinstatement of indigenous vegetation suitable for occasional inundation; 4. Where applicable for the AIPs, care must be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occur due to the herbicide used and that water contamination is avoided; and 5. Following completion of the proposed periodic maintenance activities a suitable AIP management and rehabilitation plan (including a plant species list) must be developed by an appropriately qualified specialist, and must be implemented accordingly to ensure that AIPs do not become established within the areas disturbed by maintenance and/or rehabilitation activities.
OPERATIONAL/ REHABILITATION	**6**	Monitoring of structural integrity of the culverts, crossings and in-stream dams including: • Proactive monitoring to ensure structural integrity is maintained and to identify early signs of erosion due to	• No direct negative impacts perceived.	All freshwater ecosystems		**6**	**4**	**24**	40%	**9,6**	**L**	1. Should the crossing infrastructure require replacing and/or concrete works, all control measures as stipulated in Activities 3 and 4 as applicable above must be implemented to ensure no negative impacts to the applicable freshwater HGM unit; 2. See control measures of Activity 1 with regards to movement within freshwater ecosystems; 3. Sediment traps must be installed downstream of the crossings where maintenance works are being undertaken; and 4. Any vegetation clearing (as part of further maintenance and upkeep) must preferably be undertaken by hand within the freshwater ecosystems. Should it be determined that machinery is to be used, vegetation clearing must be undertaken during the drier, summer months and vehicles

Phase	No.	Activity	Impact	Potentially affected watercourses		Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating	Control measures
		potential blockage or breakages.										must be inspected regularly for leaks. Spill kits must be readily available during works within the freshwater ecosystems.
	7	Ongoing AIP removal (where required).	• Compaction of soil and loss of habitat as a result of ongoing disturbance from vehicles and equipment; • Impacts to water quality as a result of the application of herbicides; and • Disturbance of soil which could lead to erosion.	All freshwater ecosystems		**7**	**4**	**28**	80%	**22,4**	**L**	1. Refer to control measures 1 to 3 of Activity 1 with regards to movement with the freshwater ecosystems; 2. Refer to control measures of Activity 5; 3. Ensure AIPs are managed throughout the operational lifetime of the project until suitable basal cover of indigenous vegetation is achieved; 4. It is considered imperative that all works pertaining to removal of AIPs be undertaken during the drier summer months to limit surface water contamination; 5. After AIPs have been removed, the soil surrounding these areas must be suitably loosened on completion of AIP removal and revegetated to prevent erosion; and 5. An annual follow up should be undertaken for at least 3 years post initial AIP clearance.
	8	Functioning of the freshwater ecosystems post-maintenance.	• No direct negative impacts perceived.	EDL		**-10**	**3**	**-30**	80%	**-24**	**+**	1. Monitoring of freshwater ecosystems, particularly after large rainfall events, is highly recommended. Any observed erosion must be immediately rectified.
				Artificial channel		**-8**	**2**	**-16**	60%	**-9,6**	**+**	
				Non-perennial River and associated CVB wetland		**-10**	**4**	**-40**	60%	**-24**	**+**	

In summary, potential direct impacts to the impacted reaches of the artificial channel and EDL, including increased sedimentation, changes in water quality, pattern and timing of water inflows are expected, as well as temporary habitat loss. It is therefore strongly recommended that the ecological buffer of these systems (particularly surrounding the in-stream dam associated with the EDL), be rehabilitated and revegetated with suitable indigenous plant species (both terrestrial and wetland plant species). Rehabilitation of the ecological buffer (where feasible considering the current operation of the golf course) would entail reinstatement of indigenous vegetation suitable for occasional inundation.

Indirect impacts or edge effects from the proposed periodic maintenance activities on the non-perennial river and associated CVB and downgradient reach of the EDL are possible due to the hydrological connectivity between the systems. These indirect impacts include sediment runoff into the downgradient freshwater ecosystems, dust generation and potential AIP seed dispersal which may be transported to the receiving downgradient freshwater ecosystems via runoff or wind dispersal. These activities are likely to have a Low risk significance on the functioning of the freshwater ecosystems due to the proposed periodic maintenance activities.

Should the control measures as provided in Table 6 above as well as additional “good practice” control measures applicable to a project of this nature as provided in Appendix H be implemented, the proposed periodic maintenance activities are expected to pose an overall low risk significance to the receiving freshwater environment. The long-term benefits of continued periodic maintenance of infrastructure associated with the golf course, including improvements to hydraulic connectivity and geomorphological processes, outweighs the short-term negative risk and is therefore supported by the specialist.

As the proposed activities will occur within the delineated extent of the freshwater ecosystems and the associated GN 4167 100 m and 500 m ZoR, a WUA will therefore need to be applied for in terms of Sections 21 (c) and (i) of the NWA prior to the commencement of any works.

5.3 *Impact Assessment*

The section presents the outcome of a pre-defined impact assessment undertaken as part of the NEMA EIA regulations, 2014 (as amended) process. Table 8 to Table 12 below present a summary of the expected impacts (direct and indirect) as part of the various phases (maintenance and operation / rehabilitation) and includes the impact assessment summary for the ‘no-go’ impacts and cumulative impacts. All general good housekeeping measures are provided in Appendix H. Based on the anticipated periodic maintenance activities proposed, it is assumed that with the exception of the non-perennial river and associated CVB wetland, all maintenance and rehabilitation activities will be undertaken within the freshwater ecosystems and associated 32 m ZoR.

The colour scheme presented in Table 7 was used to clarify the hierarchy of magnitude. Higher significance ratings were used to identify activities requiring focused mitigation and management interventions to reduce the impacts as far as possible.

Table 7: Colour scale used to qualify the hierarchy of severity for the various activities and aspects relating to each proposed impact.

Zero	Very Low	Low	Moderate	High

A description of the phases presented in the impact assessment is provided below:

- **Maintenance Phase:** This phase includes routine and ad-hoc maintenance activities within and adjacent to the freshwater ecosystems, including vegetation clearing, alien invasive plant removal, dam and infrastructure maintenance, erosion repairs, sediment and debris removal, and associated access requirements. Potential impacts are primarily related to temporary

disturbances to soils, hydrology, water quality, geomorphological processes and freshwater habitat;

- **Operational / Rehabilitation Phase:** This phase relates to the functioning and recovery of the freshwater ecosystems following periodic maintenance activities and includes ongoing alien invasive plant management, rehabilitation of disturbed areas and periodic monitoring and inspections. Although impacts associated with this phase are generally expected to be low and temporary, disturbances associated with maintenance access, vegetation management and rehabilitation works may result in localised soil disturbance, erosion and temporary impacts to water quality and habitat.

5.3.1 Impact 1: Modification of Hydrological Functioning and Water Quality

The proposed periodic maintenance activities have the potential to result in temporary modifications to hydrological functioning and water quality within the freshwater ecosystems. Vegetation clearing, sediment removal, erosion repairs and maintenance of in-stream dams may temporarily alter flow paths, flow velocities and local hydraulic conditions. Disturbance of soils and accumulated sediments may increase turbidity and suspended sediment concentrations, while the operation of machinery within or adjacent to the freshwater ecosystems may result in localised contamination from fuels, oils or other pollutants if not appropriately managed. Ongoing AIP removal and rehabilitation activities may also result in temporary water quality impacts associated with soil disturbance and, where applicable, herbicide application. These impacts are expected to be localised and short-term, provided that appropriate mitigation measures are implemented. Table 8 below provides a summary of the abovementioned potential impacts.

Table 8: Activities register leading to impact on hydrology and water quality.

Maintenance Phase	Operational / Rehabilitation Phase
Routine removal of excess vegetation within and along the freshwater ecosystems.	Ongoing AIP removal and follow-up control.
Removal of alien invasive vegetation within and along the freshwater ecosystems.	Rehabilitation and revegetation of disturbed areas.
General removal of litter, debris and excess sediment build-up within the freshwater ecosystems.	Monitoring of freshwater ecosystem recovery and functioning.
Basic upkeep and maintenance of in-stream dams, culverts, crossings and associated structures.	Periodic inspections and maintenance access.
Ad-hoc repair of localised bank erosion and erosion protection measures.	Maintenance of rehabilitated areas and erosion control structures.
Movement of personnel, machinery and vehicles within freshwater ecosystems and associated regulated areas.	
Temporary stockpiling of removed vegetation, sediment or debris.	

5.3.2 Impact 2: Changes to the Geomorphological Processes (Erosion and Sedimentation)

Maintenance activities may result in temporary changes to geomorphological processes through the disturbance of soils, vegetation and accumulated sediments within the freshwater ecosystems. Vegetation clearing, sediment removal, erosion repairs and maintenance of in-stream infrastructure may expose soils and increase susceptibility to erosion if not appropriately managed. Disturbance of channel banks and riparian/wetland areas may result in increased sediment mobilisation and localised sediment deposition within downstream reaches. While the objective of several maintenance activities is to improve channel stability and hydraulic functioning, temporary disturbances may occur during implementation. Rehabilitation activities are expected to reduce erosion potential and improve long-term geomorphological stability. Table 9 below provides a summary of the abovementioned potential impacts.

Table 9: Activities register leading to changes to the geomorphological processes and sedimentation.

Maintenance Phase	Operational / Rehabilitation Phase
Removal of excess vegetation within the freshwater ecosystems and ecological buffers.	Ongoing AIP removal and follow-up control.
Removal of alien invasive vegetation and associated root systems.	Rehabilitation and revegetation of disturbed areas.
Removal of accumulated litter, debris and excess sediment from channels and dams.	Monitoring and maintenance of erosion protection measures.
Ad-hoc repair of localised bank erosion.	Maintenance access within rehabilitated areas.
Maintenance and repair of in-stream dams, culverts and associated infrastructure.	
Vehicular and machinery access within freshwater ecosystems.	
Temporary stockpiling of sediment, vegetation and debris.	

5.3.3 Impact 3: Altered Freshwater Habitat and Impacts to Biota

Maintenance activities may result in temporary disturbances to freshwater habitat and aquatic biota through vegetation clearing, sediment removal, erosion repairs and maintenance of in-stream structures. Such activities may temporarily reduce available habitat, disturb feeding, breeding and refuge areas and increase noise and physical disturbance within the freshwater ecosystems. Disturbance of soils may also facilitate the proliferation of AIP species if not appropriately managed. Conversely, the removal of alien invasive vegetation, rehabilitation of disturbed areas and ongoing ecological maintenance are expected to improve freshwater habitat quality, increase indigenous vegetation cover and enhance habitat availability for aquatic and terrestrial biota over the longer term. Table 10 below provides a summary of the abovementioned potential impacts.

Table 10: Activities register leading to changes in freshwater habitat and impacts to biota.

Maintenance Phase	Operational / Rehabilitation Phase
Routine removal of excess vegetation within and along the freshwater ecosystems.	Ongoing AIP removal and follow-up control.
Removal of alien invasive vegetation within freshwater habitat.	Rehabilitation and revegetation of disturbed areas.
Removal of accumulated litter, debris and excess sediment.	Recovery and recolonisation of disturbed habitat.
Ad-hoc repair of localised bank erosion and erosion protection measures.	Monitoring of rehabilitation success and ecosystem recovery.
Maintenance of in-stream dams, culverts and associated infrastructure.	
Movement of personnel, machinery and vehicles within freshwater ecosystems.	
Temporary disturbance of freshwater and aquatic habitat during maintenance works.	

Table 11 and Table 12 below summarises the findings indicating the significance of the impacts of the proposed periodic maintenance activities with and without any management measures applied. All control measures as stipulated in Table 6 in Section 5.2 above are deemed applicable for the post-mitigation scoring.

Table 11: Summary scores rated for unmanaged and managed phases for the activities associated with the proposed periodic maintenance activities on the artificial channel.

UNMANAGED								MANAGED							
Extent	**Duration**	**Intensity**	**Magnitude**	**Probability**	**Status**	**Confidence**	**Significance**	**Extent**	**Duration**	**Intensity**	**Magnitude**	**Probability**	**Status**	**Confidence**	**Significance**
MAINTENANCE PHASE: Site preparation (where applicable), removal of excess vegetation, AIP, litter, debris and sediment from within and adjacent to freshwater ecosystems and temporary stockpiling thereof															
Impact on hydrological function and water quality															
Local	Short term	Low	Medium	Probable	**Neg (-)**	**Certain**	**Low**	Site-specific	Short term	Low	Medium	Probable	**Neg (-)**	**Certain**	**Low**
Impact to geomorphological processes (erosion and sedimentation)															
Local	Short term	Low	Medium	Probable	**Neg (-)**	**Certain**	**Low**	Site-specific	Short term	Low	Low	Probable	**Neg (-)**	**Certain**	**Very low**
Altered freshwater habitat and impacts to biota															
Local	Short term	Medium	High	Definite	**Neg (-)**	**Certain**	**Moderate**	Local	Short term	Medium	Medium	Definite	**Neg (-)**	**Certain**	**Low**
MAINTENANCE PHASE: Upkeep and maintenance of in-stream dams, culverts, crossings and associated structures, and ad-hoc repair of erosion and erosion protection measures (gabions), including potential concrete-works															
Impact on hydrological function and water quality															
Local	Short term	High	High	Probable	**Neg (-)**	**Certain**	**Moderate**	Local	Short term	Medium	Medium	Probable	**Neg (-)**	**Certain**	**Low**
Impact to geomorphological processes (erosion and sedimentation)															
Local	Short term	High	High	Probable	**Neg (-)**	**Certain**	**Moderate**	Local	Short term	Medium	Medium	Probable	**Neg (-)**	**Certain**	**Low**
Altered freshwater habitat and impacts to biota															
Local	Short term	Low	High	Probable	**Neg (-)**	**Certain**	**Moderate**	Local	Short term	Low	Medium	Probable	**Neg (-)**	**Certain**	**Low**
MAINTENANCE PHASE: Temporary disturbance of freshwater habitat and ecoservices as a result of the periodic maintenance activities															
Altered freshwater habitat and impacts to biota															
Local	Short term	Medium	Medium	Definite	**Neg (-)**	**Certain**	**Low**	Site-specific	Short term	Medium	Medium	Definite	**Neg (-)**	**Certain**	**Low**
OPERATIONAL / REHABILITATION PHASE: Ongoing AIP removal and control, rehabilitation and revegetation of disturbed areas and maintenance of rehabilitated areas and erosion control structures															
Impact on hydrological function and water quality															
Site-specific	Short term	Medium	Medium	Probable	**Neg (-)**	**Sure**	**Low**	Site-specific	Short term	Medium	Medium	Probable	**Neg (-)**	**Certain**	**Low**
Impact to geomorphological processes (erosion and sedimentation)															
Site-specific	Short term	Medium	Medium	Probable	**Neg (-)**	**Sure**	**Low**	Site-specific	Short term	Medium	Medium	Probable	**Neg (-)**	**Certain**	**Low**
Altered freshwater habitat and impacts to biota															
Site-specific	Long term	Medium	High	Definite	**Neg (-) but ultimately Pos (+)**	**Certain**	**Moderate**	Site-specific	Long term	Medium	Medium	Definite	**Neg (-) but ultimately Pos (+)**	**Certain**	**Moderate**
OPERATIONAL / REHABILITATION PHASE: Monitoring of freshwater ecosystem recovery and periodic inspections															
Impact on hydrological function and water quality															
Site-specific	Short term	Medium	Low	Definite	**Neg (-)**	**Sure**	**Low**	Site-specific	Long term	Low	Very Low	Probable	**Neg (-)**	**Certain**	**Very low**
Altered freshwater habitat and impacts to biota															
Site-specific	Short term	Medium	Low	Definite	**Neg (-)**	**Sure**	**Low**	Site-specific	Long term	Low	Very Low	Possible	**Neg (-)**	**Certain**	**Very low**

Table 12: Summary scores rated for unmanaged and managed phases for the activities associated with the proposed periodic maintenance activities on the EDL and non-perennial river.

UNMANAGED								MANAGED							
Extent	Duration	Intensity	Magnitude	Probability	Status	Confidence	Significance	Extent	Duration	Intensity	Magnitude	Probability	Status	Confidence	Significance
MAINTENANCE PHASE: Site preparation (where applicable), removal of excess vegetation, AIP, litter, debris and excess sediment from within and adjacent to freshwater ecosystems and temporary stockpiling thereof															
Impact on hydrological function and water quality															
Site-specific	Short term	Low	Medium	Probable	Neg (-)	Certain	Low	Site-specific	Short term	Low	Medium	Possible	Neg (-)	Certain	Low
Impact to geomorphological processes (erosion and sedimentation)															
Site-specific	Short term	Low	Low	Probable	Neg (-)	Certain	Very low	Site-specific	Short term	Low	Low	Possible	Neg (-)	Certain	Very low
Altered freshwater habitat and impacts to biota															
Site-specific	Short term	High	High	Definite	Neg (-)	Certain	Moderate	Site-specific	Short term	Medium	Medium	Possible	Neg (-)	Certain	Low
MAINTENANCE PHASE: Upkeep and maintenance of in-stream dams, culverts, crossings and associated structures, and ad-hoc repair of erosion and erosion protection measures (gabions), including potential concrete-works															
Impact on hydrological function and water quality															
Site-specific	Short term	Low	Medium	Probable	Neg (-)	Certain	Low	Site-specific	Short term	Low	Low	Possible	Neg (-)	Certain	Very low
Impact to geomorphological processes (erosion and sedimentation)															
Site-specific	Short term	Low	Medium	Probable	Neg (-)	Certain	Low	Site-specific	Short term	Low	Low	Possible	Neg (-)	Certain	Very low
Altered freshwater habitat and impacts to biota															
Site-specific	Short term	Low	Medium	Probable	Neg (-)	Certain	Low	Site-specific	Short term	Low	Low	Possible	Neg (-)	Certain	Very low
MAINTENANCE PHASE: Temporary disturbance of freshwater habitat and ecoservices as a result of the periodic maintenance activities															
Altered freshwater habitat and impacts to biota															
Local	Short term	High	High	Definite	Neg (-)	Certain	Moderate	Site-specific	Short term	Medium	Medium	Definite	Neg (-)	Certain	Low
OPERATIONAL / REHABILITATION PHASE: Ongoing AIP removal and control, rehabilitation and revegetation of disturbed areas and maintenance of rehabilitated areas and erosion control structures															
Impact on hydrological function and water quality															
Site-specific	Short term	Medium	Medium	Probable	Neg (-)	Certain	Low	Site-specific	Short term	Medium	Low	Probable	Neg (-)	Certain	Very low
Impact to geomorphological processes (erosion and sedimentation)															
Site-specific	Short term	Medium	Medium	Probable	Neg (-)	Certain	Low	Site-specific	Short term	Medium	Low	Probable	Neg (-)	Certain	Very low
Altered freshwater habitat and impacts to biota															
Site-specific	Long term	Medium	High	Definite	Neg (-) but ultimately Pos (+)	Certain	Moderate	Site-specific	Long term	Medium	Medium	Definite	Neg (-) but ultimately Pos (+)	Certain	Moderate
OPERATIONAL / REHABILITATION PHASE: Monitoring of freshwater ecosystem recovery and periodic inspections															
Impact on hydrological function and water quality															
Site-specific	Short term	Low	Low	Definite	Neg (-)	Sure	Very low	Site-specific	Short term	Low	Very Low	Probable	Neg (-)	Certain	Very low
Altered freshwater habitat and impacts to biota															
Site-specific	Short term	Low	Low	Definite	Neg (-)	Sure	Very low	Site-specific	Short term	Low	Very Low	Possible	Neg (-)	Certain	Very low

Based on the above assessment, with the implementation of the control measures provided in Table 6 above, the proposed periodic maintenance activities pose an overall negative low impact on the ecological integrity of the freshwater ecosystems associated with the study area, as well as the non-perennial river downgradient of the study area within the investigation area. Long term positive impacts are anticipated as a result of the rehabilitation of the freshwater ecosystems, particularly with the in-stream dam associated with the EDL. Additional “good practice” measures applicable to a project of this nature are provided in Appendix H of this report.

Following the completion of the rehabilitation measures, only long term positive cumulative impacts to these freshwater ecosystems may occur if the AIP Management and Rehabilitation Plan is well executed and ongoing maintenance ensured.

Although the proposed maintenance activities are located within 32 m of the identified freshwater ecosystems, as no listed activities as contained within the EIA Regulations of 2014 are triggered (as the proposed development is for maintenance activities only), no EA is required, on the assumption that the MMP on which this project is based, is adopted by DEA&DP.

5.4 *Cumulative Impacts*

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified in Sections 5.2 and 5.3 above. Wetlands and riparian habitats within the greater region are under continued threat due to ongoing urban expansion in the surrounding landscape.

Indirect impacts identified with the proposed periodic maintenance activities involve potential further encroachment of AIPs in freshwater ecosystems due to the disturbances associated with maintenance activities, as well as increased erosion, incision and sedimentation of the systems. Direct impacts to the freshwater ecosystems are also expected, as the proposed periodic maintenance activities will be undertaken within the delineated extent of the systems (with specific reference to the artificial channels and in-stream dam associated with the EDL). Edge effects associated with periodic maintenance activities within the ecological buffers are not considered substantial enough to contribute to the ongoing loss of freshwater ecosystems, provided the recommended control measures are applied and that the impacted reaches of the freshwater ecosystems are rehabilitated, where feasible.

According to the DWS RQS database, the greater catchment in which the study area is located indicates that several sensitive aquatic macro-invertebrate taxa and at least three threatened fish species, Cape galaxias (*Galaxias zebratus*), Cape kurper (*Sandelia capensis*) and Mozambique tilapia (*Oreochromis mossambicus*), are expected to occur within the freshwater ecosystems. Field verification confirmed the presence of only introduced fish within the impoundments. The study area was found to be largely irrelevant to supporting indigenous fish from within the catchment area. Although a population of *Oreochromis mossambicus* is present within the impoundments, it is assumed that individuals were introduced. While sensitive aquatic macro-invertebrate taxa were not sampled within the reaches of the freshwater ecosystems associated with the study area, the proposed periodic maintenance activities hold the potential to contribute to the degradation of the freshwater ecosystem habitats in the greater catchment, thereby impacting aquatic macro-invertebrate taxa, and fish and frog species composition. However, this is considered highly unlikely considering the actual footprint of the periodic maintenance activities within the freshwater ecosystems is anticipated to be limited to the artificial channel and in-stream dams, assuming that periodic maintenance activities will be undertaken during the drier, low flow season. Thus, with implementation of the control measures outlined in Section 5.2 above, any potential impacts can be acceptably reduced. Future development in the greater area should, however, consider the ecological importance of the freshwater ecosystems within the catchment to prevent significant negative impacts to the aquatic macro-invertebrate taxa, fish and frog species composition.

With rehabilitation of the impacted reaches of the freshwater ecosystem following periodic maintenance activities including the removal of existing AIP and revegetation with indigenous plant species, the PES and ecoservice provision of the freshwater ecosystems can at minimum be maintained, as per the REC and RMO.

6 CONCLUSION

FEN Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the WUA process and MMP in terms of the NEMA for the proposed general periodic maintenance of the watercourses on Steenberg Estate and Golf Course, Constantia, Western Cape Province. During the assessment undertaken in May 2026, an EDL, artificial channel and non-perennial river with associated CVB wetland were identified in association with the study area.

The PES and EIS of these freshwater ecosystems were ascertained, and the results of the ecological assessment as discussed in Section 3 of this report are summarised in the table below:

Table 13: Summary of results of the field assessment as discussed in Section 3.

Freshwater ecosystems	PES	Ecoservices	EIS	Recommended Ecological Category (REC) and Recommended Management Objectives (RMO)
EDL	Category C (Moderately modified)	Moderate	Moderate	REC: C RMO: Maintain
Extent of modification	**Low** The rehabilitation and maintenance of the in-stream dam is not anticipated to significantly modify the EDL if undertaken during the low flow season. Conversely, the rehabilitation of the dam is anticipated to improve the condition from a vegetation perspective, particularly through AIP management and control. With the implementation of appropriate control measures outlined in this report, further modification of the EDL is expected to remain low.			
Artificial channel	Category D/E (largely to seriously modified)[1]	Low	Low	-
Extent of modification	Low The anticipated extent of modification to the artificial channel network as a result of the proposed periodic maintenance activities is considered low. Significant impacts to the system are not expected, largely due to the artificial nature of the system. Nevertheless, minor alterations to the hydrological and geomorphological functioning of the system may occur as a consequence of proposed periodic maintenance activities.			
Non-perennial river (Prinseskasteel Stream) and associated CVB wetland	Category C (Moderately modified)	Moderate	Moderate to High	REC: C RMO: Maintain
Extent of modification	**Low** The anticipated extent of modification to the river system is considered low, based on the assumption that the outlet structure from the golf course to the river is not replaced. Significant impacts to the river and associated CVB wetland are not expected, largely due to the buffering and attenuation functions provided by the upstream artificial channel network and associated impoundments. Nevertheless, minor alterations to the hydrological and geomorphological functioning of the system may occur. These impacts may include slight changes to the timing, volume, and distribution of surface water inflows to the river system as well as potential water quality (through sedimentation) impacts.			

1 - An IHI assessment was not undertaken for the artificial channel due to its artificial nature; instead the PES was inferred from the outcome of the EIS, EcoService provision and diatom community assessments for this system.

The results of the National Screening Tool (2022; accessed 2026) indicates that the entire study area and investigation area is within areas indicated as being of 'Very High' aquatic biodiversity sensitivity. The sensitivities of the freshwater ecosystems indicated by the Screening Tool are supported, based on the outcome of the site investigation. The exception is the artificial channel which is considered to be of 'Moderate' aquatic biodiversity sensitivity.

The DWS Risk Assessment Matrix (2023) was applied to the freshwater ecosystems to ascertain the perceived significance of risk posed to the receiving freshwater environment by the proposed periodic maintenance activities. The outcome of the risk assessment indicates that the proposed activities pose a 'Low' risk significance to the freshwater ecosystems. It is imperative that appropriate controls are implemented when undertaking the required periodic maintenance activities. An Impact Assessment was also undertaken using methodology provided by the EAP. Based on the assessment, the proposed periodic maintenance activities pose an overall negative low impact on the ecological integrity of the freshwater ecosystems associated with the study area, as well as the non-perennial river downgradient of the study area within the investigation area. The long-term benefits of continued periodic maintenance of infrastructure associated with the golf course, including improvements to hydraulic connectivity and geomorphological processes, outweighs the short-term negative risk/ impact and is therefore supported by the specialist.

With strict enforcement of the control measures as provided in this document, specifically control measures for the anticipated temporary instream diversion and concrete works, the significance of impacts arising from the various phases of the proposed periodic maintenance activities can be effectively reduced and managed. Furthermore, it is imperative that targeted rehabilitation of the freshwater ecosystems and associated ecological buffers (particularly of the in-stream dam associated with the EDL), is undertaken to maintain and prevent a reduction of the PES of these systems as a result of the proposed periodic maintenance activities.

Authorisation in terms of Sections 21 (c) and (i) of the NWA must be obtained from the DWS for the proposed periodic maintenance activities prior to the commencement of any works. With guidance from the freshwater specialist and the relevant authorisation obtained from the competent authority, the proposed periodic maintenance activities within the freshwater ecosystems can be deemed acceptable, on the strict condition that preventative and rehabilitative measures are planned and implemented as part of the authorisation of the proposed periodic maintenance activities. Although maintenance activities will be undertaken within 32 m of the identified freshwater ecosystems, should the MMP for the proposed maintenance activities be adopted by the DEA&DP, EA would not need to be applied for. It is the reasoned opinion of the freshwater specialist that the development can be considered environmentally acceptable and can be granted authorisation, provided that the control measures as detailed in this report are adhered to.

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Appendix A : Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and FEN Consulting (Pty) Ltd and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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Appendix B : Legislative Requirements

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive normalization of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
National Water Act , 1998 (Act No. 36 of 1998) as amended (NWA)	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) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) 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 parameters and process of a General Authorisation (GA), which replaces the need to apply for a 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 need to determine the regulated area of a watercourse, as well as the degree of risk posed by an activity/ies related to a particular water use. In accordance with GN 4167 of December 2023, the regulated area of a watercourse for Section 21c and 21i of the NWA, 1998 is defined as: a) 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; b) 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 c) In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans. The GA 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 GA also does not apply where other Section 21 water uses are triggered, does not apply for most sewage infrastructure and pipelines carrying hazardous materials, water uses associated with hazardous materials, water uses associated with water and wastewater treatment works, and for most mining-related water uses.

	The GA may be exercised as follows: i) Section 21(c) or (i) water use activities that are determined to pose a LOW Risk as determined through the application of the Risk Matrix as prescribed in the Notice can be undertaken subject to the general conditions of the GA; ii) Section 21(c) or (i) water use activities set out in Appendix D1 of the Notice can be undertaken without being subject to the requirement of a risk assessment and subject to the general conditions of the GA. Such water use activities in Appendix D1 include inter alia emergency river crossings, fence erection, solar renewable infrastructure that has no direct impact on watercourses and mini-scale hydropower developments; iii) Prescribed water use activities undertaken by certain State Owned Entities as detailed in Appendix D2 of the Notice can be undertaken without being subject to the requirement of a risk assessment and subject to the general conditions of the GA; iv) Maintenance work associated with an existing lawful water use in terms of Section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix can be undertaken; v) River and stormwater management activities including maintenance of infrastructure as contained in a river management plan or similar management plan, may be conducted subject to the approval of such a plan by the relevant DWS regional office or catchment management agency; vi) Rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix can be conducted; and vii) Emergency work arising from an emergency situation and or incident associated with the persons' existing lawful water use entitlement can be undertaken, provided that all work is executed and reported in the manner prescribed in the Emergency protocol contained in Appendix C of the Notice. A GA issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence with the water use as contemplated in the GA.

Appendix C : Findings of the Desktop Analysis

Appendix C1: Ecological Importance and Sensitivity of the Study Area Based on National and Provincial Datasets

The following table contains data accessed as part of the desktop assessment and presented as a "dashboard-style" report below (Table C-1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place. Where required, further discussion and interpretation are provided.

It is important to note that although all data sources used to provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics at the scale required to inform the applicant of any potential environmental authorisation and/or water use authorisation processes that may be needed. Given these limitations, this information is considered useful as background information to the study and is important in legislative contextualisation of the risks and impacts and was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the field survey. It must, however, be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site-verified information must carry more weight in the decision-making process. Actual site conditions at the time of the assessment may differ to the background information provided by various datasets, primarily due to issues of scale of data capture. This potential discrepancy does not lower the confidence of this assessment, as the background data are used as supporting information and the results of the site assessment are based on more accurate site analysis.

Table C-1: Desktop data relating to the characteristics of the freshwater ecosystems associated with the study area and associated investigation area (Quarter Degree Square 3418AB).

Aquatic ecoregion and sub-regions in which the investigation area is located		**Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database**	
Ecoregion	Southern Folded Mountains	FEPACODE	The study area and associated investigation area is not located in a sub-quaternary catchment considered of importance as freshwater ecological priority areas.
Catchment	Berg/Bot/Potberg		
Quaternary Catchment	G22D	Wetland Vegetation Type (Figure C-1)	The majority of the study area and associated investigation area are located within the Southwest Sand Fynbos wetland vegetation (WetVeg) type, which is considered to be critically endangered (CR) according to Mbona *et al.* (2015). The remaining southeastern portion of the study area, as well as the western and southern portions of the investigation area are located within the Southwest Granite Fynobs WetVeg type, while the remaining southern portion of the investigation area is located within the Southwest Sandstone Fynbos WetVeg type. The former WetVeg type is considered CR while the latter is considered to be endangered (EN), according to Mbona *et al.* (2015).
WMA	Berg		
subWMA	Greater Cape Town		
Dominant characteristics of the Ecoregion Level II (Kleynhans *et al.* 2007)			
Code	19.03		
Dominant primary terrain morphology	Closed hills, mountains, moderate and high relief, low mountains.		
Dominant primary vegetation types	Mountain fynbos, Sand plain fynbos, West coast Renosterveld, Dune Thicket.	NFEPA Wetlands (Figure C-2)	According to the NFEPA database, no natural wetlands are indicated to occur within the study area and associated investigation area. However, seven artificial Unchannelled valley-bottom (UCVB) wetlands are indicated to occur in the study area and one artificial channelled valley-bottom (CVB) wetland is indicated to occur in the southwestern portion of the investigation area.
Altitude (m a.m.s.l)	0 - 700		
Mean Annual Precipitation (mm)	500 - 1000		
Coefficient of Variation (% of MAP)	<20 - 30	NFEPA Rivers (Figure C-2)	As per the NFEPA database (2011), no rivers are indicated to occur within the study and investigation areas. However, the Silvermine River is indicated south of the investigation area in another quaternary catchment.
Rainfall concentration index	30 - 50		
Rainfall seasonality	Winter		
Mean annual temp. (°C)	14 - 18	**National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) Rivers, Artificial Wetlands, and National Wetland Map 6 (2024) (Figure C-3)**	
Winter temperature (July)	6 - 10	According to the NBA Rivers database, no rivers are indicated to occur within the study and investigation areas. According to the National Wetland Map 6 Database, no natural wetlands are indicated to occur within the study area. Multiple natural CVB wetlands are indicated to occur in the northern and eastern portions of the investigation area. Multiple seep wetlands are indicated to occur in the southeastern portion of the investigation area, and a small seep wetland is indicated to occur in the southwestern portion of the investigation area. The systems are indicated to be in a moderately to largely modified (PES C/D) ecological condition, while the Ecological Threat Status (ETS) and Ecological Protection Level (EPL) of all wetlands are unknown. According to the artificial wetlands database, the artificial UCVB and CVB wetlands identified by the NFEPA database are indicated to be dams.	
Summer temperature (Feb)	22 - 26		
Median annual simulated runoff (mm)	200->250		
Strategic Water Source Areas for Surface Water (SWSA) (2021)		**Importance according to the City of Cape Town (CoCT) Biodiversity Network (2023) (Figure C-4 and Figure C-5)**	
Surface water SWSAs are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. The SWSA for groundwater reflect areas that have high groundwater recharge and where the groundwater forms a nationally important resource. The database developed jointly by the Mpumalanga Tourism and Parks Agency (MTPA) and the Council for Scientific and Industrial Research (CSIR) (Lötter, M.C. and Le Maitre, D., 2021) was consulted for surface water, while the Water Research Commission (WRC) developed			

database (Le Maitre, D.C. et al., 2017) was consulted for the groundwater SWSAs.

According to the SWSA databases, the entire study area and investigation area are located within the Table Mountain surface water SWSA, and is located within the Cape Peninsula and Cape Flats groundwater SWSAs.

Detail of the area in terms of the Land Type Data (Job *et al.,* 2019) (Figure C-6)

The potential presence of wetlands in the vicinity of the study and investigation areas can be examined in the context of the land type for the area. The northern portions of the study and investigation areas are located within the Ga6 land type grouping. The central portions of the study and investigation areas are located within the Bc58 land type grouping, and the remaining southern portion of the investigation area is located within the Ib93 land type grouping.

- Bc represents Land Types where eutrophic red soils are widespread. Bc and Bd Land Types are generally located in the west and in the western areas where Quaternary windblown sands are present;
- Ga Land Types are intended to accommodate parts of South Africa where podzols occur. After subtracting exposed rock, the areas covered by Lamotte or Houwhoek soils exceeds 10% of the land surface, provided the areas covered by these soils exceeds that of Aa-Ai, Ba-Bd, Ca, Da-Dc, Ea, Ib or Ic Land Types. Land may qualify for inclusion in Ga or Gb Land Types even though the area covered by Lamotte and Houwhoek soils is less than the soils characteristic of the Fa-Fc, Ha, Hb and Ia Land Types. Ga and Gb Land Types are restricted to the Southern and Western Cape coastal areas; and
- Ib landtype groupings are areas where 60-80% of the surface is occupied by exposed rock and stones/boulders and the slopes are usually steep. The rest of the area comprises mostly shallow soils, directly underlain by hard or weathered rock.

The CoCT BioNet Dataset (2023) indicates eleven Other Ecological Support Area (OESA) within the study area and one OESA within the southwestern portion of the investigation area. Three Critical Ecological Support Areas (CESA) are indicated to occur in the northern portion of the investigation area and eight CESA are indicated to occur in the southern portion of the investigation area. According to the CoCT wetlands and watercourses dataset (2023), ten Sand Fynbos depression wetlands are indicated to occur within the study area, and a Sand River Catchment River is indicated to bisect the study and investigation areas. According to the City of Cape Town database (CityMaps, 2026), the Sand River Catchment watercourse is referred to as the 'Prinseskasteel Stream'.

Critical Biodiversity Areas are High ranking "natural or semi-natural" wetlands within each type (top quarter of total scores = CBA1 (rank 1); second quarter = CBA2 (rank 2)). CBA2s are restorable irreplaceable sites, which are needed for biodiversity targets but not for management consolidation, connectivity or viability of priority Biodiversity Network sites.

CESAs are high ranking artificial wetlands or middle ranking natural or semi-natural wetlands that are not considered important for connectivity or as support areas for wetlands classified as CBAs. CBA and CESA wetlands should be managed as close to natural or near natural states as possible.

OESAs are transformed (e.g. extensive agriculture) sites with conservation importance for ecological function, faunal movement and viability of CBAs biodiversity elements. This includes canalised rivers and wetlands in poor ecological condition. OESAs can contain other natural areas (mostly degraded) located in an extensive or intensive agricultural matrix as the dominant land use.

National web based environmental screening tool (2020) (Accessed 2026) (Figure C-7)

The screening tool is intended for pre-screening of sensitivities in the landscape for assessment within the EIA process and assists with implementing the migration hierarchy, allowing developers to adjust their proposed development footprint to avoid sensitive areas.

The study area and the associated investigation area are considered to be of **very high aquatic biodiversity sensitivity** by the screening tool. The sensitivity features triggering the very high sensitivity for the study and investigation areas are:

- Being within the **Table Mountain SWSA;** and
- Being within **Wetlands** (CVBs, depressions and seeps).

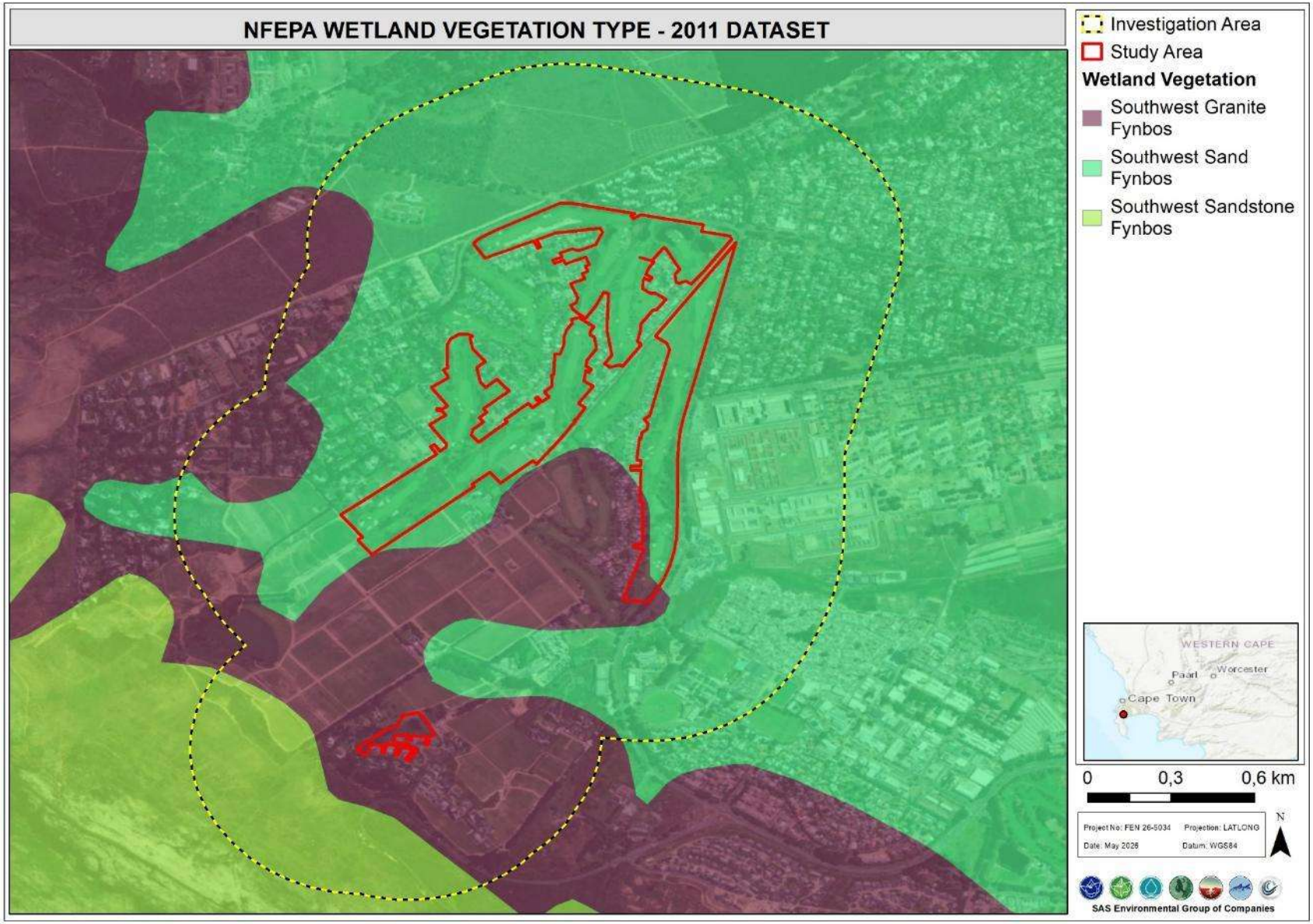


Figure C-1: Wetland vegetation types associated with the study and investigation areas as indicated by the NFEPA database (NFEPA, 2011).

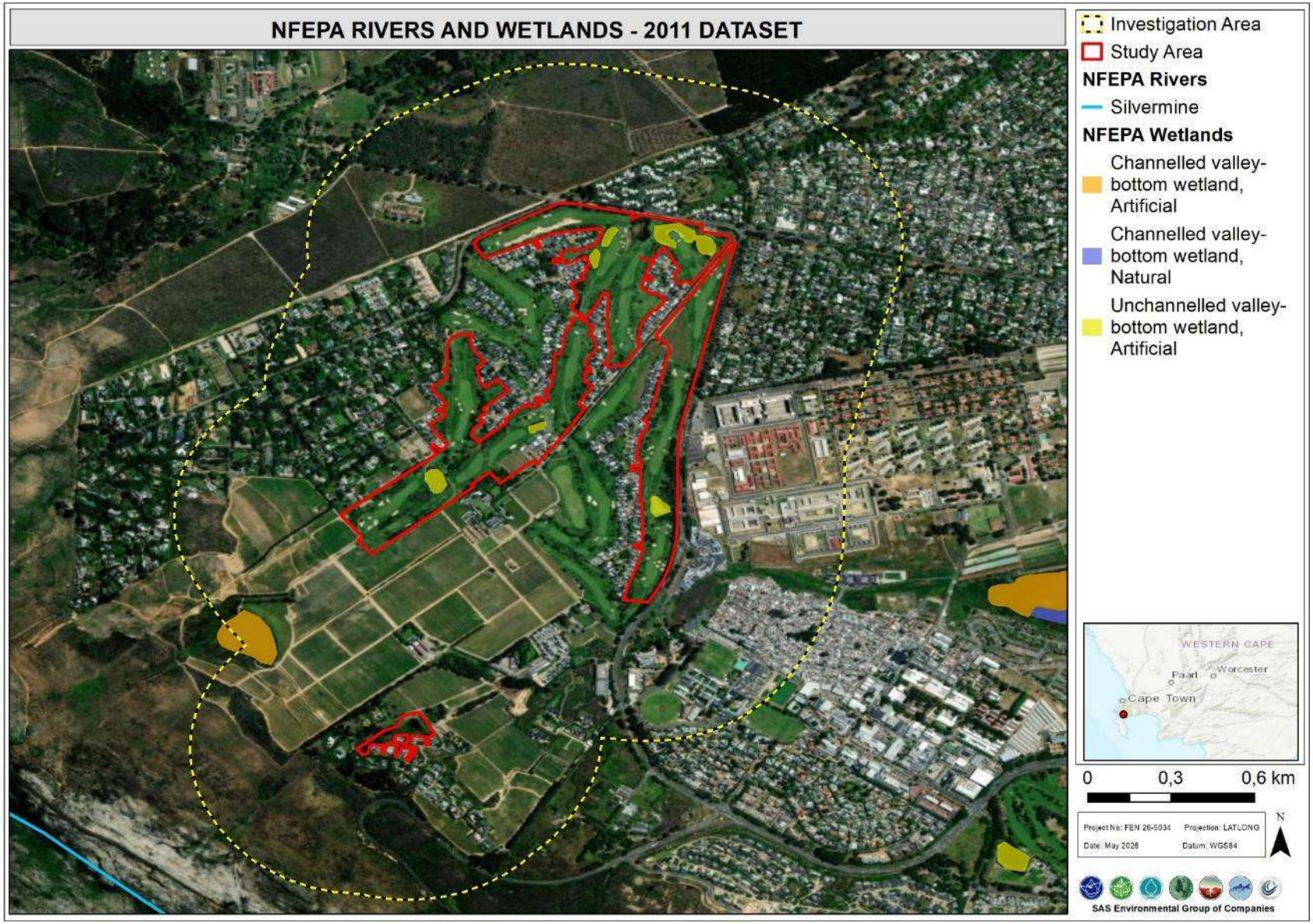


Figure C-2: NFEPA listed rivers and wetlands associated with the study and investigation areas as indicated by the NFEPA database (NFEPA, 2011).

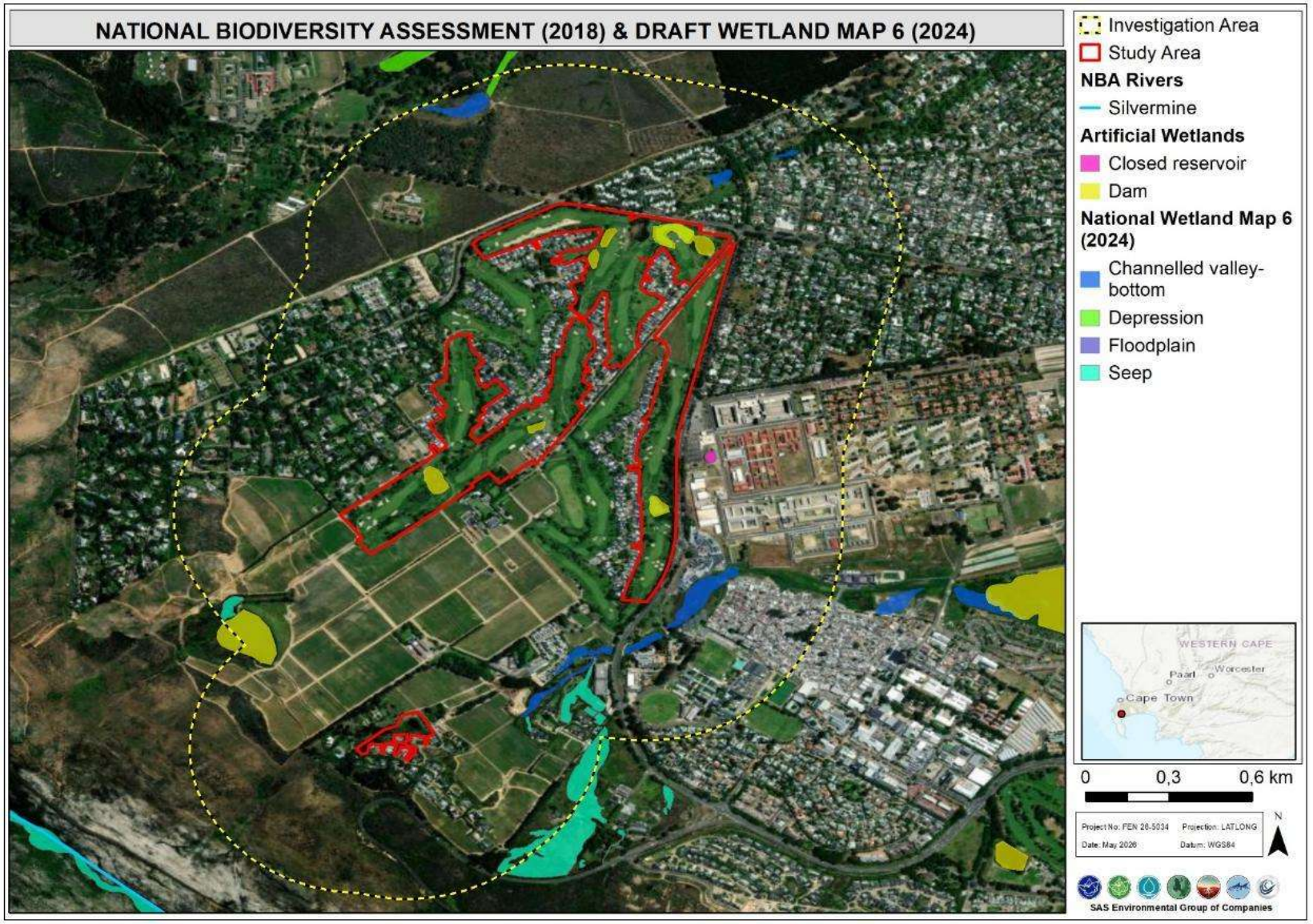


Figure C-3: Different hydrogeomorphic (HGM) units associated with the study and investigation areas according to the National Biodiversity Assessment (NBA, 2018) and draft National Wetland Map 6 (2024).

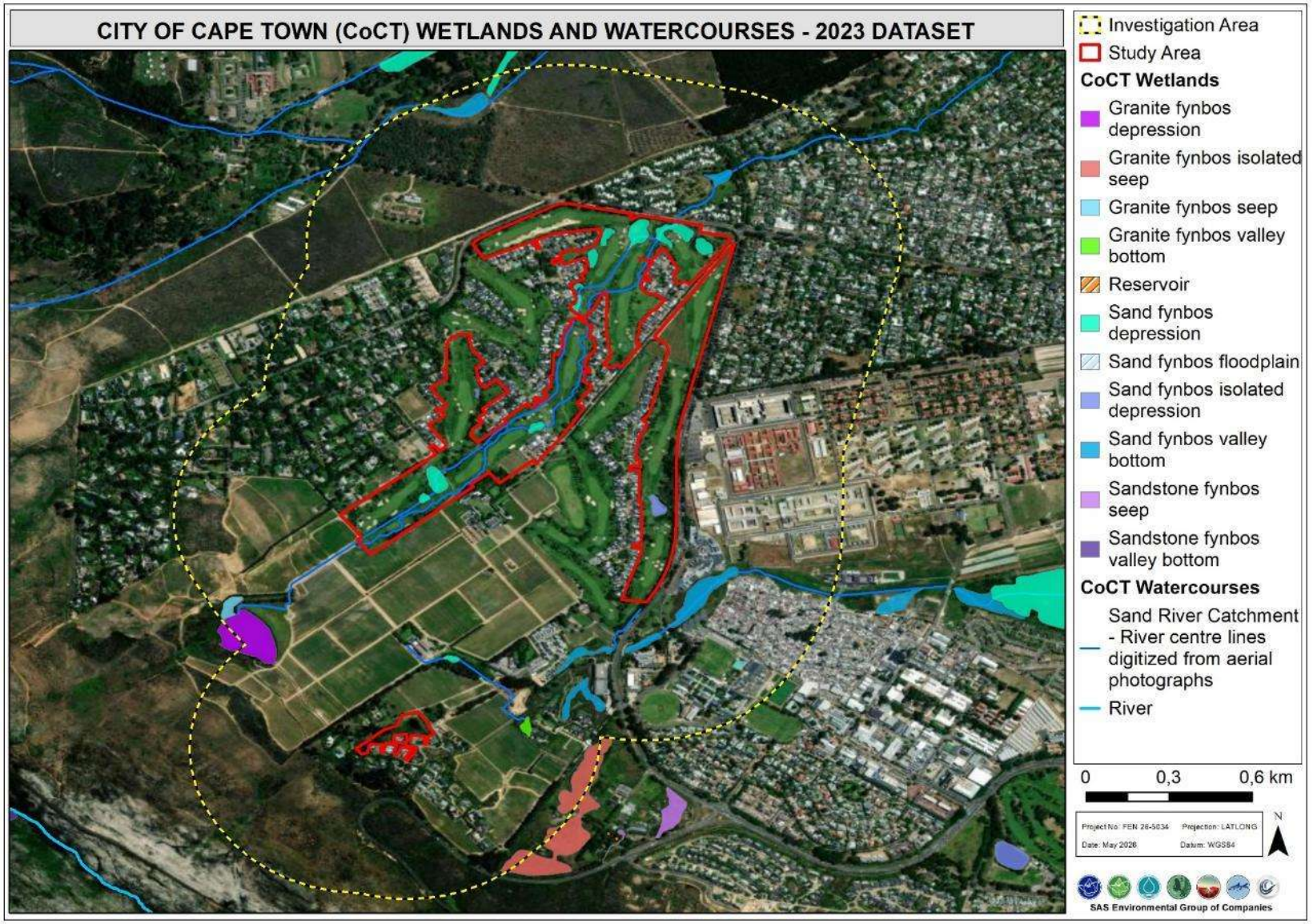


Figure C-4: Different hydrogeomorphic (HGM) units associated with the study and investigation areas according to the City of Cape Town Biodiversity Network (2023).

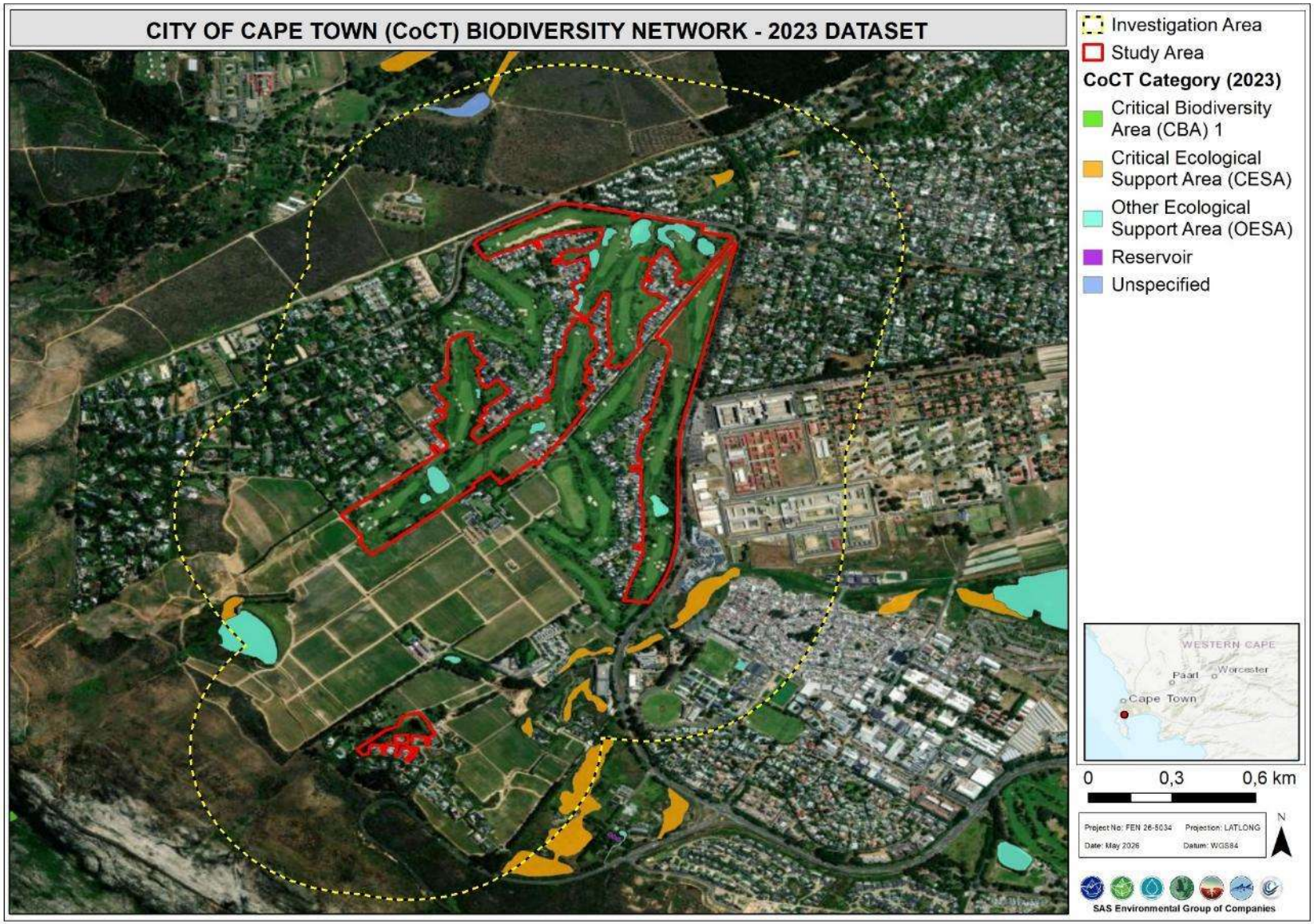


Figure C-5: Areas of ecological importance associated with the study and investigation areas as indicated by the City of Cape Town Biodiversity Network (2023).

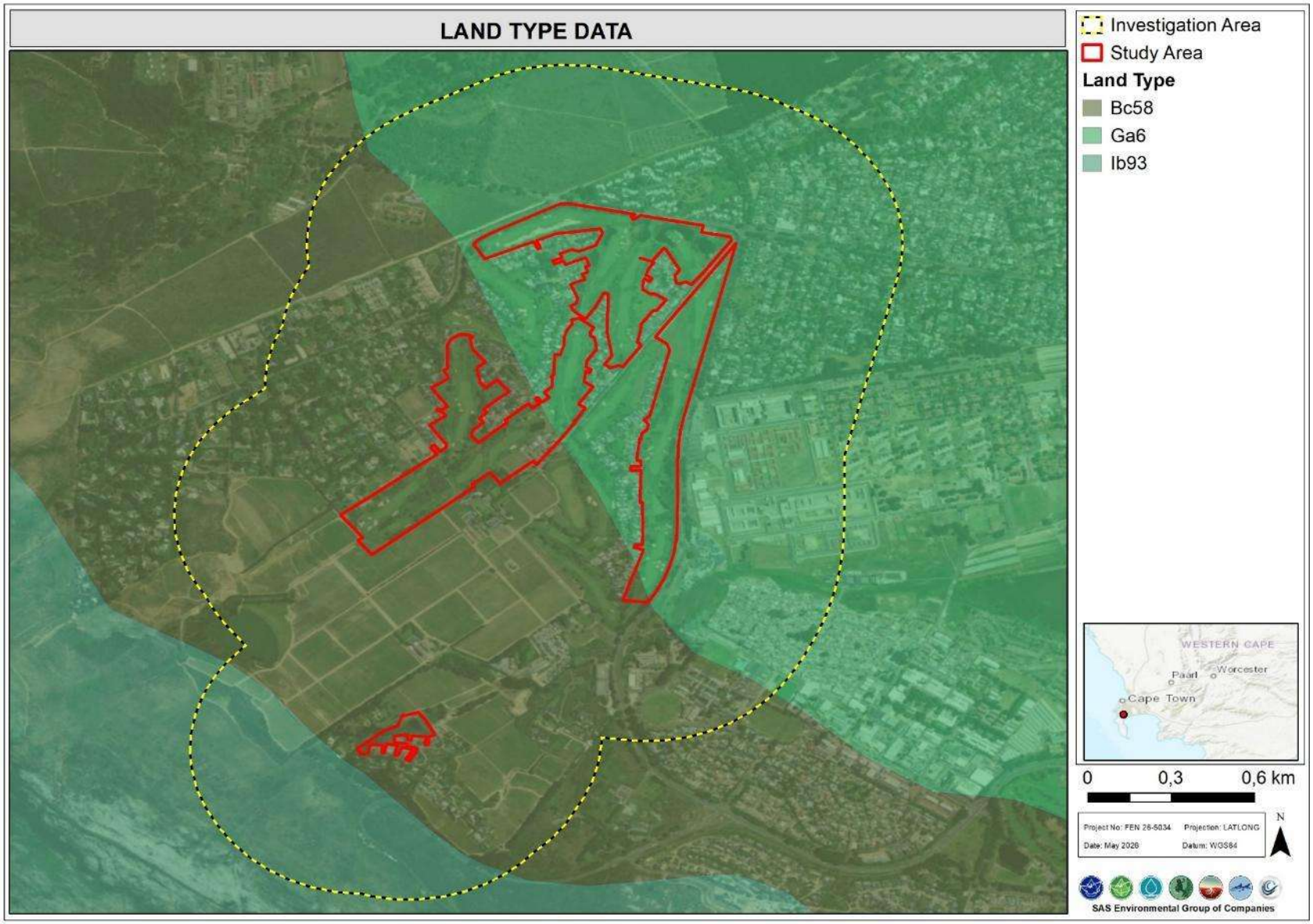


Figure C-6: Land type data associated with the study and investigation areas.

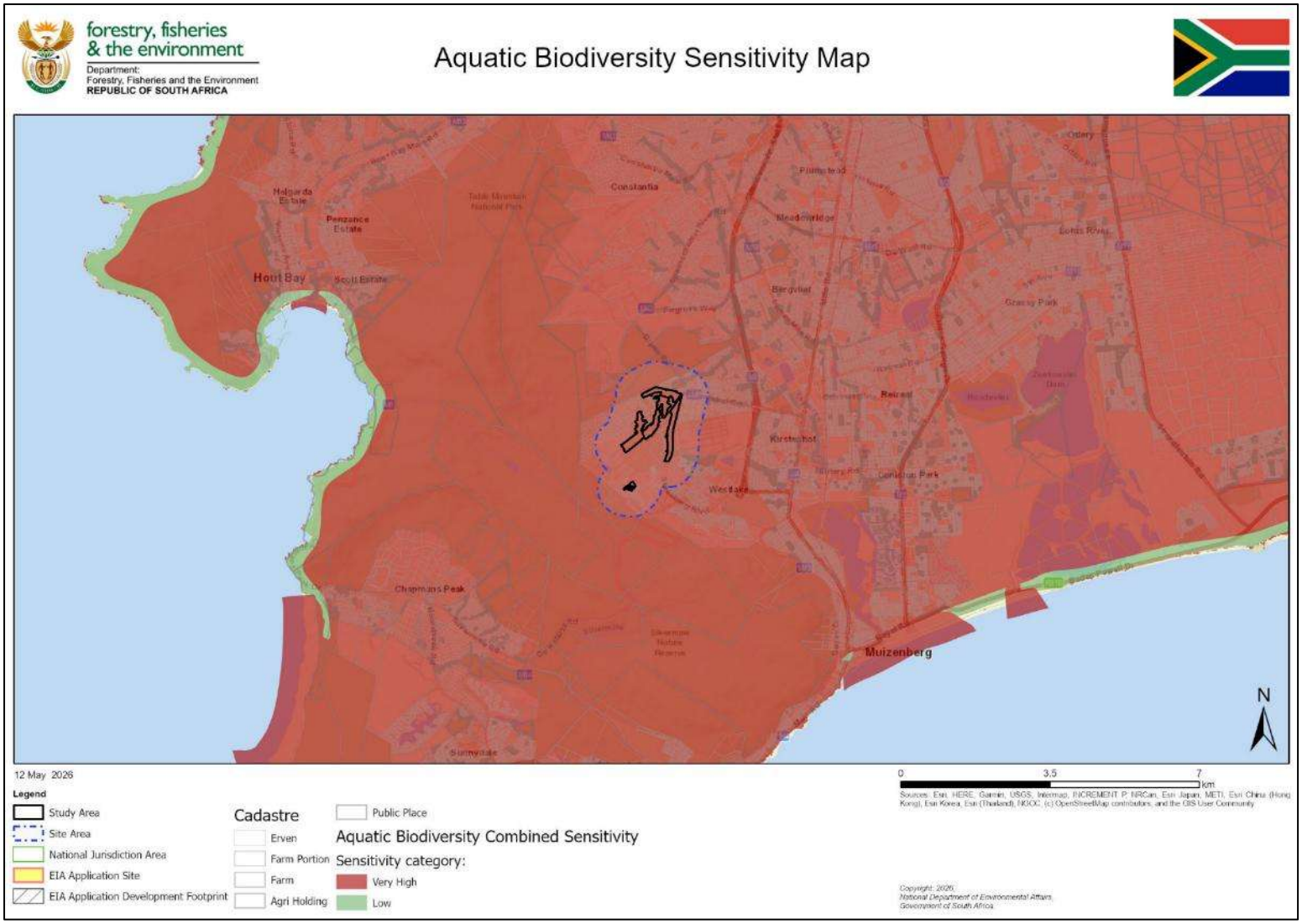


Figure C-7: Map of relative aquatic biodiversity according to the Department of Forestry, Fisheries and Environment (DFFE) Screening Tool, indicating 'very high' sensitivity within the study area (black line) and investigation area (blue dashed line).

Appendix C2: Ecological Status of Sub-Quaternary Catchments [Department of Water and Sanitation (DWS) Resource Quality Services (RQS) PES/EIS Database]

The PES/EIS database, as developed by the DWS Resource Quality Service (RQIS) department, was utilised to obtain additional background information on the project area. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as the South Africa River Health Programme (SA RHP) sites, Ecological Water Requirements (EWR) sites and Hydro Water Management System (WMS) sites.

Key information on invertebrates and background conditions associated with the SQR G22D-09294 (Keysers River) located ~2.1 km downstream of the study area as contained in this database and pertaining to the PES and EIS are tabulated in Tables C-2 and C-3 and visually presented in Figure C-8 that follows. The SQR monitoring point is located ~3 km southeast and downgradient of the study area, but hydrologically connected.

The Ecological Importance (EI) data for the SQR G22D-09294 (Keysers River) indicates the following fish species are expected to occur within the system, namely:

- *Galaxias zebratus* (Cape galaxias);
- *Sandelia capensis* (Cape kurper); and
- *Oreochromis mossambicus* (Mozambique Tilapia).

Although indicated as EN, according to SANBI (2025)[2], a morphological taxonomic revision and genetic study of the *Galaxias* species complex is underway; until such time as the study is complete, the conservation status of the taxa cannot be accurately determined.

Table C-2: Aquatic macro-invertebrates previously collected from or expected at the SQR G22D-09294 (Keysers River) monitoring point. Invertebrates in bold are taxa with moderate and high water quality preferences.

Aquatic macro-invertebrates		
Aeshnidae	***Elmidae***	*Nepidae*
Ancylidae	***Gerridae***	*Notonectidae*
Baetidae 1 Sp	*Gomphidae*	***Notonemouridae***
Baetidae 2 Sp	*Gyrinidae*	*Oligochaeta*
Belostomatidae	***Helodidae***	*Physidae*
Caenidae	*Hirudinea*	*Planorbinae*
Ceratopogonidae	***Hydracarina***	*Pleidae*
Chironomidae	***Hydropsychidae 1 Sp***	*Potamonautidae*
Coenagrionidae	*Leptoceridae*	*Simuliidae*
Corixidae	*Libellulidae*	*Tabanidae*
Culicidae	*Lymnaeidae*	*Turbellaria*
Dryopidae	*Muscidae*	***Veliidae/Mesoveliidae***
Dytiscidae	*Naucoridae*	

[2] https://speciesstatus.sanbi.org/assessment/last-assessment/061/ retrieved 4th May 2025.

Table C-3: Summary of the ecological status of the SQR reach associated with the study and investigation areas based on the DWS RQS PES/EIS database (sample location indicated in Figure C-8).

DWS RQIS PESEIS Database	G22D-09294 (Keysers River)
Synopsis	
PES Category Median	Largely Modified
Mean EI class	Moderate
Mean ES class	High
Length	7.27
Stream order	1
Default EC[4]	B (High)
PES Details	
Instream habitat continuity MOD	Large
RIP/wetland zone continuity MOD	Serious
Potential instream habitat MOD activities	Large
Riparian/wetland zone MOD	Large
Potential flow MOD activities	Large
Potential physico-chemical MOD activities	Serious
EI Details	
Fish spp/SQ	3
Fish average confidence	5
Fish representivity per secondary class	Low
Fish rarity per secondary class	Very high
Invertebrate taxa/SQ	38
Invertebrate average confidence	4.03
Invertebrate representivity per secondary class	High
Invertebrate rarity per secondary class	High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Very high
Habitat diversity class	Very high
Habitat size (length) class	Low
Instream migration link class	Moderate
Riparian-wetland zone migration link	Low
Riparian-wetland zone habitat integrity class	Moderate
Instream habitat integrity class	Moderate
Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	Very low
Riparian-wetland natural vegetation rating based on expert rating	High
ES Details	
Fish physical-chemical sensitivity description	Moderate
Fish no-flow sensitivity	Moderate
Invertebrates physical-chemical sensitivity description	Very high
Invertebrates velocity sensitivity	Very high
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	Very high
Stream size sensitivity to modified flow/water level changes description	High
Riparian-wetland vegetation intolerance to water level changes description	Very low

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;
[2] EI = Ecological Importance;
[3] ES = Ecological Sensitivity
[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

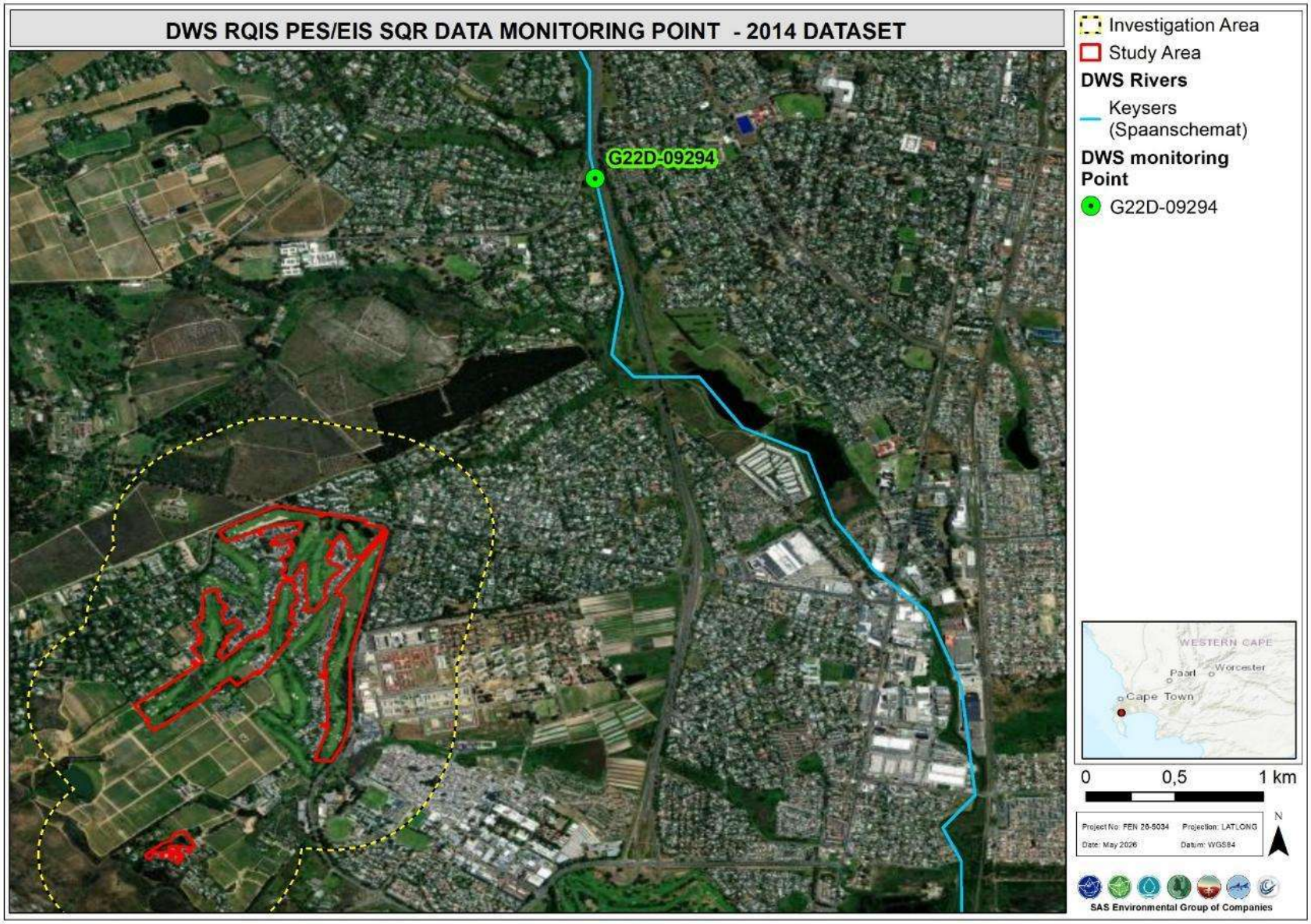


Figure C-8: Relevant Sub-Quaternary Catchment Reach (SQR) in the vicinity of the study and investigation area.

Appendix D : Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the freshwater ecosystems and drainage line features present in close proximity of the proposed development are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1. National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland feature present in the vicinity of the proposed development.

1.2. Department of Water and Sanitation (DWS) Resource Quality Information Services Present Ecological State / Ecological Importance and Sensitivity (PES/EIS) Database (2014)

The PES/EIS database as developed by the DWS RQIS department was utilised to obtain background information on the project area. The PES/EIS database has been made available to consultants since mid-August 2014. The information from this database is based on information at a sub-quaternary catchment reach (subquat reach) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as SA RHP sites, EWR sites and Hydro WMS sites. The results obtained serve to summarise this information as a background to the conditions of the freshwater ecosystem associated with the proposed development.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All wetland or riparian features encountered within the investigation area was assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis *et al*., 2013). A summary on Levels 1 to 4 of the classification system is presented in Table D-1 and Table D-2 below.

Table D-1: Classification System for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	**LEVEL 2: REGIONAL SETTING**	**LEVEL 3:LANDSCAPE UNIT**
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table D-2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4:HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean**[7] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. Department of Water Affairs (DWA) Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups' vegetation types across the country, according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups

through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting
At Level 3 of the classification system for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units
Seven primary HGM Types are recognised for Inland Systems at Level 4A of the classification system (Table D-2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchanneled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates;
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (Kleynhans *et al*., 2008) and WET-EcoServices (Kotze *et al*., 2009).

3. Freshwater Ecosystem Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act, 1998 (Act No. 36 of 1998) as “land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil”.

The wetland zone delineation took place according to the method presented in the DWAF (2005) document “A practical field procedure for identification and delineation of wetlands and riparian areas.

An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The position in the landscape, which will help identify those parts of the landscape where wetlands are more likely to occur;
- The type of soil form (i.e. the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types;
- The presence of wetland vegetation species; and
- The presence of redoxymorphic soil feature, which are morphological signatures that appear in soils with prolonged periods of saturation.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005 and 2008).

Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant period of wetness (at least three months of saturation per annum) and the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

4. WET-EcoServices (2020)

The WET-Ecoservices (v2) method by Kotze *et al.* (2020) provides an overall importance score to each of the ecoservices listed below (Table D-4). The overall importance score of each ecoservice is calculated by integrating its respective supply and demand scores (Table D-3). Each ecoservice supply and demand score in turn is calculated using an algorithm that has been designed to reflect the relative importance and interactions of the attributes represented by indicators that characterise that ecoservice.

The supply of an ecoservice is related to the innate ability of the wetland to provide a particular service, tying to its PES, while the demand on an ecoservice is founded on the wetland's catchment context (e.g. toxicant sources upstream), the number of beneficiaries and their level of dependency.

The WET-Health (v2) summary thus enables the reader to gauge both the relative importance of the individual ecoservice supply and demand scores and combined (overall) ecoservice importance.

➢ Flood attenuation	➢ Biodiversity maintenance
➢ Stream flow regulation	➢ Provision of water for human use
➢ Sediment trapping	➢ Provision of harvestable resources
➢ Phosphate assimilation	➢ Food for livestock
➢ Nitrate assimilation	➢ Provision of cultivated foods
➢ Toxicant assimilation	➢ Cultural and spiritual experience
➢ Erosion control	➢ Tourism and recreation
➢ Carbon storage	➢ Education and research

Table D-3: Integration of ecoservice supply and demand scores to derive overall importance.

Integrating scores for supply & demand to obtain an overall importance score						
		Supply				
		Very Low	Low	Moderate	High	Very High
Demand		0	1	2	3	4
Very Low	0	0,0	0,0	0,5	1,5	2,5
Low	1	0,0	0,0	1,0	2,0	3,0
Moderate	2	0,0	0,5	1,5	2,5	3,5
High	3	0,0	1,0	2,0	3,0	4,0
Very High	4	0,5	1,5	2,5	3,5	4,0

Table D-4: Ecoservice importance categories and descriptions based on integration of supply and demand scores.

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately-Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately-High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 - 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

5. Index of Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.,* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table D-5 below.

Table D-5: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans *et al.,* 2008].

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. 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	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
F	Critically / Extremely modified. Modifications have reached a critical level and the 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

6. The Riparian Vegetation Response Assessment Index (VEGRAI)

VEGRAI[3] is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results (Kleynhans *et al.*, 2007). Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Riparian vegetation is described in the National Water Act (Act No. 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a freshwater ecosystem which are commonly characterised by alluvial soil, and which are inundated or

[3] Kleynhans CJ, Mackenzie J, Louw MD. 2007. Module F: Riparian Vegetation Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report.

flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Table D-6: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

7. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purpose of assessing importance and sensitivity of watercourses is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Surface water features with higher ecological importance may require managing such surface water features in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other surface water feature types, a tool was developed using criteria from both WET-Ecoservices (Kotze *et al.,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other surface water features by DWA and thus enabling consistent assessment approaches across surface water feature types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table D-7) of the wetland system being assessed.

Table D-7: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

8. Physico Chemical Water Quality Data

On-site testing of biota specific water quality parameters including pH, Electrical Conductivity (EC), dissolved oxygen concentration (DO) and temperature. The results aid in the interpretation of the data obtained by the biomonitoring.

Water quality (physico-chemical) variables were measured *in-situ* using an Extech (EC 500 series) pH/Conductivity/TDS/temperature probe and an Extech (DO 600 series) dissolved oxygen probe and are discussed against various guidelines as follows:

- South African water quality guidelines volume 7, Aquatic ecosystems Target Water Quality Objectives (TWQR; DWAF, 1996);
- The Resource Water Quality Objectives (RWQO) for the relevant catchment (DWS, 2020).

9. Diatom Analysis

Diatoms are unicellular algae at the base of the aquatic food web and thus provide meaningful and valuable information for means of biomonitoring as they are highly representative of water quality. As diatoms are primary producers, localised within an area and due to their short life span (2 – 3 weeks) they are important indicators of short-term impacts and are thus the first indicators of change within their environment. Diatoms have a rapid response to environmental change and their ecology is well understood allowing the interpretation of specific physico-chemical conditions within the aquatic environment. Specific environmental changes (nutrient loading, salinisation, pH change and organic enrichment) can be determined based on the presence and absence of key indicator diatom taxa.

Diatom slides were prepared through use of the hot Hydrochloric Acid (HCl) and Potassium Permanganate ($KMnO_4$) method as this is the preferred method of use for South African samples, as it usually contains higher levels of organic content (Taylor *et al.,* 2007). The clean samples were mounted onto microscope slides using pleurax as it has a high refraction index (1.73) ideal for diatom frustule identification. Diatom taxa were identified to the lowest possible level of identification and diatom valves counted (400 counts) for ecological conclusions to be drawn. Dominant species ecology was inferred from Taylor *et al*. (2007) and Omnidia software (Lecointe *et al.,* 1993) were used to calculate diatom index scores with score interpretation presented in Table D-8 to Table D-11. The following indices were calculated for the present report:

- Specific Pollution sensitivity Index (SPI) (CEMAGREF, 1982) (Table D-8 & Table D-9): This index is the most comprehensive as it includes >1400 species to calculate its final score and provides a measure of organic pollution.
- Generic Diatom Index (GDI) (Coste and Ayphassorho, 1991) (Table D-9): Final score is based on genus level and is a measure of organic pollution.
- Trophic Diatom Index (TDI) (Kelly and Whitton, 1995) (Table D-10): The index's final score is quantified based on the degree of organic and inorganic pollution.
- Percentage Pollution Tolerant Valves (%PTV) (Kelly and Whitton, 1995) (Table D-11): Indicates the diatoms in the sampled community that are tolerant to pollution, thus indicating the degree of eutrophication vs organic pollution. The %PTV score indicates whether nutrients or organic pollution contributed to the TDI final score.

Table D-8: Interpretation of Ecological Categories from the SPI index scores.

Index Score (up to 20)	Ecosystem quality	Ecological Category
18 – 20	High quality	A
17 – 18		A/B
15 – 17	Good quality	B
14 – 15		B/C
12 – 14	Moderate quality	C
10 – 12		C/D
8 – 10	Poor quality	D
6 – 8		D/E
5 – 6	Bad quality	E
4 – 5		E/F
< 4		F

Table D-9: Interpretation of both the SPI and GDI scores to determine the Ecosystem Quality and Trophic level of the sampled site.

Index Score (up to 20)	Trophic Level
>17	Oligotrophic (No Pollution)
15 - 17	Oligo-mesotrophic
12 - 15	Mesotrophic
9 - 12	Meso-eutrophic
< 9	Eutrophic

Table D-10: Interpretation of the TDI score to determine the Trophic level of the sampled site.

Index Score	Trophic Level
0 – 20	Oligotrophic (No Pollution)
21 – 40	Oligo-mesotrophic
41 – 60	Mesotrophic
61 – 80	Meso-eutrophic
>80	Eutrophic

Table D-11: Interpretation of the %PTV score to determine the Ecological Status of the site.

Index Score (up to 20)	Ecological Status
< 20	Site free from organic pollution
21 – 40	Some evidence of organic pollution
41 – 60	Organic pollution likely to contribute to eutrophication
>60	Heavily contaminated with organic pollution

Values for the SPI and GDI were transformed to a score out of 20 where a score of 0 indicates eutrophication and very heavy pollution and a score of 20 indicates no pollution and oligotrophic conditions (Table D-8 and Table D-9). The TDI score is worked off a maximum of 100, where a score of <20% infers that the site is oligotrophic and free from pollution and a score >60% infers that the site is eutrophic with pollution present (Table D-10). The %PTV is worked off a maximum score of 100%, where a score of <20% infers that the site is free from organic pollution and a score >60% infers that the site is heavily contaminated with organic pollution (Table D-11). For the diatom frustule abnormality assessment, if the percentage of deformed frustules is greater than 2% of the population it is considered that there is significant impact from either pesticides or metals and further assessment is recommended, especially where mining is a related concern.

10. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

“A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure” (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the freshwater ecosystem (sections above), with the objective of either maintaining, or improving the ecological integrity of the freshwater ecosystem in order to ensure continued ecological functionality (Table D-12).

Table D-12: Recommended management objectives (RMO) for freshwater ecosystems based on PES & EIS scores.

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

***PES Categories E and F are considered ecologically unacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A freshwater ecosystem may receive the same class for the REC as the PES if the freshwater ecosystem is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the freshwater ecosystem.

Table D-13: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

11. Ecological Buffer Determination

In order to determine a relevant freshwater non-development buffer in the study area, relevant to the proposed development, the scientific buffer guideline tool was applied to the study area. The buffer guideline provides an Excel™ based buffer zone tool to determine suitable buffer zone requirements. The tool includes a rapid desktop tool for determining potential aquatic impact buffer zone requirements together with a site-based tool for determining buffer zone requirements for rivers, wetlands and estuaries. Central to the tool is a buffer model, which is populated automatically from the data inputted. Importantly, the type of development and sector into which a proposed development falls needs to be specified and has a bearing on the determination of the buffer width. The tool also considers the biodiversity-related sensitivity of the receiving freshwater ecosystems. The tool is based on best available science and is used to generate buffer zone recommendations as part of the assessment process. Figure D-1 below outlines an overview of the stepwise assessment process for buffer zone determination as applied through the tool. The buffer assessment is determined using site-based parameters using data collected for the (on-site) detailed assessment of freshwater ecosystems associated with the proposed development.

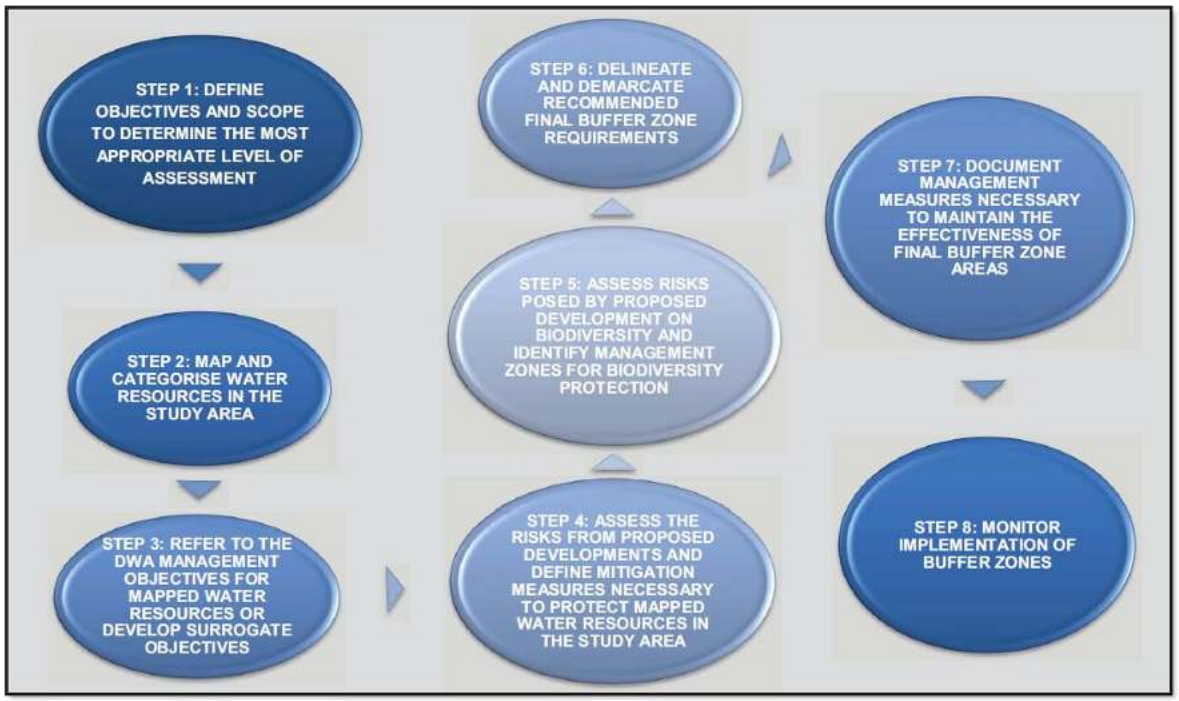


Figure D-1: Overview of the stepwise assessment process for buffer zone determination and applied through the buffer tool.

Appendix E : DWS Risk and Impact Assessment Methodology

In order for the proponent / EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

1. DWS Risk Assessment Matrix (2023)

The first stage of the risk assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- **Environmental impacts** are the consequences of these impacts on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Intensity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial scale** refers to the geographical scale of the impact; and
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to Table E-1 to Table E-3 below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The intensity, spatial scale and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 75. The likelihood of the impact occurring is determined by assigning a likelihood score of between 20% and 100% (Table E-4). The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[4] (Table E-5).

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

"RISK ASSESSMENT KEY" (Based on DWS 2023 publication: Section 21 c and i water use Risk Assessment Protocol)

[4] Some risks/impacts that have low significance will however still require mitigation.

Table E-1: Intensity (What is the intensity of the impact on the resource quality - hydrology, water quality, geomorphology, biota?)

Negative impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large deterioration in PES (by one class or more)	+4
Very high / critically harmful; critical deterioration in PES (to E/F or F class)	+5
Positive impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection status	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5

*PES of affected watercourses must be considered when scoring Impact Intensity

Table E-2: Spatial Scale (How big is the area that the activity is impacting on, relative to the size of the impacted watercourses).

Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5

Table E-3: Duration (How long does the aspect impact on the resource quality).

Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5

Table E-4: Likelihood of impact (What is the probability that the activity will impact on the resource quality).

Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

Table E-5: Rating Classes.

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

A low risk class must be obtained for all activities to be considered for a GA

Table E-6: Calculations.

Intensity = Maximum Intensity Score (negative value for positive impact)	MAX = 5
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 15 (MIN = -15 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 75
Significance\Risk = (Consequence X Likelihood) X (100/75)	MAX = 100

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/impacts were assessed for construction phase and operational phase; and
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Mitigation Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[5] are identified and described in as much detail as possible. Mitigation measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

2. Ecological Impact Assessment Method of Assessment

The first stage of the impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. Direct, indirect and cumulative impacts of the issues identified through the study, as well as all other issues identified in the EIA phase must be assessed in terms of the following criteria:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be:
  - Site specific (limited to the immediate area or site of development);
  - Local (within 5 km of the proposed development); or
  - Regional (beyond 5 km of the proposed development):

[5] Control measures should address both positive and negative impacts

- The **duration**, wherein it will be indicated whether:
  - Short term (0-5 years; after construction);
  - Medium term (5–15 years); or
  - Long term (> 15 years)
- The **intensity** establishes whether the impact is destructive or benign and attempts to quantify the magnitude of the impact and should be qualified as:
  - Low;
  - Medium; or
  - High
- The **magnitude**, quantified on a scale from 0-5, where a score is assigned:
  - Zero – Bio-physical and/ or social functions and/ or processes unaltered;
  - Very low - Bio-physical and/ or social functions and/ or processes negligibly altered / enhanced;
  - Low – Bio-physical and/ or social functions and/ or processes slightly altered / enhanced;
  - Medium – Bio-physical and/ or social functions and/ or processes notably altered / enhanced;
  - High – Bio-physical and/ or social functions and/ or processes severely altered / vastly enhanced;
- The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated, being:
  - Improbable (<5% chance of impact occurring);
  - Possible (5-20% chance of impact occurring);
  - Probable (20-95% chance of impact occurring); or
  - Definite (>95% chance of impact occurring);
- The **legal requirement**, during which the relevant South African legislation and permit requirements pertaining to the development proposal is identified and listed. Reference to the procedures required to obtain permits shall be given and a description will be provided as to whether the development proposal contravene the applicable legislation;
- The **status of the impact**, determining whether the impact will be negative, positive, or neutral (“cost –benefit” analysis). The impacts will be assessed in terms of their effect on the project and the environment;
- The **degree of confidence in predictions**, describes what degree of confidence (low, medium, or high) is in the predictions based on the available information and level of knowledge and expertise. Criteria include unsure, sure and certain; and
- Based on a synthesis of the information contained in the above-described procedure, the potential impacts will be assessed in terms of the following significance criteria:
  - *No significance*: the impacts do not influence the proposed development and/or environment in any way;
  - *Low significance*: the impacts will have a minor influence on the proposed development and/or environment. These impacts require some attention to modification of the project design where possible, or alternative mitigation;
  - *Moderate significance*: the impacts will have a moderate influence on the proposed development and/or environment. The impact can be ameliorated by a modification in the project design or implementation of effective mitigation measures; and
  - *High significance*: the impacts will have the “no-go” implication on the development or portions of the development regardless of any mitigation measures that could be implemented. This level of significance must be well motivated.

Table E-7: Definition of significance ratings (adopted from PHS Consulting, 2024)

Significance Ratings	Level Of Criteria Required
High (H)	• High magnitude with a regional extent and long-term duration • High magnitude with either a regional extent and medium-term duration or a local extent and long-term duration • Medium magnitude with a regional extent and long-term duration.
Moderate (M)	• High magnitude with a local extent and medium-term duration • High magnitude with a regional extent and short-term duration or a site-specific extent and long-term duration • High magnitude with either a local extent and short-term duration or a site-specific extent and medium-term duration • Medium magnitude with any combination of extent and duration except site specific and short term or regional and long term • Low magnitude with a regional extent and long-term duration
Low (L)	• High magnitude with a site-specific extent and short-term duration • Medium magnitude with a site-specific extent and short-term duration • Low magnitude with any combination of extent and duration except site specific and short term • Very low magnitude with a regional extent and long-term duration.
Very low (VL)	• Low magnitude with a site-specific extent and short-term duration • Very low magnitude with any combination of extent and duration except regional and long term
Neutral (N)	• Zero magnitude with any combination of extent and duration

3. Assessment of Cumulative Impacts

A "Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[6].

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section should address whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment or sense of place
- Unacceptable increase in impact

The specialist is required to conclude if the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area.

[6] Unless otherwise stated, all definitions are from the 2014 EIA Regulations, GNR 982

Appendix F : Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table F-1: Presentation of the results of the IHI assessment applied to the EDL

	MRU
INSTREAM IHI	
Base Flows	-1,0
Zero Flows	0,0
Floods	1,0
HYDROLOGY RATING	**0,5**
pH	1,5
Salts	1,0
Nutrients	1,5
Water Temperature	1,5
Water clarity	1,0
Oxygen	1,0
Toxics	1,0
PC RATING	**1,2**
Sediment	1,5
Benthic Growth	1,0
BED RATING	**1,3**
Marginal	1,5
Non-marginal	1,0
BANK RATING	**1,3**
Longitudinal Connectivity	1,0
Lateral Connectivity	1,0
CONNECTIVITY RATING	**1,0**
INSTREAM IHI %	**79,9**
INSTREAM IHI EC	**B/C**
INSTREAM CONFIDENCE	**2,9**

	MRU
RIPARIAN IHI	
Base Flows	-1,0
Zero Flows	0,5
Moderate Floods	1,5
Large Floods	1,0
HYDROLOGY RATING	**1,0**
Substrate Exposure (marginal)	1,0
Substrate Exposure (non-marginal)	0,5
Invasive Alien Vegetation (marginal)	1,0
Invasive Alien Vegetation (non-marginal)	2,0
Erosion (marginal)	2,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	1,0
Physico-Chemical (non-marginal)	1,0
Marginal	2,0
Non-marginal	2,0
BANK STRUCTURE RATING	**2,0**
Longitudinal Connectivity	1,5
Lateral Connectivity	1,0
CONNECTIVITY RATING	**1,5**
RIPARIAN IHI %	**69,4**
RIPARIAN IHI EC	**C**
RIPARIAN CONFIDENCE	**3,0**

Table F-2: Presentation of the results of the IHI assessment applied to the river (Prinseskasteel Stream)

INSTREAM IHI	MRU
Base Flows	1,0
Zero Flows	1,0
Floods	1,5
HYDROLOGY RATING	**1,1**
pH	1,5
Salts	1,5
Nutrients	1,5
Water Temperature	1,0
Water clarity	1,0
Oxygen	1,5
Toxics	2,0
PC RATING	**1,5**
Sediment	1,5
Benthic Growth	1,0
BED RATING	**1,3**
Marginal	1,5
Non-marginal	2,0
BANK RATING	**1,7**
Longitudinal Connectivity	1,5
Lateral Connectivity	2,0
CONNECTIVITY RATING	**1,5**
INSTREAM IHI %	**72,3**
INSTREAM IHI EC	**C**
INSTREAM CONFIDENCE	**2,9**

RIPARIAN IHI	MRU
Base Flows	1,0
Zero Flows	1,5
Moderate Floods	1,5
Large Floods	2,0
HYDROLOGY RATING	**1,4**
Substrate Exposure (marginal)	1,0
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	1,5
Invasive Alien Vegetation (non-marginal)	2,0
Erosion (marginal)	0,5
Erosion (non-marginal)	0,5
Physico-Chemical (marginal)	1,5
Physico-Chemical (non-marginal)	1,0
Marginal	1,5
Non-marginal	2,0
BANK STRUCTURE RATING	**1,6**
Longitudinal Connectivity	1,5
Lateral Connectivity	2,0
CONNECTIVITY RATING	**1,7**
RIPARIAN IHI %	**68,9**
RIPARIAN IHI EC	**C**
RIPARIAN CONFIDENCE	**3,0**

Table F-3: Presentation of the results of the VEGRAI assessment applied to the EDL

LEVEL 3 ASSESSMENT					
METRIC GROUP	**CALCULATED RATING**	**WEIGHTED RATING**	**CONFIDENCE**	**RANK**	**% WEIGHT**
MARGINAL	80,0	48,0	3,0	1,0	60,0
NON MARGINAL	46,7	18,7	2,0	2,0	40,0
	2,0				100,0
LEVEL 3 VEGRAI (%)				66,7	
VEGRAI EC				**C**	
AVERAGE CONFIDENCE				2,5	

Table F-4: Presentation of the results of the VEGRAI assessment applied to the river (Prinseskasteel Stream)

LEVEL 3 ASSESSMENT					
METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	% WEIGHT
MARGINAL	46,7	23,3	2,0	1,0	50,0
NON MARGINAL	44,0	22,0	2,0	2,0	50,0
2,0					100,0
LEVEL 3 VEGRAI (%)				45,3	
VEGRAI EC				**D**	
AVERAGE CONFIDENCE				2,0	

Table F-5: Presentation of the results of the Socio-cultural and Ecoservice provision provided by the EDL

		Present			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,4	0,4	0,0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	1,4	2,0	0,9	Low
	Erosion control	1,2	0,8	0,1	Very Low
	Phosphate assimilation	1,4	1,0	0,4	Very Low
	Nitrate assimilation	1,4	1,0	0,4	Very Low
	Toxicant assimilation	1,4	1,0	0,4	Very Low
	Carbon storage	1,8	2,7	1,6	Moderately Low
	Biodiversity maintenance	3,9	2,0	3,4	Very High
PROVISIONING SERVICES	Water for human use	0,0	1,0	0,0	Very Low
	Harvestable resources	3,0	0,0	1,5	Moderately Low
	Food for livestock	1,0	0,0	0,0	Very Low
	Cultivated foods	3,5	0,7	2,3	Moderately High
CULTURAL SERVICES	Tourism and Recreation	3,0	0,3	1,7	Moderately Low
	Education and Research	1,5	0,0	0,0	Very Low
	Cultural and Spiritual	2,0	0,0	0,5	Very Low

Table F-6: Presentation of the results of the Socio-cultural and Ecoservice provision provided by the artificial channel and river

		Artificial channels				River			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,9	0,0	0,0	Very Low	2,0	0,0	0,5	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!	-	-	#VALUE!	#VALUE!
	Sediment trapping	1,0	3,0	1,0	Low	1,6	3,0	1,6	Moderately Low
	Erosion control	0,3	2,9	0,2	Very Low	1,2	2,5	1,0	Low
	Phosphate assimilation	0,9	3,0	0,9	Low	1,7	3,0	1,7	Moderately Low
	Nitrate assimilation	1,0	3,0	1,0	Low	1,7	3,0	1,7	Moderately Low
	Toxicant assimilation	1,0	2,0	0,5	Very Low	1,7	2,0	1,2	Low
	Carbon storage	0,3	2,7	0,2	Very Low	2,7	2,7	2,5	Moderately High
	Biodiversity maintenance	3,8	3,0	3,8	Very High	3,9	2,0	3,4	Very High
PROVISIONING SERVICES	Water for human use	0,8	1,3	0,0	Very Low	2,4	0,0	0,9	Low
	Harvestable resources	2,5	0,0	1,0	Low	3,0	0,0	1,5	Moderately Low
	Food for livestock	0,0	0,0	0,0	Very Low	0,0	0,0	0,0	Very Low
	Cultivated foods	2,5	0,0	1,0	Low	3,3	0,0	1,8	Moderate
CULTURAL SERVICES	Tourism and Recreation	1,3	0,0	0,0	Very Low	2,6	1,3	1,8	Moderate
	Education and Research	0,0	0,0	0,0	Very Low	1,5	0,0	0,0	Very Low
	Cultural and Spiritual	0,0	0,0	0,0	Very Low	2,0	0,0	0,5	Very Low

Table F-7: Presentation of the EIS assessments applied to all HGM units.

	EDL		River		Artificial channel	
CRITERIA	EIS Scores	Confidence	EIS Scores	Confidence	EIS Scores	Confidence
BIOTIC						
Rare & endangered biota	2	High	3	High	2	High
Unique biota	3	Medium	3	Medium	1	High
Intolerant (i.e. sensitive) biota	2	High	2	High	1	High
Species/taxon richness	2	High	2	High	1	High
Median score (Biotic criteria)	**2 (Moderate)**	**Medium**	**2,5 (High)**	**Medium**	**1 (Low)**	**High**
HABITAT						
Diversity of aquatic habitat types	2	Medium	2	Medium	1	High
Refuge value of habitat types	3	Medium	2	Medium	1	High
Sensitivity of habitat to flow changes	2	Medium	2	Medium	1	High
Sensitivity of habitat to WQ changes	2	Medium	2	Medium	2	High
Migration route/corridor	3	High	3	High	1	High
Protected/natural areas	0	High	0	High	0	High
Median score (Habitat criteria)	**2,0 (Moderate)**	**Medium**	**2,0 (Moderate)**	**Medium**	**1,0 (Low)**	**High**
Overall median score	**2,0 (Moderate)**	**Medium**	**2,3 (High)**	**Medium**	**1,0 (Low)**	**High**

Appendix G : Site Sensitivity Verification Report

FRESHWATER ECOSYSTEM SITE SENSITIVITY VERIFICATION REPORT FOR THE PROPOSED PERIODIC MAINTENANCE ACTIVITIES FOR THE STEENBERG ESTATE AND GOLF COURSE, CONSTANTIA, WESTERN CAPE PROVINCE

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Water Use Authorisation (WUA) process and Maintenance Management Plan (MMP) in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA) for the proposed general periodic maintenance of the watercourses on Steenberg Estate and Golf Course, located on Erven 11193, 12379, 11039, 11111, 11072, and 12910, Constantia, Western Cape Province (Figure G-1), collectively referred to as 'the study area'.

Introduction

According to the "*Protocols for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes*" ("the Protocols") published in Government Gazette No. 43110 on 20 March 2020 and Government Gazette No. 43855 on 30 October 2020, the Environmental Assessment Practitioner (EAP) must verify the current use of the site in question and its environmental sensitivity as identified by the Screening Tool to determine the need for specialist inputs in relation to the themes included in the Protocols. The Protocols are allowed for in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"). The Protocols must be complied with for every new application for Environmental Authorisation that is submitted after 9 May 2020.

This document serves as the Site Sensitivity Verification Report for the aquatic biodiversity theme for the proposed periodic maintenance activities. The proposed periodic maintenance activities require adoption of a MMP in terms of the NEMA EIA Regulations (2014), as amended and a Water Use Authorisation (WUA).

Study Area

The study area is located within the City of Cape Town Metropolitan, in Constantia, and is associated with the Steenberg Estate and Golf Course. The study area is located west of the M42, and within an agricultural / residential transitional zone.

This Freshwater Ecosystem site sensitivity verification report relates to a Screening Tool Report (STR) completed for the site in May 2026.

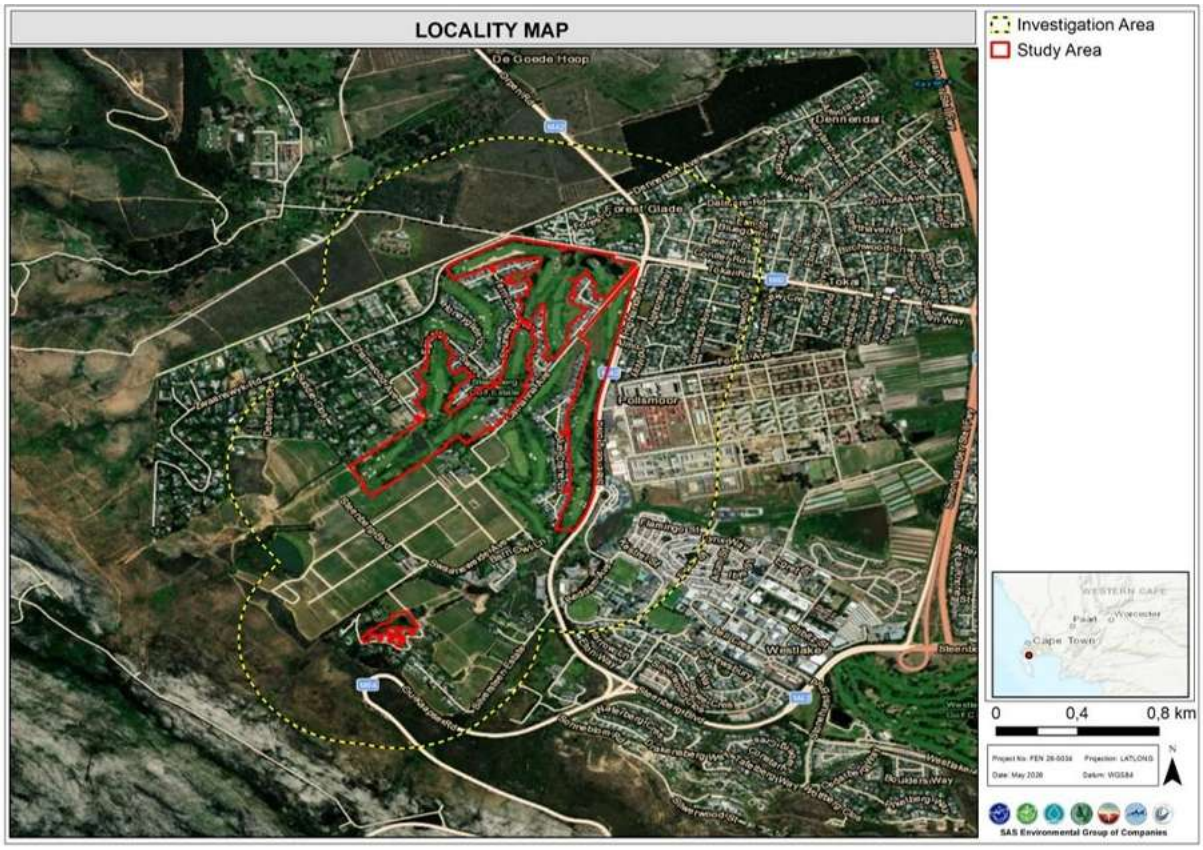


Figure G-1: Digital satellite image depicting the location of the proposed development and associated investigation area in relation to the surrounding area.

Site Verification Methodology

Information from the in-field delineation and detailed assessment of freshwater ecosystems associated with the study and investigation areas as part of the freshwater ecological assessment.

Aquatic Biodiversity Site Verification

The table below provides information regarding the outcome of the Screening Tool in terms of the aquatic biodiversity theme sensitivity associated with the proposed periodic maintenance activities as well as a brief summary of the outcome of the freshwater ecosystem specialist report in response.

Table G-1: Aquatic Biodiversity Theme Sensitivity analysis for the proposed project.

Environmental Theme	Applicable Protocol	Response
Aquatic Biodiversity **Sensitivity Rating:** the study and investigation area are located within an area of a **very high aquatic biodiversity** / freshwater sensitivity due to its locality in the Table Mountain SWSA and the presence of wetlands. **Requiring a Freshwater Ecosystem Impact Assessment.** **Actual Sensitivity:** All delineated freshwater ecosystems (with the exception of the artificial channel) and associated 32 m NEMA Zones of Regulation (ZoR) – high sensitivity; Artificial channel and associated 32 m ZoR – moderate sensitivity; Remainder of study area: low sensitivity (refer to ZoR map in the Freshwater Ecosystem Impact Assessment Report). **The designation of high sensitivity for the freshwater ecosystems associated with the proposed development is not disputed. However, the artificial channel and majority of the study area is considered to be of moderate and low aquatic biodiversity sensitivity, respectively as the majority of the study area has been transformed and the artificial channel is considered man-made.**	Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity (GN 320 of March 2020).	Due to presence of very high aquatic biodiversity features within the study area, a freshwater ecosystem assessment needs to be undertaken. This report has been compiled in support of the EIA. An impact assessment has been undertaken to determine the significance of potential impacts associated with the proposed periodic maintenance activities. A freshwater impact assessment was conducted by Freshwater Ecologist Network (FEN, 2026). During the assessment and associated field verification it was determined that the development site (study area) is of low sensitivity, with the exception of the following freshwater ecosystems: • Artificial channel – moderate sensitivity; • EDL associated with Erf 12910 – high sensitivity; and • Non-perennial river (Prinseskasteel Stream) and associated CVB wetland – high sensitivity. Refer to FEN (2026) for photographic evidence and the assessments. A freshwater impact assessment report has been compiled to support the authorisation process required in terms of NEMA. The study and associated comprehensive report (supported by a single site visit undertaken in May 2026) provided a detailed description of the freshwater ecosystems associated with the proposed project. An impact assessment and suitable control measures have been undertaken.

Appendix H : General "Good Housekeeping" Mitigation Measures and Risk Assessment Outcome

General maintenance management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecosystem ecology and biodiversity will include any activities which take place in close proximity to the proposed servitude that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater ecosystem identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should only encroach into the freshwater ecosystem if considered absolutely essential;
- The boundaries of footprint areas, including laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Appropriate sanitary facilities must be provided for the life of the maintenance phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and "spill" bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practised near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Proliferation of alien and invasive species is expected within any disturbed areas. However, alien invasive species are opportunistic, and where disturbances do occur, they will promulgate; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered within the freshwater ecosystems must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998); and
- Species-specific and area-specific eradication recommendations:
    - Footprint areas should be kept as small as possible when removing alien plant species; and
    - No vehicles should be allowed to drive through designated sensitive freshwater ecosystems areas during the eradication of alien and weed species.

Soils

- Sheet runoff from compacted areas should be slowed down by the strategic placement of berms;
- It is considered ideal that activities occur within the current season (low rainfall) to minimise impacts of sedimentation;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils;
-
- All soils compacted during the repair and maintenance phase should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Rubble, litter, debris and excess vegetation and soil must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area, as well as the immediate vicinity of the proposed work area, should be removed.

Table H-1: Risk Assessment outcomes for the proposed periodic maintenance activities.

PROJECT:		**Steenberg Golf Course MMP**		
RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities - Version 2.1.1				
Name of Assessor:	Bianca Bleuler	**Signature:**		
SACNASP Registration Number:	162898			
Date of assessment:	17-Jun-26			

Phase	No.	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity	Spatial scale	Duration	Severity	Importance rating	Consequence	Likelihood (Probability) of impact	Significance	Risk Rating
				Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)										
							Hydrology	Water Quality	Geomorph	Vegetation	Fauna									
MAINTENANCE	1	Site preparation (where applicable) for maintenance activities within the delineated extent of the applicable freshwater HGM unit and associated ecological buffers (e.g. culvert replacement where required, upkeep of in-stream dams), including: • Removal of vegetation and associated disturbances to soil (although unlikely); • Stockpiling of	• Dust generation from exposed soil potentially leading to the smothering of freshwater vegetation and biota, and altering surface water quality; • Potential soil destabilisation leading to sedimentation of the freshwater HGM units, or conversely, soil compaction leading to increased surface runoff into downstream / downgradient freshwater ecosystem; • Potential proliferation or spread of AIPs from disturbed soil; and • Contaminant spillage into the freshwater ecosystem from machinery and vehicle operation.	EDL	C	Moderate	2	2	1	2	2	**4**	1	1	**6**	**3**	**18**	80%	**14,4**	L
				Artificial channel	D/E	Low / Very low	2	2	1	2	2	**4**	2	1	**7**	**2**	**14**	100%	**14**	L
				Non-perennial River and associated CVB wetland	C	High	2	2	1	1	1	**4**	1	1	**6**	**4**	**24**	40%	**9,6**	L

Phase	No.	Activity	Impact	Potentially affected watercourses				Intensity of Impact on Resource Quality						Overall Intensity	Spatial scale	Duration	Severity	Importance rating		Consequence	Likelihood (Probability) of impact	Significance	Risk Rating
				Name/s	PES	Overall Watercourse Importance		Abiotic Habitat (Drivers)			Biota (Responses)												
								Hydrology	Water Quality	Geomorph	Vegetation	Fauna												
		maintenance equipment and storage of materials, vehicles and machinery; and • Possible indiscriminate vehicle movement.																					
	2	Clearing of vegetation, debris, litter and sediment and rectification of observed erosion within the proposed periodic maintenance site footprint area including stripping of topsoil within the freshwater habitat.	• Exposure of soil, leading to increased runoff and erosion, and thus increased likelihood for sedimentation of the freshwater ecosystems; • Loss of freshwater habitat and ecological structure resulting in impacts to biota; • Increased sedimentation of the freshwater HGM units, potentially leading to smothering of vegetation in the downstream reaches; • Proliferation or spread of alien and/or invasive vegetation as a result of disturbances; and • Potential changes to the ecoservice provision of the freshwater ecosystems.	EDL	C	Moderate		2	2	2	3	2		**6**	1	2	**9**	**3**		**27**	100%	**27**	**L**
				Artificial channel	D/E	Low / Very low		2	2	2	3	2		**6**	2	2	**10**	**2**		**20**	100%	**20**	**L**
				Non-perennial River and associated CVB wetland	C	High		1	1	1	1	2		**4**	1	2	**7**	**4**		**28**	40%	**11,2**	**L**

Phase	No.	Activity	Impact	Potentially affected watercourses				Intensity of Impact on Resource Quality						Overall Intensity	Spatial scale	Duration	Severity	Importance rating		Consequence	Likelihood (Probability) of impact	Significance	Risk Rating
				Name/s	PES	Overall Watercourse Importance		Abiotic Habitat (Drivers)			Biota (Responses)												
								Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
	3	Groundbreaking and excavations within the freshwater HGM units as part of the activities to replace culverts, gabion retaining walls, and dam walls, and provide protection works, which may include infilling and cut and fill of side slopes, excavation of areas for the installation of erosion protection measures.	• Excess soil being removed within the road surface and falling into the freshwater habitat adjacent to the road resulting in altered pattern flow and timing of water in the freshwater ecosystems; • Disturbances of soil leading to ponding of water as a result of over compaction of soil in some areas, increased AIP proliferation, and in turn altered freshwater habitat and runoff patterns; • Potential impacts on water quality and contamination of soil within the freshwater ecosystems; • Altered runoff patterns, leading to increased erosion and sedimentation of the downstream freshwater habitat; and • Potential erosion and formation of preferential flow paths as a result of disturbed soil and inappropriate slopes resulting in sedimentation	Artificial channel	D/E	Low / Very low		2	2	2	1	2	**4**	2	2	**8**	**2**		**16**	100%	**16**	**L**
				Non-perennial River and associated CVB wetland	C	High		2	2	3	1	3	**6**	1	2	**9**	**4**		**36**	80%	**28,8**	**L**

Phase	No.	Activity	Impact	Potentially affected watercourses				Intensity of Impact on Resource Quality						Overall Intensity	Spatial scale	Duration	Severity	Importance rating		Consequence	Likelihood (Probability) of impact	Significance	Risk Rating
				Name/s	PES	Overall Watercourse Importance		Abiotic Habitat (Drivers)			Biota (Responses)												
								Hydrology	Water Quality	Geomorph	Vegetation	Fauna												
			of the freshwater ecosystems.																				
	4	Installation of culverts and gabions within the delineated extent of the freshwater ecosystems (if required), which may require temporary diversion of flow.	• Minor removal of instream and marginal vegetation within the artificial channel; • Movement of machinery within channel, leading to benthic disturbance including potential damage to aquatic biota egg banks, instream sediment disturbance, and compaction of bank and bed soil; • Disturbances of soil as a direct result of removal of damaged infrastructure and replacement with new crossing structures, leading to ponding of water as a result of earthworks, over-compaction of soil due to movement of machinery, damage to fish and macroinvertebrate egg banks, potential for increased AIP proliferation (instream and freshwater), and in turn altered instream and riparian/wetland habitat, flow patterns and	Artificial channel	D/E	Low / Very low		3	2	3	1	1		**6**	2	2	**10**	**2**		**20**	100%	**20**	**L**
				Non-perennial River and associated CVB wetland	C	High		3	2	3	1	3		**6**	1	2	**9**	**4**		**36**	60%	**21,6**	**L**

Phase	No.	Activity	Impact	Potentially affected watercourses				Intensity of Impact on Resource Quality						Overall Intensity	Spatial scale	Duration	Severity	Importance rating		Consequence	Likelihood (Probability) of impact	Significance	Risk Rating
				Name/s	PES	Overall Watercourse Importance		Abiotic Habitat (Drivers)			Biota (Responses)												
								Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
			sediment distribution; • Increased sedimentation of the freshwater HGM units, leading to smothering of vegetation in the downstream reaches of the freshwater ecosystems; • Potential erosion and formation of preferential flow paths as a result of disturbed soil, and inappropriate slopes (bank and stream bed) resulting in altered sediment distribution and altered benthic characteristics affecting aquatic fauna and flora; • Potential proliferation /further spread of AIPs as a result of disturbances; and • Potential changes to the ecoservice provision of the freshwater ecosystems.																				
	5	Rehabilitation of the impacted reaches of the freshwater ecosystems, including: • Resloping,	• Exposure of soils, leading to increased runoff and erosion which can lead to increased sedimentation of the freshwater ecosystems; • Potentially altering	EDL	C	Moderate		2	2	1	2	1		**4**	1	2	**7**	**3**		**21**	80%	**16,8**	**L**

Phase	No.	Activity	Impact	Potentially affected watercourses				Intensity of Impact on Resource Quality						Overall Intensity	Spatial scale	Duration	Severity	Importance rating		Consequence	Likelihood (Probability) of impact	Significance	Risk Rating
				Name/s	PES	Overall Watercourse Importance		Abiotic Habitat (Drivers)			Biota (Responses)												
								Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
		reprofiling and revegetation of the artificial channel banks to prevent future erosion; • Revegetation of the in-stream dam associated with the EDL; and • Revegetation of the artificial channel.	surface water quality through increased turbidity from increased suspension loads and contamination from oils and hydrocarbons; • Soil compaction of the embankment; • Potential temporary disruption to the hydrological processes of the freshwater ecosystems; and • Damage and or removal of indigenous vegetation.	Artificial channel	D/E	Low / Very low		1	1	2	1	1		**4**	2	2	**8**	**2**		**16**	100%	**16**	**L**
				Non-perennial River and associated CVB wetland	C	High		1	1	1	1	2		**4**	1	1	**6**	**4**		**24**	60%	**14,4**	**L**
OPERATIONAL / REHABILITATION	**6**	Monitoring of structural integrity of the culverts, crossings and in-stream dams including: • Proactive monitoring to ensure structural integrity is maintained and to identify early signs of erosion due to potential blockage or breakages.	• No direct negative impacts perceived.	All freshwater ecosystems	C	High		1	1	1	1	1		**2**	2	2	**6**	**4**		**24**	40%	**9,6**	**L**
	7	Ongoing AIP removal (where required).	• Compaction of soil and loss of habitat as a result of ongoing disturbance from vehicles and	All freshwater ecosystems	C	High		1	1	2	-4	1		**4**	1	2	**7**	**4**		**28**	80%	**22,4**	**L**

Phase	No.	Activity	Impact	Potentially affected watercourses				Intensity of Impact on Resource Quality						Overall Intensity	Spatial scale	Duration	Severity	Importance rating		Consequence	Likelihood (Probability) of impact	Significance	Risk Rating
				Name/s	PES	Overall Watercourse Importance		Abiotic Habitat (Drivers)			Biota (Responses)												
								Hydrology	Water Quality	Geomorph	Vegetation	Fauna											
			equipment; • Impacts to water quality as a result of the application of herbicides; and • Disturbance of soil which could lead to erosion.																				
	8	Functioning of the freshwater ecosystems post-maintenance.	• No direct negative impacts perceived.	EDL	C	Moderate					-2	-1		**-4**	1	5	**-10**	**3**		**-30**	80%	**-24**	+
				Artificial channel	D/E	Low / Very low					-1	-1		**-2**	1	5	**-8**	**2**		**-16**	60%	**-9,6**	+
				Non-perennial River and associated CVB wetland	C	High					-1	-2		**-4**	1	5	**-10**	**4**		**-40**	60%	**-24**	+

Appendix I : Details, Expertise and Curriculum Vitae of Specialists

1. (a) (i) Details of the specialist who prepared the report

Bianca Bleuler	MPhil Environmental Management (Stellenbosch University)
Amanda Mileson	Postgraduate Diploma (Nature Conservation) (UNISA)
Dr Mathew Ross	PhD Aquatic Health (University of Johannesburg)

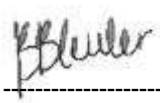
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	FEN Consulting		
Name / Contact person:	Bianca Bleuler		
Postal address:	221 Riverside Lofts, Tygerfalls Boulevard, Bellville,		
Postal code:	7539	Cell:	082 887 1547
Telephone:	011 616 7893	Fax:	N/A
E-mail:	bianca@sasenvgroup.co.za		
Qualifications	MPhil Environmental Management (Stellenbosch University) PGD Environmental Management (Stellenbosch University) BSc Hons Biodiversity and Ecology (Stellenbosch University) BSc Biodiversity and Ecology (Stellenbosch University)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Bianca Bleuler, declare that -

- I act as the **independent freshwater specialist (author)** 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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.



Signature of the Specialist

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Amanda Mileson, declare that -

- I act as the **independent specialist (reviewer)** 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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.

Signature of the Specialist

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Mathew Ross, declare that -

- I act as the **independent specialist (author and reviewer)** 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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.

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF BIANCA BLEULER

PERSONAL DETAILS

Position in Company	Field Specialist
Joined SAS Environmental Group of Companies	2023

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) (162898)

EDUCATION

Qualifications

MPhil Environmental Management (Stellenbosch University)	2022
PGD Environmental Management (Stellenbosch University)	2018
BSc Hons Biodiversity and Ecology (Stellenbosch University)	2017
BSc Biodiversity and Ecology (Stellenbosch University)	2016

Short Courses

Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University	2020

AREAS OF WORK EXPERIENCE

South Africa –Western Cape, Limpopo, Free State

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Environmental Control Officer (ECO) work
- Environmental Management Programme (EMPr) compilation

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Freshwater Offset Plan
- Maintenance and Management Plans
- Plant Species and Landscape Plans

Biodiversity Assessments

- Biodiversity Offset Plans

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF AMANDA MILESON

PERSONAL DETAILS

Position in Company	Senior Ecologist: Wetland Ecology
Joined SAS Environmental Group of Companies	2013

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Wetland Society (SAWS)
Member of the International Society of Wetland Scientists
Member of the Gauteng, Western Cape and Northern Cape Wetland Forums
Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)

EDUCATION

Qualifications

N. Dip Nature Conservation (UNISA)	2017
Advanced Diploma Nature Conservation (UNISA)	2020
Postgraduate Diploma Nature Conservation (UNISA)	2023

Short Courses

Wetland Management: Introduction and Delineation (University of the Free State)	2018
Tools for Wetland Assessment (Rhodes University)	2017
Wetland Rehabilitation (University of the Free State)	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, North West, Limpopo, Northern Cape, Eastern Cape
Africa – Democratic Republic of the Congo (DRC), Zimbabwe, Zambia

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Watercourse Delineation
- Watercourse Verification Assessment
- Watercourse (wetland / riparian) Delineation and Assessment
- Watercourse EcoService and Status Determination
- Watercourse Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Watercourse Plant Species Plans
- Watercourse Offset Plans

Biodiversity Assessments

- Biodiversity Ecological Assessments
- Biodiversity Offset Plans

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF DR MATHEW JAMES ROSS

PERSONAL DETAILS

Position in Company	Discipline Lead, Principal Aquatic Ecologist, Ecologist
Joined SAS Environmental Group of Companies	2024

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist with the South African Council for Natural Scientific Professions (SACNASP): Reg no 005072 (Ecological Sciences & Aquatic Sciences)

Accredited River Health Practitioner by the South African River Health Program (RHP)

Member of the South African Wetland Society (SAWS)

Member of the South African Society for Aquatic Scientists (SASAqS)

EDUCATION

Qualifications

PhD Aquatic Health (University of Johannesburg)	2015
MSc Aquatic Health (University of Johannesburg)	2005
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc Biological Sciences (Zoology & Botany) (University of Johannesburg)	2000

Short Courses

Algal toxicity testing workshop – Environmentek, CSIR.	2003
Grass identification course – Witwatersrand Botanical Gardens	2003
Venomous snake handling and first aid	2003
First Aid – Level 3 – Netcare 911	2004
Advanced 4x4 driving	2001
Soil Classification course with emphasis on wetland delineations (TerraSoil Science)	2009
Advanced grass identification course (Africa Land Use Training)	2010
Qualified as an Advanced Scuba Diver.	2004
Internationally accredited protection dog trainer and trials assailant.	2005

AREAS OF WORK EXPERIENCE

- South Africa – All Provinces
- Southern Africa –Botswana, Mozambique, Zimbabwe, Zambia, Namibia, Swaziland
- Eastern Africa – Tanzania, Uganda, Malawi
- West Africa – Ghana, Senegal, Angola, Cameroon, Mali, Burkina Fasso, Sierra Leone
- Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Renewable energy: Hydropower (run-of-river, pumped storage & dams), solar (floating PV, PV & CSP).
2. Fish migrations assessments and fishpass/fishway design & construction
3. Instream infrastructure: Gauging weirs, abstraction weirs.
4. Ecological Water requirements: DRIFT Modelling experience.
5. Linear developments (energy transmission, telecommunication, pipelines, roads)
6. Water resources sector (wastewater treatment works & water treatment works).
7. Mining sector (various).
8. Industrial, commercial & residential developments.

KEY SPECIALIST DISCIPLINES

- **Freshwater Assessments**

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans

- **Aquatic Ecological Assessment and Water Quality Studies**

- Fish migrations analysis
- Fishpass/fishway design and development (2D and 3D design modelling)
- Fishway integration and hydraulic modelling
- Habitat Assessment Indices (IHAS, HCR, IHI & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Response Assessment Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological analysis
- Water quality monitoring
- Screening Test
- Riverine Rehabilitation Plans
- Floral Assessments

- **Biodiversity Assessments**

- Floral Assessments
- Faunal Assessments
- Avifaunal Impact Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring

- **Modelling & Design**

- Proficient in GIS modelling and analysis
- Proficient in AutoCAD design and modelling
- Proficient in hydraulic analysis of fishways and other instream infrastructure

PROJECT EXAMPLES

Scope Of Prominent National Consultancy Projects

- Aquatic and fish ecological survey for the Ncwabeni Off-Channel Storage Scheme.
- Determination of the ecological flow requirements to sustain fish migrations and fishway evaluations, routine fishway and aquatic biomonitoring for the Kakamas Hydro-electrical Scheme (KHEP) at Neusberg Weir, Orange River.
- Aquatic ecological and impact surveys and fishway development for hydropower schemes on the Orange River at Riemvasmaak (Augrabies Falls).
- Full terrestrial and aquatic ecological and fishway (fish migrations impacts and fishway design) of the proposed Sidala Energy Solutions Rooikat and Meerkat Hydropower Schemes, Orange River.
- Aquatic & wetland ecological and impact surveys for the uMkhomazi Water Project, KZN, including fish migrations and fishway evaluations.
- Aquatic & wetland ecological and impact surveys for the construction of Foxwood Dam, Adelaide, EC, including fish migrations and fishway evaluations and the flow volumes required to sustain ecological integrity.
- Full ecological surveys for the proposed Tina Falls Hydropower Scheme (aquatics, fishways, terrestrial fauna and flora and avifauna), Mthatha, EC, and the flow volumes required to sustain the impacted section of the river.
- Fishway design and implementation for the proposed Mhlabatshane River Water Abstraction Project, Umgeni Water, KZN.
- Fish specialist surveys for the Department of Water and Sanitation Ecological Water Requirements (EWR) for the Limpopo-Luvuvhu catchment area. Including presentations on the EcoStatus protocols for capacity building of DWS personnel and utilisation of the DRIFT DSS model for impacts relating to flow variations throughout the catchment.
- Biodiversity walk-down survey for the ESKOM Zeus-Mercury powerline surveys and EMP development (eastern Gauteng).
- Ecological surveys and development of an Environmental Management Plan for University of Johannesburg (Soweto Campus and UJ Island, Vaal Dam).
- Full ecological assessment (aquatic, wetland, fauna & flora, avifaunal and vegetation) surveys for CSIR Satellite Application Centre, Hartbeeshoek.
- Full ecological assessment (aquatic, wetland, fauna & flora, avifaunal and vegetation) surveys for proposed KwaCeza Mountain Colliery, Black Umfolozi, KZN.
- Full ecological survey (avifaunal impacts, general fauna & flora, wetlands & aquatics) for the proposed ESKOM Neptune-Poseidon powerline, Eastern Cape.
- Ridge rehabilitation surveys for the Rand Water BG3 pipeline, Vaal Dam to the control works.
- Full ecological survey for the proposed SolAfrica (Bokpoort) water pipeline, Groblershoop, Northern Cape, including walk-down survey.
- Full ecological survey for the development of 132 kV powerlines for the Redstone Solar Power Plant, Lime Acres.
- Full ecological survey (including avifaunal impacts) for the development of 132 kV powerlines for the ESKOM Mookodi Integration Phase 2.
- Full ecological survey (including avifaunal impacts) for the development of 88 kV powerlines for the ESKOM Frankfort Strengthening Project.
- Full ecological survey (Avifaunal impacts, general fauna & flora, surface water ecosystems) for the proposed ESKOM Melkspruit-Rouxville 132 kV powerline, Free State & Eastern Cape.
- Full ecological surveys (surface water ecosystems, terrestrial fauna & flora and avifaunal impact surveys for the ESKOM Klipkop-Lehating 132 kV powerline, Black Rock, Northern Cape.
- Avifaunal impact surveys for the ESKOM Mahikeng-Mookodi 400 kV powerline, NWP.
- Avifaunal impact surveys for the Beaufort West Solar Farm and associated powerline development, WC.
- Full ecological surveys (surface water ecosystems, terrestrial fauna & flora, and avifaunal impact surveys for the ESKOM Swartberg Road upgrade, WC.
- Full ecological surveys (surface water ecosystems, terrestrial fauna & flora, and avifaunal impact surveys for the ESKOM Hex-Group upgrade, WC.
- Fish specialist for the Limpopo Ecological Water Requirements (EWR) project, including DRIFT modelling, and facilitation of training workshops on the use of current EcoStatus models.
- Fishway assessment and modelling for an abstraction weir on the Limpopo River.

International Experience

- Aquatic ecological and impact assessment for the Orange Falls Hydroelectric Power Scheme, Orange River, Namibia.
- Ecological flow and migration surveys for augmentation and upgrading of the Lunsemfwa Hydro Power Schemes, Zambia.
- Peer-review of the aquatic ecological and impact analysis as the senior consultant for the proposed Ngonye Falls Hydro Power Scheme, Zambezi River, Zambia, including evaluations of setting ecological flow volumes, flow management schemes and evaluation of flow-related stressors induced by the HPP.
- Fish migrations and fishway design for the proposed Ngonye Falls Hydro Power Scheme, Zambia.
- Design of a fishway facility for the Nyamagasani Hydropower Scheme, Uganda and involvement of establishing relevant ecological flow volumes;
- Fish migrations and fishway design for the Kikagati-Murongo Hydropower Project, Kagera River, Uganda/Tanzania.
- Development of aquatic impact monitoring plans for the Kikagati-Murongo Hydropower Project and implementation thereof, Uganda.
- Fish ecological surveys, fish migrations and fishway designs for the Achwa 1 and 2 Hydropower Schemes, Achwa River, Uganda.
- Fish migrations analysis and fishway design for the Kakono Irrigation Scheme development, Kagera River, Tanzania and determination of the required ecological flows within an associated tributary.
- Determination of the e-flow requirements, fish migrations analysis and fishway designs for the Dibombé Hydropower Project, Cameroon. Responsibilities included management, synthesis and assimilation of the data generated through field reports authored by the country specialists pertaining to the aquatic environment for integration into the DRIFT Model.
- Retrospective fishway design and development for four different hydropower sites for the Kibali Gold Mines, Democratic Republic of Congo.
- Fish ecological surveys and fish migration analysis/fishway design for the proposed Tsatse Hydropower Project, Revué River, Mozambique.
- Fishpass analysis and improvement surveys, Bua River Irrigation Weir, Malawi.
- Fish migrations analysis, fishpass designs and e-flow determinations for the proposed Vuka3 Hydropower Project, Cuango River, Angola.
- Aquatic baseline surveys for the proposed Kasiya Rutile Mining Development (Sovereign Metals Limited) Malawi.
- Ecological assessments for various copper/cobalt mining enterprises surrounding Kolwezi, DRC.
- Aquatic and wetland ecological assessments for the proposed Bekongor III Hydropower Project, Sierra Leone.
- Reservoir ecological studies for the proposed Kamburu floating photovoltaic solar development, Kenya.
- Lead ecological consultant for the MinHASS urban stormwater enhancement and wastewater project, Gauff Engineering, Cote d Ivoire,
- Lead ecological consultant for the Mwanza water treatment and wastewater treatment project, Suez Engineering / Sandrose Consulting, Tanzania.

Appendix J : Key Considerations to Improve and Manage the Habitat for Supporting the Western Leopard Toad

A **Biodiversity Management Plan (BMP)** for the **Western Leopard Toad** (Western Leopard Toad) should be developed in accordance with Section 43 of South Africa's **National Environmental Management: Biodiversity Act (NEMBA)**, with the primary objective of ensuring the long-term and autonomous survival of the species.

The Western Leopard Toad (*Sclerophrys pantherina*) (Bufonidae) is an **Endangered** toad species endemic to the south-western Cape, where it mainly occurs within the regions of the Cape Peninsula, Cape Flats, and Agulhas Plain. There are fragmented populations within the distribution range, between which it is postulated that little exchange of genetic material takes place (i.e., the populations are largely isolated). This is mostly due to increasing pressure from urban development within their distribution range (Cape Nature, 2026).

Figure 1J: The known distribution of the Western Leopard Toad (*Sclerophrys pantherina*) (from FrogMap Database, 2022).

Conservation Vision

To secure viable, connected populations of the Western Leopard Toad across its natural range through habitat protection, threat mitigation, research, and public participation.

Conservation Objectives

1. Protect and restore breeding wetlands and terrestrial habitat. This includes the maintenance and protection of the water habitat units that are associated with the study area.
2. Maintain or improve population viability and genetic diversity. This has limited relevance to the study area, however.
3. Reduce mortality from roads and urban infrastructure. Warning signs should be erected throughout the study area warning of the potential occurrence of froglets that may be encountered throughout the study area along the golf cart tracks and internal roads. Froglets and adult frogs must be avoided and moved from the road if applicable.
4. Prevent further habitat fragmentation by boundary fencing and walling that promoted migratory freedom of the frogs throughout the area.
5. Improve public awareness and stewardship where the residents of the golfing estate are made aware of the presence of the toads through signage and awareness campaigns.
6. Establish long-term monitoring and research programmes.

Key Threats and Management Actions

- **Habitat Loss and Fragmentation**
  Urban expansion, infrastructure development, and agricultural transformation have reduced and isolated suitable habitat. This should be taken into consideration when planning future developments within the study area. Any maintenance procedures that pertain to the surface water features throughout the study area, such as maintenance of removal of excessive marginal vegetation, desilting of the impoundments, etc., should be undertaken outside of the breeding season of the toads (breeding season is the period July to September).
- **Road Mortality**
  Large numbers of adults are killed while migrating between terrestrial habitat and breeding wetlands during the breeding season. Warning signage should be erected throughout the internal road network and golf cart paths throughout the study area.
- **Water Pollution**
  Stormwater runoff, pesticides, fertilizers, sewage spills, and swimming pool backwash degrade breeding habitat. The use of fertilisers and other agrochemicals should be carefully planned and controlled to ensure that surface water runoff does not result in contamination of the surface water features throughout the study area.
- **Invasive Species**
  Predatory fish and invasive aquatic plants reduce breeding success and habitat quality. No more fish should be introduced into the impoundments. The use of fish for pest control (such as mosquito control) can be implemented but the choice of species must be carefully considered.
- **Barriers to Movement**
  Walls, canals, fencing, and urban infrastructure impede migration routes. It is therefore essential that boundary fencing remain as “frog friendly”. Electrified fence strands at the ground level should be removed as this poses a threat to the migrating frogs. The accessibility for migrating frogs at the outfall from the last impoundment to where it crosses Tokai Road should be improved so that migrating frogs from downstream are not faced with vertical obstacles, sediment traps or other such barriers. This is a key access point for breeding frogs to gain access to suitable breeding areas within the golf estate and therefore measures to improve on accessibility should be implemented.