



Aquatic Biodiversity Impact Assessment

**Hoogeland Project: Agricultural Land
Rationalisation and Agri-Village Development
on the Hoogekraal Farms**

Date:

14th September 2026

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REPORT SUMMARY

Upstream Consulting was appointed by HilLand Environmental (Pty) Ltd to undertake an Aquatic Biodiversity Impact Assessment for the proposed Hoogeland Development on the Hoogekraal Farms near Glentana, within the George Municipal area. The approximately 644 ha development comprises agricultural and rural residential properties, conservation/open-space areas, an agri-village, equestrian facilities and associated roads and services.

This assessment follows the aquatic Site Sensitivity and Baseline Assessment undertaken in April 2026. The baseline assessment was completed at an early planning stage and was used to identify aquatic constraints and guide development of the layout. A second, more detailed field assessment was undertaken on 11 and 12 September 2026 once the proposed layout was available. This allowed the aquatic delineation to be refined, potentially affected systems to be assessed in greater detail, and the proposed development to be evaluated in relation to the verified aquatic habitat.

The site contains an extensive network of wetlands, riparian systems, and artificial dams. The natural systems assessed in detail include channelled valley-bottom wetlands, seep wetlands and riparian habitat. Ecological condition varies considerably across the site. HGM 2, HGM 28 and HGM 29 are classified as largely modified (PES Category D), principally as a result of historical agriculture, impoundments, altered drainage, erosion, roads and invasive alien vegetation. HGM 19 remains largely natural (Category B), while HGM 26 is moderately modified (Category C). The affected riparian system, HGM 1, is also moderately modified (Category C). The site therefore contains both degraded aquatic systems and areas that retain comparatively good ecological condition and function.

The development layout has incorporated much of the aquatic sensitivity identified during the baseline assessment, with the majority of natural aquatic habitat avoided and retained within conservation or open-space areas. The principal remaining interactions comprise road and service crossings, development in proximity to aquatic systems, and the proposed removal dams.

A project-specific 20 m buffer from the delineated boundary of natural aquatic ecosystems is recommended. This replaces the broader preliminary buffers applied during the baseline planning phase and is based on the more detailed assessment of the proposed activities, aquatic condition and sensitivity, impacts and proposed mitigation.

The main potential impacts identified are direct disturbance or loss of aquatic habitat, modification of hydrological processes, erosion and sedimentation, and deterioration of surface water quality. The assessed significance of these impacts is summarised below.

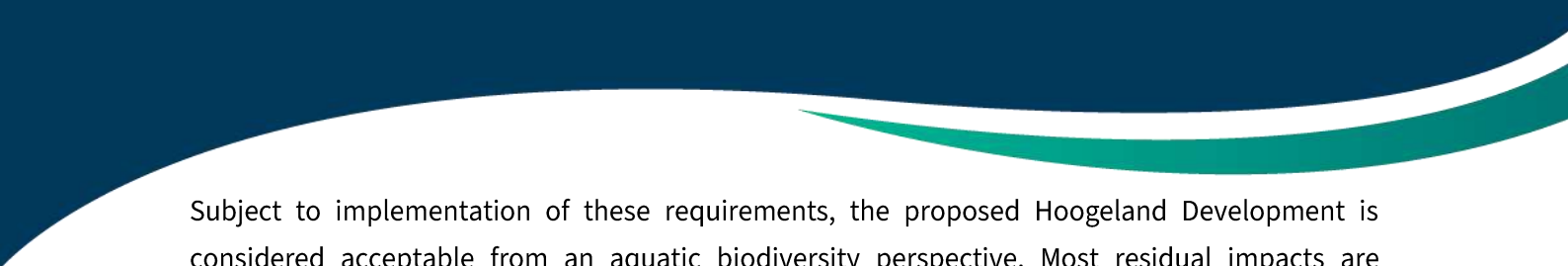
Impact	No-Go Alternative	Preferred – Without Mitigation	Preferred – With Mitigation
Habitat and biota	Low Negative	Medium Negative	Medium-Low Negative
Hydrological regime	Low Negative	Medium-Low Negative	Low Negative
Erosion, sedimentation and geomorphology	Low Negative	Medium-Low Negative	Low Negative
Surface water quality	Low Negative	Medium Negative	Low Negative

The No-Go Alternative would avoid new development related disturbance, but does not represent a stable ecological scenario. Existing pressures associated with agricultural land use, altered surface runoff patterns, erosion, impoundments and invasive alien vegetation are expected to continue, with gradual further deterioration of portions of the aquatic ecosystem likely in the absence of active management. Conversely, the preferred development introduces some unavoidable localised disturbance, but also provides an opportunity for improved protection, alien clearing, rehabilitation and coordinated management of the retained aquatic systems.

The post-mitigation ratings are dependent on effective implementation of the mitigation measures contained in this report. Particular importance is placed on incorporation of the refined aquatic delineation and 20 m buffer into the final layout, specialist review of the final layout and relevant engineering designs; appropriate design of crossings, and stormwater infrastructure, rehabilitation of disturbed aquatic and buffer areas; and long-term protection of retained aquatic habitat. Aquatic buffers and conservation areas must remain ecologically functional.

Alien invasive plant control and rehabilitation should form part of the development obligations with adequate financial provision for follow-up control and establishment. Future landowners and management bodies should be formally informed of, and acknowledge, the aquatic constraints and ongoing management responsibilities applicable to their properties.

Compliance monitoring can largely be undertaken by the appointed ECO, who should use the specialist GIS shapefiles to verify the GPS position of pegged development footprints, roads and servitudes in areas close to aquatic systems before clearing commences. Aquatic no-go areas and buffers must be demarcated on the ground and construction compliance, erosion control, rehabilitation and alien clearing verified throughout implementation. Targeted aquatic specialist and/or ecological input should be obtained at critical stages, including final design review, works within watercourses and assessment of rehabilitation success.



Subject to implementation of these requirements, the proposed Hoogeland Development is considered acceptable from an aquatic biodiversity perspective. Most residual impacts are expected to be of Low Negative significance, with permanent localised habitat disturbance remaining Medium-Low Negative. The objective from an aquatic biodiversity perspective should be to counter any residual impacts through the improved management of all remaining aquatic habitat on site.

Specialist Assessment Protocol Index

Report reference to Table 1 - Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity

2. Aquatic Biodiversity Specialist Assessment	
2.1. The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP), with expertise in the field of aquatic sciences.	Colin Fordham (400166/14 Ecology)
2.2. The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 1- Introduction 1.1 –Location & 1.3 – Project description
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:	
2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including;	Section 5 – Affected Environment Section 6- Results
(a) aquatic ecosystem types; and (b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;	Section 5.5 – The Drainage Network Section 6.1 – Identified habitat
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	Very High 1.4 -Screening tool results Section 5.4 – Conservation context Section 5.5 - SAIIE
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free-flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	Section 6 – Affected Environment
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including:	Section 6. Delineated aquatic habitat Section 7 & 8 – Affected Environment & Results
(a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and (b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat),	Section 6.1 – Drainage network Section 7.1 – Identified aquatic habitat Section 5.6 –Historic land use

wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).	
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	Section 6 – Results
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions:	
2.5.1. is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Refer to Section 7 – Impact assessment and tables
2.5.2. is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?	
2.5.3. how will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include:	Section 7 – Identified Impacts
(a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); (b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub-catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns); (c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and (d) to what extent will the risks associated with water uses and related activities change;	Section 7.2 –Flow pattern changes 7.3 - Erosion and Sedimentation Section 7.1 – Loss of aquatic habitat Section 7.4 Water Quality impacts
2.5.4. how will the proposed development impact on the functioning of the aquatic feature? This must include:	Section 8 – Impact Significance Assessment
(a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system); (b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river); (c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled 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);	Refer to Section 8 – Impact assessment and tables Section 8 – Identified Impacts Section 8 Impact Assessment

(e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and (f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);	
2.5.5. how will the proposed development impact on key ecosystems regulating and supporting services especially:	Section 8 – Impact Significance Assessment
(a) flood attenuation; (b) streamflow regulation; (c) sediment trapping; (d) phosphate assimilation; (e) nitrate assimilation; (f) toxicant assimilation; (g) erosion control; and (h) carbon storage?	Section 8 – discussion of identified impacts
2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 8 and Impact Table of Section 9
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: (a) size of the estuary; (b) availability of sediment; (c) wave action in the mouth; (d) protection of the mouth; (e) beach slope; (f) volume of mean annual runoff; and (g) extent of saline intrusion (especially relevant to permanently open systems).	Not applicable
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix 2 – Specialist curriculum vitae
2.7.2. a signed statement of independence by the specialist;	Below Declaration of Independence –Page vi
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	4.2 – Site assessment Section 4 – Approach and methodology Section 5 – Assumptions

2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;

Section 4 – Approach and methodology

Declaration of Independence

SPECIALIST REPORT DETAILS

This report has been prepared as per the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998), any subsequent amendments and any relevant National and / or Provincial Policies related to biodiversity assessments. This also includes the minimum requirements as stipulated in the National Water Act (Act 36 of 1998), as amended in Water Use License Application and Appeals Regulations, 2017 Government Notice R267 in Government Gazette 40713 dated 24 March 2017, which includes the minimum requirements for an Aquatic Compliance Statement.

Report prepared by: Colin Fordham (SACNASP No. 400166/14 Ecology)

Expertise / Field of Study:

Colin Fordham is a SACNASP registered Professional Natural Scientist (Pr. Sci. Nat.) Ecologist with 14 years of experience in the environmental and conservation sectors. He began his career in environmental consulting, spending six years compiling ecological and aquatic specialist reports for diverse development applications across Southern Africa. He then joined CapeNature as a Land Use Scientist, where he reviewed specialist reports to ensure compliance with best practices and legislation. Colin was later promoted to the senior manager position. As a Senior Landscape Conservation Intelligence Manager (LCIM) at CapeNature, Colin for five years led a team of ecological specialists and land use staff, providing strategic direction and ensuring the delivery of high-quality scientific outputs. He then re-joined the private sector as a specialist consultant with Upstream Consulting in 2025.

I, **Colin Fordham**, declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs Fisheries and Forestry and or Department of Water and Sanitation.

Signed:...  Date:....14 September 2026

TABLE OF CONTENTS

1	INTRODUCTION.....	5
1.1	LOCATION	5
1.2	AREA OF INVESTIGATION.....	6
1.3	PROJECT DESCRIPTION	6
1.4	ASSESSMENT AND LAYOUT DEVELOPMENT PROCESS	10
1.5	LEGISLATIVE CONTEXT	11
1.5.1	<i>DFFE Screening Tool Results.....</i>	<i>12</i>
2	TERMS OF REFERENCE	14
3	KNOWLEDGE GAPS	16
4	APPROACH AND METHODS	18
4.1	DESKTOP ASSESSMENT METHODS	18
4.2	FIELD ASSESSMENT AND DELINEATION METHODS.....	18
4.3	IMPACT ASSESSMENT METHODS.....	20
4.4	MITIGATION AND MONITORING.....	20
5	STUDY AREA.....	21
5.1	TOPOGRAPHY AND DRAINAGE	21
5.2	GEOLOGY AND SOILS.....	23
5.3	CLIMATE	23
5.4	VEGETATION.....	24
5.5	STRATEGIC WATER SOURCE AREAS.....	25
5.6	CRITICAL BIODIVERSITY AREAS	27
5.7	HISTORIC LAND USE.....	29
6	DESCRIPTION OF AFFECTED AQUATIC HABITAT	32
6.1	AQUATIC HABITAT DELINEATION	32
6.2	AQUATIC ECOSYSTEM CHARACTERISTICS.....	37
6.3	ARTIFICIAL WETLANDS	38
6.4	NATURAL AQUATIC ECOSYSTEM CLASSIFICATION	42
6.4.1	<i>Hillslope Seep Wetlands</i>	<i>42</i>
6.4.2	<i>Valley Bottom Wetlands.....</i>	<i>45</i>
6.4.3	<i>Non-Perennial Streams (Riparian Systems).....</i>	<i>46</i>
6.5	ECOLOGICAL HEALTH AND FUNCTIONAL ASSESSMENT – NATURAL	47
6.5.1	<i>Wetland PES.....</i>	<i>47</i>
6.5.2	<i>Riparian PES</i>	<i>29</i>
6.5.3	<i>Trajectory of Change</i>	<i>51</i>
6.6	ECOSYSTEM SERVICES AND EIS ASSESSMENTS	52
6.6.1	<i>Ecosystem Services</i>	<i>52</i>
6.6.2	<i>Ecological Importance and Sensitivity (EIS).....</i>	<i>57</i>
7	AQUATIC BUFFER ZONES.....	58
8	POTENTIAL IMPACTS.....	60

8.1	DISTURBANCE AND LOSS OF AQUATIC HABITAT AND BIOTA	60
8.2	CHANGES TO THE HYDROLOGICAL REGIME.....	61
8.3	EROSION AND SEDIMENTATION.....	61
8.4	CHANGES TO SURFACE WATER QUALITY.....	62
8.5	CUMULATIVE IMPACTS	62
9	IMPACT ASSESSMENT	64
9.1	IMPACT 1: DISTURBANCE/ LOSS OF AQUATIC HABITAT & BIOTA	64
9.2	IMPACT 2: CHANGES TO THE HYDROLOGICAL REGIME.....	65
9.3	IMPACT 3: EROSION, SEDIMENTATION AND GEOMORPHOLOGICAL CHANGE.....	66
9.4	IMPACT 4: CHANGES TO SURFACE WATER QUALITY	67
9.5	OVERALL IMPACT SIGNIFICANCE FOR THE AQUATIC BIODIVERSITY THEME	68
10	MITIGATION	70
10.1	AQUATIC HABITAT, BUFFERS AND DEVELOPMENT FOOTPRINTS	70
10.2	STORMWATER MANAGEMENT.....	71
10.3	EROSION, SEDIMENTATION AND GEOMORPHOLOGICAL PROTECTION	72
10.4	WATER QUALITY PROTECTION.....	73
10.5	LONG-TERM MANAGEMENT AND REHABILITATION.....	73
11	CONCLUSION	75
12	REFERENCES.....	77
13	APPENDIX 1 – DETAILED METHODOLOGY.....	81
13.1	DEFINITIONS	81
13.2	WETLAND DELINEATION AND HGM TYPE IDENTIFICATION	81
13.3	PRESENT ECOLOGICAL STATE (PES) – WETLANDS.....	86
13.4	WETLAND FUNCTIONAL IMPORTANCE (GOODS AND SERVICES)	88
13.5	IMPACT ASSESSMENT METHODOLOGY	90
14	APPENDIX 2- SPECIALIST CV.....	92
15	APPENDIX 3 -SPECIALIST DECLARATION.....	100
16	APPENDIX 4 -SITE SENSITIVITY VERIFICATION REPORT (SSVR)ERROR! BOOKMARK NOT DEFINED.	

LIST OF FIGURES

FIGURE 1: LOCALITY MAP OF THE PROPERTIES AND 500M STUDY AREA.....	6
FIGURE 2: HOOGELAND ZONING AND LAYOUT PLAN.....	9
FIGURE 3: SCREENING TOOL REPORT ON THE AQUATIC BIODIVERSITY THEME SENSITIVITY OF THE STUDY AREA.	13
FIGURE 4: MAP OF THE STUDY AREA IN RELATION TO THE NATIONAL WETLAND AND RIVER DESKTOP DATA INVENTORIES	22
FIGURE 5: MAP OF THE STUDY AREA IN RELATION TO THE SOUTH AFRICAN STRATEGIC WATER SOURCE AREAS MAP 26	

FIGURE 6: MAP OF THE STUDY AREA IN RELATION TO THE CONSERVATION PRIORITY AREA MAPPED BY THE WESTERN CAPE BIODIVERSITY SPATIAL PLAN (CAPENATURE 2023).....	28
FIGURE 7: HISTORIC AERIAL IMAGERY FROM 1957 , SHOWING EXTENSIVE AGRICULTURAL ACTIVITIES (APPROXIMATE STUDY AREA GIVEN IN RED POLYGON).....	31
FIGURE 8: DELINEATED HGM FRESHWATER HABITAT UNITS FOR THE STUDY AREA.	33
FIGURE 9: DELINEATED HGM FRESHWATER HABITAT UNITS AT A HIGHER SCALE ILLUSTRATING HOW THE ROAD WILL IMPACT HGM 26, NUMEROUS DAMS AND THE EQUESTRIAN CENTRE WILL RESULT IN THE LOSS OF DAM 27 AND 7.	34
FIGURE 10: DELINEATED HGM FRESHWATER HABITAT UNITS AT A HIGHER SCALE ILLUSTRATING HOW THE PROPOSED ROAD AND ITS SERVITUDE WILL IMPACT HGM 1, 2 AND 9.	35
FIGURE 11: DELINEATED HGM FRESHWATER HABITAT UNITS AT A HIGHER SCALE ILLUSTRATING HOW THE PROPOSED ROAD AND ITS SERVITUDE WILL IMPACT HGM 7, 28, 29 AND 19.....	36
FIGURE 12: SPIDER DIAGRAM SHOWING THE DEMAND AND SUPPLY OF VARIOUS ECOSYSTEM SERVICES BY THE VARIOUS UNITS	56

LIST OF TABLES

TABLE 1: RELEVANT ENVIRONMENTAL LEGISLATION	11
TABLE 2: PRESENT ECOLOGICAL STATE FOR HGM 2.....	48
TABLE 3: PRESENT ECOLOGICAL STATE FOR HGM 28.....	49
TABLE 4: PRESENT ECOLOGICAL STATE FOR HGM 29.....	50
TABLE 5: PRESENT ECOLOGICAL STATE FOR HGM 19.....	50
TABLE 6: PRESENT ECOLOGICAL STATE FOR HGM 26.....	51
TABLE 7: PRESENT ECOLOGICAL STATE OF THE HGM 1 RIPARIAN SYSTEM.....	30
TABLE 8: SUMMARY OF ECOSYSTEM SERVICES ASSESSMENT FOR THE VARIOUS HGM UNITS.....	55
TABLE 9: SUMMARY OF EIS SCORE FOR THE VARIOUS HGM RIPARIAN SYSTEMS.....	58
TABLE 10: BUFFER REQUIREMENTS FOR HOOGELAND DEVELOPMENT	59
TABLE 11: IMPACT ASSESSMENT SUMMARY FOR IMPACT 1 – DISTURBANCE OF AQUATIC HABITAT BIOTA.	64
TABLE 12: IMPACT ASSESSMENT SUMMARY FOR IMPACT 2 – CHANGES TO THE HYDROLOGICAL REGIME.....	65
TABLE 13: IMPACT ASSESSMENT SUMMARY FOR IMPACT 3 – EROSION AND SEDIMENTATION	66
TABLE 14: IMPACT ASSESSMENT SUMMARY FOR IMPACT 4 – CHANGES TO SURFACE WATER QUALITY	68

LIST OF PHOTO PLATES

PLATE 1: PHOTOGRAPH SHOWING TYPICAL LAND USE OF THE STUDY AREA	37
PLATE 2: PHOTOGRAPH SHOWING THE LARGE DAM IN HGM 2, A ROAD IS PROPOSED TO CROSS OVER THE DAM WALL, BUT THE PRESENCE OF ALIEN INVASIVE SPECIES AND THE DAM ITSELF HAS DETRIMENTALLY IMPACTED THE SYSTEM DOWNSTREAM.	39
PLATE 3: PHOTOGRAPH SHOWING THE ARTIFICIAL OFFSTREAM DAM OF DAM 7 WHICH WILL BE LOST BY THE CONSTRUCTION OF THE EQUESTRIAN CENTRE.....	41

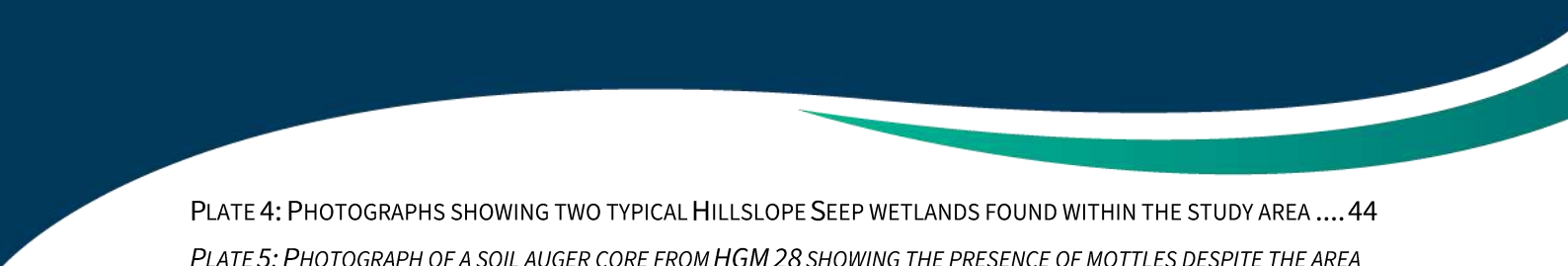


PLATE 4: PHOTOGRAPHS SHOWING TWO TYPICAL HILLSLOPE SEEP WETLANDS FOUND WITHIN THE STUDY AREA	44
PLATE 5: <i>PHOTOGRAPH OF A SOIL AUGER CORE FROM HGM 28 SHOWING THE PRESENCE OF MOTTLES DESPITE THE AREA BEING HEAVILY FARMED AND SOIL HISTORICALLY DISTURBED.</i>	46
PLATE 6: PHOTOGRAPHS SHOWING A HEAVILY INVADE RIPARIAN SYSTEM WITHIN THE STUDY AREA.....	47

1 INTRODUCTION

Upstream Consulting (Pty) Ltd was appointed by HilLand Environmental (Pty) Ltd to undertake an Aquatic Biodiversity Impact Assessment for the proposed Hoogeland Development near Glentana within the George Local Municipality, Western Cape. The proposed development comprises an approximately 644 ha area and includes approximately 105 farms averaging approximately 5 ha each. The development comprises two property types, namely Agri Properties and Eco Properties. Agri Properties are described as lifestyle or small-scale working farms, while Eco Properties comprise dwelling areas located within areas identified as more sensitive natural landscapes, with a maximum developable area of 2,000 m² per farm. Common facilities, including polo and equestrian infrastructure, are also proposed.

This assessment follows an earlier Aquatic Site Sensitivity and Baseline Assessment undertaken by Upstream Consulting in April 2026. The baseline study was completed at a planning stage, before a detailed development layout had been finalised, and the information generated was subsequently incorporated into the development planning process, allowing the layout to be informed by identified constraints. This second phase of assessment is therefore based on more detailed, project-specific information, allowing for the determination of impact significance on aquatic ecosystems, and to provide specialist aquatic biodiversity input to the Environmental Authorisation and Water Use Authorisation processes.

1.1 Location

The proposed Hoogeland development comprises numerous portions of Farm Hoogekraal No. 238 and is located directly inland of Glentana, within the George Local Municipality of the Western Cape Province. The study area is situated on the coastal platform less than 2 km from the centre of Glentana and is accessed via the N2 and Morrison Road. The study area is associated with the Maalgate River system and the broader coastal drainage network.

The locality of the study area is shown in Figure 1.

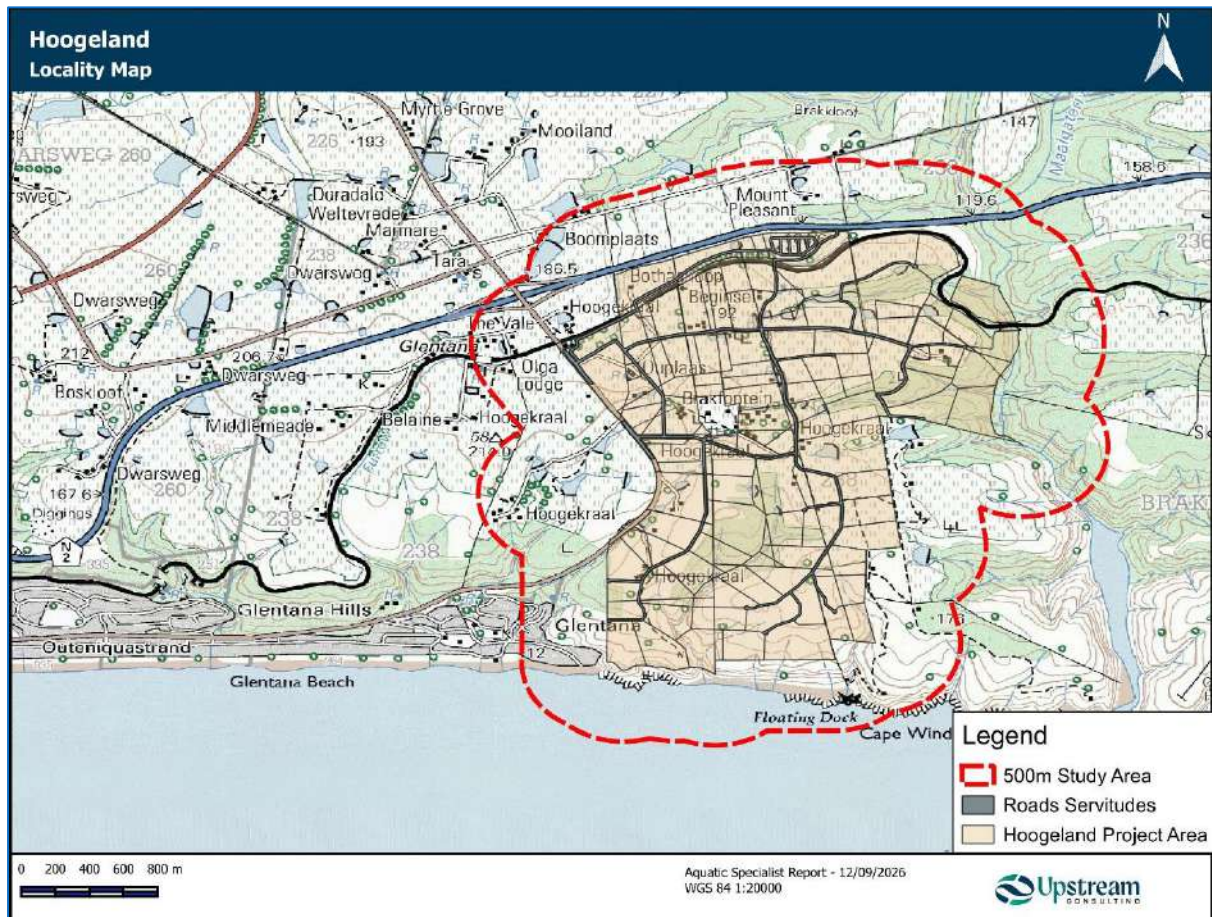


Figure 1: Locality map of the properties and 500m study area

1.2 Area of Investigation

The study area was defined as a 500 m radius surrounding the activity footprint (Figure 1). This delineation is consistent with the requirements of Government Notice 509 (GN 509) of 2016, as amended by GN 4167 of 2023, promulgated under the National Water Act (Act No. 36 of 1998), which requires Water Use Licence Applications for activities within 500 m of a wetland or 100 m of a watercourse. In addition, this report has been prepared in accordance with the Protocol for Specialist Assessment and Minimum Report Content Requirements for the Environmental Impacts on Aquatic Biodiversity (GN R 320, Government Gazette 43110, 20 March 2020), promulgated in terms of Sections 24(5)(a), (h) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). This protocol supersedes the requirements of Appendix 6 of the NEMA EIA Regulations, 2014 (as amended by GN R 326 of 2017), and sets the minimum requirements for aquatic biodiversity specialist assessments submitted as part of an Environmental Authorisation process.

1.3 Project Description

The proposed Hoogeland Development comprises an approximately 644 ha area incorporating a range of land-use zones and associated infrastructure. The development includes approximately

105 individual properties, together with areas allocated to agriculture, residential use, nature conservation and open space, communal facilities and supporting infrastructure.

The proposed land-use structure comprises a number of distinct zones, including Agriculture Zone I, Private Open Space Zone II, Nature Conservation Open Space Zone III, General Residential Zone II, Community Zone I, Utility Zone and Transport Zones II and III. The layout also identifies areas with split agricultural and conservation zoning.

The agricultural component comprises individual agricultural/lifestyle properties and areas designated for communal farming, including communal livestock farming. The residential component includes individual properties distributed throughout the development, as well as a group-housing/village component in the northern portion of the site. Proposed dwelling locations within areas designated for nature conservation are also identified on the layout plan. The development further includes communal and equestrian-related facilities.

The proposed land-use zones, property layout, proposed dwelling locations, internal road network, open-space and conservation areas, communal facilities and associated infrastructure are shown in Figure 2.

The internal road network comprises private roads and associated right-of-way servitudes. A number of 6 m wide right-of-way servitudes are identified within the development, including servitudes providing access to properties through the development. The internal roads will comprise gravel roads. Watercourse crossings will be provided by drift crossings rather than bridges. The civil engineering road layout identifies the proposed drift positions and provides a typical drift design comprising a concrete slab, specified road layerworks and rock protection.

Bulk water for household and irrigation purposes will be obtained from licensed water sources and provided within the road servitude network to the individual properties. An existing water pipeline servitude over Portion 52/238 is identified on the layout and is to remain in place.

Sanitation services to the individual properties will be provided at the property owners' expense. The northern village component will be fully serviced, with treated effluent from the wastewater treatment system intended for reuse for irrigation of the equestrian fields.

Existing electrical infrastructure occurs across portions of the development area. Electrical connections and associated infrastructure required to service individual properties will be the responsibility of the respective property owners.



The proposed development therefore comprises a mixed land-use layout incorporating agricultural, residential, conservation, open-space, communal, equestrian, community, utility and transport components, together with associated access, water, sanitation and electrical infrastructure.

The potential interaction between the various development components and the aquatic ecosystems occurring within and adjacent to the development area is assessed in the subsequent sections of this report.

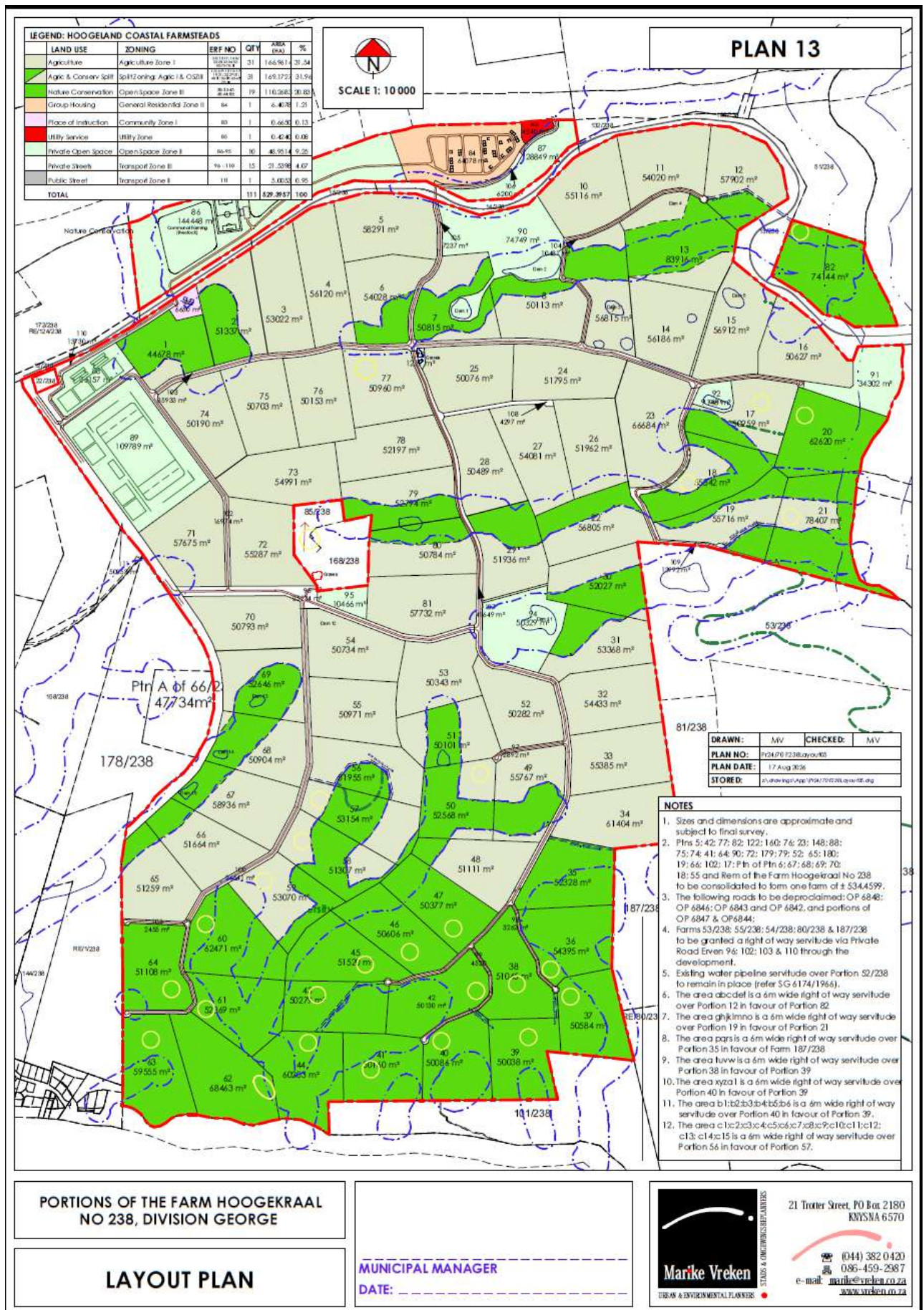


Figure 2: Hoogekraal zoning and layout plan

1.4 Assessment and Layout Development Process

The aquatic assessment of the Hoogeland Development has been undertaken as an iterative process to allow aquatic biodiversity information to inform the development layout from an early stage of planning. Upstream Consulting initially undertook an Aquatic Site Sensitivity and Baseline Assessment in April 2026, prior to the development of a detailed project layout. The purpose of the baseline assessment was to identify and broadly delineate aquatic ecosystems across the study area, characterise their hydrogeomorphic type and ecological condition, and identify aquatic constraints that should be considered during subsequent development planning.

The baseline assessment was therefore undertaken at a broad planning scale to guide layout development. The resulting aquatic delineation and precautionary buffer recommendations were therefore intended to provide a spatial framework for development planning rather than a final specific impact assessment.

The findings of the baseline assessment, as well as in-person discussions with the project team, were then incorporated into the planning of the Hoogeland Development. The resulting layout has, as far as practicable, concentrated development within historically transformed areas, retain areas of natural and sensitive habitat within conservation and open-space zoning, and make use of existing access routes where possible. The current development framework includes extensive areas designated as Nature Conservation Open Space Zone III, together with areas of combined agricultural and conservation zoning. Wetlands, riparian areas and other biodiversity constraints identified through the environmental planning process have similarly informed the spatial configuration of the development.

Once a development layout and associated infrastructure proposals became available, a second phase of aquatic assessment was undertaken. Additional field investigations were completed on 11 and 12 September 2026, with a focus on aquatic ecosystems potentially interacting with the proposed development footprint and on areas for which the initial baseline information required refinement. This allowed the aquatic delineation to be refined, additional areas to be assessed in detail, and project-specific assessments of ecological condition, ecological importance and sensitivity, and ecosystem services to be undertaken.

The present Aquatic Biodiversity Impact Assessment therefore builds upon, rather than replaces, the earlier baseline assessment. It evaluates the refined project layout against updated aquatic spatial information and identifies the remaining interactions between the development and aquatic ecosystems. The refined aquatic delineations and buffers presented in this report supersede the preliminary planning-level aquatic spatial information where differences occur. The project layout is likely to then be updated to incorporate the final specialist spatial data and recommendations arising from this assessment.

1.5 Legislative Context

The protection of water resources is essential for sustainable development and therefore many policies and plans have been developed, and legislation promulgated, to protect these sensitive ecosystems. The proposed project must abide by the relevant legislative requirements. Table 1 below shows an outline of the environmental legislation relevant to the project.

Table 1: Relevant environmental legislation

Legislation	Relevance
South African Constitution 108 of 1996	The constitution includes the right to have the environment protected
National Environmental Management Act 107 of 1998	Outlines principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state. Chapter 1(4r) states that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure. Section 24 of NEMA requires that the potential impact on the environment, socio-economic conditions and cultural heritage of activities that require authorisation, must be investigated and assessed prior to implementation, and reported to the authority.
Environmental Impact Assessment Regulations (EIA)	The 2014 regulations have been promulgated in terms of Chapter 5 of NEMA and were amended on 7 April 2017 in Government Notice No. R. 326. In addition, listing notices (GN 324-327) lists activities which are subject to an environmental assessment.
The National Water Act 36 of 1998	The proposed project requires water use authorisation in terms of Chapter 4 and Section 21 of the National Water Act No. 36 of 1998, and this must be secured prior to the commencement of activities. Chapter 4 of the National Water Act addresses the use of water and stipulates the various types of licensed and unlicensed entitlements to the use of water.
Conservation of Agricultural Resources Act (Act 43 of 1983)	The Conservation of Agricultural Resources Act (CARA) is to provide for the conservation of the natural agricultural resources by the maintenance of production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants.

National Environmental Management: Biodiversity Act No. 10 of 2004	This is to provide for the management and conservation of South Africa's biodiversity through the protection of species and ecosystems; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits.
Western Cape Biodiversity Act 6 of 2021 (WCBA)	The Western Cape Biodiversity Act (Act 6 of 2021) provides the provincial legislative framework for biodiversity conservation and management and establishes the Western Cape Biodiversity Spatial Plan (BSP) as a spatial planning tool to identify biodiversity priority areas and inform land-use planning and decision-making. In relation to the proposed Hoogeland development, the Act is relevant to the consideration of biodiversity priorities in the planning and assessment of the proposed land uses, including areas identified as biodiversity priority areas and their associated management objectives.

1.5.1 DFFE Screening Tool Results

The National Web-based Environmental Screening Tool was used to determine the environmental themes and associated specialist assessment requirements applicable to the proposed Hoogeland Development. The Screening Tool identifies areas of both Very High and Low Aquatic Biodiversity sensitivity within the broader study area. The Very High sensitivity rating is associated with the occurrence of mapped wetlands and rivers, areas identified as CBA 1, CBA 2 and ESA 1, and portions of the Outeniqua Strategic Water Source Area (Figure 3).

The Screening Tool output represents a desktop sensitivity classification and therefore requires verification against actual site conditions. An initial aquatic Site Sensitivity Verification and baseline assessment was consequently undertaken by Upstream Consulting in April 2026. This assessment confirmed the presence of numerous aquatic ecosystems within the development area, including natural wetlands, non-perennial watercourses and associated riparian habitat, as well as numerous artificial impoundments. The baseline assessment also confirmed that these aquatic features form part of a connected drainage network and that several retain ecological and hydrological importance despite extensive historical agricultural modification.

The site verification therefore confirmed that a full Aquatic Biodiversity Specialist Assessment is required in terms of the *Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity*, published in Government Notice No. 320, Government Gazette No. 43110 of 20 March 2020, under Sections 24(5)(a), (h) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The present report therefore constitutes the project-specific Aquatic Biodiversity Specialist Assessment for the proposed Hoogeland Development and has been prepared in accordance with the requirements of the Protocol.

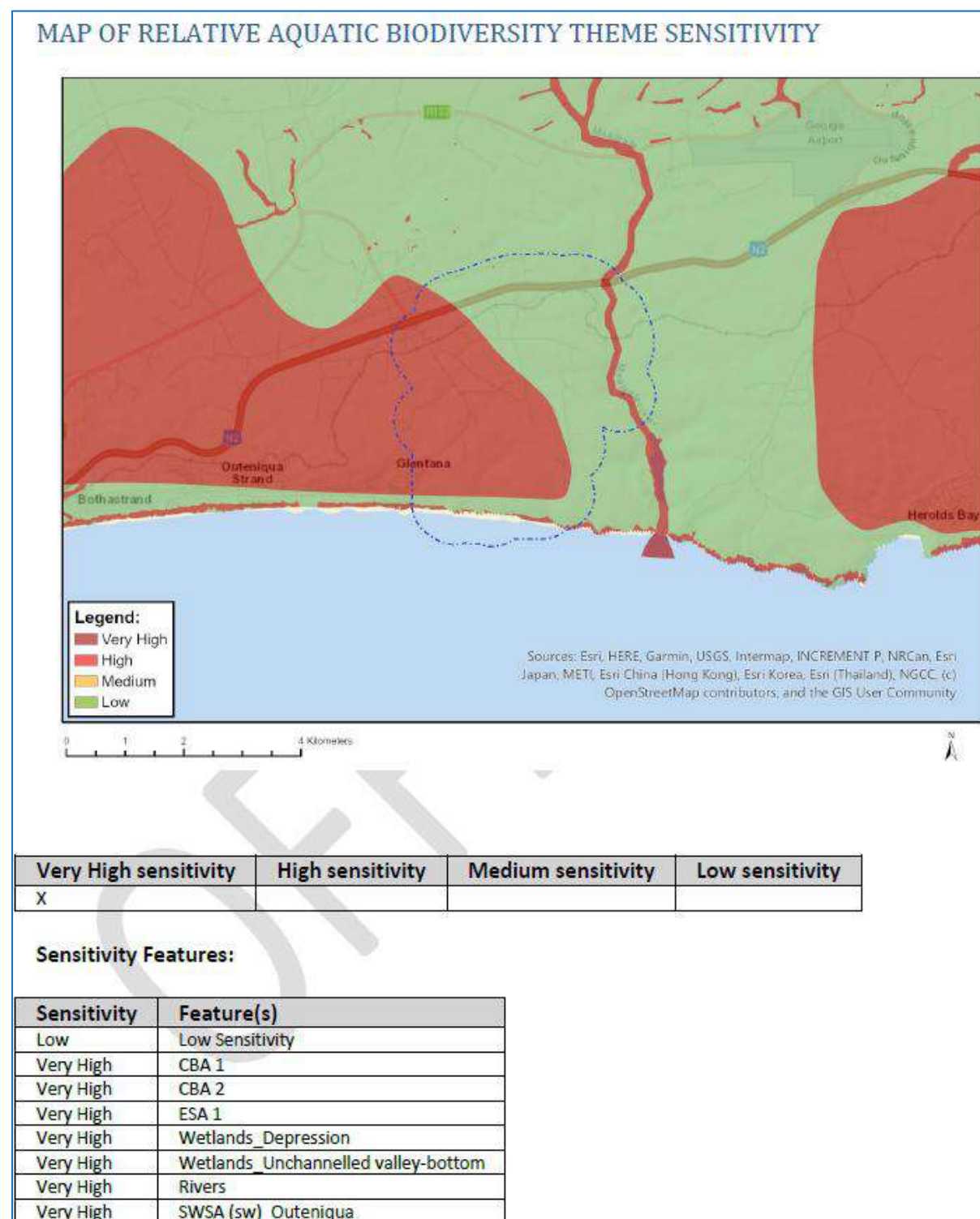


Figure 3: Screening Tool Report on the Aquatic Biodiversity Theme Sensitivity of the study area.

2 TERMS OF REFERENCE

This Aquatic Biodiversity Impact Assessment report has been compiled in accordance with the procedural requirements for Water Use Licence Applications as prescribed in GN R.267 (24 March 2017) under the National Water Act, 1998 (Act No. 36 of 1998), as well as the EIA Regulations (2014), as amended, under the National Environmental Management Act, 1998 (Act No. 107 of 1998). Furthermore, the report adheres to the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes (GN 320, 20 March 2020), specifically the protocol for Aquatic Biodiversity, ensuring compliance with national specialist reporting standards.

The assessment builds upon the Aquatic Site Sensitivity and Baseline Assessment completed in April 2026 and refines the earlier aquatic delineation and ecological assessment in relation to the proposed development layout. Below find the detailed terms of reference:

- Contextualization of the study area in terms of important biophysical characteristics and the latest available aquatic conservation planning information (including but not limited to the South African Inventory of Inland Aquatic Ecosystems (SAIIAE), vegetation, CBAs, Threatened ecosystems, NFEPA data, broader catchment drainage and protected areas).
- Desktop delineation and illustration of all watercourses within and surrounding the study area utilising available site-specific data such as aerial photography, contour data and water resource data.
- Prepare a map demarcating the respective watercourses or wetland/s, within the study area. This will demonstrate, from a holistic point of view the connectivity between the site and the surrounding regions. The maps depicting demarcated waterbodies will be delineated to a scale of 1:10 000, following the methodology described by the DWS.
- A risk/screening assessment of the identified aquatic ecosystems to determine which ones will be impacted upon and therefore require ground truthing and detailed assessment.
- Refinement and ground-truthing of the April 2026 baseline aquatic delineation in relation to the proposed development layout. Ground truthing, identification, delineation and mapping of the aquatic ecosystems in terms of the Department of Water and Sanitation (DWA 2008) *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas*.
- Classification of the identified aquatic ecosystems in accordance with the, 'National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis *et al.* 2013) and WET-Ecoservices (Kotze *et al.* 2009, 2020).
- Conduct a Present Ecological State (PES), functional importance assessment and Ecological Importance and Sensitivity (EIS) assessment of the delineated wetland and riparian habitats.
- Identification, prediction and description of potential impacts on aquatic habitat during the construction and operational phases of the project. Impacts are described in terms of

their extent, intensity, and duration. The other aspects included in the evaluation are probability, reversibility, irreplaceability, mitigation potential, and confidence in the evaluation.

- All direct, indirect, and cumulative impacts for the development and No-Go alternative will be rated with and without mitigation to determine the significance of the impacts.
- Recommend actions that should be taken to avoid impacts on aquatic habitat, in alignment with the mitigation hierarchy, and any measures necessary to restore disturbed areas or ecological processes.

3 KNOWLEDGE GAPS

Within specialist assessments, there are assumptions and limitations that may influence the interpretation of specialist findings. These limitations are recognised in the assessment and are considered when interpreting the results and assessing potential impacts. That being said, the level of information available for this assessment is substantially greater than that available during the April 2026 baseline study. The development layout is now provided, additional fieldwork was undertaken in September 2026, and the aquatic delineation and ecological assessment were refined in relation to the proposed development footprint/ specific activities. The level of assessment is therefore considered appropriate for the NEMA and NWA processes. Nevertheless, the following limitations remain:

- The assessment is based on the development layout and infrastructure information available at the time of reporting. Detailed property-specific information, including final dwelling positions, pipelines, stormwater infrastructure, sanitation systems and other services, has not yet been developed for all properties. These future components will need to comply with the aquatic buffers, no-go areas and mitigation requirements established in this report.
- The layout supplied for assessment incorporates the earlier baseline aquatic delineation and preliminary buffers. The September field assessment has subsequently refined portions of the aquatic delineation, and activity-specific buffers are being determined as part of the present assessment.
- No detailed aquatic fauna or invertebrate surveys were undertaken. The assessment focuses on aquatic habitat, ecological condition, ecosystem functioning and sensitivity rather than providing a comprehensive inventory of aquatic biota. Water-quality sampling did not form part of the scope, nor was it deemed as necessary.
- Detailed rehabilitation design and long-term management measures for individual HGM units are beyond the scope of this impact assessment. Where rehabilitation or active management of riparian areas is required, this should be addressed through separate/ future management or rehabilitation plans with appropriate specialist input.
- Given the phased nature and scale of the development, some detailed infrastructure and land-use details will only become known later. Specialist review should therefore be retained where future works are proposed within or immediately adjacent to aquatic habitats or their buffers.
- Project-specific GIS data for the cadastral boundaries and road servitudes were provided and incorporated into the spatial assessment. Other project design information was provided in PDF format, and the assessment is therefore based on the level of spatial and design detail available in the information supplied.
- The assessment of potential impacts and proposed mitigation measures is informed by the site-specific aquatic characteristics identified during the assessment, available desktop information and the professional experience of the specialist.



These limitations are not considered to prevent a reliable assessment of the proposed development, provided that the refined recommendations contained in this report are incorporated into the final development and management thereof.

4 APPROACH AND METHODS

This study followed the approaches of several national guidelines with regards to wetland/ riparian assessment. See Appendix 1. The following approach to the aquatic habitat assessment is undertaken:

4.1 Desktop Assessment Methods

The contextualization of the study area was undertaken in terms of important biophysical characteristics and the latest available aquatic conservation planning information (i.e. existing data for coastal management lines, NFEPA identified rivers and wetlands, critical biodiversity areas (WBSP 2023), estuaries, vegetation units, ecosystem threat status, catchment boundaries, geology, land uses, etc.) in a Geographical Information System (GIS). A South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the National Biodiversity Assessment of 2018 (Van Deventer *et al.* 2018). The SAIIAE offers a collection of data layers pertaining to ecosystem types and pressures for both rivers and inland wetlands. National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) 2018. It is imperative to develop an understanding of the regional drainage setting and longitudinal dynamics of the watercourses and the coastal dynamic. The conservation planning information aids in the determination of the level of importance and sensitivity, management objectives, and the significance of potential impacts.

Following this, desktop delineation and illustration of all watercourses within the study area was undertaken utilising available site-specific data such as aerial photography, contour data and water resource data. Digitisation and mapping were undertaken using QGIS 3.42 GIS software. These results, as well as professional experience, allowed for the identification of sensitive habitat that could potentially be impacted by the project and therefore required ground truthing and detailed assessment.

4.2 Field Assessment and Delineation Methods

Field assessment was undertaken in two phases. An initial broad-scale aquatic baseline assessment was undertaken on 17 April 2026 to verify desktop findings and provide aquatic constraints for development planning. Following preparation of the proposed development layout, additional field assessment was undertaken on 11 and 12 September 2026. The latter survey focused on aquatic features potentially interacting with the proposed development, areas requiring refinement of the initial delineation, and collection of information required for the project-specific ecological assessment.

General observations were made with regards to the vegetation, fauna and current impacts. The identified aquatic ecosystems were classified in accordance with the '*National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa*' (Ollis *et al.* 2013) and *WET-Ecoservices* (Kotze *et al.* 2009, 2020).

Infield delineation was undertaken with a hand-held GPS for verification and refinement of the delineated aquatic ecosystems, in alignment with standard field-based procedures in terms of the Department of Water and Sanitation (DWA 2008) *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas*. The delineation is based upon observations of the landscape setting, topography, vegetation and soil characteristics (using a hand held soil auger for wetland soils).

Determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) assessment of the delineated river/riparian habitats was undertaken utilising:

- Qualitative Index of Habitat Integrity (IHI) tool adapted from (Kleynhans, 1996) – PES
- DWA (DWS) River EIS tool (Kleynhans, 1999) - EIS

Determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) assessment of the delineated wetland habitat was undertaken utilising:

- The health/condition or Present Ecological State (PES) of the wetland was assessed using the Level 2 WET-Health assessment tool Version 2 (Macfarlane *et al.* 2020), which is based on an understanding of both catchment and on-site impacts and the impact that these aspects have on system hydrology, geomorphology and the structure and composition of wetland vegetation.
- The WET-Ecoservices tool (Kotze *et al.*, 2020) is utilised to assess the goods and services that the individual wetlands under assessment provide, thereby aiding informed planning and decision-making. Wetland benefits can be classified into goods/products (directly harvested from wetlands), functions/ services (performed by wetlands), and ecosystem scale attributes. The tool provides guidelines for scoring the importance of a wetland in delivering each of 15 different ecosystem services (including flood attenuation, sediment trapping and provision of livestock grazing).

Detailed ecological assessment focused on natural aquatic systems potentially affected by, or occurring in close proximity to, the proposed development footprint, while the broader aquatic network was retained in the spatial assessment to provide catchment and connectivity context.

4.3 Impact Assessment Methods

The approach adopted is to identify and predict all potential direct and indirect impacts resulting from an activity from planning to rehabilitation. Thereafter, the impact significance is determined. Impact significance is defined broadly as a measure of the desirability, importance and acceptability of an impact to society (Lawrence, 2007). The degree of significance depends upon three dimensions: the measurable characteristics of the impact (e.g. intensity, extent and duration), the importance societies/communities place on the impact, and the likelihood / probability of the impact occurring. Unknown parameters are given the highest score as significance scoring follows the Precautionary Principle.

Cumulative impacts affect the significance ranking of an impact because the impact is taken in consideration of both onsite and offsite sources.

Potential impacts were assessed against the proposed development layout supplied at the time of assessment, taking into account the avoidance already incorporated through the earlier baseline planning process.

4.4 Mitigation and Monitoring

Actions are thereafter recommended to prevent and mitigate the identified impacts on aquatic habitat, as well as mitigation and management measures in accordance with the mitigation hierarchy. Where detailed rehabilitation, long-term aquatic management or monitoring is required, the need for subsequent specialist input is identified rather than prescribing detailed HGM-specific management at this stage.

No-Go Areas are determined, and any necessary monitoring protocol will be developed. Aquatic buffer requirements were determined using the Macfarlane and Bredin buffer methodology, based on the proposed land uses and impact pathways now available for the project. These project-specific buffers refine the conservative planning buffers applied during the April 2026 baseline assessment.

5 STUDY AREA

The desktop/ screening study was informed by the available datasets relevant to water resources, as well as historic and the latest aerial imagery, to develop an understanding of the fluvial and geomorphic processes of the study area. The study area for the assessment was defined as the disturbance footprint i.e. the area on which the activity will take place, which includes the area that will be disturbed or impacted, plus any watercourses situated within 500 m of that activity, i.e. the 'regulated zone' of a watercourse as defined by the National Water Act. The desktop study was followed by the detailed site assessment. The general biophysical characteristics of the study area, as well as desktop data, are described below.

5.1 Topography and Drainage

The majority of study area is located on a plateau with a gentle seaward-sloping gradient, ascending from approximately 13 mamsl at the southern boundary on the coastline to roughly 192 mamsl at the northern perimeter. This topographic profile defines several a localised catchments that feeds 14 non-perennial drainage lines and the Maalgate River on the eastern boundary. The hydrological regime of these features vary from perennial, non-perennial to episodic. There are also numerous dams on the farms and systems mapped by the NBA data. Refer to Figure 4 indicating the desktop-mapped location of these features by the national 1: 50 000 river line data (NGI, 2007).

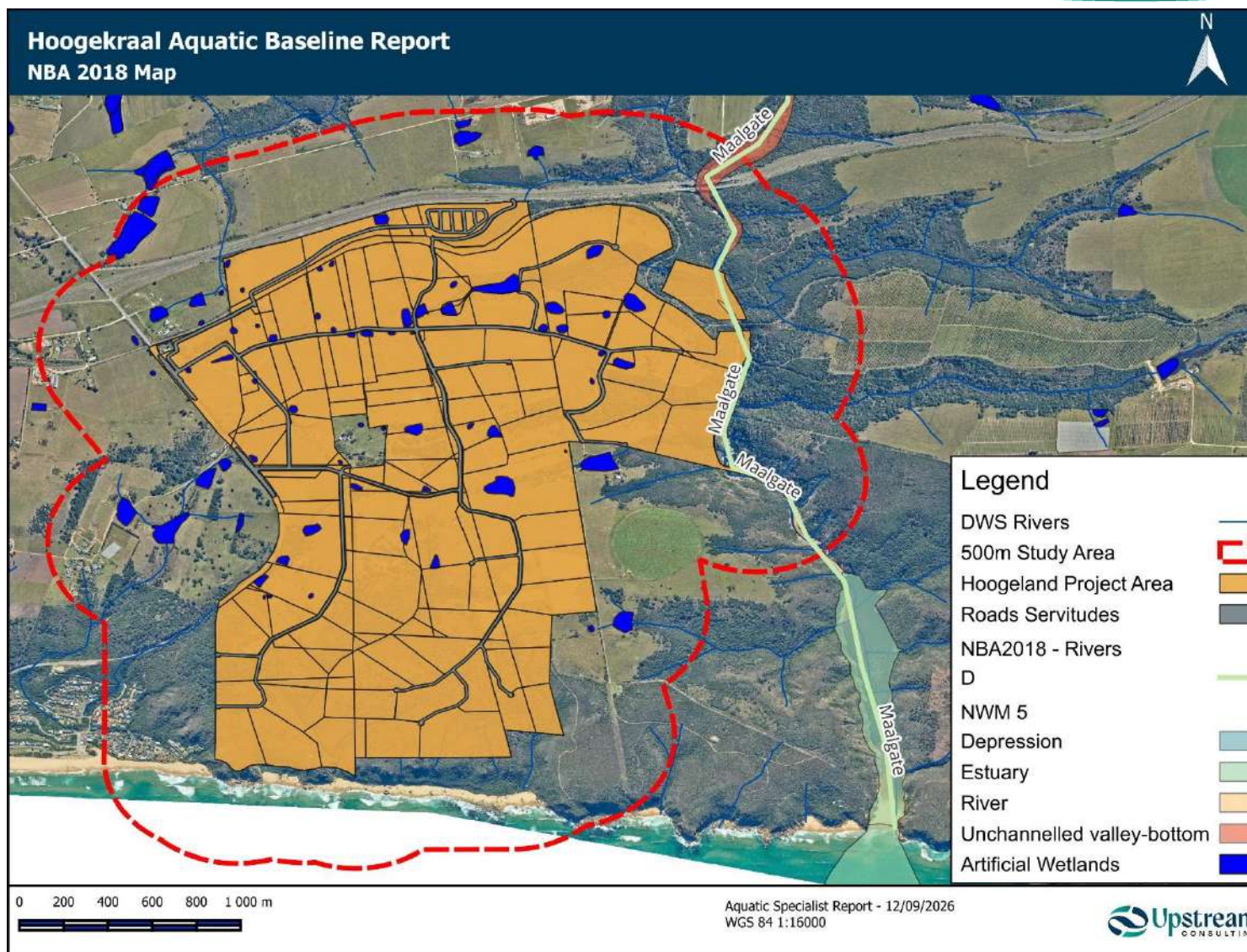


Figure 4: Map of the study area in relation to the national wetland and river desktop data inventories

5.2 Geology and Soils

The study area occurs on the southern Cape coastal platform and is underlain by sedimentary rocks of the Cape Supergroup associated with the Cape Fold Belt. In the broader region, these units are dominated by quartzitic sandstones of the Peninsula Formation of the Table Mountain Group, which form the resistant basement underlying much of the coastal plateau inland of the shoreline (Johnson *et al.*, 2006; Council for Geoscience, 2010). In the immediate coastal zone surrounding the study area, the bedrock surface is commonly mantled by unconsolidated Quaternary sediments including marine sands, colluvial materials and windblown aeolian dune sands associated with coastal depositional processes and late Quaternary sea-level fluctuations (Roberts *et al.*, 2006; Marker, 2008).

Soils within the study area are typically sandy and moderately well drained, reflecting their derivation from weathered sandstone and coastal dune deposits. Surface horizons generally comprise sandy to loamy sand topsoils with moderate organic content, underlain by deeper sandy subsoils with variable clay accumulation at depth. In localized areas, ferruginous concretions and weakly developed ferricrete horizons may occur within the subsoil profile as a result of iron mobilisation and precipitation associated with periodic wetting and drying cycles (Fey, 2010).

The sandy soil matrix generally promotes moderate infiltration; however, localised clay enrichment and ferricrete development within the subsoil can reduce permeability and impede vertical drainage. These conditions may result in perched water tables and the seasonal accumulation of soil moisture in topographic depressions or along gentle slopes. Such hydrological conditions contribute to the development of wetlands and seasonally saturated soils within the landscape. Surface runoff generated during rainfall events is typically conveyed along shallow drainage lines and ephemeral channels that ultimately discharge toward the Maalgate River and its associated tributaries. The interaction between sandy surface soils, locally restrictive subsoil horizons and the gently undulating coastal topography therefore plays an important role in the formation and maintenance of wetlands, seepage zones and drainage features within the study area.

5.3 Climate

The regional climate is temperate and strongly influenced by maritime conditions associated with the southern Cape coastal belt. The area experiences a relatively moderate climate with rainfall distributed throughout the year, although peak precipitation typically occurs during late winter and spring associated with frontal systems moving across the southern Cape. Mean Annual Precipitation in the George coastal region generally ranges between approximately 700 and 900 mm, while mean annual potential evaporation is typically in the order of 1100–1300 mm (DEA, 2014; Schulze, 2007).

Although evaporation slightly exceeds rainfall on an annual basis, the relatively high and seasonally distributed precipitation supports the persistence of surface water features and shallow groundwater systems within the landscape. Rainfall events associated with frontal systems and occasional convective storms can generate rapid surface runoff responses, particularly where soils become saturated during wetter winter months. As a result, drainage features within the study area, including tributaries and minor drainage lines that discharge toward the Maalgate River, may display seasonal or episodic flow characteristics.

The interaction between relatively high coastal rainfall, gentle topography and locally restrictive subsoil horizons contributes to the development of wetlands, seepage zones and seasonally saturated soils within low-lying portions of the landscape. These conditions support the persistence of wetland habitats and hydrologically connected drainage features within the study area, particularly along valley bottoms and areas receiving subsurface flow from surrounding slopes.

5.4 Vegetation

Based on national vegetation mapping and biodiversity assessment frameworks, the study area falls within the Garden Route Granite Fynbos vegetation type, with localised transitional influence toward Southern Afrotemperate Thicket in more mesic and sheltered positions (Mucina & Rutherford, 2006). According to the National Biodiversity Assessment (NBA 2024), this vegetation unit is classified as Critically Endangered, with only small, highly fragmented remnants remaining in a largely transformed landscape, particularly along the southern Cape coastal corridor where agricultural and peri-urban land uses have resulted in substantial habitat loss and fragmentation (SANBI, 2024).

Vegetation patterning across the site is strongly governed by substrate, soil depth, and topographic position, with hydrology acting as a key secondary driver. The more elevated and freely drained areas are typically characterised by fynbos vegetation comprising sclerophyllous shrub communities adapted to nutrient-poor, acidic soils derived from weathered granite and associated colluvial and aeolian deposits. These areas form the remaining matrix vegetation where intact patches persist, although these are now generally small and fragmented within the broader landscape context described by the NBA 2024.

In contrast, lower-lying areas, valley bottoms, and zones adjacent to drainage lines associated with the Maalgate River exhibit a transition toward denser woody vegetation, including elements of Southern Afrotemperate Thicket. These areas are influenced by higher soil moisture availability, periodic saturation, and the accumulation of finer sediments and organic material, which create more favourable conditions for woody species and mesic vegetation elements. Drainage lines and seepage zones therefore function as important ecological gradients and refugia for moisture-dependent species within a largely fynbos-dominated system.

The interaction between geology-driven soil development, localised hydrological accumulation, and topographic variability results in a heterogeneous vegetation mosaic across the study area. This mosaic reflects both natural ecotonal processes and the constrained distribution of remaining intact Garden Route Granite Fynbos remnants, which are of high conservation significance given their Critically Endangered status under the NBA 2024 classification framework (SANBI, 2024).

5.5 Strategic Water Source Areas

The western portion of the study area is formally identified as part of the Outeniqua Strategic Water Source Area (SWSA) for surface water (Lötter, M.C., and Le Maitre, 2021). Refer to Figure 5. This map resulted in the DFFE Screening Tool having a "Very High" sensitivity for the Aquatic Biodiversity Theme. It is important to note that the SWSA mapping is conducted at a national desktop scale and often identifies broad catchment areas based on modelled hydrological contribution rather than the presence of discrete on-site aquatic features.

Site-specific ground-truthing confirmed surface watercourses are located within this specific northwestern corner. SWSAs are identified in recent South African water resource and biodiversity literature as priority catchments that contribute a disproportionate share of reliable surface water yield to downstream users. These areas are important because intact vegetation and soil systems regulate runoff, sustain dry-season baseflows, and reduce the severity of flood peaks during high rainfall events. The regions also play a key role in maintaining water quality by limiting erosion, sediment transport, and nutrient loading into rivers and wetlands. In addition, SWSAs are increasingly recognised as critical ecological infrastructure that supports climate resilience by buffering hydrological extremes and maintaining catchment functioning under variable rainfall conditions.

The site also falls within the K30A DWS quaternary catchment, which primarily drains into the Maalgate River and estuary. The drainage lines on the property contribute to catchment-to-coast hydrological and ecological connectivity. The smaller drainage lines serve as essential longitudinal corridors, providing natural pathways for the movement of biota between the inland fynbos plateaus and the coastal zone. Consequently, the conservation value of the site is not derived from perennial "high flow" river dynamics, but from its functional role as a biological and hydrological link within the coastal landscape.

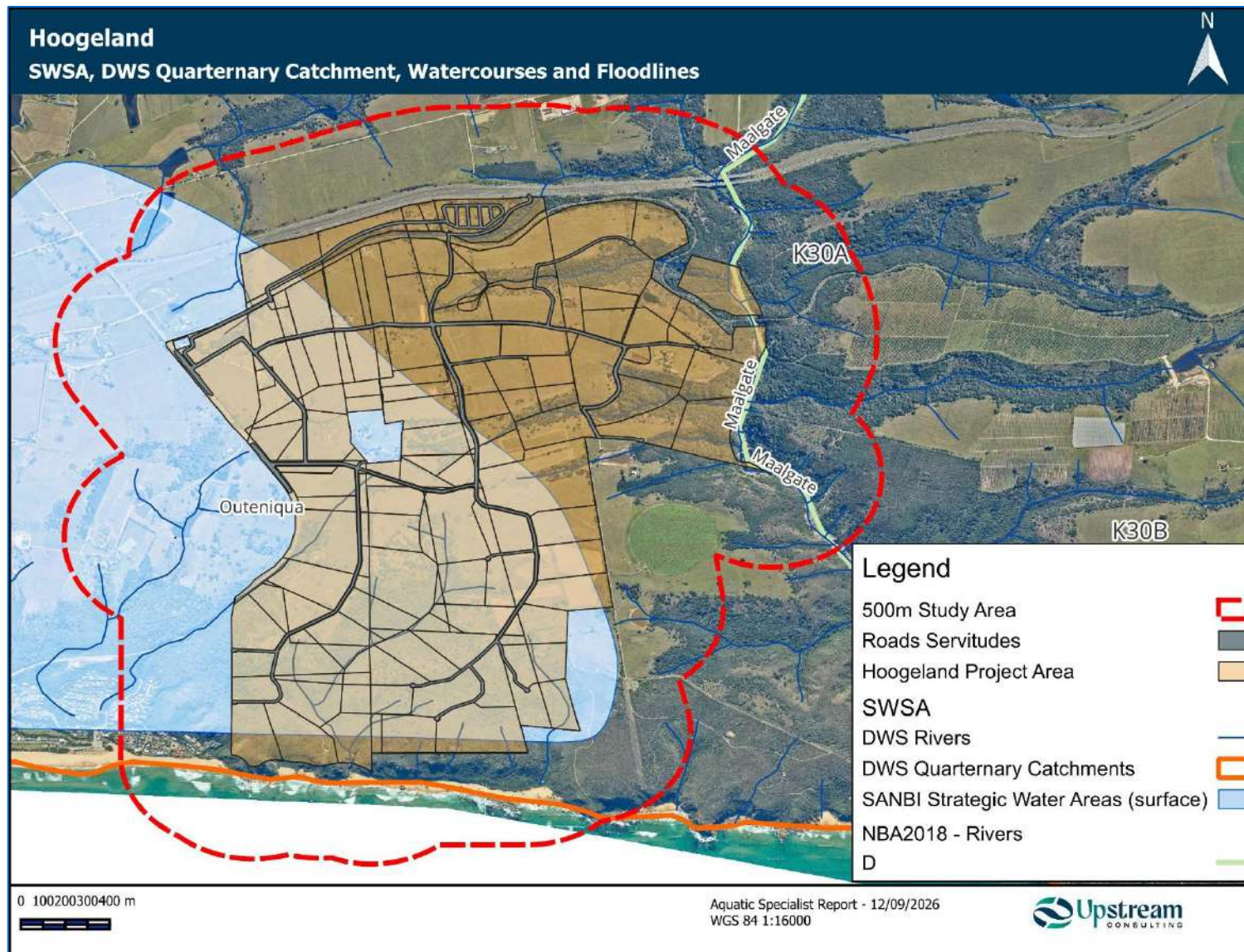


Figure 5: Map of the study area in relation to the South African Strategic Water Source Areas map

5.6 Critical Biodiversity Areas

According to the 2023 Western Cape Biodiversity Spatial Plan (WCBSP) (CapeNature, 2023), significant portions of the study area are mapped as a Terrestrial Critical Biodiversity Area (CBA 1). No Aquatic CBAs are indicated within the site, and the non-perennial drainage features present on the property are not explicitly captured in the provincial spatial dataset. Refer to Figure 6.

Although no Aquatic CBAs are mapped within the study area, the presence of extensive Terrestrial CBA 1 areas remains highly relevant to the integrity and functioning of freshwater ecosystems within those areas. Terrestrial CBAs are designed not only to conserve biodiversity in a terrestrial sense, but also to maintain key ecological processes such as hydrological regulation, soil stability, and landscape connectivity. In this context, they form part of the broader catchment system that supports the formation, persistence, and functioning of the potentially non mapped aquatic ecosystems on site.

Within the study area, terrestrial CBAs play an important role in regulating surface runoff and groundwater recharge across the gently sloping coastal plateau. Intact vegetation and soils within these areas slow overland flow, enhance infiltration, and reduce erosion and sediment transport into downstream aquatic systems, including the Maalgate River. They also support subsurface hydrological processes that sustain wetlands and maintain seasonal baseflow to streams. Where these terrestrial systems are intact, they effectively act as a buffer that stabilises aquatic ecosystem function.

Accordingly, even in the absence of mapped aquatic CBAs, terrestrial CBAs indirectly underpin the ecological integrity of all freshwater features within the study area. Their conservation is therefore essential for maintaining hydrological connectivity, water quality, and the long-term resilience of aquatic ecosystems in a landscape already subject to historical agricultural transformation and fragmentation.

In terms of the WCBSP, field verification is a critical component in refining and validating desktop-derived CBA and ESA mapping layers. The BSP is produced at a broad spatial scale and is inherently conservative, requiring site-specific ground-truthing to confirm habitat condition, ecological functionality, and the presence or absence of aquatic and terrestrial features. The field assessment undertaken for this study therefore served to verify whether mapped CBAs corresponded with on-the-ground conditions, particularly in relation to land transformation, hydrological connectivity, and the extent of intact vegetation. This approach ensures that the BSP framework is correctly interpreted at a site level and that development planning is informed by both regional conservation priorities and verified ecological realities.

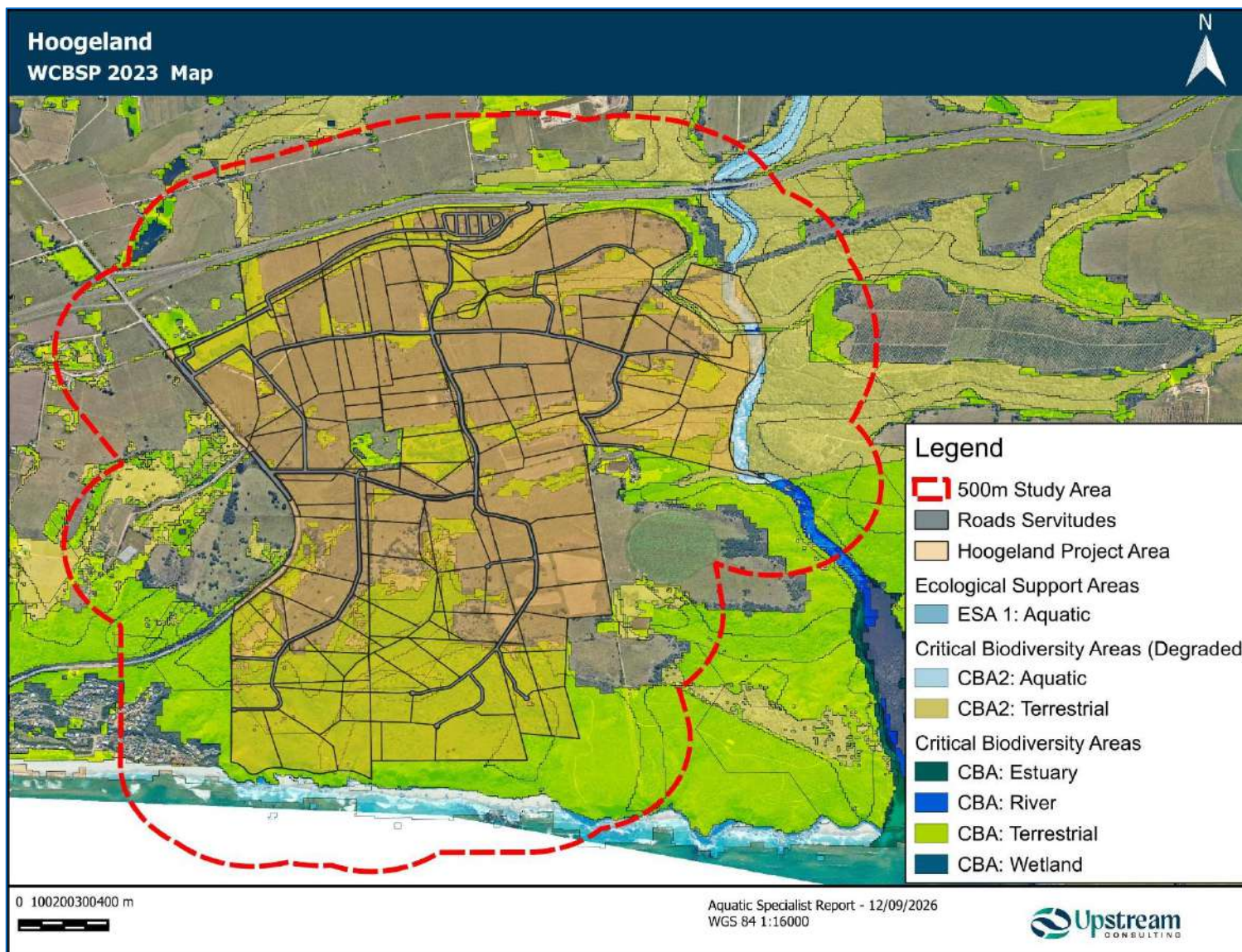


Figure 6: Map of the study area in relation to the conservation priority area mapped by the Western Cape Biodiversity Spatial Plan (CapeNature 2023)

5.6.1 Riparian PES

The rapid Index of Habitat Integrity (IHI) tool (Kleyhans, 1996) was used to determine the Present Ecological State (PES) of the affected riparian system (HGM 1) by comparing the current condition of the in-stream and riparian habitats, including existing anthropogenic impacts, relative to the estimated reference condition (Table 7). The system is characterised by well-established riparian vegetation and retains substantial portions of its natural riparian structure. However, the existing railway line passes directly through the system and has resulted in localised modification of the channel and surrounding riparian zone. Additional impacts are associated with surrounding land uses and infrastructure, including altered lateral inputs and localised flow concentration.

Bed modification within the system is moderate, with the natural channel structure retained through much of the riparian reach but with localised alteration associated with the railway infrastructure and other anthropogenic disturbances. The presence of infrastructure within the wetland and riparian corridor has modified portions of the channel and bed, although substantial areas remain representative of the natural system. Flow modification is more pronounced, with the railway embankment and associated infrastructure constraining the natural movement of water through the system and reducing lateral connectivity in affected sections. These modifications have resulted in a degree of flow confinement, particularly where the railway intersects the riparian corridor.

Inundation dynamics remain relatively well maintained, although the confinement of flows and alteration of lateral inputs associated with the railway and surrounding land uses have modified the natural distribution of water within portions of the system. The system continues to experience natural wetting and drying processes, but these are influenced by the existing infrastructure and modified catchment conditions. Bank condition is moderately affected by localised disturbance and flow concentration, with some areas showing evidence of altered bank stability and erosion associated with confined flows. Nevertheless, the riparian margins remain well vegetated, which provides an important contribution to bank stability, sediment retention and maintenance of channel structure.

Riparian condition is comparatively well maintained, with substantial and continuous vegetation cover occurring along the channel margins. The riparian vegetation provides structural habitat, contributes to bank stabilisation and assists with the retention of sediment and organic material within the system. Although localised disturbance and alien invasive vegetation occur within the broader system, the riparian zone remains well vegetated and retains much of its characteristic structure. Water quality is subject to some modification associated with the surrounding land uses and altered lateral inputs, although no indication of severe degradation of water quality was identified. Overall, the system retains important riparian habitat and ecological functioning, but the

railway infrastructure, altered flow patterns, modified lateral inputs and associated land-use pressures have resulted in a moderately modified ecological condition.

Table 2: Present Ecological State of the HGM 1 riparian system

Resource	IHI Score (Average % Intact)	Class	Rationale
HGM 1	62.5	C	The HGM 1 riparian system is well vegetated but substantially impacted by the railway line that passes through the system.

5.7 Historic Land Use

The current ecological and hydrological condition of the study area reflects a long and sustained history of agricultural land use, with evidence of transformation dating back to at least 1957 and likely earlier. Review of historical aerial imagery (Figure 7), together with site observations, indicates that large portions of the landscape were already under active cultivation or grazing at that time, with only limited remnants of natural vegetation structure remaining in more marginal or inaccessible areas. Over subsequent decades, this agricultural footprint has persisted and expanded in intensity in places, resulting in cumulative alterations to vegetation composition, soil structure, and natural drainage patterns.

The 1957 aerial imagery in particular illustrates an already highly patterned landscape, with clear signs of field subdivision, grazing infrastructure, and early forms of hydrological modification such as drainage lines and water storage features. This indicates that many of the processes currently observed on site, including soil compaction, channel modification, and fragmentation of wetland and riparian systems are not recent impacts, but rather the outcome of long-term, incremental change over several land-use cycles. The persistence of these pressures over time has likely led to a gradual reduction in ecosystem resilience and a simplification of both terrestrial and aquatic habitat structure.

Despite this historical transformation, the landscape is not uniformly degraded. Site observations and more recent aerial interpretation indicate a mosaic of disturbance intensity, with certain portions particularly in more marginal topographic positions or less intensively managed areas retaining comparatively higher levels of natural vegetation cover and ecological function. These areas are important as residual ecological patches within a largely modified matrix, and may still support remnant hydrological processes such as seepage and diffuse surface flow. However, their integrity is spatially fragmented and closely interwoven with transformed agricultural lands.

Overall, the long-term agricultural history of the study area has resulted in a landscape where ecological and hydrological processes are largely shaped by cumulative anthropogenic influence

rather than purely natural drivers. This historical context is critical in interpreting current aquatic system condition, as many of the observed wetland and drainage features represent modified or relict systems embedded within a highly transformed agricultural matrix.



Figure 7: Historic aerial imagery from 1957, showing extensive agricultural activities (approximate study area given in red polygon).

6 DESCRIPTION OF AFFECTED AQUATIC HABITAT

Following the initial desktop assessment and April 2026 baseline field investigation, additional field assessment was undertaken on 11 and 12 September 2026 once the proposed development layout was available. This allowed the original aquatic delineation to be refined in relation to the proposed development footprint and enabled more detailed assessment of potentially affected aquatic systems. The resulting delineation and HGM units are presented in Figure 8.

6.1 Aquatic Habitat Delineation

Following the contextualisation of the study area with the available desktop data, two site visits were conducted on the 17th of April and 11th of September 2026 to ground-truth the findings and accurately delineate the aquatic habitat of the study area in relation to the water use activities.

The presence and extent of wetland habitat within the study area was confirmed. In total 50 different artificial systems (Dams) and 29 natural systems were identified. Four dams would be impacted by the road and its associated servitude and two would be lost due to the construction of the equestrian centre. Six different natural HGM units would be impacted by the construction of the road to differing degrees. Refer to Figure 8 for a map of the delineated freshwater habitat and then Figures 9 - 11 which are higher scale versions of the same map to better illustrate where the road will pass through the various delineated habitat and how the equestrian centre will also impact those systems.

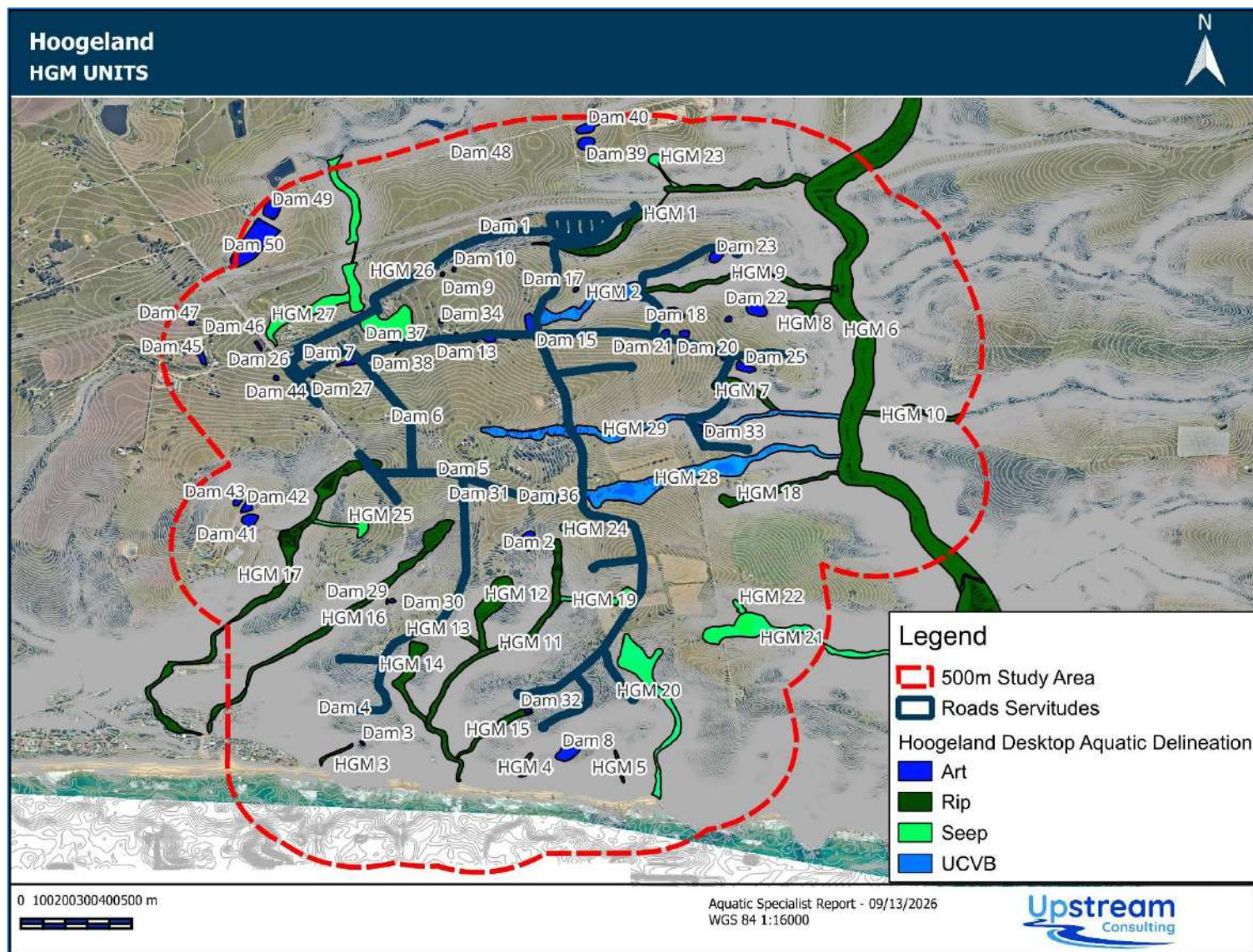


Figure 8: Delineated HGM freshwater habitat units for the study area.

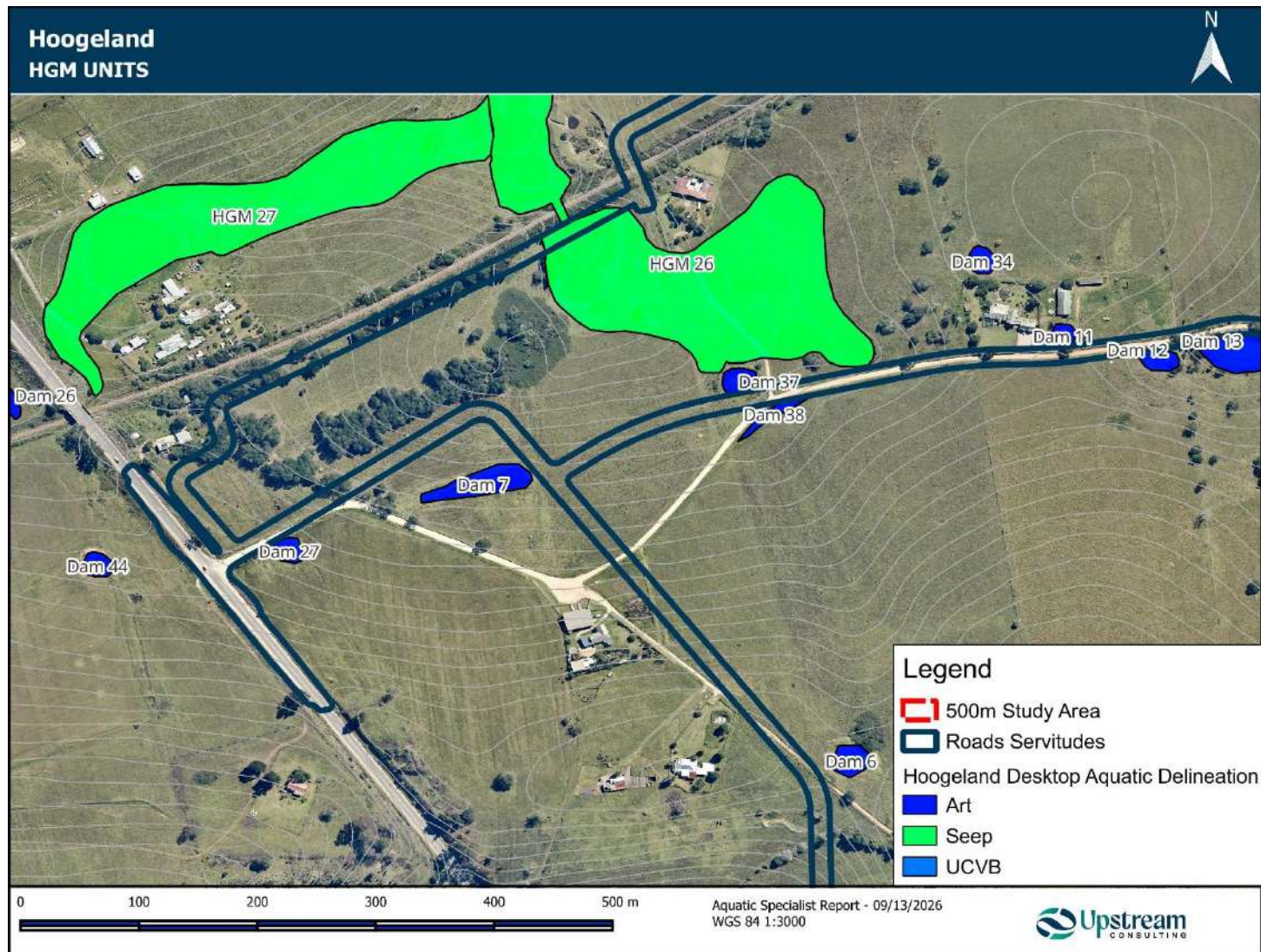


Figure 9: Delineated HGM freshwater habitat units at a higher scale illustrating how the road will impact HGM 26, numerous dams and the equestrian centre will result in the loss of Dam 27 and 7.

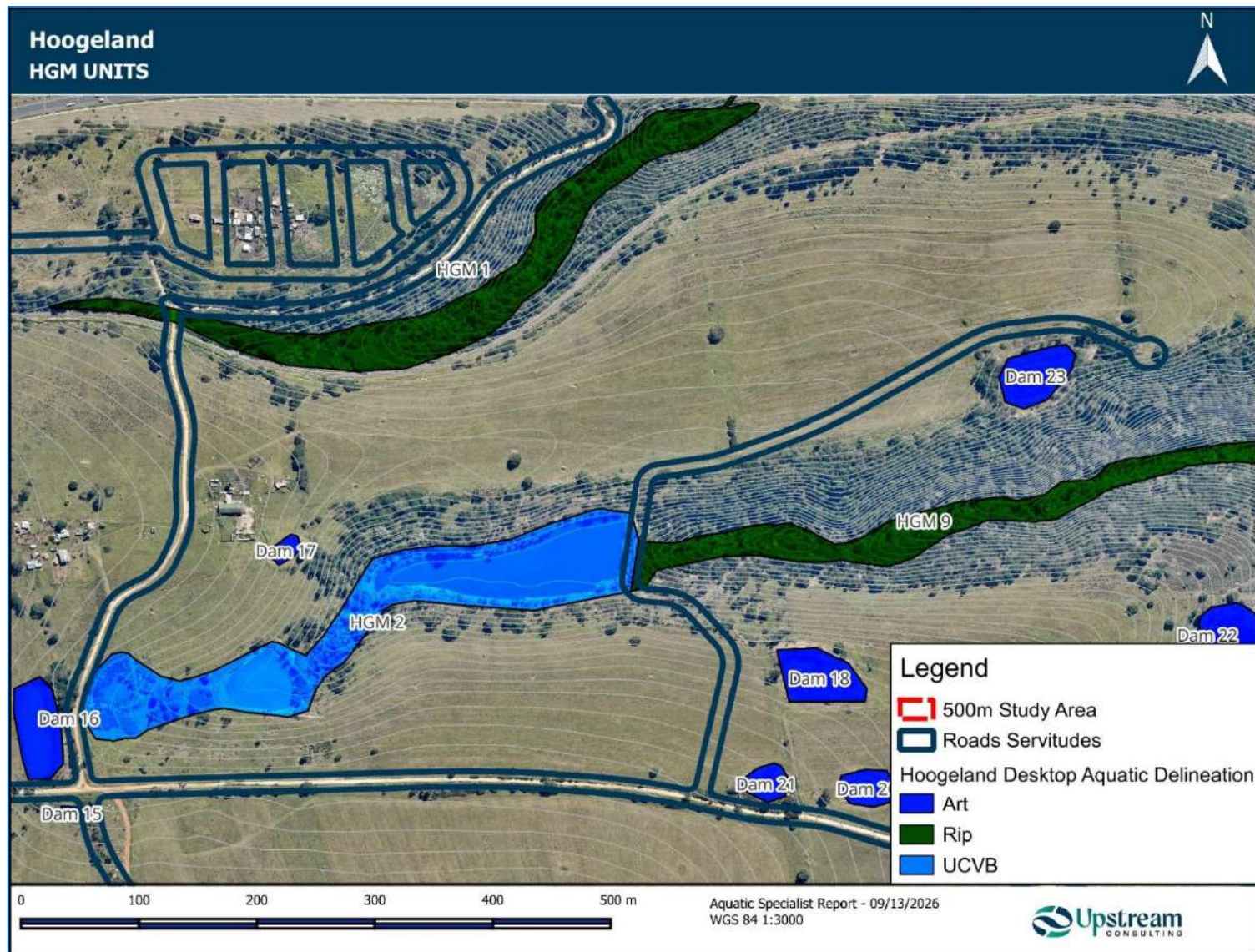


Figure 10: Delineated HGM freshwater habitat units at a higher scale illustrating how the proposed road and its servitude will impact HGM 1, 2 and 9.

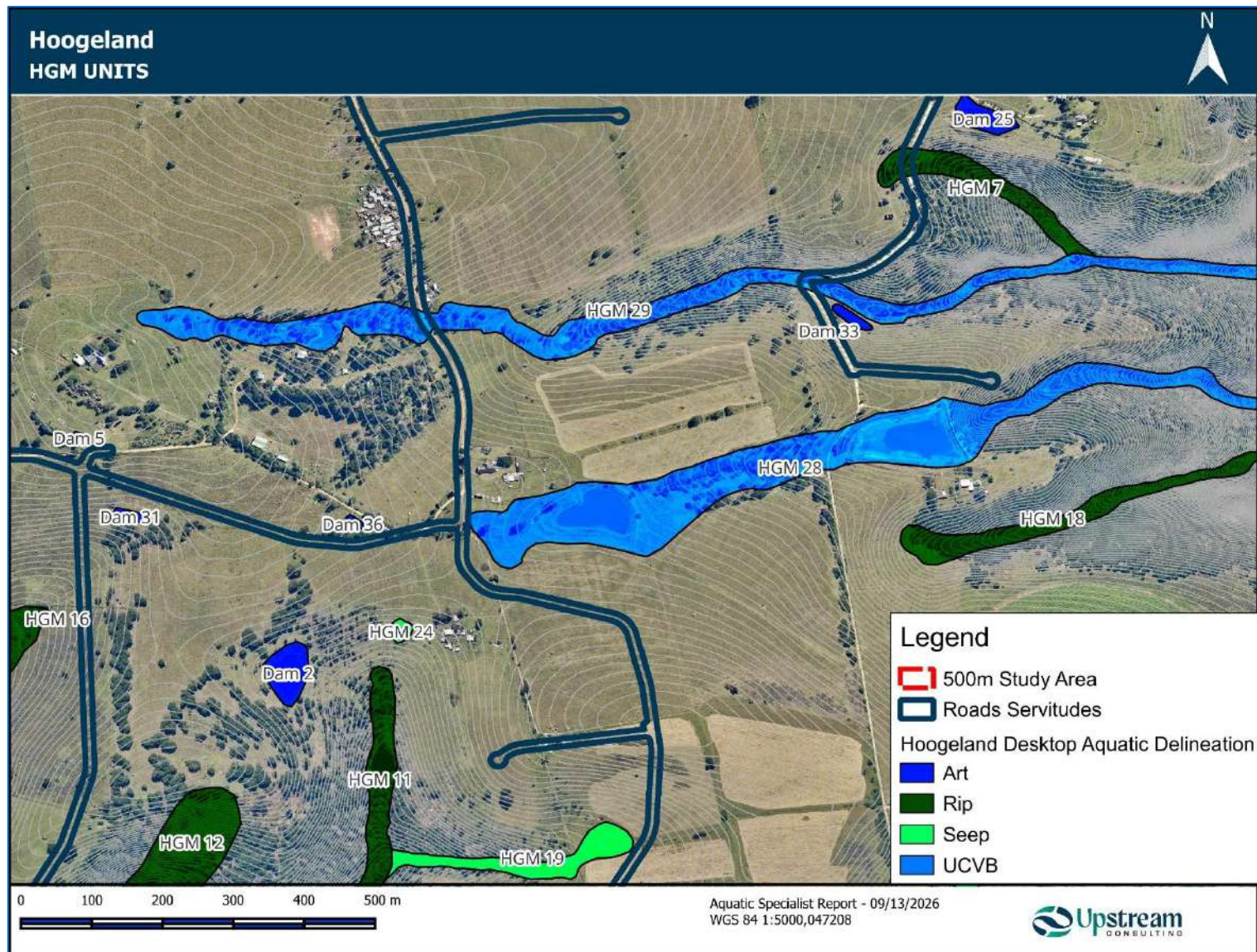


Figure 11: Delineated HGM freshwater habitat units at a higher scale illustrating how the proposed road and its servitude will impact HGM 7, 28, 29 and 19.

6.2 Aquatic Ecosystem Characteristics

The study area is situated within a coastal hinterland landscape characterised by moderately undulating topography, where local relief is expressed through a series of low-gradient interfluvies that transition into progressively incised valley systems. The terrain facilitates a radial drainage pattern, with surface and near-surface flows diverging outward from central elevated areas toward both coastal discharge points and inland river systems.

Land use within the study area has been dominated by livestock grazing for several decades, resulting in a landscape that is largely anthropogenically modified (Plate 1). The persistence of this land use has led to widespread alteration of natural vegetation structure, soil compaction, and hydrological modification. The presence of multiple farm dams, informal drainage alterations (e.g. furrows), and a network of gravel roads has further influenced surface water characteristics.

Despite this transformation, the underlying geomorphic template remains evident. The spatial distribution of aquatic features is strongly controlled by topographic position, with diffuse saturation zones occurring on upper slopes, transitioning into valley bottom systems and ultimately into confined drainage channels. This continuum reflects a classic hillslope-to-channel hydrological gradient, albeit one that has been substantially altered in terms of both structure and function.



Plate 1: Photograph showing typical land use of the study area

6.3 Artificial Wetlands

In total 50 different artificial impoundments occur throughout the study area and are primarily associated with historical agricultural activities and stormwater management (Figure 8). These features range from relatively small off-stream excavated dams to larger impoundments located within natural drainage systems. Although artificial in origin, several of the impoundments have developed wetland characteristics through the retention of water and establishment of hydrophytic vegetation. Typical vegetation associated with these systems and their margins includes *Typha capensis*, *Juncus kraussii*, *Cyperus congestus*, *Cyperus dives*, *Ficinia nodosa*, *Schoenoplectus corymbosus* and *Fimbristylis complanata*, and other wetland-associated sedges and grasses. The presence of such vegetation reflects the development of saturated or seasonally inundated conditions and provides aquatic and wetland-associated habitat. Artificial origin therefore does not imply an absence of ecological value, and the ecological functions of the individual impoundments have been considered in the assessment.

The artificial dams were considered separately from the natural wetland and riparian systems when evaluating ecological condition and importance. A conventional Present Ecological State (PES) assessment is not directly applicable to an artificial impoundment where no appropriate natural reference condition exists for the artificial feature itself. The ecological importance of the dams was therefore considered in relation to their current habitat characteristics, hydrological functioning, vegetation, connectivity and contribution to the surrounding aquatic environment. The artificial systems do not have zero ecological value; however, their ecological value is generally lower than that of the natural wetland and riparian systems within the study area, particularly where their hydrology, morphology and habitat characteristics are substantially determined by artificial excavation, impoundment and altered runoff. This distinction is important when considering the potential loss or modification of an artificial dam, as the loss of an artificial aquatic feature should not automatically be equated with the loss of an equivalent area of natural wetland ecosystem.

The location of an artificial impoundment in relation to the natural drainage network is also an important consideration. The existing dams within the study area have contributed to the alteration of natural hydrological processes, including flow timing, flow magnitude and longitudinal connectivity. Where dams are constructed directly within natural drainage systems, they can alter the hydroperiod and hydraulic characteristics of the underlying wetland, interrupt longitudinal connectivity, retain sediment and modify downstream sediment transport. Sediment retained within impoundments can reduce the supply of sediment to downstream reaches and contribute to sediment starvation, thereby altering channel morphology and downstream geomorphological processes. Impoundments may also alter downstream water temperature, nutrient dynamics and aquatic habitat through changes in the timing and volume of water released from the system (Poff & Hart, 2002; Kondolf et al., 2014; Grill et al., 2019). These effects are particularly relevant to the

study area, where the baseline assessment has identified extensive hydrological modification associated with farm dams, roads and other historical land-use activities. The valley-bottom systems have consequently experienced artificial storage, modified hydroperiods and disruption of longitudinal connectivity.

The effects of an instream impoundment are illustrated by the large dam located within HGM 2 (Plate 2). HGM 2 represents a Channelled Valley Bottom system, within which the impoundment has substantially altered the original wetland characteristics and functioning. The dam has resulted in the transformation of the affected portion of the Channelled Valley Bottom system, including a shift from the original valley-bottom wetland environment towards a more riparian-type system associated with the altered channel and impounded environment. The dam has consequently modified the natural flow regime and hydroperiod, interrupted longitudinal connectivity and altered sediment transport through the system. The retention of sediment within the impoundment also reduces the quantity of sediment available for downstream transport. The large instream dam therefore represents a substantial modification of a natural aquatic ecosystem, rather than simply an isolated artificial waterbody.



Plate 2: Photograph showing the large dam in HGM 2, a road is proposed to cross over the dam wall, but the presence of alien invasive species and the dam itself has detrimentally impacted the system downstream.

The smaller off-stream dams represent a different interaction with the aquatic environment. These features are located outside the main natural drainage axes and have generally developed as artificial depressions or impoundments receiving local runoff. Their ecological effects are consequently more localised, although they may still provide wetland habitat and perform functions such as stormwater attenuation, sediment retention and provision of habitat for wetland-associated organisms. The distinction between instream and off-stream impoundments is therefore based on their hydrological relationship with the surrounding natural aquatic systems rather than simply on the presence or absence of wetland vegetation.

The relationship between the proposed development, road servitudes and existing artificial dams is illustrated in Figure 9. Several of the proposed road servitudes occur in close proximity to existing dams, while the proposed equestrian centre will result in the loss of Dam 7 and Dam 27. The potential loss of these dams has therefore been considered in relation to their individual ecological characteristics and functions rather than treating all artificial dams as equivalent aquatic features.

Dam 7 provides a representative example of an off-stream artificial impoundment that has developed wetland characteristics (Plate 3). The feature is located outside the main natural drainage system and receives runoff from the road reserve. The concentration and retention of stormwater within the excavated depression has resulted in the establishment of wetland-associated vegetation and aquatic habitat. The ecological value of Dam 7 is therefore recognised, particularly in terms of local habitat provision, stormwater attenuation and sediment retention. However, its hydrological regime is substantially influenced by the artificial concentration of runoff from the road reserve, and it does not provide the same suite of functions as a natural wetland occupying an equivalent area within an intact drainage system.



Plate 3: Photograph showing the artificial offstream dam of Dam 7 which will be lost by the construction of the equestrian centre.

The proposed loss of Dam 7 and Dam 27 therefore represents the loss of existing artificial aquatic and wetland-associated habitat and has been considered accordingly. The assessment does not assume that these features have no ecological value because they are artificial. The significance of the loss is considered in relation to the existing ecological characteristics of each dam, the functions provided by the features, their degree of connectivity with natural aquatic systems and the extent to which those functions are retained within the surrounding landscape.

No standard aquatic buffer has been applied specifically to the artificial dam systems. This approach reflects the differing ecological characteristics and hydrological relationships of the individual impoundments and the distinction between artificial dams and the natural wetland and riparian systems identified within the study area. Applying a fixed buffer developed for natural wetland systems to every artificial impoundment would not necessarily provide an appropriate representation of the ecological sensitivity or functional requirements of each feature. Instead, potential development in proximity to the dams has been considered in relation to the specific functions and sensitivities of the individual systems and their relationship with downstream natural aquatic ecosystems. This does not remove the requirement for appropriate controls around the dams, particularly in relation to sedimentation, erosion, pollution, uncontrolled stormwater discharge and disturbance of wetland vegetation.

Where an artificial dam is retained, development and associated infrastructure should be managed to prevent unnecessary disturbance and uncontrolled changes to inflow and discharge regimes, particularly where these could affect downstream natural aquatic systems. Where an artificial dam is removed, the assessment should consider both the loss of the existing aquatic habitat and the consequences of removing the artificial storage function. In the case of Dam 7, removal of the

impoundment would eliminate an artificial area of water retention that is partly maintained by concentrated runoff from the road reserve. The removal should therefore be undertaken in conjunction with appropriate stormwater management to ensure that runoff is safely conveyed or dispersed and does not result in erosion, sediment mobilisation or adverse changes to downstream aquatic systems. Rehabilitation of the former dam footprint should seek to prevent the creation of uncontrolled drainage pathways and, where appropriate, restore the local landform and drainage conditions.

Overall, the artificial dam systems within the study area retain ecological functions and provide locally relevant aquatic and wetland-associated habitat. Their ecological value is nevertheless generally lower than that of the natural wetland and riparian systems because their morphology and hydrological regimes have been substantially influenced by anthropogenic activities. The assessment therefore distinguishes between artificial impoundments that have developed wetland characteristics and artificial structures that have substantially modified natural aquatic systems. The contrast between Dam 7, an off-stream stormwater-fed impoundment, and the large instream dam within HGM 2 demonstrates that the ecological consequences of an impoundment depend strongly on its relationship with the natural drainage system. This distinction has been considered when assessing the proposed loss of Dam 7 and Dam 27, development adjacent to existing dams, and the broader cumulative effects of historical impoundment within the study area.

6.4 Natural Aquatic Ecosystem Classification

The delineated aquatic systems within the study area were classified according to hydrogeomorphic (HGM) principles, which recognise the interaction between geomorphic setting, hydrological processes, and resultant wetland form and function. The systems observed represent a continuum rather than discrete units (Figure 8), with gradual transitions between HGM types influenced by slope, soil characteristics, and degree of confinement.

6.4.1 Hillslope Seep Wetlands

Hillslope seep wetlands within the study area occur predominantly on gentle upper slopes where subsurface water movement intersects the ground surface. These systems are driven by lateral throughflow within the soil profile, typically associated with perched or shallow groundwater conditions. The hydrological regime is characterised by seasonal saturation, with surface expression dependent on rainfall inputs and antecedent moisture conditions.

Vegetation within these seep systems is relatively uniform and indicative of hydric or mesic conditions, comprising primarily sedges (Cyperaceae) and *Juncus* spp., interspersed with pasture grasses introduced through agricultural activities (Plate 4).



Soils within these areas exhibit characteristics consistent with periodic saturation, although clear hydromorphic indicators may be subdued due to seasonal dryness at the time of assessment and disturbance-related mixing. The structural integrity of these wetlands appears compromised in places, with trampling and grazing leading to localised compaction and disruption of natural microtopography.

From a functional perspective, these seep wetlands play a role in regulating downslope hydrological inputs by moderating the release of subsurface water into valley bottom systems. However, this function is likely attenuated due to the cumulative effects of land use



Plate 4: Photographs showing two typical Hillslope Seep wetlands found within the study area

6.4.2 Valley Bottom Wetlands

Valley bottom wetlands occur along primary drainage axes in areas where topographic gradients decrease and lateral flow convergence promotes sustained saturation. Within the study area, these systems are extensively modified and often difficult to distinguish in their original form due to historical and ongoing anthropogenic impacts.

Hydrologically, these wetlands would naturally function as zones of flow attenuation and sediment deposition, with diffuse flow paths and shallow groundwater interactions. However, the installation of multiple farm dams along these systems has fundamentally altered flow regimes, introducing artificial storage, modifying hydroperiods, and disrupting longitudinal connectivity.

Geomorphologically, many of these valley bottoms exhibit signs of incision and channelisation, indicative of altered hydrological dynamics and increased flow energy. This has likely resulted from a combination of vegetation removal, concentrated runoff pathways, and reduced soil stability. In some areas, infilling and sediment redistribution have further obscured original wetland morphology.

Vegetation within these systems reflects a degraded state, with a mix of remnant hydrophilic species and invasive taxa such as *Rubus* spp. and *Solanum mauritianum*. The presence of these species is indicative of disturbance and nutrient enrichment, as well as reduced competition from indigenous vegetation.

Overall, the valley bottom wetlands represent a transitional HGM unit that has lost much of its natural structure and function, though residual wetland characteristics remain detectable through vegetation patterns, soil moisture conditions (plate 5), and landscape position.



Plate 5: Photograph of a soil auger core from HGM 28 showing the presence of mottles despite the area being heavily farmed and soil historically disturbed.

6.4.3 Non-Perennial Streams (Riparian Systems)

Further downslope, valley bottom systems transition into more confined, channelled systems that function as non-perennial streams. These systems are characterised by defined channels with episodic flow, typically driven by rainfall events and seasonal groundwater contributions.

The channels exhibit varying degrees of incision, with many showing clear signs of active erosion, bank instability, and sediment transport. These processes are exacerbated by upstream modifications, including altered flow regimes and reduced vegetative buffering capacity.

Riparian zones associated with these channels are heavily invaded by alien tree species, including *Acacia mearnsii*, *Acacia melanoxylon*, and *Eucalyptus* spp (Plate 5). These species have displaced indigenous riparian vegetation. While steeper sections of these systems appear somewhat less impacted by direct agricultural activities, they remain in a degraded state due to cumulative upstream effects and invasive species encroachment.



Plate 6: Photographs showing a heavily invade riparian system within the study area

6.5 Ecological Health and Functional Assessment – Natural

Detailed ecological assessment was undertaken for the natural aquatic systems potentially affected by, or occurring in close proximity to, the proposed development footprint. Wetland Present Ecological State was assessed using WET-Health Version 2, while the condition of the relevant riparian system was assessed using the Index of Habitat Integrity approach. The results reflect considerable variation between HGM units as a consequence of differences in historical agricultural modification, artificial impoundment, altered drainage, road infrastructure and invasive alien vegetation.

6.5.1 Wetland PES

The Present Ecological State (PES) assessment indicates a clear contrast between the valley-bottom systems HGM 2, HGM 28 and HGM 29, which are situated within an intensively farmed landscape and have been substantially modified by instream impoundments, agricultural land use and altered drainage, and the seep systems HGM 19 and HGM 26, which retain substantially greater ecological integrity. The PES assessments classify HGM 2, HGM 28 and HGM 29 as Category D (largely modified),

(Tables 2 - 4) HGM 19 as Category B (largely natural) (Table 5) and HGM 26 as Category C (moderately modified) (Table 6). The differences between the systems reflect the nature and intensity of the historical and ongoing pressures acting on each wetland, with hydrological and geomorphological modification being particularly influential in the valley-bottom systems.

HGM 2 is classified as Category D (largely modified), with a combined PES score of 57%. The hydrology component scored 58% (Category D), geomorphology 37% (Category E), water quality 77% (Category C) and vegetation 56% (Category D). The particularly low geomorphology score reflects the substantial modification of the wetland resulting from instream dams and associated alteration of the natural valley-bottom morphology and flow regime. The system occurs within a heavily farmed landscape and is exposed to surrounding cultivated areas and pasture, with associated runoff and potential sediment and water-quality inputs. Gravel roads and road crossings also occur within and adjacent to the system, with concentrated runoff and inappropriate crossing structures having resulted in the confinement of flows and the development of erosion channels within portions of the wetland. Multiple instream dams within the wetland extent further interrupt flow and sediment continuity and have altered the geomorphological structure of the system.

The vegetation component is also affected by invasive alien vegetation, including black wattle (*Acacia mearnsii*), bugweed (*Solanum mauritianum*), blackberry (*Rubus* spp), blackwood (*Acacia melanoxylon*) and pine (*Pinus* spp.). Despite these modifications, areas of indigenous wetland vegetation remain present and the system continues to provide aquatic habitat and hydrological connectivity within the catchment.

Table 3: Present Ecological State for HGM 2

Wetland PES Summary				
Wetland name	HGM 2			
Assessment Unit	CVB			
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4,2	6,3	2,3	4,4
PES Score (%)	58%	37%	77%	56%
Ecological Category	D	E	C	D
Combined Impact Score	4,3			
Combined PES Score (%)	57%			
Combined Ecological Category	D			

HGM 28 is classified as Category D (largely modified), with a combined PES score of 56%. The hydrology component scored 46% (Category D), geomorphology 45% (Category D), water quality 79% (Category C) and vegetation 57% (Category D). The system occurs within an intensively farmed landscape and is subject to a combination of agricultural land use, instream impoundments, road-related impacts and invasive alien vegetation. Cultivated lands and pasture occur within the

surrounding catchment and contribute runoff and sediment inputs to the wetland. Gravel roads and associated crossings have altered natural flow paths in portions of the system, with concentrated flows resulting in localised erosion and the development of confined channels. Instream dams occurring within the wetland extent have further modified the natural hydrological and geomorphological processes by impounding flows and altering sediment movement and deposition. The vegetation component is affected by the same invasive alien vegetation species as HGM 2, occurring to varying degrees throughout the system. The combined influence of altered hydrology, geomorphological modification, agricultural land use, road-related disturbance and invasive vegetation is reflected in the Category D classification.

Table 4: Present Ecological State for HGM 28

Wetland PES Summary				
Wetland name	HGM 28			
Assessment Unit	CVB			
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	5,4	5,5	2,1	4,3
PES Score (%)	46%	45%	79%	57%
Ecological Category	D	D	C	D
Combined Impact Score	4,4			
Combined PES Score (%)	56%			
Combined Ecological Category	D			

HGM 29 is classified as Category D (largely modified), with a combined PES score of 57%. The hydrology component scored 61% (Category C), geomorphology 56% (Category D), water quality 64% (Category C) and vegetation 43% (Category D) (Table 3). Although the hydrological component is in a better condition than HGM 2 and HGM 28, the wetland has nevertheless been substantially modified by its location within an intensively farmed landscape and by the presence of instream dams and altered drainage infrastructure. Surrounding cultivated areas and pasture contribute runoff and sediment to the wetland, while gravel roads and road crossings have altered the distribution and concentration of flows.

Inappropriate road crossings have confined flows through portions of the system and contributed to erosion and the formation of channels within the wetland surface. The instream dams have altered the geomorphological structure and sediment regime of the valley-bottom system, while invasive alien vegetation contributes to modification of the vegetation component. The relatively low vegetation score of 43% is a significant contributor to the overall modified condition of the system.

Table 5: Present Ecological State for HGM 29

Wetland name	HGM 29			
Assessment Unit	CVB			
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3,9	4,4	3,6	5,7
PES Score (%)	61%	56%	64%	43%
Ecological Category	C	D	C	D
Combined Impact Score	4,3			
Combined PES Score (%)	57%			
Combined Ecological Category	D			

HGM 19 is classified as Category B (largely natural), with a combined PES score of 89%. The hydrology component scored 92% (Category A), geomorphology 89% (Category B), water quality 87% (Category B) and vegetation 85% (Category B) (Table 5). The seep therefore retains a high degree of its natural hydrological and ecological functioning despite localised historical disturbances. A failed or partially collapsed dam occurs within the extent of the seep and has resulted in localised modification of the hydrological and geomorphological characteristics of the system, which is reflected in the component scores. An old farm track also passes through the wetland and has caused localised disturbance and some alteration of flow patterns. Invasive alien vegetation is present but is less extensive than within HGM 2, HGM 28 and HGM 29. These impacts are relatively limited in extent and have not substantially altered the overall character of the seep. The high component scores and resulting Category B classification reflect the comparatively intact condition of the system.

Table 6: Present Ecological State for HGM 19

Wetland name	HGM 19			
Assessment Unit	Seep			
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	0,8	1,1	1,3	1,5
PES Score (%)	92%	89%	87%	85%
Ecological Category	A	B	B	B
Combined Impact Score	1,1			
Combined PES Score (%)	89%			
Combined Ecological Category	B			

HGM 26 is classified as Category C (moderately modified), with a combined PES score of 75%. The hydrology component scored 53% (Category D), geomorphology 78% (Category C), water quality 89% (Category B) and vegetation 93% (Category A). The high vegetation and water-quality scores indicate that the seep itself remains in good ecological condition, while the lower hydrology score reflects modification within the surrounding landscape and immediate catchment. Gravel roads, pasture and several small dams occur within the immediate catchment and influence local runoff

and sediment movement. More substantial infrastructure occurs downstream, where the railway line passes directly through the seep and constrains and confines the natural flow paths. The N2 further bisects the lower portion of the system, resulting in additional restriction of flow and connectivity. These infrastructure-related modifications are reflected primarily in the hydrological component, which is classified as Category D, while the geomorphology remains in Category C.

Despite these pressures, the seep retains well-developed wetland vegetation and good water-quality characteristics, reflected by the Category A and B scores respectively. The overall Category C classification therefore reflects a system in which the wetland habitat itself remains comparatively intact, but its hydrological functioning has been affected by surrounding infrastructure and catchment modification.

Table 7: Present Ecological State for HGM 26

Wetland name	HGM 26			
Assessment Unit	Seep			
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4,7	2,2	1,1	0,7
PES Score (%)	53%	78%	89%	93%
Ecological Category	D	C	B	A
Combined Impact Score	2,5			
Combined PES Score (%)	75%			
Combined Ecological Category	C			

Overall, the PES assessment demonstrates that the three valley-bottom systems have undergone substantially greater modification than the two seep systems. HGM 2, HGM 28 and HGM 29 are all classified as Category D, with their condition primarily reflecting the cumulative effects of agricultural land use, instream impoundments, altered flow paths, road infrastructure, erosion and invasive alien vegetation. HGM 2 has the greatest degree of geomorphological modification, reflected in its Category E geomorphology score, while HGM 29 retains comparatively better hydrological condition. In contrast, HGM 19 retains a largely natural condition despite localised disturbance associated with the failed dam and old farm track, while HGM 26 retains particularly good vegetation and water-quality characteristics despite substantial hydrological modification associated with surrounding roads, the railway line and the N2. These differences in PES provide an important basis for interpreting the ecological importance and sensitivity of the individual aquatic systems and for assessing the potential effects of the proposed development.

6.5.2 Trajectory of Change

The assessed wetlands are considered to have a generally negative trajectory of change in the absence of active management or rehabilitation. Although many of the major historical

modifications are already established, ongoing pressures associated with altered drainage, road infrastructure, impoundments, grazing and trampling, erosion, and invasive alien vegetation are likely to result in gradual further deterioration of wetland condition and ecological functioning over time. The rate and nature of change will vary between HGM units, with the more intact seep systems potentially remaining comparatively resilient, but still vulnerable to progressive degradation where existing pressures are not addressed. This declining trajectory provides an important context for evaluating both the No-Go scenario and the potential benefits of improved conservation and management associated with the proposed development.

6.6 Ecosystem services and EIS Assessments

Wetlands are globally threatened ecosystems and are widely recognised for the ecosystem services they provide. These systems contribute to key societal and environmental objectives, including water resource management, biodiversity conservation, human safety and disaster resilience, socio-economic development, and climate change mitigation and adaptation (Kotze *et al.*, 2020). The type and extent of ecosystem services supplied by a wetland are influenced by its ecological condition, landscape context, and degree of modification, and therefore vary significantly between systems.

In addition to ecosystem services, wetlands are also assessed in terms of their Ecological Importance and Sensitivity (EIS), which reflects the intrinsic ecological value of the system and its sensitivity to disturbance. While ecosystem services focus on the benefits provided to society, EIS considers the ecological role of the wetland within the broader landscape, including aspects such as biodiversity support, habitat provision, and the maintenance of ecological processes. As such, ecosystem services and EIS provide complementary perspectives, with the former assessing functional benefits to humans and the latter assessing ecological significance and vulnerability.

Given these differences, it is necessary to assess both ecosystem service delivery and ecological importance in order to develop a comprehensive understanding of the wetland system and to inform appropriate management and decision-making.

6.6.1 Ecosystem Services

The ecosystem services assessment results for the wetland systems and the affected riparian system are presented in Table 8. The wetland systems were assessed collectively, recognising that the individual HGM units form part of an interconnected aquatic landscape and that their current ecosystem service functions are influenced by the surrounding land uses, altered drainage patterns and existing infrastructure. The relative ecosystem service profiles are illustrated in Figures 12 and 13.

The wetland systems provide a range of regulating, supporting and provisioning services, although the importance of individual services varies considerably. Flood attenuation and streamflow regulation are both assessed as being of low importance. This reflects the modified hydrological characteristics of the wetland network, where numerous existing dams, altered drainage pathways, road crossings and areas of concentrated runoff have changed the natural movement and temporary storage of water. The presence of numerous impoundments provides local water storage but does not necessarily translate into the maintenance of the broader wetland landscape's natural flood attenuation function. Similarly, modification of flow paths and the confinement of drainage in some areas limits the extent to which the remaining wetland systems regulate downstream flows.

Sediment trapping is assessed as being of high importance, despite the modified condition of several of the wetland systems. This reflects the continued ability of wetland vegetation, shallow depressions and valley-bottom areas to intercept and retain sediment transported from the surrounding agricultural areas and disturbed surfaces. The high demand for this service within the surrounding landscape further contributes to its importance. Erosion control, in contrast, is assessed as low importance. The distinction between these services reflects the current condition and configuration of the systems: while the wetlands retain areas capable of trapping sediment, modification of flow paths, agricultural land use, roads and concentrated runoff has reduced their broader capacity to regulate erosion processes.

Nitrate assimilation is assessed as being of moderate importance, while phosphate assimilation is moderately low. The relatively greater importance of nitrate assimilation reflects the capacity of the wetland systems to retain and process nutrients moving through the landscape, particularly given the agricultural land uses within and surrounding the study area. Toxicant assimilation has a high importance rating, reflecting the relatively high assessed supply of this service in relation to demand. These functions are associated with the interaction between wetland soils, vegetation and surface-water movement and remain relevant despite the modification of individual wetland systems.

Carbon storage is assessed as being of very low importance. This reflects the relatively limited contribution of the assessed wetland systems to carbon storage compared with other ecosystem services identified in the assessment. Biodiversity maintenance is similarly assessed as low importance, consistent with the substantial modification of several of the wetland systems and the influence of agricultural land use, impoundments, altered drainage and invasive alien vegetation. The systems nevertheless retain aquatic and wetland-associated habitat that contributes to biodiversity at a local scale.

Among the provisioning services, harvestable resources are assessed as being of moderately high importance, while food for livestock is of moderate importance and cultivated foods are of

moderately high importance. These ratings reflect the agricultural context of the study area and the interaction between the aquatic systems and surrounding land uses. Water for human use is assessed as very low importance, indicating that the delineated wetland systems themselves make a limited contribution to this service.

The cultural services are generally of low to very low importance. Tourism and recreation and education and research are assessed as low importance, while cultural and spiritual services are assessed as very low importance. This indicates that these functions currently make a relatively limited contribution to the overall ecosystem service profile of the assessed wetland systems.

The affected riparian system has a somewhat different profile. Sediment trapping and erosion control are both assessed as being of moderate importance, reflecting the relatively well-established riparian vegetation and its continued role in stabilising banks, reducing erosion and intercepting sediment within the riparian corridor. Carbon storage is also of moderate importance, while biodiversity maintenance is assessed as low importance. These functions remain evident despite modification associated with the railway line, surrounding roads and other land uses.

The riparian system's nutrient assimilation functions are assessed as being of low importance for both phosphate and nitrate assimilation, while toxicant assimilation is assessed as very low importance. Harvestable resources are assessed as moderately high importance, with food for livestock and cultivated foods assessed as moderately low. The remaining cultural services are of very low importance. The riparian ecosystem service profile is illustrated in Figure 13.

Streamflow regulation was not assessed for the riparian system. Under the WET-EcoServices methodology, this service is not assessed for non-wetland riparian areas due to insufficient evidence to support its assessment in these systems (Kotze *et al.*, 2020).

Overall, the ecosystem service assessment indicates that the principal services provided by the wetland systems are associated with sediment trapping, toxicant assimilation and several provisioning functions, particularly harvestable resources and cultivated foods. The riparian system has a more pronounced role in sediment trapping and erosion control, supported by its relatively well-established riparian vegetation. The relatively low rating for flood attenuation and streamflow regulation within the wetland systems is consistent with the existing degree of hydrological modification, including the influence of numerous dams, altered drainage pathways and infrastructure. The contrasting ecosystem service profiles shown in Figures 12 and 13 therefore reflect differences in the characteristics, condition and landscape context of the wetland and riparian systems.

Table 8: Summary of Ecosystem Services Assessment for the various HGM units

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

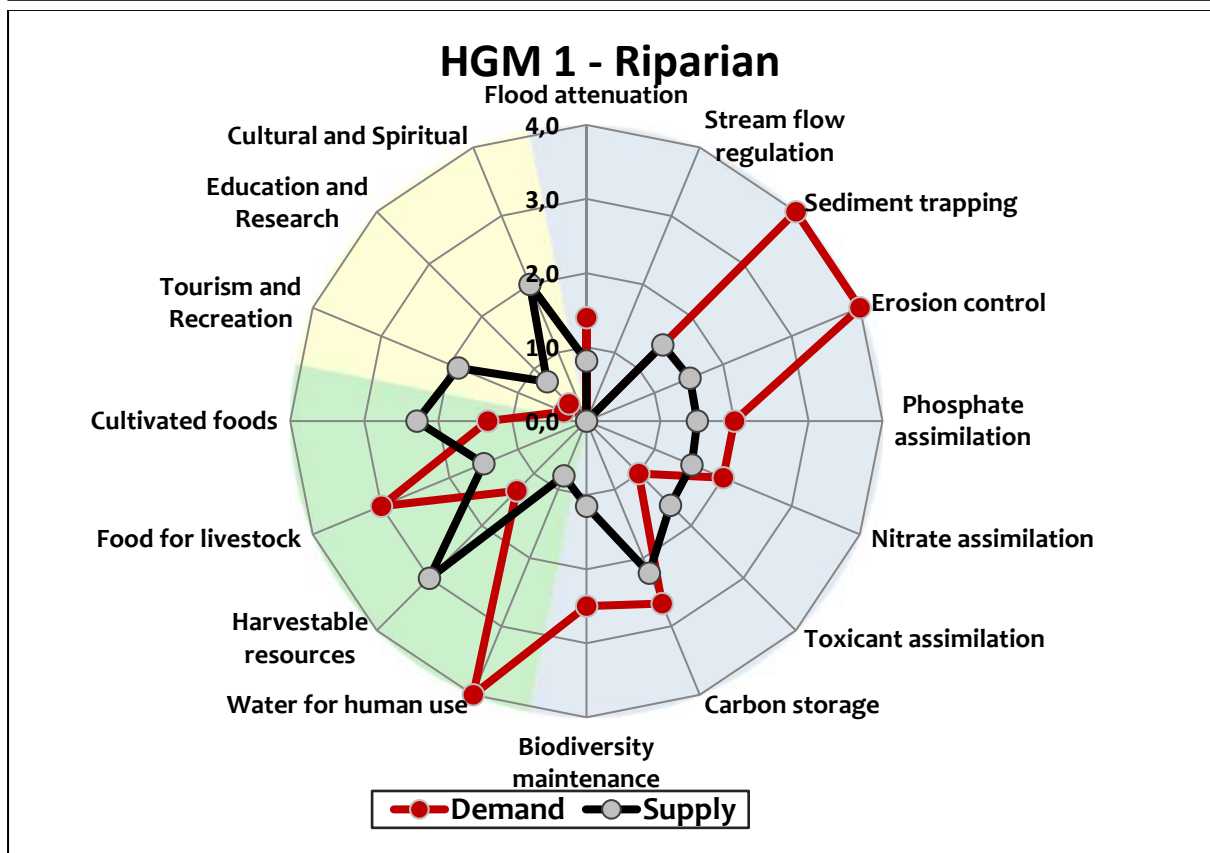
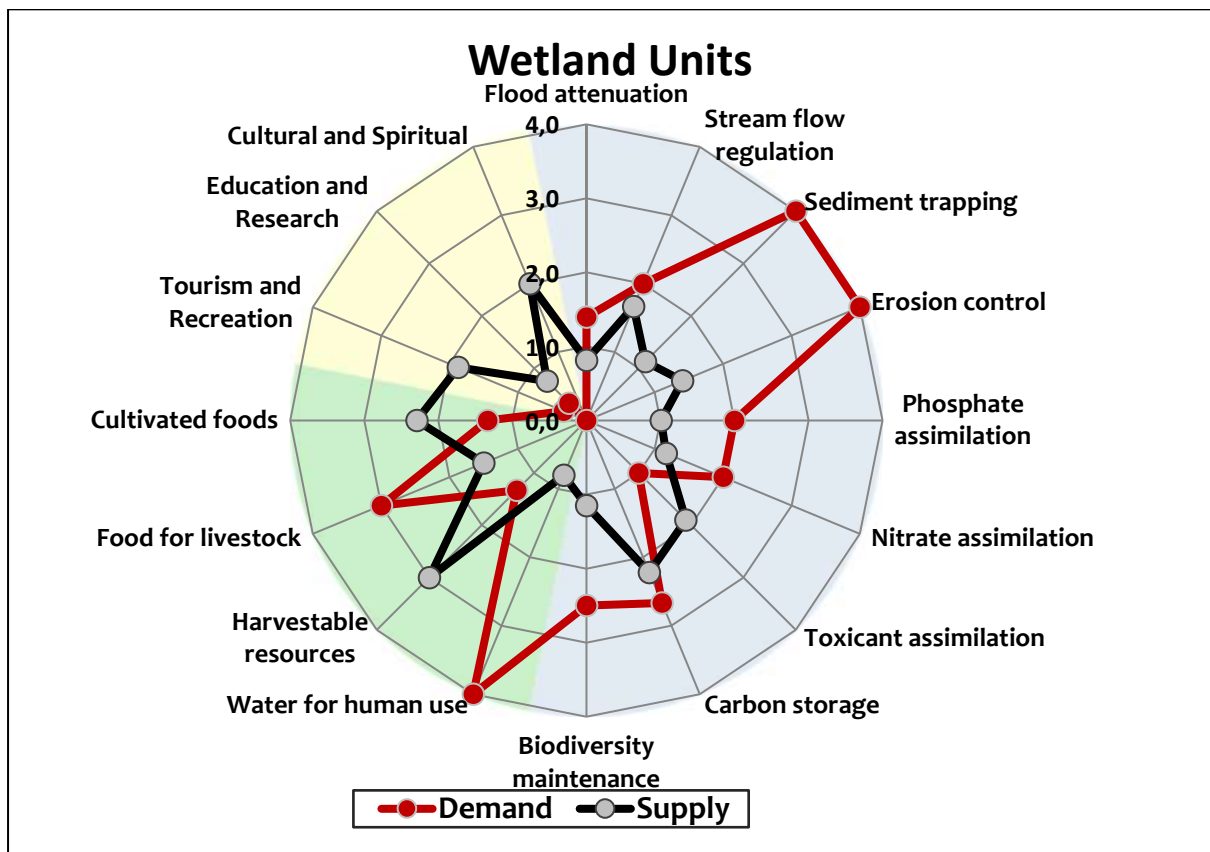


Figure 12: Spider diagram showing the demand and supply of various ecosystem services by the various units

6.6.2 Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity (EIS) assessment provides an indication of the ecological importance of the aquatic systems and their sensitivity to disturbance or changes in land use. For the wetland systems, the assessment considers biodiversity importance, functional/hydrological importance and direct benefits to society, with the overall EIS determined from these component assessments. The riparian system was assessed separately using the applicable riparian EIS assessment approach. The wetland and riparian results are therefore presented separately in Tables 9 and 10 and should not be directly compared on the basis of their numerical scores.

The wetland systems collectively achieved an overall EIS score of 2.20, corresponding to a Moderate rating (Table 9). Biodiversity importance was the highest contributing component, with a score of 2.20 (Moderate), while functional/hydrological importance and direct benefits to society were both rated Low, with scores of 1.25 and 1.00, respectively. The Moderate biodiversity importance reflects the continued contribution of the wetland systems to aquatic and wetland habitat within the broader landscape, despite the substantial modification evident in several of the systems. The systems include valley-bottom and seep wetlands that remain connected to the surrounding drainage network and retain areas of wetland-associated vegetation and habitat.

The Low functional/hydrological importance score reflects the current condition and degree of modification of the wetland network. Several of the valley-bottom systems have been affected by agricultural land use, existing dams, roads and altered drainage pathways, which have modified natural flow patterns and reduced the extent to which the systems collectively perform their natural hydrological functions. The presence of numerous dams within and associated with the wetland systems has further altered water storage and flow connectivity. Nevertheless, the wetlands continue to perform local hydrological and ecological functions, including the movement and retention of water, sediment trapping and provision of aquatic habitat.

Direct benefits to society were assessed as Low. This reflects the relatively limited direct dependence on the delineated wetland systems for human uses, notwithstanding their interaction with the surrounding agricultural landscape and their contribution to broader environmental functions. The overall Moderate EIS rating therefore reflects the continued biodiversity importance of the wetland systems in combination with their relatively low functional/hydrological importance and direct benefits to society.

Table 9: Summary of EIS score for the various HGM wetland systems

SUMMARY	Wetlands	
	Score (out of 4)	Rating
BIODIVERSITY IMPORTANCE	2,20	Moderate
FUNCTIONAL/HYDROLOGICAL IMPORTANCE	1,25	Low
DIRECT BENEFITS TO SOCIETY	1,00	Low
Ecological Importance and Sensitivity (EIS)	2,20	Moderate

The riparian system associated with HGM 1 was assigned a Low Ecological Importance and Sensitivity rating, corresponding to Ecological Category D (Table 10). The system occurs within a landscape that has been substantially transformed by agricultural land use and associated infrastructure. Despite this transformation, the riparian corridor retains established vegetation and provides refugia for aquatic-associated fauna and flora within the surrounding transformed landscape.

The Low EIS rating reflects the combination of the system's existing ecological importance and the degree of surrounding transformation. The railway line passing through the system, together with roads and other surrounding land uses, has resulted in modification of the riparian environment and has constrained aspects of natural flow and lateral connectivity. Nevertheless, the retained riparian vegetation continues to provide habitat and contributes to local ecological connectivity within an otherwise substantially transformed landscape. The Low EIS rating and Ecological Category D therefore reflect a system that retains ecological function and habitat value, but where these attributes occur within a landscape subject to substantial existing modification.

Table 9: Summary of EIS score for the various HGM riparian systems

RIPARIAN SYSTEM	ECOLOGICAL IMPORTANCE AND SENSITIVITY CATEGORY (EIS)	RATIONALE
HGM 1	LOW, EC=D	The HGM 1 system is an important refugia for fauna and flora within a relatively transformed landscape. It is still present despite much of the area being transformed through agricultural practices

7 AQUATIC BUFFER ZONES

An aquatic impact buffer zone is defined as a zone of vegetated land designed and managed so that sediment and pollutant transport carried from source areas via diffuse surface runoff is reduced to acceptable levels (Macfarlane and Bredin 2016). Aquatic buffer requirements were determined

using the risk-based methodology developed by Macfarlane and Bredin (2017). The method does not prescribe a generic setback distance, but derives an appropriate buffer from the interaction between the proposed activity and the receiving aquatic environment, which is then finalised based on specialist experience and project-specific mitigation considerations.

The April 2026 baseline assessment applied conservative preliminary buffers of 35 m around delineated aquatic systems and 42 m along the Maalgate riparian corridor. These were planning-level buffers applied before the development layout and associated activities had been sufficiently defined and were intended to guide early avoidance and layout planning.

For the present assessment, the buffer requirement was reassessed against the proposed Hoogeland layout using the Macfarlane and Bredin (2017) methodology described in Section 4.4. This allowed the buffer to be refined using the actual development context together with the characteristics, PES, EIS, ecosystem functioning, anticipated impact pathways and proposed mitigation.

The assessment produced a buffer requirement of 18 m for the construction phase and 20 m for the operational phase. The larger value has therefore been adopted as the final project-specific aquatic buffer:

Table 10: Buffer requirements for Hoogeland Development

	Buffer width (m)
Construction Phase	18
Operational Phase	20
Final aquatic impact buffer requirement (including practical management considerations)	20

A 20 m buffer from the delineated boundary of natural aquatic ecosystems is therefore recommended for the proposed Hoogeland Development. This supersedes the preliminary planning-level buffers applied during the baseline assessment and represents the refined aquatic constraint to be incorporated into the final development layout and associated spatial planning.

The buffer distances derived from the assessment are post-mitigation requirements and therefore assume effective implementation of the proposed avoidance, design, stormwater, erosion-control and operational management measures.

8 POTENTIAL IMPACTS

Aquatic ecosystems are particularly susceptible to both direct disturbance and indirect changes arising from activities within their contributing catchments. Potential impacts associated with the Hoogeland Development have therefore been considered in relation to the direct development footprint as well as changes to hydrology, sediment dynamics and water quality that may affect aquatic ecosystems beyond the immediate area of disturbance.

The proposed layout has already incorporated a substantial degree of avoidance through the earlier baseline planning process, with most natural aquatic systems and their associated buffers retained within open-space or conservation areas. Nevertheless, localised interactions remain associated principally with road and service crossings, development adjacent to aquatic systems, the proposed loss of two artificial dams, and the cumulative effects of introducing residential, agricultural, communal and equestrian land uses across the broader site. The proposed road network includes a number of watercourse crossings, predominantly using drift structures, while Dam 7 and Dam 27 will be lost to the proposed equestrian development.

The direct and indirect impacts associated with the development have been grouped into four interrelated impact categories:

- **Impact 1:** Disturbance and loss of aquatic habitat and associated biota;
- **Impact 2:** Changes to the hydrological regime and aquatic ecosystem functioning;
- **Impact 3:** Increased erosion and sedimentation; and
- **Impact 4:** Changes to surface-water quality.

The potential cumulative effects of the development are considered separately in Section 8.5. The significance of these impacts, both before and after mitigation, is assessed in Section 9.

8.1 Disturbance and Loss of Aquatic Habitat and Biota

Direct disturbance of aquatic habitat may occur where construction activities physically encroach into wetlands, riparian areas or their associated buffers. This may include vegetation clearing, excavation, filling, compaction, vehicle movement and the establishment of infrastructure. Disturbed areas may also become susceptible to colonisation by invasive alien vegetation, resulting in longer-term changes to habitat condition.

For Hoogeland, the main direct impacts with natural aquatic habitat are associated with the proposed road and service network where crossings of watercourses cannot be entirely avoided. These impacts are expected to be spatially localised but may result in loss or modification of aquatic and riparian vegetation and disruption of longitudinal continuity at individual crossing points. The

proposed loss of Dam 7 and Dam 27 will additionally result in the permanent loss of existing artificial aquatic habitat. Although these systems are anthropogenic, they presently provide local habitat and their loss therefore constitutes an aquatic impact.

The extent of habitat disturbance will depend strongly on the final construction footprint, the positioning of infrastructure relative to the delineated aquatic habitat and buffers, and the effectiveness of rehabilitation following construction. As previously mentioned, the majority of sensitive habitat has been avoided by the layout, and mitigation will reduce impact significance where encroachment is required. Additionally, the proposed conservation zoned areas and potential for improved management of the drainage areas may in fact result in increased habitat and biotic diversity.

8.2 Changes to the Hydrological Regime

Development can alter the quantity, timing, distribution and concentration of surface-water flows entering aquatic ecosystems. Increased hard or compacted surfaces, roads and modified drainage pathways may increase runoff volumes and velocities, while crossings, embankments and other infrastructure can obstruct, divert or concentrate existing flow paths. These changes can alter wetland hydroperiod, lateral connectivity and downstream flow distribution and may consequently affect aquatic ecosystem form and function.

The Hoogeland site already contains numerous historical hydrological modifications, including roads, agricultural drainage and artificial impoundments. The proposed development has the potential to introduce additional modification through the internal road network, drift crossings, stormwater management infrastructure and development of individual properties. Removal of existing artificial dams may also alter local water storage and attenuation, particularly where these features currently receive concentrated runoff. Dam 7, for example, currently retains runoff originating partly from the road reserve. However, it must also be recognised that improved management of the drainage areas can have positive impacts upon the hydrological functioning of wetlands in the study area through removal of water-depleting alien plant species and managed buffer areas.

Hydrological impacts may occur during both construction and operation and are closely linked to the potential for downstream erosion, sedimentation and changes in aquatic habitat condition.

8.3 Erosion and Sedimentation

Disturbance of soils and vegetation during construction can increase the mobilisation and transport of sediment into aquatic ecosystems. Areas of particular susceptibility include watercourse

crossings, road cut-and-fill areas, disturbed slopes, construction access routes and locations where runoff becomes concentrated.

During operation, poorly controlled stormwater may similarly result in increased runoff velocities, channel incision, bank erosion and gully formation, with mobilised sediment subsequently deposited within downstream wetlands and watercourses. This is particularly relevant at Hoogeland because several aquatic systems already exhibit geomorphological modification associated with roads, agricultural activities, impoundments and altered flow paths. Further concentration of runoff could therefore exacerbate existing erosion and sedimentation processes.

Road crossings and stormwater discharge points represent the most important potential erosion pathways and will require particular attention during detailed design and construction.

8.4 Changes to Surface Water Quality

Construction activities can introduce sediment, hydrocarbons, cement materials, waste and other contaminants into nearby aquatic systems through spills, runoff or inappropriate handling and storage. Increased turbidity and changes in the chemical characteristics of surface water may affect aquatic habitat quality and associated biota.

Potential operational sources are more diffuse and include runoff from roads and developed properties, agricultural and equestrian activities, animal waste, fertilisers and other chemicals, as well as potential contamination associated with sanitation and wastewater infrastructure. The northern village is proposed to be serviced by a wastewater treatment system, with treated effluent intended for irrigation of the equestrian fields. These activities do not necessarily result in aquatic pollution, but inappropriate design, operation or management could allow nutrients, pathogens or other contaminants to enter downstream drainage systems.

Water quality impacts are therefore primarily associated with the management of runoff, waste and potential contaminants during both construction and operation.

8.5 Cumulative Impacts

Cumulative impacts result from the combined effects of past, present and reasonably foreseeable activities and may become significant even where individual disturbances are relatively small. This is particularly relevant to aquatic ecosystems because watercourses integrate effects occurring across their wider catchments.

The Hoogeland aquatic systems occur within a landscape that has been subject to long-term agricultural modification, including grazing, cultivation, roads, impoundments, altered drainage



and invasive alien vegetation. The proposed development will introduce additional land uses and infrastructure across a large area, and numerous individually minor disturbances could therefore collectively affect aquatic habitat condition, hydrological connectivity, erosion processes and water quality if not appropriately controlled.

Conversely, the proposed layout places substantial areas of aquatic habitat and associated natural vegetation within conservation and open-space areas. The long-term cumulative outcome will therefore depend not only on controlling direct development impacts, but also on the effectiveness of future conservation management, alien vegetation control, rehabilitation and management of runoff across the development. This broader landscape context is considered in the impact significance assessment that follows.

9 IMPACT ASSESSMENT

The impact significance of the proposed project was determined for each potential impact, direct and indirect for each phase. Refer to impact Tables 11 to 15 below. The significance of the identified aquatic impacts was assessed for the No-Go Alternative and the preferred development, both before and after implementation of mitigation. The assessment considers the extent, duration, reversibility, magnitude and probability of each impact, with significance calculated using the methodology described in Section 4.3. Residual impacts are also considered to indicate the level of impact expected to remain following implementation of the recommended mitigation measures.

9.1 Impact 1: Disturbance/ Loss of Aquatic Habitat & Biota

The development will result in some unavoidable localised disturbance and loss of aquatic habitat, principally at road and service crossings and through the removal of Dam 7 and Dam 27. Most natural aquatic habitat has, however, been avoided through the layout planning process and will be retained within conservation and open-space areas. The residual impact therefore relates mainly to relatively small crossings and the loss of two artificial aquatic features rather than extensive loss of natural wetland or riparian habitat.

Under the No-Go Alternative, no new development related habitat loss would occur; however, existing pressures associated with agricultural land use, grazing, invasive alien vegetation, roads, impoundments and altered drainage would continue and are expected to contribute to gradual deterioration of aquatic habitat over time.

Table 11: Impact assessment summary for Impact 1 – Disturbance of aquatic habitat biota.

Criteria	No-Go Alternative	Preferred – Without Mitigation	Preferred – With Mitigation
Impact status	Negative	Negative	Negative
Extent (E)	Site (1)	Local (2)	Site (1)
Duration (D)	Long-term (4)	Permanent (5)	Permanent (5)
Magnitude (M)	Low (2)	Moderate (3)	Very Low (1)
Probability (P)	Probable (3)	Definite (5)	Definite (5)
Significance score	21	50	35
IMPACT SIGNIFICANCE	LOW	MEDIUM	MEDIUM-LOW
Reversibility	Recoverable	Partly irreversible	Partly irreversible
Confidence level	High	High	High
Irreplaceable loss of resources	None	Partial	Barely
Cumulative impact potential	Medium	Medium-High	Low

Mitigation potential	Moderate	Moderate	Moderate
Residual impact	Continued gradual deterioration of existing habitat under current land-use pressures.	—	Localised permanent habitat loss will remain at unavoidable crossing footprints and through removal of the two artificial dams. The extent and ecological magnitude of this loss are, however, limited relative to the aquatic habitat retained and protected across the development.

9.2 Impact 2: Changes to the Hydrological Regime

Hydrological impacts are considered potentially significant because the development extends across a relatively large catchment area containing numerous connected drainage features, while several of the assessed systems already show modification associated with roads, impoundments and altered flow paths. Without mitigation, additional development and associated drainage infrastructure could compound these existing pressures.

Following mitigation, the impact is expected to remain Low Negative. This rating assumes that natural drainage pathways are maintained, runoff is appropriately attenuated and dispersed, crossings do not unnecessarily obstruct or concentrate flow, and the 20 m aquatic buffer is implemented. Some alteration of runoff characteristics within developed portions of the site will remain unavoidable, but is not expected to materially alter the hydrological functioning of the aquatic systems. Confidence in the post-mitigation rating is Medium, primarily because detailed stormwater and property-level drainage designs are not yet available.

Under the No-Go Alternative, existing hydrological modifications associated with roads, agricultural land use, artificial impoundments and altered drainage would remain. Continued deterioration is possible where these pressures are not actively managed.

Table 12: Impact assessment summary for Impact 2 – Changes to the hydrological regime.

Criteria	No-Go Alternative	Preferred – Without Mitigation	Preferred – With Mitigation
Impact status	Negative	Negative	Negative
Extent (E)	Site (1)	Local (2)	Site (1)
Duration (D)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude (M)	Low (2)	Moderate (3)	Low (2)

Probability (P)	Probable (3)	Highly Probable (4)	Probable (3)
Significance score	21	36	21
IMPACT SIGNIFICANCE	LOW	MEDIUM-LOW	LOW
Reversibility	Recoverable	Recoverable	Recoverable
Confidence level	Medium	Medium	Medium
Irreplaceable loss of resources	None	Barely	None
Cumulative impact potential	Medium	Medium	Low
Mitigation potential	Moderate	High	High
Residual impact	Existing hydrological modification and gradual deterioration may continue in the absence of active management.	—	Low: Some alteration of runoff characteristics within developed portions of the site is unavoidable; however, appropriate stormwater design, retention of natural drainage areas and controlled crossings will limit negative changes to aquatic ecosystem hydrology.

9.3 Impact 3: Erosion, Sedimentation and Geomorphological Change

Several of the aquatic systems already display geomorphological modification associated with roads, impoundments, concentrated drainage and historical agricultural use. This increases their susceptibility to further erosion and sediment mobilisation where runoff is poorly controlled. Without mitigation, construction disturbance and concentrated stormwater could exacerbate these existing pressures. Following mitigation, including erosion and sediment controls, appropriate crossing design, rehabilitation of disturbed areas and management of stormwater discharge, the residual impact is expected to be Low Negative. Confidence is considered Medium to High, as the main risk areas are known, although detailed stormwater and construction designs are not yet available.

Table 13: Impact assessment summary for Impact 3 – Erosion and sedimentation

Criteria	No-Go Alternative	Preferred – Without Mitigation	Preferred – With Mitigation
Impact status	Negative	Negative	Negative

Extent (E)	Site (1)	Local (2)	Local (2)
Duration (D)	Long-term (4)	Permanent (5)	Long-term (4)
Magnitude (M)	Moderate (3)	High (4)	Moderate (3)
Probability (P)	Probable (3)	Highly Probable (4)	Probable (3)
Significance score	24	44	27
IMPACT SIGNIFICANCE	LOW	MEDIUM-LOW	LOW
Reversibility	Recoverable	Recoverable	Recoverable
Confidence level	High	Medium-High	Medium-High
Irreplaceable loss of resources	None	Barely	None
Cumulative impact potential	Medium	Medium-High	Medium-Low
Mitigation potential	Moderate	High	High
Residual impact	Existing erosion and geomorphological degradation are likely to continue gradually where current pressures remain unmanaged.	—	Low/ Medium-Low: Localised erosion or sediment movement may still occur, particularly at crossings and drainage outlets, but should not result in material deterioration of aquatic ecosystem condition where mitigation and maintenance are effectively implemented.

9.4 Impact 4: Changes to Surface Water Quality

The existing agricultural land use already presents some ongoing water quality problems through livestock activity, disturbed soils and runoff. The proposed development would introduce additional potential pollution sources and, without appropriate controls, could increase contaminant and nutrient inputs to downstream aquatic systems. The unmitigated impact is therefore assessed as Medium Negative.

Following mitigation, the residual impact is expected to be Low Negative. This assumes appropriate management of stormwater, wastewater and sewer infrastructure, animal waste, chemicals and hydrocarbons, together with effective construction phase pollution controls. The extensive retention of vegetated open space and the 20m aquatic buffer will further reduce the potential for pollutants to reach aquatic habitat. Confidence is considered Medium, as the broad land uses are

known but some detailed servicing, stormwater and wastewater arrangements remain subject to final design.

Table 14: Impact assessment summary for Impact 4 – Changes to surface water quality

Criteria	No-Go Alternative	Preferred – Without Mitigation	Preferred – With Mitigation
Impact status	Negative	Negative	Negative
Extent (E)	Site (1)	Local (2)	Local (2)
Duration (D)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude (M)	Low (2)	High (4)	Moderate (3)
Probability (P)	Probable (3)	Highly Probable (4)	Low Probability (2)
Significance score	21	40	27
IMPACT SIGNIFICANCE	LOW	MEDIUM	LOW
Reversibility	Recoverable	Recoverable	Recoverable
Confidence level	Medium	Medium	Medium
Irreplaceable loss of resources	None	Barely	None
Cumulative impact potential	Medium	Medium-High	Medium-Low
Mitigation potential	Moderate	High	High
Residual impact	Existing diffuse water-quality pressures are likely to continue under the current land-use regime.	—	Low: Localised water-quality deterioration remains possible, particularly during construction or following management failures, but is not expected to result in sustained deterioration of aquatic ecosystem condition where mitigation is implemented.

9.5 Overall Impact Significance for the Aquatic Biodiversity Theme

Overall, the proposed development is expected to result in mostly Low Negative residual impacts on aquatic biodiversity following mitigation, with direct habitat loss remaining Medium-Low Negative due to unavoidable permanent disturbance at crossings and the loss of two artificial dams.

Most natural aquatic habitat has been avoided through the layout planning process and will be retained within conservation/open-space areas and associated buffers.

Impact	No-Go Alternative	Preferred – Without Mitigation	Preferred – With Mitigation
Habitat and biota	Low Negative	Medium Negative	Medium-Low Negative
Hydrological regime	Low Negative	Medium-Low Negative	Low Negative
Erosion, sedimentation and geomorphology	Low Negative	Medium-Low Negative	Low Negative
Surface water quality	Low Negative	Medium Negative	Low Negative

Cumulatively, the No-Go Alternative is not considered neutral, as existing agricultural disturbance, altered drainage, erosion and invasive alien vegetation are expected to result in gradual further deterioration. The preferred development introduces localised new impacts, but also creates an opportunity for coordinated conservation management, alien clearing and rehabilitation. Subject to implementation of the recommended mitigation and management measures, the overall impact on the Aquatic Biodiversity Theme is considered Low Negative.

10 MITIGATION

The mitigation of negative impacts on biodiversity and ecosystem goods and services is a legal requirement for authorisation purposes and must take on different forms depending on the significance of the impact and the specific area being affected. Mitigation requires the adoption of the precautionary principle and proactive planning that is enabled through a mitigation hierarchy. Its application is intended to strive to first avoid disturbance of ecosystems and loss of biodiversity, and where this cannot be avoided altogether, to minimise, rehabilitate, and then finally offset any remaining significant residual negative impacts on biodiversity (DEA 2013).

The development layout has already incorporated substantial avoidance; the measures below are therefore aimed at protecting retained aquatic systems, minimising unavoidable encroachment, maintaining ecological and hydrological processes, and preventing cumulative deterioration during construction and operation.

The post-mitigation impact significance ratings presented in Section 9 are conditional on implementation of the measures below. These requirements must therefore be incorporated into the final development layout, EMPr, relevant engineering designs and the long-term management framework for the development. Where responsibility will ultimately pass to individual landowners, an owners' association or another management body, the environmental obligations must similarly be transferred and remain enforceable for the operational life of the development. Where detailed infrastructure designs are not yet available, the aquatic constraints established in this report remain applicable and should guide subsequent planning.

Compliance monitoring should be undertaken primarily by the appointed Environmental Control Officer (ECO), with targeted input from the aquatic specialist and/or ecologist at critical stages.

10.1 Aquatic Habitat, Buffers and Development Footprints

The refined aquatic delineation and 20 m aquatic buffer established in this assessment must be incorporated into the final development layout and spatial data. These areas should generally be regarded as aquatic conservation/no-go development areas, except where specific infrastructure crossings or encroachments have been assessed and accepted as part of the development.

New buildings, hard surfaces and other infrastructure should be located outside delineated natural aquatic habitat and the associated buffer wherever practicable. Any future infrastructure not assessed in this report that is proposed within an aquatic feature, or its buffer should be referred to the aquatic specialist for review before detailed design or construction.

At unavoidable road and service crossings:

- crossings must be minimised as far as possible and confined to the smallest practicable footprint and, wherever possible, make use of existing disturbed routes;
- unnecessary widening, clearing or lateral disturbance within wetlands, riparian areas and buffers must be avoided;
- temporary construction areas must be clearly demarcated and rehabilitated following completion of the works; and
- no construction camps, stockpiles, spoil disposal or long-term material storage should occur within aquatic habitat or the 20 m buffer.

The retained aquatic systems and buffers should remain predominantly vegetated. Disturbed areas must be stabilised and rehabilitated using appropriate indigenous vegetation, with ongoing control of invasive alien plants.

Alien invasive vegetation is already an important pressure within several of the aquatic systems and riparian areas. Its removal and subsequent control should therefore form a required environmental outcome of the development, rather than a discretionary future management action. No conservation or aquatic parcel should simply be transferred in a degraded state with an expectation that future landowners will undertake the initial rehabilitation themselves.

A development-wide Alien Invasive Plant Control and Aquatic Rehabilitation Plan should be prepared before construction or phased transfer of properties. It should identify priority areas, appropriate clearing methods, follow-up treatment requirements, rehabilitation objectives, responsible parties, timeframes and monitoring requirements.

Alien clearing within wetlands and riparian areas must be undertaken sensitively and progressively so that removal does not destabilise banks, expose large areas of soil or initiate erosion. Where dense alien stands currently perform a temporary soil-stabilising function, clearing must be coordinated with rehabilitation and indigenous revegetation.

10.2 Stormwater Management

Natural drainage and hydrological connectivity between hillslopes, wetlands and downstream watercourses must be maintained. Stormwater management should aim to retain, infiltrate and disperse runoff as close as practicable to its source rather than concentrating flows into aquatic systems.

Road crossings and drainage infrastructure must be designed to accommodate natural flow paths without unnecessary impoundment, diversion or concentration of flows. Crossings should maintain

longitudinal and lateral hydrological connectivity and should not create new preferential erosion channels.

Stormwater outlets must be appropriately located and designed to dissipate flow before discharge. Concentrated stormwater should not be discharged directly into wetlands or onto unstable banks. Sustainable drainage measures should be incorporated where practicable, particularly within developed areas.

Detailed stormwater and drainage designs should be reviewed against the aquatic constraints and mitigation requirements of this report before implementation. Where designs interact directly with aquatic systems, specialist review is recommended.

Removal of Dam 7 and Dam 27 must account for the existing storage and attenuation functions of these features. In particular, runoff currently intercepted by the dams must be appropriately conveyed or dispersed so that removal does not create concentrated drainage, erosion or adverse downstream hydrological effects. Rehabilitation and conservation of the natural systems must be undertaken to counter the loss of dam areas.

10.3 Erosion, Sedimentation and Geomorphological Protection

Construction disturbance should be kept to the minimum necessary, particularly at watercourse crossings and on slopes draining toward aquatic systems. Exposed soils should be stabilised as soon as practicable and disturbed areas progressively rehabilitated rather than remaining bare until completion of the entire development phase.

Appropriate sediment and erosion controls must be installed before or concurrently with earthworks where runoff may enter aquatic habitat. Excavated material and spoil must not be deposited within wetlands, riparian areas, drainage lines or buffers. Road drainage, crossings and stormwater outlets must incorporate energy dissipation and erosion protection appropriate to anticipated flows.

Any erosion, incision, bank instability or sediment accumulation associated with construction or new drainage infrastructure should be addressed promptly. Rehabilitation should target the cause of erosion, particularly inappropriate concentration or diversion of runoff, rather than simply repairing the resulting gully or eroded surface.

10.4 Water Quality Protection

Construction activities must be managed to prevent cement, hydrocarbons, sediment, waste and other pollutants from entering aquatic systems. Refuelling, servicing of machinery, concrete preparation and storage of potentially contaminating substances should occur in designated controlled areas outside aquatic habitat and buffers. Spill-response materials and procedures must be available during construction.

During operation, stormwater, sanitation, agricultural and equestrian activities must be managed so that contaminated runoff does not enter wetlands or watercourses. Wastewater infrastructure must be appropriately designed, operated and maintained, and reuse of treated effluent must not result in uncontrolled runoff, ponding or discharge to aquatic systems.

Fertilisers, pesticides, animal waste and other potentially contaminating materials should be managed to minimise nutrient and pollutant transfer to the drainage network. Maintenance of vegetated aquatic buffers is an important component of this protection.

10.5 Long-term Management and Rehabilitation

The long-term ecological outcome of the development will depend substantially on management of the retained conservation and aquatic areas. The April baseline assessment already identified invasive alien vegetation and livestock pressure as important existing threats to the aquatic systems. Long-term management should therefore include systematic alien vegetation control, appropriate management of livestock access to sensitive aquatic areas, maintenance of indigenous vegetation cover, and rehabilitation of existing erosion or degraded areas.

Detailed rehabilitation interventions need not be prescribed for every HGM unit at this stage but it is recommended that intervention be planned and developed through an appropriate rehabilitation or aquatic management plan with specialist input.

Adequate financial provision must be made by the developer for required rehabilitation, alien clearing and establishment-phase maintenance. These works must not depend solely on future individual landowners undertaking them voluntarily.

Because the development will ultimately comprise multiple properties and management areas, aquatic management obligations must be carried through into the relevant EMPr, conservation management documentation and future landowner or management requirements. Each future landowner must be formally informed of the location of aquatic habitat and buffers affecting the property and must sign acknowledgement of the associated restrictions and management responsibilities before transfer or occupation. Responsibility for maintaining buffers, controlling



alien vegetation, preventing erosion and responding to emerging aquatic impacts should therefore remain clear throughout the operational life of the development.

An adaptive management approach is recommended. Periodic inspection of the aquatic systems, particularly crossings, stormwater outlets and areas subject to rehabilitation, should be used to identify erosion, sediment accumulation, altered drainage, alien plant establishment or other deterioration and trigger corrective action where required.

11 CONCLUSION

The Hoogeland site contains a network of natural wetlands, riparian systems and artificial dams occurring within a landscape that has been modified to varying degrees by agriculture, roads, impoundments, altered drainage and invasive alien vegetation. The September 2026 field assessment refined the aquatic delineation undertaken during the initial baseline assessment and provided a more detailed assessment of the HGM units most relevant to the proposed development. The assessed systems range from relatively intact seep wetlands to substantially modified valley-bottom and riparian systems, but collectively remain important for maintaining local drainage, wetland habitat and catchment connectivity.

The development layout has responded reasonably well to the aquatic constraints identified during the baseline phase, with most natural aquatic habitat avoided and incorporated into conservation or open-space areas. The main remaining impacts are associated with road and service crossings, development adjacent to aquatic systems, and the proposed removal of Dam 7 and Dam 27. A 20 m buffer from delineated natural aquatic habitat is recommended for the current development and should replace the preliminary planning buffers previously applied.

The main potential impacts relate to direct disturbance of aquatic habitat, changes to hydrological functioning, erosion and sedimentation, and deterioration of surface water quality. Following stringent mitigation, most of these impacts are assessed as Low Negative, with the residual impact associated with permanent habitat disturbance remaining Medium-Low Negative. These impacts are considered acceptable provided that the aquatic buffers are retained, crossings and stormwater infrastructure are appropriately designed, disturbance is rehabilitated, and the management measures specified in this report are implemented.

Of particular importance is the long-term management of the retained aquatic and conservation areas. Existing alien vegetation, erosion and other land use pressures are already contributing to degradation of parts of the aquatic system. Alien clearing, rehabilitation and subsequent maintenance should therefore form part of the development obligations and should not be deferred entirely to future landowners. The aquatic and buffer areas must also remain ecologically functional and should not subsequently be converted to gardens, lawns or other incompatible uses. These requirements, together with the relevant spatial constraints, must be incorporated into the EMPr and future landowner or management obligations, with compliance verified by the ECO and specialist input obtained where required.

On this basis, the proposed development is considered acceptable from an aquatic biodiversity perspective, provided that the mitigation and management requirements contained in this report are implemented and that the final layout and relevant detailed designs are reviewed against the



refined aquatic delineation prior to construction. There are activities constituting water uses in terms of the National Water Act, and these remain subject to the applicable water use authorisation process.

12 REFERENCES

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13 APPENDIX 1 – DETAILED METHODOLOGY

13.1 Definitions

For reference the following definitions are as follows:

- **Drainage line:** A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian:** the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland:** 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 under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al.*, 1979).
- **Water course:** as per the National Water Act 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 in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

13.2 Wetland delineation and HGM type identification

Wetland delineation includes the confirmation of the occurrence of wetland and a determination of the outermost edge of the wetland. The outer boundary of wetlands was identified and delineated according to the Department of Water Affairs wetland delineation manual 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas' (DWAF, 2005a).

Wetland indicators were used in the field delineation of the wetlands: position in landscape, vegetation and soil wetness (determined through soil sampling with a soil auger and the examining the degree of mottling).

Four specific wetland indicators were used in the detailed field delineation of wetlands, which include:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur.
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation.
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

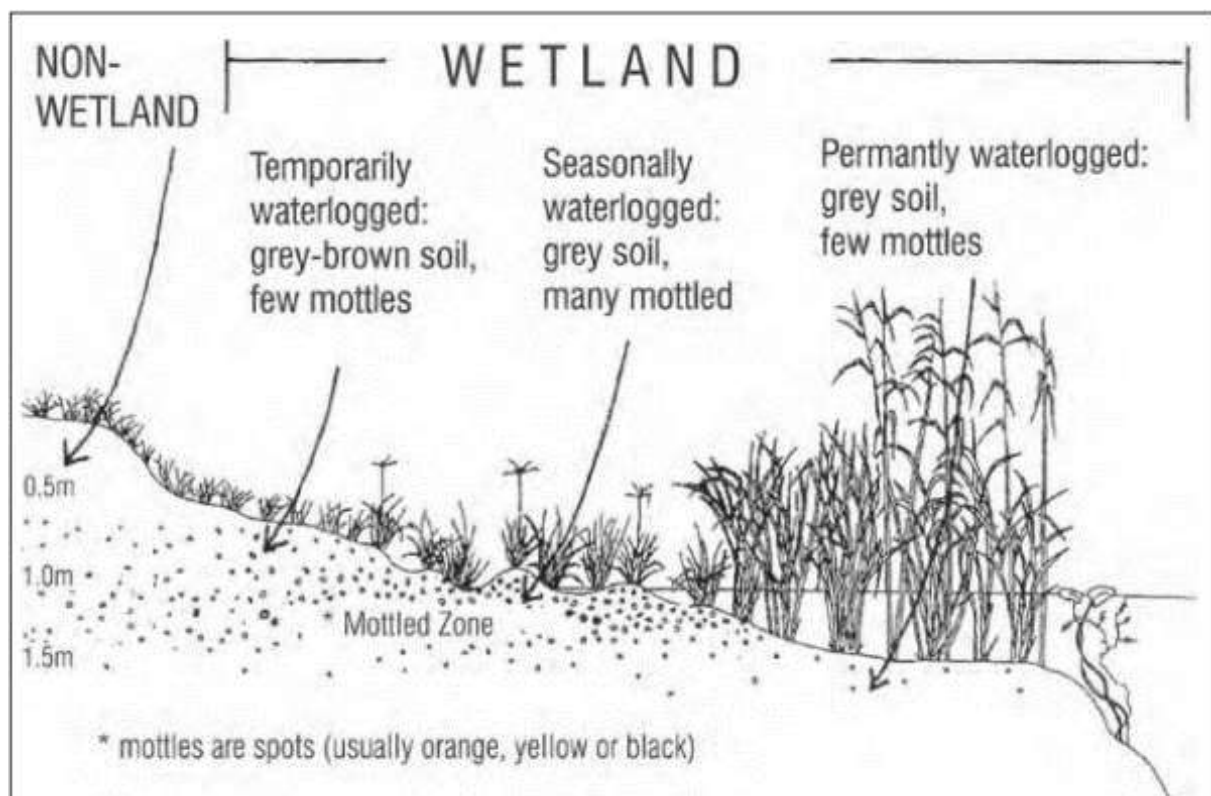


Figure A12.1a: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change as one moves along a gradient of decreasing wetness, from the middle to the edge of the wetland. Source: Donovan Kotze, University of KwaZulu-Natal.

According to the wetland definition used in the National Water Act, vegetation is the primary indicator, which must be present under normal circumstances. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a

confirmatory role. The reason is that vegetation responds relatively quickly to changes in soil moisture regime or management and may be transformed; whereas the morphological indicators in the soil are far more permanent and will hold the signs of frequent saturation long after a wetland has been drained (perhaps for several centuries).

The permanent, seasonal and temporary wetness zones can be characterised to some extent by the soil wetness indicators that they display (Table A12.1a)

A12.1a: Soil Wetness Indicators in the various wetland zones

Temporary Zone	Seasonal Zone	Permanent Zone
Minimal grey matrix (<10%)	Grey matrix (<10%)	Prominent grey matrix
Few high chroma mottles	Many low chroma mottles present	Few to no high chroma mottles
Short periods of saturation (less than three months per annum)	Significant periods of wetness (at least three months per annum)	Wetness all year round (possible sulphuric odour)

Table A12.1b: Relationship between wetness zones and vegetation types and classification of plants according to occurrence in wetlands

Vegetation	Temporary Wetness Zone	Seasonal Wetness Zone	Permanent Wetness Zone
Herbaceous	Predominantly grass species; mixture of species which occur extensively in non-wetland areas, and hydrophilic plant species which are restricted largely to wetland areas	Hydrophilic sedges and grasses restricted to wetland areas	Dominated by: (1) emergent plants, including reeds (<i>Phragmites australis</i>), a mixture of sedges and bulrushes (<i>Typha capensis</i>), usually >1m tall; or (2) floating or submerged aquatic plants.
Woody	Mixture of woody species which occur extensively in non-wetland areas, and hydrophilic plant species which are restricted largely to wetland areas.	Hydrophilic woody species restricted to wetland areas	Hydrophilic woody species, which are restricted to wetland areas. Morphological adaptations to prolonged wetness (e.g. prop roots).
Symbol	Hydric Status	Description/Occurrence	
Ow	Obligate wetland species	Almost always grow in wetlands (>90% occurrence)	
Fw/F+	Facultative wetland species	Usually grow in wetlands (67-99% occurrence) but occasionally found in non-wetland areas	
F	Facultative species	Equally likely to grow in wetlands (34-66% occurrence) and non-wetland areas	

Fd/F-	Facultative dryland species	Usually grow in non-wetland areas but sometimes grow in wetlands (1-34% occurrence)
D	Dryland species	Almost always grow in drylands

In order to identify the wetland types, using Kotze *et al.* (2009) and Ollie *et al.* (2013), a characterisation of hydrogeomorphic (HGM) types was conducted. These have been defined based on the geomorphic setting of the wetland in the landscape (e.g. hillslope or valley bottom, whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated), how water flows through the wetland (diffusely or channelled) and how water exits the wetland (Figure A12.1b).

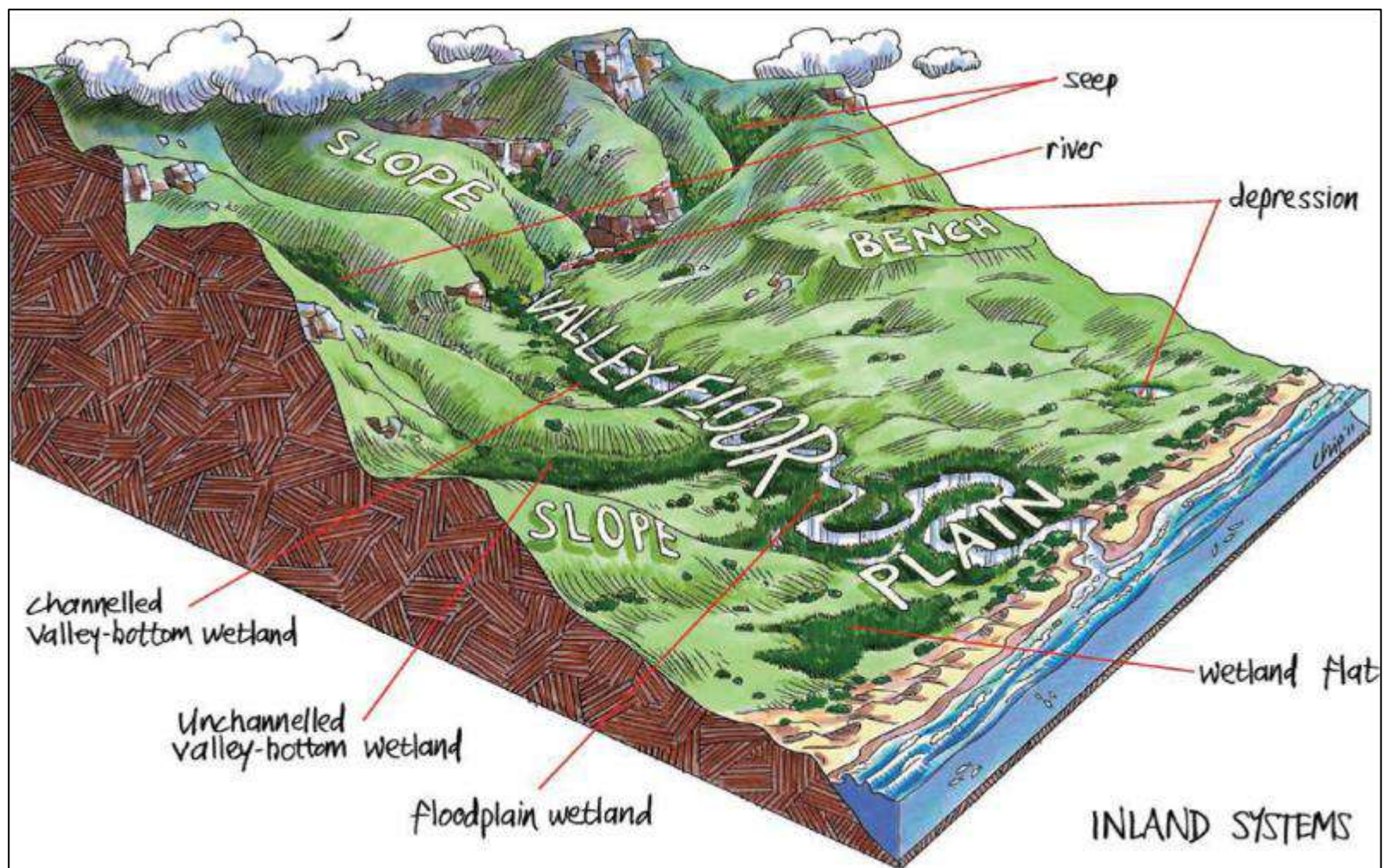


Figure A12.1b: Illustration of wetland types and their typical landscape setting (From Ollie *et al.* 2013)

13.3 Present Ecological State (PES) – Wetlands

WET-Health assists in assessing the health of wetlands using indicators based on geomorphology, hydrology and vegetation. For the purposes of rehabilitation planning and assessment, WET-Health helps users understand the condition of the wetland in order to determine whether it is beyond repair, whether it requires rehabilitation intervention, or whether, despite damage, it is perhaps healthy enough not to require intervention. It also helps diagnose the cause of wetland degradation so that rehabilitation workers can design appropriate interventions that treat both the symptoms and causes of degradation. WET-Health is tailored specifically for South African conditions and has wide application, including assessing the Present Ecological State of a wetland.

WET-Health is a tool designed to assess the health or integrity of a wetland. Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. This technique attempts to assess hydrological, geomorphological and vegetation health in three separate modules.

Hydrology is defined in this context as the distribution and movement of water through a wetland and its soils. This module focuses on changes in water inputs as a result of changes in catchment activities and characteristics that affect water supply and its timing, as well as on modifications within the wetland that alter the water distribution and retention patterns within the wetland.

Geomorphology is defined in this context as the distribution and retention patterns of sediment within the wetland. This module focuses on evaluating current geomorphic health through the presence of indicators of excessive sediment inputs and/or losses for clastic (minerogenic) and organic sediment (peat).

Vegetation is defined in this context as the vegetation structural and compositional state. This module evaluates changes in vegetation composition and structure as a consequence of current and historic onsite transformation and/or disturbance.

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. The tool attempts to standardise the way that impacts are calculated and presented across each of the modules. This takes the form of assessing the spatial extent of impact of individual activities and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact (Table A12.2a).

Impact scores obtained for each of the modules reflect the degree of change from natural reference conditions. Resultant health scores fall into one of six health categories (A-F) on a gradient from “unmodified/natural” (Category A) to “severe/complete deviation from natural” (Category F) as depicted in Table A12.2b, below. This classification is consistent with DWAF categories used to evaluate the present ecological state of aquatic systems.

An overall wetland health score was calculated by weighting the scores obtained for each module and combining them to give an overall combined score using the following formula:

$$\text{Overall health rating} = [(\text{Hydrology} \times 3) + (\text{Geomorphology} \times 2) + (\text{Vegetation} \times 2)] / 7$$

This overall score assists in providing an overall indication of wetland health/functionality which can in turn be used for recommending appropriate management measures.

Table A12.2a: Guideline for interpreting the magnitude of impact on integrity

Impact Category	Description	Score
None	No discernible modification or the modification is such that it has no impact on this component of wetland integrity.	0 – 0.9
Small	Although identifiable, the impact of this modification on this component of wetland integrity is small.	1 – 1.9
Moderate	The impact of this modification on this component of wetland integrity is clearly identifiable, but limited.	2 – 3.9
Large	The modification has a clearly detrimental impact on this component of wetland integrity. Approximately 50% of wetland integrity has been lost.	4 – 5.9
Serious	The modification has a highly detrimental effect on this component of wetland integrity. Much of the wetland integrity has been lost but remaining integrity is still clearly identifiable.	6 – 7.9
Critical	The modification is so great that the ecosystem processes of this component of wetland integrity are almost totally destroyed, and 80% or more of the integrity has been lost.	8 – 10

Table A12.2b. Health categories used by WET-Health for describing the integrity of wetlands (after Macfarlane *et al.*, 2008).

Impact Category	Description	Range	Pes
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None	Unmodified, natural.	0 – 0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural	1 – 1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the	2 – 3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4 – 5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat	6 – 7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost	8 – 10	F

13.4 Wetland Functional Importance (Goods and Services)

WET-EcoServices is used to assess the goods and services that individual wetlands provide, thereby aiding informed planning and decision making. It is designed for a class of wetlands known as palustrine wetlands (i.e. marshes, floodplains, vleis or seeps). The tool provides guidelines for scoring the importance of a wetland in delivering each of 20 different ecosystem services (including flood attenuation, sediment trapping and provision of livestock grazing). The first step is to characterise wetlands according to their hydro-geomorphic setting (e.g. floodplain). Ecosystem service delivery is then assessed either at Level 1, based on existing knowledge or at Level 2, based on a field assessment of key descriptors (e.g. flow pattern through the wetland).

The overall goal of WET-EcoServices is to assist decision makers, government officials, planners, consultants and educators in undertaking quick assessments of wetlands, specifically in order to reveal the ecosystem services that they supply. This allows for more informed planning and decision making. WET-EcoServices includes the assessment of several ecosystem services (listed in Table A12.4a) - that is, the benefits provided to people by the ecosystem.

Table A12.4a: Ecosystem services assessed by WET-Ecoservice

Ecosystem services supplied by wetlands				
Ecosystem services supplied by wetlands	Indirect benefits		Regulating and supporting benefits	
			Flood attenuation	The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
			Streamflow regulation	Sustaining streamflow during low flow periods
	Water quality enhancement benefits	Sediment trapping		The trapping and retention in the wetland of sediment carried by runoff waters
		Phosphate assimilation		Removal by the wetland of phosphates carried by runoff waters
		Nitrate assimilation		Removal by the wetland of nitrates carried by runoff waters
		Toxicant assimilation		Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters
		Erosion control		Controlling of erosion at the wetland site, principally through the protection provided by vegetation.
			Carbon storage	The trapping of carbon by the wetland, principally as soil organic matter
	Direct benefits		Biodiversity maintenance ²	
	Provisioning benefits	Provision of water for human use		The provision of water extracted directly from the wetland for domestic, agriculture or other purposes
		Provision of harvestable resources		The provision of natural resources from the wetland, including livestock grazing, craft plants, fish, etc.
		Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
	Cultural benefits	Cultural heritage		Places of special cultural significance in the wetland, e.g., for baptisms or gathering of culturally significant plants
		Tourism and recreation		Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
		Education and research		Sites of value in the wetland for education or research

Table A12.4a: Ecosystem services assessed by WET-Ecoservice

13.5 Impact Assessment Methodology

The approach adopted is to identify and assess the potential direct, indirect and cumulative impacts associated with the proposed development and to determine their significance both before and after mitigation. Impact significance is evaluated in terms of the spatial extent, duration, magnitude and probability of the impact occurring. The assessment also considers reversibility, irreplaceable loss of resources, cumulative impact potential, mitigation potential and the nature of the residual impact.

The principal significance score is calculated as follows:

$$S = (E + D + M) \times P$$

where:

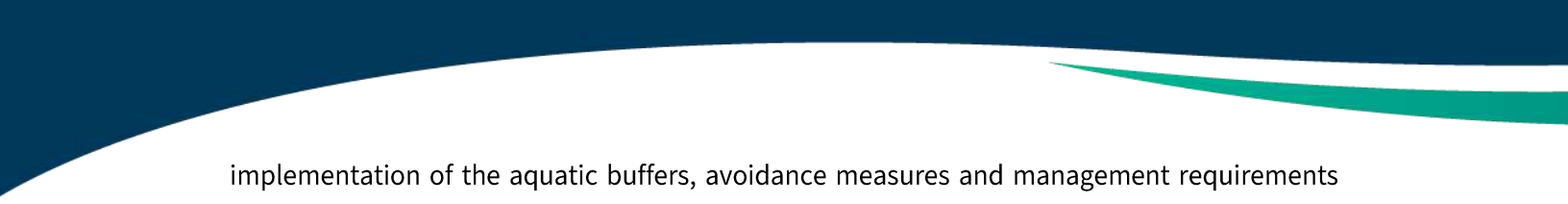
- **E = Extent** of the impact;
- **D = Duration** of the impact;
- **M = Magnitude**, taking into account the degree of ecological change, proportion of the aquatic resource affected, PES, EIS, ecological functioning and broader landscape context; and
- **P = Probability** of the impact occurring.

Reversibility is considered separately rather than incorporated numerically into the significance equation as the influence of permanence, is already reflected in the duration criterion. Irreplaceable resource loss, cumulative impact potential, mitigation potential and residual impact are similarly reported separately to assist interpretation of the numerical significance score.

The following significance classes are applied:

Significance score	Rating
0–15	Very Low
16–30	Low
31–45	Medium-Low
46–60	Medium
>60	High

Impacts are assessed for the No-Go Alternative, the preferred development without mitigation, and the preferred development following mitigation. Post-mitigation ratings assume effective



implementation of the aquatic buffers, avoidance measures and management requirements specified in this report. Where uncertainty remains, a precautionary approach is adopted.

14 APPENDIX 2- SPECIALIST CV

Curriculum Vitae

Colin Justin Fordham

BSc (Botany, Biochemistry)

Bsc Botany Honours (environmental Management)

Msc Entomology (biological Control)

**25 Blommekloof Street, Denneoord, George · Cell:0827889739,
· Email: colin@upstreamconsulting.co.za**

Personal Information

Professional profile:

A highly motivated, confident, and diligent professional with exceptional communication skills, passionate about solving complex challenges. Adept at leveraging technology and software solutions to enhance organizational systems and functionality. Well-presented, ambitious, and goal-oriented with a strong drive to achieve success.

Skills:

- Extensive experience managing budgets and complex teams of staff who vary in skillsets, experience and opinions.
- Extensive conservation expertise in managing, analysing, and implementing ecological monitoring projects of varying complexity across Marine, Estuarine, Freshwater and Terrestrial ecosystems within seven Nature Reserves in the Western Cape.
- Vast experience managing, compiling and implementing large scale conservation and environmental projects, such as BMPs, PAMPs, EIA's, BAR's and various specialist studies while working as a senior manager, environmental consultant, ecological specialist.
- Extremely respectful of different cultures, religious and ethnic beliefs and I enjoy interacting with a wide variety of people.
- Exceptional knowledge of South African ecosystems, conservation policy and legislation.
- Extensive Southern Africa botanical, coastal and freshwater habitat assessment skills as well as experience in alien plant removal and rehabilitation techniques.
- Excellent knowledge of Southern Africa, geographically and culturally.
- Highly computer literate and skilled, with knowledge of various Microsoft Office, QGIS, ArcGIS, ArcView (v3 & v9.1 & v10), Manifold (v7&v8) mapping systems and programs. I also have experience with working with Miradi Conservation software.
- Excellent verbal, report writing and presenting skills.

Date of birth: 8th December 1982

Marital status: Married, no dependants

Health: Excellent

Criminal record: None

Country of origin: South Africa

ID Number: 8212085221086

Languages: Fluent in English, Afrikaans and Xhosa

Driver's License: Code 14, EC

Skippers License: River boats up to 9m.

Summary of Employment and Tertiary Education:

- Landscape Conservation Intelligence Manager - CapeNature (2019 – 2025)
- Land Use Scientist – CapeNature (2016 – 2019)
- Wetland Specialist, KSEMS (August 2015 – June 2016)
- Environmental Consultant and Ecologist, AGES (January 2012 – August 2015)
- MSC at Rhodes University (March 2010 – December 2012)
- CES – (March 2008 – February 2010) Environmental Scientist, Botanical\GIS Specialist and Ecologist
- BSC and BSC Honours at Nelson Mandela University (2001-2007).

Work Experience

► **CapeNature Landscape Conservation Intelligence Manager (LCIM) (2019 – 2025)**

The purpose of the LCIM is to provide strategic leadership and overall accountability for the management, conservation and the promotion of human, natural and heritage assets in a CapeNature Landscape through best practice, within relevant legislative frameworks and the provision of a professional knowledge generation, capacity building and information management service, that enables strategic adaptive biodiversity management. The LCIM forms part of the Landscape Management Team, with Landscape Ecologist, Ecological Coordinator, Ecological Technician, GIS Technician and Technical Assistant all reporting to the LCIM.

As a LCIM, my key responsibilities included:

- Ensuring that Managed data, knowledge, and information flowed to produce high-quality intelligence, facilitating strategic adaptive management across priority landscape projects.
- Providing ecological decision support to guide landscape conservation through the coordination and scientific analysis of data for management planning and assessments.
- Facilitating integrated landscape and protected area planning by ensuring the development and review of key documents, such as Protected Area Management Plans (PAMPs), species Biodiversity Management Plans and ecological monitoring protocols.
- Leading capacity-building efforts to support conservation management, ecosystem resilience, and the coordination of stakeholders to ensure effective landscape conservation.
- Ensuring performance, governance, and risk management of Landscape Conservation Intelligence (LCI) through effective leadership and strategic oversight.

- Developing and reviewing landscape intelligence products, including eco-matrices, biodiversity planning documents, and data management tools, ensuring their alignment with conservation goals.
- Providing expert ecological input into landscape assessments, including site-specific impact assessments, spatial biodiversity planning, and biodiversity offset strategies.
- Managing and optimising budget allocations, ensuring financial control over the expenditure related to biodiversity projects and landscape conservation activities.
- Coordinating biodiversity data collection and monitoring activities, ensuring accurate fieldwork for priority landscape monitoring projects and habitat/species assessments.
- Sustaining key partnerships with municipalities, biosphere partners, academic institutes, and stakeholders to advance landscape custodianship and biodiversity conservation.
- Providing formal and informal decision support on biodiversity planning, permit applications, and development proposals, ensuring compliance with environmental legislation.
- Monitoring and reviewing conservation actions, including eco-matrix updates and biodiversity management plans, and facilitated input into landscape planning and expansion initiatives.
- Facilitating the development of key strategic documents, including the annual Integrated Work Plans (IWP) and APO (Annual Planning Objectives), aligning conservation priorities with landscape-level planning.
- Contributing to the development and review of biodiversity management guidelines, protocols, and spatial planning tools to ensure effective conservation strategies across landscapes.
- Reviewing and approving Protected Area Management Plans (PAMPs), contributing to the strategic vision and operational planning for the expansion and management of protected areas.
- Managing team performance, including the implementation of performance agreements, appraisals, and staff development plans, fostering a high-performance culture in the landscape team.
- Representing CapeNature at forums, workshops, and conferences, providing expert contributions and expanding the network of stakeholders committed to biodiversity conservation.
- Providing scientific analysis of biodiversity data, interpreting landscape data sources and providing actionable recommendations for biodiversity management.
- Engaging in active governance and compliance oversight, ensuring that landscape conservation units adhered to corporate policies, standards, and environmental legislation.
- Optimising staff capacity by facilitating training programs, supporting GIS and ecological training for landscape teams, and enhancing skills to support landscape conservation goals.

► **CapeNature Land Use Advice Scientist (June 2016 – 2019)**

The purpose of a CapeNature Land Use Advice Scientist is to provide specialised ecological expertise and guidance in land-use planning, development, and conservation. This role ensures that land-use decisions align with biodiversity conservation priorities, legal requirements, and sustainable environmental practices. Key responsibilities include evaluating the ecological impacts of proposed developments, reviewing specialist reports, advising on biodiversity offsets, and promoting the integration of conservation objectives into regional and local planning frameworks. The position also involves contributing to the development of biodiversity management tools, supporting research and monitoring programs, and fostering collaboration between stakeholders to protect and enhance natural ecosystems in the Western Cape.

As a Land Use Scientist, my key responsibilities included:

- Reviewing specialist reports and planning applications, providing ecological expertise to support land-use decision-making.
- Evaluating and advising on biodiversity offsets, ensuring compliance with conservation priorities and environmental regulations.
- Assessing site sensitivities and the potential ecological impacts of land-use applications, offering guidance to competent authorities.
- Developing biodiversity legislative tools, including Biodiversity Management Plans (BMPs), Alien Invasive Species (AIS) management plans, and spatial biodiversity plans.
- Identifying and recommending opportunities to expand the conservation estate through stewardship programs and other mechanisms.
- Attending site inspections, resolving development queries, and reporting non-compliance to relevant authorities.
- Representing CapeNature at conservation forums, workshops, and conferences, contributing scientific expertise.
- Supporting biodiversity research and monitoring efforts, publishing findings to inform conservation strategies.
- Maintaining an up-to-date database of land-use applications and biodiversity offsets to guide planning.
- Providing training and support to staff on environmental legislation and conservation guidelines.

► **Wetland Specialist, KSEMS (August 2015 – June 2016)**

- Project Management and coordination of sub-consultants as well as budget control handling
- Compiling specialist wetland assessments, with specific reference to estuaries, riparian zones, wetlands, coastal forests, grasslands and savannahs.
- Compilation of maps using GIS systems and analysis of data, using GIS systems
- General assistance regarding administration, co-ordination, project management and report production activities related to business projects.

► **Environmental Consultant, AGES (January 2012 – August 2015) and CES (March 2008 –February 2010) Environmental Scientist, Botanical\GIS Specialist and Ecologist.**

- Project Management and coordination of sub-consultants as well as budget control handling
- Assisting the compilation of Environmental Impact Assessment (EIA) and Botanical Survey reports, including Multivariate analysis.
- Assisting with specialist faunal and floral studies, with specific reference to estuaries, riparian zones, wetlands, coastal forests, grasslands and savannas.
- Compilation\assisting with the compilation of the following reports\studies; Environmental Impact Assessments (EIA), Basic Assessments, Scoping Reports, Environmental Management Plans, Baseline Surveys and Botanical Surveys.
- Compilation of maps using GIS systems and analysis of data, using GIS systems
- Also, general assistance regarding administration, co-ordination, project management and report production activities related to business projects.

► **Department of Botany, NMMU, (2005-2007)**

Environmental Consultant:

- Assisted in the undertaking of an EIA, for the augmentation of a water supply for Nieu Bethesda, including the construction of a pump station and two water reservoirs. Was directly responsible for the compilation of a botanical species list from samples taken from the site.
- Laboratory Technician\Teaching experience (2005 & 2006, 2010 and 2011 at Rhodes University):
- 1st year student demonstrator
 - Taught students weekly and assisted in smooth and safe operation of laboratory equipment during student practical sessions.

South African Railways Contract Work, (Spoornet), (2004-2007)

- Performed alien plant removal contracts for family business as a supervisor of a team varying from 2 – 8 men.
- Was responsible for the identification and eradication of alien plant species, application of herbicide and preservation of protected species.

Qualifications

BSc subjects, (majored in Botany and Biochemistry, (2001-2005)

BSc Honors - Botany (Environmental Management), (2006-2007)

MSc Entomology (Biological Control) - Passed

A GIS analysis of the dominant aquatic alien macrophytes and a baseline assessment of the macroinvertebrates associated with *Myriophyllum spicatum* L. in the Vaal River.

The MSc was conducted on the *Myriophyllum spicatum* L. infestation in the Vaal River. It focused on the observed switch of Alternate Stable States, from a floating plant (water hyacinth) dominated state, to a submerged aquatic alien plant (*M. spicatum*) dominated stable state.

This study required GIS analysis of satellite imagery to determine when and where the switch in dominance occurred, and how this new state would impact the future control of water hyacinth and *M. spicatum* by Working for Water teams.

Additional analysis was conducted on how the water and sediment nutrient levels could have been affected by the change in dominance. An insect faunal survey was also conducted to determine how indigenous insects were impacting and limiting the spread of *M. spicatum*. It was envisaged that this baseline study would allow the Rhodes Department of Entomology to quantify the impact that future biological control agents would have on the existing *M. spicatum* population.

- Additional Short Courses Completed
 - Biological Control Short Course – Prof Martin Hill, Rhodes University February 2010.
 - ArcGIS Short Course – Prof Gillian McGregor, Rhodes University, April 2010.
 - Project Management Course – Chris Upfold - April 2008
 - EIA Course – Rhodes University – Pass (Highly Competent) (Nov 2008)
 - CES Courses
 - Financial Management of Projects (Oct 2008)
 - Basic Assessments (Oct 2008)
 - Wetland Delineation and Assessment Short Course – Pass (Sep 2009)
 - Biological Control Short Course – Pass (February 2010)
 - Conservation Coaches Short Course – Pass (February 2018)
- Presentations and Posters:
 - Twenty-one presentations given on behalf of CapeNature while working as a Land Use Scientist and as a Landscape Conservation Intelligence Manager.
 - These were presented to a wide range of stakeholders, as well as fellow scientists and members of the public. Both in person and virtually on MS Teams and Zoom platforms.
 - Facilitated seventeen different large-scale workshops for various CapeNature conservation orientated products.

- Constructed wetlands and their efficiency for wastewater treatment, Nelson Mandela Metropolitan University. March 2006
- Mapping the *Myriophyllum spicatum* infestation in the Vaal River and its implications for biocontrol. Weeds Workshop Conference 30th August -3rd September 2010.
- A baseline study of the insects associated with an infestation of *Myriophyllum spicatum* L. in the Vaal River. Entomology Society (3rd – 6th July 2011)
- A GIS analysis of the macrophytes in the Vaal River and a baseline survey of the invertebrates associated with *Myriophyllum spicatum*. Weeds Workshop (6th – 9th July 2011)

References

Mr Garth Mortimer
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Mr Mbulelo Jacobs

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Dr Ernst Baard

CapeNature

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Operations

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15APPENDIX 3 -SPECIALIST DECLARATION

Specialist Company Name:	Upstream Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	NA
Specialist name:	Colin Fordham			
Specialist Qualifications:	M.Sc. – Entomology (Biological Control) B. Sc. (Hons) - Botany (Environmental Management) B.Sc. – Botany and Biochemistry SACNASP registered Professional Wetland Scientist			
Professional affiliation/registration:	Colin Fordham is a SACNASP registered Professional Natural Scientist (Pr. Sci. Nat.) Ecologist with 14 years of experience in the environmental and conservation sectors.			
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Postal code:	6530	Cell:	0648575560	
Telephone:		Fax:		
E-mail:	Colin@upstreamconsulting.co.za			

DECLARATION BY THE SPECIALIST

I, __Colin Fordham_____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

Name of Company: Upstream Consulting

DATE: 14/09/2026

