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AQUATIC SITE SENSITIVITY AND BASELINE REPORT

FOR THE PROPOSED

DEVELOPMENT ON PORTIONS 59 AND 62 OF FARM BRAKKLOOF NO. 443, BITOU MUNICIPALITY

DATE: 21 January 2026

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SUMMARY

Upstream Consulting was appointed by Stargate Innovations (Pty) Ltd to undertake an Aquatic Site Sensitivity Verification and Baseline Assessment for Portions 59 and 62 of Farm Brakkloof No. 443, Plettenberg Bay, within the Bitou Local Municipality. The assessment was triggered by a *Very High* aquatic sensitivity rating assigned by the DFFE Screening Tool, primarily due to the site's partial overlap with the Outeniqua Strategic Water Source Area (SWSA) and an Aquatic Ecological Support Area (ESA 1).

Desktop analysis and field verification confirmed the presence of three non-perennial drainage systems and several artificial wetland features within the study area. These were classified into six hydrogeomorphic (HGM) units, of which three (HGM1, HGM2 and HGM3) are potentially sensitive to development-related impacts. No perennial rivers or natural wetlands occur on the site. The drainage features are strictly episodic, conveying stormwater runoff toward the coastal zone during high-intensity rainfall events.

HGM1 represents the primary drainage line and functions as an important longitudinal ecological corridor linking inland fynbos/thicket vegetation with the coastal environment. HGM2 is a minor first-order tributary that contributes to local-scale connectivity, while HGM3 is an artificial wetland formed by stormwater discharge from the access road and provides limited attenuation and water quality functions.

Although portions of the site overlap with mapped Aquatic ESA and SWSA areas at a desktop level, site specific verification indicates that these designations do not align closely with the observed hydrological features. The mapped ESA corridor does not correspond with the on-site drainage lines or natural flow paths, suggesting that the aquatic sensitivity classification reflects broad scale modelling which is recommended by the WCBSP to be verified by ground-truthing.

Historical land use, including agriculture, mining, and invasive alien plant infestation, has significantly influenced the current condition of the landscape. Mining activities altered local hydrology by creating artificial depressions, while surrounding urban and quarry development has increased stormwater runoff entering the site. Recent alien vegetation clearing has improved ecological conditions in some areas, although legacy impacts remain evident.

Aquatic buffer zones were calculated using the Macfarlane and Bredin (2017) buffer tool, resulting in recommended buffers of 29 m for the main drainage line (HGM1) and 26 m for the minor tributary (HGM2), with a 5 m buffer around the artificial wetland. These buffers are based on an “after-mitigation” scenario and are intended to guide future layout planning.

Due to the presence of watercourses on site, and because treated wastewater is proposed to be discharged into HGM1, this baseline and sensitivity assessment does not constitute a compliance statement. A full aquatic biodiversity impact assessment will be required as part of the EIA process to evaluate potential ecological, hydrological, geomorphological and water quality impacts associated with the proposed discharge and associated infrastructure.

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.

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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 botanical 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. In 2025 Colin joined Upstream Consulting as a professional aquatic ecologist. Amongst other qualifications, Colin holds a M.Sc. degree in Entomology (Biological Control of Aquatic Plants) from Rhodes University.

I, **Debbie 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: ...21 January 2026

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1 INTRODUCTION

Upstream Consulting was appointed Stargate Innovations Pty Ltd to conduct an aquatic site sensitivity verification and baseline report for aquatic habitat to determine opportunities and constraints to develop Portions 59 and 62 of Brakkloof Farm 443, near Plettenberg Bay

The site sensitivity verification assessment was undertaken to investigate the Very High aquatic biodiversity sensitivity rating of the DFFE Screening Tool and the requirement of a Site Sensitivity Verification and Baseline Report. Government Notice No. 645, dated 10 May 2019, includes the requirement that an Initial Site Sensitivity Verification Report must be produced for a project footprint (Figure 1). As per Part 1, Section 2.3, the outcome of the Initial Site Verification must be recorded in the form of a report that-

- Confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;
- Contains a motivation and evidence of either the verified or different use of the land and environmental sensitivity.
- is submitted together with the relevant reports prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

This report has been produced specifically to consider the aquatic biodiversity theme and addresses the content requirements of (a) and (b) above. The report will be appended to the respective specialist study included in the Basic Assessment Reports produced for the project.

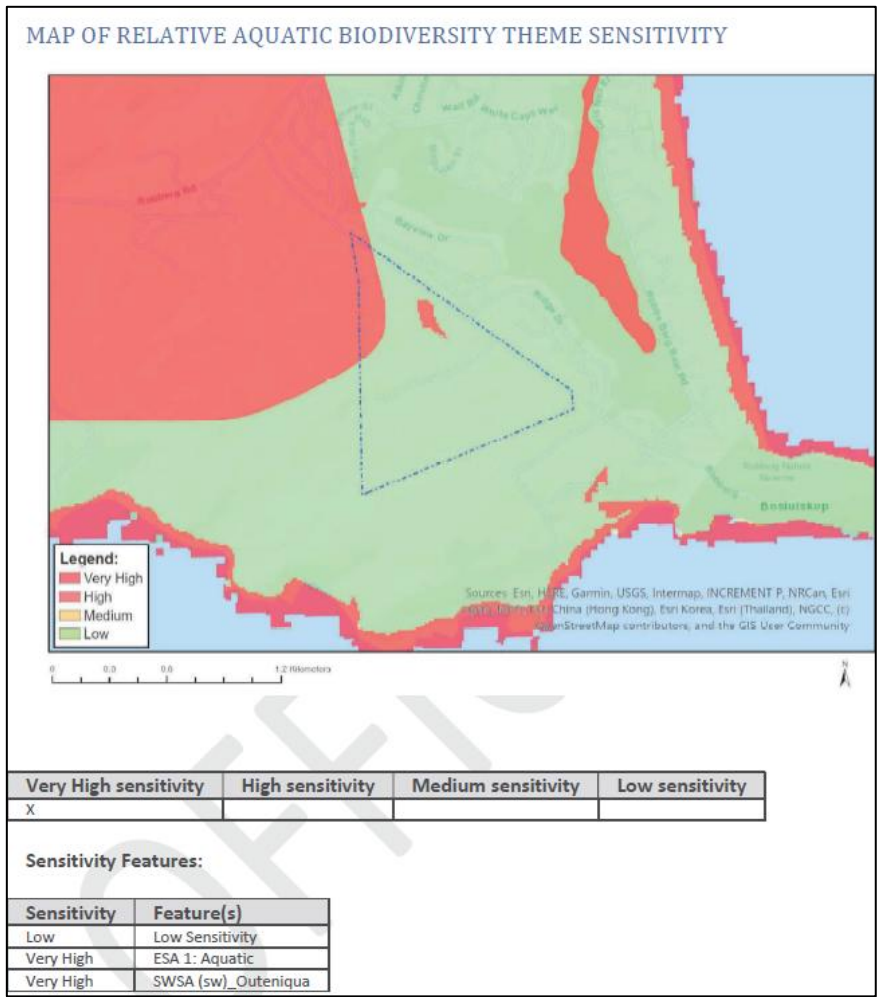


Figure 1: DFFE Screening Tool map of aquatic biodiversity theme sensitivity indicating very high sensitivity on portions of the study area.

The scope of work included the undertaking of a ground truthing exercise to identify and delineate any aquatic habitat or features in the study area. Following which, this report contextualises the findings in relation to the broader study area and national databases and plans, identifies any constraints to development, and provides guidance on legislative implications with regards to development.

2 LOCATION

The study area is located on the coastal platform less than 5km from the center of Plettenberg Bay in Bitou Local Municipality. The site extends over three triangular farm portions in an undeveloped area between Robberg Road and the coastline (Figure 2). It is bordered (and accessed) by Whale Rock Drive (opposite the Whale Rock Ridge housing estate) which leads to the Robberg Nature Reserve on the peninsula.

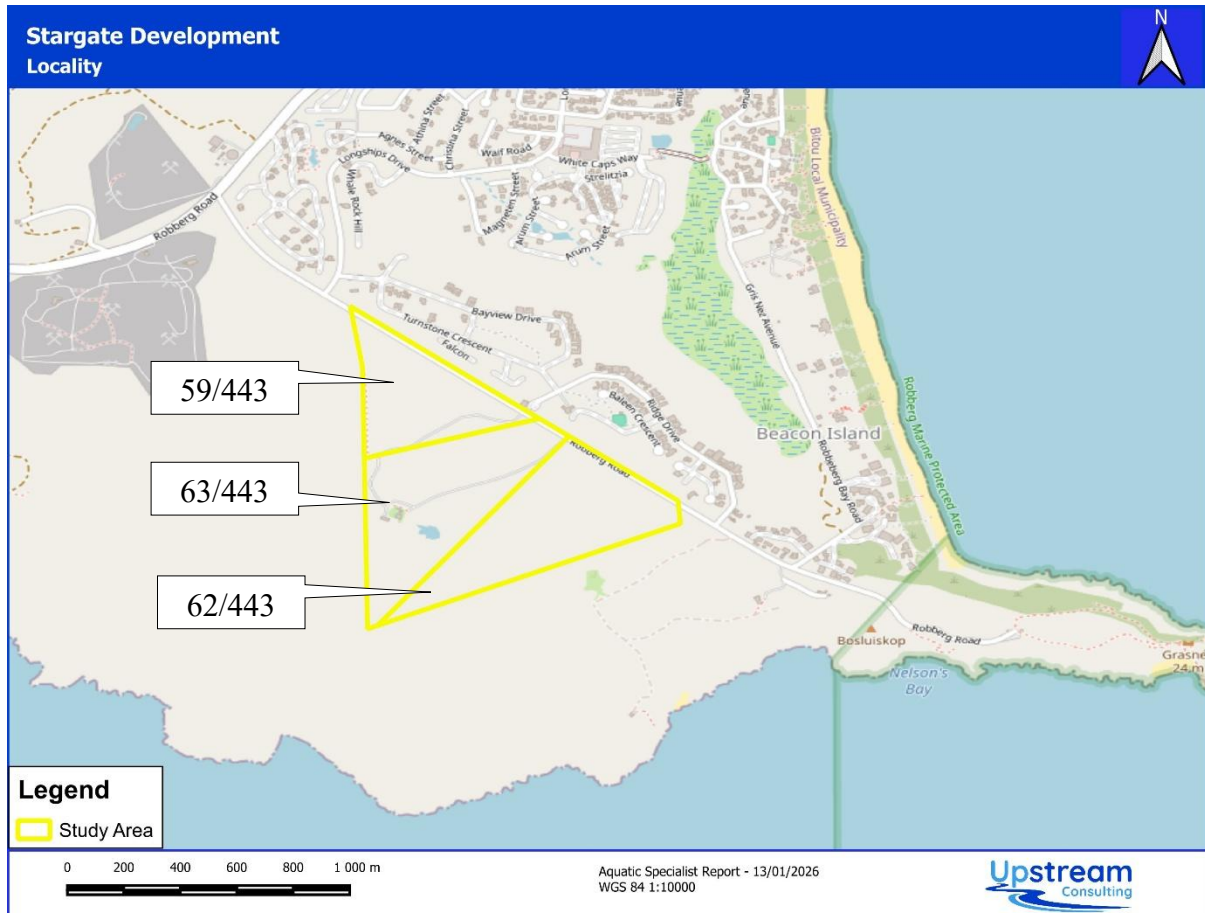


Figure 2: Locality map of the three farm portions in relation to the developed urban area and the Robberg Peninsula

3 PROJECT DESCRIPTION

The following conceptual details have been provided by the client:

“Initial Concept:

- *The intention is to develop areas identified as least sensitive on Portion 59 into a Sectional Title Retirement Complex, consisting of about 200 semi-attached units of approximately 200m² each, as well as associated roads and infrastructure.”*
- *“Portions 63 and 62 will be rezoned from Agriculture 1 to Open Space III (Nature Conservation area) and are in the process of being incorporated into the Robberg Coastal Corridor.*
- *An archaeological museum is planned on Portion 62 with tourist facilities such as an amphitheatre and a limited number of tourist accommodation units.”*

Refer to Figure 3 for a preliminary layout on Portion 59.

Refer to Figure 4 for a conceptual plan of the museum area and sewer reticulation network currently under investigation.

Engineering Services:

- There is no municipal service available for development. Alternative water and sewer supply will need to be explored. Although the area is included in the infrastructure Master plan as a future development area, there are no known timelines for the required municipal infrastructure upgrades.
- The intention is to extract water from an existing borehole on the northern most site subject to the confirmation of water quality and quantity. The water will be stored and redistributed to residential units.
- A Private Bio Sewage Waste Wastewater Treatment Plant is proposed to accommodate the expected sewer demand. Sewerage will be gravity piped to the Sewerage package plant which will be positioned on Ptn 62. The position of the plant has not yet been finalised but it will discharge to the existing “water resource” (minor stream) upstream of its discharge point to the sea. “

The purpose of this baseline sensitivity assessment is, however, to inform planning and therefore the above project description is only provided for context and to show the nature of development proposed.

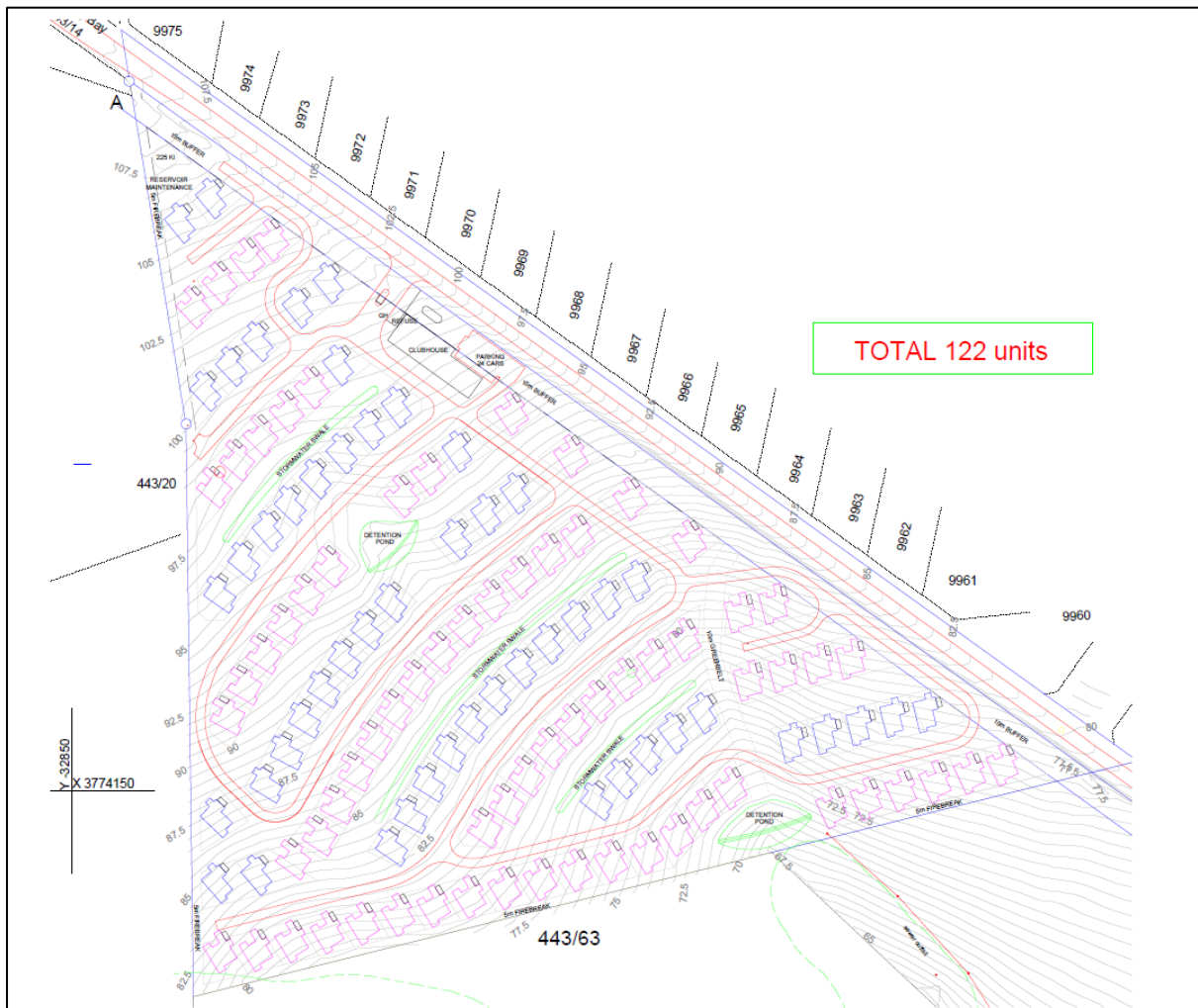


Figure 3: Preliminary layout plan for Portion 59

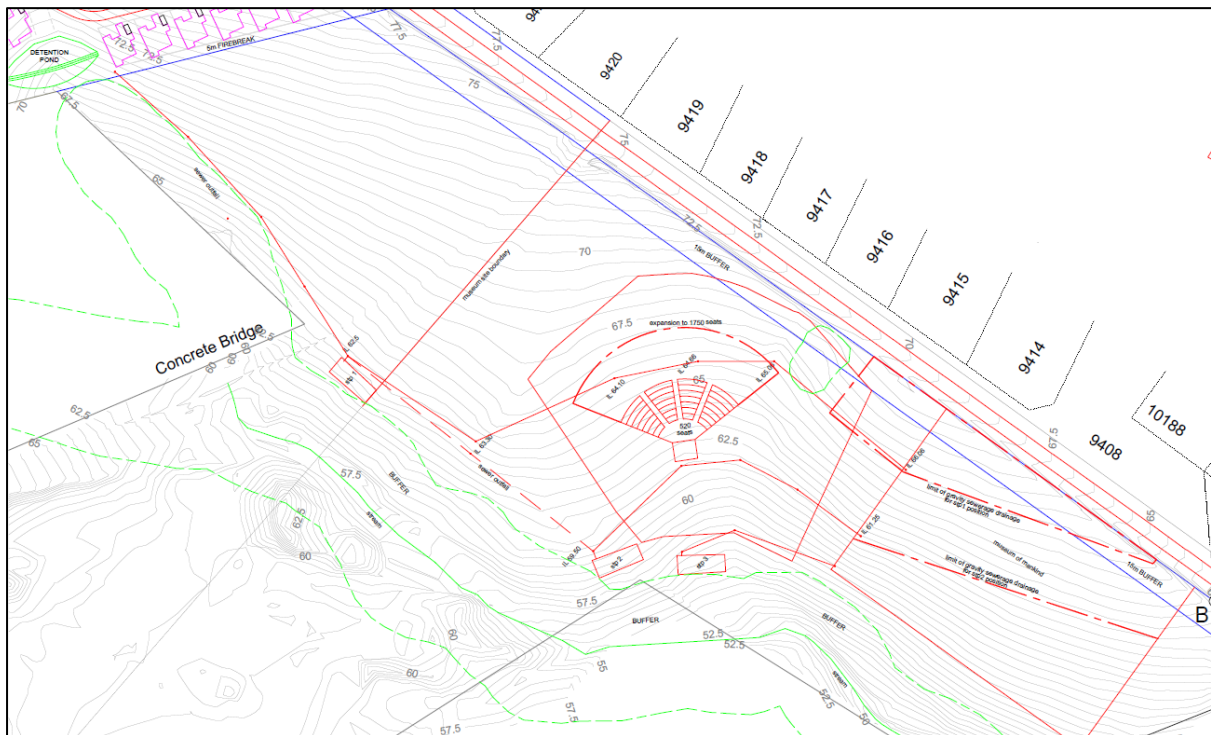


Figure 4: Conceptual design of the museum area and various sewer layouts under investigation

4 METHODS

This study followed the approaches of several national guidelines with regards to wetland/riparian identification and delineation. Refer to Appendix 1 for detail method statement.

- The aquatic habitats within the study area were identified and mapped on a desktop level using available data. Digitization and mapping were undertaken using QGIS 3.40.0 "Bratislava" GIS software.
- 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 processes of the study area.
- Following the desktop findings, a site assessment was conducted to verify the location and extent of these systems. 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 WETECoservices (Kotze *et al.* 2009;2020).
- Infield delineation was undertaken with a hand-held GPS, for mapping of any potentially affected 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).

5 ASSUMPTIONS AND LIMITATIONS

The following is a list of assumptions and limitations associated with this report:

- Further assessment and a full impact report will be undertaken once detailed design information is available.
- There are currently no design or layout alternatives proposed for the services, and all current proposed development is conceptual and will require further assessment.
- Depending on detailed development design characteristics and proposed mitigation measures, calculated buffer distances can vary. Therefore, buffer distances calculated in this report may differ from subsequent reports.
- The scope of work is restricted to contextualisation of the study area in relation to water resource management, watercourse identification, and delineation of aquatic habitat within the survey area and immediate surroundings.
- Aquatic ecosystems vary both temporally and spatially. Once-off surveys such as this can miss certain ecological information due to seasonality, thus limiting accuracy and confidence.
- While disturbance and transformation of habitats can lead to shifts in the type and extent of aquatic ecosystems, it is important to note that the current extent is reported on here.
- All soil/vegetation/terrain sampling points were recorded using a Garmin Montana Global Positioning System (GPS) and captured using Geographical Information Systems (GIS) for further processing.
- Infield soil and vegetation sampling was only undertaken within a specific focal area on the properties, while the remaining watercourses were delineated at a desktop level with limited accuracy.

6 DESCRIPTION OF THE AFFECTED ENVIRONMENT (DESKTOP)

6.1 TOPOGRAPHY AND DRAINAGE

The study area is characterized by a gentle seaward-sloping gradient, descending from approximately 90 m amsl at the western boundary along Robberg Road to roughly 70 m amsl at the eastern perimeter. This topographic profile defines a localised catchment that feeds a central non-perennial drainage line and two minor tributaries. The hydrological regime of these features is strictly episodic, with surface flow occurring only as a result of high-intensity precipitation events. Under typical climatic conditions, these channels remain dry and function as intermittent pathways for storm-driven discharge. Refer to Figure 5 indicating the desktop-mapped location of these features by the national 1: 50 000 river line data (NGI, 2007).

While the site falls within the K60G DWS quaternary catchment, it is hydrologically disconnected from any major inland river systems. Instead, surface drainage terminates after a short distance within the coastal littoral zone. Despite this lack of connectivity to larger fluvial networks, the drainage lines perform a critical role in regional catchment-to-coast regulation and landscape connectivity. They 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.

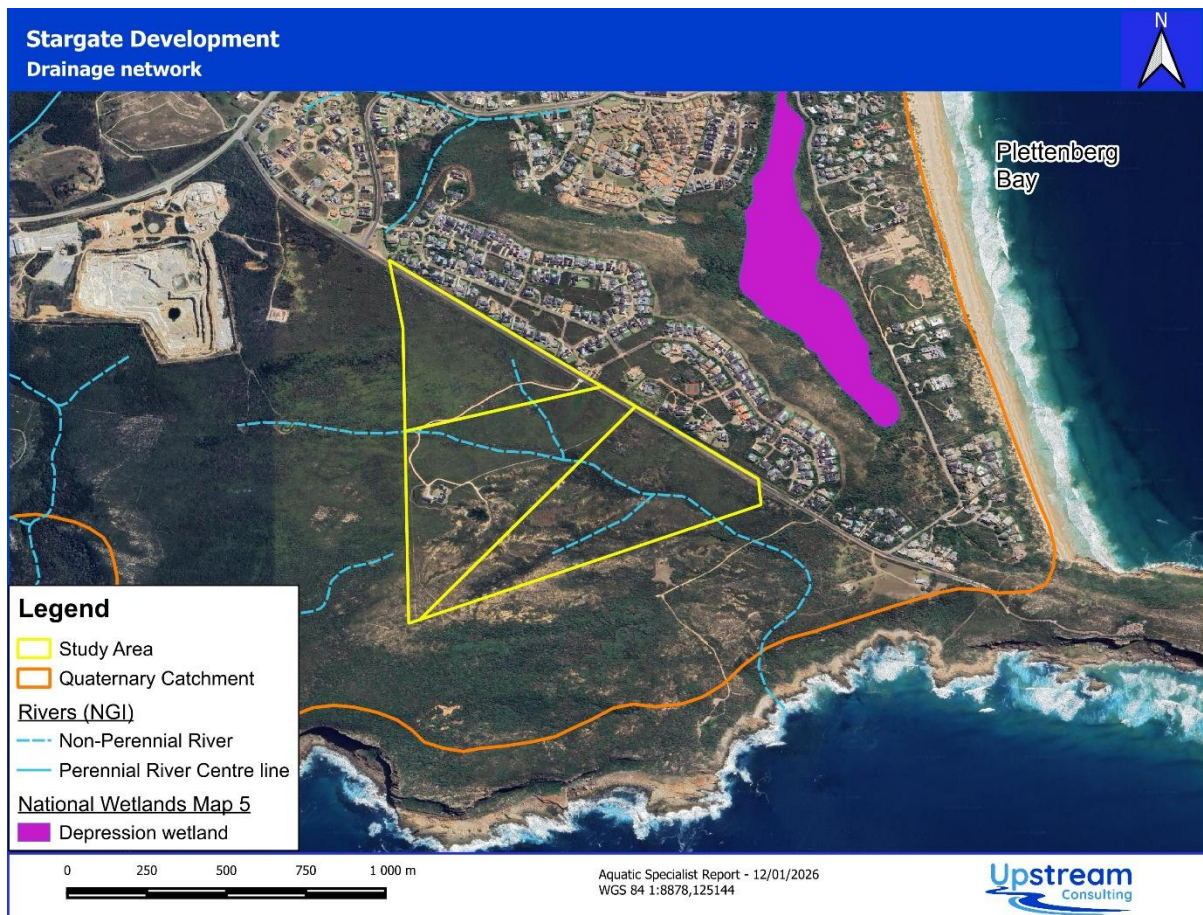


Figure 5: Map of the study area in relation to the national wetland and river desktop data inventories

6.2 GEOLOGY AND SOILS

The site is underlain by Quaternary alluvial and aeolian deposits that overlie Cretaceous sedimentary rocks of the Robberg Formation, with deeper basement units comprising quartzites of the Peninsula Formation. Soils consist of a thin, organic-rich silty sand topsoil horizon underlain by a thicker residual layer of low-permeability sandy silty clay and clayey silt, corresponding to CL, MH and ML material classes (refer to geotechnical investigation report). These residual horizons contain ferricrete nodules formed through repeated wetting and drying cycles, indicating historical soil moisture fluctuation. The low permeability of the clay-rich subsoil restricts infiltration and promotes rapid surface runoff generation during rainfall events, directing flow toward the central drainage line.

6.3 CLIMATE

The regional climate is temperate and maritime, with a Mean Annual Precipitation of approximately 650–850 mm and Mean Annual Evaporation exceeding 1200 mm. This moisture deficit limits sustained soil saturation and groundwater recharge, resulting in short-lived surface flow responses following rainfall. Consequently, the non-perennial drainage line and its tributaries function primarily as intermittent conduits, transporting episodic runoff through the site toward the adjacent coastal environment only when precipitation thresholds are exceeded.

6.4 VEGETATION

Based on the botanical specialist findings in the Scoping Report, the vegetation is characterised as a transitional ecotone between fynbos and thicket (Vlok, 2010). The distribution of these communities is strictly governed by the site's topography and moisture availability. The upper, more exposed slopes are dominated by a diverse fynbos community, specifically Garden Route Shale Fynbos, which includes a high variety of *Erica* and *Proteaceae* species. However, as the topography descends into the sheltered valley and along the drainage lines, the vegetation transitions into a denser thicket component. In these lower-lying drainage areas, the increased protection from wind and the higher soil moisture levels facilitate the growth of taller, woodier species typical of coastal thicket. The botanical specialist report notes that while fynbos is the matrix vegetation, the valley bottoms and drainages act as refugia for these thicket elements, creating a structural mosaic.

6.5 STRATEGIC WATER SOURCE AREAS

The northwestern 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 6. 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 modeled hydrological contribution rather than the presence of discrete on-site aquatic features.

Site-specific ground-truthing confirmed that no surface watercourses are located within this specific northwestern corner. The hydrological importance of this area is therefore likely related to subsurface processes and groundwater recharge rather than the maintenance of active surface water systems. While SWSAs are critical for regional water security, the potential impacts of development on groundwater infiltration and aquifer recharge fall under the ambit of a specialist geohydrological assessment, which is being conducted as a separate component of this application.

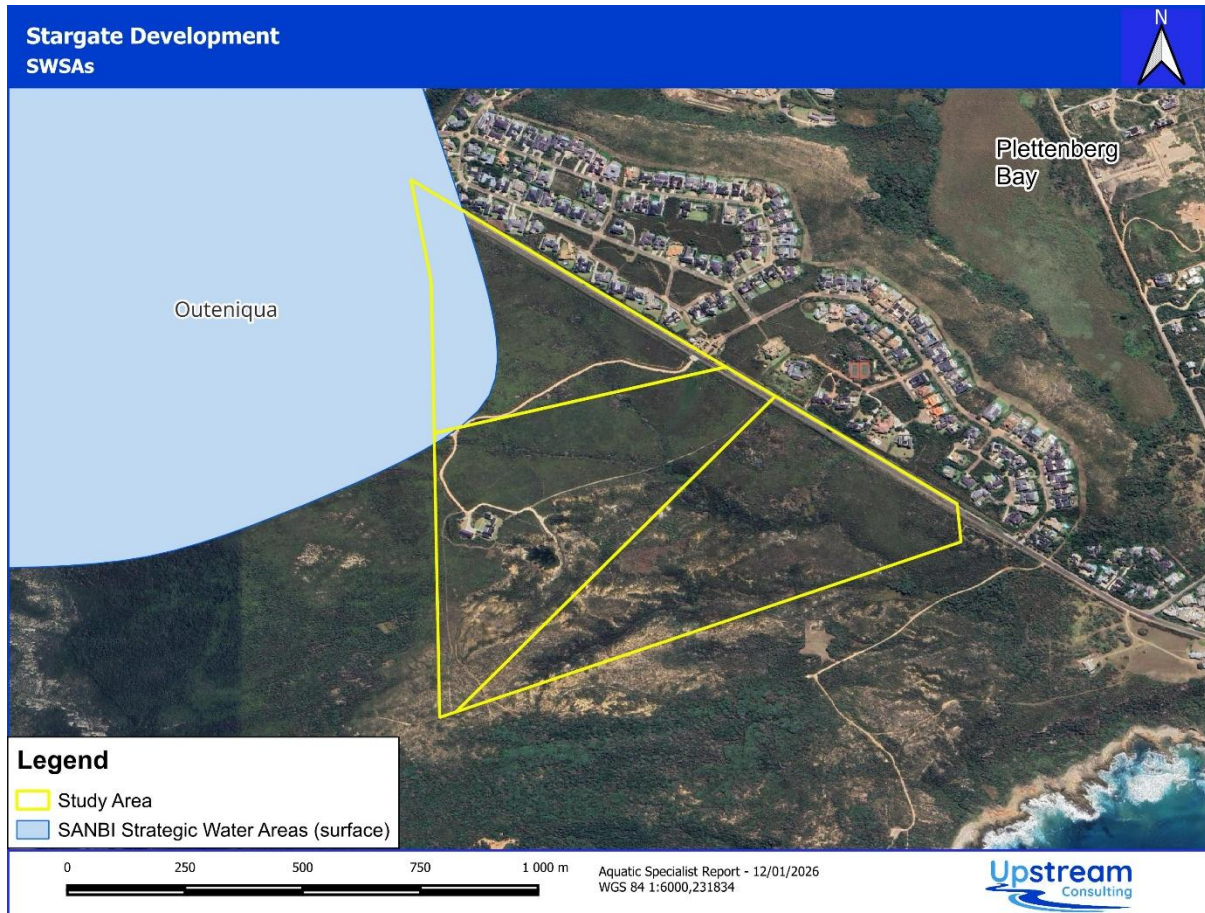


Figure 6: Map of the study area in relation to the South African Strategic Water Source Areas map

6.6 CRITICAL BIODIVERSITY AREAS

According to the 2023 Western Cape Biodiversity Spatial Plan (WCBSP) (CapeNature, 2023), the study area is predominantly 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 7.

A section of the northern portion of the site is mapped as an Aquatic Ecological Support Area (ESA 1), intended to function as a corridor supporting aquatic processes. However, site-specific ground-truthing and topographical analysis indicate that this mapped corridor does not correspond with the actual drainage lines observed on site, nor does it align with the local catchment's natural low points, flow paths, or the Strategic Water Source Area footprint.

This misalignment suggests that the ESA 1 designation in this locality is a product of broad-scale desktop modelling and the WCBSP encourages field work by the relevant specialists to refine the mapping. As a result, the functional relevance of the mapped ESA corridor to on-site aquatic biodiversity is considered low. The aquatic ecological value of the site is more accurately defined by the presence of episodic drainage features that convey surface runoff during rainfall events, rather than by the provincially mapped ESA designation. Additionally, the southern portions are planned to be included in the Robberg Coastal Corridor Protected

Environment. Given the property's proximity to the Robberg World Heritage Site the client has stated that the proponent has already engaged with CapeNature Landscape East Stewardship officials about joining the RCCPE.

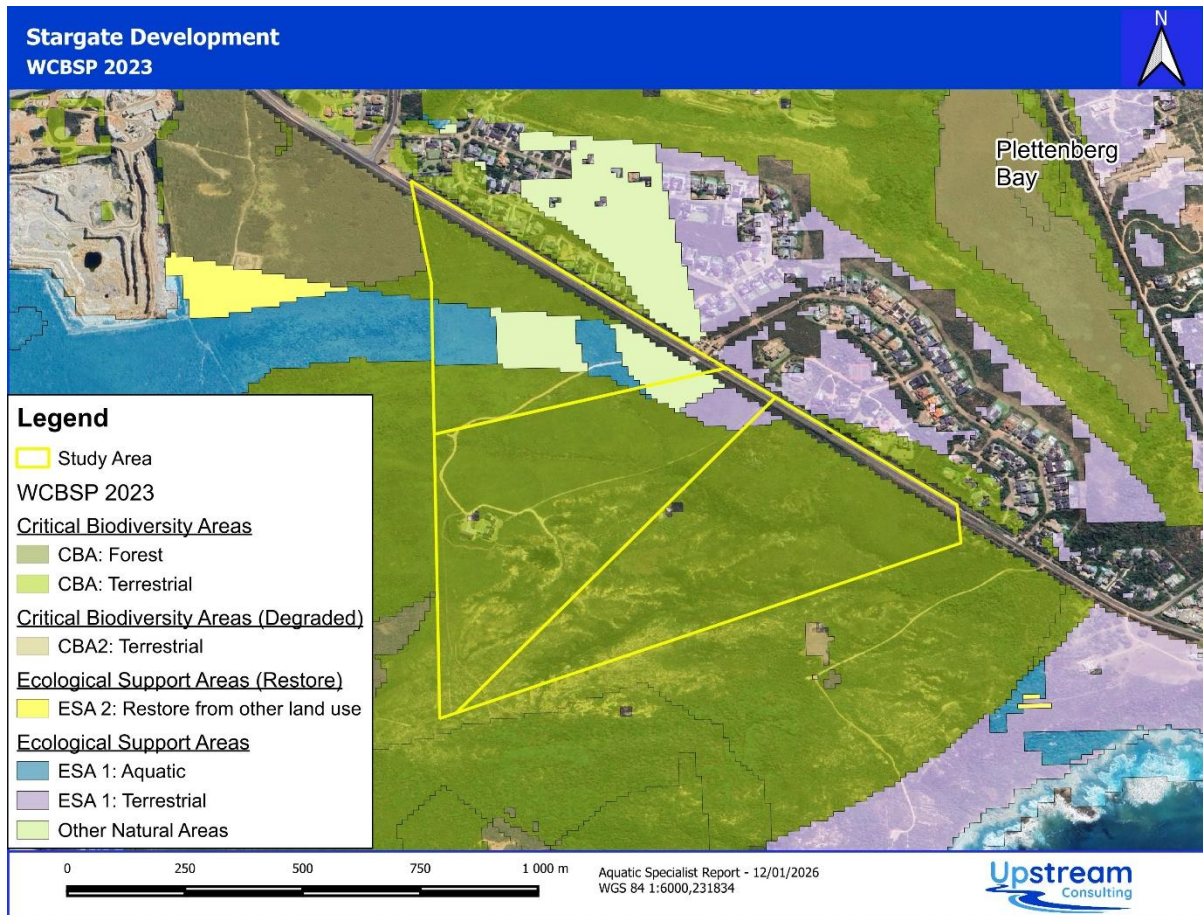


Figure 7: Map of the study area in relation to the conservation priority area mapped by the Western Cape Biodiversity Spatial Plan (CapeNature 2023)

6.7 HISTORIC LAND USE

The current ecological and hydrological condition of the study area reflects a history of agricultural use, mineral extraction and fluctuating levels of invasive alien plant infestation. Review of historical aerial imagery (Figures 8 & 9), together with site observations, indicates a landscape characterised by variable disturbance intensity, with some portions of the site having been extensively transformed while others remain comparatively intact.

6.7.1 Agricultural and Mining Impacts

The northern (upper) portion of the site shows clear evidence of historical cultivation, with visible plough lines and altered soil structure indicating past crop production. These activities would have significantly disturbed the original soil horizons and indigenous fynbos seedbank. In contrast, the central and lower portions of the site were historically subjected to sand and gravel extraction. These mining activities represent the most substantial anthropogenic

modification to the site's hydrology. Excavation along one of the non-perennial tributaries resulted in the formation of a localised basin that now functions as a seasonal, artificial wetland feature. This has altered natural flow attenuation, sediment deposition and the geomorphic behaviour of that drainage line.

6.7.2 Hydrological Modification and Stormwater Regimes

Local infrastructure and surrounding development have further modified surface flow patterns across the site. The gravel access road that traverses the property intercepts upslope runoff via a longitudinal drainage ditch, which concentrates previously diffuse overland flow and directs it through small culverts into the drainage lines. This has created confined discharge points and altered the spatial distribution of stormwater entering the channels.

At a broader scale, the surrounding landscape has transitioned from a largely rural coastal plain to an increasingly developed node. Residential estates and an active commercial quarry have increased the extent of impervious surfaces in the upstream catchment. This is likely to have resulted in higher peak flows and higher velocity stormwater pulses entering the site during rainfall events compared to historical conditions.

6.7.3 Alien Invasive Plants

Past soil disturbance associated with cultivation and mining facilitated extensive invasion by alien woody species, which displaced the indigenous fynbos–thicket mosaic. Unlike many neighbouring properties, recent management interventions have successfully cleared large stands of invasive alien trees from the site.

Despite these historical pressures, parts of the site have experienced minimal direct disturbance. These areas retain elements of the original geomorphic form and indigenous vegetation, providing important reference conditions for understanding the site's natural ecological template.



Figure 8: Historic aerial imagery from 1974 (purple polygon depicts ploughed lands and red polygon depicts approx. mined area but there is also other disturbances visible)



Figure 9: Historic aerial imagery from 1990 (purple polygon depicts ploughed lands and red polygon depicts approx. mined area but there are also other types of disturbance visible)

7 RESULTS

7.1 IDENTIFICATION AND DELINEATION

A site visit was undertaken on the 6th of January 2026 to identify, groundtruth, and delineate aquatic features within the study area. Following which, an accurate baseline map of aquatic features was developed.

The site assessment confirmed the presence of the three non-perennial watercourses depicted by the 1:50 000 national river line data. Additionally, artificial wetland habitat was identified in the old quarry pit, a stormwater outlet pond alongside Whale Rock Drive, and within the dam. Refer to Figure 10 below.

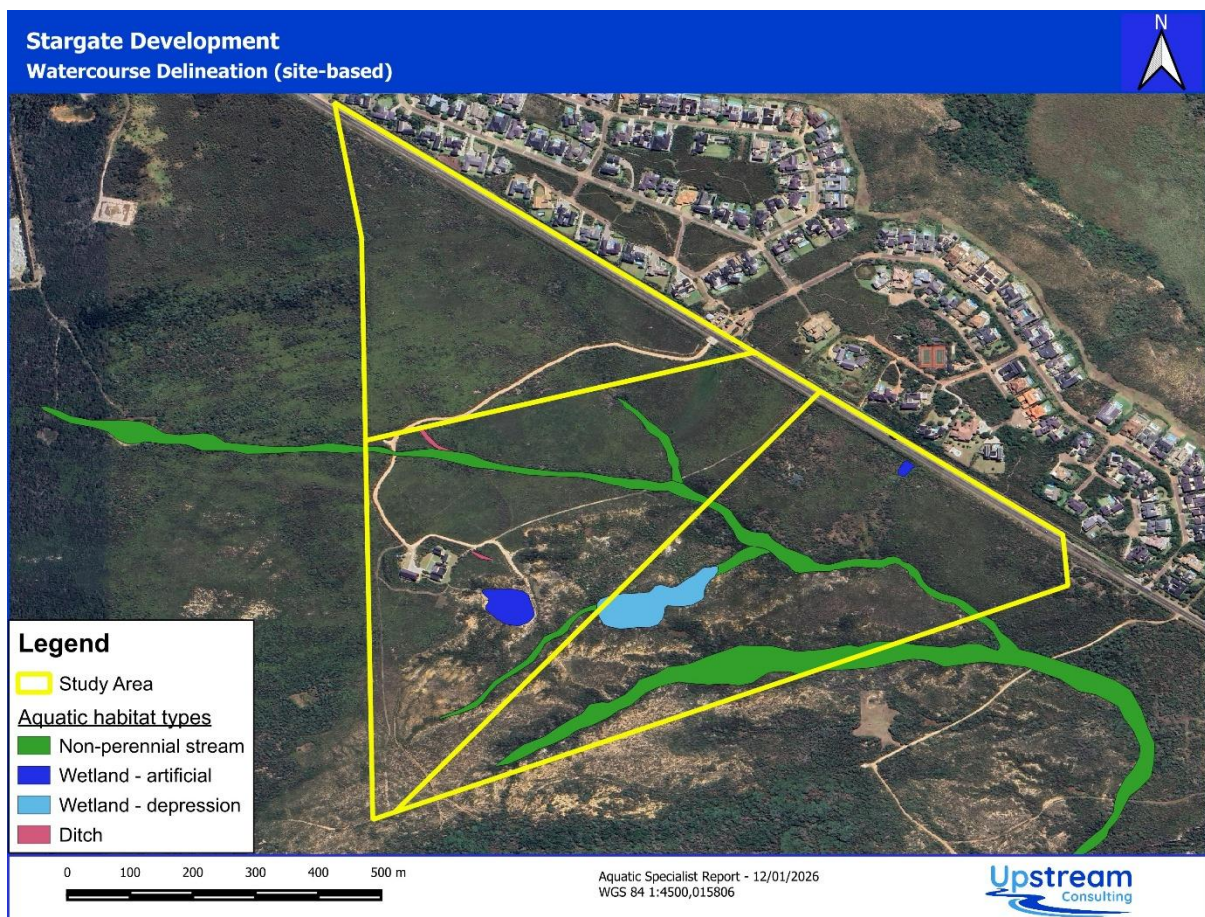


Figure 10: Mapped aquatic habitat within the study area

The watercourses were then separated and classified into six (6) hydrogeomorphic units and referred to as follows:

- HGM1 (Non-perennial stream)
- HGM2 (1st order tributary stream)
- HGM3 (Artificial wetland – road stormwater outlet)
- HGM4 (1st order tributary stream – with wetland depression)
- HGM5 (Artificial wetland - dam)
- HGM6 (1st order tributary stream)

Refer to Figure 11.

Further screening determined that only the HGM1 (non-perennial stream), HGM2 (minor tributary channel), and HGM3 (artificial wetland) watercourses are at risk of being impacted by the project. The other watercourses were therefore not assessed in further detail.

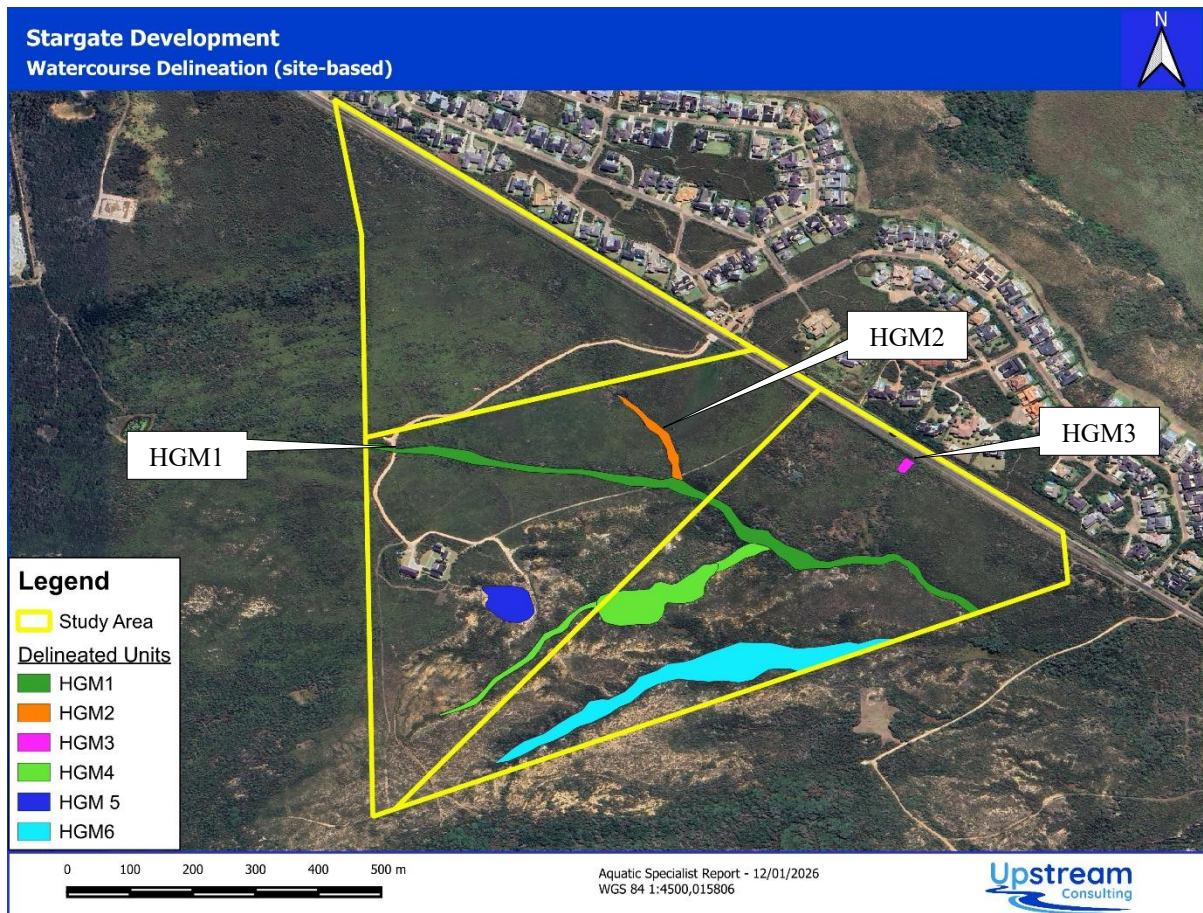


Figure 11: Map of delineated HGM units

7.2 DESCRIPTION OF AQUATIC HABITAT

The aquatic habitats of the study area are characterized by their non-perennial, episodic nature and are heavily influenced by the site's historical land use. No perennial rivers or large permanent water bodies exist on the property.

7.2.1 HGM1: Non-perennial Stream

The HGM1 watercourse is the main drainage line within the study area. It originates upslope, near the operational quarry off Robberg Road, and flows through the properties to the sea. It is classified as an episodic stream. Its primary functional role is the attenuation and conveyance of stormwater runoff from the upper catchments (including areas transformed by historical agriculture and upslope development) toward the coastal littoral zone. The riparian zone of HGM 1 is narrow and does not support obligate wetland vegetation due to the absence of

prolonged saturation. Instead, it is characterised by a structural ecotone where fynbos species mix with taller thicket elements that thrive in the slightly higher moisture levels of the valley bottom. Previously densely invaded by alien invasive trees, the recent clearing operations have been successful.

The dry channel is approximately 2 meters in width with vertical 1m high banks. Its substrate consists primarily of fine alluvial silty sands over a low-permeability clayey-silt residual horizon, which facilitates the rapid seaward transport of surface runoff.

Despite the lack of permanent water, HGM 1 is still a significant aquatic feature on site from a functional perspective as it provides a longitudinal ecological corridor to and from the coast.



Plate 1: Photograph of the dry stream channel of HGM1 on portion 62

7.2.2 HGM2: Non-perennial Tributary

HGM 2 is a minor, first-order non-perennial tributary located on the left bank of the primary drainage line (HGM 1). It originates approximately 100 meters downslope (south) of the existing access road and its associated pipe culvert. This unit is characterized by a short, narrow, and relatively shallow channel set within a small, V-shaped first-order valley. Unlike HGM 1, HGM 2 has a more confined catchment and a very short flow path before it terminates at the confluence with the main system. While there are pipe culverts beneath the gravel road, the drainage lines do not extend north of the road. The culverts are there to direct stormwater runoff from upslope that collects in a drain under specific points below the road. Beyond the road, the drainage lines become more defined and form channels and riparian habitat.

The hydrological regime is strictly ephemeral and episodic. The channel remains dry throughout the year, only facilitating water movement during significant precipitation events that exceed the infiltration capacity of the surrounding slopes. The system lacks any wetland characteristics, such as hydromorphic soils or stagnant water indicators, and functions purely as a terrestrial-aquatic conduit.

HGM 2 has relatively intact riparian vegetation cover compared to the more disturbed upper slopes. Because the topography of the first-order valley provides a degree of shelter from wind and slightly higher localized moisture retention in the soil, the vegetation is characterized by a denser thicket-fynbos ecotone. Similar to the rest of the site, this corridor was historically affected by invasive alien plants but has benefited from recent clearing efforts.

The conservation importance of HGM 2 is primarily derived from its role as a supplementary ecological corridor. It is not of high EIS and is a minor feature with infrequent hydrological activity, but it contributes to the overall landscape connectivity of the site. It serves as a natural input to HGM 1, ensuring the continuity of the drainage network.



Plate 2: Photograph taken upslope of the road, showing no channel or riparian vegetation, looking towards HGM2 which forms beyond Portion 59



Plate 3: Photograph of the road culvert which is not in fact within riparian habitat but directs surface runoff, collected by the roadside ditch upslope, towards the downslope watercourse



Plate 4: Photograph of the HGM2 drainage line on portion 63 (indicated by the taller thicket plant species) which flows to the HGMI

7.2.3 HGM3: Artificial temporary wetland

HGM 3 is a small, highly localised, artificial depressional feature situated on the eastern perimeter of the site, immediately adjacent to Whale Rock Drive. This unit is entirely anthropogenic in origin, consisting of a shallow impoundment likely created during the construction of the road infrastructure. The feature is defined by low-relief earth berms (two situated perpendicular to the road and one running parallel to it) which act to impede surface runoff from the road drain (probably installed to prevent downslope erosion). These modifications have created a small, shallow basin that intermittently slows surface flow, though it lacks the geomorphology of a natural wetland system.

The hydrological regime is characterised by temporary soil wetness rather than sustained surface ponding. The contributing catchment (water input) is minor, and the feature receives very little actual stormwater runoff. Its "wetland" status is marginal, as the saturation is transient and occurs only after significant rainfall events. There is no evidence of a perched water table or groundwater emergence; instead, the feature simply delays the infiltration and evaporation of a negligible volume of surface water.

From a biodiversity perspective, HGM 3 is of negligible value. The short hydroperiod and the artificial nature mean it does not support aquatic dependent species. The vegetation is primarily opportunistic and does not consist of true obligate hydrophytes, and they are characteristic more of a disturbed area species. Additionally, while this feature technically displays signs of temporary saturation, its conservation importance is Very Low. It is a man-made feature of road construction that performs no significant ecological service. But it is recommended to retain it because it serves as a minor, localized point of surface water impedance to reduce the risk of erosion from the drain.



Plate 5: Phragmites australis below road stormwater outlet indicating HGM3 artificial wetland

7.3 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). For any development a buffer area between activities and watercourses can assist with managing a variety of potential impacts.

Currently there are no formalised riverine buffer distances provided by the provincial authorities and as such the buffer model as described Macfarlane and Bredin (2017) for wetlands, rivers and estuaries was used. Using the buffer tool, it was determined that a 29m buffer zone should be adopted around the main stream (HGM1) and a 26m buffer around the small tributary (HGM2).

The table below shows the final results from the Buffer Tool. It is important to note that these buffer widths are based on the ‘after mitigation’ scenario which includes the implementation of measures to control stormwater flow and velocity.

	Buffer Segment 1	Buffer Segment 2	Buffer S
Final aquatic impact buffer requirements (including practical management considerations)			
Construction Phase	16	15	Not A
Operational Phase	29	26	Not A
Final aquatic impact buffer requirement	29	26	Not A

Figure 12 below is a map of the buffer zones in relation to the delineated riparian habitat. The artificial wetland at the stormwater outlet has been afforded a 5m buffer to prevent direct disturbance.

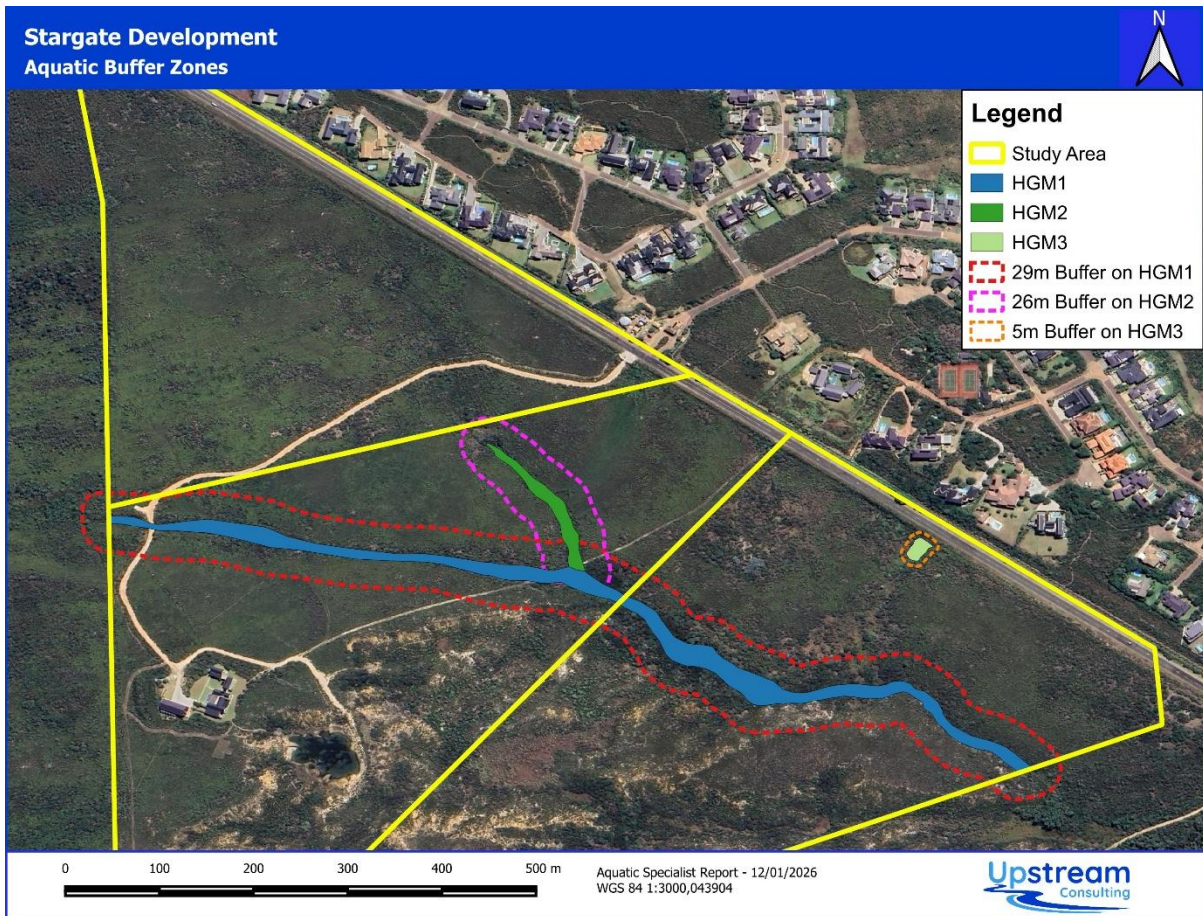


Figure 12: Recommended aquatic buffer areas

8 POTENTIAL IMPACTS

The impacts of any proposed development will directly correlate with the design and layout of the development and proposed operational phases of the development. A detailed impact investigation will need to be conducted after the design phase.

The potential direct and indirect impacts associated with the project were identified and can be grouped into four encapsulating impact categories where associated or interlinked impacts are grouped.

Therefore, the potential impacts include:

- Impact 1: Loss or disturbance of aquatic habitat and biota
- Impact 2: Alterations to the hydrological regime
- Impact 3: Sedimentation and erosion
- Impact 4: Changes to surface water quality
- Impact 5: Cumulative impacts on the aquatic resources of the area

9 POTENTIAL MITIGATION

A mitigation measure is an action or strategy designed to reduce, prevent, or offset negative environmental impacts caused by a proposed development. These measures are commonly used in environmental management, conservation, and impact assessments to ensure that developments or land-use activities do not cause significant harm to aquatic ecosystems. The aim of mitigation measures is primarily to reduce the negative impact rating score and where possible increase any positive impact rating scores according. The implementation of mitigation hierarchy is key to reducing the level of negative impacts. In this case the primary mitigation measure should be avoidance. Avoid any physical disturbance, erosion, or pollution of the riparian ecosystems. It is important to note that these mitigation measures are subject to change based on layout or design alternatives considered.

9.1 DESIGN PHASE

The primary objective of the design phase is to ensure that the development and any Wastewater Treatment Plant (WTP) layout, infrastructure, and treatment processes are planned in a way that avoids or minimises direct and indirect impacts on riparian systems through sound engineering and environmental planning. These mitigation measures include:

- The adoption and management of the recommended aquatic buffer zones between the development infrastructure and riparian systems.
- A stormwater management plan (including SUDS principles) must be developed by an engineer in the design phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater management infrastructure must be designed to ensure the runoff from the development is not contaminated before entering the surrounding area. The volume and velocity of water must be reduced sufficiently to prevent erosion of channels. Effective stormwater management must also include effective stabilisation of any exposed soil.
- The various units can be fitted with rainwater tanks to encourage rainwater harvesting and minimise the volume of runoff from the properties.
- Soft infrastructure must be considered where practical. For example, permeable surfaces can be done via permeable concrete block pavers (such as Amorflex), brick pavers, stone chip, and gravel and may contribute to slowing surface flows (especially if maintained). Baffles in the stormwater conduits are effective. Stormwater managed by the development could be discharged into porous channels / swales ('infiltration channels or basins') running near parallel or parallel to contours within and along the

edge of the development. This will provide for some filtration and removal of urban pollutants (e.g. oils and hydrocarbons), provide some attenuation by increasing the time runoff takes to reach low points, and reduce the energy of storm water flows within the stormwater system through increased roughness when compared with pipes and concrete V-drains.

- Design discharge structures to avoid direct concentrated outflow into existing erosion gullies or unstable sections of any aquatic ecosystem.
- Design robust WWTP that will remain operation for the longest periods of time while ensuring the best treatment of sewage.
- If there are any sewerage pump stations required, reasonable measures must be taken to provide back-up for mechanical, electrical, operational or process failure and malfunction at pump stations. At a minimum there should be an alarm system to warn of an electrical failure and sufficient standby equipment to provide for reasonable assurance that the infrastructure can be fully functional within at least 24 hours. Emergency power shall be provided that will prevent overflows from occurring during any power outage. Installing permanent generators at each station is strongly advised.
- Sewerage pump stations (if required) will need to be placed within a suitably lined, impermeable concrete bunded area with the capacity to hold untreated waste water in an emergency and provide for sufficient time for maintenance staff to address any faults/ problems. This is to limit the risk of untreated sewage overflowing in the event of any leakage or accidental spillage at the pump station.

9.2 CONSTRUCTION PHASE

Within the Construction Phase the aim of all role players is to implement site activities in a controlled and compliant manner that avoids disturbance to riparian zones, prevents erosion and pollution, and ensures short-term impacts are minimised through best practices and oversight. These mitigation measures include

- A construction method statement must be compiled and available on site. It must consider the buffer zones and include methods to avoid unnecessary disturbance and prevent material being washed into any of the wetlands.
- The edges of the development area relative to the aquatic habitat must be clearly staked-out and demarcated prior to construction commencing.
- Appointing an independent Environmental Control Officer (ECO) to monitor construction activities and ensure environmental compliance.
- Limit vegetation clearing to only those areas required for infrastructure installation; retain natural buffers where designed.
- Continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas. Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use.
- Install erosion and sediment control measures (e.g., silt fences, sediment traps, berms, straw bales) on the downslope edges of disturbed areas within the development footprint.

- Stabilise exposed soils promptly using geotextiles, mulch, or indigenous grass seeding.
- Locate construction camps, laydown areas, and materials stockpiles outside of the riparian zone and buffer area.
- Implement temporary stormwater controls such as cut-off trenches, sediment basins or swales to prevent dirty water from entering watercourses.
- Keep spill kits on site, and ensure all workers are trained in emergency spill response.
- Conduct environmental inductions for all site workers, with emphasis on riparian system sensitivity and legal compliance.

9.3 OPERATIONAL PHASE

The operational phase is the most crucial in ensuring that the long term impacts of a development are minimised. Within the operational phase it is critical to maintain ongoing performance of any WWTP in a way that safeguards water quality, flow regimes, and riparian habitat integrity over the long term, while ensuring adaptive management and legal compliance of the overall development. These mitigation measures are recommended to be implemented

- Ensure that any treated effluent consistently meets the conditions of the relevant DWS water use authorisation.
- Regularly monitor water quality both upstream (if possible) and downstream of any discharge points, using parameters aligned with aquatic ecosystem health.
- Implement an adaptive management approach to modify operations based on monitoring results (e.g., improve treatment stages or adjust discharge volumes/timing).
- If required, maintain separation of clean and dirty water systems, especially during rainfall events, to prevent overloading of the treatment plant or discharge of untreated stormwater.
- Stormwater exit points must include a best management practice approach to trap any additional suspended solids and pollutants originating from the proposed development. Also include the placement of stormwater grates (or similar). The use of grease traps/oil separators to prevent pollutants from entering the environment from stormwater is recommended. To ensure the efficiency of these, they must be regularly maintained.
- Inlet protection measures to capture solid waste and debris entrained in storm water entering the storm water management system (inlet protection devices) will need to be incorporated into the design of the system and could include the use of either curb inlet/inlet drain grates and/or debris baskets/bags. These must be maintained during operational phases.
- It is also important to note that storm water infrastructure will likely require regular on-going maintenance in the form of silt, debris/litter clearing in order to ensure their optimal functioning.
- Rehabilitate and maintain vegetation to serve as a buffer between development or WWTP infrastructure and the natural drainage system.
- If a risk, use fencing and/or bollards to prevent unauthorised access (by vehicles, livestock, or people) to sensitive areas, except for management purposes.
- Continue alien invasive plant control throughout the site, particularly around discharge zones and disturbed banks.

- Develop an emergency response plan for spills, bypass events, or treatment failures, including clear responsibilities and communication chains. The Department of Water Affairs regional office should be notified, as soon as possible, of any significant chemical spill or leakage to the environment where there is the potential to contaminate surface water or groundwater.
- Ensure ongoing maintenance and servicing of any mechanical components and infrastructure to avoid untreated releases or failures.

10 PRELIMINARY LAYOUT RECOMMENDATIONS

Following site-specific delineation of the aquatic features and associated buffer zones, the spatial data were provided to the project engineer to inform the preliminary development layout. This has ensured that the current conceptual plans for Portions 59 and 62 are generally aligned with the identified aquatic constraints.

The preliminary layout for Portion 59 proposes approximately 122 residential units. No riparian habitat was identified on this portion of the site, and only a negligible section of the calculated aquatic buffer extends into the property boundary. All proposed infrastructure is currently located outside of the delineated buffer areas. The conceptual Stormwater Management Plan, which includes vegetated swales aligned with site contours and two detention ponds, is supported from an aquatic perspective, as it promotes flow attenuation and sediment control. The potential for sediment starvation, where low-sediment runoff promotes bed and bank scouring, must still be investigated.

The proposed borehole in the northern corner of Portion 59 is unlikely to directly affect surface water features. However, it is recommended that a geohydrological specialist confirm that groundwater abstraction will not result in drawdown effects that could indirectly influence baseflow contributions to the downslope drainage systems.

On Portion 62, the proposed museum and amphitheatre have also been positioned outside of the aquatic buffers. Despite this, a detailed Aquatic Biodiversity Impact Assessment will be required to assess potential construction-phase sedimentation and operational-phase erosion risks. The most significant aquatic-related risks on this portion of the site are associated with the proposed sewer pipeline and the discharge of treated effluent from the Wastewater Treatment Plant into HGM1.

Key issues that must be addressed in the full impact assessment include the potential alteration of the hydroperiod due to a shift from episodic to more continuous flow conditions, possible degradation of water quality through nutrient enrichment or contamination, and increased erosion risk associated with point-source discharge into highly erodible soils.

While the preliminary engineering layout reflects a proactive attempt to avoid sensitive aquatic areas, the confirmed presence of natural watercourses on site, together with the proposed sewer infrastructure and wastewater discharge, means that a full Aquatic Biodiversity Impact

Assessment is required rather than a Compliance Statement. This Site Sensitivity Verification is sufficient to inform the current planning stage, but the final design must be reviewed once detailed civil drawings are available.

The project will also require a Water Use Licence Application (WULA) in terms of the National Water Act (Act 36 of 1998). This is likely to include Section 21(a) for abstraction, Sections 21(c) and (i) for activities within the regulated area of a watercourse, and Section 21(f) for the discharge of wastewater. These requirements will be confirmed with the Breede-Olifants Catchment Management Agency (BOCMA) once the design has been finalised.

11 CONCLUSION

The aquatic assessment identified a network of non-perennial drainage features and artificial wetland areas that function primarily as episodic stormwater conveyance systems linked to the coastal environment. No perennial rivers or natural wetland systems were recorded. The main non-perennial river (HGM1) represents the most sensitive aquatic feature on site due to its longitudinal connectivity and its role in receiving and transporting runoff from the surrounding catchment.

Desktop sensitivity mapping indicates high aquatic sensitivity within the study area; however, site-specific verification confirmed that the mapped Aquatic Ecological Support Area does not align with the physical hydrological features present on the property. The ecological relevance of the site's aquatic systems is therefore more accurately defined by their geomorphic and hydrological function as intermittent drainage pathways rather than by provincial-scale spatial designations.

This report provides a baseline characterisation of aquatic features, sensitivity patterns, and buffer requirements to inform preliminary development planning. However, given the presence of watercourses on site and the proposed discharge of treated wastewater into HGM1, a full aquatic biodiversity impact assessment will be required as part of the EIA process to evaluate potential impacts on hydrology, geomorphology, water quality and associated ecological processes prior to any development approval.

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APPENDIX 1: DEFINITIONS AND METHODS

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

12.1 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.

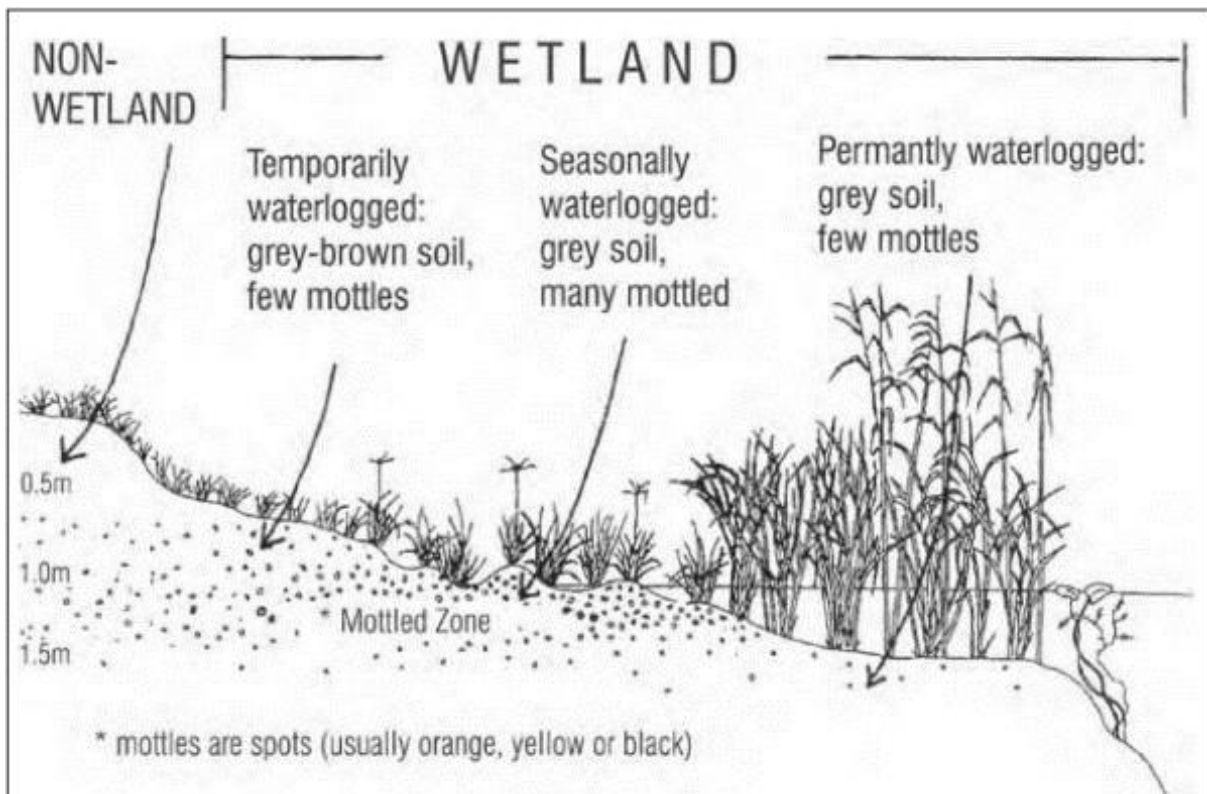


Figure: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change as one moves along a gradient of decreasing wetness, from the middle to the edge of the wetland. Source: Donovan Kotze, University of KwaZulu-Natal.

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: 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: 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	

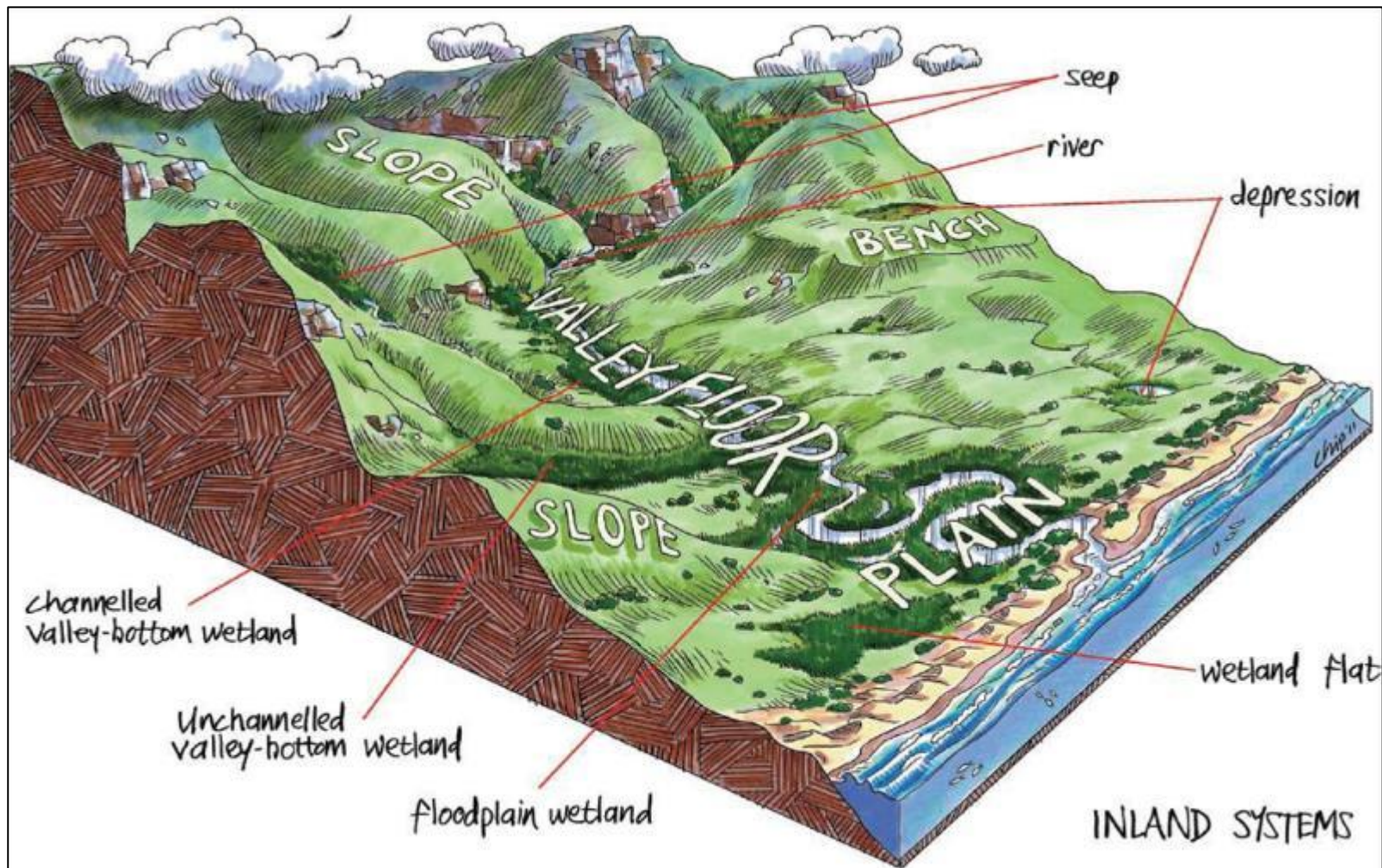


Figure: Illustration of wetland types and their typical landscape setting (From Ollis et al. 2013)

12.2 DELINEATION OF RIPARIAN AREAS

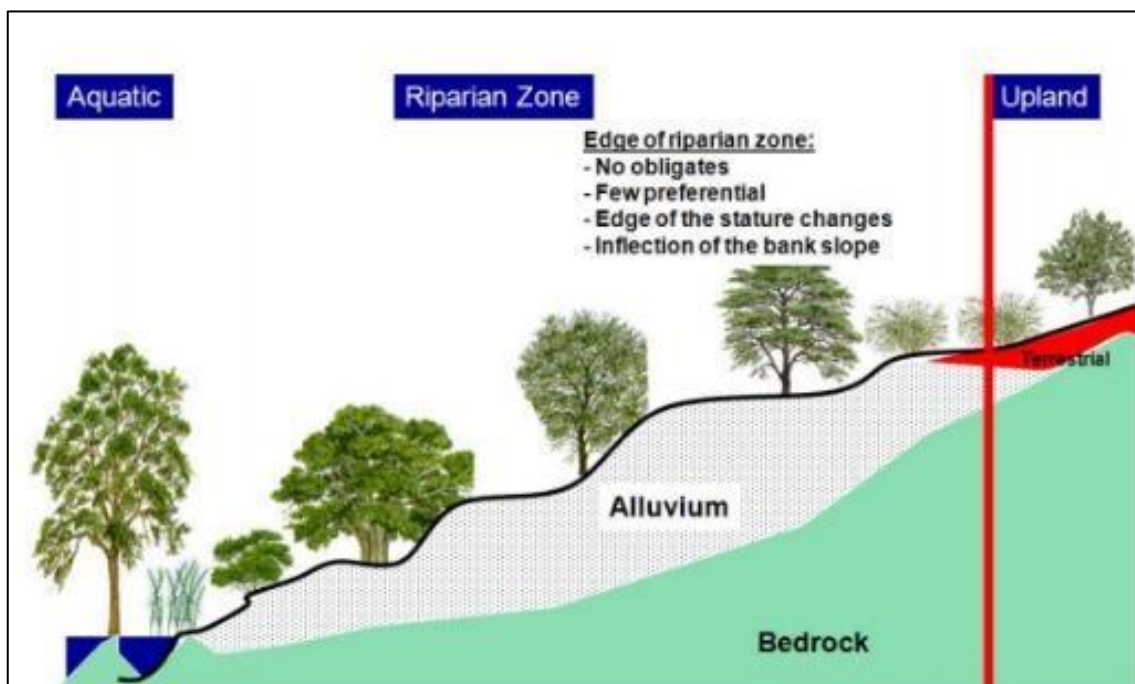
Riparian zones are described as “the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas” i , Riparian zones can be thus be distinguished from adjacent terrestrial areas through their association with the physical structure (banks) of the river or stream, as well as the distinctive structural and compositional vegetation zones between the riparian and upland terrestrial areas. Unlike wetland areas, riparian zones are usually not saturated for a long enough duration for redoxymorphic features to develop. Riparian zones instead develop in response to (and are adapted to) the physical disturbances caused by frequent overbank flooding from the associated river or stream channel.

Like wetlands, riparian areas can be identified using a set of indicators. The indicators for riparian areas are: - **Landscape position**; - Alluvial soils and recently deposited material; - **Topography** associated with riparian areas; and - **Vegetation** associated with riparian areas. Landscape Position As discussed above, a typical landscape can be divided into 5 main units), namely the: - Crest (hilltop); - Scarp (cliff); - Midslope (often a convex slope); - Footslope (often a concave slope); and - Valley bottom. Amongst these landscape units, riparian areas are only likely to develop on the valley bottom landscape units (i.e. adjacent to the river or stream channels; along the banks comprised of the sediment deposited by the channel). Alluvial soils are soils derived from material deposited by flowing water, especially in the valleys of large rivers. Riparian areas often, but not always, have alluvial soils. Whilst the presence of alluvial soils cannot always be used as a primary indicator to accurately delineate riparian areas, it can be used to confirm the topographical and vegetative indicators. Quaternary alluvial soil deposits are often indicated on geological maps, and whilst the extent of these quaternary alluvial deposits usually far exceeds the extent of the contemporary riparian zone; such indicators are useful in identifying areas of the landscape where wider riparian zones may be expected to occur.

Topography and recently deposited material associated with riparian areas The National Water Act definition of riparian zones refers to the structure of the banks and likely presence of alluvium. A good indicator of the presence of riparian zones is the presence of alluvial deposited material adjacent to the active channel (such as benches and terraces), as well as the wider incised “macro-channels” which are typical of many of southern Africa’s eastern seaboard rivers. Recently deposited alluvial material outside of the main active channel banks can indicate a currently active flooding area; and thus the likely presence of wetlands. Vegetation associated with riparian areas unlike the delineation of wetland areas, where redoxymorphic features in the soil are the primary indicator, the identification of riparian areas relies heavily on vegetative indicators. Using vegetation, the outer boundary of a riparian area can be defined as the point where a distinctive change occurs: - in species composition relative to the adjacent terrestrial area; and - in the physical structure, such as vigour or robustness of

growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the health, compactness, crowding, size, structure and/or numbers of individual plants. As with the delineation approach for wetlands, the field delineation method for riparian areas focuses on two main indicators of riparian zones: - **Vegetation Indicators**, and - **Topography** of the banks of the river or stream.

Additional verification can be obtained by examining for any recently alluvial deposited material to indicate the extent of flooding and thus obtain at least a minimum riparian zone width. The following procedure should be used for delineation of riparian zones: A good rough indicator of the outer edge of the riparian areas is the edge of the macro channel bank. This is defined as the outer bank of a compound channel, and should not be confused with the active river or stream channel bank. The macro-channel is an incised feature, created by uplift of the subcontinent which caused many rivers to cut down to the underlying geology and creating a sort of “restrictive floodplain” within which one or more active channels flow. Floods seldom have any known influence outside of this incised feature. Within the macro-channel, flood benches may exist between the active channel and the top of the macro channel bank. These depositional features are often covered by alluvial deposits and may have riparian vegetation on them. Going (vertically) up the macro channel bank often represents a dramatic decrease in the frequency, duration and depth of flooding experienced, leading to a corresponding change in vegetation structure and composition.



A schematic diagram illustrating the edge of the riparian zone on one bank of a large river. Note the coincidence of the inflection (in slope) on the bank with the change in vegetation structure and composition. The edge of the riparian zone coincides with an inflection point on the bank; where there are not obligates upslope; few preferential. The boundary also coincides with the outer edge of the stature differences (DWAF 2008).