

AQUATIC BIODIVERSITY IMPACT ASSESSMENT

PROPOSED DEVELOPMENT OF KINETIC CATAMARANS INDUSTRIAL FACILITY ON ERF 1339, AS WELL AS DEVELOPMENT / REDEVELOPMENT OF THE SOUTH AFRICAN SEA CADET CORPS INFRASTRUCTURE ON ERF 1316, KNYSNA, WESTERN CAPE

DATE: 05 September 2025

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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 SACNASP Registration number 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 1.2 Description of the Development Area: Existing and Proposed
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 6 – Affected Environment Section 7 – Results 7.1 - Identified Aquatic Habitats
(a) aquatic ecosystem types; and (b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;	Section 6 – Affected Environment
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	Areas of Very High 1.4 -Screening tool results Section 6, Conservation context and 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 status (i.e. if the site includes a wetland /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 Protected Area
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including:	Section 7 – Results Section 7.1 Identified aquatic habitat Section 6 – Affected Environment
(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	Section 6 – Affected Environment Section 7.1 – Identified aquatic habitat Section 7 - Results

floodplain habitat), 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 8 – Potential Impacts Section 7 – Results Refer to SSVR – Appendix 5
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 10 –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 8 – Potential 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 8.2 – Impact 2: Flow pattern changes 8.3 – Impact 3: Erosion and Sedimentation Section 8.1 – Impact 1: Loss of riparian habitat Section 8.4 – Impact 4: Water Quality impacts
2.5.4. how will the proposed development impact on the functioning of the aquatic feature? This must include:	Section 10 – 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 (increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); (e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and (f) 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.);	Refer to Section 10 –Impact assessment and tables Section 8 – Potential Impacts Section 10 - Impact Assessment

2.5.5. how will the proposed development impact on key ecosystems regulating and supporting services especially:	Low Impact (after mitigation) Section 10 – 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 potential 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 8.1 and Impact Table of Section 10
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).	N/A
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 and Appendix 3
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 Licence Application and Appeals Regulations, 2017 Government Notice R267 in Government Gazette 40713 dated 24 March 2017, which includes the minimum requirements for an Aquatic Biodiversity Report.

Report prepared by: Colin Fordham (400166/14 Ecology)

Expertise / Field of Study: Colin is a SACNASP registered Professional Natural Scientist (Pr. Sci. Nat.) ecologist with 14 years of experience in the environmental sector. 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, before being promoted to senior management as a Landscape Conservation Intelligence Manager for five years.

As a Senior Landscape Conservation Intelligence Manager (LCIM) at CapeNature, Colin led a team of ecological specialists and land use staff, providing strategic direction and ensuring the delivery of high-quality scientific outputs. His role encompassed knowledge generation and dissemination, capacity building, ecological monitoring and strategic adaptive management, equipping him with the leadership and expertise to tackle complex ecological challenges.

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: ...05 September 2025

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SUMMARY

Upstream Consulting was appointed by Kinetic Catamarans to assess the aquatic biodiversity impacts of a proposed development in Knysna, Western Cape. The project involves constructing a yacht factory and redeveloping the South African Sea Cadet Corps infrastructure, including the existing jetty and slipway.

The project site is in an industrial area of Knysna, adjacent to the Knysna Estuary and the Ashmead channel. The DFFE screening tool identified the area as having "Very High" aquatic biodiversity sensitivity due to the presence of the Knysna Estuary, a Freshwater Ecosystem Priority Area (FEPA) Subcatchment, and a Strategic Water Source Area (SWSA). The Site Sensitivity Verification Report confirmed the need for a full Aquatic Biodiversity Impact Assessment.

The assessment was conducted in accordance with the DFFE Protocol for the assessment and reporting of environmental impacts on aquatic biodiversity. The process involved a desktop study using GIS and a site visit to confirm findings and delineate aquatic habitats and determine the impacts that proposed project would have on the aquatic ecosystems and propose suitable mitigation measures accordingly. The study identified that the only aquatic system to be impacted by the proposed works is the Knysna Estuary.

The study area has been part of the Knysna Estuary's urban-industrial zone since before 1973 and still maintains key natural features and ecological functions. The intertidal zones support a variety of saltmarsh species. The presence of robust, unmown vegetation helps to slow surface runoff and prevent bank erosion. Despite past modifications like bank stabilization and infill, the estuary's underlying structure remains stable, with strong tidal flushing maintaining its ecological health (PES B). The study area is located within the Estuary Functional Zone, which is recognized in the 2025–2029 Management Plan for its role in supporting a mix of low-intensity leisure zones and high-sensitivity quiet zones, the latter of which protects critical saltmarsh and eelgrass habitats. The Ashmead channel adjacent to the site also serves as a crucial nursery and foraging area for migratory birds and juvenile fish.

The Knysna Estuary is a globally significant ecosystem, considered South Africa's most biodiverse estuary and a key component of the Garden Route National Park. It has a high ecological importance and provides essential ecosystem services, including acting as a nursery for numerous fish and invertebrate species, and supporting threatened species like the Endangered Knysna seahorse. A 2005 assessment classified the estuary's health as "largely natural" (PES B), while the most recent comprehensive 2020 review showed a negative trajectory due to decreased freshwater inflow and increased urban pressure, but maintained the same PES (B). This is particularly evident in the Ashmead Channel which is a section that has suffered from nutrient enrichment and eutrophication from stormwater runoff and the dysfunctional WWTW. The eutrophication has led to the loss of valuable eelgrass beds, which serve as a critical habitat for many species. The ongoing threats highlight the need for targeted

interventions to clear invasive species, improve stormwater management, and restore bank habitats to bolster the estuary's resilience.

The impact assessment considered two alternatives:

- No-Go Alternative: Retaining the current inadequate infrastructure would result in continued degradation of the aquatic systems, with a continued low negative ecological impact.
- Preferred Alternative: The proposed development, while causing temporary impacts, is considered acceptable with appropriate mitigation measures, resulting in a low impact on the aquatic environment. The impacts were found to be of **Low significance after mitigation**.

The report concluded that there are no fatal flaws associated with the preferred alternative, provided that all recommended mitigation measures are strictly implemented and monitored.

Key mitigation measures include:

- Minor design changes to remove the need for a gravel parade ground (and its associated parking, adjacent to the facility (this will impact sensitive saltmarsh);
- A “Grow don’t Mow” policy 5m from all saltmarsh habitat – this buffer will greatly benefit the existing habitat;
- The implementation of SUDS;
- Ensuring construction footprint is kept minimal;
- Preventing the trampling of tidal habitats;
- Containment and proper disposal of any hazardous waste developed during the operational phase of the facility;
- Implementing a monitoring program to ensure compliance and
- Proper stormwater management control.

The specialist has no objection to the project's authorisation as long as all mitigations are implemented

1 INTRODUCTION

Upstream Consulting has been appointed by Kinetic Catamarans to undertake an aquatic biodiversity sensitivity assessment for the proposed development of Kinetic Catamarans Industrial Facility on Erf 1339, as well as development / redevelopment of the South African Sea Cadet Corps infrastructure on Erf 1316, Knysna, Western Cape.

The development of Kinetic Catamarans will involve the construction of a yacht factory, located adjacent to an existing yacht factory (located to the west of the current proposed development property). External facilities will include the factory building, loading bays, and additional parking areas (Figure 1). As the project is still in the design phase, many details regarding outbuildings and supporting infrastructure have yet to be finalised. The redevelopment of Sea Kadet facilities will include upgrading of the facility within the erf boundary and like for like replacement of existing jetty and slipway.

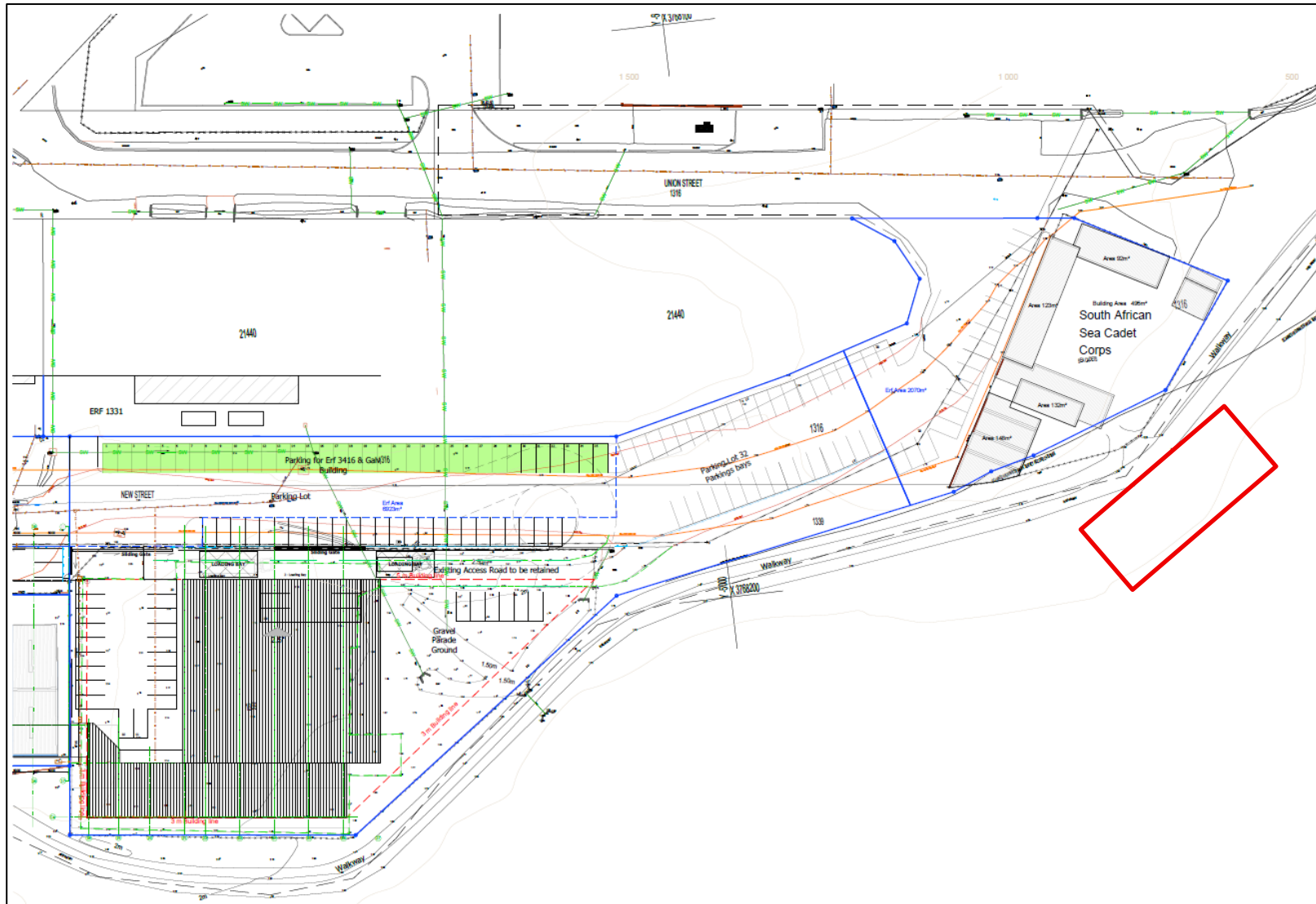


Figure 1: Map illustrating the proposed scope of works, approximate location of the slipway and jetty (indicated in red polygon), adjacent to the South African Sea Cadet Corps facility.

1.1 LOCATION

The site is located within the town of Knysna (Figure 2). The proposed development property is located within the industrial area of Knysna, south of Waterfront Drive, located on New Street, adjacent to the Ashmead channel in the Knysna Estuary. It is currently used as a driver's training facility by the Knysna Municipality and mostly paved. The property is within the designated Knysna Urban edge and is currently zoned Undetermined Use Zone. There is however an ongoing town planning process to rectify the zoning and accommodate the land use. The study area for assessment included a 500m radius from the proposed development footprint.

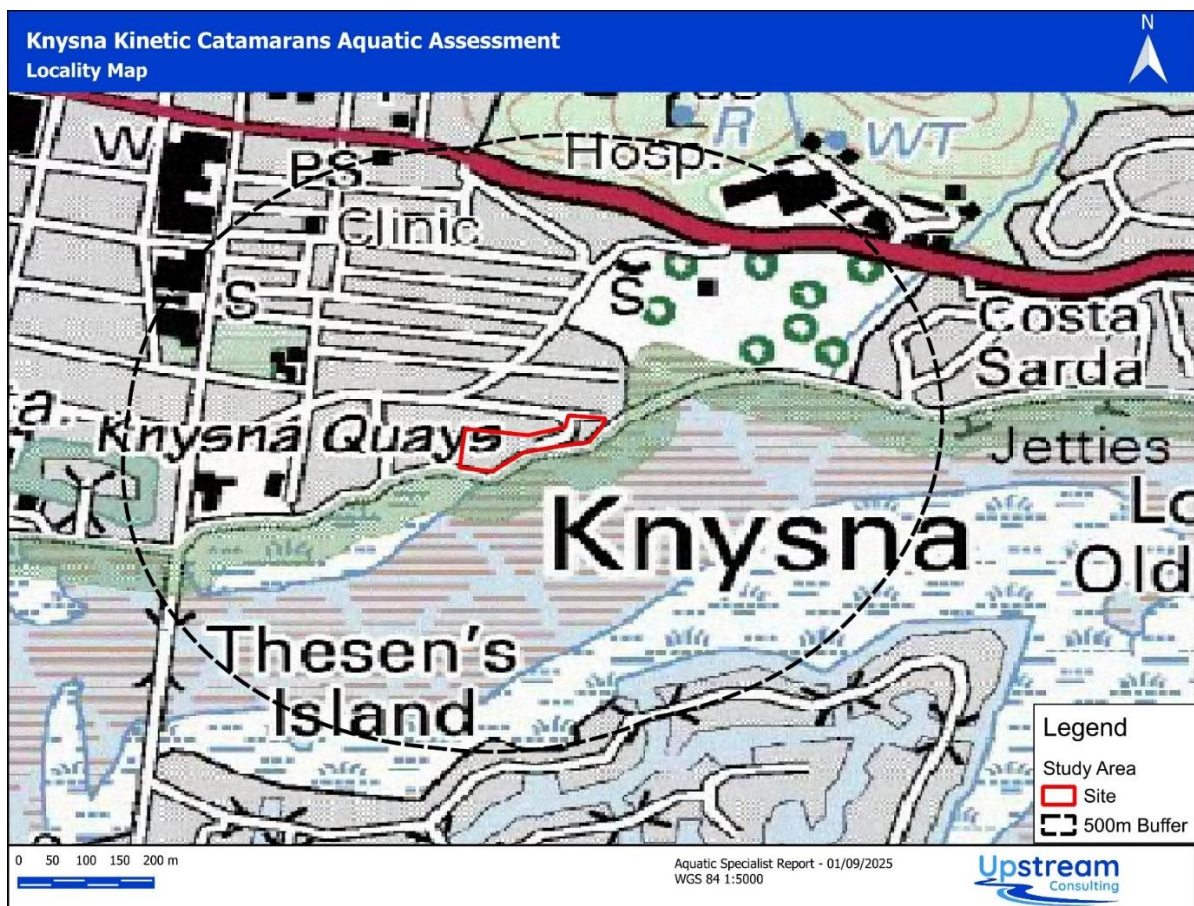


Figure 2: Cadastral Locality map, illustrating project location and 500m buffer.

1.2 SCREENING TOOL RESULTS

The National Web based Environmental Screening Tool was utilised for this proposal in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended, to screen the proposed site for any environmental sensitivity. The Screening Tool identifies related exclusions and/ or specific requirements including specialist studies applicable to the proposed site. The Screening Tool allows for the generating of a Screening Report referred to in Regulation 16 (1) (v) of the Environmental Impact Assessment Regulations 2014, as amended whereby a Screening Report is required to accompany any application for Environmental

Authorisation. Requirements for the assessment and reporting of impacts of development on aquatic biodiversity are set out in the *'Protocol for the assessment and reporting of environmental impacts on aquatic biodiversity published in Government Notice No. 648, Government Gazette 45421, on the 10 of May 2020'*.

The DFFE Screening Tool results show that the drainage areas in the study area have Very High aquatic biodiversity sensitivity due to Knysna estuary, FEPA Subcatchment and SWSA Outeniqua for Surface Water (Figure 3). Therefore, the project required the assessment and reporting of impacts on Aquatic Biodiversity. The site verification assessment was undertaken (Appendix 5) and submitted to the client. The Very High aquatic biodiversity sensitivity rating for the area was confirmed. Therefore, the Aquatic Biodiversity Impact Assessment report was required and has been compiled in accordance with the latest NEMA Minimum Requirements and Protocol for Specialist Aquatic Biodiversity Impact Assessment (10 May 2020).

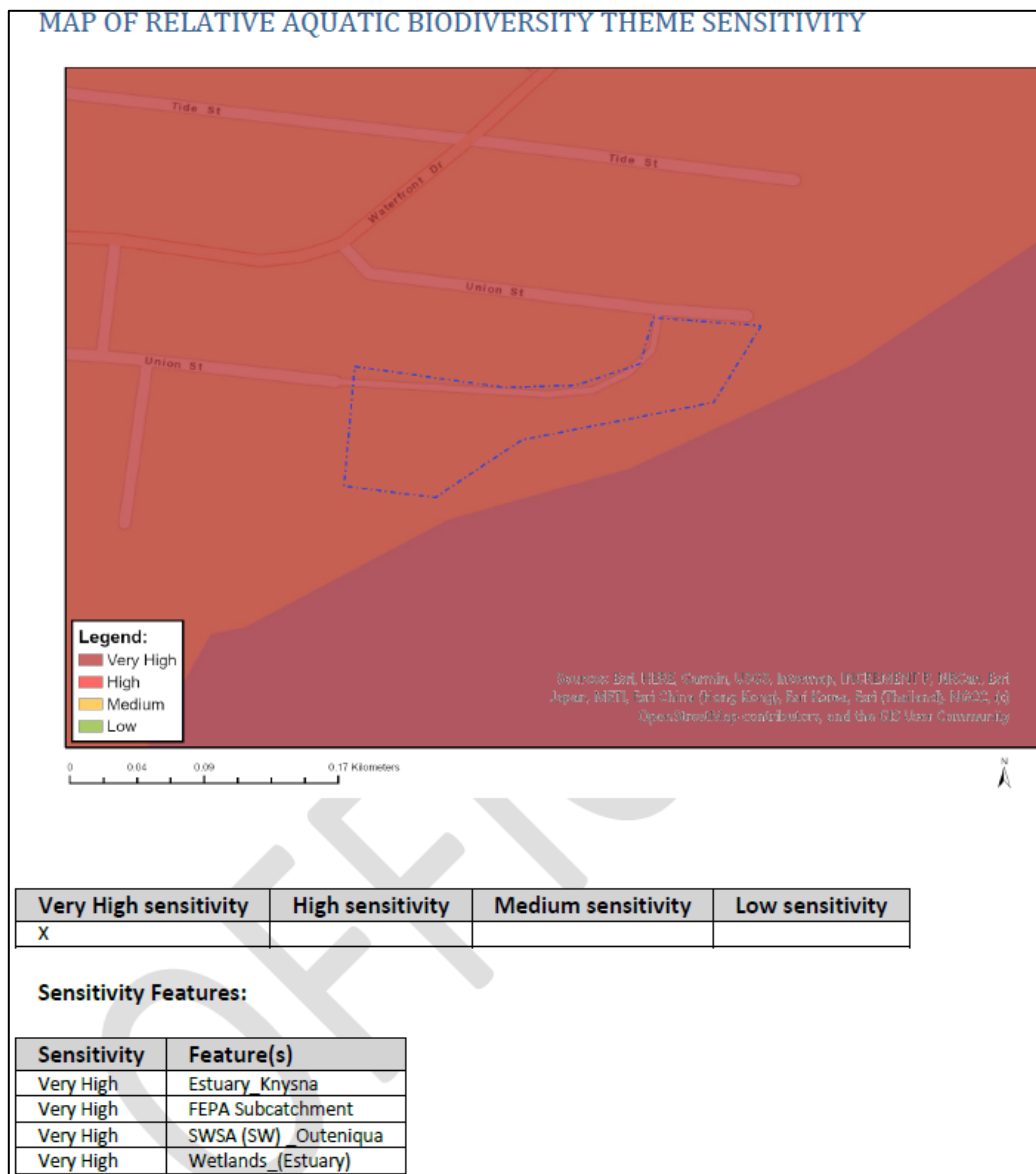


Figure 3: Preliminary Screening Tool Report on the Aquatic Biodiversity Theme Sensitivity of the various sewer lines.

2 RELEVANT LEGISLATION

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. Table 1 below outlines 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. 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 (EIA) Regulations	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 may require a Water Use License (WUL) in terms of Chapter 4 and Section 21 of the National Water Act No. 36 of 1998. 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)	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 (Act No. 6 of 2021)	The Western Cape Biodiversity Act provides a framework for the protection, conservation, and management of biodiversity in the province, including Critical Biodiversity Areas (CBAs). It ensures that land-use planning and development decisions consider the ecological value of CBAs to maintain biodiversity and ecosystem services. The Act aligns with national biodiversity priorities and mandates the identification, designation, and protection of ecologically significant areas. It also supports sustainable land-use practices and promotes conservation stewardship to prevent habitat degradation and biodiversity loss.

3 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, any Red data book information, 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, i.e. the hydrological zone of influence while classifying the hydrogeomorphic type of the respective water courses / wetlands in relation to present land-use and their current state. 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.
- 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).
- Conduct a Present Ecological State (PES), functional importance assessment and Ecological Importance and Sensitivity (EIS) assessment of the delineated wetland and riparian habitats. – **No need to conduct due to extensive current and accurate assessments conducted on the Knysna estuary.**
- 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 that must be included in the evaluation are probability, reversibility, irreplaceability, mitigation potential, and confidence in the evaluation.
- All direct, indirect, and cumulative impacts for each 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.
- Rehabilitation guidelines for disturbed areas associated with the proposed project and monitoring.

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. 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. Digitization and mapping were undertaken using QGIS 3.40 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 BASELINE ASSESSMENT METHODS

A site assessment was conducted on the 17th of August 2025 to confirm desktop findings, gather additional information, and define the boundaries of the aquatic habitat. 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). The primary system located adjacent to the site is the Knysna Estuary which is managed by SANParks. The site has several on site and stormwater drains that drain into the estuary directly.

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 (DWAF 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 handheld soil auger for wetland soils).

There is extensive research done on the Knysna estuary which defined the PES and EIS of the system by both SANParks and researchers, therefore the determination of PES and EIS for this site were deemed unnecessary, as the literature and research is current and extensively peer reviewed.

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. A methodology for assigning scores to the respective impacts is described in Appendix 1.

Cumulative impacts affect the significance ranking of an impact because the impact is taken in consideration of both onsite and offsite sources. For example, pollution making its way into a river from a development may be within acceptable national standards. Activities in the surrounding area may also create pollution which does not exceed these standards. However, if both onsite and offsite pollution activities take place simultaneously, the total pollution level may exceed the standards. For this reason, it is important to consider impacts in terms of their cumulative nature.

4.4 MITIGATION AND MONITORING

Actions are thereafter recommended to prevent and mitigate the identified impacts on aquatic habitat, in alignment with the mitigation hierarchy, as well as any measures necessary to restore disturbed areas or ecological processes. No-Go Areas were determined, and any necessary monitoring protocol was provided.

5 ASSUMPTIONS AND LIMITATIONS

- 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 and classification is reported on here.
- All soil/vegetation/terrain sampling points were recorded using a Garmin 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 around the proposed activities, while the remaining watercourses were delineated at a desktop level with limited accuracy.
- No detailed assessment of aquatic fauna/biota (e.g. fish, invertebrates, microphytes, etc.) was undertaken and not deemed necessary.
- The vegetation information provided is based on observation not formal vegetation plots. As such species documented in this report should be considered as a list of dominant and/or indicator wetland/riparian species.
- There were no seasonal limitations presented during assessment and the confidence level is high.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the field survey and based on the assessor's working knowledge and experience with similar projects. The degree of confidence is considered high.

6 DESCRIPTION OF THE AFFECTED ENVIRONMENT

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. The relevant spatial information regarding the site is described below.

The study area lies adjacent to the Knysna Estuary and the Southern Eastern Coastal Belt DWA Level 1 Ecoregion within DWS quaternary catchment K50B of the Gouritz Catchment Management Area (Figure 4). The K50B catchment surrounds the Knysna River and its tributaries. There are many unnamed perennial and non-perennial tributaries in this catchment. The study area also falls within the desktop mapped Outeniqua Strategic Water Source Areas (Figure 3).

The site sits at an elevation of between 1 and 2 m.a.s.l. on the banks of the Knysna Estuary. According to the latest national desktop river and wetland inventories (NBA and NWM 5), the estuary is the only estuary within the study area (Figure 5). According to national river map the largest system within the study area is the Knysna River and an unnamed perennial stream. The Knysna River is categorised as being in moderate health, having a Present Ecological State (PES) score of 'C', which is Moderately modified according to national data (NBA 2018).

According to the Western Cape Biodiversity Spatial Plan (WCBSP) (CapeNature, 2023) the biodiversity priority areas mapped by the WCBSP relative to the study area are shown in Figure 6. The WCBSP identifies biodiversity priority areas, Critical Biodiversity Areas, Ecological Support Areas (ESAs) and Other Natural Areas (ONA), which, together with Protected Areas (PA), are important for the persistence of a viable representative sample of all ecosystem types and species, as well as the long-term ecological functioning of the landscape. The primary purpose of the WCBSP is to guide decision-making about where best to locate development. Only low-impact, biodiversity- sensitive land-uses are appropriate within CBA and within PA only development in line with the designated protected area management plan should be permitted. The entire site falls within the PA designation labelled as the Knysna Protected Environment (declared 2004), and which falls under the management of SANParks adjacent to the Garden Route National Park (declared 2009).

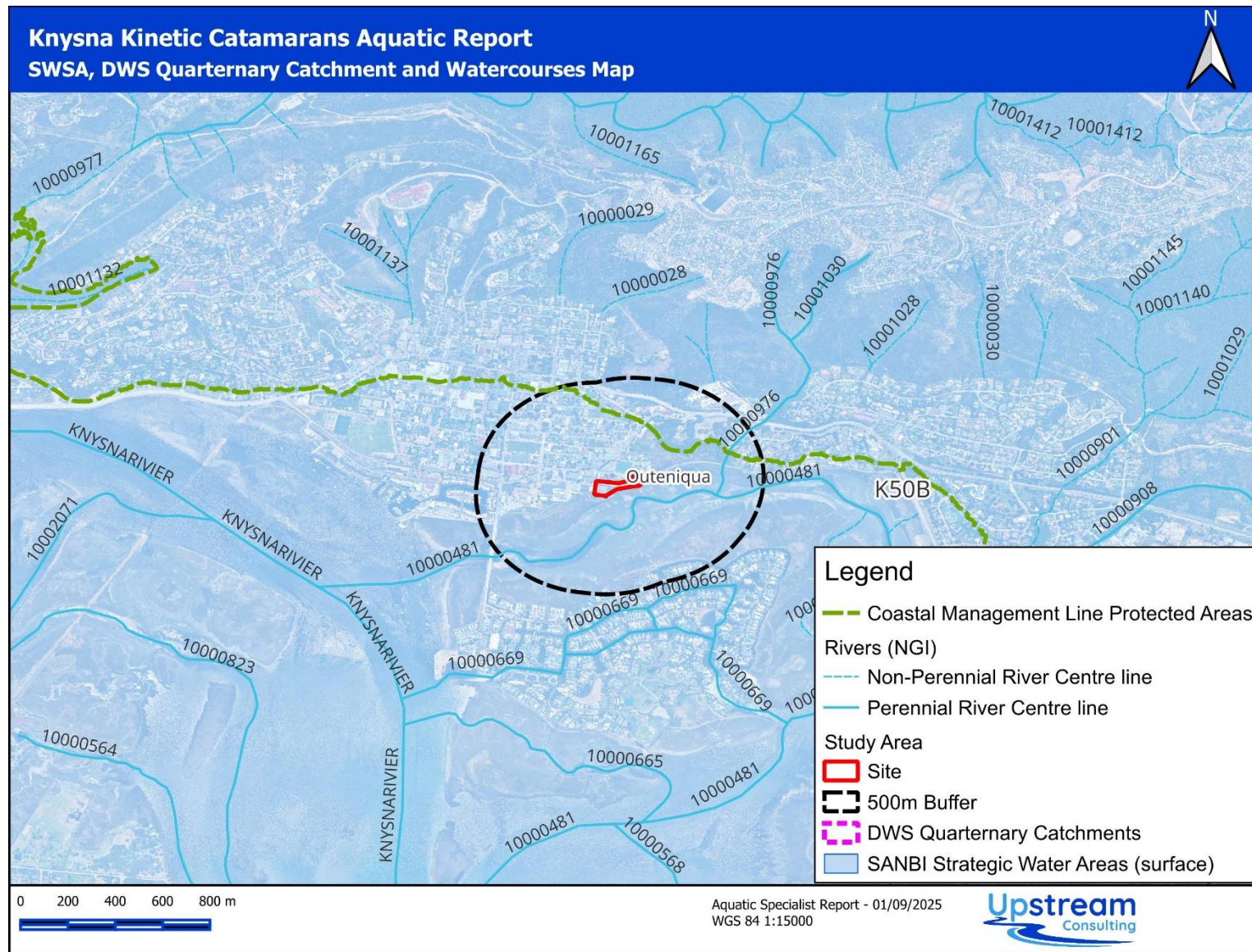


Figure 4: Map of the site in relation to SWSAs and quaternary catchments

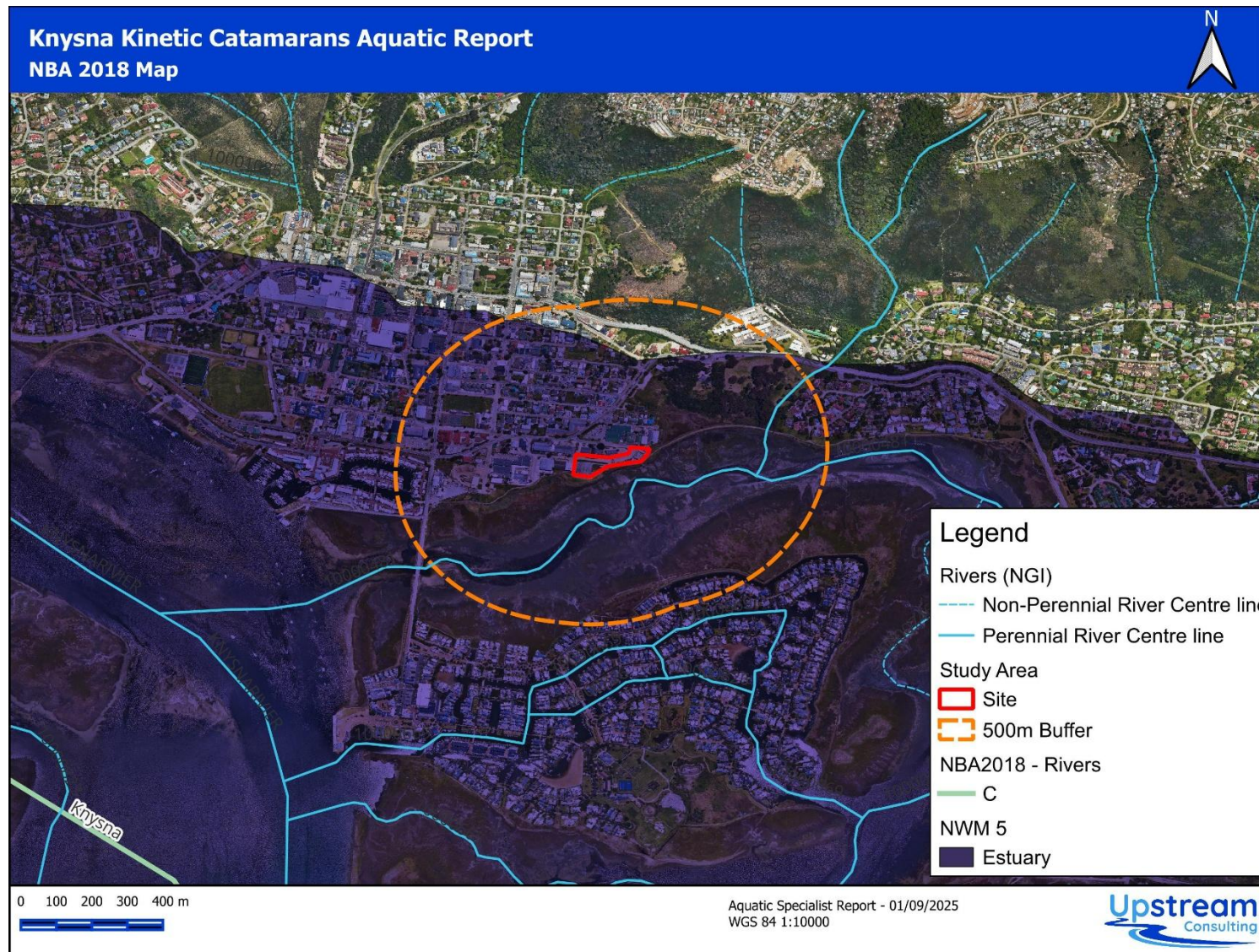


Figure 5: The site in relation to the national wetland and river desktop data inventories

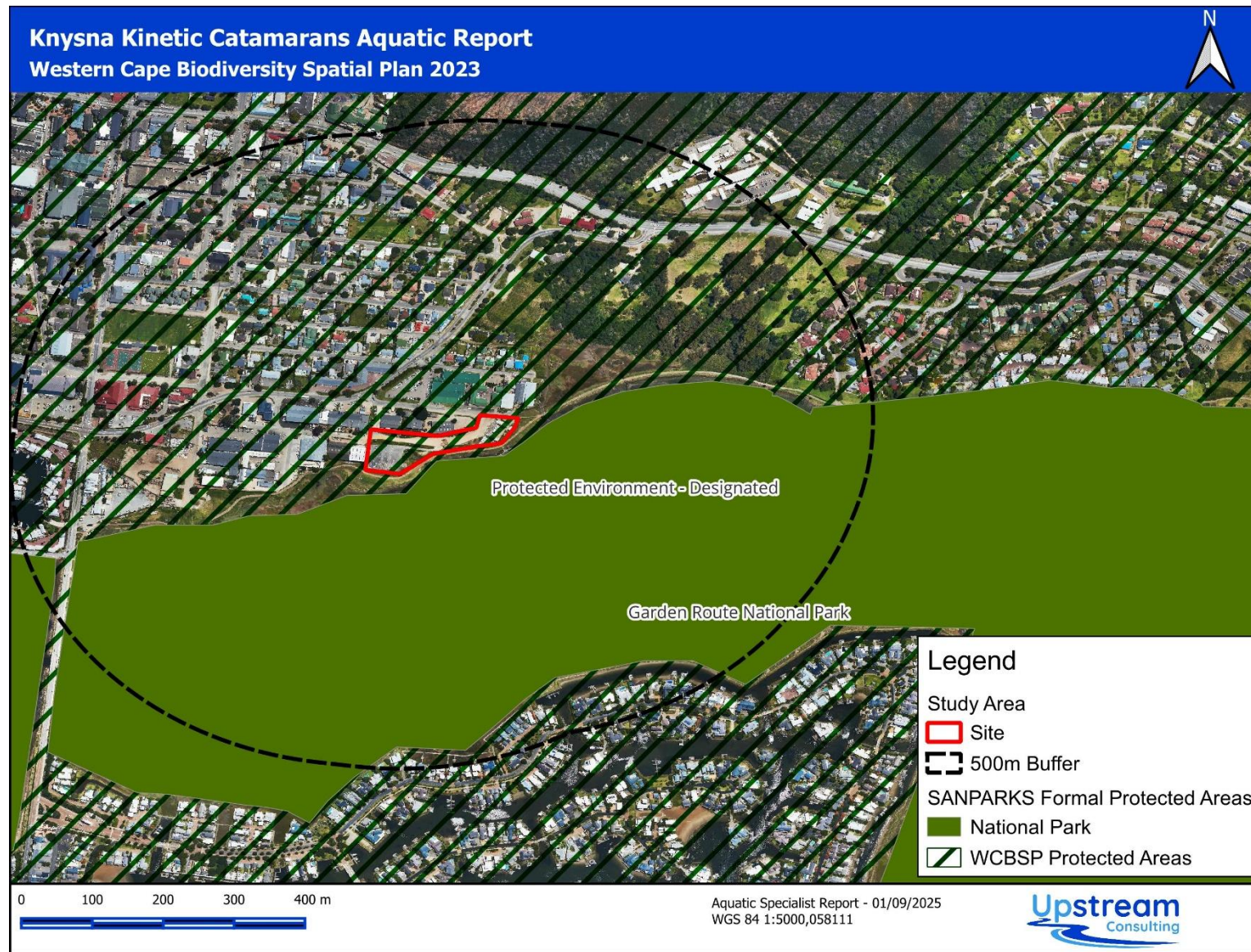


Figure 6: Map of the site in relation to the WCBSP conservation priority areas (WCBSP 2023)

6.1 HISTORIC CONTEXT AND FUTURE THREATS

Through reviewing historical aerial imagery, the site character has been significantly disturbed since at least 1973 (Figure 7). The extent of urban development of the town of Knysna has change much of the runoff and drainage patterns of the catchment. Over time, the urban expansion activities have resulted in the loss of additional riparian habitat and transformed surface runoff patterns. In short, the past catchment land use practices and associated infrastructure have impacted several watercourses in the immediate and surrounding environment and the estuary itself. However, this study is only reporting on any potential impacts from this proposed development, not all the past impacts. It is however important to understand the broader historic context of the study area for this assessment. Therefore, it is noted that the estuary is already in a impacted ecological state.

Future threats to the estuary include additional urban expansion and climate change. The expansion of the urban activities and infrastructure in the form of additional development has the potential to result in a further decrease water availability, and quality to the freshwater systems, while climate change is expected to alter the hydrological and geomorphological characteristics. The changes in rainfall patterns and flood intensity, interspersed with prolonged droughts, are expected to impact both surface and groundwater systems in the region. Engineering designs for the development of Knysna specifically needs to be designed to account for increase in intense flooding events which may initiate erosion and loss of infrastructure.



Figure 7: Aerial imagery taken of the area in 1973, showing the existing site (red box).

7 RESULTS

The aquatic habitats within a 500m radius of the proposed project were identified and mapped on a desktop level utilising available data. To identify the wetland/river types, using Kotze *et al.* (2009) and Ollis *et al.* (2013), a characterisation of hydrogeomorphic (HGM) types was conducted. Following the desktop findings, the infield site assessment confirmed the location and extent of these systems. Subsequent screening provided an indication of which of these systems may potentially be impacted upon by the project. There are several factors which influence the level of impact, such as type of system, position of the system in relation to the project and position the system is in the landscape.

7.1 IDENTIFIED AQUATIC HABITATS

Following the contextualisation of the study area with the available desktop data, a site visit was conducted on the 17th of August 2025, to groundtruth the findings and delineate the aquatic habitat within study area. In total there are two different natural HGM units identified and mapped within the 500m study area, the Knysna Estuary and an unnamed perennial riparian system to the far east of the study area. Only the Knysna Estuary will be impacted by the proposed scope of works. The additional information collected in the field allowed for the development of an improved baseline river and wetland delineation map (Figure 8).

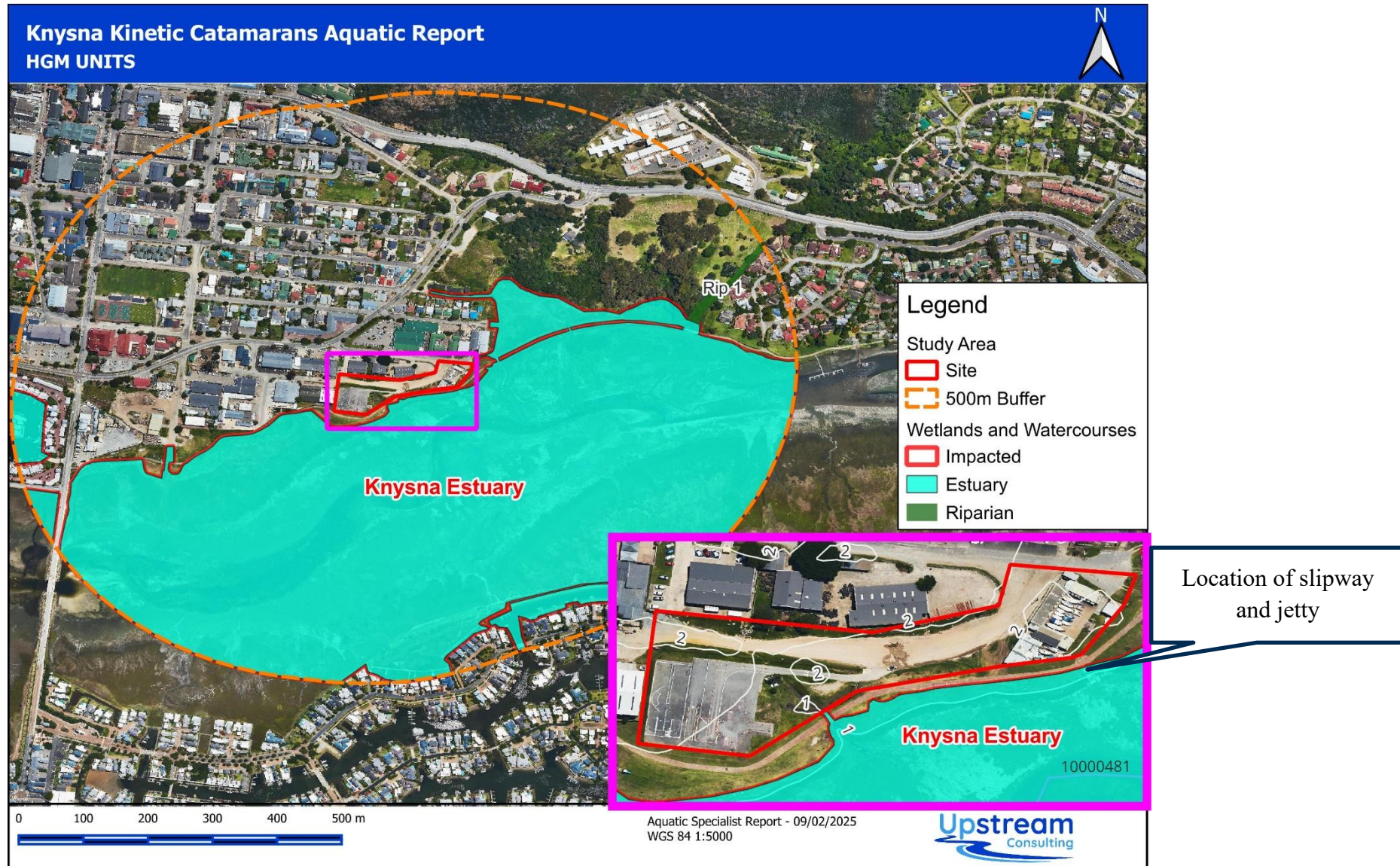


Figure 8: Map of the delineated aquatic habitat within the study area following site verification, pink box is zoomed in site with contours.

7.2 DESCRIPTION OF AQUATIC HABITAT

Following the conclusion of the mapping exercise, this section provides a description of the various systems that are currently being impacted by the state of the sewer system and will be impacted in the future construction\maintenance phases.

7.2.1 Knysna Estuary

This section of the Knysna Estuary where the study area is lies not far from Costa Sarda area and border the Ashmead Channel. This area has been functioning as an a notably urban-industrial zone since prior to 1973. Despite local historical disturbances, the estuarine margin retains important natural features (Plates 1 -13). Intertidal zones remain vegetated with saltmarsh species like, *Carpobrotus edulis* (sour-fig), *Sarcocornia perennis* (glasswort), *Chenolea diffusa* (sea-blite), and *Triglochin striata* (sea arrow-grass), while reedbeds of *Juncus kraussii* (sea rush) and *Phragmites australis* (common reed) persist along stormwater-affected stretches (closer to Costa Sarda). The dryer lawn areas on site are dominated by *Stenotaphrum secundatum* (Buffalo grass) and *Cynodon dactylon* (Common Bermuda grass).

It is evident that where the vegetation is not mowed or trampled, robust saltmarsh vegetation structure grows, which in turns slows down surface run off and limits the impact of bank erosion on the various drains (Plate 4).

Geomorphologically the section near the study area has undergone historical modification from bank stabilisation stormwater channels, canal-edge development, and fill has occurred, yet the underlying estuarine structure remains stable with no widespread erosion noted (Plate 13). Tidal flushing continues to support ecological function (evident from sections of saltmarsh persisting beyond the stormwater pipelines which are below the High Water Mark (HWM) (Plates 4 – 6). The 2025–2029 Garden Route National Park Management Plan emphasises this area’s role within the Estuary Functional Zone (~2,400 ha) and classifies it within predominantly low-intensity leisure zones, with adjacent high-sensitivity quiet zones protecting saltmarsh and eelgrass habitat (Hayes *et al.* 2024).

Hydrologically, the system experiences strong tidal influence, with periodic freshwater input, modified by stormwater, echoing concerns raised in the EMP regarding water quality impacts from urban runoff and reduced river inflows (Hayes *et al.* 2024). Despite anthropogenic pressures, this section of the estuary remains ecologically significant, contributing to estuarine nursery habitat and migratory bird foraging areas, such as for example the Egyptian goose (*Alopochen aegyptiaca*) (Plate 9). The Estuarine and Garden Route National Park Management Plans (SANParks 2020 and 2025) and highlight the need for targeted interventions such as clearing invasive species, improving stormwater management, and restoring bank habitat to bolster resilience.



Plate 1: Photograph taken of the existing facility located adjacent to the site



Plate 2: A photograph taken of the area of expansion for the facility



Plate 3: A photograph taken of the three stormwater drains on the property but adjacent to the site



Plate 4: A photograph taken of one of the drains showing active saltmarsh area where the drain is below the HWM, note the left bank where the vegetation is not mowed.



Plate 5: A photograph taken of one of the drains showing active saltmarsh habitat where the drain is below the HWM, note the right bank where the vegetation is mowed and appears to have been damaged



Plate 6: A photograph taken of one of the drains showing active saltmarsh area with mudprawns holes and a full stormwater drain.



Plate 7: A photograph taken of the drains discharge point showing active saltmarsh area and base level of the estuary.



Plate 8: A photograph taken of a rehabilitated green strip section adjacent to the parking lot.



Plate 9: A photograph taken of a pair of Egyptian gees with chicks using habitat, adjacent to the Sea Cadets.



Plate 10: A photograph taken of the drain from the parking lot

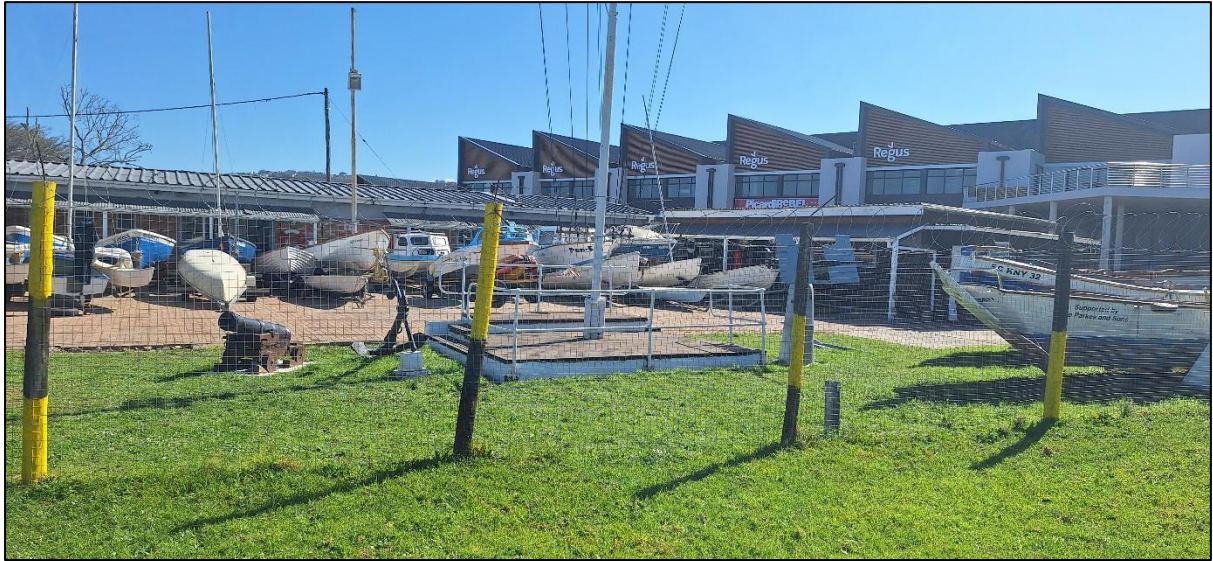


Plate 11: A photograph taken of the sea cadet facility



Plate 12: A photograph taken of people using the Sea Cadet facility and the floating jetty with concrete slipway



Plate 13: A photograph indicating the extent of salt marsh up to the walkway adjacent to the Knysna Estuary.

7.3 PES

The Present Ecological State (PES) of a river, wetland or estuary represents the extent to which it has changed from the reference or near pristine condition (Category A) towards an impacted system which can be critically modified at Category F (details provided in Appendix 1). The Knysna Estuary is amongst the most researched in South Africa and the most recent detailed study to classify the estuary PES was compiled by Claassens *et al.* (2020). The estuary is a globally significant ecosystem, holding the highest conservation importance in South Africa. It is recognized as a key component of the Garden Route National Park and is considered South Africa's most biodiverse estuary, supporting approximately 42% of the country's estuarine species (Claassens *et al.*, 2020 and SANParks 2025). The estuary provides crucial ecosystem services, serving as a vital nursery for numerous fish and invertebrate species and supporting a significant tourism. Its ecological health is critical for the survival of several threatened and endemic species, most notably the Endangered Knysna seahorse (*Hippocampus capensis*) and the Critically Endangered false limpet (*Siphonaria compressa*). The survival of these species is intrinsically linked to the health of the extensive, stable beds of the Endangered eelgrass (*Zostera capensis*) that characterize the estuary's sub-tidal habitats (Claassens *et al.*, 2020).

An older 2005 assessment of the Knysna Estuary's (PES) (DWA 2009), evaluated the system's condition against a natural, unmodified state and classified it as PES B. This designation indicated that the estuary was in a "*largely natural*" condition with only slight modifications to its physical and biological characteristics. However, the most recent research has revealed a concerning trend. The 2020 review of the estuary's health showed a negative trajectory in all variables studied, suggesting the estuary is declining in health from its previous PES B status (Claassens *et al.*, 2020). This deterioration is primarily attributed to a decrease in freshwater inflow, which has led to a loss of the natural salinity gradient in the upper reaches of the estuary, impacting species distribution. The estuary also faces increasing pressure from development, resource overexploitation, and habitat degradation (Claassens *et al.*, 2020).

The estuary's ecological sensitivity is heightened by its unique physical characteristics. It is a permanently open estuary with a microtidal regime, and its large, deep main basin acts as a significant sediment trap. The system's high-energy mouth, coupled with its relatively small tidal range and a very large tidal compartment, contributes to a generally stable and well-mixed water column in the main channel (Claassens *et al.*, 2020). However, the system's resilience is being tested by multiple anthropogenic stressors. These include continued pressure from urban development, which contributes to diffuse pollution, and the cumulative effects of declining water quality, which can disrupt delicate ecological balances and threaten the habitats of key indicator species like the eelgrass (Claassens *et al.*, 2020).

The Ashmead channel, a distinct side-branch of the estuary, is a particularly sensitive area that has shown significant degradation. Characterised by shallow water and a low flushing rate, the channel is highly susceptible to the effects of nutrient enrichment. According to Claasens *et al.* (2020) water quality has deteriorated markedly since 2003, primarily due to it being the receptor for stormwater runoff and non-compliant effluent from the nearby Knysna Waste Water Treatment Works (WWTW). These discharges have introduced high loads of nutrients, causing eutrophication.

The eutrophication in the Ashmead channel has resulted in severe ecological consequences. The excess nutrients have stimulated persistent and widespread blooms of nuisance macroalgae, which form dense mats that can smother the benthos. This has led to anoxic conditions in the sediment and displaced the valuable *Zostera capensis* seagrass beds that once dominated the area (Claassens *et al.*, 2020). The loss of these seagrass habitats has a cascading negative effect on the channel's biota, as they provide critical structure, food sources, and nursery grounds for a wide range of species. The situation in the Ashmead channel serves as a microcosm of the broader threats facing the entire estuary and highlights the urgent need for improved wastewater management and urban planning (Claassens *et al.*, 2020). Since 2020 there has been no change to the threats that the estuary faces so the PES determined by Claasens *et al.* (2020) remains valid.

7.4 ECOSYSTEM SERVICES AND EIS

Estuaries are globally threatened ecosystems and are well-recognized for the ecosystem services which they supply. Furthermore, these ecosystems make potentially important ecosystem services contributions to several broad-scale imperatives of government, including water resource management; biodiversity conservation; human safety and disaster resilience; socio-economic development and poverty elimination; and climate change mitigation and adaptation. Individual wetland/riparian areas differ according to their characteristics, contexts and the suite of ecosystem services which they supply to society (Kotze *et al.* 2020). Thus, there is a need to assess and compare estuary areas in terms of ecosystem services delivery. A higher Present Ecological Status (PES) score indicates that the ecosystem is in a better and more natural condition. This allows it to provide a greater range and quality of ecosystem services.

The Knysna Estuary provides a multitude of ecosystem services that are crucial for both the environment and human society. It is considered South Africa's most important estuary for conservation and is a central element of the local economy and culture (Turpie and Clark, 2007). The system's stability and rich biodiversity provide the foundation for these benefits, which are broadly categorized as supporting, provisioning, regulating, and cultural services.

A critical provisioning and supporting service is the estuary's function as a nursery area for marine fish (Whitfield *et al.*, 2023). Species like the Cape stumpnose and white steenbras rely on the estuary's protected waters for their juvenile stages, contributing to regional fisheries. The estuary also provides habitat for a variety of migratory and resident birds, including Palearctic migrants, and supports rare and endangered species such as the African clawless otter and the Knysna seahorse.

The extensive eelgrass beds, particularly of the endemic *Zostera capensis*, are a key supporting service (Whitfield *et al.*, 2023). These beds are the largest and most stable in southern Africa, with extensive beds located within the Ashmead channel near the site (although they are decreasing in size). These beds provide crucial nursery habitats for numerous invertebrate species and contribute to climate mitigation by storing carbon. The estuary's salt marshes are also vital, stabilizing banks and improving water quality by trapping sediment and cycling nutrients (Whitfield *et al.*, 2023).

In terms of regulating services, the estuary's plant and algal communities are essential for maintaining water clarity and cycling nutrients, thereby supporting the overall health of the system (Whitfield *et al.*, 2023). These natural processes help to buffer the system against pollution and other stressors. The complex interplay of these habitats, from the salt marshes to the seagrass beds, creates a resilient and productive environment.

The Knysna Estuary is a significant provider of cultural services, offering a wide range of non-material benefits to people. It serves as a major recreational hub for activities such as fishing and boating, and its aesthetic beauty and unique natural character contribute to the livelihoods of many in the region (Whitfield *et al.*, 2023). The estuary is a "*public good*" that provides a diverse array of benefits, highlighting its immense value beyond simple ecological function. This all contributes to the High EIS score associated with the Knysna estuary

7.5 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). Currently there are no formalised riverine, wetland or estuarine buffer distances provided by the provincial authorities and as such the buffer model as described Macfarlane & Bredin (2017) for wetlands, rivers and estuaries was used. Given that this area had been developed since prior to 1973, it is recommended that no further encroachment into the delineated estuarine area outside of the construction footprint be permitted. Therefore, no additional buffer is required.

8 POTENTIAL IMPACTS

Aquatic ecosystems are particularly vulnerable to human activities, and these activities can often result in irreversible damage or longer term, cumulative changes. The proposed scope of works includes the development of infilled urban erven and the modernisation of the South African Corps Sea Cadet Facility as well as the replacement and maintenance “like for like” of the South African Corps Sea Cadet jetty and slipway. Given the sensitivity of the Knysna Estuary, these activities can result in the loss of intact vegetation, ecologically important species and species of conservation concern, as well as the associated loss of ecological processes. A main concern is the potential loss of good condition intertidal areas, and the impact on *Zostera* beds, that may continue into the operational phase. The loss of this intact habitat must be prevented and the disturbance of the *Zostera* beds must especially be avoided.

The activities which will result in impacts upon the ecosystem include disturbance/loss of saltmarsh and grassed areas and bank modifications, potential infilling of estuarine habitat, clearance of salt marsh vegetation resulting in bare ground, and burying of aquatic habitat/biota (amongst others). Severity of these impacts will all be determined following the implementation of appropriate mitigation measures.

The significance of an impact to the environment or ecosystem can only be assessed in terms of the change to ecosystem services, resources and biodiversity value associated with that system or component being assessed. 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. The direct and indirect impacts associated with the project are grouped into four encapsulating impact categories where associated or interlinked impacts are grouped.

Impacts have been separated into construction and operational phases of the project within the following categories:

8.1 HABITAT LOSS AND DEGRADATION

The disturbance or loss of aquatic habitat refers to the direct and indirect physical destruction or disturbance caused by activities such as excavations, vegetation clearing, and trampling of habitat. These impacts can result in the deterioration of aquatic ecosystem integrity and a reduction/loss of habitat for aquatic dependent flora and fauna. As *Zostera capensis* is a keystone species (listed as endangered) any habitat loss may cause significant negative consequences upon the coastal environment. Jetties built on stilts do not pose a significant threat to the hydrological health of the system as they do not interfere with water circulation. However, significant impacts occur due to the eradication of saltmarsh and intertidal vegetation in the vicinity of jetties.

The replacement of the jetty and slipway will require the removal of saltmarsh vegetation and soil excavation for the placement of the poles. These activities will directly result in localised habitat loss and degradation. Apart from direct excavation activities, during construction the machinery and workers will impact habitat. Indirectly, the discarded excavated material can bury habitat and smother benthic communities, which may result in the loss of aquatic biodiversity (Figure 9).



Figure 9: Photograph showing an example of the localised changes to salt marsh from excavations for jetty construction

Due to construction, alien invasive species may encroach into newly disturbed areas and outcompete indigenous vegetation and reduce aquatic biodiversity in the remaining habitat. The removal of estuarine vegetation weakens the banks' stability causing it to be undercut and ultimately collapse into the estuary. This may cause the burying of aquatic habitat and cause aquatic faunal fatalities. The disturbances from construction and continued change during operation can result in the creation of foreign habitats and increased alien plant infestation.

During operation, the jetty and slipway can impact the habitat indirectly through the casting of a shadow on an area to such an extent that the natural plants can no longer be sustained in the area. This will reduce the buffering services it currently provides. Vegetation not only stabilises the river bank but is also an important habitat for many bird species and aquatic invertebrate species below water. Additionally, there is potential for ongoing disturbance to the *Zostera* beds through use of the jetty in this vicinity during the operational phase. There is currently a significant amount of *Zostera capensis* at the jetty slipway site.

Physical changes by means upgrading the current dirt road to a sealed tar or paved road and portions of the pavement to parking areas will also result in the reduction in size of important buffer strips of grassland.

8.2 HYDRODYNAMIC CHANGES

Estuaries continually change in response to hydrodynamic variations (such as floods) and infrastructure such as bridges, slipways and jetties impact the natural, fluctuating state. Jetties and slipways which extend into the channel can change the hydrodynamics of an estuary and replace intertidal habitats. They stabilise banks and reduce longitudinal connectivity in the intertidal zone causing stabilisation of the naturally dynamic sand flats. This existing impact of the slipway and jetty lessens the impact significance of the replacement of this infrastructure, as these has already resulted in geomorphic change in this location.

The jetty and slipway are highly unlikely to result in any modifications to water inputs, levels, salinity or estuary mouth position. When required the replacement of the jetty and slipway will require temporary flow diversion/ dewatering as the poles will need to be replaced and concrete removed and replaced. The localised alteration of flow paths and changes to micro-topography/ bathymetry can change the natural hydrodynamic of the site, but this is unlikely. These impacts can also result in erosion and sedimentation, especially if high flow conditions occur during these specific construction activities (but again, this will be very localised in extent). The construction of the buildings on the site will result in a small reduction of grassed area and slight increase in stormwater inputs into the estuary. The construction phase will also change the runoff patterns across the construction site, but these will still pass through the existing stormwater drains. The formalisation of the road and parking areas will also increase stormwater runoff into the various drains.

During operation, artificial bank stabilisation associated with jetties and slipways permanently changes the hydrodynamics and introduces foreign habitats to the system. However, this impact is existing and preventable if the construction does not further alter the gradient of the bed and bank. The operational phase of the parking lot and building will increase the volume of stormwater flowing from the site, by a small degree.

8.3 EROSION AND SEDIMENTATION

The construction of buildings roads, pavements, jetties and slipways can result in an unnatural accelerated erosion and deposition of sediment. During construction there will be vegetation clearance and soil disturbance within the estuarine functional zone for the buildings, pavement, and parking lot while for the jetty and slipway there may be loss of saltmarsh/ mudflats. These direct impacts upon the estuary can result in erosion and sedimentation. Although this impact is initiated during the construction phase it is likely to persist into the operational phase.

Construction will cause disturbed areas, where invasive alien plants can establish, eventually leading to the reduction of the natural vegetation and ultimately soil erosion.

8.4 WATER AND NOISE POLLUTION

Water and/or soil pollution cause negative changes in the physical, chemical and biological characteristics of water resources (i.e. water quality). This can result in possible deterioration in aquatic ecosystem integrity and a reduction in, or loss of, species of conservation concern (i.e. rare, threatened/endangered species). During construction there are a number of potential pollution inputs into the aquatic systems (such as hydrocarbons and raw cement). Pollutants alter the water quality parameters such as turbidity, nutrient levels, chemical oxygen demand and pH. These alternations impact the species composition of the systems, especially species sensitive to minor changes in these parameters. Sudden drastic changes in water quality can also have chronic effects on aquatic biota in general and result in localised extinctions. Hydrocarbons including petrol/diesel and oils/grease/lubricants associated with construction activities (machinery, maintenance, storage, handling) may potentially enter the system by means of surface runoff or through dumping by construction workers. Raw cement entering the system through incorrect batching procedure and/or direct disposal. The incorrect positioning and maintenance of the portable chemical toilets and use of the surrounding environment as ablution facilities may result in sewage and chemicals entering the system.

There is potential for solid waste such as litter to enter the aquatic habitat through generation and disposal by workers. Objects which are particularly detrimental to aquatic fauna include plastic bags and bottles, pieces of rope and small plastic particles. Large numbers of aquatic organisms are killed or injured daily by becoming entangled in debris or as a result of the ingestion of small plastic particles. If allowed to enter the ocean, solid waste may be transported by currents for long distances out to sea and around the coast. The impact of floating or submerged solid materials on aquatic life (especially birds and fish) can be lethal and can affect rare and endangered species.

During construction operations, noise may have an impact on aquatic organisms in the vicinity. Benthic invertebrates have been shown to be relatively insensitive to low frequency sound, whilst fish appear to be able to tolerate moderate sound levels. Foraging birds are expected to avoid the sound source should it reach levels sufficient to cause discomfort. Due to the existence of similar habitats within the surrounding area, it is not expected that avifauna will be excluded from feeding on a particular food source. Mammals, such as the otters which occur in this area, would likely move away from the disturbance. During maintenance there could be water pollution impacts similar to those encountered in the construction phase. However, the construction will be short in duration and noise pollution will have no permanent impacts.

8.5 CUMULATIVE IMPACTS

Too many structures and formalisation of the urban centre of Knysna will inevitable have a greater cumulative impact on the Knysna Estuary. Having too many structures will impact on bird life; significantly reduce the much needed estuarine functional zone vegetation, loss of saltmarsh habitat and changes to shoreline hydraulics and sedimentation. Continued

formalisation of dirt roads and grassed areas will also increase volume of stormwater runoff and level of estuary pollution through contaminated stormwater.

9 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 mitigation measures detailed within this report must be taken into consideration during financial planning of the construction phase of the structures. This is to ensure that sufficient funds are available to implement all the measures required to maintain the current PES score of the estuary impacted upon.

Any potential risks must be managed and mitigated to ensure that no deterioration to the water resource takes place. Standard management measures should be implemented to ensure that any on-going activities do not result in a decline in water resource quality. Mitigation measures related to the impacts associated with the construction activities are intended to augment standard/generic mitigation measures included in the project-specific Environmental Management Programme (EMPr).

The monitoring of the development activities is essential to ensure the mitigation measures are implemented. Therefore, compliance with the mitigation recommendations must be audited by a suitably qualified independent Environmental Control Officer with an appropriately timed audit report. In the case where there is extensive damage to any aquatic system, where rehabilitation is required, a suitably qualified aquatic specialist must audit the site. Monitoring for non-compliance must be done on a daily basis by the contractors. Photographic records of all incidents and non-compliances must be retained. This is to ensure that the impacts on the aquatic habitat are adequately managed and mitigated against and the successful rehabilitation of any disturbed areas within any system occurs. Monitoring should especially focus on preventing water pollution, avoiding disturbance of aquatic habitat, and preventing unnecessary soil disturbance or infilling.

The following mitigation measures must be adhered to during all project phases:

- The implementation of SUDS (Sustainable Urban Drainage Systems) is critical for the paving and parking areas.
 - SUDS is green infrastructure solutions for managing rainwater in urban areas by mimicking natural drainage processes, such as infiltration and filtration, rather than conventional piping systems. SUDS includes features like green roofs, permeable pavements, rain gardens, and vegetated areas to reduce flood risk, improve water quality, enhance biodiversity, and add amenity value to the urban environment. SUDS are a key strategy for increasing urban resilience against climate change and for creating more sustainable and liveable cities.

- The facility needs to implement rainwater harvesting to reduce the volume of runoff entering the estuary.
- Any green strips of permeable pavement like the *Carpobrotis edulis* planted in Plate 8 and represented in Plate 10 should be retained.
- A “Grow Don’t Mow” policy should be adopted for any of the open green spaces within 5m of any saltmarsh to allow for the adjacent vegetation to grow robust like Plate 4. Such vegetation structure slows down surface water flow and increases infiltration. It also provide additional habitat for saltmarsh fauna.
- Damage to saltmarsh must be minimised and to the *Zostera* beds must be avoided during the construction and operational phase. The jetty and slipway may not be expanded beyond their existing footprint.
- No infillings, excavations or retaining walls should be allowed.
- The jetty is currently a floating jetty and must be constructed of unpainted hardwood and/or building standard treated pine. Recycled plastic ‘timber’ may also be used. No metal frames or structures should be allowed that can rust and degrade rapidly over time.
- No roofs, rooms or other structures may be attached to or built onto the jetty. Railings may be considered if in keeping with the purpose of the structure.
- Gangways are not to be wider than the current structure. Consider the use of removable planks at intervals along the gangway which can be removed when the jetty is not in use, to increase sunlight upon the saltmarsh below.
- Pontoons must be made from corrosion-proof material and should be constructed in such a way that if ruptured they remain afloat.
- All pontoons must be clean of any foreign materials such as oil residue or chemicals and must be inspected prior to installation.
- The structures must cause the minimum disturbance to the normal current flow of the river and may not cause stagnant water areas.
- The structures may not cause an obstruction or change to natural sand movement or cause accelerated erosion of the riverbank. There must be no drains, channels or culverts dug in the estuary.
- Artificial stabilisation and infilling below the high water mark should not be allowed, outside of the current design.
- During construction and operation, trampling of tidal habitat like salt marshes should be prevented. The primary motivation for allowing these structures is to protect indiscriminate trampling. The creation of pathways must be prevented. Measures such as the placement of wooden boards/ planks on top of the saltmarsh surface, to be used as temporary walkways and removed after construction, are acceptable.
- The working corridor must be kept to a minimum and be identified and demarcated clearly before any construction commences to minimise the impact. This must be approved by the ECO prior to commencement. Site supervisors must ensure that impacts are confined to the construction zone. Staff environmental induction must take place prior to construction commencing and any subcontractors utilised must be inducted before starting work onsite.

- Construction of the slipway must only be undertaken under dry conditions with no rainfall predicted during significant construction within it. Additionally, it is advisable that the work is planned with consideration to the low and high tides of the estuary.
- The excavations within aquatic habitat should be, as far as possible, manually hand-dug rather than dug using machinery. Machinery within the estuarine habitat must be avoided as far as possible. Excavation of any soils in the aquatic habitat must be done to allow the storage of soil in sequence. Topsoil must be removed and stored very carefully for rehabilitation.
- Any material excavated from the estuary must not be dumped onto any vegetated areas. Any fauna (crabs, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted.
- Affected surface vegetation must be removed, appropriately stored then reinstated, immediately post-construction, as close to their original position as possible, to reduce the possibility of longer-term change to the vegetation community.
- Dewater in a manner that does not cause erosion and does not result in water with a high silt content flowing into the channel. Remove the dewatering structures as soon as possible after the completion of dewatering activities.
- Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils.
- It is the landowner and contractor's responsibility to 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, for the necessity, type proposed to be used, effectiveness and impacts of the product on aquatic biota.
- A monitoring programme shall be in place, not only to ensure compliance with the EMPr throughout the construction phase, but also to monitor any post-construction environmental issues and impacts such as erosion. The monitoring should be regular and daily visits are encouraged.
- The property owners are encouraged to share their jetty and slipway with their neighbours, as far as possible. It should be noted that as per the EMPr the Ashmead channel is zoned as a no motorised zone. This can substantially reduce the need for more privately-owned structures that would collectively have a greater impact on the environment.
- The applicant's must maintain the jetty in a serviceable condition according to the instructions set by CapeNature. Should such a structure no longer be required or used, the lessee must remove the structure and rehabilitate the riverbank. Regular inspections of these structures must take place.
- Maintenance operations of the jetty and slipway must ensure a minimal footprint. No additional excavations or vegetation clearance should be involved, only necessary maintenance such as debris removal. This maintenance should be undertaken with manual labour unless otherwise approved by an environmental authority.

- No construction camp or activities may be established on any current grassed or green areas, outside of the current design footprint.
- During the operational phase of the new yacht building facility the following mitigation measures are required:
 - **Waste and Material Storage:** All materials, especially hazardous ones like paints, solvents, and lubricants, should be stored indoors in secure, designated areas. These should be kept in properly labeled, sealed containers and placed within a secondary containment system, such as a spill tray or a containment berm, to capture any leaks or spills.
 - **Spill Prevention and Response:** A comprehensive Spill Prevention, Control, and Countermeasure (SPCC) plan is crucial. This plan should include procedures for material handling, a detailed inventory of all chemicals and their locations, and regular inspections of storage containers and equipment for leaks.
 - **Employee Training:** All employees should be trained on the proper handling of hazardous materials, spill response procedures, and the location and use of spill kits. This is a critical step to ensure that any spills are contained and cleaned up promptly, minimizing the risk of contamination.
 - **Floor Drains and Sewer Connections:** It is essential to ensure that no floor drains inside the facility are connected to the stormwater sewer system. All wash water, which may contain paint particles, dust, and other pollutants, should be collected and disposed of properly, not discharged into a public drain.
 - **Recycling and Waste Disposal:** Implementing a plan for recycling and proper disposal of all waste products, including spent solvents, abrasives, and waste oil, is also vital. This includes using a licensed hazardous waste contractor for materials that cannot be recycled.
- The establishment of the gravel parade ground and parking bays on that area are not supported.
- The Knysna Estuary Forum must be made aware of the proposed works (once approval has been received). The applicant is encouraged to join the Estuary Forum.
- The ECO must ensure that the contractors have fully complied (partial compliance is unacceptable) with all the recommendations within this report, as well as the EMPr, before leaving site, and the local municipal environmental officer, SANParks, Cape Nature, DFFE Oceans and Coasts, landowners and Estuary Forum should undertake ongoing monitoring.
- Construction must be immediately followed by suitable rehabilitation.
- Soil replacement must be conducted in same sequence as excavated and excess soil removed from the estuary.
- The solid domestic waste must be removed and disposed of offsite. All post-construction building material and waste must be cleared in accordance with the EMPr.
- In the case where there is extensive damage to any aquatic system, where rehabilitation is required, a suitably qualified aquatic specialist must audit the site.

10 IMPACT SIGNIFICANCE

The impact significance of the proposed project was determined for each potential impact of the project, for both the Preferred Alternative and the No-Go Alternative (Tables 2 & 3).

It was determined that, after mitigation, the impacts associated with the Preferred Alternative will have a Medium to Low significance level. The impacts associated with the No-Go Alternative were evaluated as having a Low negative significance, as the status quo of trampling of saltmarsh, will continue. Please refer to Chapter 10 for detailed mitigation measures. Mitigation must focus on preventing the loss of saltmarsh vegetation and ensuring the avoidance of the *Zostera* beds.

Table 2: Evaluation of potential impacts upon aquatic habitat from construction and operation (all impacts are negative in nature)

CONSTRUCTION PHASE IMPACTS										
Impact	Mitigation	Extent	Duration	Magnitude	Probability	Significance	Reversibility	Mitigation Potential	Irreplaceable Resource Loss	Cumulative Impact
DISTURBANCE/ LOSS OF HABITAT	Without Mitigation	Local (2)	Long term (4)	Low (2)	Definite (5)	Medium (55)	Recoverable (3)	Med	Yes	Very Low
	With Mitigation	Site (1)	Short (2)	Low(2)	Low probability (2)	Low (12)	Reversible (1)	Low	No	Very Low
MODIFIED HYDRODYNAMICS	Without Mitigation	Local (2)	Short (2)	Low (2)	Probable (3)	Low (27)	Recoverable (3)	Med	No	Very Low
	With Mitigation	Site (1)	Very Short (2)	Very Low (1)	Low probability (2)	Low (10)	Reversible (1)	Low	No	Very Low
EROSION AND SEDIMENTATION	Without Mitigation	Local (2)	Long term (4)	Low (2)	Highly probable (4)	Medium (44)	Recoverable (3)	Med	Partial	Very Low
	With Mitigation	Site (1)	Short (2)	Very Low (1)	Low probability(2)	Low (10)	Reversible (1)	Low	No	Very Low
POLLUTION	Without Mitigation	Regional (3)	Medium term (3)	Very Low (1)	Low probability (2)	Low (20)	Recoverable (3)	High	No	Very Low
	With Mitigation	Site (1)	Short (2)	Very Low (1)	Improbable (1)	Low (7)	Recoverable (3)	Low	No	Very Low
OPERATIONAL PHASE IMPACTS										
Impact	Mitigation	Extent	Duration	Magnitude	Probability	Significance	Reversibility	Mitigation Potential	Irreplaceable Resource Loss	Cumulative Impact
DISTURBANCE/ LOSS OF HABITAT	Without Mitigation	Regional (3)	Permanent (5)	Moderate (3)	Highly probable (4)	Medium (56)	Recoverable (3)	Med	Yes	Very Low
	With Mitigation	Local (2)	Long term (4)	Moderate (3)	Low Probability (2)	Medium(20)	Reversible (1)	Low	No	Very Low

MODIFIED HYDRODYNAMICS	Without Mitigation	Local (2)	Permanent (5)	Very Low (1)	Probable (3)	Medium (33)	Recoverable(3)	High	No	Very Low
	With Mitigation	Site (1)	Permanent (5)	Very Low (1)	Improbable (1)	Low (8)	Reversible (1)	Low	No	Very Low
EROSION AND SEDIMENTATION	Without Mitigation	Local (2)	Long term (4)	Low (2)	Probable (3)	Medium (33)	Recoverable (3)	Med	Partial	Very Low
	With Mitigation	Site (1)	Short (2)	Very Low (1)	Low Probability (2)	Low (10)	Reversible (1)	Low	No	Very Low
POLLUTION	Without Mitigation	Regional (3)	Permanent (5)	Moderate (3)	Probable (3)	Medium (56)	Recoverable (3)	High	No	Very Low
	With Mitigation	Site (1)	Immediate (1)	Very Low (1)	Improbable (1)	Low (4)	Reversible (1)	Low	No	Very Low

Table 3: Evaluation of the No-Go Alternative (which means no changes to the status quo)

Impact	Nature	Extent	Duration	Magnitude	Probability	Significance	Reversibility	Irreplaceable Resource Loss
DISTURBANCE/ LOSS OF HABITAT	Negative direct impact – trampling of aquatic habitat to access the channel	Site (1)	Long term (4)	Low (4)	Probable (3)	Low (27)	Recoverable	No
EROSION AND SEDIMENTATION	Negative indirect impact – informal pathways through the saltmarsh causing sediment disturbance	Site (1)	Long term (4)	Low (4)	Probable (3)	Low (27)	Recoverable	No
MODIFIED HYDRODYNAMICS	Existing flow patterns from parking lot and paved areas continues.	Site (1)	Long term (4)	Low (4)	Probable (3)	Low (27)	Recoverable	No
POLLUTION	Existing hydrocarbon spillage from vehicles on parking lot and drivers training facility	Site (1)	Long term (4)	Low (4)	Probable (3)	Low (27)	Recoverable	No

11 CONCLUSION

The aquatic habitats within 500m of the project footprint were identified and mapped on a desktop level using available data. Following this, a site assessment was conducted to confirm desktop findings, gather additional information, and define the boundaries of the aquatic habitat. The groundtruthed findings are largely in alignment with the information of the desktop databases.

Two separate systems were identified within the 500m study area and risk assessment determined that only the Knysna Estuary would be impacted by this proposed project. The Knysna Estuary has a PES of B (Largely Natural) with high EIS and the Ashmead Channel adjacent to the development is currently impacted by the dysfunctional Knysna WWTW. This property has been infilled and existed since prior to 1973.

Impact assessment determined that after mitigation, the preferred alternative will have a low impact upon aquatic habitat, after mitigation. The project is unlikely to result in any significant change to ecosystem integrity or functioning. Mitigation should focus on limiting the disturbance area to an absolute minimum, the changing of design to remove the gravel parade ground and its associated parking area, retaining as much indigenous vegetation as far as possible (a Grow Don't Mow policy near the saltmarsh), ensuring that no hazardous waste leaves the facility into the surrounding ecosystem during operational phase and the implementation of SUDS.

In conclusion, there are no fatal flaws associated with the proposed activities provided all the mitigation measures are strictly implemented and monitored. The specialist has no objection to the authorisation of the proposed activity assuming that all mitigations are implemented.

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APPENDIX 1 –DETAILED METHODOLOGY

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 episodic 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.

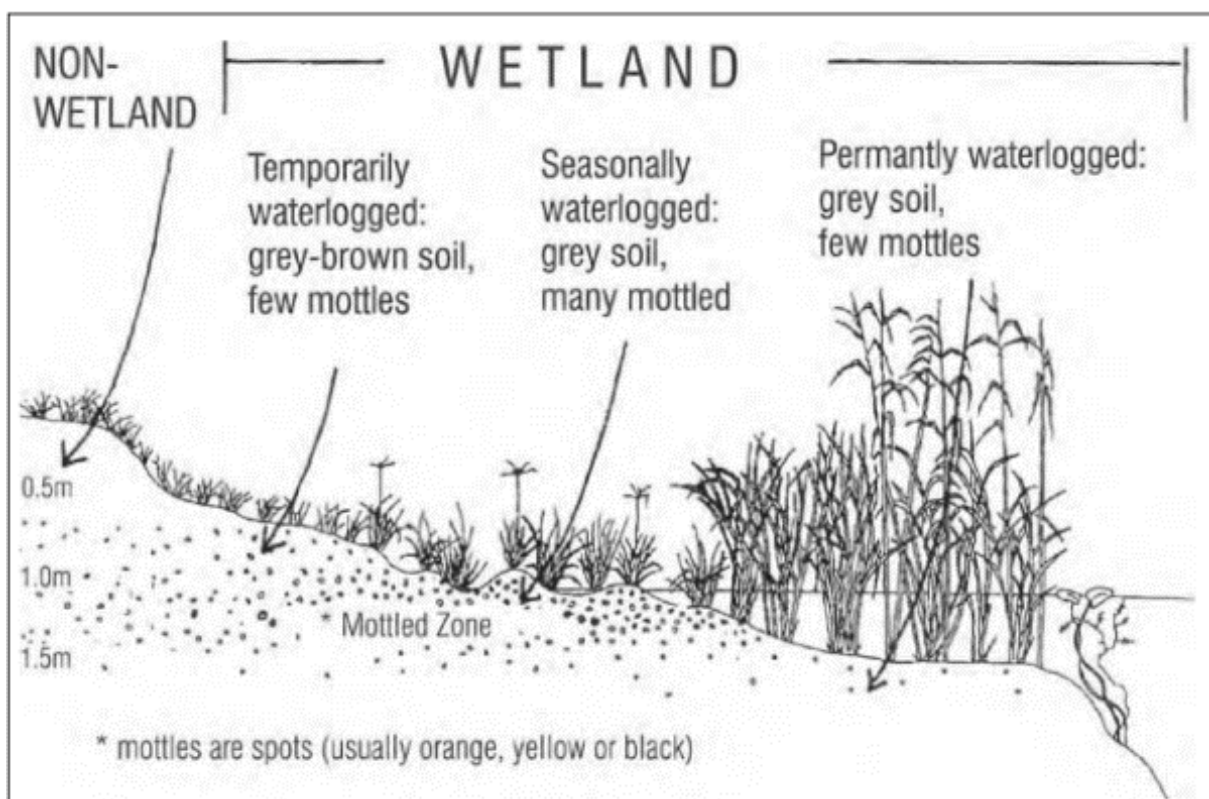


Figure A12.1a: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change as one move along a gradient of decreasing wetness, from the middle to the edge of the wetland. Source: Donovan Kotze, University of KwaZulu-Natal.

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 Ollis *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).

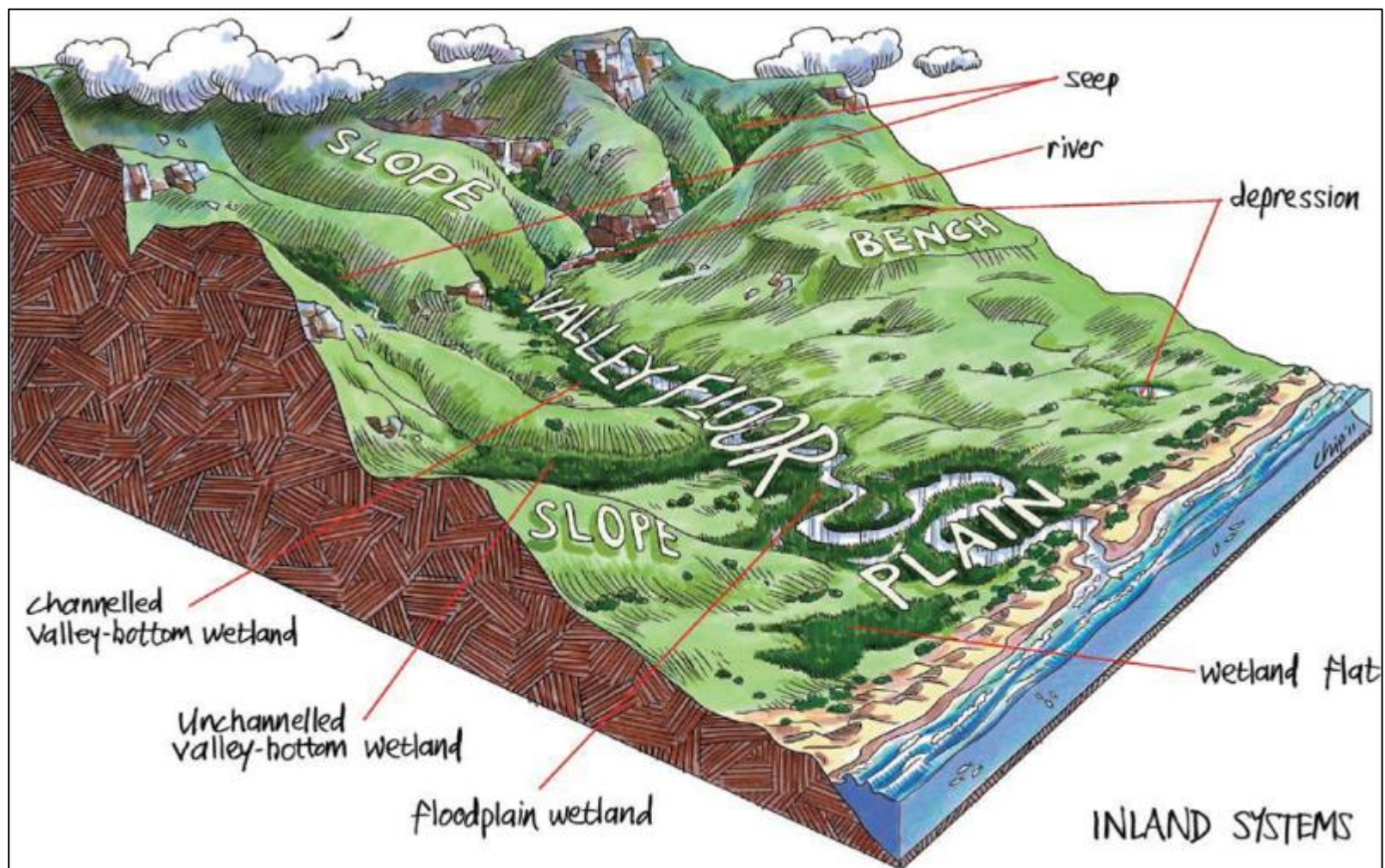


Figure A12.1b: Illustration of wetland types and their typical landscape setting (From Ollis *et al.* 2013)

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 (Figure 12.2a). Unlike wetland areas, riparian zones are usually not saturated for a long enough duration for redoximorphic 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 redoximorphic 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.

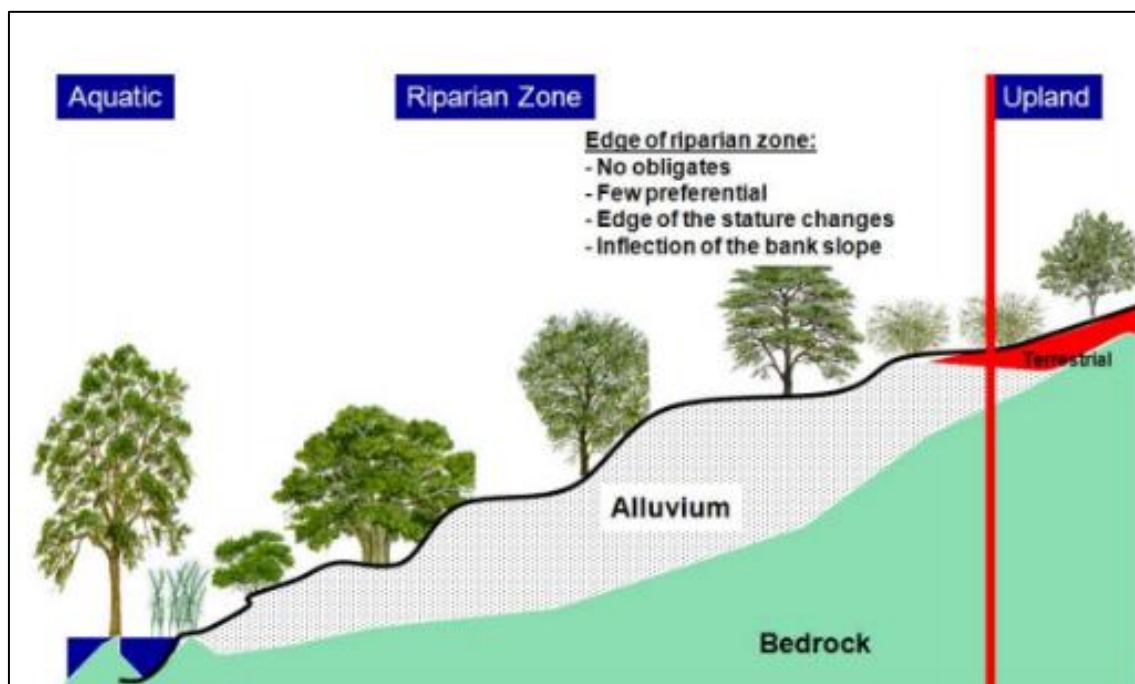


Figure A12.2a: A schematic diagram illustrating the edge of the riparian zone on one bank of a large river. Note the coincidence of the inflection (in slope) on the bank with the change in vegetation structure and composition. The edge of the riparian zone coincides with an inflection point on the bank; where there are

not obligates upslope; few preferential. The boundary also coincides with the outer edge of the stature differences (DWAF 2008).

12.3 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 (mineralogenic) 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	Wet-Health Category
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 habitats and biota may have taken place.	1 – 1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	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 features	6 – 7.9	E
Critical	Modifications have reached a critical level, and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10	F

12.4 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.

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			Provisioning benefits		Biodiversity maintenance ²		Through the provision of habitat and maintenance of natural process by the wetland, a contribution is made to maintaining biodiversity
						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-Ecoservices

12.5 PRESENT ECOLOGICAL STATE (PES) – RIPARIAN

Habitat is one of the most important factors that determine the health of river ecosystems since the availability and diversity of habitats (in-stream and riparian areas) are important determinants of the biota that are present in a river system (Kleynhans, 1996). The ‘habitat integrity’ of a river refers to the “maintenance of a balanced composition of physic-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region” (Kleynhans, 1996). It is seen as a surrogate for the assessment of biological responses to driver changes.

DWAF have developed a modified IHI, designed to accommodate the time constraints associated with desktop assessments or for instances where a rapid assessment of river conditions is required. The protocol does not distinguish between instream and riparian habitat and addresses six simple metrics to obtain an indication of Present Ecological State (PES). Each of the criteria are rated on a scale of 0 (close to natural) to 5 (critically modified) (Table A1.1) according to the following metrics:

- Bed modification

- Flow modification
- Inundation
- Bank condition
- Riparian zone condition
- Water quality modification

This assessment was informed by (i) a site visit where potential impacts to each metric were assessed and evaluated and (ii) an understanding of the catchment feeding the river and land uses / activities that could have a detrimental impact on river ecosystems.

Table A1.1: The rating scale for each of the various metrics in the assessment

Rating Score	Impact Class	Description
0	None	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.
0.5 - 1.0	Low	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.
1.5 - 2.0	Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited.
2.5 - 3.0	Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.
3.5 - 4.0	Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.
4.5 - 5.0	Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.

The six metric ratings of the HGM under assessment are then averaged, resulting in one value. This value determines the Habitat Integrity PES category for the HGM (Table A1.2).

Table A1.2: The habitat integrity PES categories

Habitat Integrity PES Category	Description
A: Natural	Unmodified, natural.
B: Good	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C: Fair	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.

D: Poor	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E: Seriously modified	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F: Critically modified	Critically / Extremely modified. Modifications have reached a critical level, and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed, and the changes are irreversible.

12.6 ECOLOGICAL IMPORTANCE & SENSITIVITY – RIPARIAN

The ecological importance of a wetland/river is an expression of its importance to the maintenance of biological diversity and ecological functioning on local and wider scales. Ecological sensitivity (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Kleynhans & Louw, 2007; Resh et al., 1988; Milner, 1994). Both abiotic and biotic components of the system are taken into consideration in the assessment of ecological importance and sensitivity (Table A1.3).

The scores assigned to the criteria in Table A1.3 were used to rate the overall EIS of each mapped unit according to Table A1.4, below, which was based on the criteria used by DWS for river eco-classification (Kleynhans & Louw, 2007) and the WET-Health wetland integrity assessment method (Macfarlane et al., 2008).

Table A1.3: Components considered for the assessment of the ecological importance and sensitivity of a riparian system. An example of the scoring has also been provided.

Ecological Importance and Sensitivity assessment (Rivers)		
Determinants		Score (0-4)
& BIOTA & RIPARIAN INSTREAM	Rare & endangered (range: 4=very high - 0 = none)	0,5
	Unique (endemic, isolated, etc.) (range: 4=very high - 0 = none)	0,0
	Intolerant (flow & flow related water quality) (range: 4=very high - 0 = none)	0,5
	Species/taxon richness (range: 4=very high - 1=low/marginal)	1,5
RIPARIAN INSTREAM HABITATS	Diversity of types (4=Very high - 1=marginal/low)	1,0
	Refugia (4=Very high - 1=marginal/low)	1,5
	Sensitivity to flow changes (4=Very high - 1=marginal/low)	1,0
	Sensitivity to flow related water quality changes (4=Very high - 1=marginal/low)	1,0
	Migration route/corridor (instream & riparian, range: 4=very high - 0 = none)	1,0

	Importance of conservation & natural areas (range, 4=very high - 0=very low)	2
MEDIAN OF DETERMINANTS		1,00
ECOLOGICAL IMPORTANCE AND SENSITIVITY CATEGORY (EIS)		LOW, EC=D

Table A1.4: The ratings associated with the assessment of the EIA for riparian areas

Rating	Explanation
None, Rating = 0	Rarely sensitive to changes in water quality/hydrological regime
Low, Rating =1	One or a few elements sensitive to changes in water quality/hydrological regime
Moderate, Rating =2	Some elements sensitive to changes in water quality/hydrological regime
High, Rating =3	Many elements sensitive to changes in water quality/ hydrological regime
Very high, Rating =4	Very many elements sensitive to changes in water quality/ hydrological regime

12.7 IMPACTS ASSESSMENT METHODS

Description and determination of the significance of the predicted impacts in terms of the criteria below to ensure a consistent and systematic basis for the decision-making process. Significance is numerically quantified on the basis score of the following impact parameters:

1. **Extent (E)** of the impact: The geographical extent of the impact on a given environmental receptor.
2. **Duration (D)** of the impact: The length of permanence of the impact on the environmental receptor.
3. **Reversibility (R) of the impact:** The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change
4. **Magnitude (M)** of the impact: The degree of alteration of the affected environmental receptor.
5. **Probability (P)** of the impact: The likelihood of the impact actually occurring.

A widely accepted numerical quantification of significance is the formula:

$$\mathbf{S=(E+D+R+M)*P}$$

Where: *Significance*=(*Extent+Duration+Reversibility+Magnitude*) * *Probability*

The significance of environmental impacts is determined and ranked by considering the criteria presented in **Table 11.7A** below. All criteria are rank according to ‘Very Low’, ‘Low’, ‘Moderate’, ‘High’ and ‘Very High’ and are assigned scores of 1 to 5 respectively.

Table 12.7A: *Defining the significant in terms of the impact criteria.*

Impact Criteria	Definition	Score	Criteria Description
Extent (E)	Site	1	Impact is on the site only
	Local	2	Impact is localized inside the activity area
	Regional	3	Impact is localized outside the activity area
	National	4	Widespread impact beyond site boundary. May be defined in various ways, e.g. cadastral, catchment, topographic
	International	5	Impact widespread far beyond site boundary. Nationally or beyond
Duration (D)	Immediate	1	On impact only
	Short term	2	Quickly reversible, less than project life. Usually up to 5 years.
	Medium term	3	Reversible over time. Usually between 5 and 15 years.
	Long term	4	Longer than 10 years. Usually for the project life.
	Permanent	5	Indefinite
Magnitude (M)	Very Low	1	No impact on processes
	Low	2	Qualitative: Minor deterioration, nuisance or irritation, minor change in species/habitat/diversity or resource, no or very little quality deterioration. Quantitative: No measurable change; Recommended level will never be exceeded.
	Moderate	3	Qualitative: Moderate deterioration, discomfort, Partial loss of habitat /biodiversity /resource or slight or alteration. Quantitative: Measurable deterioration; Recommended level will occasionally be exceeded.
	High	4	Qualitative: Substantial deterioration death, illness or injury, loss of habitat /diversity or resource, severe alteration or disturbance of important processes. Quantitative: Measurable deterioration; Recommended level will often be exceeded
	Very High	5	Permanent cessation of processes
Reversibility (R)	Reversible	1	Recovery which does not require rehabilitation and/or mitigation.
	Recoverable	3	Recovery which does require rehabilitation and/or mitigation.

Impact Criteria	Definition	Score	Criteria Description
	Irreversible	5	Not possible, despite action. The impact will still persist, and no mitigation will remedy or reverse the impact.
Probability (P)	Improbable	1	Not likely at all. No known risk or vulnerability to natural or induced hazards
	Low Probability	2	Unlikely; low likelihood; Seldom; low risk or vulnerability to natural or induced hazards
	Probable	3	Possible, distinct possibility, frequent; medium risk or vulnerability to natural or induced hazards.
	Highly Probable	4	Highly likely that there will be a continuous impact. High risk or vulnerability to natural or induced hazards
	Definite	5	Definite, regardless of prevention measures.

The *significance* (s) of potential impacts identified according to the criteria above has been colour coded for the purpose of comparison. This colour coding will be used in impact tables.

Significance is deemed Negative (-)		
0 - 30	31 - 60	61 - 100
Low	Medium	High

APPENDIX 2- SPECIALIST CV

CURRICULUM VITAE

COLIN JUSTIN FORDHAM

BSC (BOTANY, BIOCHEMISTRY)

**BSC BOTANY HONOURS (ENVIRONMENTAL
MANAGEMENT)**

MSC ENTOMOLOGY (BIOLOGICAL CONTROL)

Colin Justin Fordham

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

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APPENDIX 3 DRAFT MONITORING PLAN

Draft Monitoring Plan

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- **RESPONSIBLE PERSON**

- **Appointment:**

A SACNASP-registered scientist must be appointed to oversee and conduct monitoring activities requiring specialist input or analysis.

- **Monitoring Schedule:**

- **Before Construction:** Conduct baseline monitoring.
- **During Construction:** Perform monitoring monthly.
- **Post-Construction:** Conduct monitoring annually, or as recommended by the scientist after the first operational phase monitoring report.

- **Duties:**

- Conduct site inspections, collect water quality samples, and perform fixed-point photography.
- Analyse the results and compile a brief report detailing compliance levels and recommendations.
- Submit the report to the relevant authorities.

- **MONITORING POINTS**

- **Identification and Marking:**

Establish permanent and clearly mark (or GPS point) three monitoring points:

1. Upstream: To provide background conditions unaffected by the development.
2. At the mine: To assess direct impacts of runoff.
3. Downstream: To evaluate the cumulative effects of the development.

- **Documentation:**

Use fixed-point photography to create a visual record at each monitoring point, supporting observational notes.

- **MONITORING FREQUENCY**

- Baseline Data: Collect data before any commencement on site.
- During Construction: Conduct monitoring monthly.
- Operational Phase: Conduct monitoring annually, or as advised by the scientist following initial reporting.

- **VARIABLES TO MEASURE**

Water Quality

Test for parameters such as:

- Total Suspended Solids (mg/l)
- Nitrate Nitrogen (mg/l as N)
- Nitrite Nitrogen (mg/l as N)
- Ammonia Nitrogen (mg/l as N)
- Ortho Phosphate (mg/l as P)
- E. coli (count per 100 ml)
- Ammonium (mg/l as N)
- Total Kjeldahl Nitrogen (mg/l as N) – not that important
- Total Phosphate (mg/l as P)
- Total Residual Chlorine (µg/L) – not that important
- Free chlorine (mg/l) – not that important
- EC
- pH
- COD
- and any specific pollutants like hydrocarbons or heavy metals.

- Sample Collection: Use sterilized bottles for sample collection and ensure samples are analysed in an accredited laboratory.
- On-Site Testing: Utilize field kits for measuring pH, DO, and temperature.

Flow Patterns

Observations: Note whether water is present, its level, and its movement (e.g., standing, slow, fast flow).

Visual Observations: Regularly observing water levels and flow patterns at specific points along the watercourse can provide insights into any noticeable changes. You can use simple markers like stakes or painted rocks at key locations to track water levels over time.

Erosion and Sedimentation

- Visual Inspections: Check for signs of erosion, bank instability, and sediment accumulation.
- Control Structures: Inspect sediment control measures and stormwater outlets for functionality.
-

Vegetation

- Invasive Species: Identify any alien invasive plants and document any encroachment into buffer zones.
- Habitat Condition: Record signs of vegetation degradation or habitat change.

- **REPORTING AND ADAPTIVE MANAGEMENT**

- **Record-Keeping:**

Maintain a detailed logbook (e.g., Excel spreadsheet) of all monitoring activities, including:

- Weather conditions
- Observations
- Collected data

Photographic Records: Take regular photographs from fixed points to observe any changes in flow characteristics, water clarity, and the presence of sediment.

- **Reporting Schedule:**

- During Construction: Submit quarterly reports.
- Post-Construction: Submit annual reports.

- **Report Content:**

- Analysis of trends of
- Photographs of
- Deviations from baseline conditions
- Recommendations for corrective actions

- **Non-Compliance Response:**

- Notify authorities immediately upon identifying non-compliance.
- Consult with the SACNASP scientist to determine corrective measures.
- Implement actions to rectify issues and achieve compliance within one week.

- **ADAPTIVE MANAGEMENT**

- **Additional Measures:**

If necessary, and only after consultation with the scientist/ authorities, implement additional controls, such as:

- Installing sediment traps
- Adjusting stormwater management structures
- Reinforcing erosion control mechanisms

- **Plan Review:**

Reassess the effectiveness of monitoring and mitigation measures and update the plan as needed, in consultation with aquatic specialists.

- **Stakeholder Communication:**

Engage with relevant stakeholders and authorities if significant impacts occur and collaborate on solutions.

APPENDIX 4 -SPECIALIST DECLARATION

Specialist Name: B-BBEE	Company	Upstream Consulting		
		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.		
Physical address:		25 Blommekloof Street, George		
Postal address:		25 Blommekloof Street, George		
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: 05/09/2025

Project: Development of Kinetic Catamarans on Erf 1339 and the Redevelopment of the South African Sea Cadets on Erf 1316, Knysna

APPENDIX 5 -SITE SENSITIVITY VERIFICATION REPORT (SSVR)

Site verification report – Aquatic Ecology

Government Notice No. 645, dated 10 May 2019, includes the requirement that an Initial Site Sensitivity Verification Report must be produced for a development footprint. As per Part 1, Section 2.3, the outcome of the Initial Site Verification must be recorded in the form of a report that-

- (a) Confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;
- (b) Contains a motivation and evidence of either the verified or different use of the land and environmental sensitivity;
- (c) 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 ecology theme and addresses the content requirements of (a) and (b) above. The report will be appended to the respective specialist study included in the BAR Reports produced for the projects.

Site sensitivity based on the aquatic biodiversity theme included in the Screening Tool and specialist assessment

Based on the DFFE Screening Tool, the entire site is located within an area of Very High. This is due to Knysna estuary, FEPA Subcatchment and SWSA Outeniqua for Surface Water. Therefore, the project required the assessment and reporting of impacts on Aquatic Biodiversity. (Figure 1). Therefore, the project required the assessment and reporting of impacts on Aquatic Biodiversity.

The site verification assessment was undertaken and submitted to the client. The site verification specialist findings were informed by a site visit undertaken on the 17th of August 2025. The photographs within Plates 1 - 3 below show the various aquatic features present on site. This information was then compared to current wetland inventories, 1: 50 000 topocadastral surveys mapping and the site. A baseline map was then developed (Figure 1).

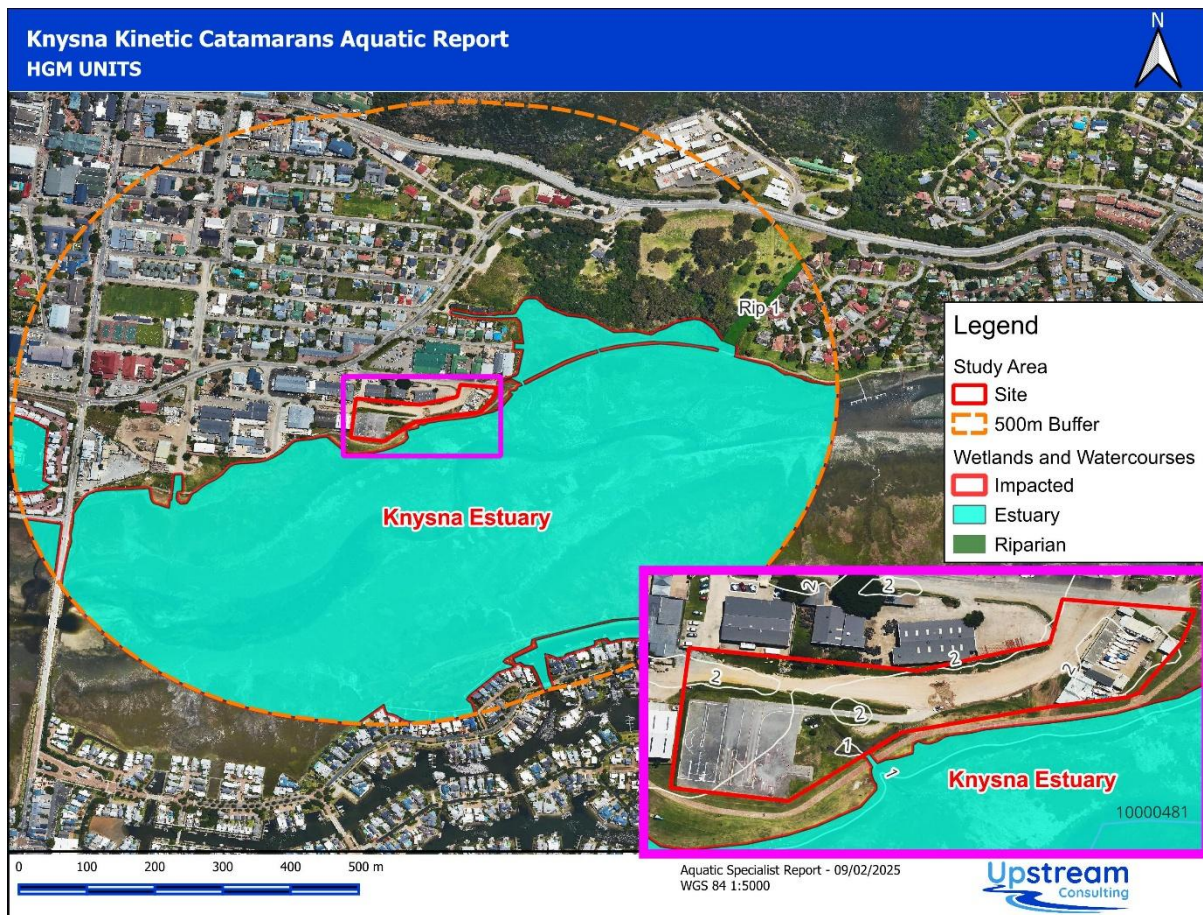


Figure 1: Delineated aquatic habitat within the study area



Plate 1: A photograph of the site adjacent to the Knysna Estuary.



Plate 2: A photograph of the Saltmarsh on the site where stormwater drains drain the site into the Knysna estuary



Plate 3: A photograph of the Jetty and slipway that the South African Sea Corp facility uses which will require maintenance and like for like replacement in future

Motivation of the outcomes of the sensitivity map and key conclusions

In conclusion, the DFFE Screening Tool resulted in Very High sensitivity ratings within the development footprint, and surrounding area, for Knysna estuary, FEPA Subcatchment and SWSA Outeniqua for Surface Water. The site should be assessed as sensitive with regards to aquatic biodiversity due to these aspects

It is recommended that a full Aquatic Biodiversity Impact Assessment is undertaken for the project.

The environmental sensitivity input received from the aquatic ecology specialist will be taken forward and considered within the formal EA process and the impact to these areas assessed. Appropriate layout and development restrictions will be implemented within the development footprint to ensure that the impact to aquatic ecology is deemed acceptable by the aquatic ecologist.