Proposed Mixed Use Development for RE/464 Gwayang Industrial Park, George.

Aquatic Biodiversity Scoping and Site Sensitivity Verification Report

Prepared For: Cape EAPrac

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DECLARATION OF SPECIALIST INDEPENDENCE

• I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);

• At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;

• Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;

• I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;

• I do not have any influence over decisions made by the governing authorities;

• I undertake to disclose 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 a competent authority to such a relevant authority and the applicant;

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• All the particulars furnished by me in this document are true and correct.

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Expertise: > 13 years' experience working on aquatic ecosystems across South Africa, with a focus on the Southern Cape in the last 7 years. Includes research and consulting expertise, having published > 10 water-related research articles and compiled > 400 aquatic specialist reports. Research and consulting have been in a range of sectors including agriculture, urban developments, linear structures, renewable energy, conservation, and mining.

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GLOSSARY

Buffer	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted to reduce the impact of adjacent land uses on the wetland or riparian area. Buffers are land use specific and are calculated for the specific environmental context and proposed land use.
Characteristics of a watercourse	Means the resource quality of watercourse within the extent of a watercourse.
Construction	Means any works undertaken to initiate or establish activities, site preparation including vegetation removal and ground levelling that may result in impeding or diverting or modifying resource quality.
Delineation of a wetland or riparian habitat	Means delineation of wetlands and riparian habitat according to the methodology as contained in the Department of Water Affairs and Forestry, 2008 publication: A Practical Field Procedure for Delineation of Wetlands and Riparian Areas or amended version.
Diverting	Means to, in any manner, cause the instream flow of water to be rerouted temporarily or permanently.
Flow-altering	Means to, in any manner, alter the instream flow route, speed or quantity of water temporarily or permanently.
Impeding	Means to, in any manner, hinder or obstruct the instream flow of water temporarily or permanently.
Regulated area of a watercourse	a) The outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, dams and lakes. b) In the absence of a determined 1 in 100-year flood line or riparian area as contemplated in (a) above the area within 100m of distance from the edge of a watercourse where the edge of the watercourse (excluding floodplains) is the first identifiable annual bank fill flood bench. c) In respect of a wetland: a 500m radius around the delineated boundary (extent) of any wetland (including pans).
Rehabilitation	Means the process of reinstating natural ecological driving forces within part or whole of a degraded watercourse to recover former or desired ecosystem structure, function, biotic composition and associated ecosystem services.
Resource quality	Of a watercourse means the quality of all the aspects of a water resource including: (a) The quantity, pattern, timing, water level and assurance of instream flow; (b) The water quality, including the physical, chemical and biological characteristics of the water; (c) The character and condition of the instream and riparian habitat, and; (d) The characteristics, condition and distribution of the aquatic biota.
Site Assessment	Comprehensive evaluation of the proposed development site, including the identification of wetlands, watercourses, and soil characteristics.
Topography	The physical features of the land surface, considered for its potential influence on drainage and ecological features.
Vadose Zone	Extends from the top of the ground surface to the water table. Also known as the unsaturated zone.

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ABBREVIATIONS

CBA:	Critical Biodiversity Area
CD:NGI:	Chief Directorate: National Geo-spatial Information
CR:	Critical Endangered
DFFE:	Department of Environment, Forestry and Fisheries
DWAF:	Department of Water Affairs and Forestry
DWS:	Department of Water & Sanitation
EIS:	Ecological Importance and Sensitivity
ESA:	Ecological Support Area
FEPA:	Freshwater Ecosystem Priority Area
GA:	General Authorisation
GPS:	Global Positioning System
NEMA:	National Environmental Management Act
NFEPA:	National Freshwater Ecosystem Priority Areas
NWA:	National Water Act
NWM5:	National Wetland Map 5
PES:	Present Ecological State
SACNASP:	South African Council for Natural Scientific Professions
SWSA:	Strategic Water Source Areas
WCBSP:	Western Cape Biodiversity Spatial Plan
WUL:	Water Use License

1. INTRODUCTION

Confluent Environmental (Pty) Ltd were appointed by Cape EAPrac to compile an aquatic specialist scoping report as part of the Environmental Impact Assessment for a proposed mixed-use development on a portion of RE/464, Pacaltsdorp, George. The development has been proposed by the George Municipality and the proposed development area is approximately 185 hectares in extent (Figure 1). It is located adjacent to the R102 'airport road' from which access to the site is obtained. Another access point is through an existing residential suburb (Groeneweide Park) on the north-eastern area from York Street which is the main road into the George CBD. The site is therefore well located from a development perspective. The Gwaing River is in the valley bottom west of the site with tributaries extending across the site which ultimately reach the river. West of the site and adacent to the river are significant existing features, namely the George waste disposal site (dump) and the Gwaing Wastewater Treatment Works (WWTW). Southeast of a site is an existing industrial area located between the N2 highway and York Street.

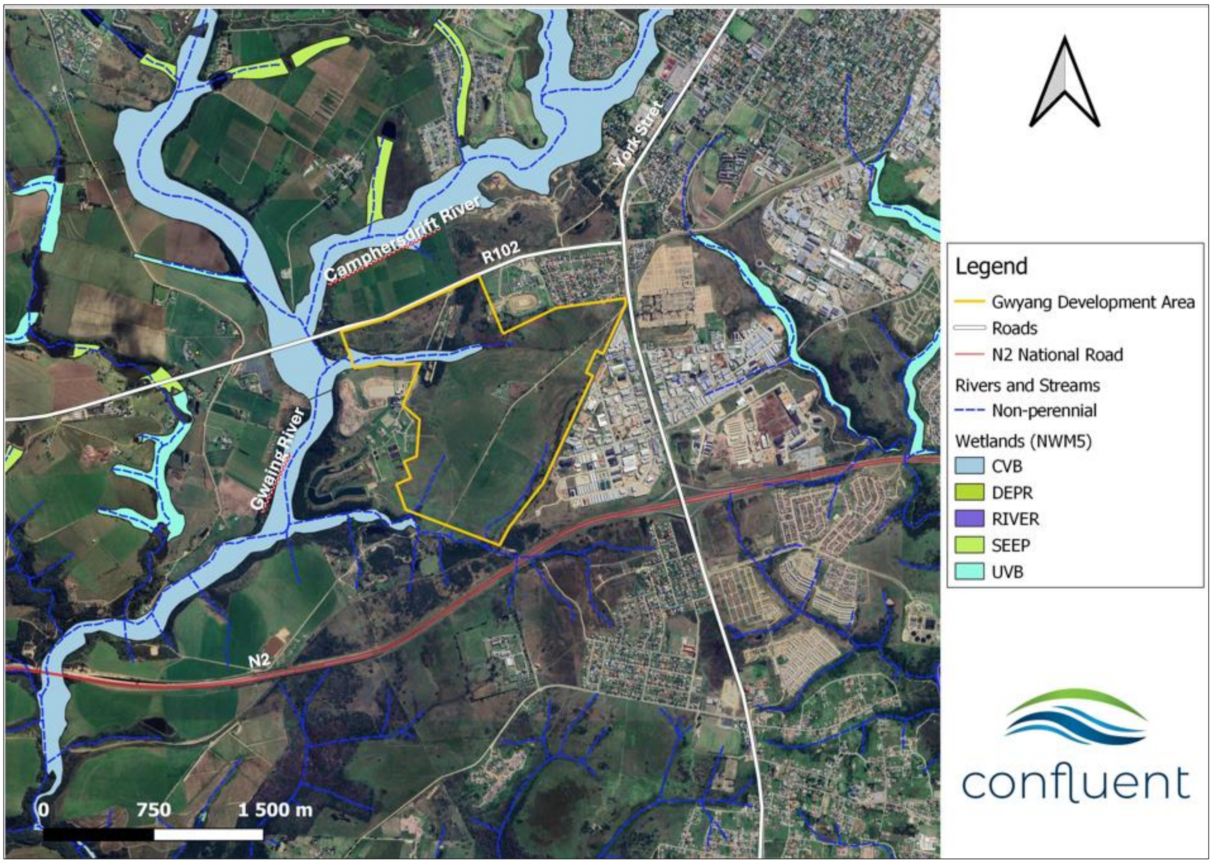


Figure 1. Location of the proposed development area on RE/464 in George showing mapped watercourses and roads for reference.

1.1 The Proposed Development

The development is proposed by the George Municipality who would like to create registrable erven for release in an integrated mixed-use development. An initial Aquatic Biodiversity Sensitivity Screening report was compiled to inform the conceptual development plan, which has subsequently been revised to produce at least two alternative layouts, and may still be modified to accommodate various requirements and site sensitivities.

For both layouts, the development assessed in this report would result in the development of significant residential areas for expansion in the form of group housing and apartments. Industrial areas would include light and heavy industry, but the specifications were unknown at the time or writing. Large business / retail complexes referred to as 'big box developments' are planned for along the R102, and facilities supporting the local community such as a creche and religious centre would be incorporated. The development would need be serviced by an interconnected network of roads and would require the installation of supporting services such as water and sewerage connections and pipelines.

The relative areas of each land use is summarised in Table 1 and the proposed layout of the preferred layout is shown in Figure 2.

Table 1. Land use areas proposed corresponding to the Preferred Layout Site Development Plan.

Land Use Description	Zoning - George Integrated Zoning Scheme By-Law	Units	Stands	Area (ha)	% Ha
Group Housing	General Residential Zone II Group Housing	137	4	3.9	1.17%
Apartment Housing	General Residential Zone IV Flats/Apartments	1850	7	9.3	2.79%
Light Industrial	Industrial Zone I	-	32	17.8	5.34%
Heavy Industrial	Industrial Zone II & III	-	16	36.5	10.95%
Mixed Use / Business / Retail	Business Zone I	-	8	15.1	4.53%
Public facilities (Creche's & religious centre)	Community Zone I & II	-	4	0.3	0.09%
Public Squares	Open Space Zone I	-	4	0.7	0.21%
Municipal Land Fill Site & WWTW	Utility Zone	-	2	57.9	17.37%
Municipal Solar Farm	Utility Zone	-	1	24.5	7.35%
Open / conservation areas etc.	Open Space Zone I	-	9	134	40.20%
Planned roads	Transport Zone II	-	TBC	33.4	10.02%
Total number of units/stands		**1988**	**87**	**333.3**	**100%**

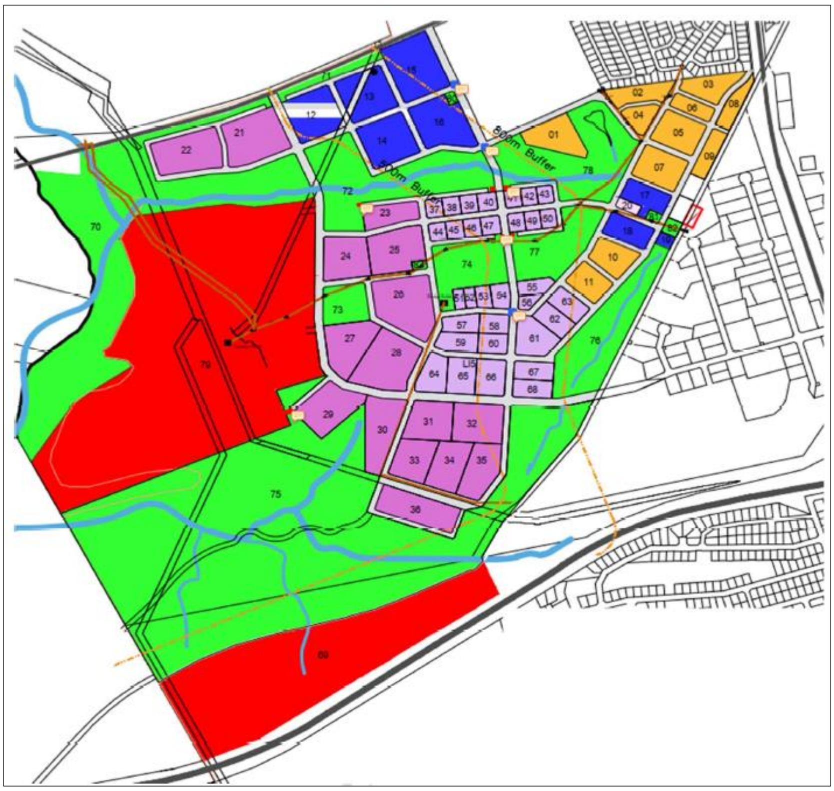


Figure 2. Preferred Site Development Plan for RE/464, Gwayang Precinct.

Following a series of engagements between the biodiversity specialist team, planning, designers, and project managers, an alternative Site Development Plan was developed (Table 2 and Figure 3).

Table 2. Land use areas proposed corresponding to the Alternative Layout Site Development Plan.

Gwayang Development - George										
Projected Land Use										
Land Use Description	Zoning - George Integrated Zoning Scheme By-Law	Units	Stands	Density	stand size (average)	Area (ha)	FAR	GLA (m2)	% of total area	% of units
Group Housing	General Residential Zone II Group Housing	145	4	35	285	4.1	na	na	4.1%	7.6%
Apartment Housing	General Residential Zone IV Flats/Apartments	1762	7	200	1.3	8.8	1.0	88081	8.8%	92.4%
Light Industrial	Industrial Zone I	na	32	na	0.6	20.7	1.5	310637	11.4%	na
Heavy Industrial	Industrial Zone II & III	na	17	na	2.2	38.1	1.5	570926	21.0%	na
Mixed Use / Business / Retail	Business Zone I	na	8	na	2	15.0	3.0	450525	8.3%	na
Public facilities (Creche's & religious centre)	Community Zone I & II	na	4	na	0.07	0.3	1.0	2607	0.1%	na
Open / conservation areas etc.	Undetermine Use Zone	na	na	na	na	0.3	na	na	0.1%	na
Open / conservation areas etc.	Open Space Zone I	na	4	na	1.0	55.9	na	na	30.8%	na
Planned roads	Transport Zone II	na	tbd	na	na	38.2	na	na	21.1%	na
Total number of units/stands		1907	75			181.3			100%	100%

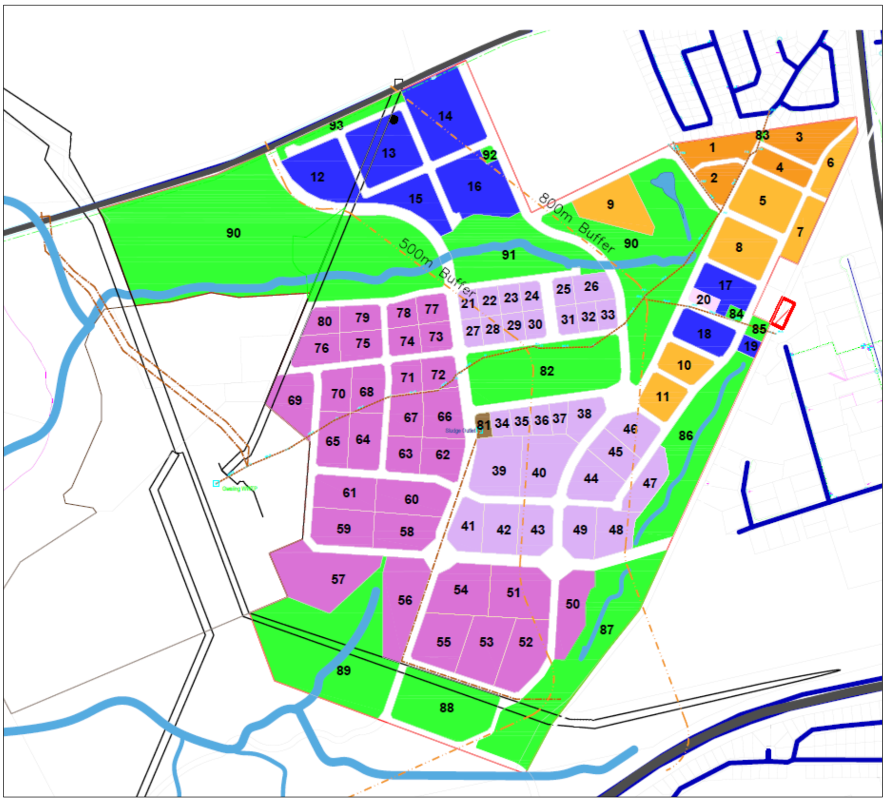


Figure 3. Alternative Site Development Plan following engagement with biodiversity specialists.

Benefits of the Alternative SDP are that it aims to cross fewer watercourses at less sensitive points, avoid an area of sensitive fynbos, and avoid an area adjacent to the airport road where golden moles have been recorded.

1.2 Key Legislative Requirements & Scope of Work

1.2.1 DFFE Screening Tool Results

According to the Department of Environment, Forestry and Fisheries (DFFE) screening tool, aquatic biodiversity at the site has a **Very High** sensitivity (Figure 4). The sensitivity features upon which this rating is based are:

- Critical Biodiversity Areas: Aquatic
- Rivers
- Strategic Water Source Area
- Wetlands and Estuaries

The scope of work for this report is guided by the legislative requirements of the National Environmental Management Act (NEMA) and the National Water Act (NWA; Act No 36 of 1998).

While the animal species theme did not form part of this assessment, it is important to note this theme has a HIGH sensitivity for various species including the Knysna Leaf-folding Frog (*Afrixalus knysnae*) which occurs in depression wetlands in the George area with fairly specific habitat requirements.

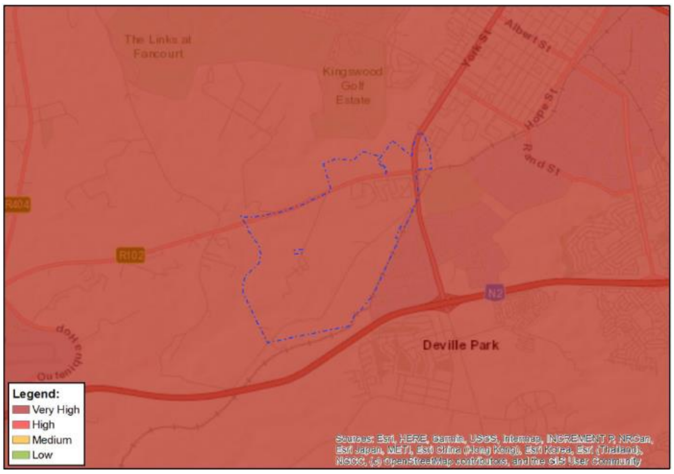


Figure 4. Results of the DFFE Screening Tool which indicate Very High Sensitivity of the Aquatic Biodiversity theme for RE/464.

1.2.2 National Environmental Management Act

According to the protocols specified in GN 320 (Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity) of the National Environmental Management Act (NEMA; Act No. 107 of 1998), assessment and reporting requirements for aquatic biodiversity are associated with a level of environmental sensitivity identified by the national web-based environmental screening tool (screening tool). An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being of:

- **Very High** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment; or
- **Low** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement.

The screening tool classified the site as being of **Very High** aquatic biodiversity. According to the protocol, a site sensitivity verification must be undertaken to confirm the sensitivity of the site as indicated by the screening tool. This includes an assessment of the following:

Interrogation of available desktop resources including:

- DWS spatial layers (1:50 000 rivers)
- National Freshwater Ecosystem Priority Areas (NFEPA) spatial layers (Nel *et al.,* 2011)
- National Wetland Map 5 and Confidence Map (CSIR, 2018)
- Western Cape Biodiversity Spatial Plan (WCBSP, 2017).

Conduct a site visit to determine the site sensitivity:

- Identification and classification of watercourses within and adjacent to the site according to methods detailed by Ollis *et al*. (2013);
- Determine the watercourse Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) using an appropriate method (if watercourses are present).
- Delineate wetland / riparian areas following methods prescribed by DWAF (2015).

- Determine an appropriate buffer for wetland areas using the site-specific buffer tool developed by Macfarlane and Bredin (2016).

1.2.3 National Water Act

The Department of Water & Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers.

A watercourse means:

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

For the purposes of this assessment, a wetland area is defined according to the NWA (Act No. 36 of 1998) as:

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

Wetlands must therefore have one or more of the following attributes to meet the NWA wetland definition (DWAF, 2005):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil;
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils; and
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

No activity may take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). According to Section 21 (c) and (i) of the National Water Act, an authorization (Water Use License or General Authorisation) is required for any activities that impede or divert the flow of water in a watercourse or alter the bed, banks, course or characteristics of a watercourse. The regulated area of a watercourse for section 21(c) or (i) of the Act water uses means:

a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or

c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

According to Section 21 (c) and (i) of the NWA, any water use activities that do occur within the regulated area of a watercourse must be assessed using the DWS Risk Assessment Matrix (GN 4167 of 2023) to determine the impact of construction and operational activities on the flow, water quality, habitat and biotic characteristics of the watercourse. Low-Risk activities require a General Authorisation (GA), while Medium or High-Risk activities require a Water Use License (WUL).

2. CATCHMENT CONTEXT

2.1 Catchment Features

The project area is located within the southeastern coastal belt (Ecoregion Level 2:20.02). The terrain is described as closed hills of moderate and high relief and moderately undulating plains. Altitude ranges between 0 - 1300 m.a.m.s.l.

Combined environmental features such as high soil erodibility and rainfall intensity, coupled with low soil permeability make the site susceptible to erosion which could potentially damage infrastructure if stormwater is not well managed making extensive use of Sustainable Drainage Systems (SuDS) practices (Table 3).

Topography of the site is variable but generally gently sloping in agricultural areas which drain towards more steeply sloped watercourses.

Table 3. Summary of relevant catchment features for the proposed development area.

Feature	Description
Quaternary catchment	K30B
Mean Annual Runoff	300 mm
Mean Annual Precipitation	787 mm
Inherent erosion potential of soils (K-factor)	0.7, High
Soil permeability	Low, (estimated at 10^{-6} m/s)*
Rainfall intensity	Zone 4, Very High
Ecoregion Level II	20.02: south-eastern coastal belt
Geomorphological Zone	D, Upper foothills
NFEPA area	None defined
Mapped Vegetation Type	Terrestrial: Garden Route Granite Fynbos (FFg5; Critically Endangered) Aquatic: Cape Lowland Alluvial Vegetation (Aza2; Endangered)
Conservation	Garden Route Biosphere Reserve Critical Biodiversity Areas Critical Biodiversity Areas (Degraded) Ecological Support Areas (Restore)

The Mean Annual Precipitation for quaternary catchment K30B is 787 mm and the Mean Annual Runoff is 300 mm (Table 3). Rainfall occurs year-round with seasonal peaks in spring and autumn (Figure 5).

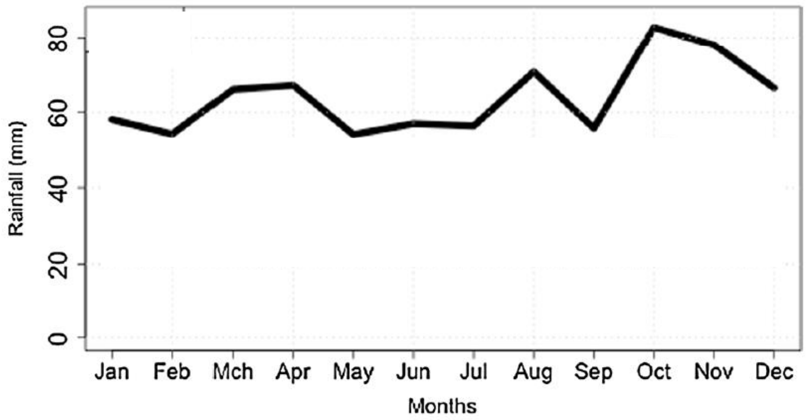


Figure 5. Area-averaged monthly rainfall for the coastal Southern Cape indicating peaks in Mar-Apr, Aug, and Oct. Data averaged between 1979 and 2011 (Engelbrecht et al., 2015).

The project area is located within the southeastern coastal belt (Ecoregion Level 2:20.02). The terrain is described as closed hills of moderate and high relief and moderately undulating plains. Altitude ranges between 0 – 1 300 m.a.m.s.l.

2.2 Vegetation

The mapped vegetation type for most of the site is Garden Route Granite Fynbos which has a conservation status of *Critically Endangered* (Figure 6). This status was amended in 2014 from the previous status of Endangered due to increasing development in areas where the vegetation type occurs in and around George.

Vegetation along the Gwaing River is mapped as Cape Lowland Alluvial Vegetation. This vegetation type was gazetted in 2022 as *Endangered* and is associated with flat landscapes with slow-flowing, meandering rivers. Soils are typically alluvial fine sandy, silty and clayey.

Both highlighted vegetation types are indicated as narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018) placing the ecosystem at risk of collapse.

Natural vegetation at the project site has been historically disturbed by clearance for pasture and contouring of fields which were used for dryland grazing for many decades. This was followed by irrigation with treated wastewater from the Gwayang WWTW over extensive areas. High densities of alien invasive plants occur along the Gwaing River which have modified the original vegetation type. These include extensive stands of very large *Eucalyptus* sp. trees.

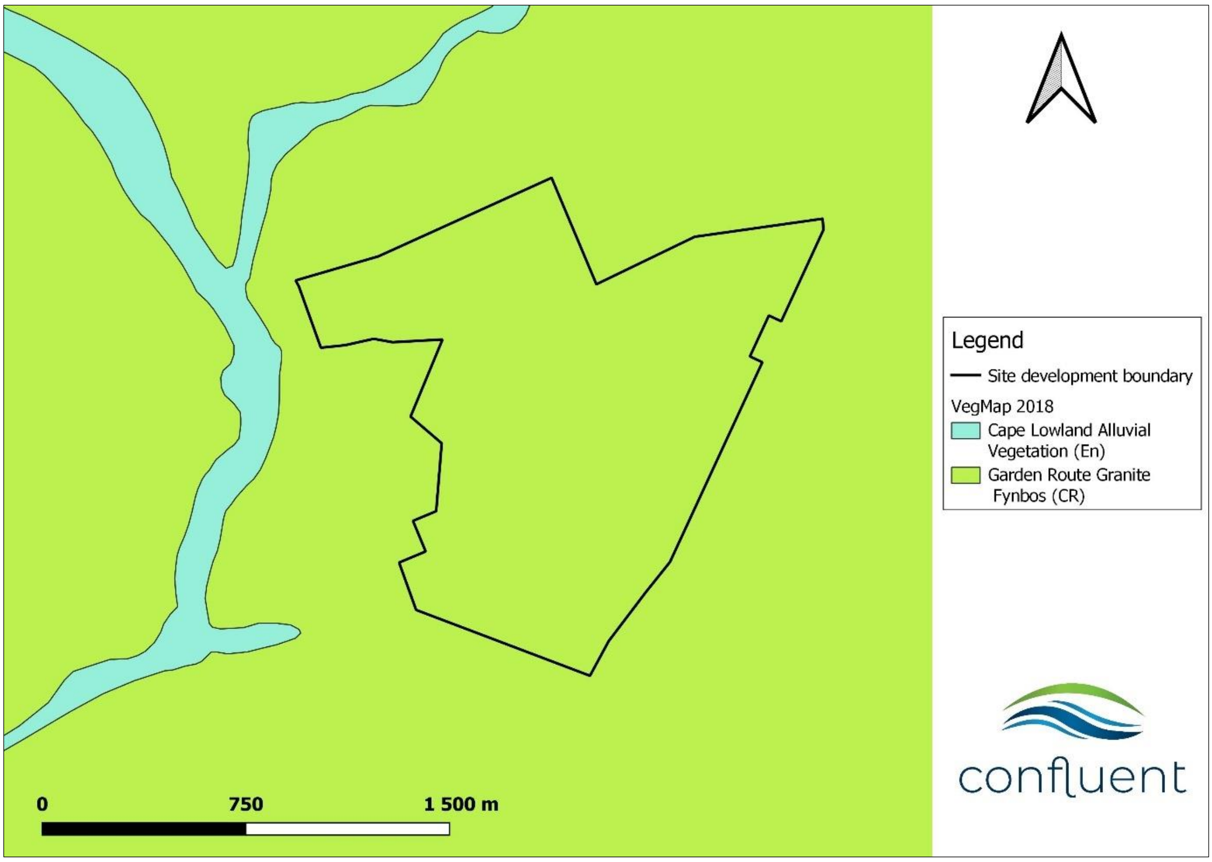


Figure 6. Mapped vegetation types on and near the development site according to SANBI VegMap (2018).

2.3 Conservation and Catchment Management

2.3.1 Western Cape Biodiversity Spatial Plan

A map of the conservation classification areas the Western Cape Biodiversity Spatial Plan (WCBSP; 2017) is presented in Figure 7. The Gwaing River is predoominantly classified as Critical Biodiversity Area Level 1, (**CBA1; Aquatic**). The two westerly flowing tributaries of the Gwaing River have mixed classifications with areas indicated as CBA1, CBA2 (Degraded) and Ecological Support Areas to be Restored (ESA2). The definitions and management objectives for each of these categories is provided in Table 4. Necessary actions in relation to the WCBSP are to ensure that development on the site does not result in negative impacts to the ecological structure and function of watercourses adjacent to the site.

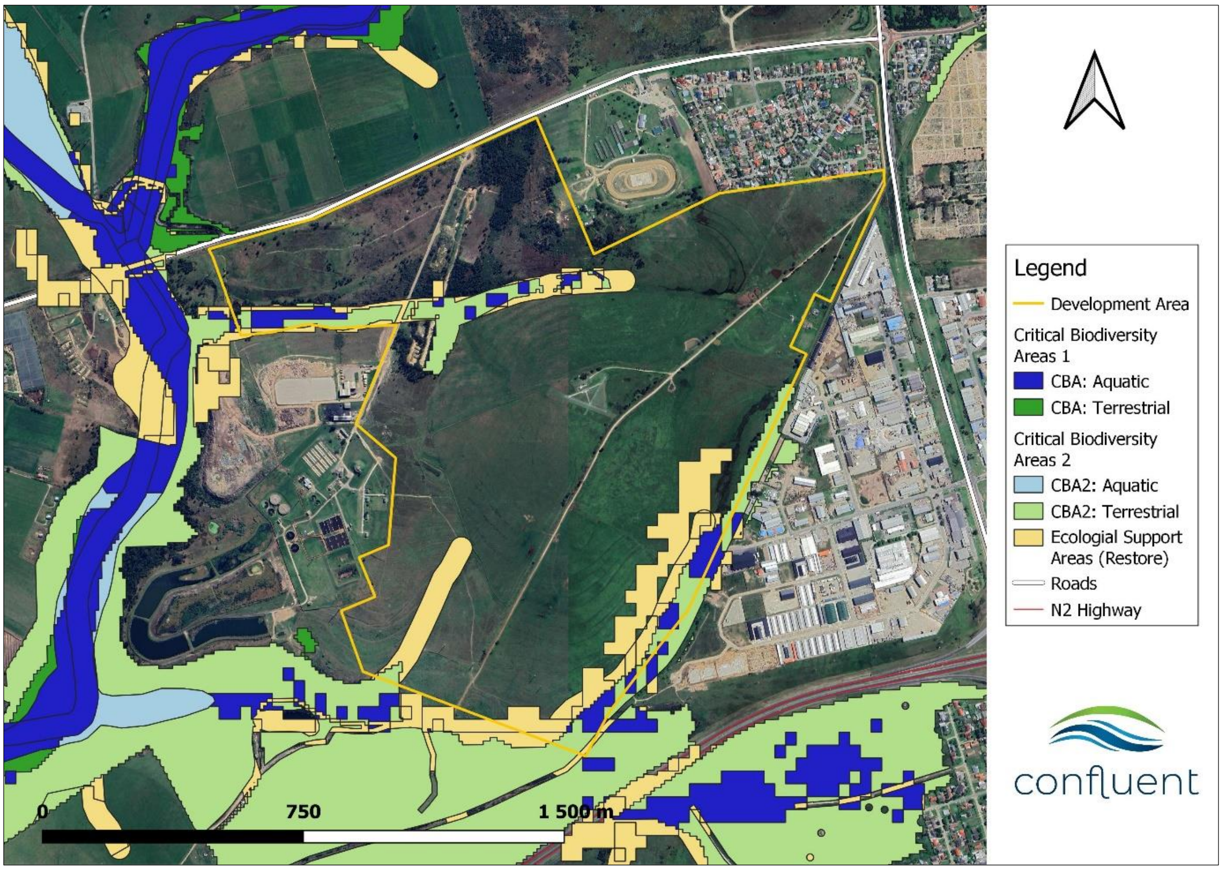


Figure 7. The Gwayang development area in relation to mapped conservation features of the Western Cape Biodiversity Spatial Plan (2017).

Table 4. Definitions and objectives for conservation categories identified in the Western Cape Biodiversity Spatial Plan (WCBSP, 2017).

Area Classification	Definition	Management Objective
Critical Biodiversity Area 1 (CBA1)	"Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure."	"Maintain in a natural or near-natural state, with no further loss of natural habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate."
Critical Biodiversity Area 2 (CBA2; Degraded)	"Areas in a degraded or secondary condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure."	"Maintain in a natural or near-natural state, with no further loss of habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land-uses are appropriate."
Ecological Support Area 2 (ESA2; Restore)	"Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of	"Restore and/or manage to minimize impact on ecological processes and ecological

	PAs or CBAs and are often vital for delivering ecosystem services.”	infrastructure functioning, especially soil and water-related services, and to allow for faunal movement.”

2.3.2 National Freshwater Ecosystem Priority Areas

The sub-quaternary catchment of the project area has not been classified at any level according to the National Freshwater Ecosystem Priority Atlas (NFEPA; Nel *et al.,* 2011).

2.3.3 Catchment Conservation Issues

The Freshwater Biodiversity Information System (FBIS) has no records of historical fish sampling along the Gwaing River, but records show that *Galaxias zebratus* (Cape galaxias) and *Sandelia capensis* (Cape kurper) have been recorded in the Malgas River upstream. Theoretically they should occur in the Gwaing River, but as no targeted sampling has been conducted it is not known whether they still occur in the river. It is also likely that these fish have been extirpated from the local reach given the water quality impacts associated with the discharge of wastewater, and possibly leachate from the waste dump. The conservation status of these fish species according to the IUCN Red List is ‘Data Deficient’ and ‘Decreasing’ respectively. As regional endemic fish species, it is important to maintain water quality and habitat in rivers to a degree that does not compromise their persistence within the river system.

From this perspective any development at the site should not further compromise water quality in the Gwaing River, and should aim to ensure that water leaving the site is of a good quality.

2.3.4 Resource Quality Objectives

Resource Quality Objectives (RQOs) are defined as clear goals (numerical or descriptive statements) relating to the quality of a water resource and are set in accordance to the management class for the resource to ensure the water resource is protected. The purpose of RQOs is to set clear objectives for the resource against which water use licenses and the related impacts can be evaluated and managed to achieve a balance between the need to protect and utilise the resource. The Breede-Gouritz Catchment Management Agency (BGCMA) recently concluded an assessment of major rivers in the Water Management Area (DWS, 2018).

The Gwaing River was assessed, and the Present Ecological State (PES) was classified as E, Seriously Modified. The Target Ecological Category (TEC) is to maintain the PES at this level. Numerical limits in terms of water quality are defined below:

Dissolved Inorganic Nitrogen	< 100 µg/L
Dissolved Inorganic Phosphate	< 20 µg/L
Turbidity	< 10 NTU
Dissolved Oxygen	> 5 mg/L
E. coli	< 500 / 100 ml

These parameters are not measured routinely on the Gwaing River and should therefore be assessed as part of the more detailed impact assessment for the proposed development. This will provide a comprehensive baseline understanding of existing impacts affecting water quality at the site.

2.4 Mapped Watercourses

Mapped watercourses are indicated in Figure 8. Wetlands and flow paths are mapped at a national scale using spatial data with some ground-truthing. This means that sites must be thoroughly ground-truthed to verify the presence and classification of mapped watercourses, and to indicate where watercourses occur that have not been mapped. The latter occurs frequently in George which is an area rich in wetlands that are not well represented on national spatial layers.

The 1 m site contours are indicated in Figure 8 and can be used to indicate possible areas where wetlands could occur on the site. However, while most wetlands occur in valley-bottoms, it is definitely not uncommon for wetlands to occur on flat areas or hillslopes. Ground-truthing of the site for watercourses therefore entails a thorough assessment of the complete site following a desktop review of possible wet areas.

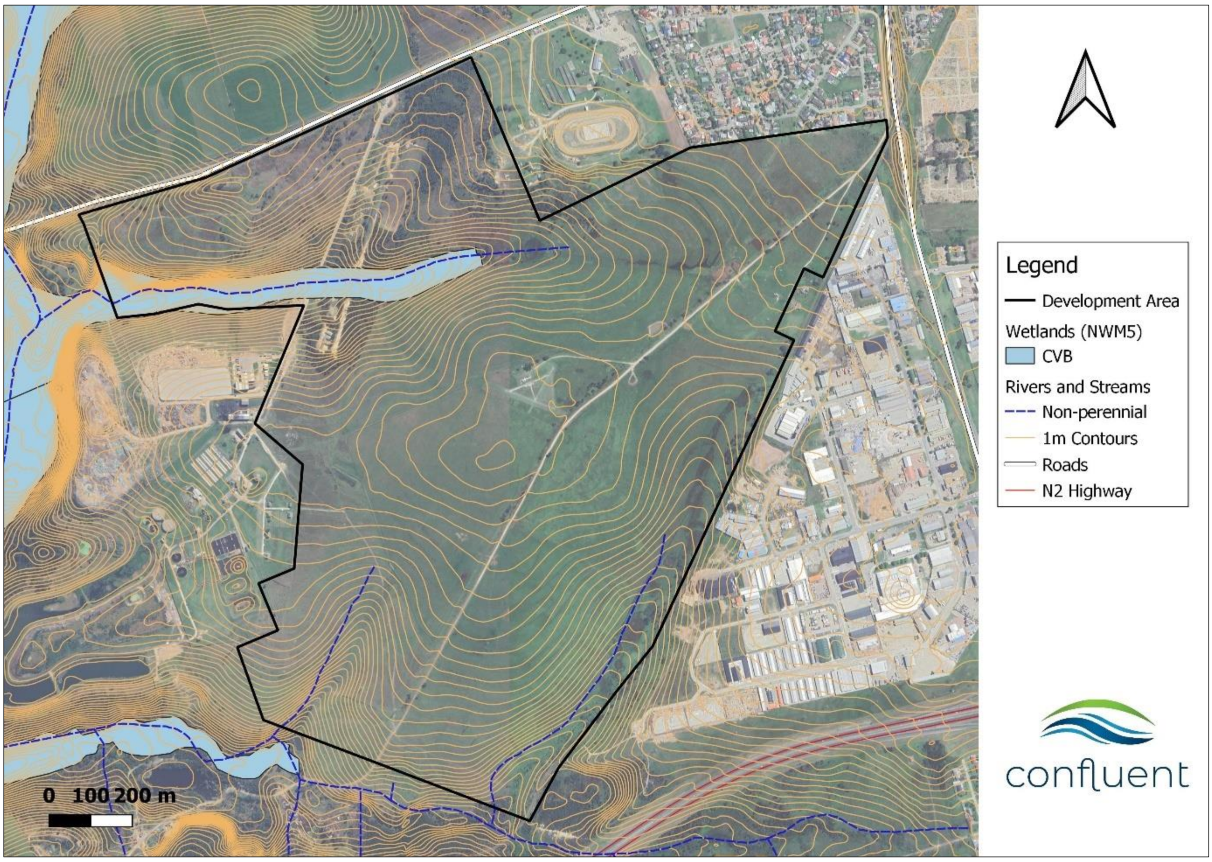
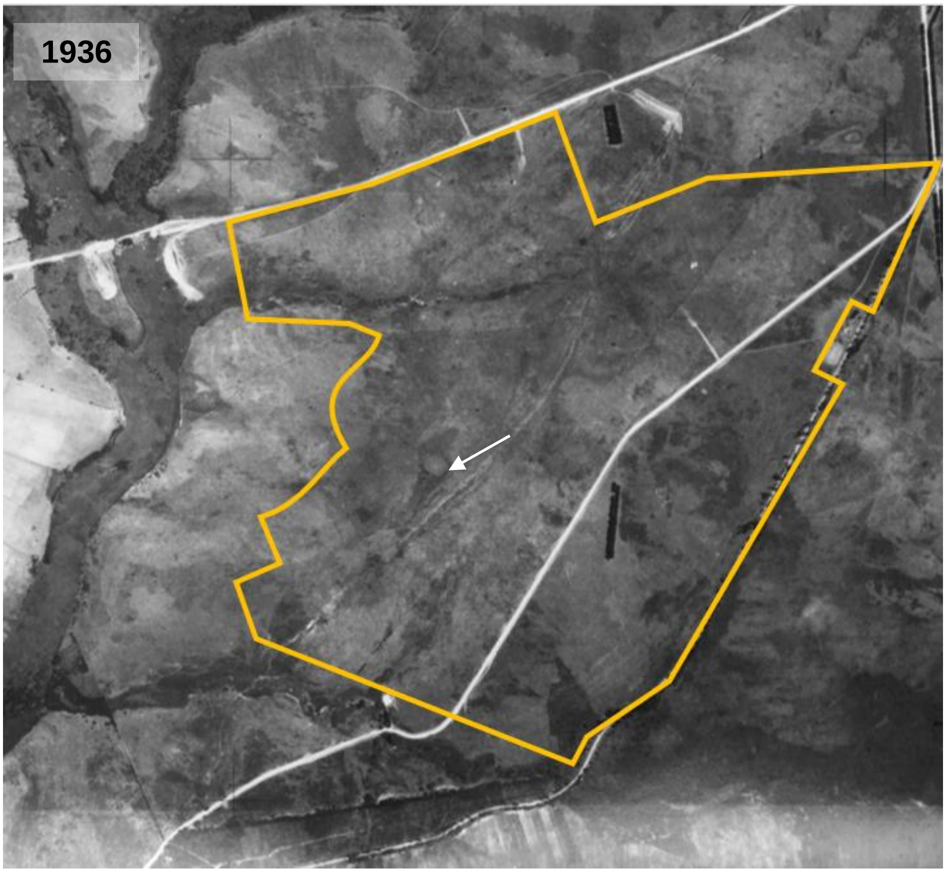


Figure 8. Mapped watercourses according to the National Wetland Map 5 (NWM5) and 1:50 000 flow paths (DWS).

2.5 Historical Assessment

The development area has had a lot of historical disturbance. In 1936 the two westerly flowing tributaries of the Gwaing River are very distinct. The Gwaing River also showed a very distinct margin which was undisturbed by present day impacts associated with multiple impacts such as diggings, WWTW, landfill and widespread alien invasion. The road which transects the south-eastern portion of the site was present in 1936 and is in approximately the same location at present. The railway line that forms part of the south-eastern boundary had already been constructed in 1936.



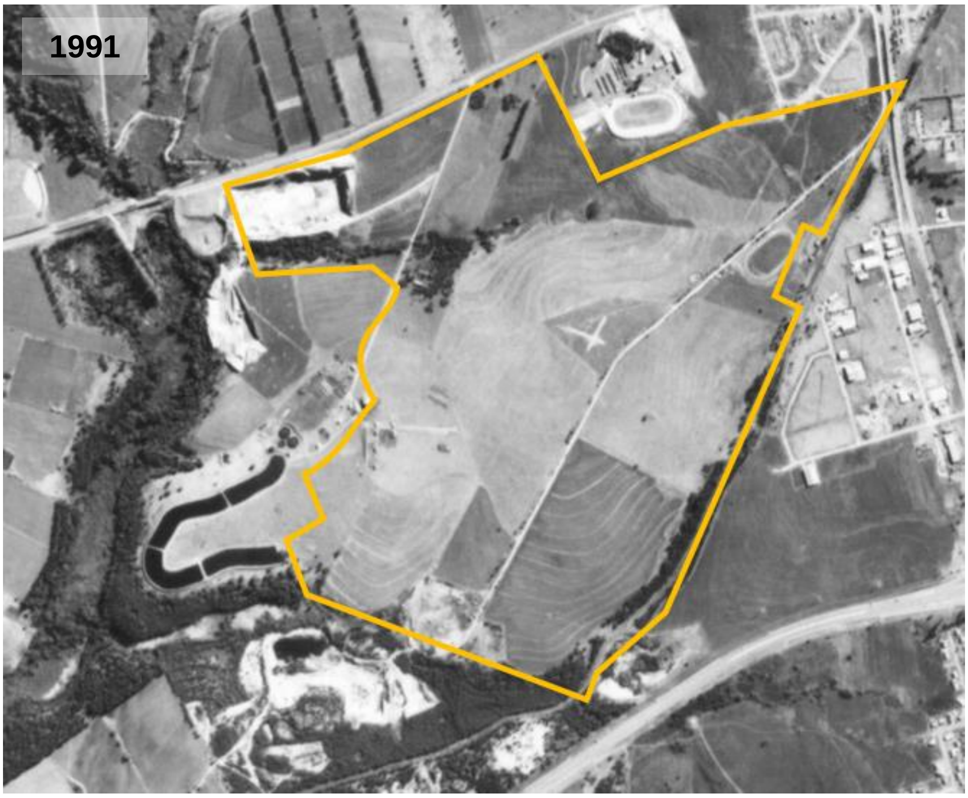


Figure 9: Historical photos showing the development area through notable changes between 1936 and 1991 (CD:NGI & Google Earth imagery).

A present-day image of the site has been overlaid with areas of historical and present modifications and large-scale disturbances. Agricultural fields were not identified in Figure 10 but make up the bulk of the remainder of the site. Fields are currently utilised for grazing cattle and were historically irrigated with moveable sprinklers using water from the WWTW. Kikuyu grass was sown on some of the fields for the purpose of commercial supply of instant lawn. This operation has ceased along with the irrigation.

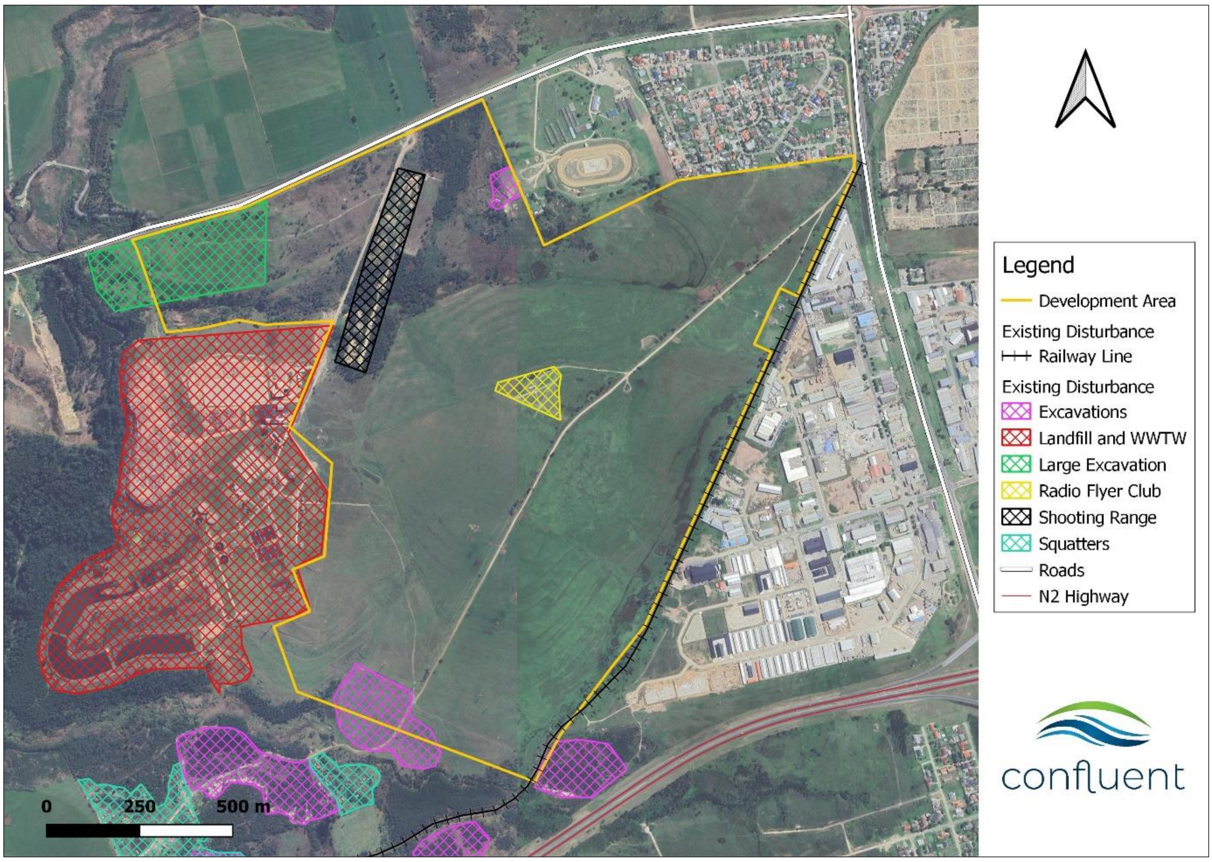


Figure 10. Map of the development area and immediate surrounds showing existing and recent disturbances to the site.

3. SITE ASSESSMENT

3.1 Site Visit

The site has been visited at multiple points during multiple time periods. The first assessments were undertaken for the purpose of a high-level sensitivity screening report. The site was visited over two days in September 2022. Subsequently the site was revisited three times in March 2023. The GPS tracks covered during these visits are in Figure 11. These time periods can be considered early spring and late summer respectively. During both site visits minimal rainfall had occurred in the preceding days. Several sites were revisited between the first and second site visits providing a high confidence assessment of most watercourses at the site.

Figure 11. Property boundary showing GPS track walked during different dates for the site visit.

3.2 Watercourse Delineation

Delineated watercourses are shown in Figure 17. Observations during the site visit confirmed the presence of mapped wetlands and drainage lines indicated by national spatial layers (Figure 8) and identified additional, unmapped features which will be discussed.

3.3 Dams

Over several decades many small dams were excavated into the water table on flatter areas of the site, and in mapped watercourses where they are considered instream dams. These dams provide drinking water for livestock and habitat for a range of animals. Some of the dams inspected have created habitat for birds, amphibians and small mammals and are therefore providing a valuable ecosystem service. Other dams that fill very rarely or are frequently used by cattle have less value because they are frequently dry or highly disturbed through trampling and defecation resulting in high growth of pond weed.

Figure 12. An excavated dam from which cattle drink regularly and trample thoroughly. This feature may have originally been a wetland flat similar to surrounding features which was excavated to hold more water for livestock.

3.4 Artificial Wetlands

Historical irrigation with wastewater from the WWTW creates what can appear to be wetlands in some of the fields (Figure 13). However, irrigation has ceased for approximately 5 years and areas that were previously irrigated now show no indication of wetland features.

Figure 13. Periodic irrigation of wastewater from the WWTW on agricultural fields. Arrow indicates historical natural wetland now excavated.

Stormwater discharge from the Pacaltsdorp Industrial Area enters an existing watercourse beneath the railway on the eastern extent of the site (Figure 14). At the time of both site visits, a low flow of discharged water was perceptible and appeared to be of very poor quality (Dark grey colour with foam). Downstream the surface flow diminishes, and the soil is saturated and densely vegetated with *Juncus effusus* reeds and a few other wetland plant species (Figure 15). The movement of water through soil and vegetation creates a natural filter which can facilitate the improvement of poor water quality from the industrial area – a valuable ecosystem service. Furthermore, several small, instream dams are constructed along the wetland which function as stormwater detention ponds during periods of high rainfall and surface runoff. These features over further opportunities for water quality improvement.

Figure 14. Condition of water flowing out from the industrial area into the top of the railway wetland area during the first site visit (Sep 2022) and the second site visit (Mar 2024).

The stormwater outflow has extended wetland conditions further upstream than occurred under reference (natural) conditions prior to the development of the industrial area. The wetland is barely visible on historical images, while recent images show that wetland habitat originates at the outflow of the stormwater drain. While the stormwater and wastewater discharge from the industrial area has enhanced the wetland feature from its natural state the water source is not going away and in fact, if the development is approved a significant increase in water will occur. It is therefore important that this feature be accommodated and supported within the planned development. Further downstream, the natural wetland is present in a modified state where it continues to the Gwaing River confluence.

Figure 15. Broad unchanneled valley-bottom conditions below the industrial area outflow. Inset photo of soil auger result indicating seasonal wetland conditions.

The geotechnical study indicated that groundwater seepage may occur in the upper 1.5 m of the profile during wet seasons although no seepage was reported in any test pits (Outeniqua Labs, September 2022). The seasonally high water-table and low soil permeability is evident where contouring of fields excavated approximately 0.5m along the slope, resulting in the formation of patches of wetland vegetation where stormwater discharges from a pipe draining the suburb of Groeneweide Park. Discharging stormwater is released via a piped outlet into the field where it spreads and then follows the contour before seeping down the upper portion of the watercourse.

3.5 Natural Wetlands

A number of small natural wetland areas occur in the vicinity of the radio flyer club. These are mainly classified as wetland flats due to their position on flat terrain with almost no inflow from slopes. The disjunctive nature of this area of wetlands may be due to historical disturbance such as construction of the road and radio flyer club.

Towards the incinerator of the dump site is a cluster of what appear to be 4 small dams which have been excavated into a historical wetland flat area. This site is visible on historical imagery but has been repeatedly excavated over many decades. It also receives runoff when wastewater is irrigated from the WWTW (Figure 13).

Figure 16. Natural wetlands showing wetland flat near the radio flyer club (top picture), and unchanneled valley-bottom wetland towards the showgrounds (bottom picture).

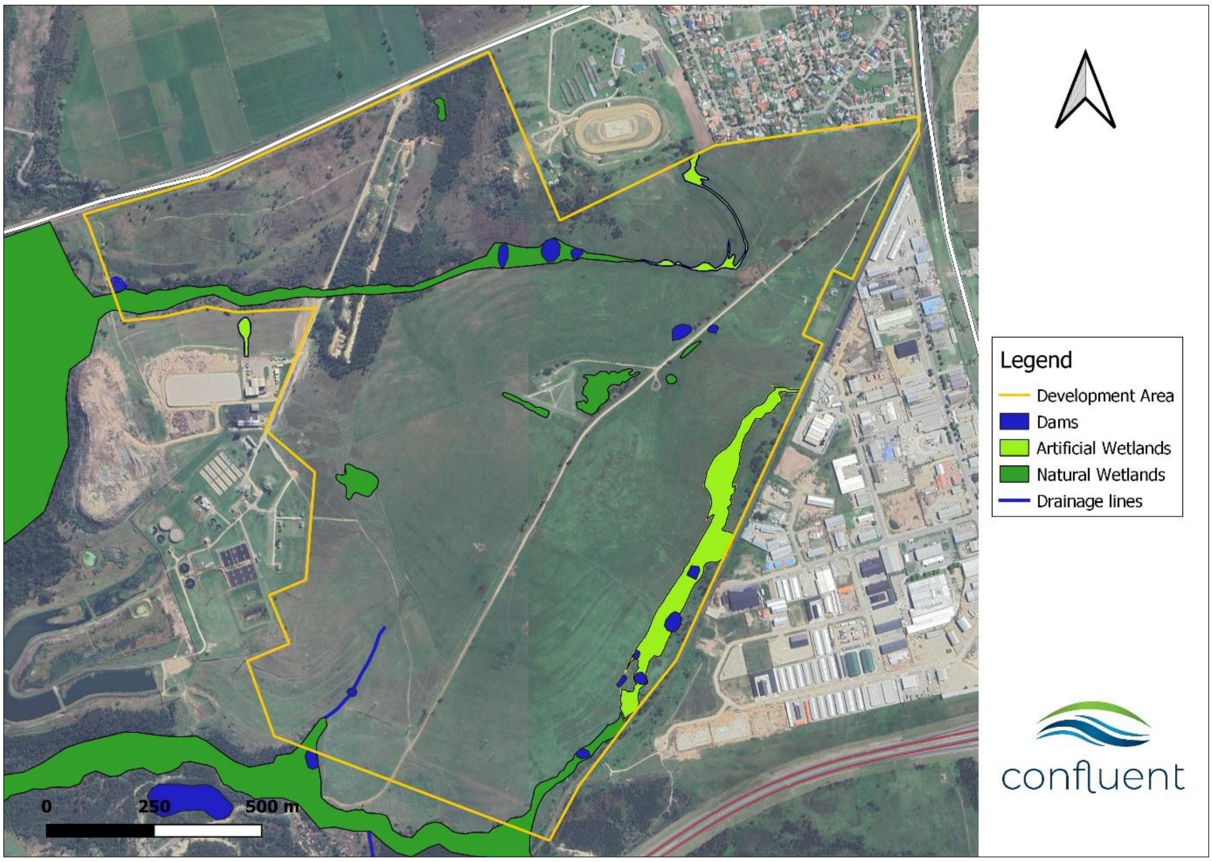


Figure 17. Delineated watercourses with associated classifications.

4. WATERCOURSE ASSESSMENT

4.1 Ecological Importance and Sensitivity

4.1.1 Wetlands

The Ecological Importance and Sensitivity (EIS) score was determined using methods developed by Rountree *et al.* (2013). Ecological Importance provides a measure of a wetland's importance to the maintenance of ecological diversity and functioning at local and broader spatial scales. Ecological Sensitivity describes the wetland's ability to tolerate disturbance and recover from these events.

A map of delineated watercourses and their associated EIS is provided in Figure 18. This map was updated following renewed site assessments in March 2024.

The wetland tributaries of the Gwaing River had a High EIS, while the other wetland types were all Moderate. Connectivity to the Gwaing River is an important aspect increasing the importance of tributaries. This importance is transferred to the artificial wetlands because they effectively extend the wetlands further upstream thus creating additional habitat. The wetland flats (Incinerator, Radio Flyer and Showgrounds) in comparison are isolated and therefore of little importance in terms of connectivity. They do however provide a unique habitat in the regional context of George given the wetland type is no longer frequently encountered due to urban development and agriculture.

Table 5. Summarised assessment of the Ecological Importance and Sensitivity of wetlands in the proposed development area.

Ecological importance and sensitivity	Gwaing Tributary Wetlands	Incinerator Wetland	Radio Flyer Wetlands	Artificial Wetlands
Biodiversity support				
Presence of Red Data species	0	0	0	0
Populations of unique species	1	1	2	1
Migration/feeding/breeding sites	2	1	2	2
Landscape scale				
Protection status of wetland	2	1	1	1
Protection status of vegetation type	4	4	4	4
Regional context of the ecological integrity	2	0	2	0
Size and rarity of the wetland types present	2	1	2	0
Diversity of habitat types	2	1	1	2
Sensitivity of the wetland				
Sensitivity to changes in floods	4	1	1	2
Sensitivity to changes in low flows	2	1	1	1
Sensitivity to changes in water quality	3	2	3	1
ECOLOGICAL IMPORTANCE AND SENSITIVITY	**HIGH**	**MODERATE**	**HIGH**	**MODERATE**

4.1.2 Dams

There are no methods that have been developed to determine the EIS of dams. This assessment therefore relies on the specialist knowledge of the author. Dams that are instream or located very close to natural watercourses (e.g. Gwaing River) have higher value than off-channel dams as they offer an extension of aquatic habitat within or adjacent to the watercourse which provides additional habitat for fauna and flora. Many of the instream dams on the site have not been disturbed or cleared of silt and vegetation for many decades. They have therefore accumulated diverse wetland and aquatic vegetation and associated animals (e.g. amphibians) which utilise the habitat. These dams are considered High sensitivity sites. The dams that resulted from earthworks and quarrying to the south-west of the site are located near the confluence with the Gwaing River and therefore also attract a range of aquatic plants and animals that have colonised the habitat. Off-channel dams that receive very little water or are continuously disturbed by livestock drinking are considered Low sensitivity (Figure 18). It must be noted that the classification of a watercourse includes dams into which or from which water flows. Therefore, any instream dams are considered part of the watercourse and are regulated in terms of the National Water Act.

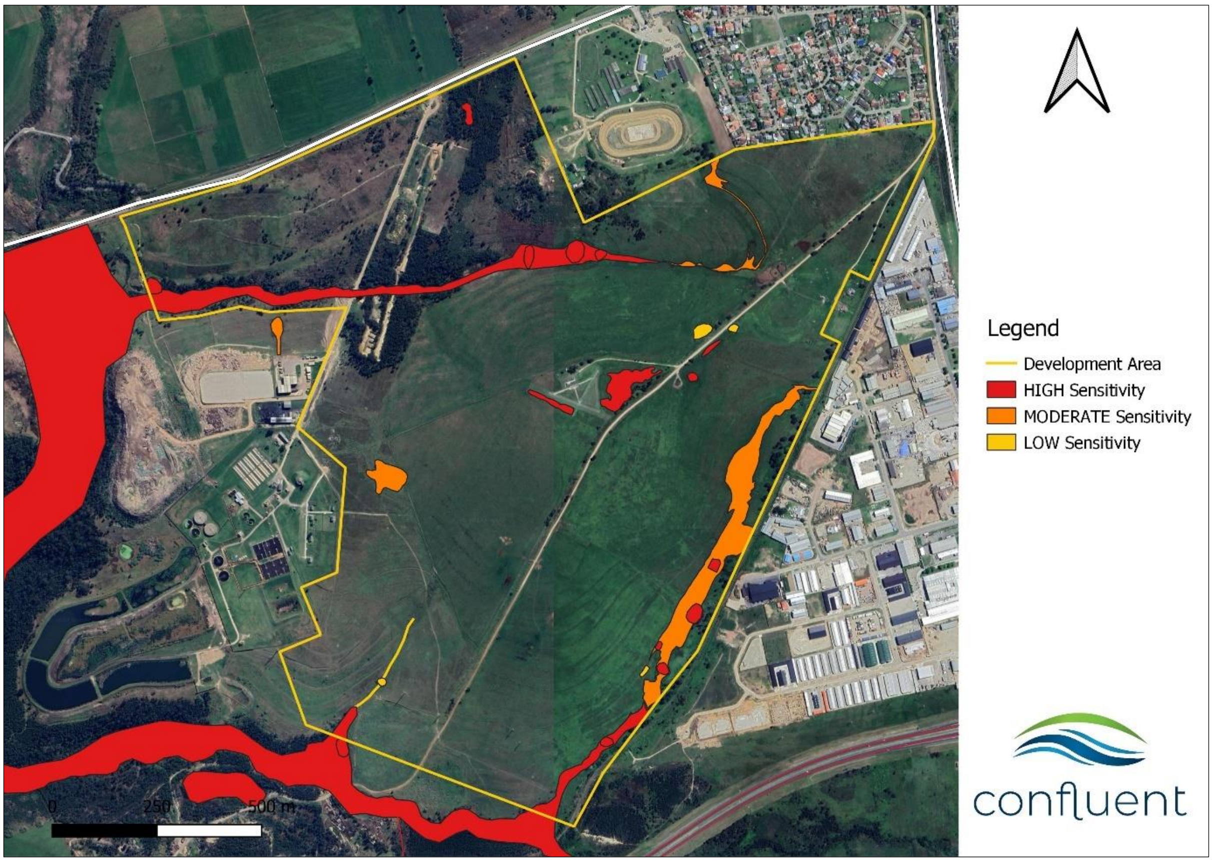


Figure 18. Sensitivity of delineated watercourses.

4.2 Ecosystem Services

Ecosystem services provided by various wetlands in their present state were assessed following methods developed by Kotze *et al*. (2020). Results are presented in Table 6.

Westerly flowing tributaries of the Gwaing River provide important functions in terms of stream flow regulation and biodiversity (connectivity and migration corridors). They also have an important function in the removal of nutrients and toxic elements from inflowing water which includes stormwater runoff and high pollutant discharges from the Industrial Area.

While the incinerator and radio flyer wetlands are considered natural, the ecosystem services that are derived from them are minimal and are primarily based on biodiversity value. They are located on flat areas of the site with no surface connectivity to watercourses flowing into the Gwaing River.

From this assessment it is evident that artificial wetlands that have arisen from stormwater inflow provide a range of useful functions. These have been assessed in the present state of the site but may ***increase in importance in the context of future development***. It is therefore recommended that artificial wetlands be conserved with minimal disturbance and further utilised in the context of Sustainable Drainage Systems (SuDS).

Table 6. Ecosystem Services provided by wetlands in their present state.

		Gwaing Tributary Wetlands	Incinerator Wetland	Radio Flyer Wetlands	Artificial Wetlands
ECOSYSTEM SERVICES		Importance Scores			
Regulating and Supporting Services	Flood attenuation	Very low	Very low	Very low	Low*
	Stream flow regulation	Moderately high	Very low	Very low	Very low
	Sediment trapping	Very low	Very low	Very low	Low*
	Erosion control	Low	Low	Low	Moderate
	Phosphate assimilation	Moderately low	Very low	Very low	Moderate*
	Nitrate assimilation	Low	Very low	Very low	Moderate*
	Toxicant assimilation	Moderately low	Very low	Very low	Moderate*
	Carbon storage	Very low	Very low	Very low	Very low
	Biodiversity Maintenance	Moderately high	Moderate	Moderate	Low
Provisioning Services	Water for human use	Very low	Very low	Very low	Very low
	Harvestable resources	Very low	Very low	Very low	Very low
	Food for livestock	Low	Very low	Very low	Moderate
	Cultivated foods	Low	Very low	Very low	Very low
Cultural Services	Tourism & recreation	No score	No score	No score	Very low
	Education & research	No score	No score	No score	Very low
	Cultural & spiritual	Low	Very low	Very low	Very low

* These have been assessed in the present state of the site but may ***increase in importance in the context of future development***.

4.3 Aquatic Impact Buffer Zones

Riparian means where the land meets a watercourse, and refers to the interface between these two habitats. Buffer areas are linear zones adjacent to wetland and riparian areas managed with the intention of protecting water resources from diffuse pollution associated with adjacent land uses. In addition, they provide habitat for wildlife and aid movement through increasingly fragmented landscapes. Some well established benefits of buffer zones include:

- ✓ Maintain channel stability
- ✓ Control microclimate and temperature
- ✓ Flood attenuation
- ✓ Maintain wildlife habitat
- ✓ Sediment removal from diffuse runoff
- ✓ Nutrient removal from diffuse runoff
- ✓ Improve habitat connectivity
- ✓ Screening adjacent disturbance
- ✓ Enhance visual quality
- ✓ Control noise levels
- ✓ Improve air quality
- ✓ Create recreational opportunities

Many of these benefits would be realised by including adequate aquatic impact buffer zones throughout the proposed development.

Buffer zone widths were determined using the site-based Riparian Buffer model developed by Macfarlane & Bredin (2017) which is the more comprehensive of the two available models. The model incorporates locally determined environmental factors such as soil type, slope, annual rainfall, soil erodibility and inherent runoff potential at the site. Based on the proposed land use selected (Mixed use / Light Industrial / Residential) the buffers were determined as follows:

High Sensitivity Watercourses: 40 m
Moderate Sensitivity Watercourses: 30 m
Low Sensitivity Watercourses: 22 m

The revised map of delineated watercourses (March 2024) was updated to include aquatic impact buffers recommended for different levels of sensitivity (Figure 19).

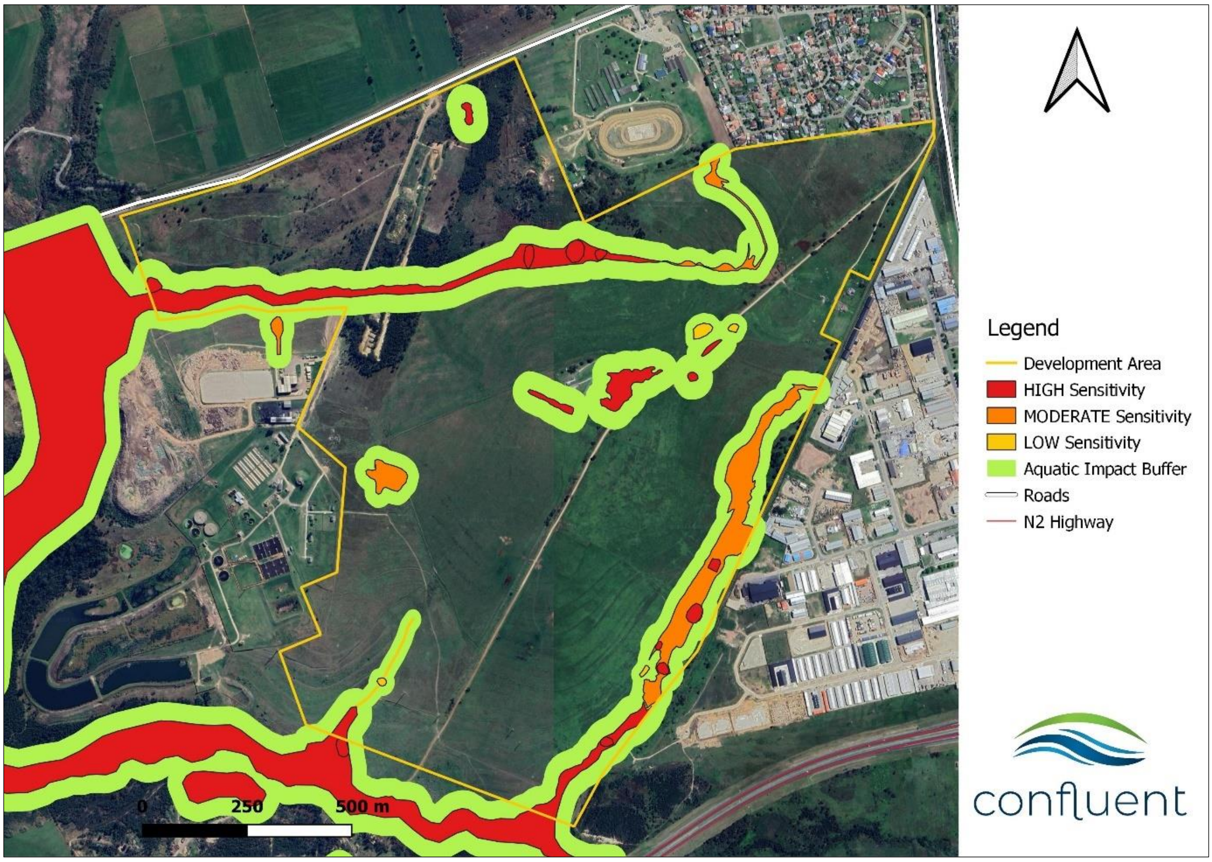


Figure 19. Project area indicating full extent of the aquatic buffers associated with watercourses of different sensitivities.

5. DEVELOPMENT PROPOSAL COMPARISONS

The preferred development proposal was received in March 2024 was overlaid with the aquatic sensitivities and buffers of the site (Figure 20). A number of potential conflicts were identified and are summarised in Table 7.

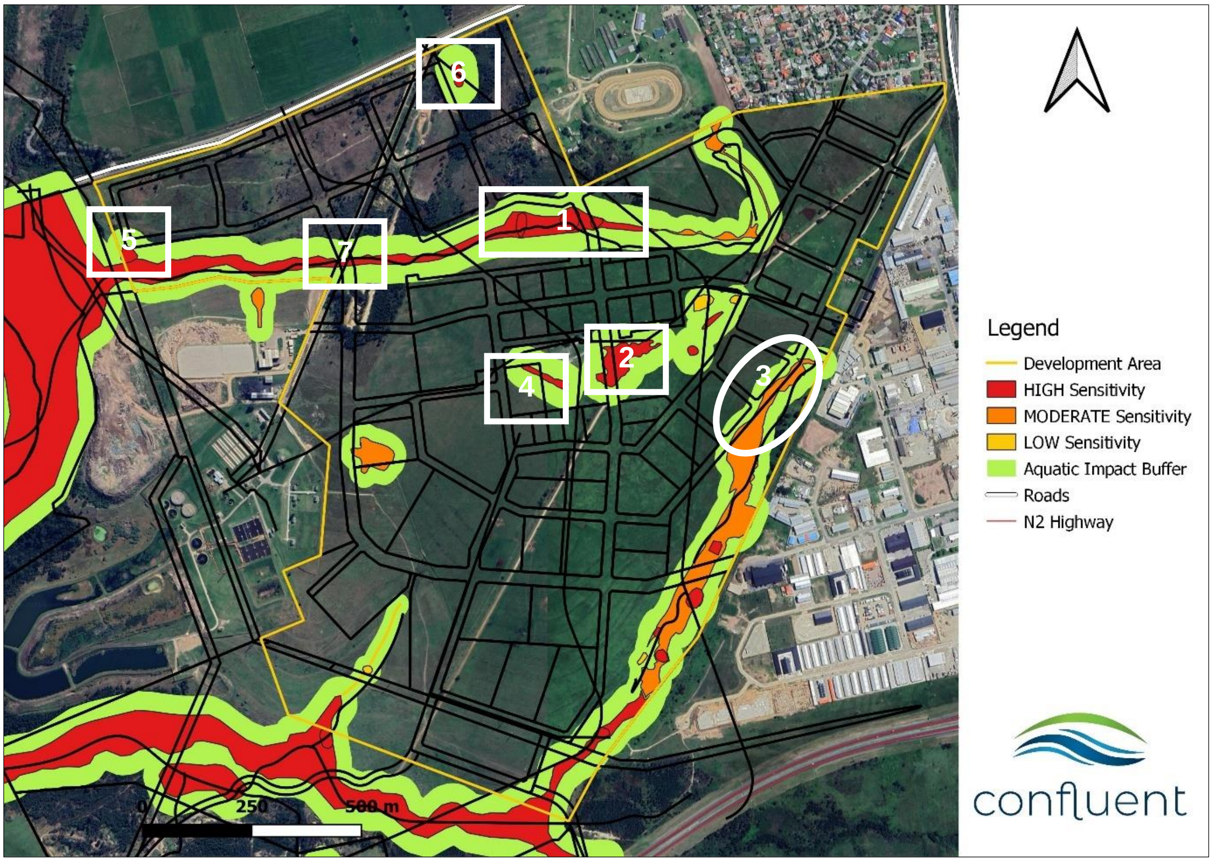
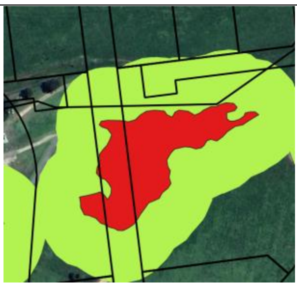
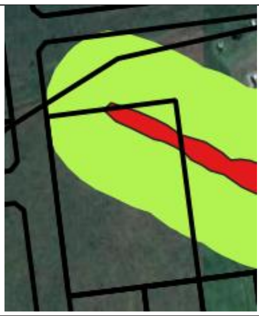
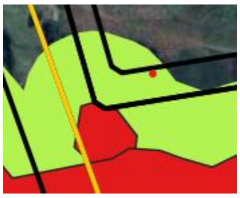
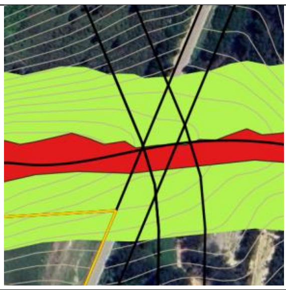


Figure 20. Map indicating the preferred SDP overlaid with aquatic features and associated buffers areas (Mar 2024).

Table 7. Development conflict areas with reasons and recommendations for adjustments.

Map Ref	Image Capture	Reasons	Recommend
1		High degree of buffer encroachment and a crossing in a HIGH sensitivity watercourse. There is already any existing crossing further downstream to be upgraded which increases	1. Reduce extent of erven to the north and south to ensure roads are removed from high sensitivity buffers. 2. Move the crossing east towards the moderate sensitivity feature further upstream.

		cumulative impacts.	
2		Road in northern area of the buffer and road crossing through high sensitivity wetland	1. Move intersecting road out of the wetland. Is this road essential? Could traffic be diverted to the road west of this feature? It would create a larger continuous habitat which is a positive. 2. Move northern road out of the buffer.
3		Roads in buffer of wetland feature of moderate sensitivity. Creates additional impacts when there is already a road crossing further downstream.	1. Move roads and erven out of the wetland and buffer area. This wetland has excellent potential for SUDS in terms of water quality and quantity controls.
4		Possible erf (not indicated in report) in wetland and buffer. Not sure what the lines are for.	Remove erf from wetland and buffer.
5		Road and erven encroaching into buffer and dam edge on very steep slope	Recommend that the road and erven be pulled back to the higher slope further from the wetland buffer (red dotted line below). The 1m contours do not pick up this change in two slopes. Below the red dotted line is very steep. 
6		Erf on High sensitivity wetland and buffer	1. The access road should be an acceptable impact, but the erf should be restricted in terms of preserving the remainder of the wetland and buffer area as open space.

7		Increased area of riparian vegetation and buffer disturbance in the vicinity of an existing crossing.	1. Try to reduce the footprint of disturbance in and adjacent to the wetland by using the existing road and crossing as far as possible.

Several meetings were held to work on avoiding and minimising these impacts, and the development the alternative SDP stemmed from these engagements. The alternative SDP overlaid with aquatic sensitivity features is presented in Figure 21. Referring back to Table 7, most of the highlighted issues with the previous plan have been addressed as follows:

1. The road crossing was moved further east to avoid the high sensitivity instream dam, and the erven were moved away from the buffer.
2. The road intersecting the wetland flat area was removed and the area is now indicated as an open space with two wetland features. The roads encroach slightly into the buffer, but overall this is a significant improvement.
3. The road is still in the buffer along the 'industrial wetland', but the erven and roads have now been moved out of the wetland itself.
4. Not an erf, part of open space.
5. Development in this area was removed altogether in the revised plan due to the presence of golden moles.
6. Road still crosses the buffer, but no erf is located in the wetland. This is an improvement, but it would still be preferable to
7. It was not possible to use the existing road due to the presence of a High Sensitivity fragment of fynbos and the presence of golden moles. Therefore, the road was moved to the east to avoid these features. An alternative crossing location is not likely to be feasible based on extensive discussions with the traffic engineer. The impacts of this crossing would therefore be assessed in the impact assessment.

Overall, the improvements to the Alternative SDP significantly reduce the development impact on aquatic ecosystems and are viewed positively.

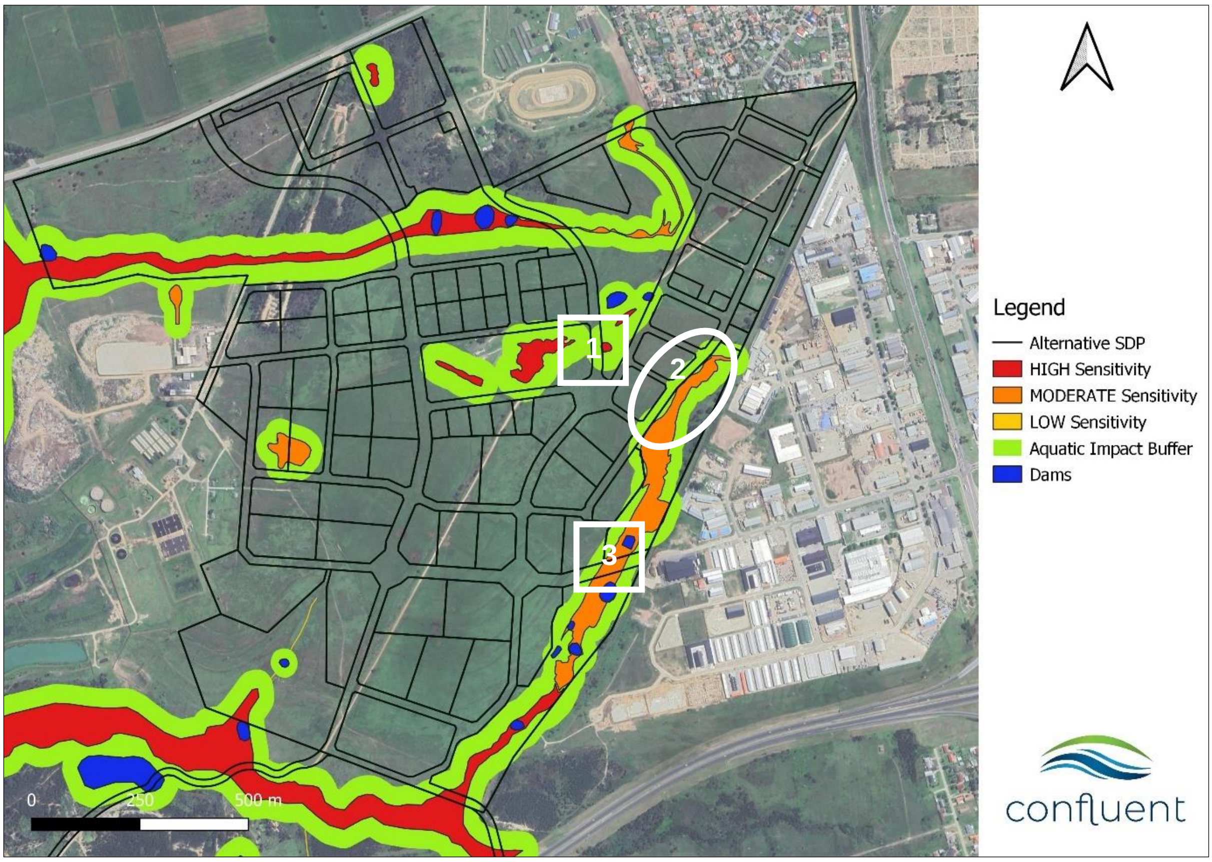


Figure 21. Map indicating the Alternative SDP overlaid with aquatic features and associated buffers areas (Mar 2024). Numbered areas are identified as design and layout opportunities for improvements.

6. SITE SENSITIVITY VERIFICATION

The site sensitivity verification for this site is confirmed as **Very High** due to the presence of natural watercourses which will be directly and indirectly affected by the proposed development. The proposed development therefore requires an Aquatic Specialist Impact Assessment.

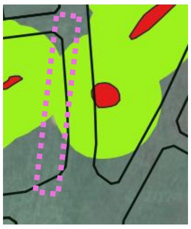
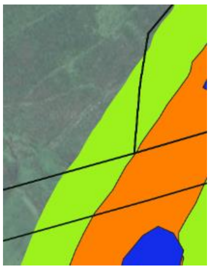
7. PRELIMINARY IMPACT ASSESSMENT CONSIDERATIONS

As a scoping report, this assessment does not include a comprehensive impact assessment. In this section, the main impacts associated with each development phase are highlighted along with mitigation measures. This section is provided to the development and engineering team to provide guidance in terms of further planning for the development, as well as for Interested and Affected Parties concerned about potential impacts and whether they will be considered in the process. All impacts will be thoroughly addressed and rated in the impact assessment report to follow this one.

7.1 Layout and Design

Despite significant improvements to the preferred layout, aspects of the alternative layout could be further refined to reduce impacts to aquatic ecosystems. These refinements are considered fairly minor revisions of the layout and are summarised in Table 8.

Table 8. Development conflict areas with reasons and recommendations for adjustments to the Alternative Layout\.

Map Ref	Image Capture	Reasons	Recommend
1		North-south road through central wetland flats crosses the buffer right on the edge of a wetland flat considered to be High Sensitivity.	If feasible, realign the road to the left of the wetland so that it intersects the buffer between the two wetlands. See pink dotted area for recommendation.
2		The road follow the buffer very close to the edge of the wetland for a significant distance.	The buffer in this section is 30m Attempt to pull the erven and road back to at least 15m from the delineated watercourse.
3		The erf encroaches into the buffer and right up to the wetland edge. In addition the road crossing, this represents a cumulative impact that could be minimised. The road crossing is diagonal to the watercourse which increases the risk of erosion.	As above. Attempt to reconfigure the erven so the road crossing can be perpendicular to the watercourse.

- In addition to the points identified in the following table, it is recommended that wherever feasible, the road crossings planned for High Sensitivity watercourse crossings carry a minimal footprint. The preferred design for culverts would be fairly large box culverts with an open / buried base so that habitat can essentially be continuous through the crossing. Larger space also ensure that wildlife can move more freely beneath the road and carries less risk in terms of being undersized for increasing flood volumes and frequency in the future.
- The stormwater management plan must incorporate SuDS to ensure impacts are minimised across the precinct. Consideration must be given to scale, with precinct-wide and erf specific conditions stipulated. See the operational phase mitigation measures for more stormwater related suggestions.

7.2 Construction Phase Impacts

Most of the anticipated impacts and mitigation measures for the construction phase will remain relevant beyond the scoping phase of this assessment. The potential impacts a fairly well understood and mitigation exists which can significantly reduce the impacts. These impacts will be further assessed in more detail in the impact assessment report. The main impacts are highlighted here with typical mitigation measures.

Anticipated Impacts

- Rainfall during construction will result in increased suspended sediments transported to and through watercourses. This will negatively impact water quality and habitat through smothering of instream vegetation and substrates.
- Construction vehicles operating in areas closer than necessary to watercourses could cause unnecessary disturbance to soils, vegetation, water quality and aquatic biota.
- The construction of watercourse crossings including culverts and / or bridges will directly impact on instream habitat, water quality, and biota.
- Disturbed areas will rapidly be colonised by alien invasive plant species such as Black Wattle and Bugweed which are already present at the site.

Typical Mitigation Measures

- An Environmental Control Officer (ECO) must be appointed for the duration of the project, including prior to commencement of construction, at which time notification of commencement must be provided to relevant authorities.
- The ECO must undertake weekly and ad hoc monitoring of water clarity at key points upstream and downstream of works using a water clarity tube. Measurements should be taken prior to construction to ensure the baseline conditions are well understood. AD hoc measurements should be taken following heavy rainfall events.
- The construction team should always check the week ahead, and daily weather reports in site meetings. Work must be stopped during and immediately following rainfall. Site preparation for predicted rainfall must include bunding loose materials, installing silt fencing or hay-bale check-dams where runoff may pick up high velocities and cause erosion.
- Where development is outside of watercourse buffers, the buffer should be delineated and marked off as a No-Go area for staff and vehicles. All staff and new contractors to the site must be made aware of this restriction. The aim is to minimise excessive disturbance of watercourses and ensure vegetation and soils remain intact.
- When constructing watercourse crossings, these should ideally be constructed during periods of low flow with minimal water flow. If necessary, water can be pumped around the construction site to minimise pollution while construction proceeds.
- Any disturbed wetland or riparian plants that can be rescued prior to disturbance should be collected and replanted (where feasible) in disturbed areas of the watercourse to encourage stabilisation of disturbed soil as soon as possible.

- Clearance of alien invasive plant species should be ongoing throughout the construction phase in areas where work has, or is being undertaken. This should be under supervision of the ECO.
- Post-construction, the entire precinct must be kept free of alien invasive plant species. Until private land ownership has been confirmed, this is the responsibility of the George Municipality.

7.3 Operational Phase Impacts

Anticipated Impacts

- Discharge of water containing industrial waste to stormwater drains leading to natural watercourses will cause water pollution. If the frequency of occurrence is moderate to high then sensitive species will disappear from the system, creating permanent modification and potentially transferring negative impacts to the Gwaing River downstream. The likelihood of this impact occurring is very high given that it is already observable from the existing industrial area where water entering the receiving wetland area is perpetually dark grey with foam. Even though the discharge of industrial wastewater to stormwater drains is illegal, it has to be assumed that it will happen given lack of awareness, poor compliance monitoring and lack of consequences.
- High volume and high velocity stormwater runoff from vastly increased impervious areas will result in channel incision, erosion, vegetation loss in the short term, and can lead to terrestrialisation of wetland habitats in the longer term. The two main roads through the precinct running in a north-south direction are orientated downslope and are likely to carry very high runoff via stormwater drains directly to the Gwaing River tributary in the valley bottom.
- Fragmentation of riparian and wetland habitat will occur due to two roads planned to cross the Very High Sensitivity watercourse to the north. These roads are only about 300m apart but cannot be merged in the layout because the traffic must be split between rubbish dumping vehicles to the west and vehicles with other business in the precinct to the east. The double crossing is a cumulative impact which will exacerbate disturbance due to noise, lights, pollution (road runoff), and possible collisions with vehicles. A similar impact will occur in the wetland flat area where the road crosses between wetland units.
- Blockage of sewer lines, leaking sewer lines, or pump stations could result in overflowing sewage entering watercourses creating a health hazard and water pollution.

Typical Mitigation Measures

- Given that the George Municipality will likely remain the holder of the Water Use License for this development, it is in their interests to ensure prospective landowners are aware of potential consequences of illegal dumping which should be clarified in all title deeds or conditions of sale.
- Very clear conditions regarding the discharge of water containing waste must be stipulated in title deeds for prospective landowners. It must be clear that ‘only rain in the drain’ must be strictly implemented.
- Signage must be applied to every newly installed stormwater drain indicating “No Dumping, Drains to River”. Ideally one of the cement slabs / kerbings should be

imprinted with this slogan, or similar, to prevent it fading / falling off / being stolen. Alternatively, it could be spray painted through a stencil. See below examples.

- In addition to signage relating to illegal dumping, additional signage encouraging all landowners (not just industrial) to report leaking waste or dumping of waste to the municipality should be encouraged. Sewer manhole covers should be imprinted with 'Care for our Rivers, Report Leaks' to encourage a citizen response to leaks.
- The Stormwater Management Plan must ensure that upfront planning in the design and layout phase includes precinct wide interventions such as the construction of new features such as swales and detention ponds and doesn't entirely depend on natural watercourses to attenuate stormwater.
- The Stormwater Management Plan should also include minimum requirements for industrial developments in terms of attenuating stormwater on site. These conditions should form part of the conditions of ownership and be incorporated into title deeds. These can be developed in collaboration with the aquatic ecologist. Ideally the adjacent industrial area should be visited to understand current impacts and how these could have been mitigated with upfront planning.
- Runoff modelling must present pre- and post-development runoff rates for 1 in 100-year flood return intervals. The goal should be to attain pre-development runoff volumes through the implementation of SuDS (Sustainable Drainage Systems).
- Areas being drained from the proposed industrial area, must consider the inclusion of constructed wetlands to attenuate stormwater volumes and encourage settlements of solids and water quality improvement.
- Traffic calming measures such as a speed bump on the approach and exit of the new watercourse crossings should be considered provided they do not create serious congestion.
- Lighting at watercourse crossings should be minimised using 'warm light' bollard type lights as opposed to 'white light' high post lighting. The former attracts less insects (and their predators) and is less disruptive to wildlife.
- Ensure revegetation of disturbed areas with naturally occurring indigenous plants to provide adequate vegetation cover for wildlife in areas adjacent to the roads. This will be provided in more detail in the impact assessment as it is system specific.
- Watercourses must be maintained free of alien invasive species. As part of the open space network, this remains the responsibility of the George Municipality. Unless formally amended through an 'Adopt a Spot' agreement.
- Where feasible, sewage pipelines should preferably cross watercourses above ground and be attached to bridge or culvert structures so that leaks are more readily observable and maintenance to pipelines less of a disturbance.

7.4 Cumulative Impacts

Anticipated Impacts

- The Gwaing River already carries high pollution loads and the habitat has degraded seriously from its reference state, which was more like a channelled valley bottom wetland. The development of the Gwayang Precinct carries a serious risk of cumulative impacts in terms of further water pollution, and increased flood-related erosion and scouring.
- Small watercourses across the site have established vegetation and associated features which have developed over a prolonged period of minimal disturbance apart from agricultural impacts. The precinct development is likely to undergo phased development representing repeated waves of disturbance leading to cumulative impacts to species, habitat and water quality.

Typical Mitigation Measures

- Previous mitigation measures stipulated for the management of stormwater and pollution control across the site are applicable and aim to minimise the cumulative impact to the Gwaing River.
- Development phases must be managed following all mitigation measures, ideally by the same ECO to ensure familiarity with he habitat, requirements and site-specific sensitivities.
- Monitoring of key ecosystem indicators throughout construction phase is necessary to ensure aquatic systems are protected. More detailed monitoring measures will be provided in the impact assessment report.

7.5 Assessment of No-Go Alternative

Under the No-Go scenario the precinct would likely continue to be used for agricultural activities and aquatic ecosystems which would have limited impacts apart from trampling and grazing. The No-Go scenario does carry its own risks however, which include the spread of alien vegetation through watercourses, pollution and degradation associated with unlawful land invasions (already observed in the Gwaing River tributary) and ongoing pollution of the 'industrial wetland' area. Maintenance of the status quo therefore carries a low to moderate risk of further degradation of aquatic ecosystems across the site.

7.6 Information Requirements for the Detailed Environmental Impact Assessment Phase

- Detailed Stormwater Management Plan ideally compiled in collaboration with the aquatic specialist. Information such as the geotechnical report for the site should be reviewed as this would include information such as permeability of soil and areas with a high water table.
- Detailed designs of the proposed road crossings planned at each watercourse, as well as in buffer areas. Engineering designs should only be finalised following review of this report, and consultation with the aquatic ecologist.
- Services plan including stormwater and sewage lines to be installed, and how crossings would be achieved. Any pump stations necessary should also be included.

These reports will also be required in support of the application for a Water Use License.

8. REFERENCES

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