Proposed New Bulk Sewer Pipelines in Pienaarstrand, Great Brak, Western Cape.

Aquatic Biodiversity Impact Assessment.

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EXECUTIVE SUMMARY

Confluent Environmental (Pty) Ltd was appointed by Cape EAPrac to provide an Aquatic Biodiversity Impact Assessment for the proposed new sewer pipelines and pump stations in Pienaarstrand, Great Brak River, Western Cape. Proposed by the Mossel Bay Municipality, the new sewer line extends for approximately 4 km from Eekhoring Street in Glentana to the Dolphins Creek Golf Estate, following mainly the Morrison Road reserve with short sections extending into adjacent private and railway properties. The proposed pump stations are upgrades to existing conservancy tanks, which are the current method of wastewater collection in the area. The assessment was guided by the requirements of the National Environmental Management Act (NEMA) and the National Water Act (NWA).

The Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool classified the area as having “Very High” Aquatic Biodiversity Sensitivity, as the route crosses mapped aquatic Critical Biodiversity Areas (CBA 1), sections of the Great Brak Estuary’s Estuarine Functional Zone (EFZ), and two mapped wetland types (Channelled Valley Bottom and Seep wetlands). However, a site visit conducted in October 2025 confirmed that the mapped features cannot be validated as watercourses as defined in the NWA and at best could be described as flow paths, lacking distinct channels, aquatic habitat, riparian vegetation, or hydric soils. Only the first crossing was confirmed as a non-perennial stream with intermittent flow and no estuarine or wetland habitat, while the other two features are described as flow paths where water flows downslope via interflow in the soil layers, with no distinct channel and insufficient residence in the soil to form wetland conditions.

The Great Brak Estuary has a Present Ecological State of C/D (Moderately to Largely Modified) but remains ecologically important. The project area falls within the Southern Coastal Belt Ecoregion, with Hartenbos Dune Thicket (Endangered) vegetation and high erosion potential soils. The estuary and surrounding floodplain are recognised in the Western Cape Biodiversity Spatial Plan (2023) and National Freshwater Ecosystem Priority Areas (NFEPA) as critical areas for biodiversity conservation and ecological support.

Potential impacts during construction include erosion, sedimentation, and disturbance of estuarine habitat, while operational phase impacts may include pollution risks from sewage leaks or blockages. These impacts were assessed as Minor to Negligible with effective mitigation. Key mitigation measures include strict erosion and sediment control, demarcation of no-go zones, installation of watertight manholes and elevated air valves within flood-prone areas in the Estuarine Functional Zone, frequent inspections for leaks, and rapid response protocols for potential sewage spills.

The Department of Water and Sanitation (DWS) Risk Assessment confirmed that the development falls outside the regulated area of any defined watercourse, and therefore does not require authorisation under Section 21(c) or (i) of the NWA. The development is consistent with the objectives of the Great Brak Estuarine Management Plan (EMP), which promotes improved water quality and infrastructure maintenance to prevent pollution.

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;
- have the necessary qualifications and guidance from professional experts in conducting specialist reports relevant to this application, including knowledge of the relevant Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein is and will remain the intellectual property of Confluent Environmental. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.
- All the particulars furnished by me in this document are true and correct.

Specialist: Mr. Franco de Ridder (MSc., Candidate Natural Scientist. Aquatic Science – 166398)

Date: November 2025

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GLOSSARY

Aquatic Biodiversity	The variety of plant and animal life in water ecosystems, relevant to the study due to the site's proximity to potential water bodies.
Desktop Review	Preliminary assessment based on existing data and information, conducted prior to on-site investigations.
Erosion Control Methods	Techniques employed to prevent or minimize soil erosion, such as haybale check dams or silt fencing, are crucial in areas with high inherent erosion potential.
Estuary	A partially enclosed coastal body of water where freshwater from rivers and streams meets and mixes with saltwater from the ocean. This interaction between fresh and saltwater creates a unique and dynamic environment that supports a diverse array of plant and animal species.
Freshwater Ecosystem Priority Area (FEPA)	Designated areas of high importance for freshwater ecosystem conservation, identified as a sensitivity feature in the DFFE screening tool.
Site Assessment	Comprehensive evaluation of the proposed development site, including the identification of wetlands, watercourses, and soil characteristics.
Sensitivity	The degree to which a particular area or ecosystem is susceptible to disturbance or impact, crucial in determining potential environmental consequences.
Topography	The physical features of the land surface, considered for its potential influence on drainage and ecological features.
Wetland	An area where water covers the soil, or is present either at or near the surface, contributing to biodiversity and ecological significance.
Western Cape Biodiversity Spatial Plan (WCBSP)	A plan indicating categorized areas based on their ecological importance in the Western Cape region.

ABBREVIATIONS

CD:NGI:	Chief Directorate: National Geo-spatial Information
DFFE:	Department of Environment, Forestry and Fisheries
DWAF:	Department of Water Affairs and Forestry
DWS:	Department of Water & Sanitation
CBA:	Critical Biodiversity Area
EFZ	Estuarine Functional Zone
EIS:	Ecological Importance and Sensitivity
EMP:	Estuarine Management Plan
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
SACNASP:	South African Council for Natural Scientific Professions
WCBSP:	Western Cape Biodiversity Spatial Plan
WUL:	Water Use License

1. INTRODUCTION

Confluent Environmental Pty (Ltd) was appointed by Cape EAPrac to provide aquatic specialist inputs for the proposed new sewer line from Manatoka Lane to Dolphins Creek Golf Estate, Groot Brak, Western Cape. The proposed sewer line mostly falls within the road reserve of Morrison Road, with a small extent proposed to run adjacent to the railway, extending a total length of approximately 4 km (Figure 1). The proposed new sewer line is situated approximately 200 m south of the N2 highway. The closest perennial river is the Great Brak River, flowing into the Great Brak Estuary, approximately 3.4 km to the northwest (Figure 1).

The scope of work for this report is guided by the legislative requirements of the National Environmental Management Act (NEMA; Act 107 of 1998) as well as the National Water Act (NWA; Act No. 36 of 1998).

Figure 1. Location of the proposed new sewer line route adjacent to Morrison Road, Great Brak, Western Cape.

1.1 Key Legislative Requirements

1.1.1 National Environmental Management Act and DFFE Screening Tool Results

According to the protocols specified in GN 320 (Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, when Applying for Environmental Authorisation), assessment and reporting requirements for aquatic biodiversity are associated with the level of environmental sensitivity identified by the national web-based environmental 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.

According to the National Environmental Management: Integrated Coastal Management Act (ICMA; Act No. 24 of 2008), as amended by Act No. 36 of 2014, an "estuary" is defined as:

- A body of surface water that is permanently or periodically open to the sea;
- A body of surface water in which a rise and fall of the water level as a result of the tides is measurable at spring tides when the body of surface water is open to the sea;
- A body of surface water in respect of which the salinity is higher than freshwater as a result of the influence of the sea, and where there is a salinity gradient between the tidal reach and the mouth of the body of surface water

The definition of estuarine habitat is more extensive in terms of listing Notice 3 (GN R 985) published under the NEMA EIA regulations (2014), which define an estuary as the Estuarine Functional Zone (EFZ) and defined as: "the area in and around an estuary which includes the open water area, estuarine habitat (such as sand and mudflats, rock and plant communities) and the surrounding floodplain area, as defined by the area below the 5 m topographical contour (referenced from the indicative mean sea level)."

Estuaries must be managed in a coordinated and efficient manner according to a national estuarine management protocol, which includes the following requirements:

- Development within the defined estuarine boundaries must be consistent with the strategic vision and objectives set for effective integrated management of estuaries.

The spatial layer defining the EFZ is only delineated by using the 5 m topographical contour surrounding an estuary, mostly only from a desktop level. Thus, ground truthing is essential to confirm the extent of the EFZ. All areas included within the EFZ are, by definition low-lying, and flooding can therefore be an important consideration for the proposed new sewer line even where estuarine habitat is not present.

1.1.2 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, 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

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

"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 (GN4167) 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).

1.2 DFFE Screening Tool Results

The Department of Environment, Forestry and Fisheries (DFFE) screening tool classified the site as being of **Very High** sensitivity for aquatic biodiversity (Figure 2) for the following reasons:

- An aquatic Critical Biodiversity Area 1 (CBA 1) is mapped within the route of the proposed new sewer line.
- The proposed new sewer line route is mapped within the Great Brak Estuary.
- The proposed new sewer line route is mapped to extend over a Channelled valley-bottom wetland and a Seep wetland

According to the protocol, a Site Sensitivity Verification (SSV) must be undertaken by an appropriately qualified specialist to confirm the sensitivity of the site as indicated by the screening tool.

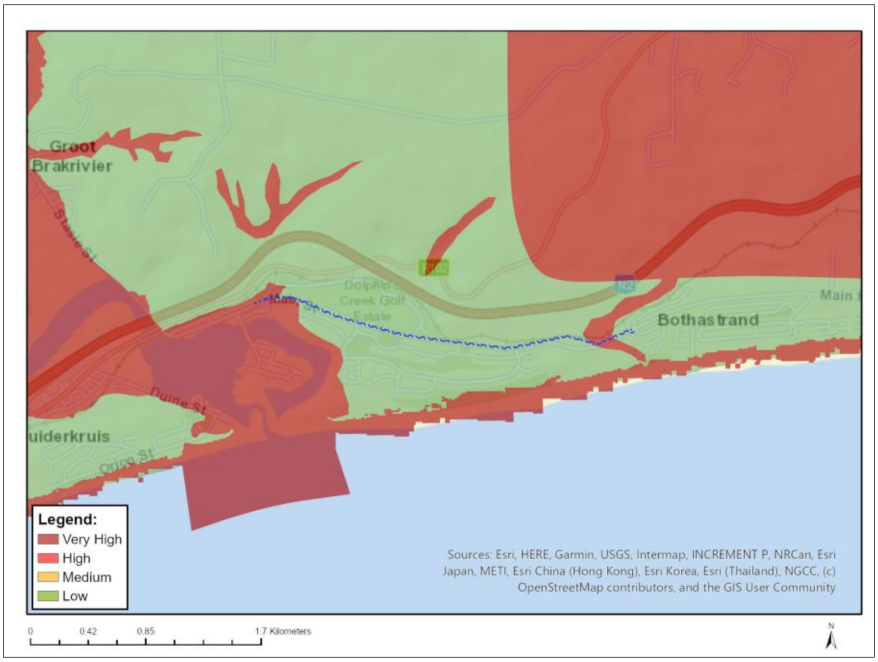

Figure 2: Results of the DFFE Screening Tool which indicate Very High Sensitivity of the Aquatic Biodiversity theme for the proposed new sewer line.

1.3 Assumptions and Exclusions

A site visit was conducted in October 2025, which is considered spring. The preceding 3-months had produced very little rainfall in the area compared with average expected rainfall. It is possible that sensitive features such as rare or unique biota (e.g. amphibians), plants or habitat were not observed during the site visit, but are influenced by season, time of day, flow level or vegetation cover. The site and surroundings have been disturbed for several years, which may also result in an absence of more prominent wetland vegetation.

1.4 The Proposed New Sewer Line

Mossel Bay Municipality proposes to replace and upgrade the existing sewer system between Glentana and Great Brak River (Figure 1) by converting two existing communal conservancy tanks into fully operational pump stations and installing new rising and gravity main lines along Morrison Road. The existing system currently relies on conservancy tanks that require regular manual emptying, which has become operationally unsustainable as residential development has increased. During peak periods, tank overflows have been reported due to insufficient storage capacity.

The two existing conservancy tanks include one at Eekhoring Street, serving ±20 properties, and one at Pienaar Strand on ERF 554**,** serving ±95 existing and 32 future properties. Both tanks will be modified to function as sewer pump stations (PS1 and PS2), requiring new pumping infrastructure that conveys effluent from Glentana to the existing municipal connection point at Dolphins Creek Golf Estate, which ultimately feeds into the Great Brak municipal system.

Most of the sewer line will be installed within the road reserve along Morrison Road, with only a few short sections extending into the building lines of adjacent private properties and the railway reserve. Most of the sewer line route follows an existing, redundant potable water line. The area is currently serviced by communal conservancy tanks from which sewage is collected by the municipality. No bulk sewer lines are present, which is why the proposed sewer line is being investigated.

Provision is made for a maximum 7m wide disturbance envelope (mapped) to accommodate the entrance holes for Horizontal Directional Drilling (HDD) & pipe cracking, trenching, space on either side of the trench for machinery (excavator) and a temporary stockpile of soil from the trench to be backfilled after installation. It is proposed that a portion of Erf 554 (Bitou Street; Figure 3) be used as a temporary site camp for the temporary storage of construction materials and equipment.

1.4.1 Pump Stations

Pump Station 1 (PS1) – Eekhoring Street

The existing ±13 m² masonry-and-concrete conservancy tank will be internally modified by dividing it into chambers and installing mechanical pumps and associated pipework. Electrical supply will be via the existing miniature substation at Eekhoring Street. Pumped flows will enter a new Ø90 mm Class 12 HDPE rising main installed through a combination of pipe jacking, pipe cracking into an existing redundant Ø100 mm Asbestos Cement (AC) water pipeline, and trenching.

Pump Station 2 (PS2) – Pienaar Strand

The existing ±14 m² tank at Bitou Street on ERF 554 will be expanded to ±24 m² by adding a new pump sump and valve chamber. Modifications remain within municipal property. PS2 will discharge into an existing Ø110 mm rising main, which will connect to the newly installed Ø110 mm Class 12 rising main along Morrison Road. Power supply will be sourced from the miniature substation at Manatoka Lane.

Figure 3: Temporary site camp (indicated as storage) on a portion of Erf 554 (purple). Pipelines, as proposed, and the 7m buffer are included in red, green, and yellow.

1.4.2 Pipelines

The proposed development of the pipeline itself is divided into three (3) sections:

1. **New Ø90mm Rising Main**

   The pipeline alignment following Morrison Road reserve for ±1.33 km, where it will tie into a new transfer manhole to be connected to the existing gravity sewer system at Manatoka Lane (Figure 4).

   The method of installation will be a combination of Horizontal Directional Drilling (HDD) at road crossings, pipe cracking into the existing Ø100mm Asbestos Cement (AC) water pipeline, and trenching (maximum of 1m wide trench with a 3m work area on either side of the trench).

Figure 4: The beginning (top) and end (bottom) of the proposed pipeline following Morrison Road reserve for ±1.33 km. 7m disturbance envelope applied.

2. **New Ø160mm Gravity Line**
   The installation of a Gravity Line extending from the new manhole in Pienaar Street to the existing manhole in Manatoka Lane, traversing Erf 507, Morrison Road, and Erf 516 (Figure 5). The length of this infrastructure is to be ±0.1km. Installation is to happen via HDD & trenching.

Figure 5. The gravity line alignment from the new manhole in Pienaar Street to the existing manhole in Manatoka Lane for ±0.1km, 7m disturbance envelope applied.

New Ø110mm Rising Main (± 2.41km)

This pipeline will extend from Manatoka Lane to Dolphins Creek Golf Estate (Figure 6). The length of the pipeline will be ±2.41km. The pipeline extending into the bush (left image in Figure 6) follows the railway reserve since along this section of Morrison Road, there is insufficient space within the road reserve to accommodate the pipeline due to the presence of other services.

Method of installation will be a combination of HDD at road crossings, Pipe Cracking into the existing Ø100mm AC water pipeline, and trenching (maximum 1m wide trench with a 3m work area on either side of the trench).

Figure 6. The pipeline alignment from Manatoka Lane (left) to Dolphins Creek Golf Estate (right) for ±2.41km, 7m disturbance envelope applied.

2. CATCHMENT CONTEXT

2.1 Catchment Features

The proposed new sewer line is located across two quaternary catchments, K20A and K30A (Figure 7). Three mapped non-perennial streams are crossed by the proposed sewer line. (Figure 8: Yellow blocks). The project area is located within the southern coastal belt (Ecoregion Level 2:22.02). The terrain is described as closed hills and mountains with moderate to high relief, with plains also significant. Altitude ranges between 0 – 700 m.a.m.s.l, with rainfall occurring year-round, with seasonal peaks in spring and autumn (Figure 9). The vegetation type at the site is mapped as Southeastern Strandveld (FS12: Least Concern) and a small section of Hartenbos Dune Thicket (AT40: Endangered). With Hartenbos Dune Thicket having a narrowly distributed with evidence of ongoing biotic disruption from invasive species. A detailed account of the vegetation within the proposed construction footprint can be found in the botanical report provided by Confluent Environmental (B. Fouche). The rainfall intensity in the area is classified as High to Very High, and the inherent erosion potential of soils also as High, thus resulting in the erosion of soils and stormwater management to be carefully considered when construction is taking place in this area (Table 1). Furthermore, the continuous challenge to stabilise the eroding slopes adjacent to the N2, approximately 200 m northeast of the proposed sewer line, also highlights the severity of the erosion potential in the surrounding area.

Table 1. Summary of relevant catchment features for the proposed sewer line area.

Feature	Description
Quaternary catchment	K20A and K30A
Mean Annual Runoff	141.93 – 173.03 mm
Mean Annual Precipitation	616 mm
Inherent erosion potential of soils (K-factor)	0.61, High
Rainfall intensity	High
Ecoregion Level II	22.02, Southern Coastal Belt
Geomorphological Zone	N/A
NFEPA area	Sub-quaternary reach 9083, Fish FEPA & Sub-quaternary reach 9087, No FEPA Status.
Mapped Vegetation Type	AT40: Hartenbos Dune Thicket (EN) and FS12: Southeastern Strandveld (LC).
Conservation	CBA1: Aquatic and Terrestrial & CBA2: Terrestrial; WCBSP (2023).

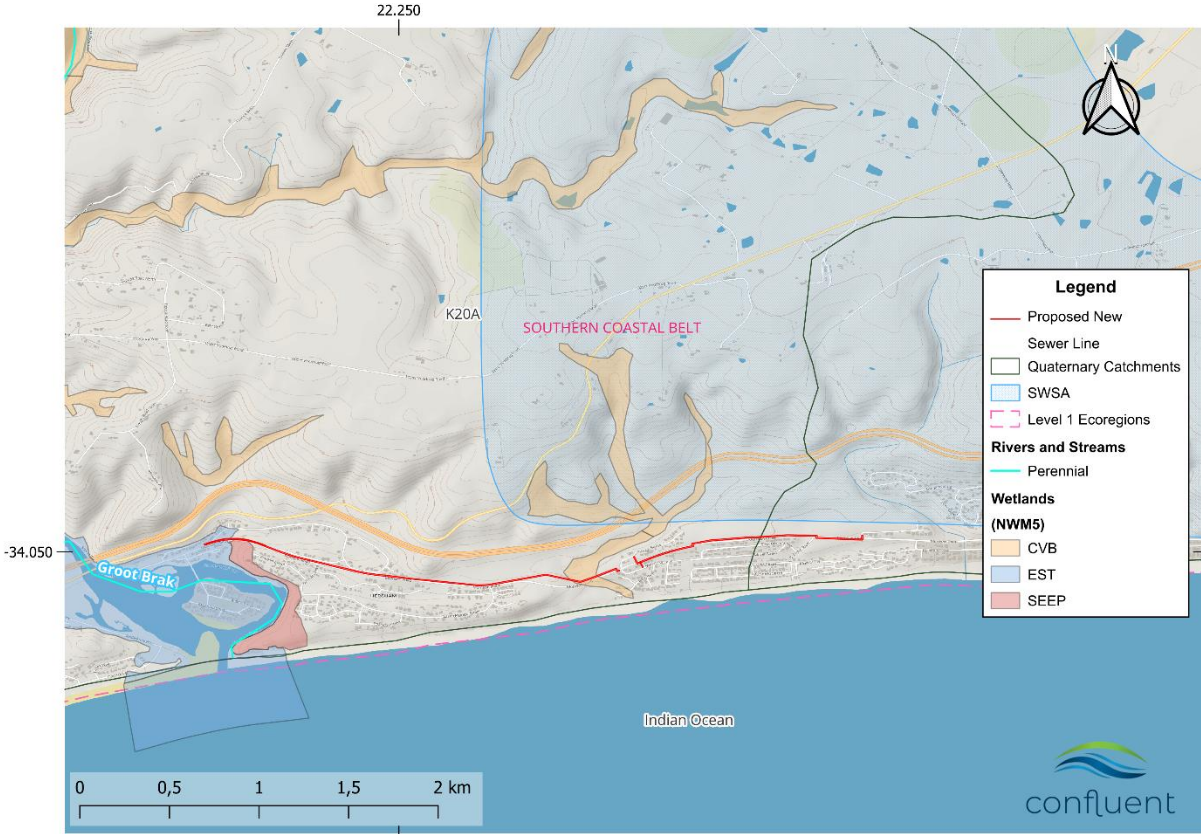

Figure 7. Location of the proposed sewer line in the quaternary catchment K20A and K30A.

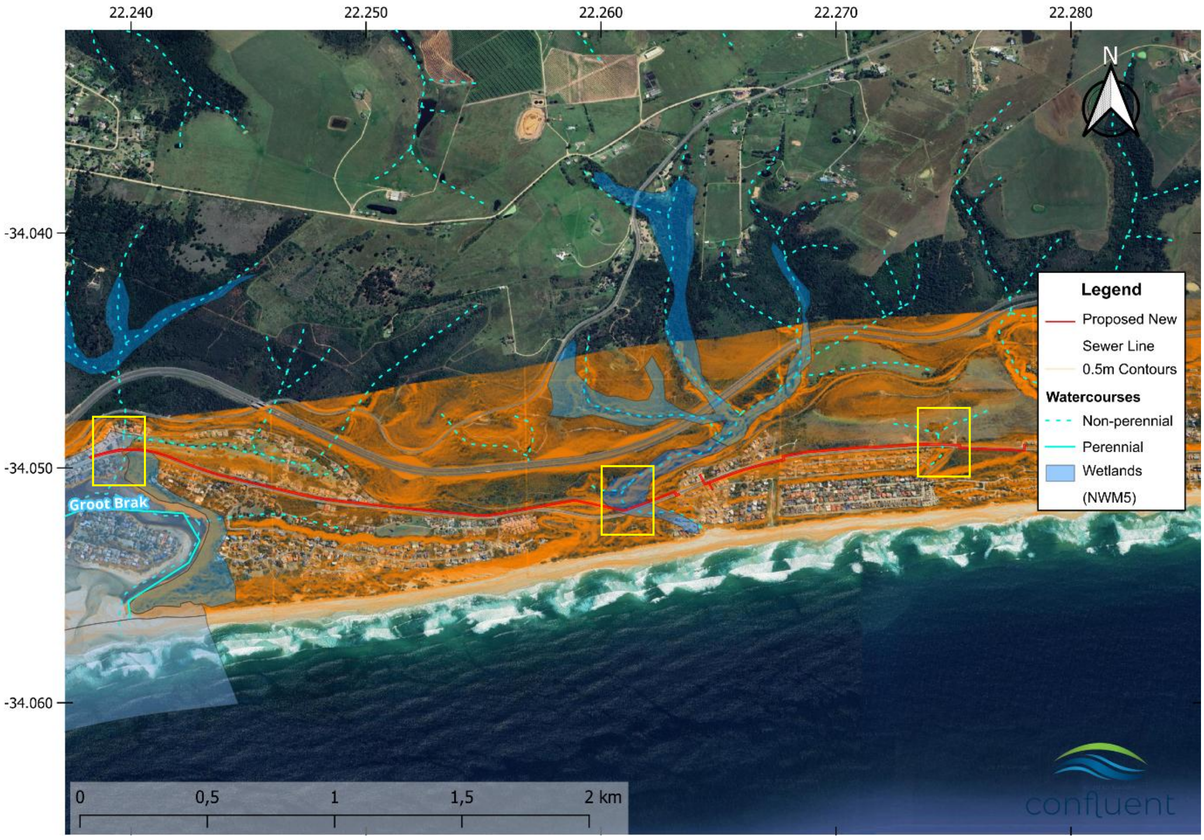

Figure 8: The proposed sewer line in relation to mapped watercourses and 0.5m contours. Yellow areas indicate mapped watercourse crossings.

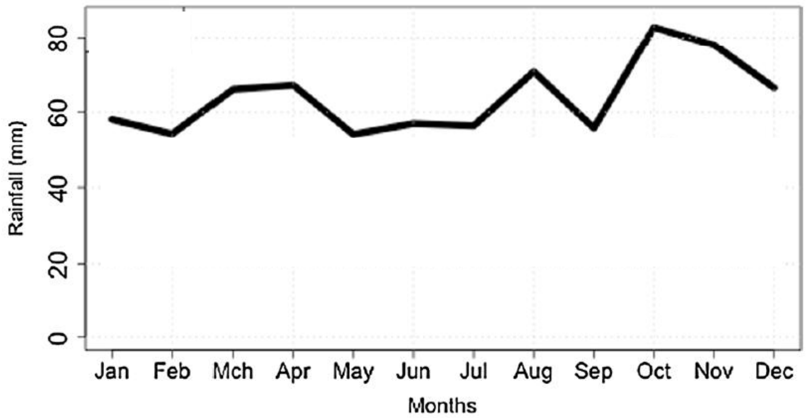

Figure 9. Area-averaged monthly rainfall for the coastal Southern Cape indicating peaks in Mar-Apr, Aug, and Oct. Data averaged between 1979 and 2011 (Engelbrecht et al., 2015).

2.2 Mapped Watercourses

The proposed sewer line is mapped to cross three mapped watercourses discussed from west to east. The first crossing (GPS: -34.049244, 22.239678) is within the mapped EFZ of the Groot Brak estuary, crossing over a mapped non-perennial stream, almost at the entrance of the golf course, approximately 1.7 km east of the N2 off-ramp. The non-perennial stream is mapped to flow in a southern direction, terminating in the Great Brak Estuary and originating approximately 983 m north of the sewer line (Figure 8). A non-perennial stream is also mapped within the extent of the golf course, joining the first-mentioned stream approximately 55 meters from the sewer line. A seep wetland is also mapped to be present on the eastern slope of the first-mentioned non-perennial stream (Figure 10).

The second crossing (GPS: -34.051738, 22.261239) is located approximately 3.8 km east of the N2 off-ramp within an undisturbed section along Morrison Road (Figure 8). The non-perennial stream is mapped to flow in a southern direction, terminating in the Indian Ocean. The non-perennial stream is mapped to originate approximately 1.7 km north of the sever line. A channelled valley bottom (CVB) wetland is also mapped to occur associated with the non-perennial stream. The non-perennial stream is also mapped to flow past the proposed laydown area, with the CVB wetland mapped to the upper extent of the laydown area (Figure 11).

The third crossing (GPS: -34.049008, 22.274516) is approximately 5 km east of the N2 off-ramp and 55.7 m west of H.C. Botha Street. The non-perennial stream is mapped to flow in a south-westerly direction. The non-perennial stream originates on agricultural land adjacent to the north of the sewer line, with a tributary mapped towards the west to join the non-perennial stream 48.8 m north of the sewer line crossing. The non-perennial stream is mapped to terminate adjacent to Thys Olivier Street.

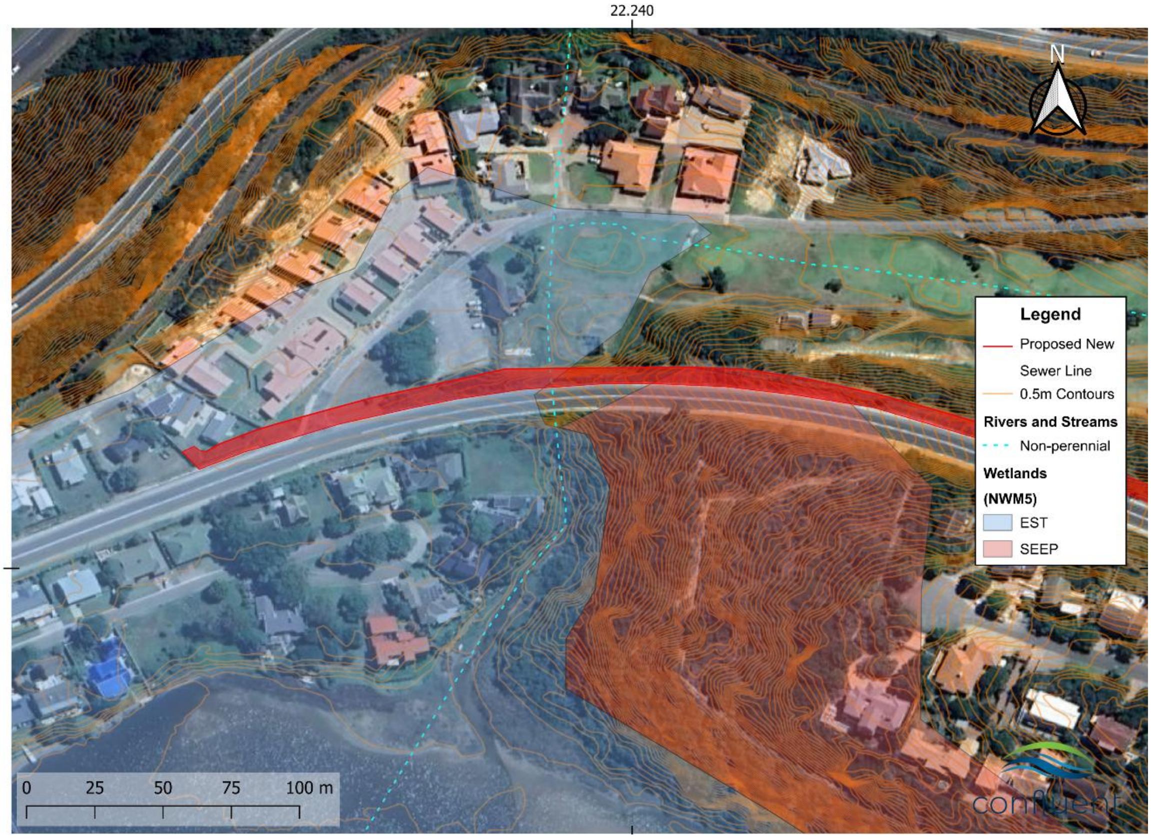

Figure 10: The proposed sewer line at the first crossing of mapped watercourses.

Figure 11: The proposed sewer line at the second crossing of mapped watercourses.

Figure 12: The proposed sewer line at the third crossing of mapped watercourses.

2.3 Conservation and Catchment Management

2.3.1 Western Cape Biodiversity Spatial Plan

The main purpose of a biodiversity spatial plan is to ensure that the most recent and best quality spatial biodiversity information can be accessed and used to inform land use and development planning, environmental assessments and authorisations, natural resource management and other multi-sectoral planning processes. The WCBSP plan achieves this by providing a map of terrestrial and freshwater areas that are important for conserving biodiversity patterns and ecological processes – these areas are called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). The WCBSP indicated the following spatial planning units associated with the watercourses being crossed by the proposed new sewer line and the terrestrial features within the construction area (Figure 13):

- An aquatic and terrestrial Critical Biodiversity Area 1 (CBA1),
- A terrestrial Critical Biodiversity Area 2 (CBA2)

The main reasons for the designation of these planning units are:

- The sewer line is proposed in the Coastal Resource Protection Area of Eden.
- A section of the Western Cape Milkwood Forests (EN) occurs along the proposed route.
- A South Strandveld Western Strandveld Channelled Valley Bottom Wetland associated with the watercourse that would be crossed by the sewer line.

- A South Strandveld Western Strandveld Floodplain Wetland associated with the watercourse that would be crossed by the sewer line.
- The proposed sewer line falls within a FEPA River Corridor.
- The proposed sewer line falls within the Estuarine Functional Zone (EFZ) of the Groot Brake estuary.
- The sewer line is proposed in two watercourse protection areas named the Southern Coastal Belt and Groot-Brak (Figure 13).

Necessary actions in relation to the WCBSP are to ensure that development on the site does not result in negative impacts on the ecological structure and function of watercourses adjacent to and on to the site (Table 2).

It must be noted however, that for any aquatic-related features associated with mapped CBA areas to be relevant, the mapped aquatic feature would need to be verified as present during the site visit. Aquatic CBAs generally align with mapped watercourses, but always require ground-truthing.

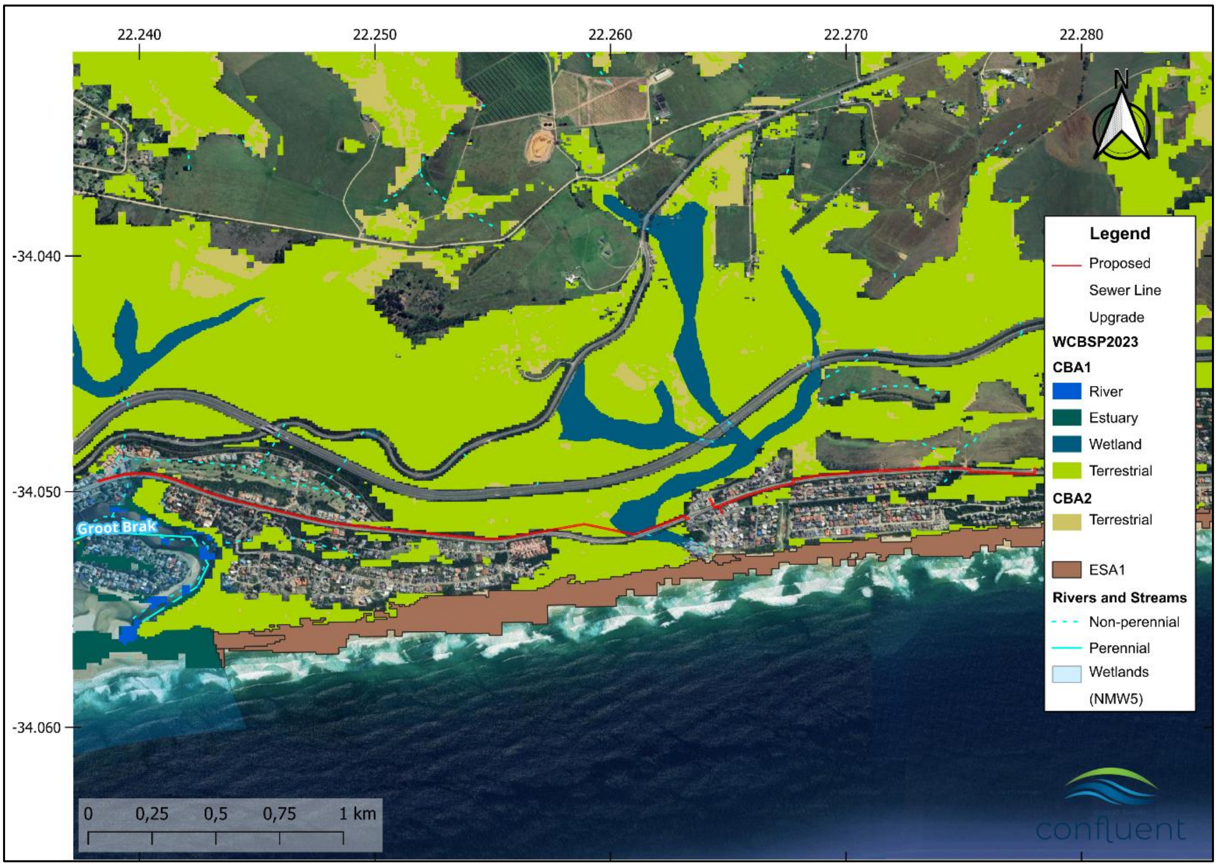

Figure 13. The proposed sewer line to mapped conservation features of the Western Cape Biodiversity Spatial Plan (2023).

Table 2. Definitions and objectives for conservation categories identified in the Western Cape Biodiversity Spatial Plan (WCBSP, 2017).

WCBSP Category	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)	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.

2.3.2 National Freshwater Ecosystem Priority Areas

According to the National Freshwater Ecosystem Priority Atlas (NFEPA; Nel *et al*., 2011) the sub-quaternary reach (SQR 9083), is classified as a Fish Support Area, (FSA). The management objective for fish support areas is:

"Sub-quaternary catchments that are required to meet biodiversity targets for threatened and near threatened fish species indigenous to South Africa. Fish support areas also include SQRs that are important for the migration of threatened and near-threatened fish species. River reaches in Fish Support Areas need to be maintained in a condition that supports the associated populations of threatened fish species."

Fish Support Areas are designated in SQRs where endangered fish species occur, but the condition of rivers is lower than an A or B ecological category.

Important fish species present in the SQR are 2 Western Cape endemics, *Galaxius zebratus* and *Sandelia capensis* (Cape kurper). The IUCN Red List classifies these fish as **Data Deficient** and **Decreasing** respectively. Both species occur in flowing rivers and streams and are unlikely to be in isolated or unchanneled wetlands. However, two invaluable and relevant ecosystem services provided by wetlands are the maintenance of base flows supported by interflow through soil during periods of low rainfall, and the removal of pollutants from urban areas, which results in cleaner water delivered to flowing streams and rivers. It is important that these functions be preserved within the SQR, and wastewater is carefully managed to minimise any inflows of polluted water.

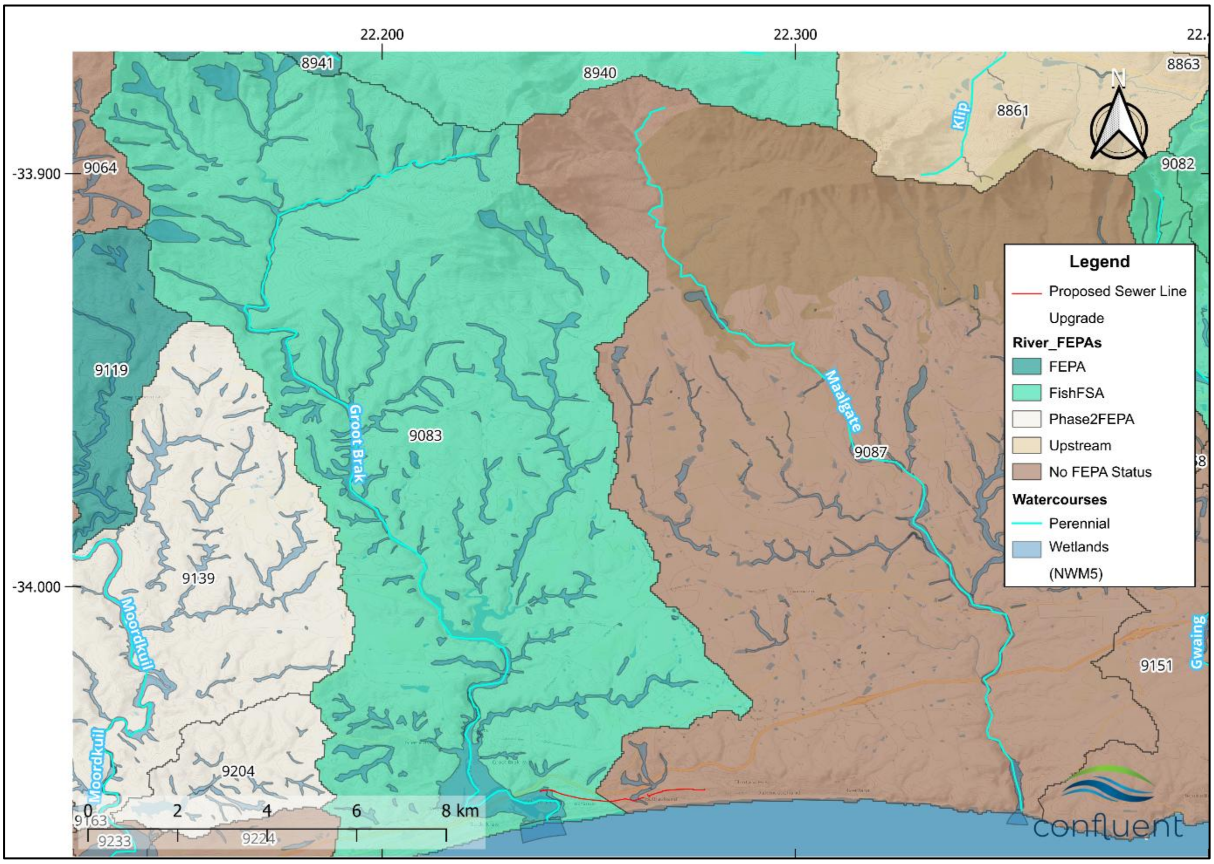

Figure 14: Map indicating the proposed sewer line location in relation to mapped Freshwater Ecosystem Priority Areas (Nel et al., 2011).

2.4 Flood lines of the Great Brak Estuary

The Great Brak Estuary, situated within the Garden Route District near Mossel Bay, forms part of the area assessed by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) to establish coastal management lines and flood risk zones. The *Floodline Assessment* for the Groot Brak Estuary determined the 50-year and 100-year floodlines to support risk-based spatial planning and the management of future development within the floodplain. The study considered both current and future climate scenarios to provide a comprehensive understanding of flood behaviour within the estuarine environment (DEA&DP, 2021).

The assessment incorporated hydrodynamic modelling of flood flow patterns, sediment dynamics, and the influence of tidal and wave processes on water levels within the estuary. The Groot Brak Estuary was modelled for both open and closed mouth conditions, reflecting its natural "temporary open-closed" state. These conditions directly influence the extent and depth of flooding along the estuarine floodplain, particularly in low-lying areas adjacent to the main channel and infrastructure corridors.

Flood levels within the estuary were found to reach between approximately 6 and 7 m above mean sea level near the mouth, increasing further upstream where the channel narrows, notably near the Stasie Road Bridge. These findings highlight the susceptibility of portions of the estuary's floodplain to inundation during major flood events. Any infrastructure located within the Estuarine Functional Zone (EFZ) or mapped flood line, such as the proposed sewer line, should therefore be carefully planned and implemented with consideration of flood risk and potential hydrological connectivity to the estuary. The determined 1 in 100 and 1 in 50-year flood lines are in very close proximity to one another, differing by a meter or less (Figure 15; DEA&DP, 2021).

According to the determined flood lines, the proposed new sewer line is to be constructed within the 1 in 100 and 1 in 50-year flood lines of the Great Brak Estuary (Figure 16). It is thus recommended that mitigations should be applied to reduce the likelihood of any spillage of sewage during flooding events.

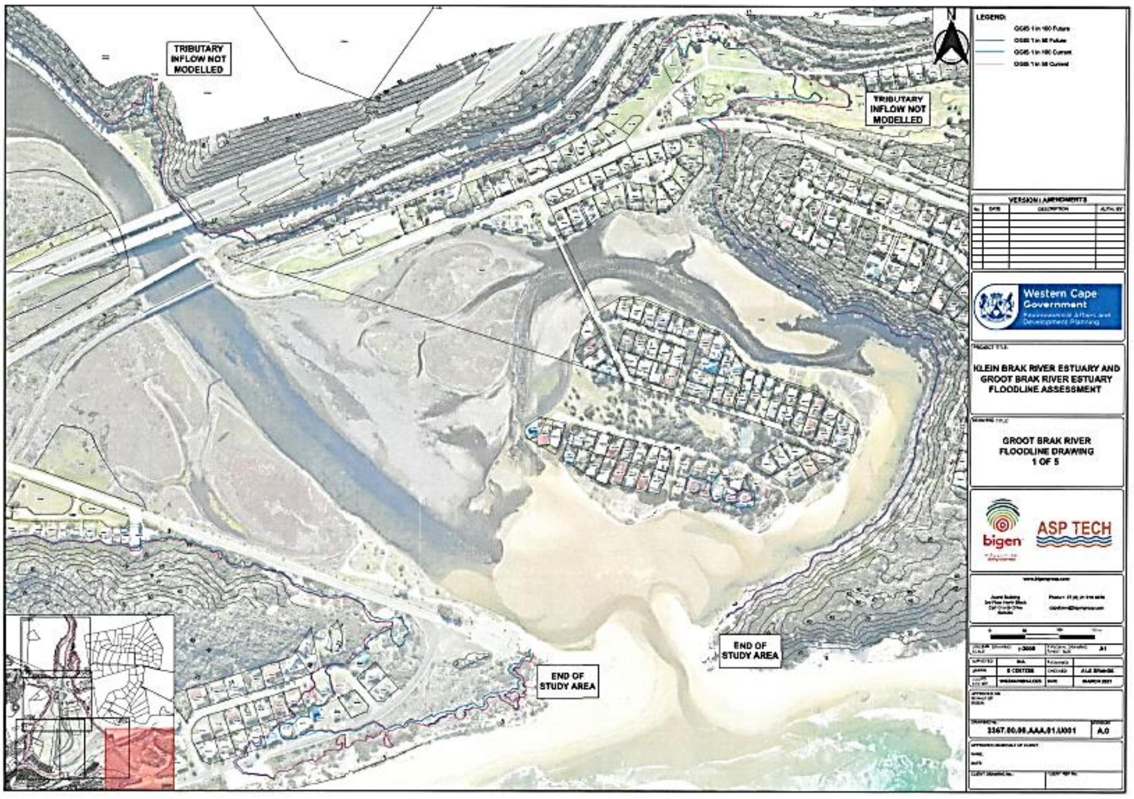

Figure 15: 1:50 (red) and 1:100 (blue) flood lines (DEA&DP, 2021).

Figure 16: The proposed sewer line in relation to the 1:50 (green) and 1:100 (blue) flood lines (DEA&DP, 2021).

2.5 Great Brak Estuarine Management Plan

Estuaries are recognised as particularly sensitive and dynamic ecosystems and the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008, as amended by Act 36 of 2014) (ICMA), via the prescriptions of the South African National Estuarine Management Protocol (the Protocol), require Estuary Management Plans (EMPs) to be prepared for estuaries in order to create informed platforms for efficient and coordinated estuarine management. To this end, the Great Brak River EMP was compiled in 2018 (DEADP, 2018) and provides a detailed situation assessment of the estuary as well as management objectives aimed at achieving an agreed-upon vision for the estuary, which is as follows:

"The Great Brak River estuary is managed in a transparent, accountable and cooperative manner to ensure an appropriate balance between biodiversity conservation, recreational use, human safety and development, now and in the future."

Specific management objectives highlighted in the EMP that are relevant to the proposed development include are listed in Table 3. The primary objective of the proposed sewer line will be to replace some of the existing conservancy tanks and connect the existing sewer system to the main sewer system. In this respect, the project is aligned to many of the management objectives of the EMP – particularly with respect to improving water quality in the estuary.

Table 3: Management objectives included in the Estuarine Management Plan (EMP) for the Great Brak Estuary (objectives highlighted in bold are relevant to the proposed sewer line).

Description	Management Objectives
1. Conservation of estuarine biodiversity	• Zonation plan for the estuary approved and implemented. • Great Brak River EMP integrated within local, district and provincial level planning documents (IDPs and SDFs). • Alien vegetation clearing and monitoring operations in place. • **Future development on the estuary is constrained to ensure that it does not compromise estuary health, ecosystem functioning and/or sensitive species (e.g. no development in the 1:50 year flood line).** • Harvesting of living marine resources (fish and bait) on the estuary remains within sustainable limits, resource users do not exceed applicable size and bag limits
2. Restoration of estuary health	• Freshwater environmental reserve for the Great Brak River estuary implemented; revised dam operating rules for the Wolwedans are in force and respected. • Quantity and quality of freshwater reaching the estuary adequate to restore and maintain estuary health. • **Sewage and storm water entering the estuary monitored and controlled**
3. Effective and efficient mouth Management	• Mouth Management Plan (MMP) accepted and signed off by all relevant authorities (DWS, • Disaster Management, Weather SA, Eden and Mossel Bay Municipalities). • Beaching protocols are implemented in accordance with the accepted Mouth Management • Plan & approved Maintenance Management Plan (MMP).
4. Water quality management	• Water quality samples collected and analysed in accordance with EMP requirements. • Bacteriological (Faecal coliforms, E. coli and Enterococci) and physico-chemical parameters (nitrate, nitrite, ammonia, phosphorus, silica, suspended sediment, toxic substances) from water quality samples taken in the estuary.
5. Visitor management	• Informative and educational signage erected at key points access points that highlights the conservation importance and value of the Great Brak River estuary. • Visitors are sensitive to and aware of activities affecting health and functioning of the estuary, and management regulations governing use of the estuary. • Quality and quantity of visitor facilities (ablutions, parking, etc.) sufficient to meet visitor expectations and requirements.
6. Development planning	• **Future development on the estuary is constrained to ensure that it does not compromise the existing sense of place, conservation value and/or cultural heritage resources associated with the Great Brak River estuary**
7. Harmonious and effective Governance	• Great Brak River Estuary Advisory Forum convened and meets regularly. • Manager for the Great Brak River estuary appointed and capacitated • Arrangements for co-operative governance of the Great Brak River estuary defined and agreed to by all participating agencies. Finance required for implementation of the Great Brak River estuary EMP secured and available. • Adequate capacity and resources available for implementation of the EMP amongst participating agencies
8. Enhanced public awareness and appreciation for the Great Brak River estuary	• Functional and effective stakeholder communication, education and awareness programmes are in place. • Informative and educational signage erected at key access points that highlights the conservation importance and value of the Great Brak River estuary • Great Brak River estuary recognised as an important local ecotourism destination.
9. Research and monitoring	• Adequate research and monitoring is being conducted that allows for quantification of utilisation patterns, changes in abiotic and biotic health, and benefits accruing to local communities and national economy.

2.6 Resource Quality Objectives

The classification of water resources and development of Resource Quality Objectives (RQOs) for the Breede-Gouritz Catchment Management Area was finalised in 2018 (DWS, 2018). The estuary falls within quaternary catchment K20A, which falls within the G14 Gouritz-Olifants Integrated Unit of Analysis (IUA). The Water Resource Class for this IUA is III, indicating sustainable minimal protection and high utilisation. The estuary falls within G14-E16 priority resource unit, and gazetted RQOs are provided in Table 4 below. While the Present Ecological State (PES) of the estuary is C/D (Moderately to Largely Modified – see section 3.2), the Target Ecological Category (TEC) for the Great Brak Estuary been set as an **E (Seriously Modified)**, which indicates a highly impacted river with a low level of protection for high utilisation for socio-economic development.

Table 4: Resource Quality Objectives (RQOs) for the Great Brak estuary.

IUA	Class	Quaternary Catchment	RU	Resource Name	Biophysical Node Name	TEC	Component	Sub-component	Indicator	RQO Narrative	RQO Numeric
G14 Groot-Brak	III	K20A	G14-E16	Groot-Brak Estuary	gxi5	E	Quantity	Flow	MMR/MAR (% Nat)	Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality.	Months: Oct, Nov, Dec, Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Annual MMR/MAR (% Nat): 62.2, 67.3, 55.3, 48.2, 43.4, 55.7, 49.2, 54.9, 38.3, 43.7, 63.4, 63.8, 56.2
							Quality	Nutrients	DIN	Inorganic nutrient concentrations not to exceed TPCs for macrophytes and microalgae	River inflow: NOx-N not to exceed 100 µg/ℓ over 2 consecutive months, NH_3-N not to exceed 20 µg/ℓ over 2 consecutive months; Estuary (except during upwelling or floods): average NOx-N not to exceed 100 µg/ℓ, no single measurement to exceed 150 µg/ℓ, average NH_3-N not to exceed 20 µg/ℓ during survey, no single measurement to exceed 100 µg/ℓ
									DIP		River inflow: PO_4-P not to exceed 20 µg/ℓ over 2 consecutive months; Estuary (except during upwelling or floods): average PO_4-P not to exceed 20 µg/ℓ during survey, no single measurement to exceed 50 µg/ℓ
								Salinity	Salinity	Salinity distribution not to exceed TPCs for fish, invertebrates, macrophytes and microalgae	A salinity gradient should always be present in the upper reaches of the estuary (Zone D and F), an REI zone should always be present in the upper reaches of the estuary (Zone D and F), salinity should not exceed 35
								System variables	Dissolved oxygen	System variables not to exceed TPCs for biota	Entire estuary and river inflow: DO >5 mg/ℓ
									pH		6 < pH > 8.5 in estuary
								Pathogens	Enterococci	Concentrations of waterborne pathogens should be maintained in an Acceptable category for full contact recreation	≤185 Enterococci/100 ml) (90th percentile)
									Escherichia coli		≤500 E. coli/100 ml (90th percentile)
							Habitat	Hydrodynamics	Mouth state	Maintain connectivity with marine environment at a level that ensures water quality and habitat remains suitable for biota typically found in the estuary	Closed mouth state should not increase by >10% from established baseline
								Sediment	Sediment characteristics, Channel shape/size	Flood regime is sufficient to maintain natural bathymetry and sediment characteristics	Channel shape/size, sediment grain size and organic matter must not change by >30% from established baseline

IUA	Class	Quaternary Catchment	RU	Resource Name	Biophysical Node Name	TEC	Component	Sub-component	Indicator	RQO Narrative	RQO Numeric
							Biota	Microalgae	Biomass and community composition of phytoplankton and benthic microalgae community	Maintain the composition and richness of phytoplankton and benthic microalgae groups and medium-low biomass	Maintain low phytoplankton biomass. Maintain microalgal group diversity as measured for the baseline survey; phytoplankton biomass should not increase by more than 20% above baseline concentrations; phytoplankton group diversity to should not change more than 20% from baseline conditions; maintain high subtidal benthic microalgal biomass during the closed mouth phase and low intertidal benthic microalgal biomass during the open phase; Epipelic diatoms indicative of brackish conditions should be found during the closed phase.
								Macrophytes	Extent, distribution and richness of macrophytes	Maintain extent, distribution and richness of macrophyte groups, limit colonisation/spread of the EFZ by alien species	Maintain distribution of macrophyte habitats as for present (2013): Submerged macrophyte, *Ruppia cirrhosa* beds: ~5 ha, *Zostera capensis* present during open mouth conditions, intertidal salt marsh: ~13 ha, supratidal and floodplain salt marsh: ~26.6 ha), Reed (*Phragmites australis)* and sedge stands in the middle / upper reaches: ~2.5 ha); prevent excessive filamentous macroalgal growth. Area covered should be half that covered by submerged macrophytes and less than 50 % of the open water surface area; maintain the zonation of salt marsh and distribution of different species along an elevation gradient. Ensure the long-term persistence of intertidal salt marsh species such as *Triglochin* spp. and *Cotula coronopifolia*; prevent hypersaline sediment and groundwater conditions in the salt marsh. Sediment electrical conductivity should be approximately 30 mS and similar to groundwater values.
								Invertebrates	Macrofauna community composition, abundance and richness	Maintain composition, richness and abundance of different groups of benthic macrofauna and zooplankton	Density of mudprawns should exceed 100 – 150 burrow counts per m2 in the highest density areas; in the zooplankton, the density of Pseudodiaptomus hessei should exceed levels of about 5000-10000 m3 in the upper estuary in spring. Salinity variation in the estuary is highly variable and the mouth remains closed for extended periods - this may also lead to the temporary absence of some invertebrate species that might be expected to occur here.
IUA	**Class**	**Quaternary Catchment**	**RU**	**Resource Name**	**Biophysical Node Name**	**TEC**	**Component**	**Sub-component**	**Indicator**	**RQO Narrative**	**RQO Numeric**
								Fish	Fish community composition, abundance and richness	Maintain composition, richness and abundance of different groups of fish, prevent colonisation/increase of alien species	Fish assemblage should comprise the five estuarine association categories in similar proportions (diversity and abundance) to that under the reference. Numerically, assemblage should comprise: Estuarine species (40-60%), Estuarine associated marine species (30-50%), Indigenous freshwater fish (1-5%); Category Ia species should contain viable populations of at least two species (e.g. *G. aestuaria*, & *Hyporamphus capensis*); Category IIa obligate dependents should be well represented by at least two large exploited species
								Birds	Avifauna community composition, abundance and richness	Maintain composition, richness and abundance of different avifauna groups	Retain species richness, abundance and density of bird counts of resident and migrant waders, gulls, terns, wading birds and waterfowl within 15 % of present state (2006).

2.7 Historical Assessment

Taking into account the extent of the pipeline, the historical assessment will focus on the three crossings, as a broad-scale view will not show the details of the watercourses in question.

Historically, the environment in the proximity of the watercourse crossings has been used for agriculture since 1939, with more residential development taking place in the years leading up to 1991. However, the immediate surroundings at crossing three remained natural during the past 86 years, from 1939 until the present.

At the first crossing in 1939, a prominent channel can be observed that is connected to the Great Brak Estuary, runs north for a short extent, passing through an agricultural field until it reaches the railway. In the years leading up to 2011 and onwards, the agricultural field was converted to a golf estate, Morrison Road was constructed, and the channel north of the proposed sewer line seems to be piped from the rail southwards, opening up in a culvert just before Morrison Road (Figure 17: Blue arrow). The channel south of the proposed sewer line has become densely vegetated to the point that the channel is not visible from satellite imagery (Figure 17).

At the second crossing, a prominent line of drainage can be observed running through an agricultural field southwards to the ocean, without any additional signs of any watercourses in the immediate surroundings of the crossing in 1939. In the years leading up to 2011, Morrison Road was constructed, crossing the drainage line and residential houses were constructed southwest of the crossing, with the land north of the proposed sewer line remaining as agricultural fields. The area southeast of the crossing has revegetated with natural vegetation in the years from 1939 to the present (Figure 17).

At the third crossing, the area surrounding the crossing is natural vegetation, with the only development being the railway in 1939. In 1939, no prominent watercourses could be observed near the crossing. In the years leading up to 2011, Morrison Road was constructed, crossing the mapped watercourse and residential houses were constructed southeast of the crossing, with the land north of the proposed sewer line and towards the southwest of the crossing remaining as natural vegetation in the years from 1939 to the present. In 2011, a natural line of drainage can be seen that is densely vegetated and piped for a short extent, passing underneath the road and the proposed laydown area, to open in a culvert onto the beach (Figure 17: Red arrow).

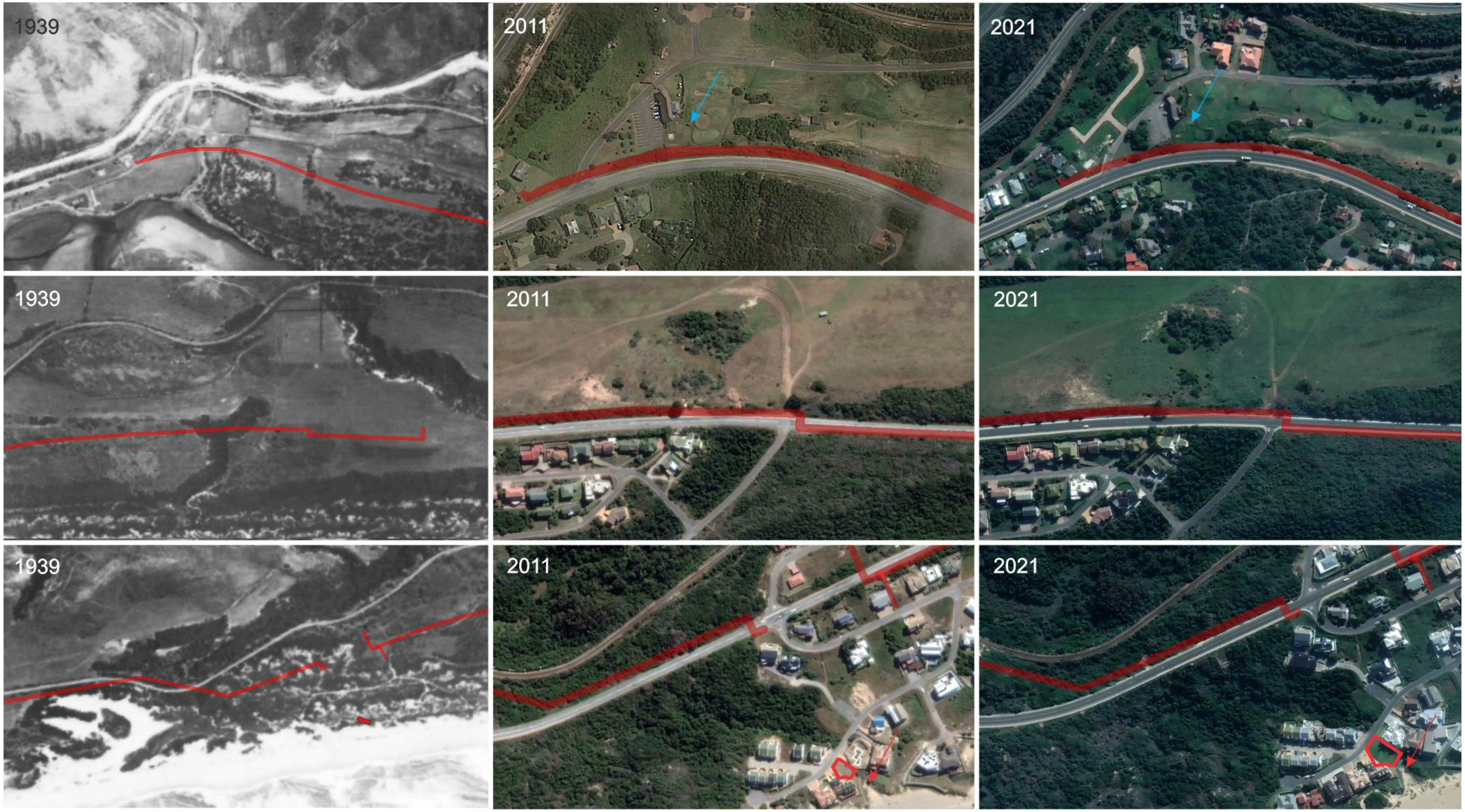

Figure 17. Historical photos showing the proposed sewer line from 1939 until 2021 for the first, second and third mapped watercourse crossings (upper, middle and lower rows of images respectively) CD:NGI & Google Earth imagery).

3. SITE ASSESSMENT

The site visit was conducted on the 17th of October 2025, during which time the entire extent of the proposed sewer line was traversed on foot (Figure 18). At the time of the site visit, the weather was clear. The extent of the sewer line's terrain can be described as undulating, with a flat section at the start of the proposed sewer line near the Great Brak Estuary. The soil across the entire extent of the sewer line is sandy (Figure 19: A), with expected high water infiltration rates.

The vegetation along and within all mapped watercourses on the site is terrestrial and includes, but is not limited to, *Osteospermum moniliferum* (Bietou), *Hermannia flammea, Carissa bispinosa* (Num-Num), *Pterocelastrus tricuspidatus* (Candlewood), *Sideroxylon inerme* (Milkwood) and several *Searsia* species (Figure 19: B). Some alien vegetation was also observed, especially in the mapped watercourse at the first crossing, which includes *Acacia cyclops* (Rooikrans), *Ricinus communis* (Castor Bean), *Solanum mauritianum* (Bugweed) and *Melia azedarach* (Chinaberry). Evidence of alien clearing was observed more towards the east along the proposed sewer line (Figure 19: D). It should be noted that at the time of the site visit, a portable water pipe transporting water from the reservoir was leaking, creating a deep puddle and causing erosion along the fence located just south of the pump station (Figure 19: D).

Figure 18: Map showing the GPS track in relation to the proposed sewer line.

Figure 19: A – Sandy soil in the location of the proposed sewer line, B – General vegetation in the area, C – Evidence of alien clearing, D – Leaking potable water pipe.

3.1 Watercourse Classification

According to the Ollis et al. (2013) classification system, the watercourse at the first crossing does not have any features associated with a watercourse and is best described as a flow path and not as a watercourse. In terms of the classification system, a river-type watercourse requires the presence of a channel—that is, “a geomorphological feature represented by a clearly defined bed and banks, within which water flows with sufficient force to exert (potential) erosive power on its boundary, which is clear of terrestrial vegetation in channelled systems” The first-crossing watercourse does not meets all these criteria as it does not displays prominent bed (bed is completely vegetated as observed in Figure 20: A and B), but banks are present, indicating that flowing water occurs, but not frequently enough to maintain a definable channel. As mentioned above, the mapped watercourse is dominated by terrestrial invasive plants with no visible aquatic or estuarine habitat (Figure 20: A). The site visit also confirmed that the mapped watercourse is piped beneath the golf course, opening into a culvert approximately 23 m north of the road, then flowing through another culvert beneath the road (Figure 20: B). A small patch of Mat Sedge (*Cyperus textilis*) is present on a bank of the mapped watercourse; however, it is not an indication of a functioning wetland. At the time of the site visit, untreated sewer from the conservancy tanks of the golf estate was leaking into the mapped watercourse (Figure 20: C). It appears that the conservancy tanks also have an overflow that discharges directly into the mapped watercourse. The mapped seep wetland was not observed (Figure 20: B).

The mapped watercourse at the second crossing can be described as a flow path and not as a watercourse, as per the definition by the NWA. The reasons are that the area mapped as a watercourse does not show any geomorphological (channel, bed, or banks), hydrological, or aquatic ecological indicators typically associated with a defined watercourse. Therefore, the watercourse does not meet Ollis et al. (2013) criteria for a river or wetland system. No aquatic habitat, riparian vegetation, or hydric soil characteristics were observed. The area represents a hydrological flow path where water may move downslope through the soil during rainfall events as a result of the local topography. The high permeability of the sandy soil also contributes to this classification, resulting in deep interflow greater than 40 cm, contributing to the lack of wetland features within the area. The area at the second crossing is very steep, and a culvert is present, allowing flow to pass underneath the road (Figure 20: D). The flow path continues southwards to enter a culvert underneath the proposed laydown area and on to the beach. No estuarine or aquatic habitat was observed in this location. The variation in this area is dominated by Milkwood trees (*Sideroxylon inerme*).

The mapped watercourse at Crossing Three is also referred to as a flow path for the same reasons mentioned above. The section north of the proposed sewer line is predominantly pasture with a few *Searsia* species within the valley (Figure 20: E), in contrast to the section south of the proposed sewer line, which is dominated by dense thicket vegetation. At the time of the site visit, the culvert passing underneath the road was being worked on, exposing the existing infrastructure on the southern side of the road (Figure 20: F).

Figure 20: A – Alien invasive Solanum mauritianum (Bugweed) within the mapped watercourse at the first crossing, B – Culverts aligned with the watercourse at the first crossing with overflow pipe of conservancy tanks, C – Conservancy tanks adjacent to the west of the mapped watercourse, D – A view of the flow path at the second crossing towards the south, E – A view of the flow path at the third crossing towards the north showing the agricultural field, F – A view of the flow path at the third crossing towards the south showing the exposed existing infrastructure in sandy soil.

3.2 Present Ecological State (PES) and Ecological Importance & Sensitivity (EIS)

The only aquatic feature that will be affected by the proposed sewer line will be the Great Brak Estuary, as the other mapped watercourses were confirmed as poorly defined flow paths and not as watercourses. No wetland features were observed during the site visit, as stated in the section above.

3.2.1 Great Brak Estuary

The rapid level assessment for the Great Brak estuary confirmed the Present Ecological State as **C/D – Moderately to Largely Modified** (Van Niekerk et al., 2014), indicating that while loss and/or change of natural habitat and biota have occurred, the basic ecosystem functions and processes remain predominantly unchanged. In this respect, alterations to water quality and the hydrodynamics of the estuary (e.g. prolonged mouth closure) are considered the most important variable with respect to impacts on habitat (Table 5). This, in turn, has notably influenced the majority of biotic indicators, with macrophytes, fish and birds most heavily affected. The Recommended Ecological Category (REC) is also set at **C** (Van Niekerk et al., 2014). The EIS of the estuary is presented in Table 6 and is rated as **Important**.

Table 5: Present Ecological State (PES) of the Groot Brak Estuary as determined by Van Niekerk et al. (2014).

Variable	Weight
Hydrology	C
Hydrodynamics and Mouth Condition	C/D
Water Quality	D
Physical Habitat Alteration	B
Habitat Health Score	**C**
Microalgae	C/D
Macrophytes	D/E
Invertebrates	D
Fish	D/E
Birds	C
Biotic Health Score	**D**
PES	**C/D**

Table 6: Estuarine Importance Scores (EIS) of the Groot Brak Estuary (Turpie and Clark, 2007)

Criteria	Weight	Score
Estuary Size	15	90
Zonal Rarity Type	10	80
Habitat Diversity	25	10
Biodiversity Importance	25	80
Functional Importance	25	77
Weighted Estuary Importance Score		**63.25**

4. LEGISLATIVE IMPLICATIONS

4.1 Site Sensitivity Verification

Given that the first section of the sewer line is located within the 1:50- and 1:100-year flood line of the Great Brak Estuary, is in a mapped FEPA, and considering that the EIS of the estuary is considered to be High, the aquatic biodiversity potentially affected by the proposed sewer line is confirmed to be **Very High**. Although the remainder of the sewer line would have had a low sensitivity for the aquatic biodiversity theme. Thus, an aquatic biodiversity impact assessment has been compiled to address the potential impacts of the proposed sewer line.

4.2 DWS Risk Assessment

In terms of Section 21 c) and i) of the NWA, the proposed sewer line falls outside of the regulated area of any nearby watercourses (i.e. more than 100 m from a river/stream and more than 500 m from a wetland). Furthermore, the sewer line is downstream of several mapped watercourses, and it cannot therefore impact on these aquatic features (Figure 21). While the estuary is located within 100 m of the sewer line replacement, an estuary is not defined as a watercourse and a Section 21 c) and i) authorisation is therefore not applicable.

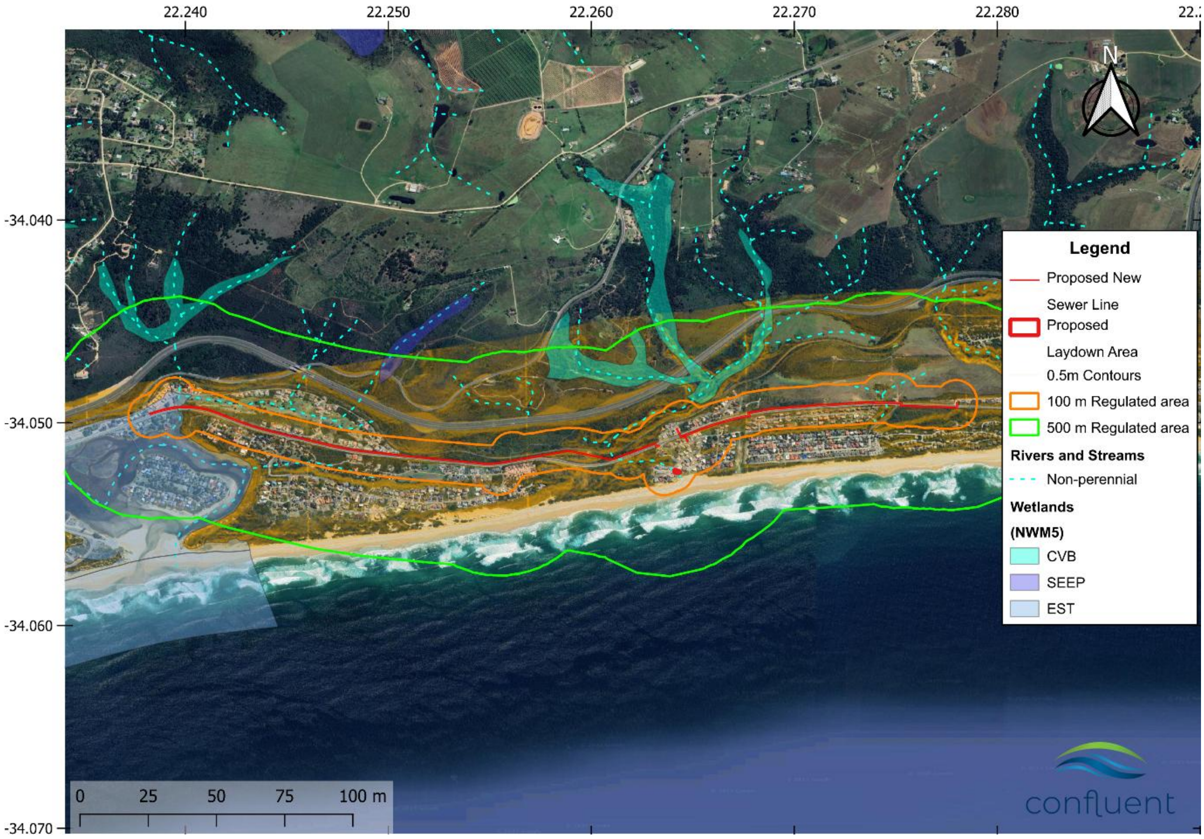

Figure 21: The proposed location of the sewer line in relation to the 500 m and 100 m regulated area as defined in the National Water Act.

4.3 Aquatic Biodiversity Impact Assessment

The impact assessment is fundamentally guided by the mitigation hierarchy, which seeks to avoid and minimise impacts as the first priority (Figure 22). Every effort must be made to avoid and minimise impacts and rehabilitate affected areas. Offsets are the final option in the mitigation hierarchy. The impact assessment considers not only direct and indirect impacts, but also cumulative impacts, which are additive. Cumulative impacts in this instance must not cause irreversible decline to the conservation status of species and the presence of special habitats or cause a significant loss in ecosystem services. Residual impacts are negative impacts that remain after all reasonable and practical changes have been made to location, siting, scale, layout, technology, and design of the proposed development. Provided the residual impacts are Very Low or Low, no offset is required. However, if the residual impacts are Medium or High, then an offset is required. Very High residual impacts cannot be offset and are unlikely to be authorised.

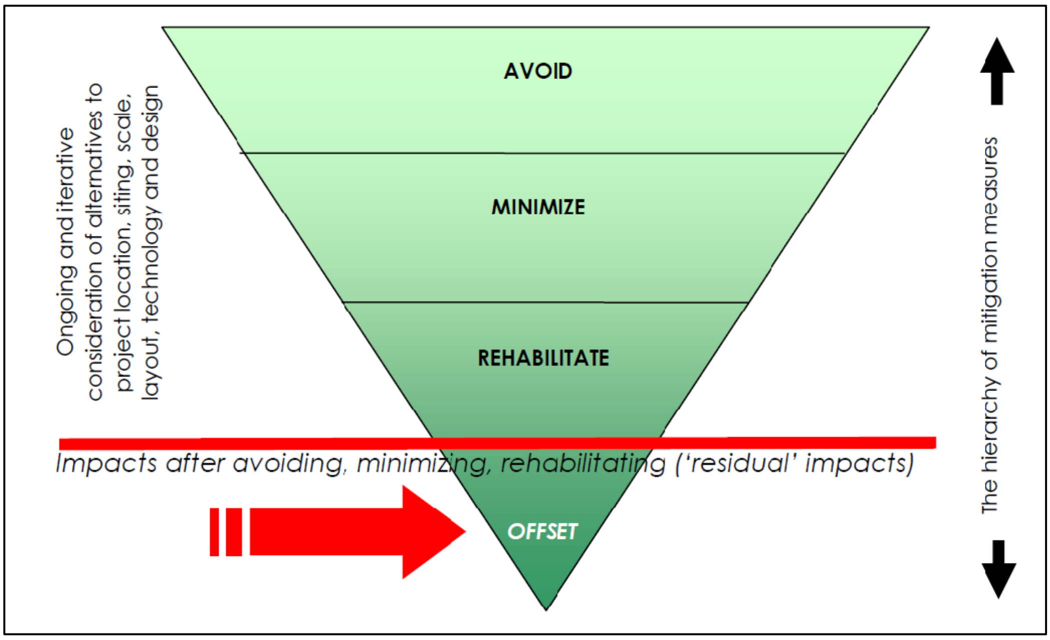

Figure 22: Mitigation hierarchy applied in the assessment of impacts.

The impacts related to the proposed sewer line on the aquatic biodiversity are limited only to the section of the sewer line (approximately 160 m) located within the 1:50 and 1:100 year flood lines (Figure 15). This is due to the absence of any definable aquatic features or watercourses along the remaining length of the sewer line.

Each of the impacts expected to occur during the construction and operational phase has been assessed in terms of their significance. The main impacts associated with the sewer line are as follows:

- Decrease in water and habitat quality because of leaking sewer infrastructure.
- Increased chances of erosion due to the clearing of vegetation and construction activities, resulting in sedimentation within the Hydrological Flow Path at the first crossing, flowing into the Great Brak Estuary.

4.3.1 No-Go Option

The no-go option considers the scenario where the sewer line upgrade is not approved. In this case, the use of the sewer line would continue under the present conditions.

Impact 1: Decrease in the water quality of the estuary caused by sewage leaks from overflowing conservancy tanks within the catchment of the Great Brak Estuary.

Currently, several conservancy tanks located within the catchment of the Great Brak Estuary and associated with the proposed upgrade of the sewer line have the potential to overflow and lead to untreated sewage entering surrounding drainage features and hydrological flow paths. Evidence observed during the site assessment indicates that sewage leakage and/or overflow from some of these conservancy systems may be entering watercourses and drainage pathways that ultimately discharge into the estuary. Leaking of sewage can cause pollutants, such as nutrients (nitrogen and phosphorus), pathogens, and organic matter, to be directly discharged into the estuary. This can lead to a decline in water quality, potentially causing eutrophication, which may result in algal blooms. Algal blooms deplete oxygen levels, harming aquatic life and disrupting the natural ecological balance of the estuary.

	Without Mitigation	**With Mitigation**
Intensity	High	High
Duration	Permanent	Permanent
Extent	Local	Local
Probability	Almost certain	Unlikely
Significance	**-90: Moderate**	**-45: Minor**
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

Mitigation:

- Conduct frequent inspections for any potential leaks during operation (twice a year).
- Test water during inspections (twice a year) to detect any possible leaks.
- Report leaks as soon as possible to the municipality.
- Have spill containment measures and emergency response procedures in place in case of accidental leakage.
- Empty the conservancy tanks more frequently with honey-suckers (increase frequency as the usage increases).

Significance:

The significance of the impact without mitigation is Moderate, implying that the impact is likely to occur, but can be mitigated; however, mitigation is subject to impact being observed and mitigation measures being implemented. The implementation of which is beyond the scope of this report.

The significance of the impact with mitigation remains Minor, with an increase in the frequency of inspection and sewage removal, the impact can be mitigated significantly.

4.3.2 Layout and Design Phase

Impact 1: Sewer line design in the flood line.

The first section of the sewer line is located within the 1:50 and 1:100 year floodline. The primary concern around the development, or maintenance of sewerage infrastructure in flood-prone areas is the prevention of the leakage of sewage during flood events, which could pollute the estuary.

	Without Mitigation	With Mitigation
Intensity	High	High
Duration	Brief	Brief
Extent	Local	Local
Probability	Likely	Probably
Significance	**-50: Minor**	**-40: Minor**
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

Mitigation:

- Air valves along sewer lines must be elevated above the 1:100-year flood line
- Sewer manhole covers should not be made of metal because of the risk of theft.
- Manholes must be designed to be watertight to prevent environmental contamination from leaking sewage and to avoid ingress of surface water during rainfall and flood events. Watertight manholes achieve this seal using components like gaskets on the manhole cover, proper joint sealing between sections, and leak-resistant pipe-to-manhole connections, which are essential for system integrity and cost efficiency.

Significance:

Sewer infrastructure located within a flood line poses a risk of sewage leakage or surface water ingress during flood events, potentially contaminating the estuarine environment. The impact is rated as Minor (-50) without mitigation, as flood conditions may compromise system integrity if components are not adequately sealed. With the implementation of watertight manholes, elevated air valves, and non-metal manhole covers to prevent theft and maintain system security, the impact is reduced to a slightly lower score in the Minor category (-40), with the likelihood of the impact occurring being lower.

4.3.3 Construction Phase

Impact 2: Disturbance of estuarine habitat caused by construction activities.

Construction activities will take place in close proximity to estuarine habitat. These activities include clearing of vegetation, excavation of trenches, stockpiling of materials and mixing of cement (e.g. for construction of manholes). Care must therefore be taken to minimise disturbance and impact on adjacent habitat.

	Without Mitigation	With Mitigation
Intensity	High	Moderate
Duration	Short term	Short term
Extent	Limited	Very limited
Probability	Almost certain	Unlikely
Significance	**-60: Minor**	**-24: Negligible**
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

Mitigation:

- An Environmental Control Officer (ECO) must be appointed for the duration of the construction phase to monitor and report back on compliance with conditions of the environmental authorisation.
- Consult weather forecasts daily and weekly. Do not work during rainfall and minimise the storage of mobile materials in low-lying areas. Plan the construction area as if it could be inundated with floodwaters in the event of a significant rainfall event.
- The width of the working area through must be as narrow as possible and must be clearly demarcated. The stream outside of this demarcated area must be considered as a No-Go area.
- Revegetation of the pipeline area must be actively supported by planting kweek grass: *Cynodon dactylon*.
- Open trenching for sewer lines should be done in as short a stretch as possible and backfilled with material as soon as possible to reduce the likelihood of material loss in the event of flooding. Excavated soil should be placed on the northern side of the trench.
- Keep a skip on site so that any waste materials can be conveniently discarded and removed. This includes small amounts of dirty water, such as that used for mixing concrete.
- Equipment and materials lay-down areas should be located at the proposed site camp only.
- Post-construction site clean-up must be completed to ensure the entire site footprint and the surrounding area have been cleared of litter and any waste materials associated with construction. The ECO should be informed of the construction close-out and complete an inspection to ensure this measure has been implemented.

Significance:

Construction-related disturbance in close proximity to estuarine habitats may lead to sedimentation, vegetation loss, and reduced ecological integrity. These short-term impacts are expected during excavation, material stockpiling, and other construction activities. This impact is rated as Minor (-60) without mitigation and Negligible (-24) with strict adherence to demarcation, erosion control, and rehabilitation measures.

4.3.4 Operational Phase

Impact 3: Pollution of estuarine habitat caused by pipeline blockages.

There is a high likelihood that occasional leaks will occur due to blockages or damaged sections of the pipeline. Standard operating procedures must be developed and implemented in order to detect, respond to and contain leaks when these do occur. The objective is to reduce the risk of pollution entering the estuary.

	Without Mitigation	With Mitigation
Intensity	High	Moderate
Duration	Brief	Brief
Extent	Local	Local
Probability	Almost certain	Almost certain
Significance	**-60: Minor**	**-54: Minor**
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

Mitigation:

- When blockages to sewerage infrastructure within the EFZ occur, the maintenance team should ensure a honey-sucker is on standby to mop up any spills or overflows for removal and disposal at the Wastewater Treatment Works.
- Any serious sewage spills that result in large quantities of sewage leaking from a manhole must be contained in a temporary coffer dam, which can be constructed using sandbags for the walls and plastic sheeting as a base. From here, honey-suckers can collect sewage for removal.
- Any water-tight seals around manholes, joints or other access points that must be broken for maintenance should be replaced thereafter to ensure the mitigation measures to prevent water ingress or sewage leakage are maintained under flood scenarios.
- Keep sewer line servitudes clear of dense vegetation to facilitate access and reduce the risk of roots cracking sewer lines.

Significance:

Blockages or failures of the sewer pipeline could lead to the discharge of sewage into the estuarine system, causing nutrient enrichment and potential health risks for aquatic biota. While leaks may occur occasionally, rapid containment and repair will minimise long-term effects. This impact is rated as Minor (-60) without mitigation and remains Minor (-54) with prompt spill response and infrastructure maintenance procedures.

5. RECOMMENDATION

It is recommended that a 10 m buffer area be allowed from the southern edge of the laydown area (Figure 23). This will reduce the likelihood of any material entering the ocean, on the beach, or blocking the culvert below the laydown area. Care should also be taken when converting the conservancy tank to a pump station (PS2) to ensure that untreated sewage does not spill into the flow path, onto the beach or into the ocean. It is thus recommended that spill kits be on site during construction and that a check dam be constructed if a large amount of spillage is expected. Additionally, it is recommended that the sewer line be located in the most disturbed areas adjacent to the road or railway, especially where the sewer line is proposed to run over the hill next to the railway (Figure 6). However, this recommendation relates to terrestrial impacts and is further discussed in the Terrestrial / Botanical specialist report (B. Fouche, Confluent Environmental).

Figure 23: Proposed laydown area in relation to the recommended 10 m buffer

6. CONCLUSION

In conclusion, the proposed new sewer line in Pienaarstrand is not expected to result in significant or irreversible impacts to any aquatic ecosystems, provided that all recommended mitigation and management measures are effectively implemented. The site verification confirmed that all the mapped watercourses at the crossings function as poorly defined flow paths, lacking the features used to classify watercourses in terms of the NWA. Although sections of the project occur within the Estuarine Functional Zone and mapped flood lines of the Great Brak Estuary, the implementation of appropriate erosion control, watertight infrastructure design, and routine maintenance will ensure that potential impacts remain minimal. Overall, the project aligns with the objectives of the Great Brak Estuary

Management Plan and supports improved wastewater management in the area while maintaining the ecological integrity of surrounding aquatic systems.

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APPENDIX 1: IMPACT ASSESSMENT METHODOLOGY

Individual impacts for the construction and operational phase were identified and rated according to criteria which include their intensity, duration and extent. The ratings were then used to calculate the consequence of the impact which can be either negative or positive as follows:

Consequence *= type x (intensity + duration + extent)*

Where type is either negative (i.e. -1) or positive (i.e. 1). The significance of the impact was then calculated by applying the probability of occurrence to the consequence as follows:

Significance *= consequence x probability*

The criteria and their associated ratings are shown in Table 7.

Table 7: Categorical descriptions for impacts and their associated ratings

Rating	Intensity	Duration	Extent	Probability
1	Negligible	Immediate	Very limited	Highly unlikely
2	Very low	Brief	Limited	Rare
3	Low	Short term	Local	Unlikely
4	Moderate	Medium term	Municipal area	Probably
5	High	Long term	Regional	Likely
6	Very high	Ongoing	National	Almost certain
7	Extremely high	Permanent	International	Certain

Categories assigned to the calculated significance ratings are presented in Table 8.

Table 8: Value ranges for significance ratings, where (-) indicates a negative impact and (+) indicates a positive impact

Significance Rating	Range	
Major (-)	-147	-109
Moderate (-)	-108	-73
Minor (-)	-72	-36
Negligible (-)	-35	-1
Neutral	0	0
Negligible (+)	1	35
Minor (+)	36	72
Moderate (+)	73	108
Major (+)	109	147

Each impact was considered from the perspective of whether losses or gains would be irreversible or result in the irreplaceable loss of biodiversity of ecosystem services. The level of confidence was also determined and rated as low, medium or high (Table 9).

Table 9: Definition of reversibility, irreplaceability and confidence ratings.

Rating	Reversibility	Irreplaceability	Confidence
Low	Permanent modification, no recovery possible.	No irreparable damage and the resource isn't scarce.	Judgement based on intuition.
Medium	Recovery possible with significant intervention.	Irreparable damage but is represented elsewhere.	Based on common sense and general knowledge
High	Recovery likely.	Irreparable damage and is not represented elsewhere.	Substantial data supports the assessment