Aquatic Biodiversity Impact Assessment

Erf 1486, Vermont, Western Cape Province

June 2025

Report Information

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Executive Summary

The owner of Erf 1486, Vermont, proposes subdivision of the property to create several erven for single residential use and one erf in the south for group housing. Additionally, following consultation with the Overstrand Municipality, the project will include the upgrade of an existing 110 mm diameter sewer pipeline to a 160 mm diameter pipeline along Kolgans Close Road.

Wetland conditions are known to exist within the erf and were previously delineated by Job and Ratcliff (Freshwater Consulting Group, 2006), commissioned by the Overstrand Municipality. In 2018, Joshua Gericke conducted a freshwater screening assessment of the erf, to inform feasibility and layout of the current proposed project (EnviroSwift, 2018). Subsequently, the owner has decided to proceed with the Environmental Authorisation (EA) application process for the proposed project.

Following the aquatic biodiversity screening assessment of the proposed site by Joshua Gericke on the 17th of August 2018, a natural Unchanneled Valley-Bottom (UVB) wetland was confirmed and delineated on the erf (EnviroSwift, 2018). During a follow up site assessment by Gericke and van Zyl (Delta Ecology, 2023) on the 30th of May 2023, an updated delineation of the UVB wetland was determined (**Figure i**). The wetland had expanded slightly in the south eastern corner of the erf, possibly as a result of increased stormwater input in this area.

The wetland is part of a 1.4 km long wetland system that originates within the study area and ends at the Vermont Pan to the southeast (**Figure i**). A depression has been excavated towards the centre of the erf, with an overflow pipe that crosses beneath Lynx Road and flows into the wetland on the far side thereby creating a hydrological link between the wetlands within the site and the greater wetland to the southeast. An additional stormwater outlet is found in the southeast corner of the erf, which discharges runoff from the neighbouring housing development into the wetland. The remainder of the 1.5 ha erf is extensively disturbed and characterised by a mixture of alien and indigenous vegetation.

Given the confirmed presence of a wetland which is likely to be impacted by the proposed development, the area was determined to be of "Very High" aquatic sensitivity. If the specialist determines that the Aquatic Biodiversity sensitivity is "Very High", the GN320 of 2020 requires that a full aquatic biodiversity impact assessment must be submitted as set out by the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020).

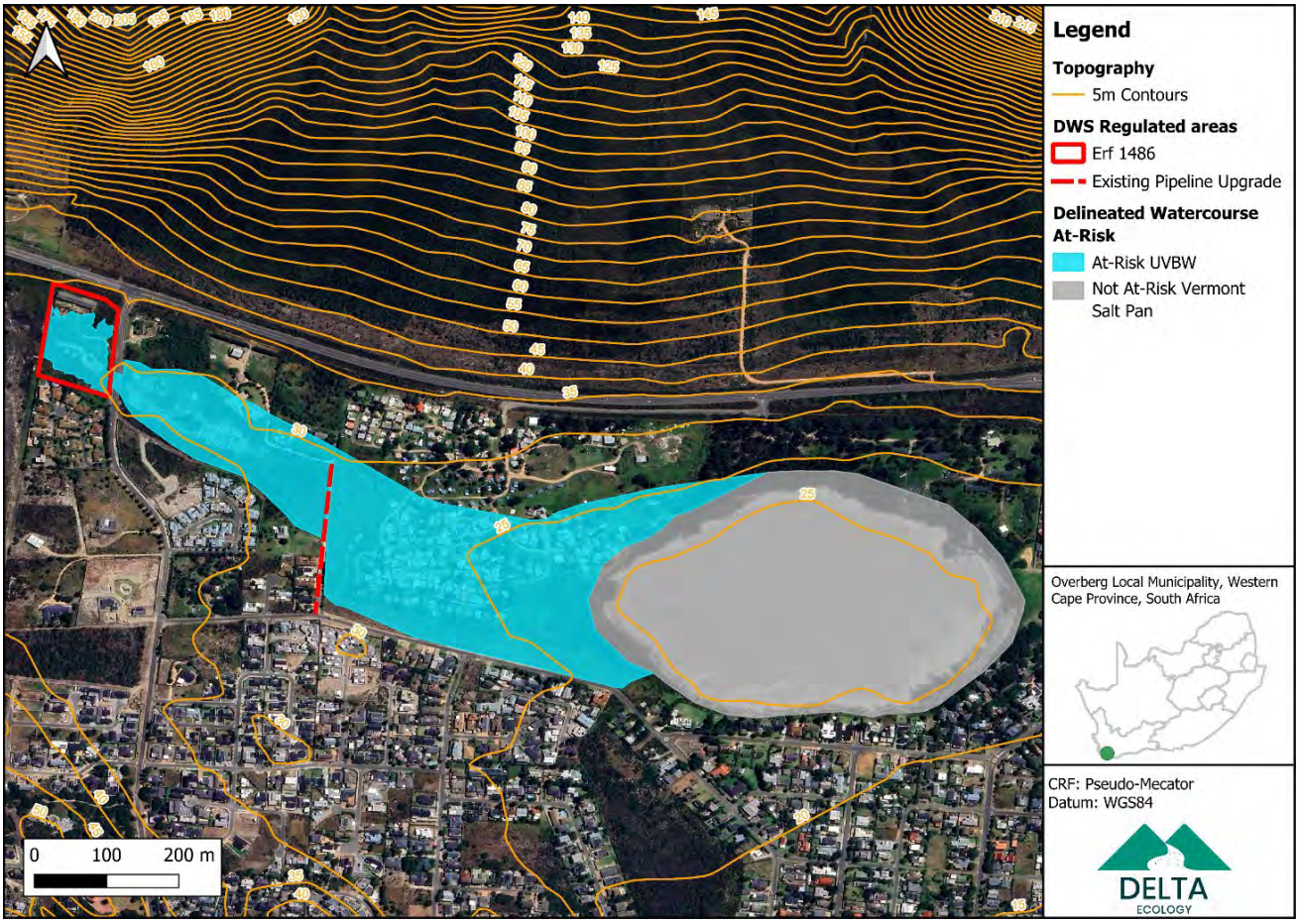

Figure i: Delineated "At risk" UVB wetland.

In this impact assessment, the delineated at-risk UVB wetland (**Figure i**) was assessed using current best practice assessment methodologies to determine the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS), Wetland Ecosystem Services (WES), and Recommended Ecological Category (REC) metrics. The results of these assessments are as follows:

Table i: Results of the wetland status quo assessment.

	PES	EIS	WES (Highest)	REC
UVB Wetland	D	Moderate	Moderate	D-C

Although the condition of the UVB wetland was largely disturbed, the EIS and WES scores indicates that the wetland is moderately sensitive and important in terms of conservation planning or provision of ecosystem services.

Aquatic biodiversity impacts / risks associated with the development were identified and assessed using both an impact assessment methodology compliant with NEMA requirements and the Risk Assessment Matrix (RAM) prescribed by GN 4167 of 2023.

The potential aquatic biodiversity impacts for all three layout alternatives identified were assessed first without, and then with, the application of mitigation measures.

All the potential impacts to the UVBW were the lowest (both prior and after the implementation of mitigation measures) for Alternative Layout 3. This layout is therefore preferred from an aquatic perspective, as it entails all proposed residential erven to be located outside the delineated permanent wetland area. Additionally, in this preferred layout although some portions of the erven extend slightly into the outer edge of the seasonal and temporary wetland zones, these portions will be designated as no-go areas and will be excluded from any development activities.

Five out of the seven post-mitigation scores fell within the "Low" impact categories for the preferred Alternative Layout 3. Wetland loss (during construction) and alteration of flow (during operational phase) received the highest impact significance score, which fell within the 'Medium' category, both prior and after mitigation measures.

The proposed layout has gone through various iterations to ensure that the layout overlapping with the delineated wetland area is minimal. Ordinarily, wetland loss would fall within the 'high' category, but the minimal area of wetland to be lost (0,024 Ha) and the degraded nature of the wetland has reduced the impact significance.

The "no go" scenario was assessed and found to be of "Low" impact significance as this scenario would result in continuation of existing impacts to the wetland due to the within wetland disturbances and adjacent land uses. No indirect impacts were noted.

The outcome of the RAM prescribed by GN 4167 of 2023 found that wetland loss and alteration of flow were of a **Medium Risk** to the UVBW. In terms of the NWA (Act 36 of 1998) and its regulations, a full Water Use License Application (WULA) in terms of c and i water uses will be applicable to the development activities on the site.

It is recommended that an Aquatic Ecologist be consulted during the design of the residential dwellings and Town Housing unit, and an Environmental Control Officer (ECO) should be appointed during the construction of the Town Housing development in the south of the erf.

It is furthermore highlighted that a suitable Wetland Offset, Rehabilitation, and Management Plan will be required for the project in terms of the DWS 'no net loss' policy (Macfarlane *et al*, 2014). *It is the opinion of the specialist that rehabilitating the remnant UVBW onsite will be a feasible and acceptable offset for the proposed development.*

It is the opinion of the specialist that the proposed development should be approved subject to application of the mitigation measures listed in this report.

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Area of Specialisation	Freshwater Ecology

Kimberley van Zyl is an ecologist and environmental scientist with over 7 years' experience in the environmental management field. She holds a MSc. degree in Water Resource Management from the University of Pretoria and her professional affiliations include the South African Council for Natural Scientific Professions (SACNASP) and the Southern African Society of Aquatic Scientists (SASAqS). Kimberley's work experience has exposed her to a range of projects across various business sectors such as mining, agriculture, and construction, as well as the public sector. A signed statement of independence will be provided as a separate document.

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Joshua Gericke is an aquatic biodiversity specialist with over 12 years of experience. He has undertaken over 100 aquatic biodiversity screenings, assessments, and plans. In addition to his honour's degree, he has completed several relevant short courses on a variety of topics including hydrophytic vegetation identification, wetland assessment methodologies, SASS5 river health assessments, and hydropedology. Prior to his consulting career, Joshua worked for the City of Cape Town's Biodiversity Management Branch for almost 9 years and received the Mayoral Outstanding Service Award for work in the field of urban wetland and estuary management. A full CV can be provided on request.

1. Introduction

The owner of Erf 1486, Vermont, proposes subdivision of the property to create several erven for single residential use and one erf in the south for group housing (**Figure 1-2** - **Figure 1-3**). Additionally, following consultation with the Overstrand Municipality, the project will include the upgrade of an existing 110 mm diameter sewer pipeline to a 160 mm diameter pipeline along Kolgans Close Road (**Figure 1-2** and **Figure 1-4**).

The study area for this aquatic assessment is the extent of Erf 1486 and the location of the pipeline upgrade, within Vermont, Overstrand Local Municipality. Erf 1486 is bordered to the north by the R43 road reserve, to the west by the Hoek van der Berg Private Nature Reserve, to the south by a small residential housing estate and to the east by Lynx Road (**Figure 1-5**). The erf contains a gravel access road which enters the site from Lynx Road and terminates at the derelict buildings in the northwest corner of the site (**Figure 1-5**).

Wetland conditions are known to exist within the erf and were previously delineated by Job and Ratcliff (Freshwater Consulting Group, 2006), commissioned by the Overstrand Municipality. In 2018, Joshua Gericke conducted a freshwater screening assessment of the erf, to inform feasibility and layout of the current proposed project (EnviroSwift, 2018). Subsequently, the owner has decided to proceed with the Environmental Authorisation (EA) application process for the proposed project.

Following the aquatic biodiversity screening assessment of the proposed site by Joshua Gericke on the 17th of August 2018, a natural Unchanneled Valley-Bottom (UVB) wetland was confirmed and delineated onsite (EnviroSwift, 2018). The wetland was confirmed, and an updated delineation was undertaken during a site assessment by Gericke and van Zyl (Delta Ecology, 2023) on the 30th of May 2023.

The wetland is part of a 1.4 km long wetland system that originates within the erf and ends at the Vermont Pan to the southeast. A depression has been excavated towards the centre of the erf, with an overflow pipe that crosses beneath Lynx Road and flows into the wetland on the far side thereby creating a hydrological link between the wetlands within the erf and the greater wetland to the southeast (refer to **Figure 1-5**). An additional stormwater outlet is found in the southeast corner of the erf, which discharges runoff from the neighbouring housing development into the wetland (**Figure 1-5**). The remainder of the 1.5 ha erf is extensively disturbed and characterised by a mixture of alien and indigenous vegetation.

Given the confirmed presence of a wetland which is likely to be impacted by the proposed residential development, the area was determined to be of "Very High" aquatic sensitivity. If the specialist determines that the Aquatic Biodiversity sensitivity is "Very High", the GN320 of 2020 requires that a full aquatic biodiversity impact assessment must be submitted as set out by the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020).

The aim of this aquatic biodiversity impact assessment is to (1) determine the Present Ecological State (PES) and ecological importance of the wetland system present, (2) to assess the potential impact of the proposed development on the mapped and confirmed wetland, and (3) to provide recommendations for impact mitigation.

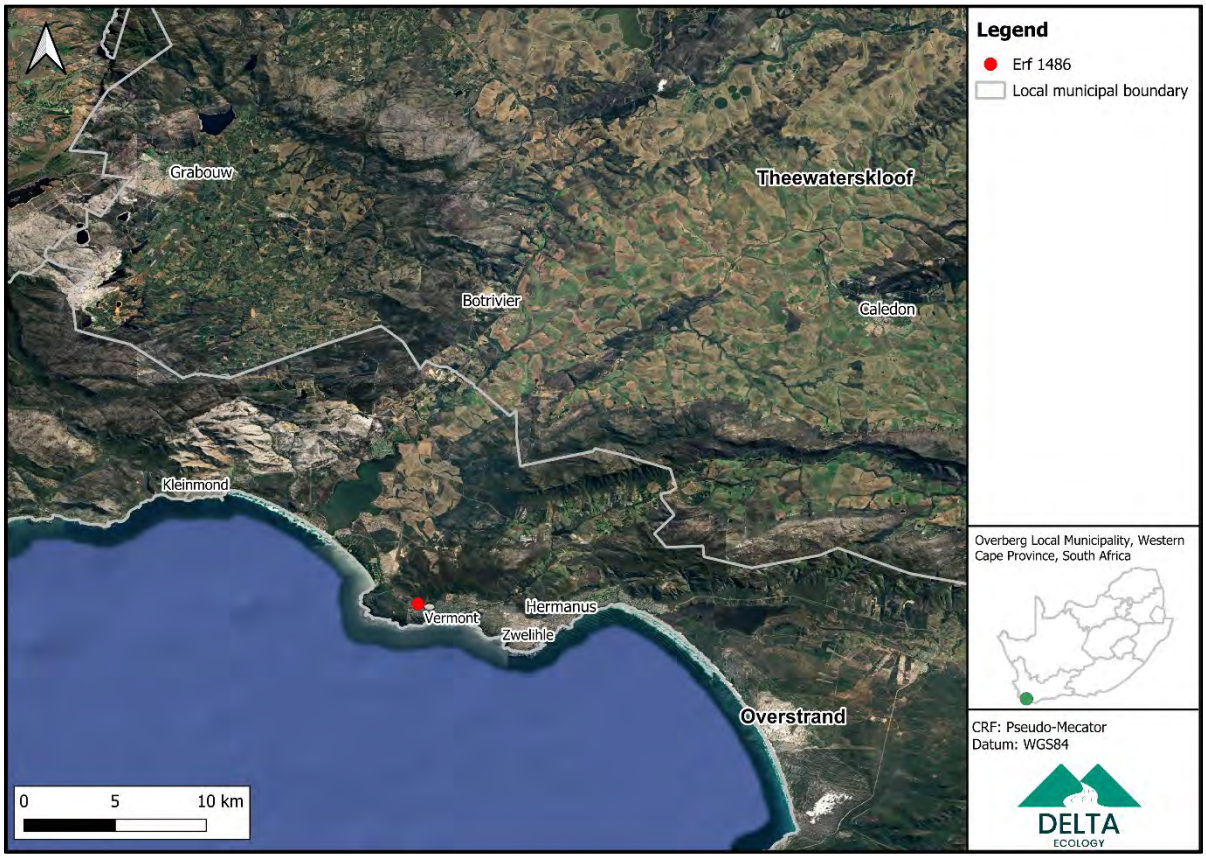


Figure 1-1: Regional Locality Map.

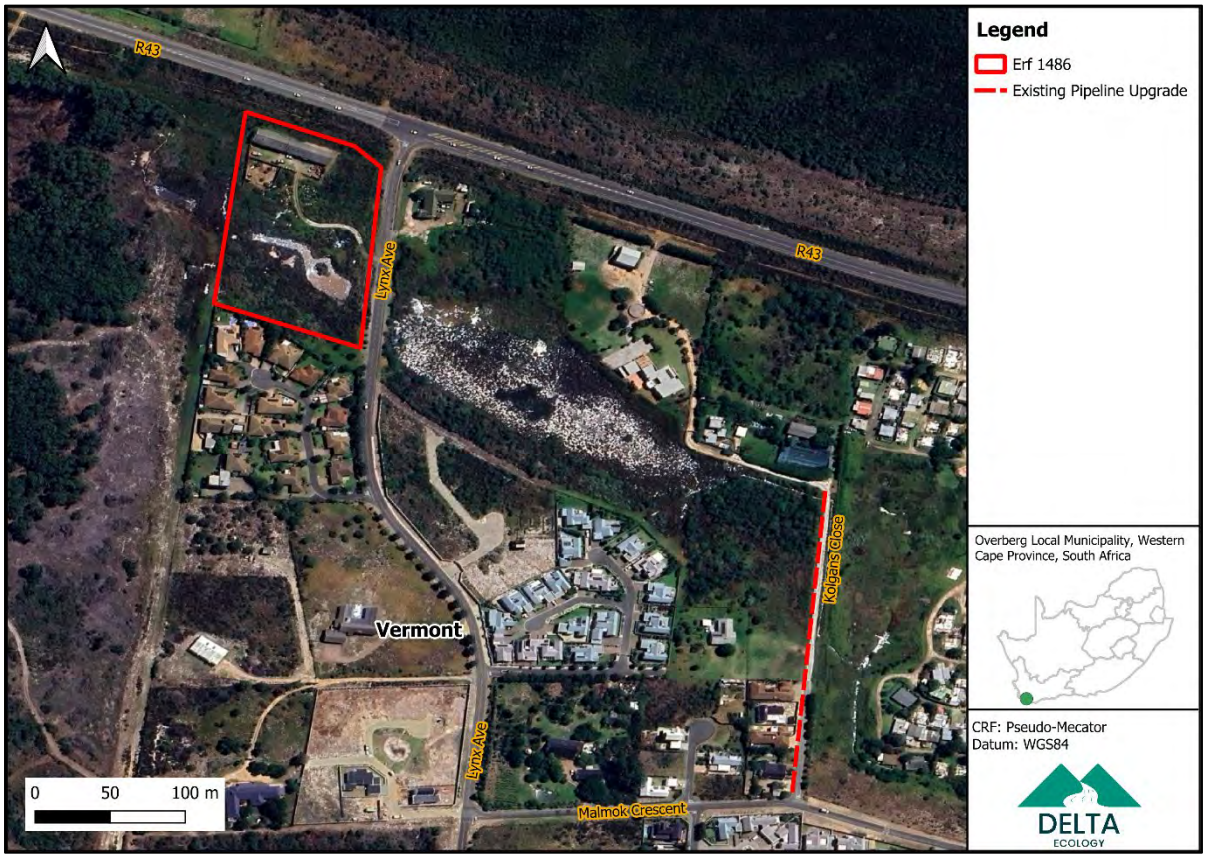
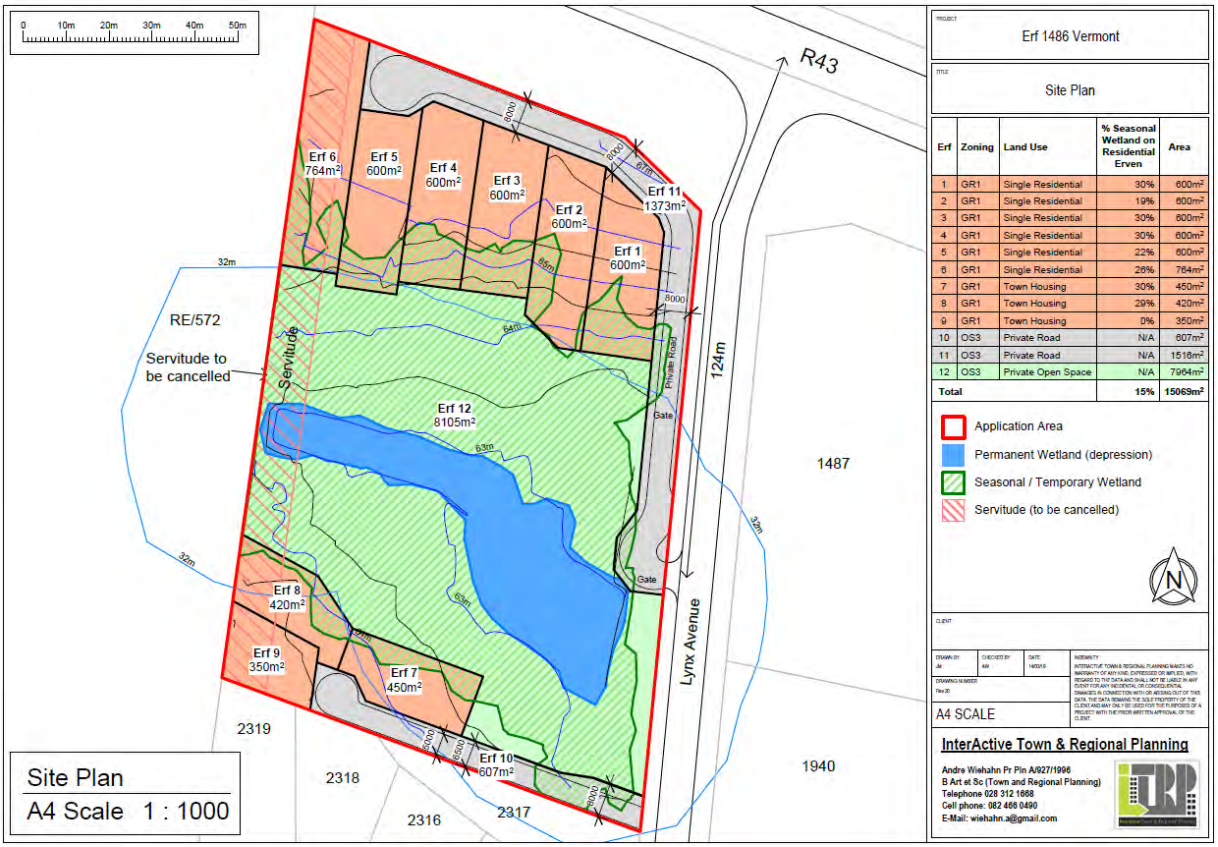


Figure 1-2: Location of the proposed site, Erf 1486, and upgrade of existing pipeline, in Vermont.



Erf	Zoning	Land Use	% Seasonal Wetland on Residential Erven	Area
1	GR1	Single Residential	30%	600m²
2	GR1	Single Residential	19%	600m²
3	GR1	Single Residential	30%	600m²
4	GR1	Single Residential	30%	600m²
5	GR1	Single Residential	22%	600m²
6	GR1	Single Residential	28%	764m²
7	GR1	Town Housing	30%	450m²
8	GR1	Town Housing	29%	420m²
9	GR1	Town Housing	0%	350m²
10	OS3	Private Road	N/A	607m²
11	OS3	Private Road	N/A	1516m²
12	OS3	Private Open Space	N/A	7964m²
Total			15%	15069m²

Figure 1-3: Preferred Layout (Alternative 3) for the site.

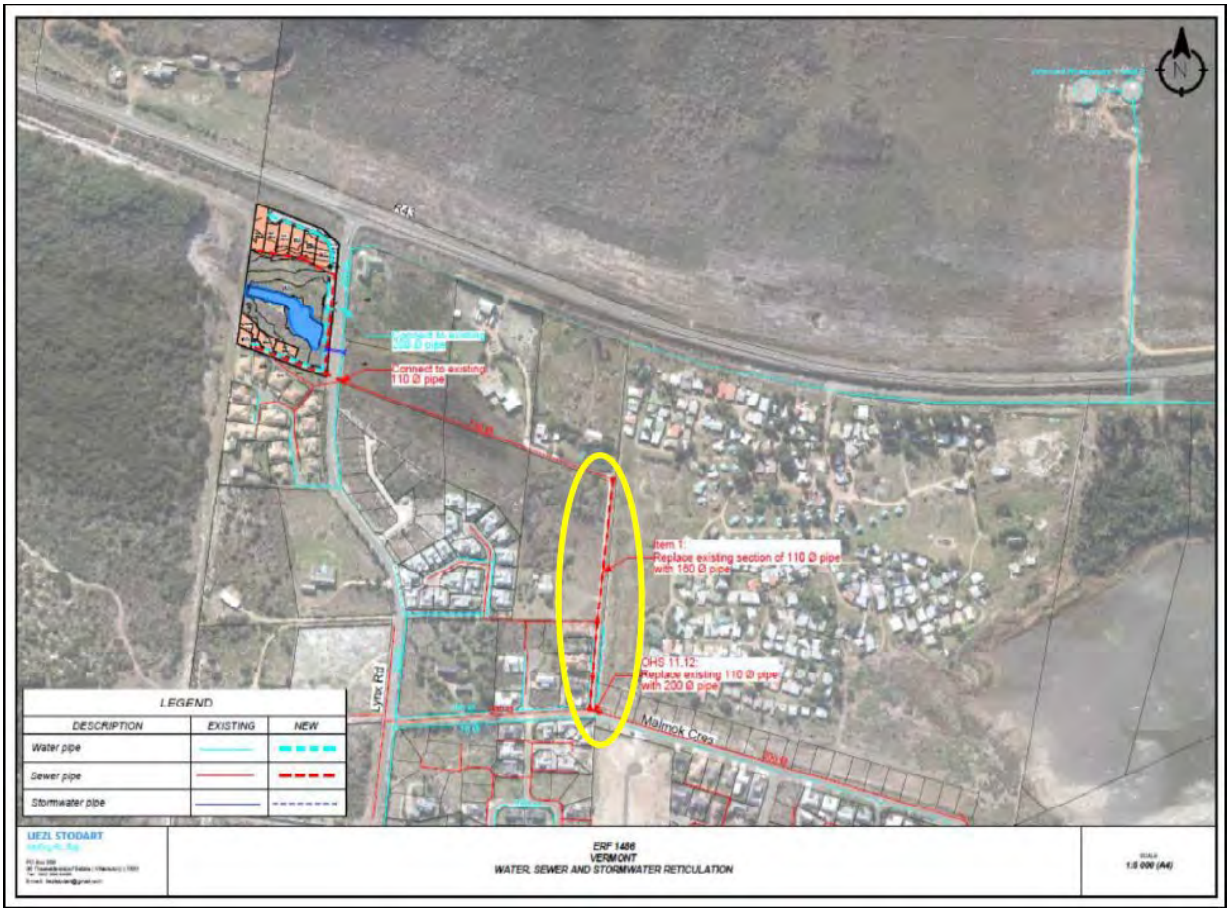


Figure 1-4: Location of the municipal sewer pipeline upgrade (indicated in yellow).

Figure 1-5: Location of infrastructure and landmarks within and adjacent to the study area.

1.1. Terms of Reference

The terms of reference agreed upon for this aquatic biodiversity assessment include:

- A desktop background assessment to identify potential aquatic biodiversity constraints associated with the proposed development.
- A site assessment to confirm aquatic biodiversity constraints.
- Delineation of watercourse (s) likely to be impacted, or to be "At-Risk", because of the proposed development activities using a combination of site-based and desktop methodologies as appropriate.
- Verification of the aquatic site sensitivity as either "Very High" or "Low".
- Drafting of an aquatic biodiversity impact assessment report including the following:
    - General site description;
    - Site sensitivity verification;
    - Determination of the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) and the contribution to Wetland Ecosystem Services (WES);
    - Assessment of potential aquatic biodiversity impacts of the proposed development on the watercourse present onsite;
    - Application of the Risk Assessment Matrix (RAM) stipulated by GN 4167 of 2023 promulgated in terms of the National Water Act (Act 36 of 1998); and
    - Provision of mitigation measures to reduce aquatic biodiversity impact as far as possible.

1.2. Limitations and Assumptions

The following limitations and assumptions apply to this assessment:

- The site assessment was undertaken on the 30th of May 2023, during the winter season in the Western Cape Province. Therefore, this assessment does not cover complete seasonal variation in conditions at the site. This is however, in the opinion of the specialist, of no material consequence to outcome of this assessment.
- The duration of the site assessment was approximately 4 hours which was sufficient to adequately assess the watercourse and the aquatic biodiversity risk posed by the proposed project.
- The watercourse was delineated using a Garmin handheld GPSMAP 66i with an expected accuracy of 3 m or less at the 95% confidence interval. In the opinion of the specialist, this limitation is of no material significance to the assessment and all aquatic biodiversity constraints have been adequately identified.
- The information provided by the client forms the basis of the planning and layouts discussed.
- Formal vegetation sampling was not done by the specialist, however general observations pertaining to vegetation were recorded based on onsite visual observations. Furthermore, only dominant, and noteworthy plant species were recorded. Thus, the vegetation information provided has limitations for true botanical applications.
- Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions, species' seasonality, and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage.
- Description of the depth of the regional water table, geohydrological, hydrology, and hydro pedological processes falls outside the scope of the current assessment.
- Flood line calculations fall outside the scope of the current assessment.
- A Species of Conservation Concern (SCC) scan, fauna and flora assessments were not included in the current study.
- Watercourse delineation plotted digitally may be offset by at least five meters to either side. Furthermore, it is important to note that, during converting spatial data to final drawings, several steps in the process may affect the accuracy of areas delineated in the current report. It is therefore suggested that the no-go areas identified in the current report be pegged in the field in collaboration with the surveyor for precise boundaries. The scale at which maps and drawings are presented in the current report may become distorted should they be reproduced by, for example, photocopying and printing.
- The delineation does not consider climate change or future changes to watercourses resulting from increasing catchment transformation. The reason for this is because the accepted best practice method for delineating watercourses in South Africa, required by GN 509[1], uses key indicators obtained in the field to determine the wetland's **current** edge. *The applicant should be cognisant of the risk that the extent, ecological state, and function of the onsite watercourse may change over time, due to altered land use in the catchment.*

[1] Also refer to Section 3.2. for a detailed description of this methodology.

Change to the onsite watercourse could be because of a variety of reasons, including the removal of Alien Invasive Species (AIS) on the adjacent property. It is this specialist's opinion that the removal of the AIS, and the impact thereof, should be monitored by both the applicant and the landowner/ entity initiating the clearing of AIS.

- Notwithstanding the above limitations, the specialist is of the opinion that the aquatic biodiversity constraints for the project have been adequately identified for the purposes of this aquatic biodiversity assessment.

Notwithstanding the above limitations, the specialist is of the opinion that the aquatic biodiversity constraints for the site have been adequately identified for the purposes of this aquatic biodiversity assessment.

1.3. Use of this report

This report reflects the professional judgement of its author and, as such, the full and unedited contents of this should be presented in any application to relevant authorities. Any summary of the findings should only be produced with the approval of the author.

2. Site Sensitivity Verification

According to the national web-based environmental screening tool report generated for the site, the Combined Aquatic Biodiversity Theme Sensitivity is classified as "Very High" (DFFE, 2023). The classification trigger is the location of the site within a Strategic Water Source Area (SWSA) for surface water (Boland).

As per the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020), prior to initiation of specialist assessments, the current land use, and the potential environmental sensitivity of the site - as identified by the national web-based environmental screening tool - must be confirmed by undertaking an Initial Site Sensitivity Verification. This Initial Site Sensitivity Verification aims to confirm or dispute the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool.

Note on Strategic Water Source Areas:

Strategic Water Source Areas (SWSAs) are described in the Water Research Commission Report No. TT754/1/18 (Le Maitre *et al*. 2018). These are divided into surface water (sw) and groundwater (gw) sources. Strategic Water Source Areas (SWSA) for surface water are defined as areas of land that supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important.

The application area has been mapped as falling within a Strategic Water Source Area for surface water (SWSA-sw) i.e the Boland SWSA-sw and this is reflected in the DFFE Screening Tool Report. The Boland SWSA-sw covers a very large area of 6 083 square kilometres and this mainly includes the important mountain catchment areas of the Boland Mountains (i.e. Hottentots Holland, Jonkershoek, Du Toits Kloof and Bains Kloof Mountains). This SWSA-sw supplies about 79% of the water for the dams that provide most of the water supplied to various towns in the area.

The Water Research Commission Report is a high-level strategic study that provides an overview of Strategic Water Source Areas at a National scale. It is not appropriate for the results of this study to be used at a project scale. The proposed development is in the lowlands and is not located in a mountain catchment area (**Figure 5-1**).

Following the aquatic biodiversity screening assessment of the proposed site on the 17th of August 2018, a natural UVB wetland was confirmed and delineated onsite (EnviroSwift, 2018). The wetland was confirmed, and an updated delineation was undertaken during a site assessment by Gericke and van Zyl (Delta Ecology, 2023) on the 30th of May 2023.

The wetland has been disturbed and transformed through the construction of buildings, excavation of a dam / depressional area, and roads. Despite this, it is clear from hydromorphic soil and hydrophytic vegetation indicators that both natural wetland function and habitat exist within the erf and form part of the larger wetland system of the Vermont Salt Pan. The proposed development is likely to impact the hydrology, water quality and wetland vegetation present. Encroachment of the development into the onsite wetland will impact the geomorphology of the wetland.

Given the confirmed presence of an onsite wetland which is likely to be impacted by the proposed development, the site was determined to be of "Very High" aquatic sensitivity. According to GN R. 320 of 2020, if the specialist determines that the Aquatic Biodiversity sensitivity of the site is "Very High", then a full Aquatic Biodiversity Impact Assessment must be compiled as part of the Basic Assessment (BA) process.

3. Methodology

The methodology used in this aquatic biodiversity impact assessment report, including a desktop background assessment, one site visit, and the delineation, and classification of the wetland associated with the proposed site, is outlined in the subsections below.

3.1. Desktop Assessment

A review of desktop resources was undertaken to determine the nature of the proposed site, the presence of watercourses in the vicinity, and the significance of the site in terms of biodiversity planning. The following desktop resources were consulted:

- Topographical information from the National Geographical Information Service (NGI);
- The South African Atlas of Climatology and Agrohydrology (1997, 2007 and 2009);
- The South African National Biodiversity Institute (SANBI) (2018) National Vegetation Map (NVM);
- The SANBI NWM5 (2018);
- The National Freshwater Ecosystem Priority Area (NFEPA) (CSIR, 2011) wetland, wetland vegetation group classification, river and FEPA datasets;
- The Natural Agricultural Resource Atlas of South Africa: Version 1.2 (NAR, 2022).
- The Western Cape Biodiversity Spatial Plan (WCBSP, 2023).

3.2. Wetland Identification & Delineation

Watercourses were identified and delineated using the method described in the Manual for the Identification and Delineation of Wetlands and Riparian Areas for field-based delineation (DWAF, 2008). This method is the accepted best practice method for delineating watercourses in South Africa and its use is required by GN 509. For wetlands, the method makes use of four key field indicators to guide the delineation process (refer to **Box 1**):

Box 1. Four indicators of wetland presence as described in DWAF (2008):

1. The **position in the landscape** – Identifies parts of the landscape where wetlands are more likely to occur;
2. The presence of **aquatic vegetation communities**;
3. The presence of **hydromorphic soil features**, which are morphological signatures that appear in soils with prolonged periods of saturation (associated with anaerobic conditions). Key hydromorphic features include:
    a. Mottling – Formation of clumps of iron oxide within the soil matrix in the form of orange, yellow, black, or reddish-brown speckling. Mottling occurs in most soils and reaches maximum density in the centre of the seasonal zone with sparse mottling in the temporary zone and no mottling in the permanent zone.
    b. Gleying – Shift in soil colour from the terrestrial baseline towards a blue, green, or grey colour and an overall reduction in soil chroma. This phenomenon is normally difficult to identify in the temporary zone, noticeable in the seasonal zone and most significant in the permanent zone.
    c. Organic Surface Layers – surface layers with very high organic content that typically occur in the wetland seasonal and permanent zones.
    d. Organic Streaking – Streaks of organic matter within the soil column which may be present in all zones, but particularly the temporary and seasonal zones.

Soil samples were taken for inspection by hand augering to determine soil form, presence of redoximorphic and other hydromorphic soil features. Aquatic vegetation communities were identified using the (DWAF, 2008) classification of wetland plant species, along with auxiliary information from (Van Ginkel *et al*., 2011). Wetland plant species classification categories include:

- Obligate species (occurring in wetlands >99% of the time – usually in the permanent or seasonal zone);
- Facultative Positive species (67 to 99% of the population occurs within wetlands – typically in the seasonal and temporary zones with the remaining 1 to 33% in the adjacent area on the wetland periphery);
- Facultative Species (33 – 67% of the population occurs within wetlands – usually in seasonal or temporary zones with the remaining 67 – 33% in the adjacent area on the wetland periphery);
- Facultative Negative Species (1 – 33% of the population occurs within wetlands – usually in the temporary zone with the remaining 99 to 67% in the adjacent area on the wetland periphery);
- Wetland Cosmopolitan Species (No specific affinity for wetlands and colonise wetland and terrestrial areas).

3.3. Wetland Classification

The Ollis *et al* (2013) Classification System for Wetlands and Other Aquatic Ecosystems in South Africa, as used in this assessment, is a tiered structured classification system that provides a uniform description of wetland types based on their hydrogeomorphic characteristics (**Figure 3-1**).

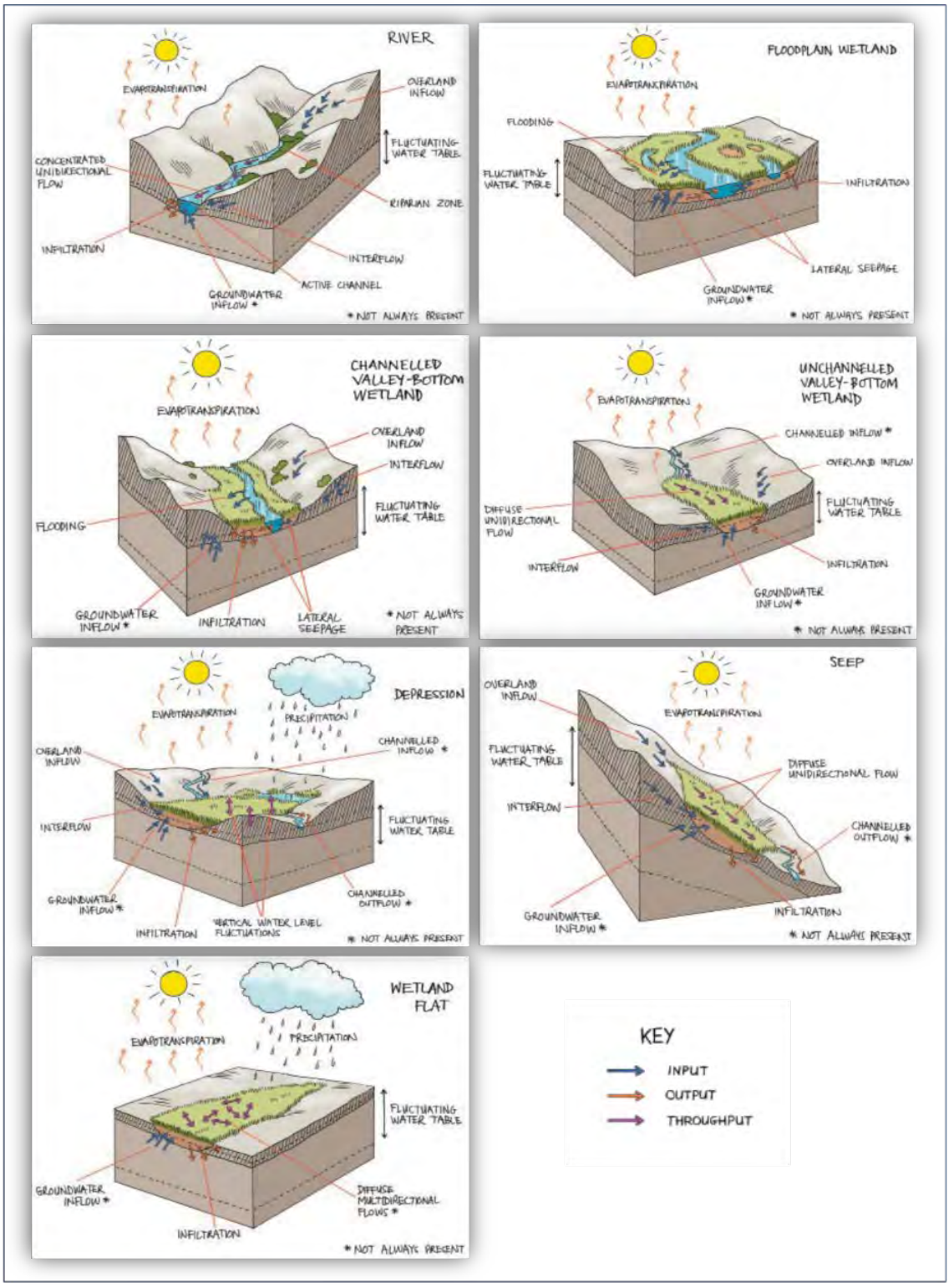


Figure 3-1: Wetland Hydrogeomorphic Types as defined in the Classification System for Wetlands and Other Aquatic Ecosystems in South Africa (Ollis *et al*., 2013).

3.4. Present Ecological State Assessment

WET-Health Version 2 (Macfarlane *et al*. 2020) is a modular tool designed to evaluate and assess the Present Ecological State (PES) of wetland hydrogeomorphic units based on the degree to which the wetland has deviated from its natural reference condition. The tool accounts for four inter-related components that influence wetland health. These consist of three core drivers of wetland change namely hydrology, geomorphology and water quality, along with vegetation as a responding variable. A separate PES score is derived for each of these components, which are then combined into a single PES score for the wetland hydrogeomorphic unit. The scores for each component and the overall score fall into one of six Ecological Categories defined in **Table 3-1** below.

The tool offers three levels of assessment:

1. Level 1A, a low-resolution desktop-based assessment;
2. Level 1B, a high-resolution desktop-based assessment; and
3. Level 2, a detailed rapid field-based assessment.

Level 1A is applied to provincial and national scale assessments of many wetlands, while Level 1B is applied to catchment scale assessments or to rapid individual assessments. The Level 2 assessment incorporates information from a direct onsite assessment of the wetland and its catchment and adds detail by separately assessing the various disturbance units within the wetland. The level 2 PES assessment was applied in this case.

Table 3-1: PES Categories Scores as defined WET-Health Version 2 (Macfarlane *et al*., 2020).

Ecological Category	Description	Impact Score	PES Score (%)
A	Unmodified, natural.	0-0.9	90-00
B	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	80-89
C	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	60-79
D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	40-59
E	Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	20-39
F	Critically modified. Modifications have reached a critical level, and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	0-19

3.5. Ecosystem Service Assessment

WET-EcoServices Version 2 (Kotze *et al*. 2020) is a structured and rapid field-based evaluation tool designed to assess the wetlands ecosystem services based on its Hydrogeomorphic (HGM) unit. The tool accounts for 16 ecosystem services which are derived from regulating (e.g., flood attenuation), provisioning (e.g., water supply), supporting (e.g., biodiversity maintenance), and cultural (e.g., tourism and recreation) services (refer to **Annexure 1**). The tool evaluates the scale of ecosystem services supplied (in terms of a score out of 4 per service) relative to other wetlands and furthermore compares the scale of service supply to the demand for each service. The scores are divided into seven categories as per **Table 3-2**.

The tool offers two levels of assessment, namely Level 1 (a rapid desktop assessment) and Level 2 (a detailed field-based indicator assessment). Level 1 is designed for conducting rapid desktop assessments of many wetlands across provincial and national scales. Ratings are assigned based on the Hydrogeomorphic unit of the wetland. Level 2 is designed for conducting robust in-field assessments of ecosystem services for respective wetland types. The level 2 Ecosystem Service assessment was applied in this case.

Table 3-2: Ecosystem Services Importance Categories Scores as defined in WET-EcoServices Version 2 (Kotze *et al*. 2020).

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately-Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately-High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 - 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

3.6. Ecological Importance and Sensitivity Assessment

The Ecological Importance and Sensitivity (EIS) method (Rountree *et al.* 2013) is a rapid scoring system designed to identify the ecological importance and sensitivity of wetlands to disturbances across multiple scales (i.e., catchment to international scales). The full EIS method integrates three important components, namely, ecological importance and sensitivity, hydro-functional importance, and basic socio-economic importance. The hydro-functional and socio-cultural benefits were however assessed using the updated WET-EcoServices assessment methodology and these two components were therefore omitted from this EIS assessment. The EIS score ranges from 0-4, and it provides an index for prioritisation and management of water resources. The EIS categories are presented in **Table 3-3**.

Table 3-3: Ecological Importance and Sensitivity Categories (DWAF, 1999).

EIS Category	Description	Range of Median
Very high	Ecologically important and sensitive on a national or even international level. These river systems and their biota are usually very sensitive to flow and habitat modifications and provide only a small capacity for use.	>3 and <=4
High	Ecologically important and sensitive on a regional or national scale. These river systems may be sensitive to flow and habitat modifications.	>2 and <=3
Moderate	Watercourses that are considered to be ecologically important and sensitive on a provincial or local scale. The biota of these watercourses is not usually sensitive to flow and habitat modifications.	>1 and <=2
Low/marginal	Watercourses that are not ecologically important and sensitive at any scale. The biota within these watercourses is not sensitive to flow and habitat modifications.	>0 and <=1

3.7. Recommended Ecological Category

The method for determining the Recommended Ecological Category (REC) for water resources is described in Rountree *et al.* (2013). The objective of the REC is to define the management objective for wetlands and does so in accordance with the following rules:

- A wetland within PES Category A (unmodified) cannot be rehabilitated. The management objective will therefore always be to maintain the existing PES Category.
- A wetland within PES Category B, C or D with a "Low marginal" or "Moderate" EIS score must also be maintained in the pre-development PES category.
- A wetland within PES Category B, C or D with a "High" or "Very High" EIS score must, where practically possible, be rehabilitated to a PES category that is one higher than the pre-development category. E.g. a wetland with a pre-development PES score of C and a "High" EIS score must be rehabilitated to a PES category B. Where this is not practically possible, maintenance of the pre-development PES category will be the management objective.
- PES Categories E or F are considered unsuitable and always require rehabilitation to a PES Category D.

3.8. Impact and Risk Assessment

The impact assessment utilised the Delta Ecology impact assessment methodology as specified in **Annexure 2.** The risk assessment utilised the methodology and RAM stipulated by GN 4167 of 2023 promulgated in terms of the National Water Act (Act 36 of 1998).

4. Desktop Assessment

A review of desktop resources was undertaken. A summary of key desktop information relevant to this assessment is provided below.

4.1. Biophysical Context

According to the Council for Geoscience geological map (ENPAT), the soils in this region are dominated by grey regic sands and other soils. The geology onsite consists of recent coastal sand and dunes, with slight occurrence along the coast of shale of the Bokkeveld Group and sandstone of the Peninsula Formation, Table Mountain Group. The soil types and descriptions map developed by the Department of Agriculture, Forestry and Fisheries (DAFF) indicates that this region is characterised by greyish sandy soils which are excessively drained. Soils tend to be poor in clay (<15%).

According to the NFEPA (CSIR, 2011) spatial dataset, this area corresponds to the wetland vegetation type Southwest Sand Fynbos (**Figure 4-1**), which where UVB wetlands are present, is listed as Critically Endangered (CR) and Poorly Protected (PP).

The general biophysical characteristics of the proposed study area is summarised in **Table 4-1**.

Table 4-1: General characteristics of the proposed study area.

Site attribute	Description	Data source
Eco-region	Southern Coastal Belt	Department of Water Affairs Level 1 Ecoregions (DWS, 2011)
Terrestrial Vegetation Type	Hangklip Sand Fynbos (CR-MP)	National Vegetation Map of South Africa, 2018 (SANBI, 2018)
Dominant Geology and Soils	Recent coastal sand and dunes with slight occurrence along the coast of shale of the Bokkeveld Group and sandstone of the Peninsula Formation, Table Mountain Group.	Cape Farm Mapper (ENPAT, 2021)
Soil Erodibility Factor (K)	0.64 (High)	SA Atlas of Climatology and Agrohydrology (Schulze, 2009)
Soil Depth & Clay Percentage (%)	>= 750 mm & <15%	Soil types and descriptions for the Western Cape, Department of Agriculture, Forestry and Fisheries (DAFF, 2021)
Mean Annual Precipitation (mm)	587 mm	SA Atlas of Climatology and Agrohydrology (Schulze, 2009)

Rainfall seasonality	Winter rainfall	
Mean Annual Temperature (°C)	16.10 °C	
Water Management Area (WMA)	Breede-Olifants	Water Management Areas (DWAF, 2023)
Quaternary Catchment	G40G	South African Quaternary Catchments Database (Schulze *et al*. 2007)
Wetland Vegetation Group (for wetlands within the applicable terrestrial vegetation type)	Southwest Sand Fynbos (CR-PP)	NFEPA Wetland Vegetation Types (CSIR, 2011)

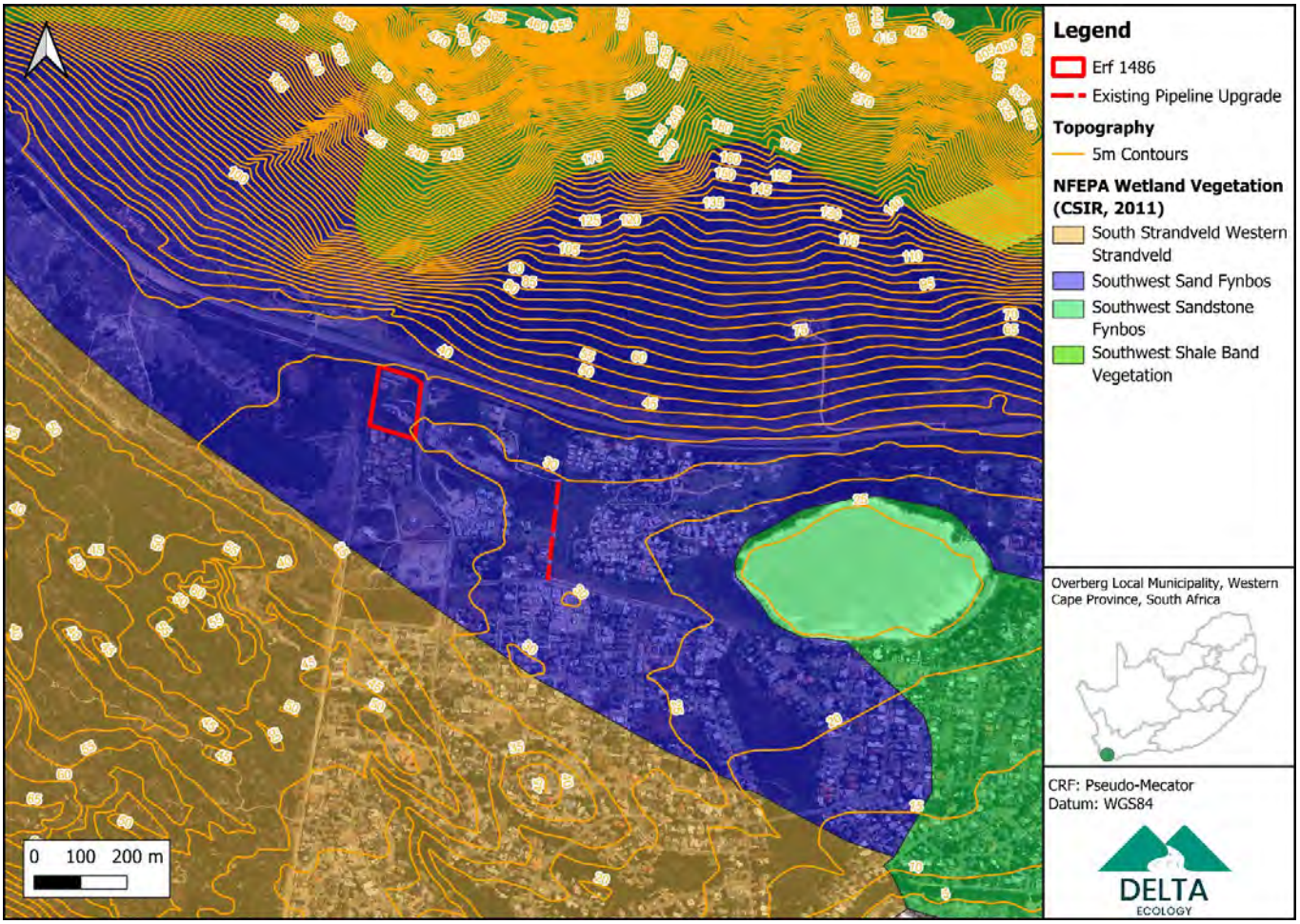


Figure 4-1: Wetland vegetation types (NFEPA, 2011).

4.2. Biodiversity Planning Context

The area under evaluation is located within the Breede-Olifants Water Management Area (WMA), quaternary catchment G40G. The applicable sub-quaternary catchment is demarcated as a Fish Support Area and Fish Sanctuary (CSIR, 2011). The regional setting, in terms of the Level 1 DWA (now Department of Water and Sanitation) Ecoregions, is within the Southern Coastal Belt (**Table 4-1**).

Extending across much of the proposed study area, the NFEPA wetland layer indicates the presence of a large unnatural Channelled Valley-Bottom (CVB) wetland system extending from Erf 1486 in a south-easterly direction and ultimately augmenting the Vermont Salt Pan (**Figure 4-2**). It was however the opinion of Job and Ratcliff (2006), EnviroSwift (2018) and this current assessment, that the wetland is a natural UVB wetland system. In addition, the National Geospatial Information Service (NGI) topo-cadastral map indicates two non-perennial drainage lines within 500 m of the study area which are likely associated with the identified wetland system (**Figure 4-2**), however will not be impacted upon by the proposed development.

Within the proposed study area, the WCBSP does not identify any aquatic Critical Biodiversity or Ecological Support areas (WCBSP, 2023), only terrestrial CBAs/ESAs (**Figure 4-3**).

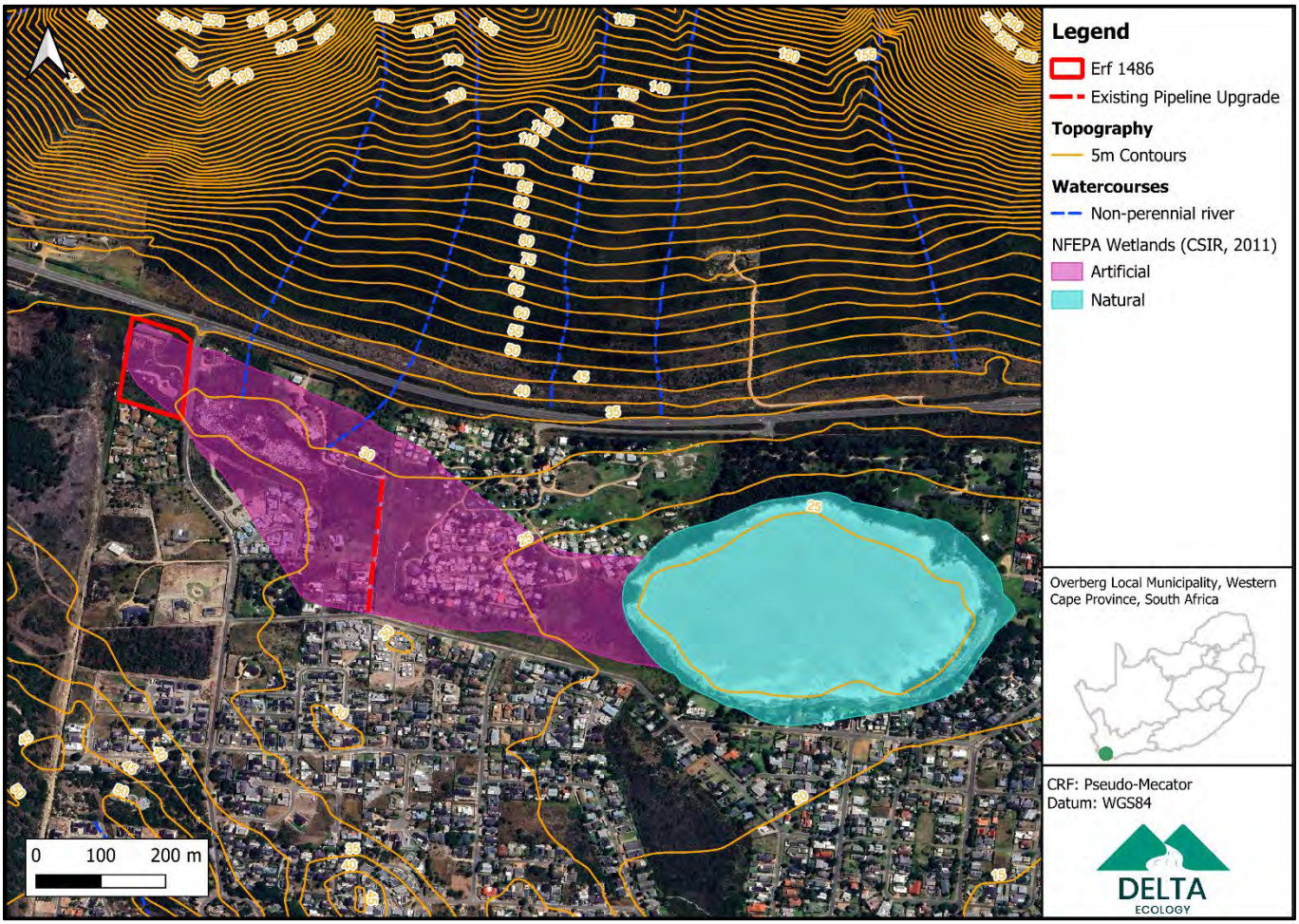


Figure 4-2: Mapped watercourses within the study area (NFEPA, 2011).

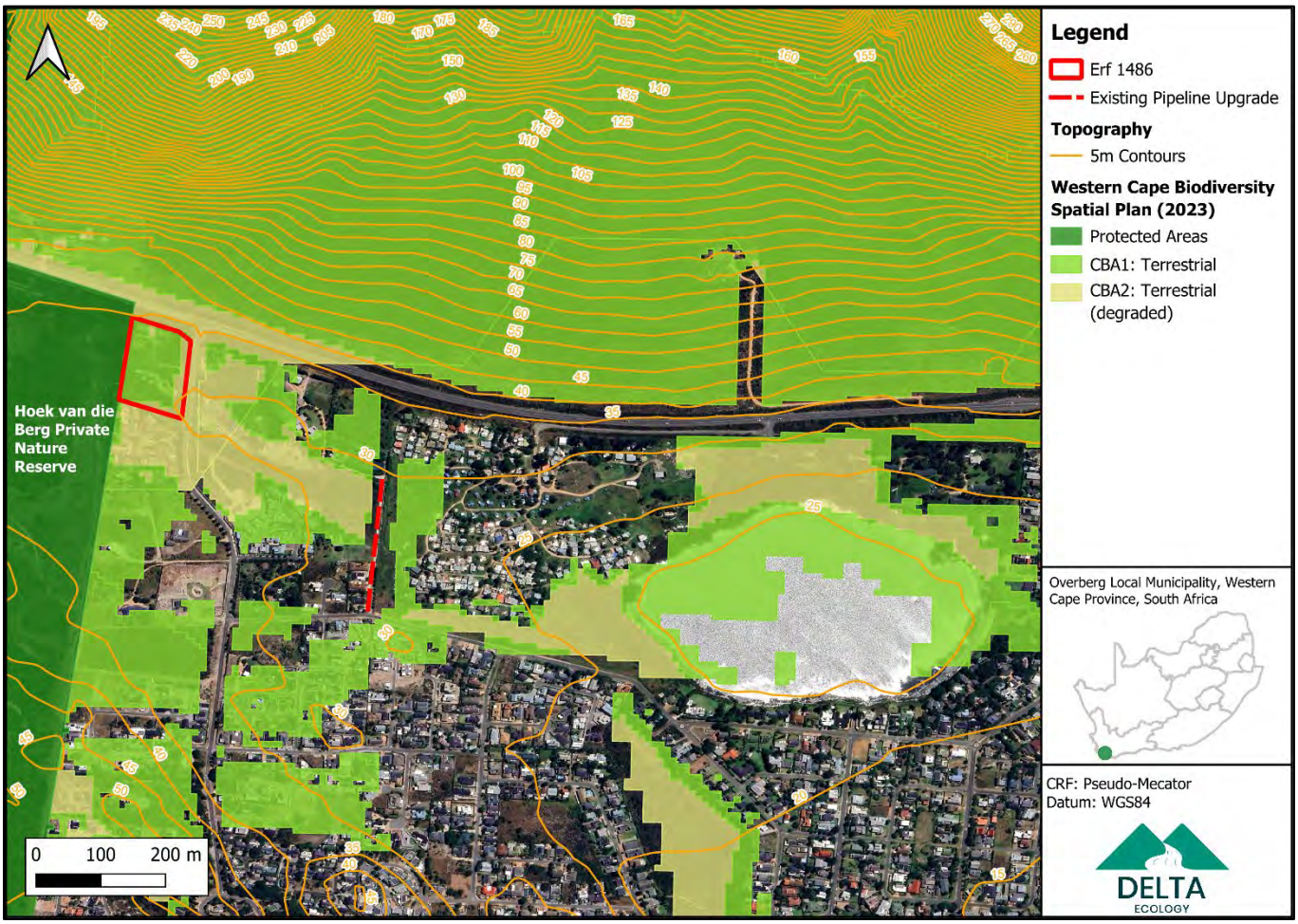


Figure 4-3: Terrestrial CBAs, ESAs, and Protected Areas (WCBSP, 2023).

4.3. Climate Change Perspective

The Beck *et al.* (2018) 1 km^2 climate model utilises the Köppen-Geiger climate classifications to represent measured present and predicted future climate scenarios. The data was consulted to determine the expected climatic shift by the end of the present century at the project location. The area is predicted to shift from Csb Warm-summer Mediterranean climate zone to BSh Arid, steppe, hot climate zone (**Figure 4-4**).

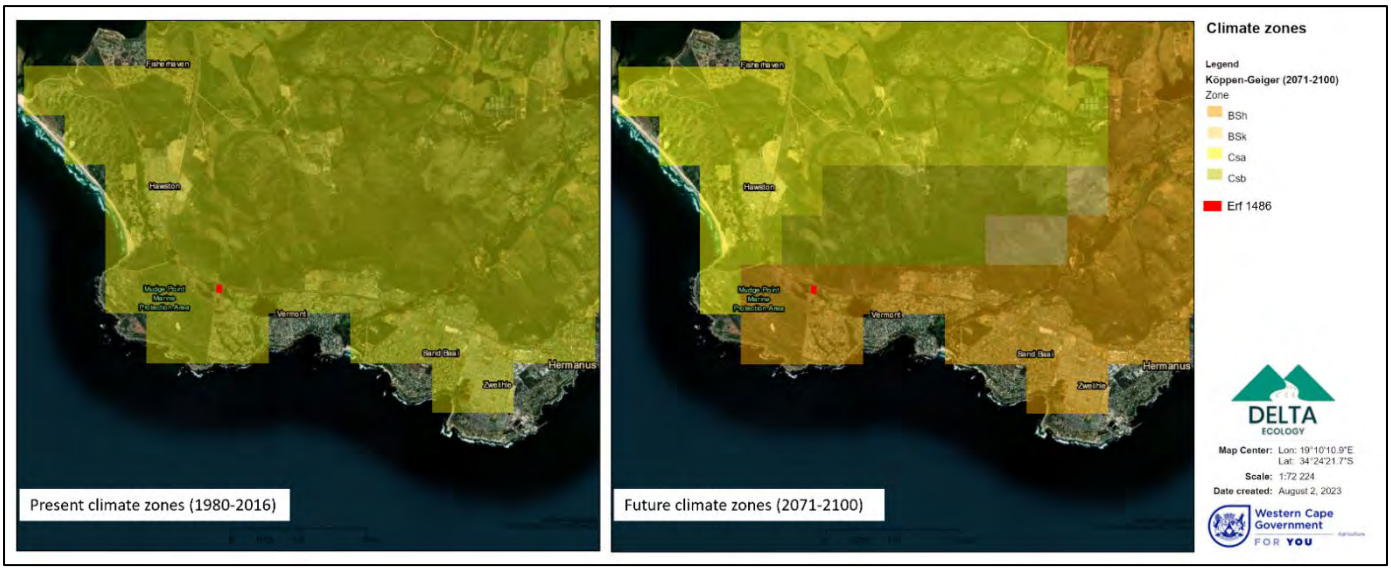


Figure 4-4: Beck *et al.* (2018) Köppen-Geiger climate zones for present day and for the close of the century.

The Western Cape Climate Response Strategy (DEADP, 2014) acts as a provincial level strategy modelled on the NCCRP. The strategy sets out the priorities for the Western Cape with regards to climate change adaptation and mitigation. The overarching intention of the strategy is to reduce climate vulnerability and increase adaptive capacity within the Western Cape in a manner that contributes to the attainment of the province's socio-economic and environmental goals.

Wetlands are a key factor in determining climate resilience due to the nature of ecosystem services offered. Streamflow regulation is important for maintaining baseflow of perennial rivers during climate-change induced droughts. During increased intensity rainfall events, attenuation and sediment trapping services reduce the risk of flooding downslope/stream. Furthermore, peat wetlands trap substantial carbon, reducing the impact anthropogenic carbon emissions. Conversely, peat removal or disturbance can release substantial volumes of carbon thereby increasing climate change impacts.

The wetland in question does not contain peat, however the soils present do contain high amounts of carbon. The wetland is small, degraded in nature and is therefore unlikely to contribute significantly towards climatic-change resilience. Construction within the wetland is unlikely to lead to a significant release of carbon into the atmosphere, although construction within the wetland is discouraged. No further assessment of potential climate impact is necessary.

5. Site Description

The proposed study area is located within Overstrand Local Municipality. The erf is bordered to the north by the R43 road reserve, to the west by the Hoek van der Berg Private Nature Reserve, to the south by a small residential housing estate and to the east by Lynx Road. The erf contains a gravel access road which enters the site from Lynx Road and terminates at the derelict buildings in the northwest corner of the site.

The study area is situated on a gentle slope in a southerly direction at a gradient of between 1 % and 3 %. The gradient rises steadily from the northern erf boundary across the R43 trunk road to the Onrusberge mountains, where slopes in excess of 60 % are visible (**Figure 5-1**). **Figure 5-2** shows elevation (height above mean sea-level [AMSL] in metres) over distance via a straight line transect from the northern boundary to the southern boundary of the erf. The highest point of the erf is at the northern boundary approximately 34m AMSL, while the lowest point is towards the centre, and associated with the wetland at about 28,5m. The elevation rises slightly from this point to approximately 30 m AMSL at the southern boundary (**Figure 5-2**).

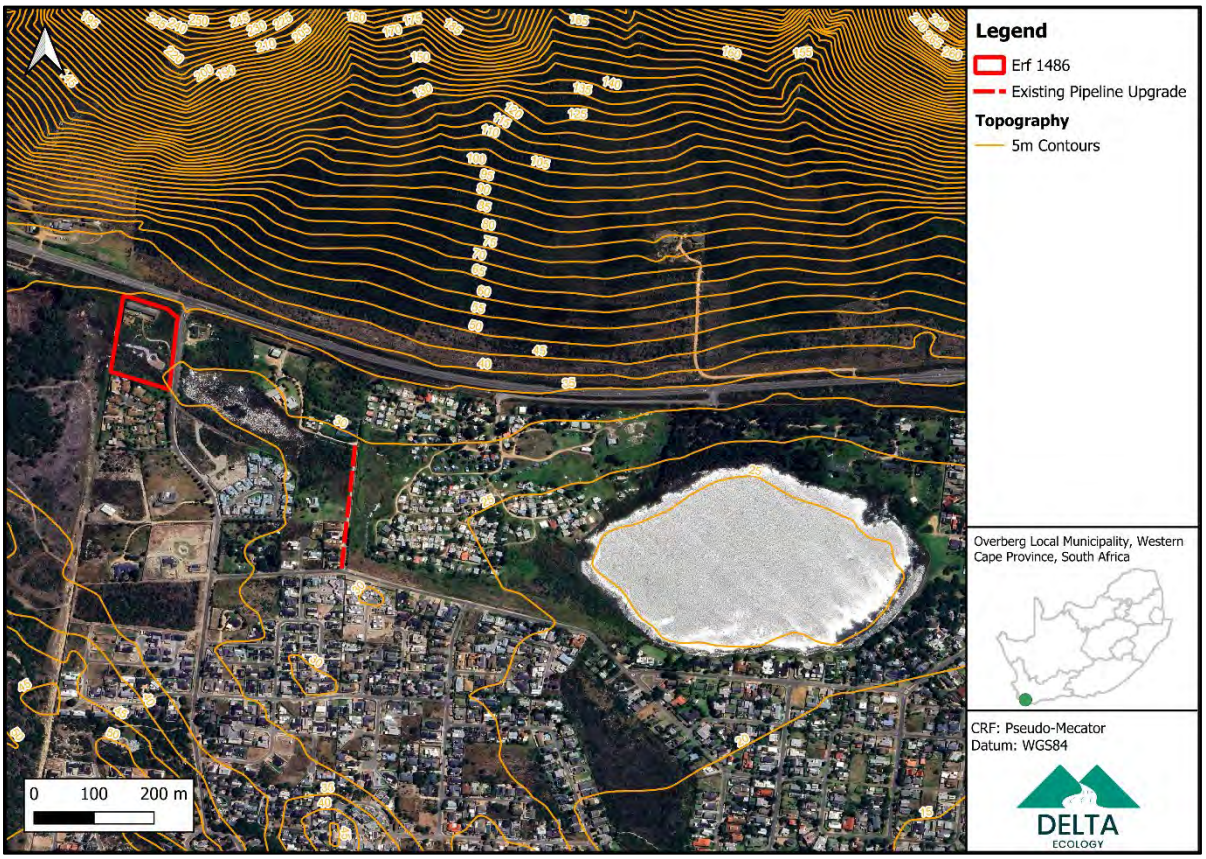


Figure 5-1: Topography of the study area and surrounds.

Figure 5-2: Elevation profile for the Erf, showing height over distance from north to south.

5.1. Erf 1486

Vegetation within the erf was extensively disturbed, with a mixture of indigenous species such as *Senecio halimifolius* and the wetland obligate *Juncus kraussi* (**Figure 5-5**) alongside alien invasive species such as Kikuyu grass (*Cenchrus clandestinum*, refer to **Figure 5-6**) and pampas grass (*Cortaderia selloana*). While the latter species is not wetland obligate, it is commonly found in wetlands where it grows particularly densely (van Outshoorn, 2014). An additional wetland obligate species, *Typha capensis*, was also found in isolated patches during the site assessment (**Figure 5-8**).

Hydrology could be observed on the site, with runoff from the neighbouring housing estate's stormwater system into the depression clearly visible. Terrestrial soils within the study area are dark grey, sandy and appear to be well drained (**Figure 5-8A**). Soils that were sampled in wetter areas near the depression did not differ markedly from terrestrial soils, aside from appearing darker and with a higher organic content than the terrestrial baseline (**Figure 5-8B**). Mottling and gleying are not expected in this wetland. Mottling was however found in isolated patches on the southern periphery of the depression in brown soils that are likely the result of limited historical infilling (**Figure 5-9A**).

The wetland was delineated at the outer boundary of the temporary zone (**Figure 5-10**). The presence of saturated, high carbon soils (**Figure 5-9B**) and isolated instances of mottling within the upper 500 mm of the soil was used in conjunction with the presence of hydrophytic vegetation to delineate the wetland. The excavated depression represented the permanent zone (**Figure 5-10**).

Figure 5-3: Overview of the proposed site from the derelict buildings, facing south.

Figure 5-4: Derelict buildings located in the north of the proposed site.

Figure 5-5: Wetland obligate *Juncus kraussi* indicated by the arrow. This species, along with *Senecio halimifolius*, were used as primary indicators of the outer boundary of the wetland within the study area.

Figure 5-6: Dense clumps of alien invasive *Pennisetum clandestinum* along the edges of the depression within the study area, particularly where sediment dredged from the depression was dumped.

Figure 5-7: Additional wetland species *Typha capensis*, located in front of the derelict buildings onsite.

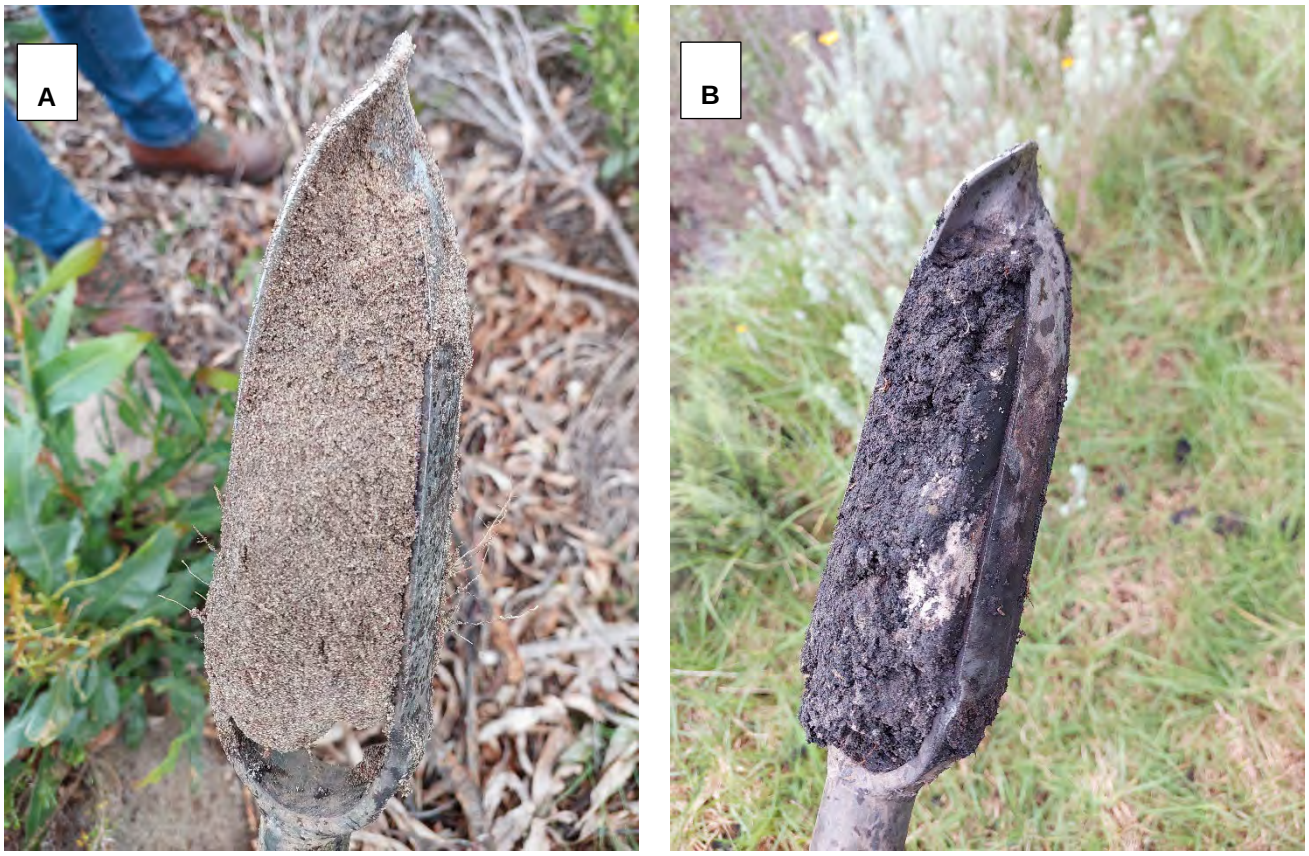


Figure 5-8: A) Near-surface soil sample, showing typical terrestrial soil conditions within the study area. Terrestrial soils within the study area are sandy, characterised by a uniform grey - brown colour, with no mottling, gleying or organic matter visible. B) Near-surface soil sample, taken within a wet area; darker chroma observed.

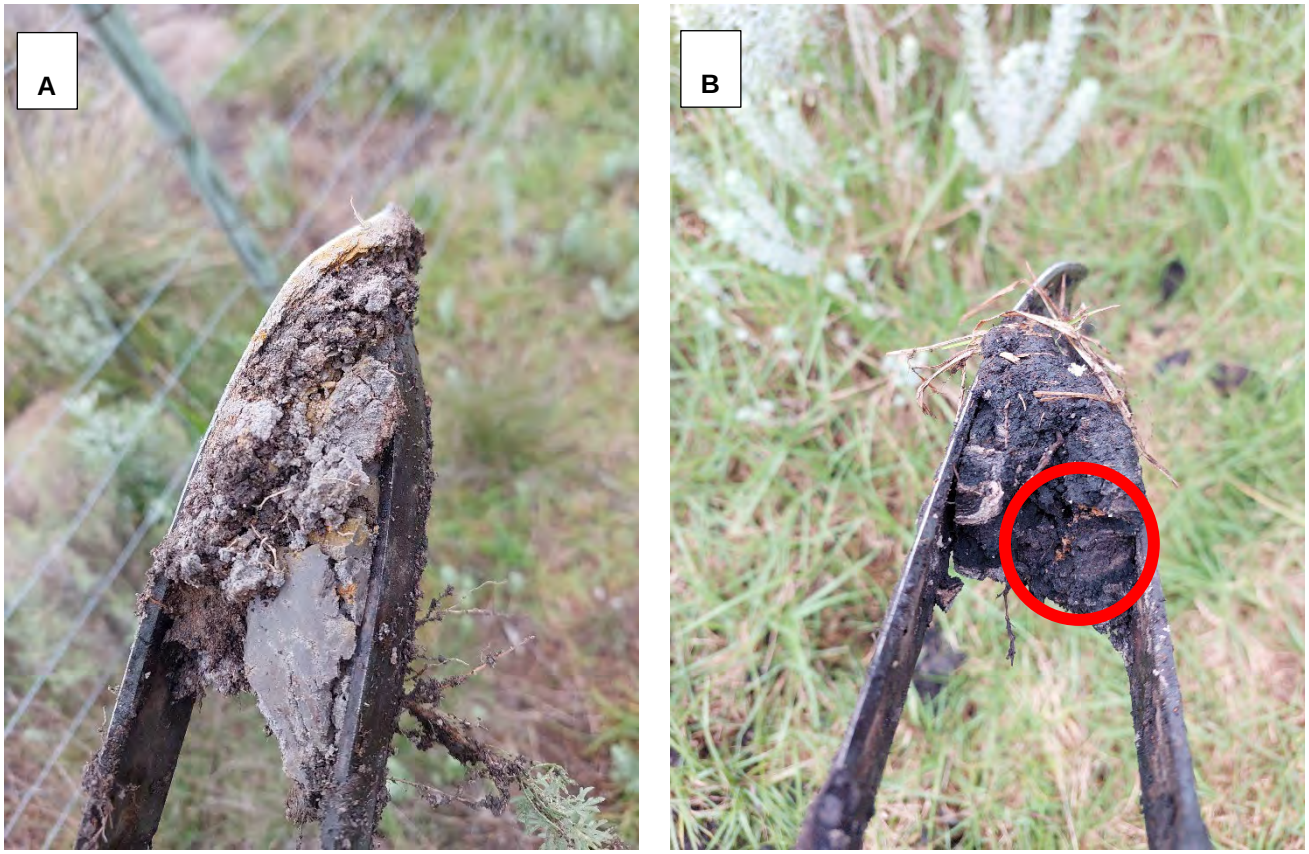


Figure 5-9: A) Soil taken from within a wet area. Rusty orange-coloured mottles are observed; alongside fill material and B) rusty orange mottle (red circle) observed in high carbon, dark soils from a wet area.

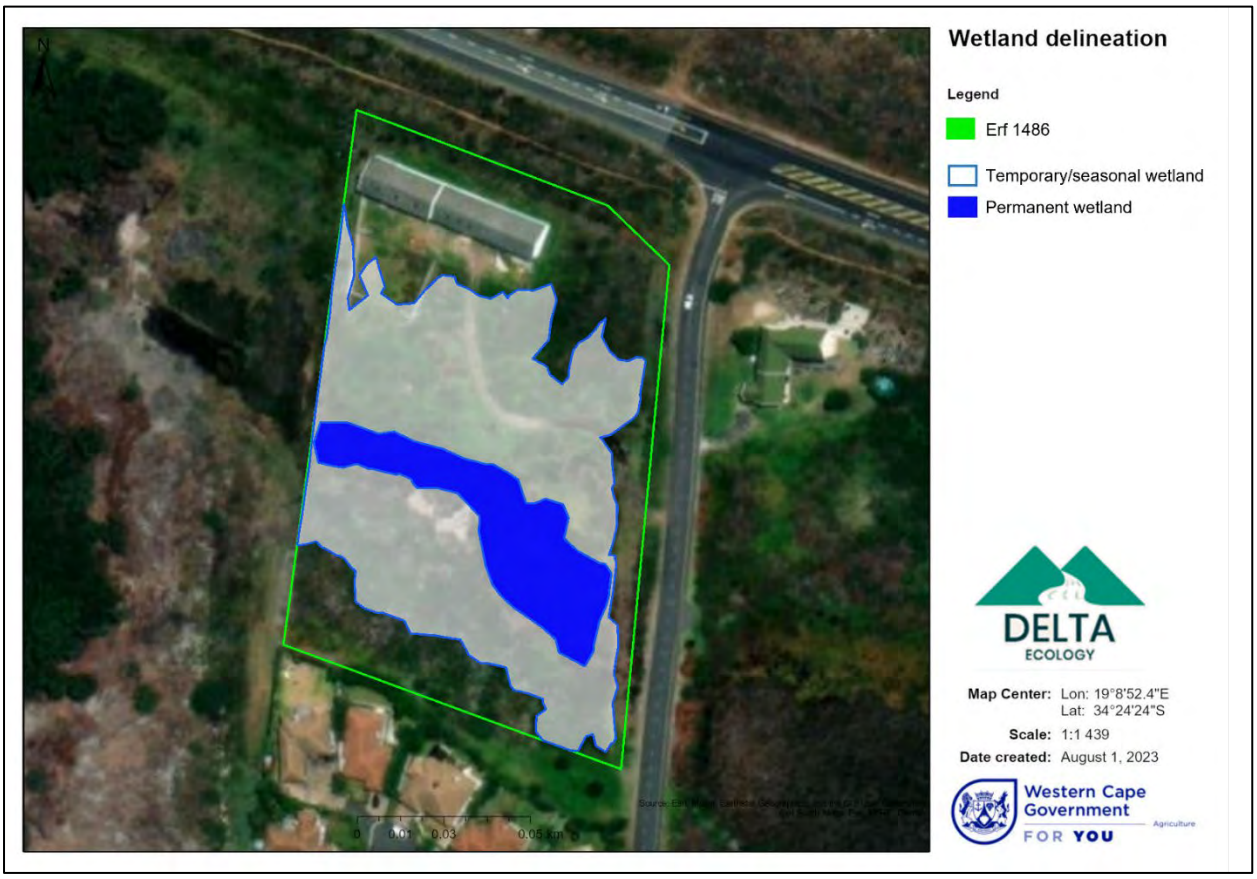


Figure 5-10: Delineated UVB wetland within Erf 1486.

5.2. Pipeline upgrade

The existing pipeline is located along Kolgans Close Road (**Figure 5-11** and **Figure 5-12**). The wetland area along the stretch of this road where the pipeline is to be upgraded, is critically degraded, i.e. relic or historical, due to infill from the road. Other notable impacts to the general UVBW in this vicinity include artificial channels (**Figure 5-13**), roads, residential dwellings, excavation, and culverts, which have altered natural flow regime, vegetation, water quality and geomorphology.

The vegetation within the functional UVB wetland downslope / adjacent to the road, consists of wetland obligate species *Juncus krausii*, *Cyperus textilis*, with wetland facultative *Senecio halimifolius* and *Zantedeschia Aethiopica* along the outer boundary of the functional wetland area.

Soils that were sampled in the UVB wetland did not differ markedly from terrestrial soils, aside from appearing darker and with a higher organic content than the terrestrial baseline (**Figure 5-14**).

Given that the Erf, and the proposed pipeline to be upgraded, are located more than 387 m away from the Vermont Salt Pan, no impacts to this wetland as a result of the project is expected. Therefore, the only watercourse deemed to be "At Risk" is the UVBW (**Figure 5-15** and **Figure 5-16**).

Figure 5-11: *Zantedeschia Aethiopica* in the UVB wetland along the existing road.

Figure 5-12: Channel along the road, within the UVB wetland.

Figure 5-13: Channel within the UVB wetland.

Figure 5-14: Soil sample from the wetland.

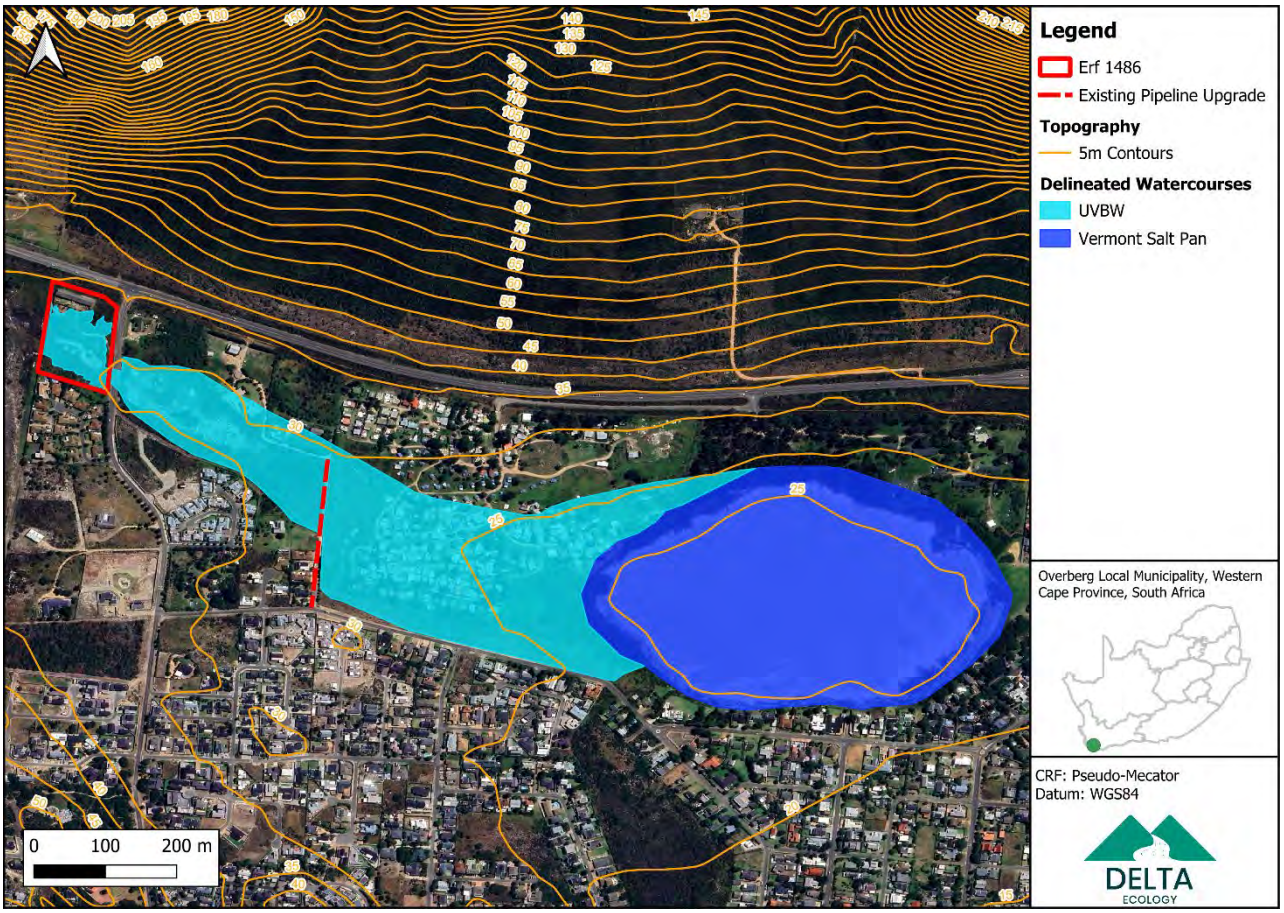


Figure 5-15: Delineated wetlands.

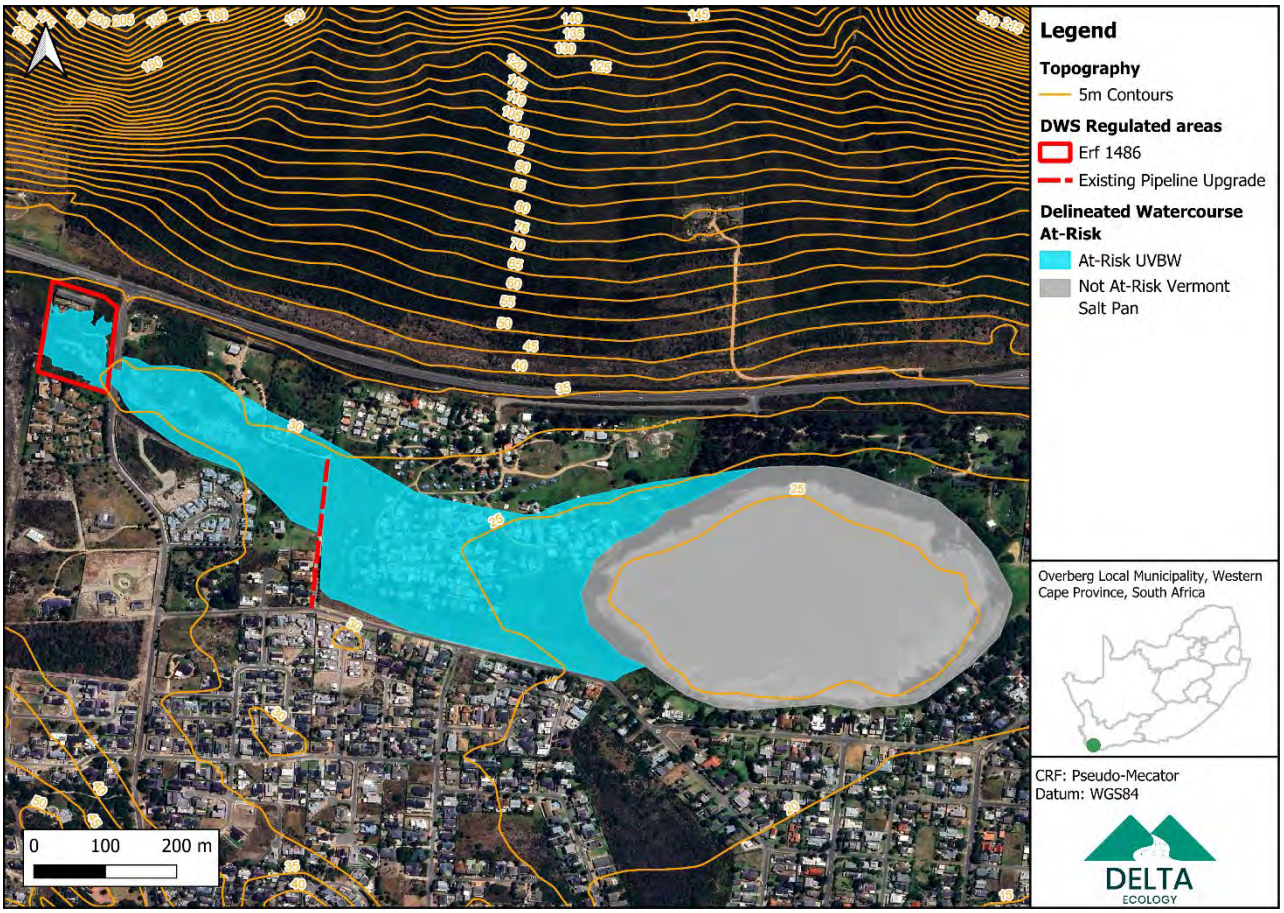


Figure 5-16: At risk wetland.

Table 5-1: Classification of the at-risk wetland.

Factor	Wetland
System	Inland
Ecoregion	Southern Coastal Belt
Landscape Setting	Valley-Floor
Hydrogeomorphic type	Unchanneled valley bottom
Drainage	Rainfall and Interflow
Seasonality	Permanent – Seasonal/temporary
Anthropogenic influence	Excavation, vegetation clearing, alien invasive vegetation, and infilling
Vegetation	Southwest Sand Fynbos
Geology	Recent coastal sand and dunes with slight occurrence along the coast of shale of the Bokkeveld Group and sandstone of the Peninsula Formation, Table Mountain Group
Substrate	Sandy Loam with areas that have been infilled
Salinity	Fresh

6. Wetland Status Quo Assessment

In this study, the wetland present within the proposed development area was assessed to determine its Present Ecological State (PES), Ecological Importance and Sensitivity (EIS), and contribution to Wetland Ecosystem Services (WES). These metrics were used to determine the management objective expressed in terms of the Recommended Ecological Category (REC).

6.1. Present Ecological State

The Macfarlane *et al.* (2020) WET-Health Version 2.0 assessment produced an overall Present Ecological State (PES) score within category D (**Table 6-1**). This indicates that the wetland was in a largely modified condition at the time of the assessment. The key factors that influenced the scoring are summarised below.

Hydrology

- The natural flow regime of the UVB Wetland (UVBW) has been altered as a result of disturbances such as the excavation to create the centre depressional area on the erf itself, historical vegetation clearing and infilling, and catchment hardening associated with the roads, dirt tracks, residential areas.
- Although there is an overflow pipe that crosses beneath Lynx Road and flows into the wetland on the far side, the construction of Lynx Road, and excavation within the centre of the site, has created a dam within the centre of the UVBW.

- The presence of nutrient rich laterite, in soils that are naturally nutrient poor, such as those on the proposed development area, are associated with the dominance of invasive species such as the dense clumps of Kikuyu grass (*Pennisetum clandestinum*) seen onsite, which leads to altered surface roughness and therefore altered flow regimes in the wetland.
- The hydrology of the UVBW has been impacted by the presence of urban residential land use within the wetland itself, and in the wetland's immediate catchment area. Urban land use such as residential areas and tarred roads has resulted in flow diversion and catchment hardening which is associated with increased runoff and storm peak flows.
- The wetland has been canalized, leading to concentration of flow, and likely the drying out of the wetland in various locations.
- Additionally, a stormwater outlet is in the southeast corner of the erf, which discharges runoff from the neighbouring housing development into the wetland. Additional stormwater outlets into the wetland are observed downstream of the erf.

Vegetation

- While several communities of indigenous hydrophytic species were noted, there was moderate vegetation disturbance within the wetland area as a result of:
    - The excavation of the dam on the erf;
    - Large areas of the UVBW on the erf were brush cut during 2004, and downstream of the erf large areas were cleared during 2022;
    - Construction activities associated with the derelict houses on the erf, and downstream residential areas;
    - Dumping of rubble within the wetland area.
- The vegetation present within the wetland is characterised by a mixture of alien and indigenous vegetation. Alien invasive species noted onsite include dense clumps of Kikuyu grass (*Cenchrus clandestinum*) and pampas grass (*Cortaderia selloana*).
- No species of conservation concern were noted. According to the Botanist appointed for the proposed project, at least one plant SoCC (*Disa hallackii*) may be present in low numbers (Nick Helme Botanical Surveys, 2023).

Geomorphology

- The geomorphology of the UVBW wetland was largely modified by the excavation of the depressional / dam area in the centre of the erf.
- Additionally, historical vegetation clearing, infilling, and hardening across large areas of the wetland has resulted in extensive disturbance to its natural geomorphic state.
- The wetland system extends from the study area in a south-easterly direction and ultimately augments the Vermont Salt Pan. The construction of Lynx Road, Kolgans Close Road, and numerous other roads, has seriously altered this portion of the UVBW's geomorphology.

Water Quality

- The water quality within the UVB wetland has been disturbed because of the adjacent infilling and compaction of the southern portion of the Erf; along with large portions which have been infilled downstream within the wetland due to residential development, which has resulted in:
    - Leaching of toxicants and nutrients from the infilling materials such as hydroxyl ions from cement particles and nitrates from laterite.
- The water quality within the wetland is likely to be impacted by the residential nature of the catchment.
- It is likely that runoff entering the wetland through the stormwater outlets is likely polluted by the surrounding catchment area for example, runoff from roads is likely to contain contaminants such as laterite, oil, fuel, rubber from car tires and other pollutants.

Table 6-1: Outcome of the WET-Health Assessment for the delineated UVBW.

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	6.3	5.9	4.1	4.3
PES Score (%)	37%	41%	59%	57%
Ecological Category	**E**	**D**	**D**	**D**
Trajectory of change	↓	↓	↓	↓
Confidence (revised results)	Not rated	Not rated	Not rated	Not rated
Combined Impact Score	5.5			
Combined PES Score (%)	45%			
Combined Ecological Category	**D**			
Hectare Equivalents	4.7 Ha			

6.2. Ecosystem Services

The UVB wetland's contribution to ecosystem services was assessed using the WET-EcoServices Version 2 methodology. The method includes the assessment of sixteen potential ecosystem services including both direct and indirect human benefits. The assessment results are summarised in **Table 6-2**.

Importance scores were all within the 'Very Low' to 'Moderately Low' category for the wetland to ecosystem services, apart from moderately important sediment trapping, biodiversity maintenance, phosphate, nitrate, and toxicant assimilation, and carbon storage ecosystem services, which were of moderate importance.

UVBWs generally provide a high level of sediment trapping, phosphate, nitrate , and toxicant assimilation services due to their gentle gradient, ability to diffuse low and peak flows, and generally permanent wetness. There is demand for these services due to the residential/urban landuse within the immediate surrounding catchment area (residential development to the south, Storm Water outlet discharging into the wetland area, and tarred roads to the north and east).

The demand for Biodiversity Maintanence is moderate, due to the UVBW being connected to the NFEPA designated Vermont Pan downstream. In addition, the wetland is located within a vegetation type that is Critically Endangered (CR). However, the UVBW's condition and location within an urban context depresses the provision of this service. Thus, the importance of this ecosystem service supplied by the UVB relative to that supplied by other wetlands is Moderate.

The moderate importance associated with carbon storage services is as a result of the global demand for storage of carbon, thereby reducing total atmoshperic greenhouse gas concentrations. Soils in the wetland – especially the seasonal to permanent zone - were indicative of moderate/moderately high level of carbon sequestration.

Table 6-2: The outcome of the ecosystem services assessment for the delineated UVBW.

ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	2.0	1.3	1.2	Low
	Stream flow regulation	2.0	0.3	0.7	Very Low
	Sediment trapping	2.3	2.0	1.8	Moderate
	Erosion control	1.8	1.6	1.1	Low
	Phosphate assimilation	1.8	3.0	1.8	Moderate
	Nitrate assimilation	2.0	3.0	2.0	Moderate
	Toxicant assimilation	2.3	3.0	2.3	Moderate
	Carbon storage	2.4	2.7	2.2	Moderate
	Biodiversity maintenance	2.6	2.0	2.1	Moderate
PROVISIONING SERVICES	Water for human use	1.6	1.3	0.8	Very Low
	Harvestable resources	1.5	0.7	0.3	Very Low
	Food for livestock	1.5	0.3	0.2	Very Low
	Cultivated foods	2.1	0.3	0.8	Very Low
CULTURAL SERVICES	Tourism and Recreation	1.5	0.0	0.0	Very Low
	Education and Research	1.0	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

6.3. Ecological Importance and Sensitivity

The wetland achieved a median score of 2.0 which falls within the "Moderate" category, indicative that the wetland is ecologically important and sensitive on a provincial or local scale. The biota of the wetland is not particularly sensitive to flow and habitat modifications. The results of the assessment and the reasoning behind the scores are presented in **Table 6-3.**

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Table 6-3: Results of the EIS assessment.

Ecological Importance and Sensitivity	UVB Wetland	Reason
Biodiversity Support (Median)	**1.67**	
Presence and status of Red Data species:	2	At least two bird Species of Conservation Concern (SoCC) may use the site for foraging, and at least one plant SoCC (*Disa hallackii*) may be present in low numbers, but no plant or animal SoCC were recorded on site during the survey. The Cape Dwarf Chameleon (*Bradypodion pumilum)* is listed as Vulnerable and may occur on the Erf (Nick Helme Botanical Surveys, 2023). *Bradypodion pumilum* was noted near the vicinity of the pipeline upgrade, although this is not a wetland dependant spp.
Populations of unique species/uncommonly large populations of wetland species:	0	None noted.
Migration/breeding/feeding sites: (Importance of the unit for migration, breeding sites and/or feeding):	4	Possibility to be a breeding site for hardy amphibians; considered to be an important corridor to downstream Vermont Salt Pan.
Landscape Scale (Median)	**1.80**	
Protection status of the wetland: (National (4), Provincial/Private (3), municipal (1 or 2), public area (0 or 1)	0	The wetland is located within a privately owned property and is not protected.
Protection status of the vegetation type: (SANBI guidance on the protection status of the surrounding vegetation)	4	Southwest Sand Fynbos (CR-PP) NFEPA (2011) WetVeg type, however vegetation within the wetland at present is disturbed.
Regional context of the ecological integrity: (Assessment of the PES (habitat integrity), especially in light of regional utilisation)	1	PES – D for the UVBW.
Size and rarity of the wetland type/s present: (Identification and rarity assessment of wetland types)	3	CR status indicates slight rarity, but degraded status has left only common, tolerant elements of the ecosystem intact. The size of the UVBW is relatively large and unique for the general area.

Ecological Importance and Sensitivity	UVB Wetland	Reason
Diversity of habitat types: (Assessment of the variety of wetland types present within a site)	1	One wetland type present in a largely modified ecological condition; representation of permanent and seasonal – temporary zones provide a limited diversity of habitat types.
Sensitivity of the Wetland (Median)	**2.00**	
Sensitivity to changes in floods: (Floodplains at 4; valley bottoms 2 or 3; pans and seeps 0 or 1)	2	The wetland may be sensitive to flooding due to the stormwater outlet observed on the Erf; and the construction of Lynx Road downstream/along the eastern boundary of the wetland area. However, the wetland is augmented by SW flow from adjacent residential areas, and there is an overflow pipe that crosses beneath Lynx Road and flows into the wetland on the far side, and excavation within the centre of the site, creating a dam within the centre of the UVBW.
Sensitivity to changes in low flows/dry season: (Unchanneled VB's probably most sensitive)	2	UVBW's are naturally very sensitive to changes in low flows/dry season; current impacts in the catchment affecting the wetlands natural flow regime render the wetland less sensitive.
Sensitivity to changes in water quality: (Especially natural low nutrient waters – lower nutrients likely to be more sensitive)	2	The wetland's immediate surrounding land use is residential which has likely impacted the water quality over the years; however, it is still expected that the water quality within the wetland is sensitive to changes in water quality.
Ecological Importance and Sensitivity Score	**2.0**	
Ecological Importance and Sensitivity Category	**Moderate**	

6.4. Recommended Ecological Category

According to the Rountree *et al.* (2013) method for determining REC, the management objective for any wetland within the PES Category B, C or D with a "Low marginal" or "Moderate" EIS score must also be maintained in the pre-development PES category. In this case, the UVBW has a PES of D so the management objective should be to maintain the wetland in the pre-development PES category of D, or to improve the condition of the wetland to a category C if feasible. Any planned rehabilitation should therefore target this category.

7. Aquatic Impact Identification

The proposed project entails the proposed subdivision of Erf 1486, Vermont, to create several erven for single residential use and one erf in the south for group housing (**Figure 1-3** and **Figure 7-1**).

Three alternatives have been considered during the EIA process. Alternative 1 was the initial layout proposed by the applicant (**Figure 7-1**). However, several site-specific sensitivities were identified that warranted avoidance that Alternative 1 did not accommodate. These included the ecological corridor linking the Hoek van der Berg Nature Reserve to the Vermont Salt Pan in the southeast, areas identified as high ecological sensitivity and the presence of the central wetland system. Therefore, Alternative 2 was developed during the first round of public participation which attempted to avoid the permanent wetland (**Figure 7-2**). Further site analysis revealed that some erven were still encroaching into the wetland zone in Alternative 2. This would have compromised wetland functioning and faunal movement.

In response, a revised site development plan, Alternative 3, has been formulated in direct response to specialist findings and concerns raised during the public participation process. These concerns primarily related to the functionality of the wetland and its hydrological connectivity with the adjacent Vermont Salt Pan. Under the revised layout, all proposed residential erven are located outside the delineated permanent wetland area. *Additionally, it is important to note that while some portions of the erven extend slightly into the outer edge of the seasonal and temporary wetland zones in Alternative 3, these portions will be designated as no-go areas and will be excluded from any development activities.* Refer to **Figure 7-1.**

The layout of the access roads under Alternative 3 will result in a minor loss of approximately 0,024 ha (3 %) of the 0,90-ha wetland, this is significantly reduced compared to the previous alternatives and is considered acceptable by the freshwater specialist, provided that mitigation measures and a comprehensive Wetland Offset and Rehabilitation Management Plan are implemented.

The presence of the ecological corridor remains a vital consideration, as it serves as a movement route for ground-dwelling fauna between the nearby nature reserve and the Vermont Salt Pan. The inclusion of a large portion of the site (58%) as private open space within the current layout (Alternative 3) is regarded as a highly desirable design outcome. Moreover, the central wetland area was mapped by the botanical specialist as having high ecological sensitivity. Consequently, the residential erven have been placed in low sensitivity areas those already disturbed and dominated by alien vegetation such as *Cenchrus clandestinus* (kikuyu grass).

Following consultation with the Overstrand Municipality, the project will include the upgrade of an existing 110 mm diameter sewer pipeline to a 160 mm diameter pipeline along Kolgans Close Road (**Figure 1-4)**. The upgrade will be done within an existing road, and within the path of the existing line, as follows:

1. **Excavation:** Excavation equipment such as backhoes or excavators is used to dig a trench along the path of the existing sewer pipe. Where the pipe is situated in a surfaced road, the surface will need to be cut and broken up and the unsuitable material spoiled. The trench width will be in the order of 800 mm. The depth is not currently known, but typically within the order of 1,5 m.
2. **Removal of existing pipe:** Once the trench is dug, the existing sewer pipe is exposed and removed. This may involve cutting the pipe into manageable sections for removal. To maintain existing sewer flow, it may be necessary to install temporary structures and make use of pumps to bypass existing sewer flow;
3. **Installation of new pipe:** The new larger 160 mm diameter pipe is installed in the trench on appropriate compacted bedding material and connected to the existing sewer system at existing manholes using appropriate connectors and sealing materials;
4. **Backfilling:** Once the pipe is installed and connections secured, a bedding material is installed followed by backfill material and compacted. The pipe is tested (pressure and mirror). In the case where the pipe is installed in the road, the road layer works will need to be reinstated as well as the surface (asphalt, paving etc.).

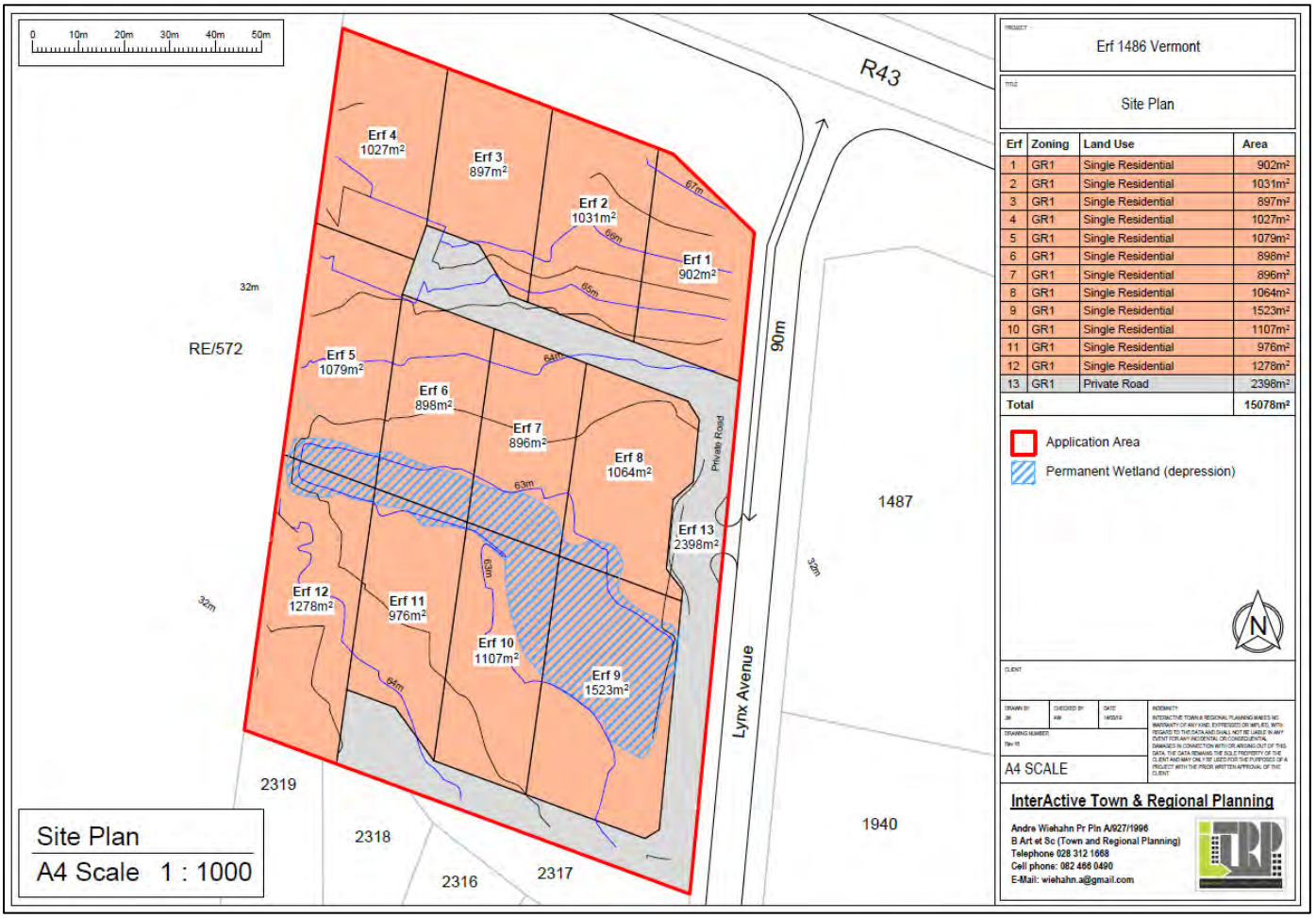
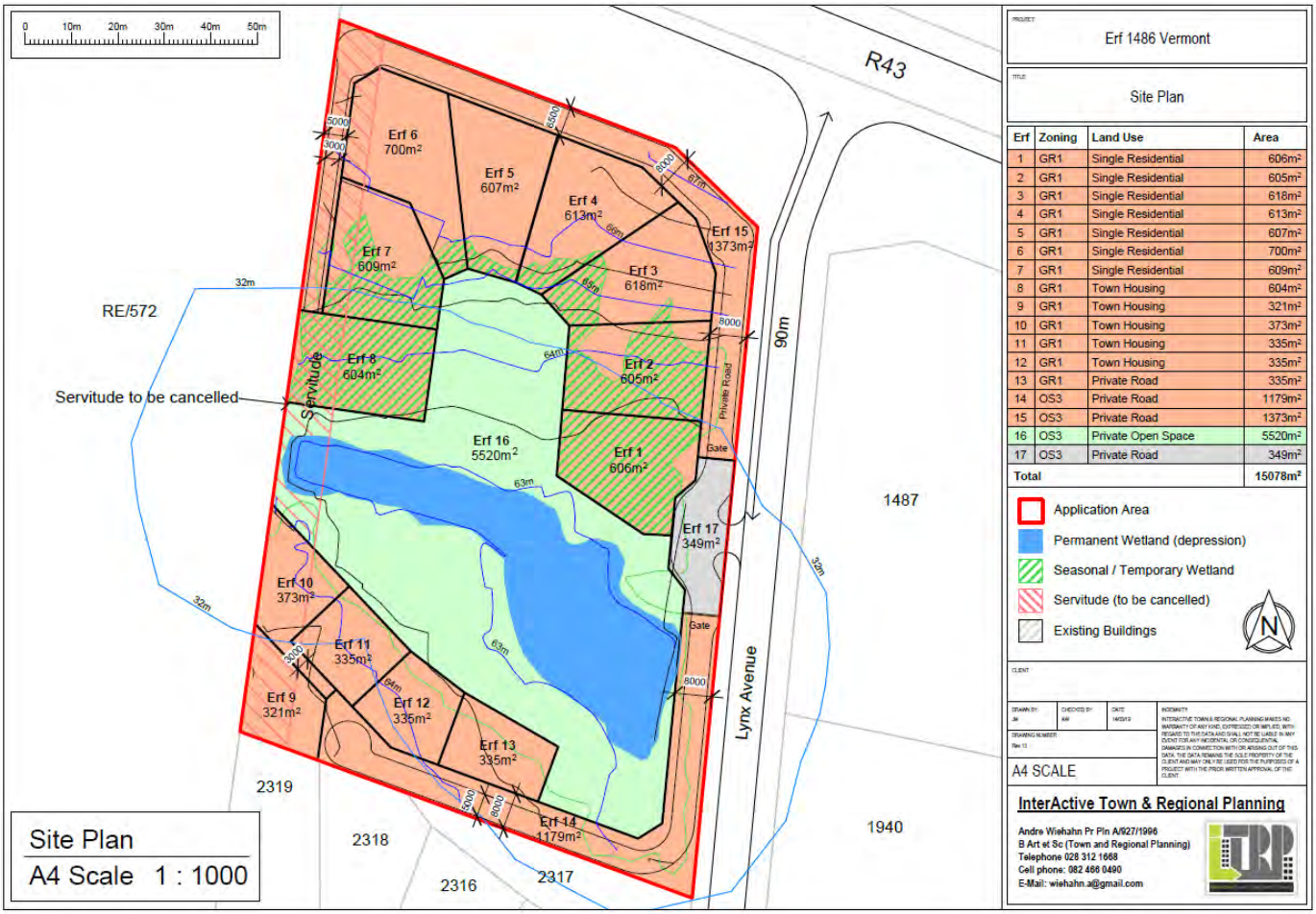
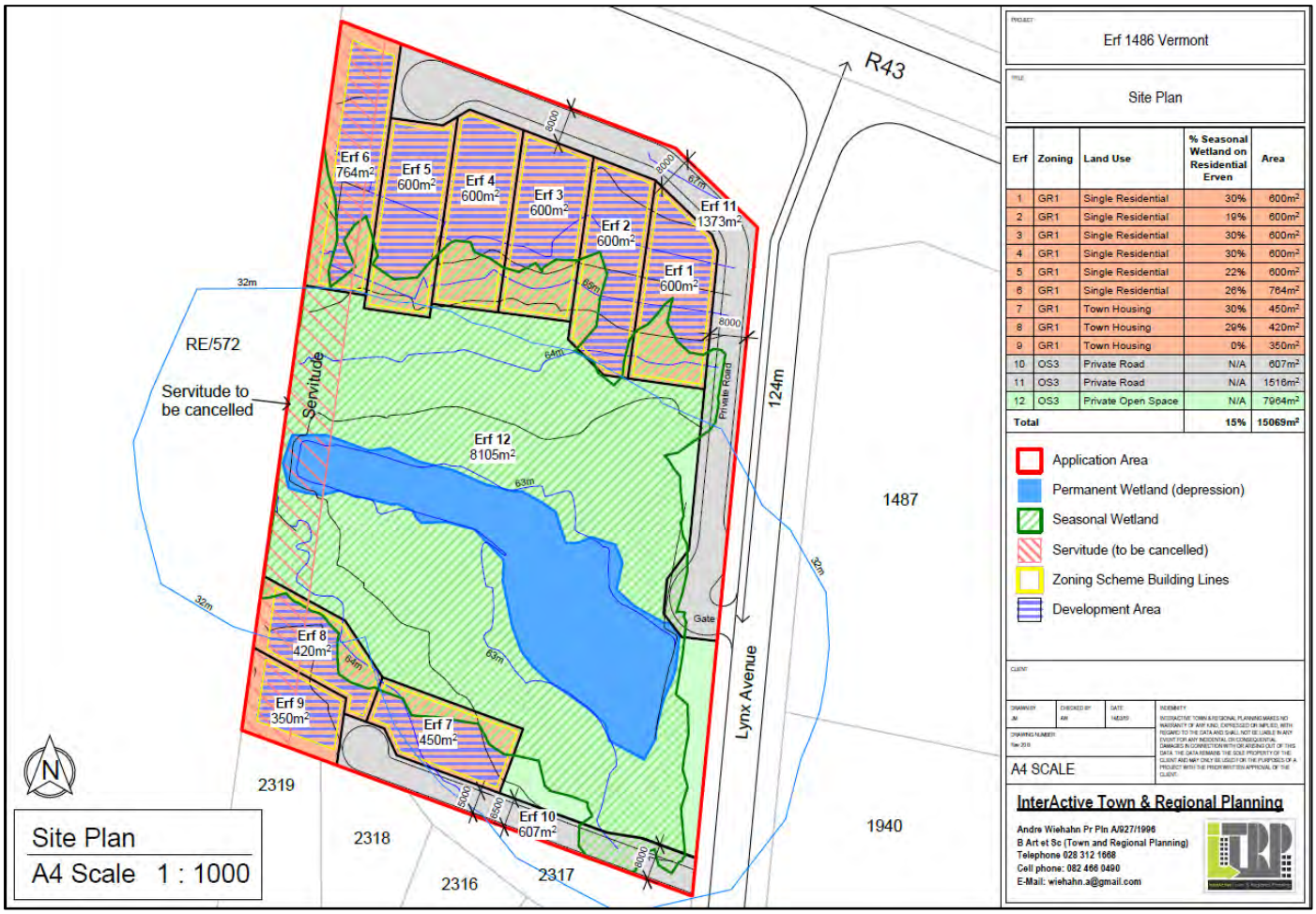


Figure 7-1: SDP Alternative 1 for Erf 1486.



Erf	Zoning	Land Use	Area
1	GR1	Single Residential	606m²
2	GR1	Single Residential	605m²
3	GR1	Single Residential	618m²
4	GR1	Single Residential	613m²
5	GR1	Single Residential	607m²
6	GR1	Single Residential	700m²
7	GR1	Single Residential	609m²
8	GR1	Town Housing	604m²
9	GR1	Town Housing	321m²
10	GR1	Town Housing	373m²
11	GR1	Town Housing	335m²
12	GR1	Town Housing	335m²
13	GR1	Private Road	335m²
14	OS3	Private Road	1179m²
15	OS3	Private Road	1373m²
16	OS3	Private Open Space	5520m²
17	OS3	Private Road	349m²
Total			15078m²

Figure 7-2: SDP Alternative 2 for Erf 1486.



Erf	Zoning	Land Use	% Seasonal Wetland on Residential Erven	Area
1	GR1	Single Residential	30%	600m²
2	GR1	Single Residential	19%	600m²
3	GR1	Single Residential	30%	600m²
4	GR1	Single Residential	30%	600m²
5	GR1	Single Residential	22%	600m²
6	GR1	Single Residential	26%	764m²
7	GR1	Town Housing	30%	450m²
8	GR1	Town Housing	29%	420m²
9	GR1	Town Housing	0%	350m²
10	OS3	Private Road	N/A	607m²
11	OS3	Private Road	N/A	1516m²
12	OS3	Private Open Space	N/A	7964m²
Total			15%	15069m²

Figure 7-3: Preferred Layout (Alternative 3) for Erf 1486.

The potential impacts to the UVBW as a result of the proposed development are listed below:

Construction Phase

1. Areas of the onsite UVBW will be lost (i.e. complete loss in flow regime, water quality, vegetation, and geomorphic structure) as a result of the private road construction *(Minor loss of approximately 0,024 ha (3 %) of the 0,90-ha wetland).*
2. Habitat disturbance within the UVBW may occur due to the construction of residential housing and the upgrade of the sewer pipeline.
3. Alteration of the flow regime of the UVBW during construction of the residential housing.
4. Water quality impairment due to increased sediment input, potential spillage, or release of potentially contaminated runoff into the UVBW during construction of the residential housing and the upgrade of the sewer pipeline.

Operational Phase

5. Habitat disturbance due to the use of the wetland as a public open space; and any maintenance associated with the sewer pipeline.
6. Alteration of the flow regime of the UVBW once the housing development is complete, due to potential flow diversion / increase in storm flows.

7. Water quality impairment due to the release of potentially contaminated stormwater (hydrocarbons) into the UVBW; and potential leakage associated with the sewer pipeline and maintenance thereof.

8. Impact Assessment

The potential aquatic impacts for all three layout alternatives identified in Section 7 were assessed first without and then with application of mitigation measures.

All the potential impacts to the UVBW were the lowest (both prior, and after, the implementation of mitigation measures) for Alternative Layout 3. This layout is therefore preferred from an aquatic perspective, as it entails all proposed residential erven to be located outside the delineated permanent wetland area. Additionally, in this preferred layout although some portions of the erven extend slightly into the outer edge of the seasonal and temporary wetland zones, these portions will be designated as no-go areas and will be excluded from any development activities.

Five out of the seven post-mitigation scores fell within the "Low" impact categories for the preferred Alternative Layout 3. Wetland loss (during construction) and alteration of flow (during operational phase) received the highest impact significance score, which fell within the 'Medium' category, both prior and subsequent to mitigation measures.

The proposed layout has gone through various iterations in order to ensure that the layout overlapping with the delineated wetland area is minimal. Ordinarily, wetland loss would fall within the 'high' category, but the minimal area of wetland to be lost (0,024 Ha) and the degraded nature of the wetland has reduced the impact significance.

The "no go" scenario was assessed and found to be of "Low" impact significance as this scenario would result in continuation of existing impacts to the wetland due to the within wetland disturbances and adjacent land uses. No indirect impacts were noted.

8.1. Construction Phase

Table 8-1: Assessment results for Impact 1

Impact 1: Wetland Loss						
Description	At present, areas of the onsite UVBW will be lost (i.e. complete loss in flow regime, water quality, vegetation, and geomorphic structure) as a result of the private road construction associated with the residential development (minor loss of approximately 0,024 ha (3 %) of the 0,90-ha wetland). The remaining delineated wetland area will be set aside for Private Open Space. The UVBW has a PES score in the D category (Largely Modified), however still offers ecosystem services of moderate importance and exhibits Moderate EIS. The wetland vegetation type is CR and although the fynbos onsite is considered senescent, there could potentially be SoCC. There is also hydrological connection to the Vermont Salt Pan downstream which is an NFEPA designated wetland area.					
Mitigation Measures	An Offset, Rehabilitation and Management Plan must be drafted by a suitably qualified specialist.					
	Impact Without Mitigation			**Impact With Mitigation**		
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence						
Intensity of Impact	4	4	3	-	-	-
Duration of Impact	5	5	5	-	-	-
Extent / spatial scale of impact	1	1	1	-	-	-
Reversibility	4	3	3	-	-	-
Loss of irreplaceable resources	3	3	2	-	-	-
Cumulative Impact	3	3	3	-	-	-

Probability						
Frequency of the Activity	1	1	1	-	-	-
Likelihood of the Incident / Impact occurring	5	5	5	-	-	-
Impact Significance						
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence	3.09	3.00	2.54	-	-	-
Probability	5	5	5.00	-	-	-
Impact Significance	**3.47 Medium**	**3.40 Medium**	**3.04 Medium**	**NA**	**NA**	**NA**

Table 8-2: Assessment results for Impact 2

Impact 2: Habitat Disturbance	
Description	Disturbance of wetland habitat within the UVBW may occur due to the proximity of the proposed residential development, including but not limited to vegetation clearing, infilling, and construction of the housing; as well as the upgrade of the existing sewer pipeline.
Mitigation Measures	Designate the UVB wetland area as a No Go for construction activities (for both the residential development and the replacement / upgrade of the sewer pipeline). Clearly demarcate the construction footprint (including construction camp, access roads, stockpile areas and working servitudes) with orange hazard tape, fencing or similar prior to the commencement of any activity, and strictly prohibit the movement of construction vehicles and personnel outside of the demarcated areas. Locate site camps, laydown areas, stockpile areas, construction material, equipment storage areas, vehicle parking areas, bunded vehicle servicing areas and re-fuelling areas in designated areas of already hardened surface or disturbed areas located outside of the No Go area. These areas should preferably be located on level ground in a previously disturbed area of vegetation approved by the Environmental Control Officer (ECO). Cut and fill must be avoided where possible during the set-up of the construction site camp. Demarcation of the construction footprint/working servitude must be signed off by an ECO (or similar). Demarcation should not be removed until construction is complete, and rehabilitation (if applicable) has taken place. Limit access into the construction footprint to existing access roads. Prohibit the dumping of excavated material, building materials or removed vegetation within the No Go area. Building material must be stored at the designated storage area located outside of the no-go area. Spoil material must be appropriately disposed of at a registered waste disposal facility. Undisturbed topsoil and subsoils removed from the construction footprint must be stored separately at the designated stockpile area for future rehabilitation. Vegetation clearance should be restricted to the relevant development components and indigenous vegetation cover should be maintained as far as practically possible. Vegetation which is considered suitable for rehabilitation activities after construction (such as indigenous grasses and other herbaceous species) should be carefully removed from the construction footprint and stored at an appropriate facility for use in later rehabilitation activities. Clear and remove any rubble or litter that may have been accidentally deposited into the no-go area because of construction activities and dispose of at an appropriate registered facility. An ECO must inspect the construction footprint on a weekly basis and must take immediate measures to address unforeseen disturbances to the wetland. Any disturbed / compacted areas falling outside of the demarcated construction footprint must be immediately rehabilitated. Depending on the extent of damage the method of rehabilitation may require input from an aquatic specialist / suitably qualified contractor.

	Once construction has been completed, orange hazard fences as well as all construction waste, rubble, and equipment must be removed from the construction footprint. In line with the NEMBA, all AIPS listed under the amended AIPS Lists (DEFF: GN1003, 2020) must either be removed or controlled on land under the management of the proponent. An Offset, Rehabilitation and Management Plan must be drafted by a suitably qualified specialist. Rehabilitation must take place as soon as possible after construction is completed, and monitoring of rehabilitated areas must be undertaken. A suitably qualified professional must supervise the rehabilitation and monitoring activities.

	Impact Without Mitigation			Impact With Mitigation		
	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
Consequence						
Intensity of Impact	4	4	3	3	3	2
Duration of Impact	3	3	3	3	3	2
Extent / spatial scale of impact	1	1	1	1	1	1
Reversibility	2	2	2	2	2	2
Loss of irreplaceable resources	2	2	2	2	2	2
Cumulative Impact	3	3	3	3	2	2
Probability						
Frequency of the Activity	4	4	4	4	4	4

Likelihood of the Incident / Impact occurring	5	4	4	4	3	3
Impact Significance						
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence	2.63	2.63	2.27	2.27	2.18	1.72
Probability	5	4	4	4	3.5	3.5
Impact Significance	**3.10 Medium**	**2.90 Medium**	**2.61 Medium**	**2.61 Medium**	**2.45 Low/Medium**	**2.08 Low**

Table 8-3: Assessment results for Impact 3

Impact 3: Altered Flow Regime						
Description	Site clearance, infilling, and compaction will result in alteration of the flow regime of wetland area on the site. Hardened catchment area would result in increased stormwater runoff, velocity and increased flood peaks within the wetland and would also likely result in sedimentation and erosion.					
Mitigation Measures	Designate the wetland area as a No Go for construction activities (for both the residential development and the replacement / upgrade of the sewer pipeline). The status quo in terms of hydrological connection from Erf 1486 to the downstream system must be maintained / should not be impacted because of the proposed development. If possible, conduct construction activities of dwellings, associated stormwater infrastructure and any rehabilitation activities during summer months (November to March). Ensure that effective stormwater management measures are implemented during construction. Stormwater management must ensure that no runoff, which will impair the water quality and lead to increased sedimentation, may enter the downstream wetland area. Additionally, clean SW which does enter the downstream wetland system should do so in a manner that ensures no erosion occurs, specifically during storm events, such as through vegetated swales. Appropriately designed raft foundations for residential dwellings may significantly reduce the impact on subsurface flow and therefore reduce this impact / risk. Rainwater harvesting schemes may reduce runoff intensity and thereby mitigate the impact of catchment hardening. The alien invasive vegetation present within the wetland area must be removed and replanted with indigenous wetland vegetation. An Offset, Rehabilitation and Management Plan must be drafted by a suitably qualified specialist.					
	Impact Without Mitigation			**Impact With Mitigation**		
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence						
Intensity of Impact	3	3	3	3	3	3
Duration of Impact	3	3	3	3	3	3
Extent / spatial	2	2	2	2	1	1

scale of impact						
Reversibility	3	3	3	3	3	3
Loss of irreplaceable resources	2	2	2	2	2	2
Cumulative Impact	3	3	3	3	2	2
Probability						
Frequency of the Activity	4	4	4	4	4	4
Likelihood of the Incident / Impact occurring	5	4	4	4	3	3
Impact Significance						
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence	2.63	2.63	2.63	2.63	2.27	2.27
Probability	5	4	4	4	3.5	3.5
Impact Significance	**3.10 Medium**	**2.90 Medium**	**2.90 Medium**	**2.90 Medium**	**2.51 Low**	**2.51 Low**

Table 8-4: Assessment results for Impact 4

Impact 4: Water Quality Impairment	
Description	Accidentally spilled cement, construction chemicals, sewage during the upgrade of the pipeline, or petrochemicals from construction vehicles may find their way into the wetland area. Additionally, litter and dumping may occur due to the proximity of the proposed development to the wetland area.
Mitigation Measures	Designate the wetland area as a No Go for construction activities (for both the residential development and the replacement / upgrade of the sewer pipeline). The site manager / ECO must check the No Go area for pollution/spills, erosion damage and sedimentation weekly and after every heavy rainfall event. Should pollution, erosion or sedimentation be noted, immediate corrective measures must be undertaken. Fuel, chemicals, and other hazardous substances should preferably be stored offsite, or as far away as possible from the no-go area. These substances must be stored in suitable secure weather-proof containers with impermeable and bunded floors to limit pilferage, spillage into the environment, flooding, or storm damage. Inspect all storage facilities, vehicles, and machinery daily for the early detection of deterioration or leaks and strictly prohibit the use of any vehicles or machinery from which leakage has been detected. Mixing and transferring of chemicals or hazardous substances must take place outside of the No Go area, and must take place on drip trays, shutter boards or other impermeable surfaces. Drip trays must be utilised at all fuel dispensing areas; and during the maintenance of existing sewer flow as possible. Vehicles and machinery should preferably be cleaned off site. Should cleaning be required on site it must only take place within designated areas outside of the No Go area and should only occur on bunded areas with a water/oil/grease separator. Dispose of used oils, wash water from cement and other pollutants at an appropriate licensed landfill site. Avoid the use of infill material or construction material with pollution / leaching potential. Where possible, in situ earthen materials must be used during construction to reduce the risk of leachate from imported materials contaminating the wetland area. Concrete should preferably be imported as “ready-mix” concrete from a local supplier. Should onsite concrete mixing be required it must not be done on exposed soils. Concrete must be mixed on an impermeable surface in an area of low environmental sensitivity identified by the ECO outside of the no-go area. Surplus or waste concrete must be sent back to the supplier who will dispose of it. Construct temporary bunds around areas where cement is to be cast in situ.

	Dispose of concrete and cement-related mortars in an environmental sensitive manner (can be toxic to aquatic life). Disposal of any of these waste materials into the No Go area is strictly prohibited. Washout must not be discharged into the no-go area. A washout area should be designated, and wash water should be treated on-site. Clean up any spillages immediately with the use of a chemical spill kit and dispose of contaminated material at an appropriately registered facility. Provide portable toilets where work is being undertaken (1 toilet per 10 workers). These toilets must be located within an area designated by the ECO outside of the no-go area and should preferably be located on level ground. Portable toilets must be regularly serviced and maintained. Provide an adequate number of bins on site and encourage construction personnel to dispose of their waste responsibly. Waste generated by construction personnel must be removed from the site and disposed of at a registered waste disposal facility on a weekly basis.

	Impact Without Mitigation			Impact With Mitigation		
	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
Consequence						
Intensity of Impact	4	4	3	3	3	3
Duration of Impact	2	2	2	2	2	2
Extent / spatial scale of impact	2	2	1	2	2	1
Reversibility	3	3	3	3	3	2
Loss of irreplaceable resources	2	2	2	2	2	2
Cumulative Impact	3	3	3	3	3	2
Probability						

Frequency of the Activity	4	4	4	4	4	3
Likelihood of the Incident / Impact occurring	5	4	4	5	4	3
Impact Significance						
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence	2.90	2.90	2.27	2.54	2.54	2.09
Probability	5	4	4	5	4	3
Impact Significance	**3.32 Medium**	**3.12 Medium**	**2.62 Medium**	**3.03 Medium**	**2.83 Medium**	**2.27 Low**

8.2. Operational Phase

Table 8-5: Assessment results for Impact 5

Impact 5: Habitat Disturbance						
Description	Disturbance of wetland habitat within the wetland area due to the proximity of the proposed development to the wetland area, and maintenance of the pipeline. During the operational phase, foot traffic, along with littering and dumping in the wetland area may result in disturbance of wetland habitat.					
Mitigation Measures	Prohibit littering and dumping within the wetland area. Clear and remove any rubble or litter that may have been accidentally deposited into the wetland and dispose of at an appropriate registered facility. Monitoring of litter/dumping within the wetland must be managed by a Homeowners Association (HoA). Care should be taken to not disturb indigenous wetland vegetation during any maintenance of the pipeline. In line with the NEMBA, all AIPS listed under the amended AIPS Lists (DEFF: GN1003, 2020) must either be removed or controlled on land under the management of the proponent. Vegetation which needs to be re-planted (if applicable) within each northern Erf (Figure 7-1) should be planted with indigenous vegetation, which would be considered an adequate buffer during operational phase considering the nature of development (single residential dwellings).					
	Impact Without Mitigation			**Impact With Mitigation**		
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence						
Intensity of Impact	3	2	2	3	2	2
Duration of Impact	2	2	2	2	2	2
Extent / spatial scale of impact	1	1	1	1	1	1
Reversibility	2	2	2	2	2	2

Loss of irreplaceable resources	2	2	2	2	2	2
Cumulative Impact	2	2	2	2	2	2
Probability						
Frequency of the Activity	5	5	4	4	4	4
Likelihood of the Incident / Impact occurring	4	4	4	4	3	3
Impact Significance						
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence	2.09	1.72	1.72	2.09	1.72	1.72
Probability	4.5	4.5	4	4	3.5	3.5
Impact Significance	**2.57 Medium**	**2.28 Low**	**2.18 Low**	**2.47 Low**	**2.08 Low**	**2.08 Low**

Table 8-6: Assessment results for Impact 6

Impact 6: Altered Flow Regime						
Description	Site clearance, infilling, and compaction will result in alteration of the flow regime of wetland area. Hardened catchment area would result in increased stormwater runoff, velocity and increased flood peaks within the wetland and would also likely result in sedimentation and erosion.					
Mitigation Measures	Vegetation which needs to be re-planted (if applicable) within each northern Erf (Figure 7-1) should be planted with indigenous vegetation, which would be considered an adequate buffer during operational phase considering the nature of development (single residential dwellings). Runoff from the proposed development must not increase from the pre-development to the post-development scenario. The status quo in terms of hydrological connection from Erf 1486 to the downstream system must be maintained / should not be impacted because of the proposed development. Discharge stormwater from rooftops into rain harvesting tanks. This will limit the volumes of stormwater runoff that will reach the wetland area. Where possible, water collected in rain harvesting tanks can be utilized for flushing of toilets, washing etc. Stormwater runoff should preferably be discharged as diffuse flow into well vegetated areas outside of the wetland. Energy dissipaters / erosion protection measures (such as lining with stones, grass, reno-mattresses, or gabions) must be constructed where stormwater is released to reduce the runoff velocity and therefore erosion. Sheet runoff from hardened surfaces must be intercepted and the treatment and infiltration of runoff must be promoted. Sediment traps should be incorporated into stormwater drains / swales upstream of any discharge points. Monitor the wetland area for erosion and sedimentation after heavy rainfall events. Any erosion noted must be immediately addressed. Rehabilitation measures may include the removal of accumulated sediment by hand, filling of erosion gullies and rills, the stabilisation of gullies with silt fences, riprap, and the revegetation of stabilised areas. Stormwater systems will require ongoing maintenance. Any build-up of silt or debris within stormwater drains or swales will need to be cleared to ensure the continued functioning of the systems. Any damage to stormwater infrastructure, and any flaws identified in the functionality of stormwater infrastructure, must be rectified immediately. Appropriately designed raft foundations for residential dwellings may significantly reduce the impact on subsurface flow and therefore reduce risk. Rainwater harvesting schemes may reduce runoff intensity and thereby mitigate the impact of catchment hardening.					
Impact Without Mitigation				**Impact With Mitigation**		
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence						

Intensity of Impact	4	3	3	3	3	3
Duration of Impact	5	5	5	5	5	5
Extent / spatial scale of impact	2	2	2	2	1	1
Reversibility	3	3	3	3	3	3
Loss of irreplaceable resources	2	2	2	2	2	2
Cumulative Impact	3	3	3	3	2	2
Probability						
Frequency of the Activity	4	4	4	4	3	3
Likelihood of the Incident / Impact occurring	5	4	4	5	3	3
Impact Significance						
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Consequence	3.18	2.81	2.81	2.81	2.45	2.45
Probability	5	4.0	4.0	5	3.0	3.0

Impact Significance	3.54 Medium	3.05 Medium	3.05 Medium	3.25 Medium	2.56 Low / Medium	2.56 Low / Medium

Table 8-7: Assessment results for Impact 7

Impact 7: Water Quality Impairment	
Description	Vegetation which needs to be re-planted (if applicable) within each northern Erf (Figure 7-1) should be planted with indigenous vegetation, which would be considered an adequate buffer during operational phase considering the nature of development (single residential dwellings). Pollutants may enter the wetland via stormwater or sewage leaks (although highly unlikely). However, with the inclusion of stormwater design measures which allow for the infiltration and treatment of stormwater this impact can be greatly reduced.
Mitigation Measures	Design a SWMP which will allow for the infiltration and treatment of stormwater. All stormwaters must receive basic filtering and treatment prior to its release. Incorporate measures into the stormwater design to trap solid waste, debris and sediment carried by stormwater. Measures may include the use of curb inlet drain grates and debris baskets/bags. Stormwater generated from areas with a higher risk of contamination such as parking areas and roads (as applicable) must receive basic filtering and treatment prior to its release into surrounding areas. Stormwater systems must be monitored and maintained into perpetuity and collections of debris and solid waste removed from grates and baskets. The developer must confirm who will be responsible for this monitoring and maintenance as well as their roles (likely HoA). Operational phase mitigation implemented during the design/construction phase: • Construct sewage pipelines in accordance with the relevant SANS / SABS specifications. • Design the pipelines to accommodate the operating and surge pressures. • Provide surge protection e.g. air valves. • Allow for scour valves along pipelines to ensure sewage pipelines can be emptied in a controlled manner if required. • Allow for surcharge containment and emergency storage of 2 hours of peak flow at manholes located within areas upslope of the wetland. Containment/emergency storage may include a concrete box or earthen bund surrounding the manholes. The backup storage capacity of manholes may also be improved by raising the manholes by one meter. Repair all sewage leaks as soon as reasonably possible after detection. Inspection of all sewage pipes should be conducted by a plumber once every 10 years. The sewage system must be monitored and maintained into perpetuity. The developer must confirm who will be responsible for this monitoring and maintenance as well as their roles.

	The wetland area must be regularly inspected for waste. Any waste or litter noted must be immediately removed and disposed of at a registered waste disposal facility. The developer must confirm who will be responsible for this monitoring of the wetland area (HoA).					
	Impact Without Mitigation			Impact With Mitigation		
	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
Consequence						
Intensity of Impact	4	3	3	3	3	3
Duration of Impact	3	3	3	3	3	2
Extent / spatial scale of impact	2	1	1	1	1	1
Reversibility	3	3	3	3	3	2
Loss of irreplaceable resources	2	2	2	2	2	2
Cumulative Impact	3	3	3	3	3	2
Probability						
Frequency of the Activity	4	4	3	3	2	2
Likelihood of the Incident / Impact occurring	4	4	4	3	3	3
Impact Significance						

	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
Consequence	3	2.36	2.36	2.36	2.36	2.09
Probability	4	4	3.5	3	2.5	2.5
Impact Significance	**3.2 Medium**	**2.69 Medium**	**2.59 Medium**	**2.49 Low / Medium**	**2.39 Low**	**2.17 Low**

8.3. No Go Alternative

Table 8-8: Assessment results for the "No Go" Scenario

"No Go" Scenario				
Description		**Although it is unknown whether the development area would be further developed in future, it is assumed that the site would remain as is, which is in a disturbed condition consisting of unused, degraded land. The No-Go option would result in the continuation of impact to the wetland due to adjacent land uses – and would therefore still result in negative impact to the wetland onsite.**		
Mitigation Measures		**None**		
	Impact Without Mitigation		**Impact With Mitigation**	
Consequence				
Intensity of Impact	3	Medium / Harmful	0	Not Applicable
Duration of Impact	5	Beyond 20 years / Permanent	0	Not Applicable
Extent / spatial scale of impact	1	Limited to project site	0	Not Applicable
Reversibility	3	Moderate cost / Moderate likelihood of success	0	Not Applicable
Loss of irreplaceable resources	2	Low	0	Not Applicable
Cumulative Impact	2	Low	0	Not Applicable
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	0	Not Applicable
Likelihood of the Incident / Impact occurring	4	Likely	0	Not Applicable
Impact Significance				

Consequence	2,45	Low	0,00	Not Applicable
Probability	2,5	Low	0,00	Not Applicable
Impact Significance	**2,46**	**Low**	**0,00**	**Not Applicable**

9. Risk Assessment

The RAM prescribed by GN 4167 of 2023 promulgated in terms of the National Water Act (Act 36 of 1998) was applied to the proposed project with the following outcomes:

1. The risk associated with wetland loss during the construction phase and flow alteration during the operational phase, were found to be within the Medium Risk category.
    - The delineated UVBW has a PES score in the D category (Largely Modified), exhibits Moderate EIS and offers Moderate ecosystem services.
    - The historical wetland vegetation type is CR.
    - There is hydrological connection to downstream wetland areas of importance (Vermont Salt Pan).

In terms of the NWA (Act 36 of 1998) and its regulations, a full Water Use License Application (WULA) in terms of c and i water uses will be applicable to the development activities on the site. The completed RAM is attached as **Annexure 3**.

10. Conclusion and Recommendation

The UVB wetland associated with the proposed study area was classified and delineated during a site assessment on the 30th of May 2023, during the winter season. Although the site was found to be disturbed in nature, given the confirmed presence of a wetland which is likely to be impacted by the proposed development, the area was determined to be of "Very High" aquatic sensitivity.

As the initial screening of the area confirmed that the Aquatic Biodiversity sensitivity of the site is "Very High", the GN320 of 2020 requires that a full aquatic biodiversity impact assessment must be submitted as set out by the NEMA (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020). Delta Ecology was appointed to undertake an aquatic biodiversity impact assessment of the proposed development.

In this impact assessment, the delineated UVB wetland was assessed using current best practice assessment methodologies to determine the PES, EIS, WES, and REC metrics. The results of these assessments are as follows:

Table 10-1: Results of the wetland status quo assessment.

	PES	EIS	WES (Highest)	REC
UVB Wetland	D	Moderate	Moderate	D-C

Although the condition of the UVB wetland was largely disturbed, the moderate EIS and WES scores indicates that the wetland is moderately sensitive and important in terms of conservation planning or provision of ecosystem services.

Aquatic biodiversity impacts associated with the development were identified and assessed using both an impact assessment methodology compliant with NEMA requirements and the RAM prescribed by GN 4167 of 2023.

The potential aquatic biodiversity impacts for all three layout alternatives identified were assessed first without, and then with, the application of mitigation measures.

All the potential impacts to the UVBW were the lowest (both prior and after the implementation of mitigation measures) for Alternative Layout 3. This layout is therefore preferred from an aquatic perspective, as it entails all proposed residential erven to be located outside the delineated permanent wetland area. Additionally, in this preferred layout although some portions of the erven extend slightly into the outer edge of the seasonal and temporary wetland zones, these portions will be designated as no-go areas and will be excluded from any development activities.

Five out of the seven post-mitigation scores fell within the "Low" impact categories for the preferred Alternative Layout 3. Wetland loss (during construction) and alteration of flow (during operational phase) received the highest impact significance score, which fell within the 'Medium' category, both prior and after mitigation measures.

The proposed layout has gone through various iterations to ensure that the layout overlapping with the delineated wetland area is minimal. Ordinarily, wetland loss would fall within the 'high' category, but the minimal area of wetland to be lost (0,024 Ha) and the degraded nature of the wetland has reduced the impact significance.

The "no go" scenario was assessed and found to be of "Low" impact significance as this scenario would result in continuation of existing impacts to the wetland due to the within wetland disturbances and adjacent land uses. No indirect impacts were noted.

The outcome of the RAM found that wetland loss and alteration of flow were of a **Medium Risk** to the UVBW. In terms of the NWA (Act 36 of 1998) and its regulations, a full WULA in terms of c and i water uses will be applicable to the development activities on the site.

It is recommended that an Aquatic Ecologist be consulted during the design of the residential dwellings and Town Housing unit, and an Environmental Control Officer (ECO) should be appointed during the construction of the Town Housing development in the south of the erf.

It is furthermore highlighted that a suitable Wetland Offset, Rehabilitation, and Management Plan will be required for the project in terms of the DWS 'no net loss' policy (Macfarlane *et al*, 2014). *It is the opinion of the specialist that rehabilitating the remnant UVBW onsite will be a feasible and acceptable offset for the proposed development.*

It is the opinion of the specialist that the proposed development should be approved subject to application of the mitigation measures listed in this report.

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Annexure 1: Ecosystem Services

Table A1: Ecosystem Services included in the WET-EcoServices v.2 (Extracted from Kotze *et al.*, (2020)).

Services contributing to indirect benefits	**Regulating and supporting services**	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland/riparian area, thereby reducing the severity of floods downstream (Adamus et al. 1987; MEA 2005)
		Streamflow regulation		Sustaining streamflow during low flow periods (McInnes and Everard 2017)
		Water quality enhancement services	Sediment trapping	The trapping and retention in the wetland/riparian area of sediment carried by runoff water (Adamus et al. 1987)
			Phosphate assimilation	Removal by the wetland/riparian area of phosphates carried by runoff water, thereby enhancing water quality (O'Geen et al. 2010)
			Nitrate assimilation	Removal by the wetland/riparian area of nitrates carried by runoff water, thereby enhancing water quality (O'Geen et al. 2010)
			Toxicant assimilation	Removal by the wetland/riparian area of toxicants (e.g. metals, biocides and salts) carried by runoff water, thereby enhancing water quality (O'Geen et al. 2010)
			Erosion control	Controlling of erosion at the wetland/riparian area, principally through the protection provided by vegetation (MEA 2005).
		Carbon storage		The trapping of carbon by the wetland/riparian area, principally as soil organic matter (Kumar et al. 2017)
	Biodiversity maintenance[1]			Through the provision of habitat and maintenance of natural process by the wetland/riparian area, a contribution is made to maintaining biodiversity (Liquete et al. 2016)
Services contributing to direct benefits	**Provisioning services**	Provision of water for human use		The provision of water which is taken directly from the wetland/riparian area for domestic, agriculture or other purposes (Kumar et al. 2017)
		Provision of harvestable resources		The provision of natural resources from the wetland/riparian area - including craft plants, fish, wood, etc. (McInnes and Everard 2017)
		Food for livestock		The provision of grazing for livestock (McInnes and Everard 2017)
		Provision of cultivated foods		The provision of cultivated foods from within the wetland/riparian area (McInnes and Everard 2017)
	Cultural (non-material) services	Cultural and spiritual experience		Places of special cultural significance in the wetland/riparian area - e.g. for baptisms or gathering of culturally significant plants (McInnes and Everard 2017)
		Tourism and recreation		Sites of value for tourism and recreation in the wetland/riparian area, often associated with scenic beauty and abundant birdlife (McInnes and Everard 2017)[2]
		Education and research		Sites of value in the wetland/riparian area for education or research (McInnes and Everard 2017)

[1]It is recognized that biodiversity maintenance is not an ecosystem service in the strict sense (Liquete *et al.* 2016) and is framed in less anthropocentric terms than all the other services, but it underpins many other services and is widely acknowledged as having high value to society broadly, even in the absence of any local or downstream beneficiaries.

[2]WET-EcoServices focuses on recreational services which are specifically nature-based, e.g., bird watching. It does not account specifically for recreational services from wetland/riparian areas that have been converted into sports grounds, children's playgrounds, or other built infrastructure.

Annexure 2: Impact Assessment Methodology

Impact assessment methodologies are based on qualitative ratings of the various factors and represent a standardised method for presenting a substantiated specialist opinion regarding the significance of a particular class of impact. Delta Ecology has developed a rapid numerical impact assessment methodology, applied in this report, that incorporates a range of factors commonly assessed to which numerical values from 1 to 5 are assigned to each rating category. Six primary factors are used to determine Consequence, and two primary factors are used to determine Probability. These two secondary factors are used to determine Impact Significance for each identified impact. Consequence, Probability and Impact Significance are determined by a set of formulae which incorporate weightings for each primary and secondary factor.

The weightings for each factor were determined by application of the formulae to over 50 pre-existing ecological impact assessments. These assessments employed other methodologies and were accepted by the relevant environmental authorities. These assessments were primarily from reports drafted by Delta Ecology staff during previous employment but also included unrelated ecological impact assessments freely available on the internet. The weighting system has therefore been derived as a means of real-world formula calibration rather than by logic alone. The final methodology achieves impact significance ratings that are consistently in line with industry standards.

Key elements of the approach include a detailed description of the nature of the impact and of the proposed mitigation measures, assessment of each factor for both the "with mitigation" and "without mitigation" scenarios and includes the provision of a rationale for each rating where appropriate. The resulting impact significance ratings may be adjusted, if necessary, in accordance with specialist opinion, given adequate motivation for the deviation from the standard methodology.

The various factors, formulae and weightings are provided in the table below:

Scoring of impacts			
Factor	**Weighting**	**Score**	**Description/Rating**
Consequence	**8**		
Intensity	4	1	Very Low / Non-harmful
		2	Low / Slightly Harmful
		3	Medium / Harmful
		4	High / Very Harmful
		5	Very High / Disastrous
Duration	1	1	Up to 1 month
		2	1 month to 1 year
		3	One year to 5 years
		4	5 to 20 years
		5	Beyond 20 years / Permanent
Spatial scale/extent	3	1	Limited to project site
		2	Limited to local catchment
		3	Multiple local catchments
		4	Limited to quaternary catchment
		5	Regional, National, International
Reversibility	1	1	Passive restoration / High likelihood of success

		2	Low-cost rehabilitation / Moderately high likelihood of success
		3	Moderate cost / Moderate likelihood of success
		4	High cost / Low likelihood of success
		5	Very high cost / Very low likelihood of success
Loss of irreplaceable resources	1	1	None
		2	Low
		3	Medium
		4	High
		5	Very High
Cumulative Impact	1	1	Very Low
		2	Low
		3	Medium
		4	High
		5	Very High
Probability	**2**		
Frequency of the activity	1	1	Once off activity / less than once in 20 years
		2	5 to 20 years
		3	1 to 5 years
		4	Monthly to annually
		5	Weekly to Monthly
Likelihood of the Incident / Impact occurring	1	1	Highly unlikely
		2	Unlikely
		3	Possible
		4	Likely
		5	Definite
Consequence = (Intensity x 4) + Duration + (Extent x 3) + Reversibility + Loss of Irreplaceable Resources + Cumulative Impact) / 11			
Probability = (Frequency + Probability) / 2 OR = 5 where likelihood is definite			
Impact Significance = (Consequence x 8) + (Likelihood x 2) / 10			
Impact Significance Categories			
0 - 1.5			Very Low
1.6 - 2.5			Low
2.6 - 3.5			Medium
3.6 - 4.5			High
4.5 and above			Very High

Annexure 3: DWS RAM

PROJECT: Vermont Erf 1486 Residential Development

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities - Version 2.1.1

Name of Assessor: Kimberley van Zyl **Signature:**

SACNASP Registration Number: Pr. Nat. Sci. Reg. No. 117097 (Ecological Science)

Date of assessment: 23-May-25

Risk to be scored for all relevant phases of the project (factoring in specified control measures). MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE

Phase	Activity	Impact	Potentially affected watercourses			Overall intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance										
CONSTRUCTION	<1> Preparation of site for the construction of the residential development i.e. clearing, preparation, and infill of foreign material (soil & concrete), within proximity of the UVBW; Construction of the residential dwellings within proximity of the UVBW; upgrade of the existing sewer pipeline.	<1a>Wetland Loss	UVBW	D	Moderate	8	1	5	14	3	42	100%	42	M	High
		<1a>Wetland Habitat disturbance	UVBW	D	Moderate	4	1	2	7	3	21	60%	12.6	L	High
		<1b>Alteration of flow	UVBW	D	Moderate	6	2	2	10	3	30	60%	18	L	High
		<1c>Water quality impairement	UVBW	D	Moderate	6	1	2	9	3	27	60%	16.2	L	High
OPERATIONAL	<2>Operation of the residential development and maintenance on the sewer pipeline.	<2a>Wetland Habitat disturbance	UVBW	D	Moderate	4	1	2	7	3	21	60%	12.6	L	High
		<2b>Alteration of flow	UVBW	D	Moderate	6	2	5	13	3	39	80%	31.2	M	High
		<2c>Water quality impairement	UVBW	D	Moderate	6	1	2	9	3	27	60%	16.2	L	High