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SPECIALIST TECHNICAL OPINION MEMORANDUM

ASSESSMENT OF IMPACTS AND PROVISION OF MITIGATION MEASURES CONCERNING THE FINAL LAYOUT AND BULK SERVICE INFRASTRUCTURE FOR THE PROPOSED MIXED-USE DEVELOPMENT ON ERF 266 AND A PORTION OF THE REMAINDER OF ERF 21 IN RIVERSDALE, HESSEQUA MUNICIPALITY, WESTERN CAPE PROVINCE.

JUNE 2025

BACKGROUND

In June 2023, Dietmar de Klerk, a then member of DDK Consulting, compiled an Aquatic Biodiversity Impact Assessment (ABIA) Report and DWS Section 21 (c) and (i) Risk Assessment Matrix for the proposed Mixed-Use Development in Riversdale, Western Cape Province. Given that no technical information regarding the specifications and/or locations of the associated bulk service infrastructure, was available at the time of compiling the ABIA Report in 2023, the identification and delineation of natural freshwater ecosystems as well as the assessment of their Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) was confined to the cadastral border of Lot 266 and a portion of the remainder of Lot 21, proposed to be developed.

In May 2023, Sharples Environmental Services (Pty) Ltd., approached FEN Consulting (Pty) Ltd., in order to provide an Specialist Opinion Memorandum regarding the potential impact the proposed development and associated bulk infrastructure will have on natural freshwater ecosystems in the surrounding area which was not assessed in the 2023 ABIA Report, as well as to provide suitable and feasible mitigation measures in order to ensure that the impacts to natural freshwater ecosystems are minimised as far as feasibly possible, thereby promoting sustainable development in the Western Cape.

Summary of the findings of the Aquatic Biodiversity Impact Assessment compiled by Dietmar de Klerk, dated June 2023:

Below is a summary of the findings of the ABIA for the proposed mixed-use development, dated June 2023, that was undertaken by Dietmar de Klerk

Figure 1: Map of freshwater ecosystems delineated (orange polygon) within the proposed development area (red polygon) (De Klerk, 2023).

The following natural aquatic features were found within the study area:

- *A tributary of the Naroo River was identified approximately 100m from the western edge of the development area. Given that this watercourse was not located on the concerned properties proposed to be developed as well as accessibility constraints, this watercourse was not assessed further in the June 2023 ABIA report. The watercourse is indicated as a Channelled Valley-Bottom Wetland in Figure 1 above.*
- *A relatively small (approximately 2500 m2) hillslope seep wetland was identified within the middle of the proposed development area (orange polygon). This hillslope seep wetland was assessed to be in a Seriously Modified (PES Class E) ecological condition, given its size and position on the slope of a hill surrounded by intensive crop production and associated anthropogenic disturbances for several decades, resulting in significant topographical alterations impacting the hydrological and geomorphological functioning of this seep wetland as well as associated impacts to sediment balance and water quality. Additionally, the seep wetland area was actively utilised for crop production with the complete removal of indigenous hydrophytic vegetation.*
- *Whilst the Present Ecological State of the tributary of the Naroo River was not assessed, the Resource Quality Information System (RQIS) of the Department of Water and Sanitation (DWS) indicated the Naroo River, specifically the H90C-09211 sub-quaternary reach data monitoring point, as having a **Largely Modified** (PES Class D) ecological condition. The same PES category was applied to the tributary of the Naroo River and used to inform the assessment of impacts of the proposed mixed-use development on this system.*

The 2023 ABIA report also concluded that no aquatic ecosystem impacts of medium - high negative significance on freshwater ecosystems were anticipated for the proposed mixed-use development, given the application of proposed mitigation measures. Additionally, the compiled DWS Risk

Assessment Matrix indicated a Low Risk Significance for both the construction and operational phases of the proposed mixed-use development on both the delineated hillslope seep wetland and the tributary of the Naroo River. The primary mitigation measure used to inform the risk assessment process was that the delineated hillslope seep wetland area should not be developed and rather either incorporated into the stormwater management plan for the development proposal or demarcated as open space and remain undeveloped.

INTRODUCTION

FEN Consulting (Pty) Ltd. was appointed by Sharples Environmental Services (Pty) Ltd., to provide specialist consulting services in support of the Environmental Impact Assessment (EIA) process for the proposed mixed-use development on Lot 266 and a portion of the remainder of Lot 21 in Riversdale. The consulting services would take the form of a Specialist Technical Opinion Memorandum, consisting of the following, as outlined below:

- **Phase 1**: Undertake a Desktop Assessment of the study area to identify and verify the relevant freshwater ecosystems as identified by the previous assessor, and where deemed necessary, to refine those delineations;
- **Phase 2**: Based on the findings of the desktop assessment process, incorporate the technical information provided by the EAP, relating to the latest Spatial Development Plan (SDP) and Bulk Infrastructure specifications and layouts, provide an impact statement of all identified impacts including a statement of the perceived cumulative impacts on freshwater assemblages in the region;
- Provide recommendations on management and mitigation measures with respect to the proposed development in order to avoid, manage and mitigate impacts on the freshwater ecology associated with the study area; and
- Compile a brief Specialist Technical Opinion Memorandum highlighting the results of the assessment (i.e. this report).

Development Proposal:

Belladonna (Pty) Ltd. is proposing the development Lot 266 and a portion of the remainder of Lot 21 in Riversdale, which is currently utilised and zoned for agricultural land use.
The current proposal is to develop the concerned properties as a larger mixed-use residential development comprising of several different residential offerings. Additionally, the Hessequa Municipality has recently issued a decision to include the concerned properties within the municipal urban edge due to increased demand for residential opportunities within the town of Riversdale.
Erf 266 & Erf 21 is located to the Western boundary of Riversdale. Erf 21 is divided into two sections by the N2 National Road. The extent of the complete site is approximately 85,13 ha. The development footprint of Erf 21, North of the N2, is 56,4 ha. Development will take place over a 15– 20-year period and will consist of the following zonings:

- Twenty-seven (27) Agricultural Zone II smallholdings comprising approximately 27.5 hectares with a total coverage of 48.8% of the total development area;
- One hundred and fifty-nine (159) Single Residential erven comprising approximately 10.4 hectares with a total coverage of 18.4% of the total development area;
- Three (3) pockets of General Residential Zone II offerings comprising approximately 10.4 hectares with a total coverage of 18.4% of the total development area;
- One (1) Business Zone of approximately 0.7 hectares in extent with a total coverage of 1.2% of the total development area;
- Seven (7) Transport Zone II areas of approximately 3.8 hectares in extent with a total coverage of 6.7% of the total development area;
- One (1) Transport Zone III area of approximately 1.9 hectares in extent with a total coverage of 3.4% of the total development area;

- One (1) Utility Zone of approximately 0.2 hectares in extent with a total coverage of 0.4% of the total development area; and
- One (1) Open Space Zone I of approximately 1.5 hectares in extent with a total coverage of 2.7% of the total development area.

Please refer to **Addendum D** for a visual representation of the latest Spatial Development Plan (SDP).

Civil engineering services will be designed in accordance with the design standards of the Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development as published by the CSIR as well as the minimum requirements of Hessequa Municipality.

Access Roads:

Urban Engineering completed a Traffic Impact Assessment for the proposed mixed-use development, identifying the following Short- and Long-term measures required:

Short Term: To access Erf 21, it is proposed that Erica Street be extended over Erf 22 as per the proposed site development plan. It is further proposed that the current 4-way Stop at intersection of Bauhinia Street and Protea Street, to be converted to a new 2-way Stop controlled intersection with priority movement along the Bauhinia approaches to the intersection.

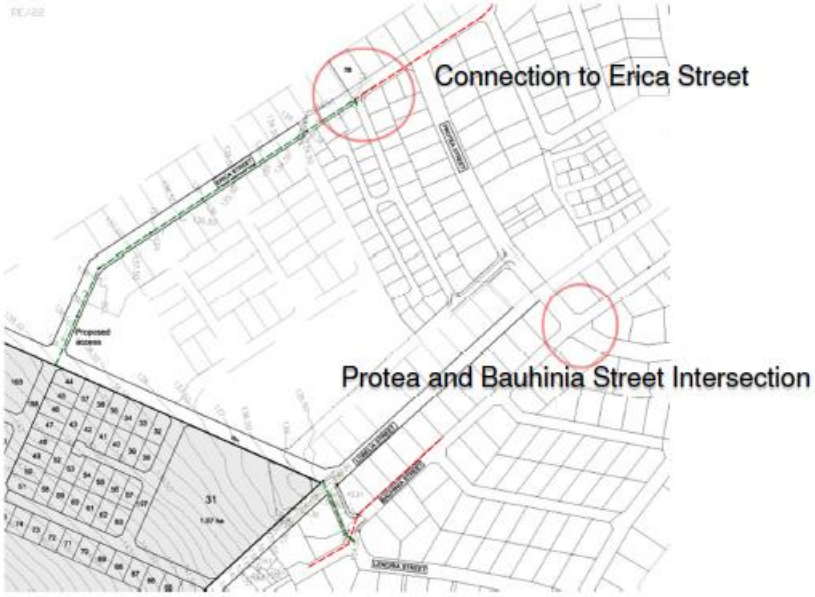


Figure 2 : Short term access road measures to be implemented for the proposed mixed-use development.

Long Term: Formalisation of the gravel road currently situated within the Lobelia Street Road reserve.

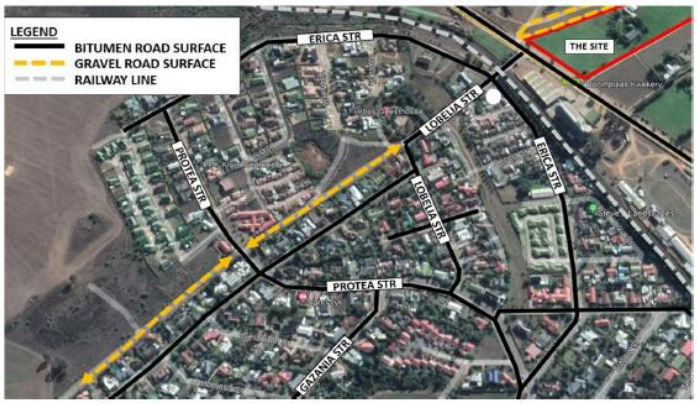


Figure 3: Future proposed formalization of gravel road. Extract from Urban Engineering TIA.

The access roads will consist of a 6,5m wide extension of Erica Street (Class 5b), over Erf 22 as well as an extension, of 6,5m wide, Bauhinia Street (Class 5b). The 5-15-year development window will result in the completion of Lobelia Street with a 6,5m wide road surface. Surface treatments will consist of 13,2 and 6,7mm aggregates with a single coat thick slurry. Intersections will be constructed with 80mm Interlocking segmented paving.

The design criteria will be based on the design standards of the Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development.

Stormwater Management:

The following measures as described below and outlined in the Stormwater Management Plan (SWMP) compiled by Graeme McGill Consulting, as proposed to mitigate the impact of the post development stormwater runoff on the existing infrastructure downstream:

- Installation of 5 000 kl water tanks on each residential erf will contribute to the attenuation of initial stormwater runoffs;
- Public Open Spaces will be utilised as recreation areas as well as stormwater detention areas where the concentration of stormwater runoff will be minimised through the application of landscaping techniques, i.e. by creating grass lined swales, undulations and depressions; and
- Post development runoffs will be attenuated with the construction of stilling basins and energy dissipating structures at outlet structures.

The post-development stormwater requirements identified Sustainable Urban Drainage Principles (SUDS) to provide post-development attenuation to pre-development levels for storm events ranging from 1:5-year to the 1:50-year storm events as well as provide controlled discharge of the 1:100-year storm event to not cause significant downstream damage.

The primary means to attenuate peak flows will be to route stormwater runoff through four (4) attenuation ponds located on suitably positioned erven as depicted in **Addendum E**.

Pond 1 will be located at the lowest point of Erf 29 in the eastern corner. Additionally, the hillslope seep wetland identified and delineated in 2023 will be incorporated into an open space.

The proposed agricultural smallholdings will each have a stormwater runoff system on each erf and the combined runoff is to be routed past the attenuation ponds, directly to Outfall 1 (Link L18).

The attenuated runoff will leave the development site and enter two outfalls (Outfall 1:L18 and Outfall 2:L15) which extend across Erf RE/22, as depicted in **Addendum E**. The outfalls combine into a single outfall which will follow a similar route as the existing cutoff channel which passes around the Langezicht Development before entering the existing channel which receives runoff from the adjacent residential development.

To achieve the required stormwater attenuation a set of orifices and a spillway have been designed at the outlet structure of each of the 4 attenuation ponds. These outlet structures are rectangular chambers with orifice slots set at different elevations, through which flow from the pond enters the chamber. The top is open, with a grid protection cover, and an outlet pipe. Each pond also has a spillway. Please refer to **Addendum F**.

In the event that the pipes along the proposed private roads in the development become blocked, it is proposed that the road prism be designed to convey the peak runoff and direct it towards the 4 attenuation ponds. In the event that the outlet structures and outlet pipes of the ponds become blocked, each pond has a spillway which has been designed to safely discharge the peak inflow.

It was deemed appropriate to size the internal stormwater reticulation for the 1:5 year peak flows. The balance of flow up to the 1:100 year peaks must be conveyed in the road prism. The exceptions are the outfalls (links L15, L16, L19 and L31) for which it is proposed to size these for the 1:100 year peak flows. The road prism flow is to enter the ponds through 5m long section of dropped kerb. This will be included in the detail design. The roads will generally follow the existing natural slopes, however in order to route the runoff from all the agricultural erven directly to the outfall (L15), Street 2 should be vertically aligned so that any surface flow in Street 5 from the agricultural erven, will flow northwards via links L12 and L13.

In order to quantify the stormwater quality treatment, the indicators of suspended solids and total phosphorus was used. The objectives selected for the proposed development were:

- Suspended solids (SS): 80% reduction
- Total phosphorous (TP): 45% reduction

Forebays:

Each pond will have a forebay where litter and sediment will be trapped for collection and removal. The forebays will be located at the main inflow point for each attenuation pond, will incorporate a concrete base and will be separated from the rest of the pond by a low gabion wall. An entrance ramp will provide access for maintenance. Details are depicted in **Addendum F**.

Biological Filter Beds:

A 1.2m deep biological filtration bed will be provided at each attenuation pond. The biological filtration bed. The Water Quality Volume (WQv) represents the runoff from the 24-hour duration, 1:0,5-year storm. The remaining areas of the attenuation pond bases will be in-situ soil. For the agricultural erven biological filter beds are to be provided for the dwellings and paved driveways.

Stormwater Infrastructure Maintenance:

The ongoing sustainability of the proposed stormwater management system is linked to the effective maintenance of all its components. These include the attenuation ponds, the outlet structures, manholes, pipes, spillways, and channels.

Stormwater infrastructure on public roads and erven will be maintained by the local municipality and stormwater infrastructure on privately owned property will be maintained by the registered owners. The responsible bodies will be required to ensure that the stormwater system is in good repair, in a healthy state and regularly serviced.

Bulk Potable Water Link Services:

In accordance with the GLS Report, dated June 2015, a 1855m long, 200mm Ø, uPVC Bulk Water Link between the existing 200mm Ø high level pipe network, at the northwestern corner of the Cemetery (adjacent to N2) and Erf 21 will be required to service the proposed development. Additionally, it is proposed to upsize the pipeline to a 250mm Ø, uPVC pipe to accommodate future residential development on Erf 22. Please refer to **Addendum G**.

Internal Potable Water Reticulation:

New 75/110/160/200mm Ø Class 9 uPVC water mains complete with isolating valves; fire hydrants and erf connections will be provided as part of the development proposal. Individual Erf connections will be made with HDPE PE80 PN12,5 pipes and will terminate with an end cap.

Sewerage:

The existing Waste Water Treatment Works (WWTW) has a design capacity of 4,0 Ml/d. Hessequa Municipality confirmed on 30 July 2024, through the Municipal Manager Mr. A. de Klerk, that the WWTW in Hessequa Municipality (Riversdale) consists of sufficient capacity to accommodate the proposed development.

Sewer Link and Bulk Infrastructure:

Drainage Zone 1: Sewage, from drainage zone 1, will drain in a north-eastern direction. A 160mm Ø connecting sewer main will be constructed, parallel to the Erica Street link road, and connect to existing 160mm Ø sewer main. This drainage zone represents approximately 87% of the development area.

Drainage Zone 2: Sewage, from drainage zone 2, will drain in a north-eastern direction. A 160mm Ø connecting sewer main will be constructed to link to the existing 160mm Ø sewer main in Bauhinia Street. This drainage zone represents approximately 13% of the development area.

Hessequa Municipality confirmed on 30 July 2024, through the Municipal Manager Mr. A. de Klerk, that the existing sewer network, in Riversdale, consists of sufficient capacity to accommodate the proposed development.

Bulk Electrical Services:

Connection Points:

The connection point for the proposed development will be the 35mm2 Cu x 3 core MV cable between the Miniature substations "*MS-Subsebtrale C-Lanoria St*" and "*MS-Bauhinia St*" where a new 4-way ring unit will be supplied and installed.

When the load requirement of the development proposal exceeds the available capacity of 856 kVA of the abovementioned 35mm2 Cu x 3 core MV cable, a new 11KV feeder, indicated in green in **Addendum E**, is to be supplied and installed from the existing 11kV Overhead powerline (OHPL) between the "*Main Intake Substation*" and "*SS Main*". The 11kV feeder will consist of a ring unit, 11kV underground cable and 11kV OHPL. Please refer to **Addendum H** for a visual representation.

In order to identify all freshwater ecosystems that may potentially be impacted by the proposed development, a 500 m "zone of investigation" around the study area, in accordance with Government Notice (GN) 4167 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), as amended (NWA), was used as a guide in which to assess possible sensitivities of the receiving freshwater environment. This area – i.e. the 500 m zone of investigation around the study areas – will henceforth be referred to as the "*investigation area*".

This specialist technical opinion memorandum aims to provide information to guide the proposed development in the vicinity of freshwater ecosystems within the study area, to ensure the ongoing functioning of the ecosystems, such that local and regional conservation requirements and the provision of ecological services in the local area are supported, while still considering the need for sustainable economic development.

ASSUMPTIONS AND LIMITATIONS

- **No additional site assessment** was undertaken to identify and delineate the relevant freshwater ecosystems associated with the development proposal, including bulk service infrastructure, other than the freshwater ecosystem(s) identified by the previous assessor, as this fell outside of the current scope of work;
- Freshwater ecosystems other than the hillslope seep wetland identified and delineated by the previous assessor, **were not ground-truthed** and therefore the assumption must be made that the delineation of their boundaries are essentially purely desktop-informed. However, these freshwater ecosystem boundaries are deemed sufficiently accurate for development planning purposes given that they were informed by the use of topographic maps, historical and current digital satellite imagery, and historical aerial photographs were deemed necessary in some instances;
- **No official quantitative tools** were run in the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the identified freshwater ecosystems as this falls outside of the current scope of work. Relevant Ecological Databases were perused to obtain background PES and EIS assessment data of the identified freshwater ecosystems that was then used to inform the assessment of potential impact risks contained in the compiled DWS GN. 4167 Risk Assessment Matrix. This background data was also used to provide a high level indication of the current impacts on the freshwater ecosystems, their sensitivity and value in terms of ecological service provision; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, the desktop delineations as provided in this specialist opinion memorandum are deemed appropriately accurate to guide any future development plans.

ASSESSMENT APPROACH

- The desktop assessment, reports on the findings from the relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA], 2011 database; the Western Cape Biodiversity Spatial Plan (2017) and the National Biodiversity Assessment (2018) which was undertaken to aid in identifying freshwater ecosystems;
- The national web based Environmental Screening Tool (DEA, 2020) was undertaken to screen the study areas for any environmental sensitivity, with specific focus on aquatic sensitivities;
- Delineation of all freshwater ecosystems (using desktop methods) within 500 m of the study area in accordance with GN 4167 as published in the Government Gazette 49833 of 2023 as it relates to activities as stipulated in Section 21(c) and (i) of the NWA.

RESULTS

DESKTOP ASSESSMENT FINDINGS

Historical aerial photographs, digital satellite imagery and/or provincial and national freshwater ecosystem databases were used to identify points of interest in the surrounding area at a desktop level. Signatures may be utilised to identify freshwater ecosystems on historical photographs or digital satellite imagery, which includes the following:

- **Linear features:** since water flows/moves through the landscape, freshwater ecosystems often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- **Vegetation** associated with freshwater ecosystems: a distinct increase in density as well as shrub size near flow paths;

- **Hue**: with water flow paths often showing as white/grey or black and outcrops or bare soil displaying varying chroma created by varying vegetation cover, geology, and soil conditions. Changes in the hue of vegetation with freshwater ecosystem vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In Colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- **Texture**: with areas displaying various textures, created by varying vegetation cover and soil conditions.

Table 3 below contains data accessed as part of this desktop assessment and presented as a "*dashboard-style*" report. The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for integration of results by the reader to take place. Where required, further discussion and interpretation are provided.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics at the scale required to inform the applicant of any potential environmental authorisation and/or water use authorisation processes that may be needed. Given these limitations, this information is considered useful as background information to the study and is important in legislative contextualisation of the risks and impacts and was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance. It must, however, be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case site verified information must carry more weight in the decision-making process.

Ecological Status of Sub-Quaternary Catchments [Department of Water and Sanitation (DWS) Resource Quality Information Services (RQIS) PES/EIS Database]

The PES/EIS database, as developed by the DWS RQS department, was utilised to obtain additional background information on the project area. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as the South Africa River Health Programme (SA RHP) sites, Ecological Water Requirements (EWR) sites and Hydro Water Management System (WMS) sites.

Key information on background conditions associated with the study area, as contained in this database and pertaining to the PES and EIS for the SQRs H90C – 09220 (Vet River) are tabulated in **Table 1** and **Table 2** and visually presented in **Figure 14** below. This monitoring point is located approximately 2.5km east of the study area and 1.6km east of proposed external bulk infrastructure with the proposed development being upgradient of the monitoring point.

The Ecological Importance (EI) data for H90C – 09220 (Vet River) indicated that no fish species are expected to occur at this point. The EI data for H90C – 09220 (Vet River) indicates that the following macro-invertebrate species are expected to occur at this site:

Table 1: Invertebrates previously collected from or expected at the H90C – 09220 (Vet River) monitoring point.

Aquatic macro-invertebrates	
Ancylidae	*Hydropsychidae 2 sp*
Baetidae > 2 sp	*Leptoceridae*
Ceratopogonidae	*Leptophlebiidae*
Chironomidae	*Muscidae*
Culicidae	*Oligochaeta*
Elmidae/dryopidae	*Potamonautidae*
Gyrinidae	*Teloganodidae*
Heptageniidae	*Veliidae/mesoveliidae*

Table 2: Summary of the ecological status of the sub-quaternary catchment (SQ) reach associated with the proposed development based on the DWS RQS PES/EIS database (Figure 14).

DWS RQIS PESEIS Database	H90C – 09220 (Vet River)
PES Category Median	Class E (Seriously Modified)
Mean EI class	Low
Mean ES class	Very High
Length	5.33
Stream order	2
Default EC[4]	A (Very High)
PES Details	
Instream habitat continuity MOD	Large
RIP/wetland zone continuity MOD	Serious
Potential instream habitat MOD activities	Serious
Riparian/wetland zone MOD	Serious
Potential flow MOD activities	Large
Potential physico-chemical MOD activities	Serious
EI Details	
Fish spp/SQ	None
Fish average confidence	N/A
Fish representivity per secondary class	N/A
Fish rarity per secondary class	N/A
Invertebrate taxa/SQ	16
Invertebrate average confidence	5.00
Invertebrate representivity per secondary class	Moderate
Invertebrate rarity per secondary class	High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	N/A
Habitat diversity class	Low
Habitat size (length) class	Low
Instream migration link class	Moderate
Riparian-wetland zone migration link	Low
Riparian-wetland zone habitat integrity class	Low
Instream habitat integrity class	Low
Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	Low
Riparian-wetland natural vegetation rating based on expert rating	Low
ES Details	
Fish physical-chemical sensitivity description	N/A
Fish no-flow sensitivity	N/A
Invertebrates physical-chemical sensitivity description	Very high
Invertebrates velocity sensitivity	Very high

DWS RQIS PESEIS Database	H90C – 09220 (Vet River)
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	Very high
Stream size sensitivity to modified flow/water level changes description	Very high
Riparian-wetland vegetation intolerance to water level changes description	High

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;
[2] EI = Ecological Importance;
[3] ES = Ecological Sensitivity
[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

Table 3: Desktop data relating to the characteristics of the study and investigation areas (Quarter Degree Square (QDS) 3421AA & 3421AB).

Aquatic ecoregion and sub-regions in which the study area is located	
Ecoregion	Southern Coastal Belt
Catchment	Breede
Quaternary Catchment	H90C
WMA	Gouritz
subWMA	Gouritz
Dominant characteristics of the Southern Coastal Belt Ecoregion Level II (Kleynhans *et al.* 2007)	
Code	22.02
Dominant primary terrain morphology	Undulating hills, Moderately Undulating Plains.
Dominant primary vegetation types	South and South-west Coast Renosterveld, Mountain Fynbos, Afromontane Forest, Dune Thicket.
Altitude (m a.m.s.l)	0 – 500
MAP (mm)	300 – 700
Coefficient of Variation (% of MAP)	20 – 35
Rainfall concentration index	<15 – 30
Rainfall seasonality	All year, Winter
Mean annual temp. (°C)	14 – 18
Winter temperature (July)	4 – 20
Summer temperature (Feb)	14 – 30
Median annual simulated runoff (mm)	20 – 250
Strategic Water Source Areas for Surface Water (SWSA) (2021) (Figure 7)	
Surface water SWSAs 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. They include transboundary areas that extend into Lesotho and Swaziland. The sub-national Water Source Areas (WSAs) are not nationally strategic as defined in the report but were included to provide complete coverage.	
According to the SWSA databases, the southern portion of the investigation area falls within the Langeberg surface water SWSA. However, the study and investigation areas are not located within a groundwater SWSA.	
National web based environmental screening tool (2020) (Figure 13)	
The screening tool is intended for pre-screening of sensitivities in the landscape for assessment within the EIA process and assists with implementing the migration hierarchy, allowing developers to adjust their proposed development footprint to avoid sensitive areas.	

Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
FEPACODE	The western portion of the study and investigation areas are located within a sub-quaternary catchment identified as an efficient catchment for rehabilitating to an A or B (natural/good) condition to meet under achieved river type targets (FEPA CODE = 3).
Wetland Vegetation Type (Figure 9)	The majority of the study and investigation areas fall within the East Coast Shale Renosterveld wetland vegetation (WetVeg) type, while a portion of the southern boundary of the investigation area falls with the East Coast Silcrete Renosterveld WetVeg type. Both of these WetVeg types are considered to be Critically Endangered (CR) according to Mbona *et al.* (2015).
NFEPA Rivers (Figure 10)	As per the NFEPA database, the Naroo River, a tributary of the Vet River, is indicated in the northeastern corner of investigation area. According to the PES 1999 and RIVCON databases, the Naroo River is in a moderately modified (RIVCON C) ecological condition.
NFEPA Wetlands (Figure 10)	According to the NFEPA Database, a flat wetland is indicated in the centre of the study area. A channelled valley bottom (CVB) wetland is indicated in the northwestern portion of the investigation area, with three additional CVB wetlands indicated in the southeastern portion of the investigation area. Numerous smaller CVB, unchannelled valley-bottom (UCVB) and flat wetlands are indicated in the investigation area. All of the wetlands within the study and investigation areas are in a heavily modified ecological condition (WETCON Z1), except for the CVB wetland located in the furthest southeastern portion of the investigation area which is considered to be in a moderately modified (WETCON C) ecological condition.
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) Rivers, Artificial Wetlands, and National Wetland Map 6 (2024) (Figure 11)	
According to the NBA Rivers database, the Naroo River is located in the northeastern boundary of the investigation area. According to the National Wetland Map 6 Database, a depression wetland is indicated to traverse the centre of the study area. A large floodplain wetland associated with the Naroo River is indicated in the northeastern boundary of the investigation area. A CVB wetland is indicated to occur in the northwestern portion of the investigation area, as well as three additional CVB wetlands in the southeastern portion of the investigation area. All of the wetlands in the study and investigation areas are indicated to be in a heavily to critically modified (Class D/E/F) ecological condition, however, the CVB wetland in the furthest southeastern portion of the investigation area is indicated to be in a moderately modified ecological condition (Class C). The wetlands all have an Ecological Threat Status (ETS) of CR and an Ecological Protection Level (EPL) of Not Protected (NP). The Artificial Wetlands database indicates that multiple dams are located within the investigation area.	
Detail of the study area in terms of the Western Cape Biodiversity Spatial Plan (2023) (Figure 12)	
According to the WCBSP (2023), the eastern portion of the study area is located within a Critical Biodiversity Area (CBA) 1 and 2: Terrestrial areas. The central and southeastern portions of the investigation area, associated with the proposed external infrastructure are located within CBA 1: Wetland and CBA 2: Aquatic areas. The remaining central and southeastern portions of the investigation area are located in CBA 1 and 2: Terrestrial areas. **CBAs** are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. CBA 1 are areas likely to be in a natural condition and CBA 2 are those areas that are potentially degraded or represent secondary vegetation. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.	
Detail of the area in terms of the Land Type Data (Job *et al.*, 2019) (Figure 8)	

The western portion of the study area and its associated investigation area are considered to have **very high aquatic sensitivity**, as well as the eastern portions of the proposed external infrastructure. The remaining areas are considered of low aquatic sensitivity. The triggering feature for the high sensitivity for the very high sensitivity is: ➢ Being within a surface water SWSA (Langeberg); and ➢ Being within depression wetlands.	The potential presence of wetlands in the study and investigation areas can be examined in the context of the land type for the area. Majority of the study and investigation areas fall within the Dc32 land type grouping. The remainder of the northern boundary of the study and investigation areas fall within the Fb31 land type grouping, the eastern and southern boundaries of the investigation area fall within the Db12 and Db21 land type groupings, respectively. a. The Db Land Types accommodate duplex soils and gleycutanic soils, including Estcourt, Sterkspruit, Swartland, Valsrivier and Kroonstad soil forms. After subtracting exposed rock land, these Land Types consist of land with more than 50% duplex soils. Db refers to land where brown duplex soils are dominant; b. The soils in the Dc grouping can have predominantly prismacutanic and/or pedocutanic horizons. This land type is mainly conglomerate, sandstone and mudstone of the Uitenhage Group and shale of the Bokkeveld Group, however it can also be overlain by Tertiary silcrete; and c. Fb Land Types are intended to accommodate pedologically young landscapes that are not predominantly rock and not predominantly alluvial or Aeolian, and in which the dominant soil forming process has been rock weathering, the formation of orthic topsoil horizons, and commonly clay illuviation, giving rise to lithocutanic horizons. The soil forms which epitomize these processes are Glenrosa and Mispah. However, exposed rock and soils belonging to almost any other soil form may be found in these Land Types, provided they do not qualify the land for inclusion into another Land Type. Fb indicates land in which lime occurs regularly (there need not be much lime) in one or more valley bottom sites.

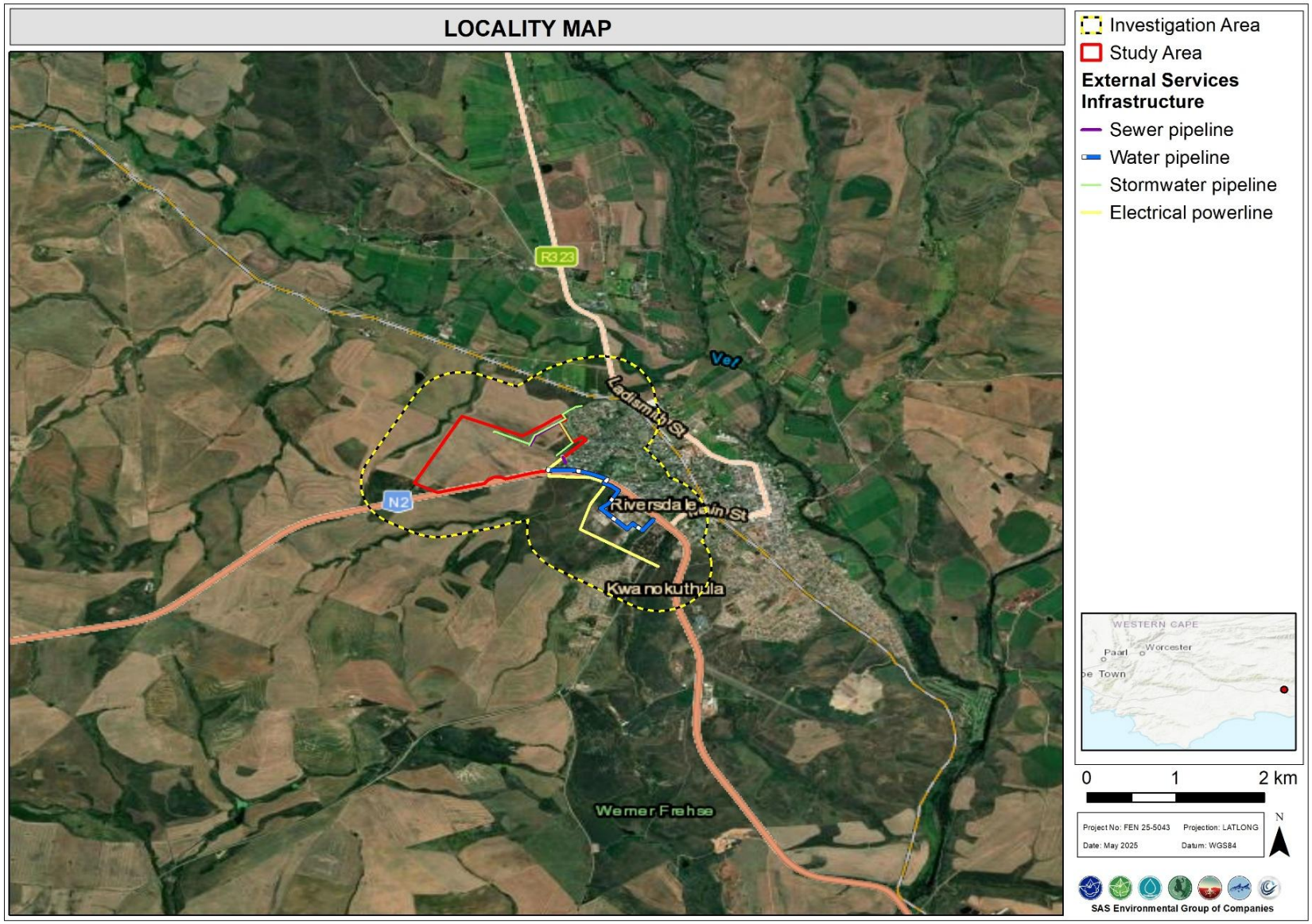


Figure 4: Digital satellite image depicting the study and investigation area in relation to the surrounding area.

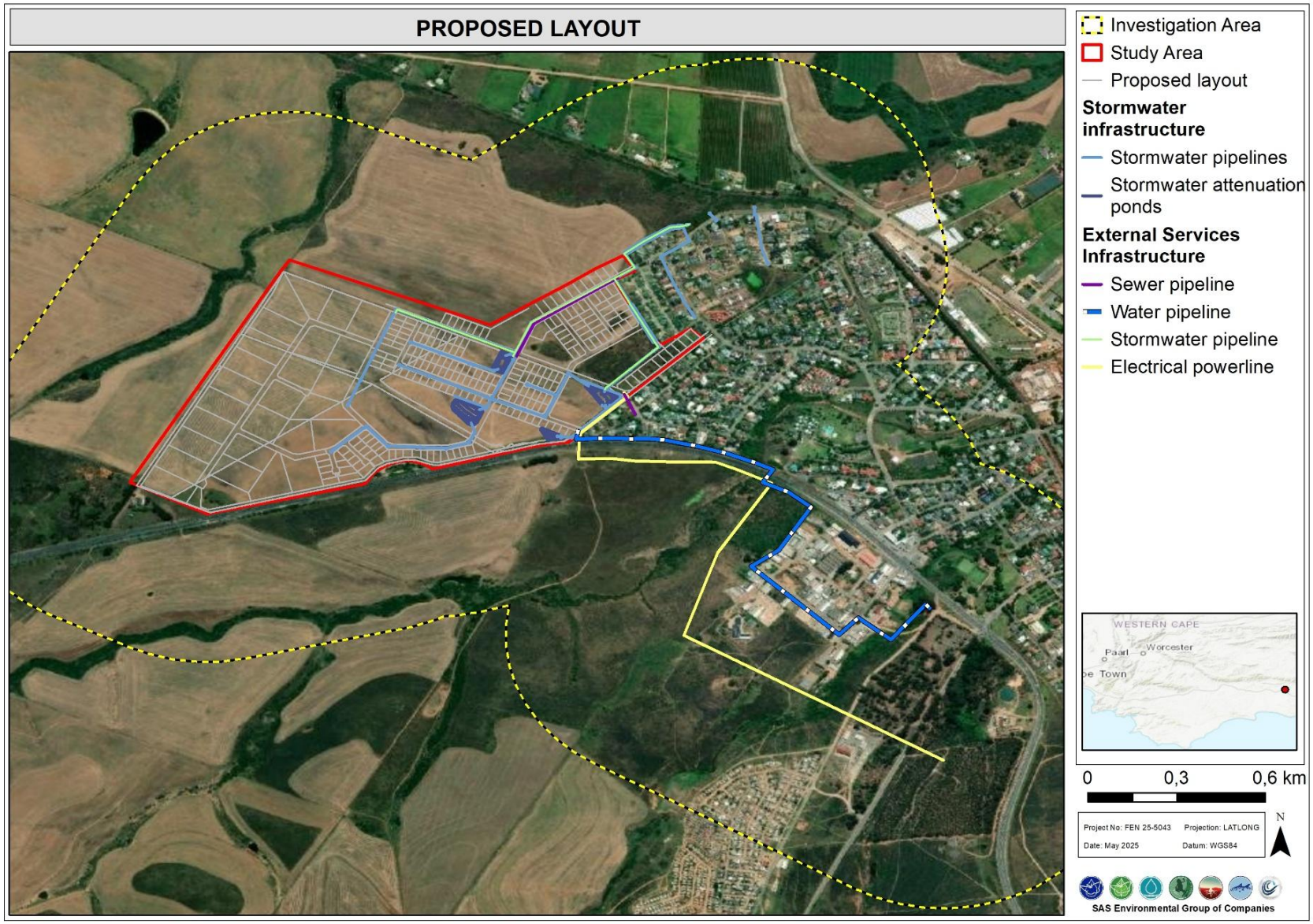


Figure 5: Digital satellite image depicting the proposed layout of the mixed-use development in relation to the surrounding areas.

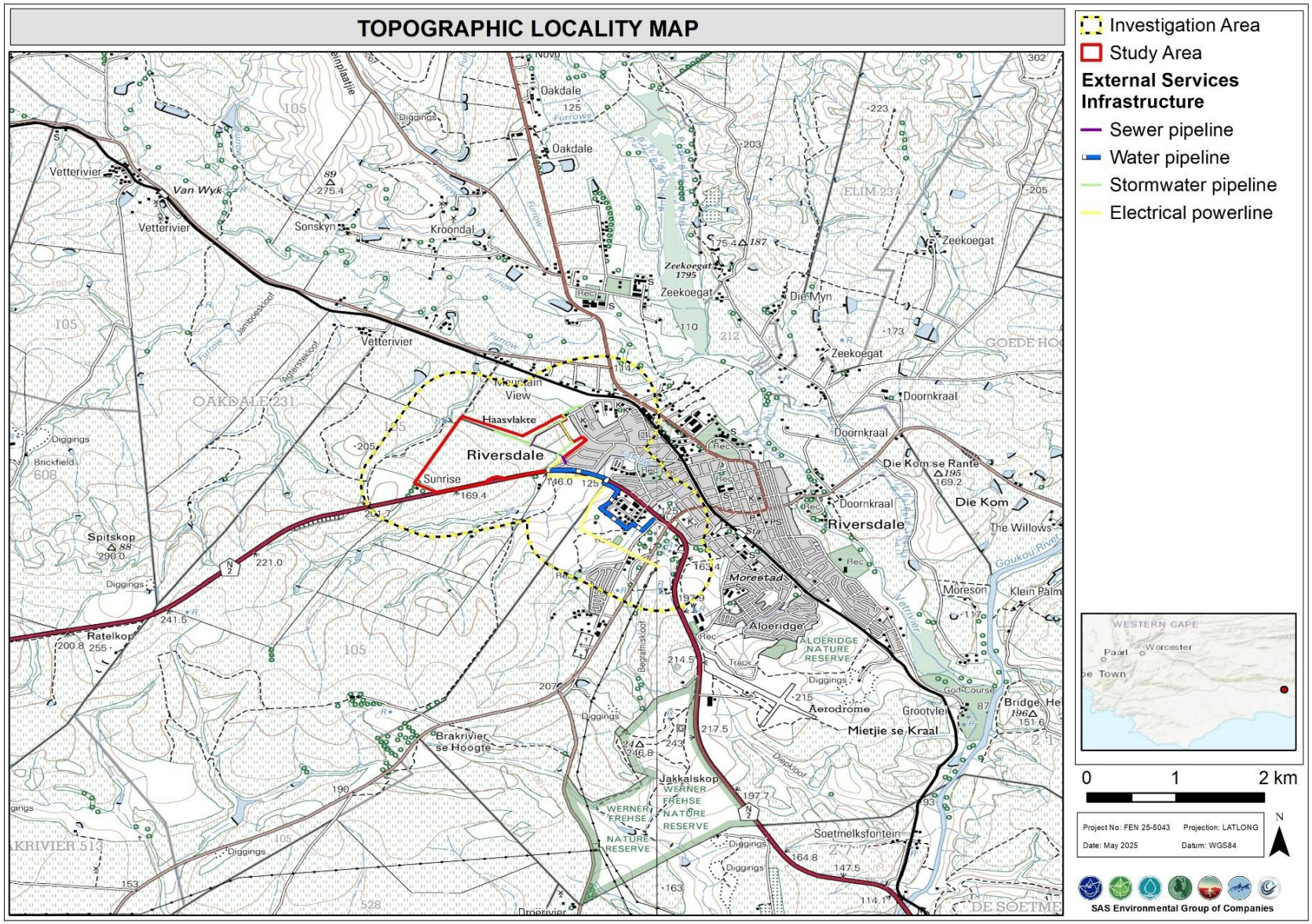


Figure 6: Location of the study and investigation areas depicted on a 1:50 000 topographical map, in relation to surrounding area.

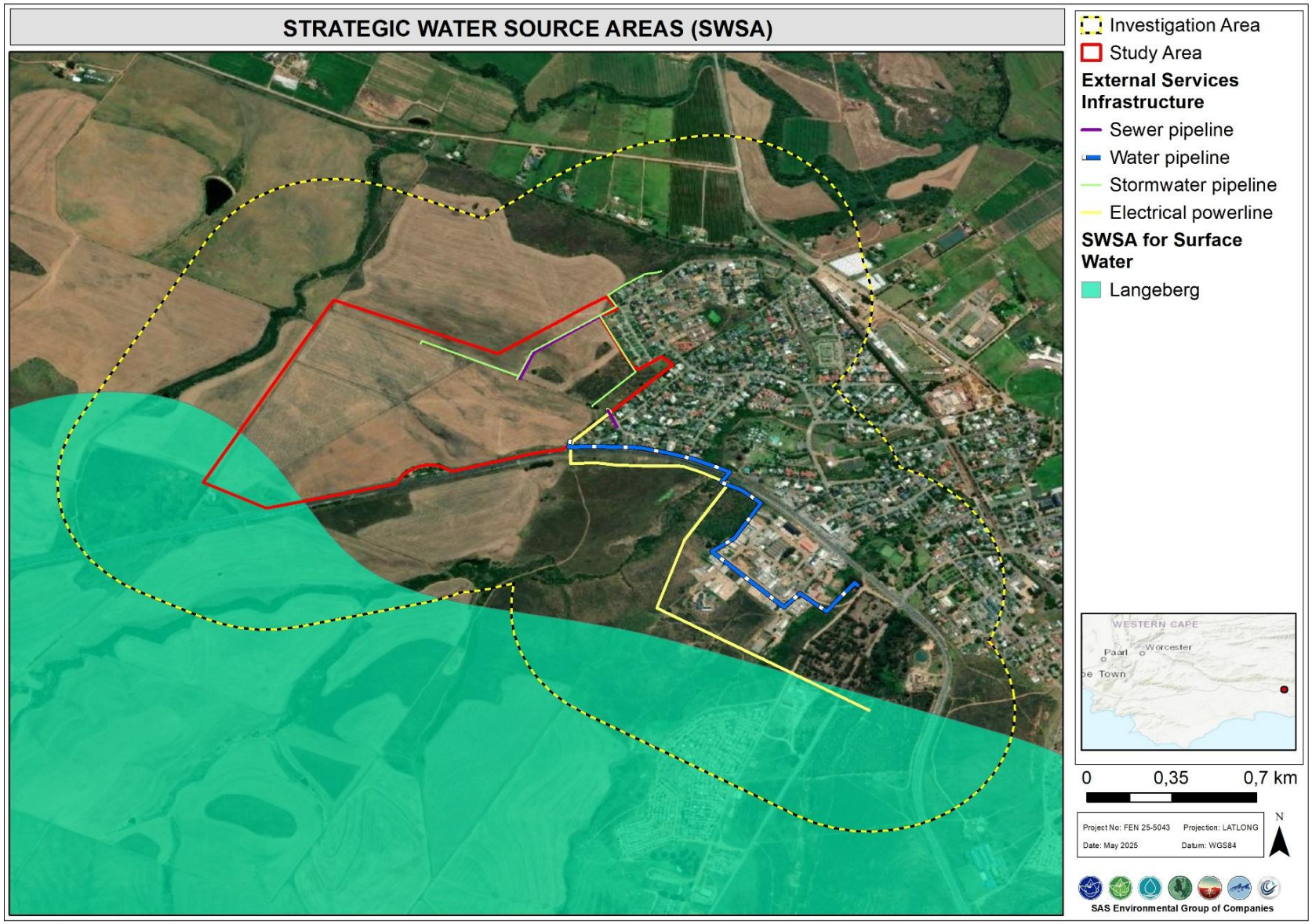


Figure 7: Strategic Water Source Area (SWSA) in relation to the study and investigation areas.

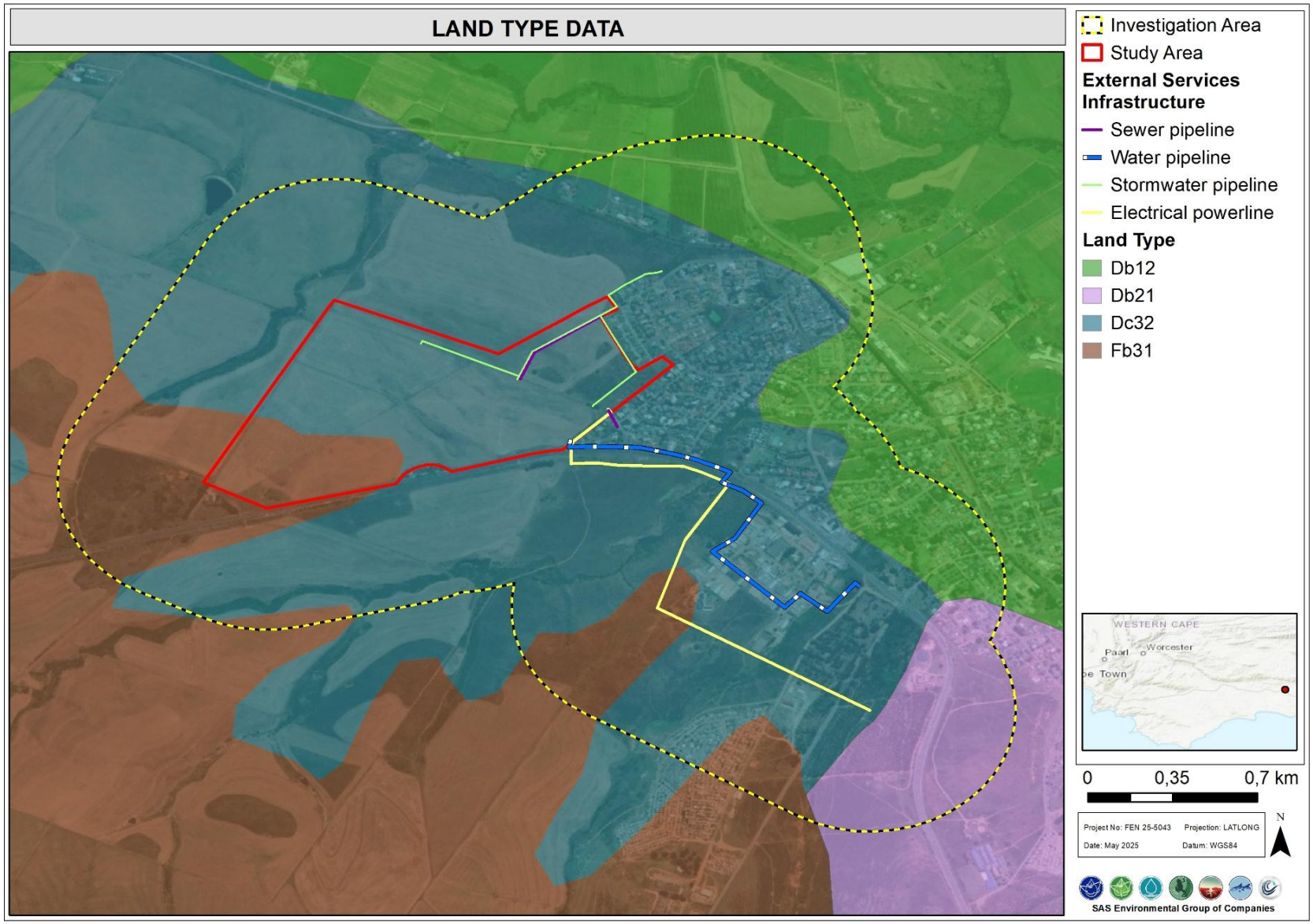


Figure 8: Study and investigation areas in relation to Land Type Data (Job *et al*., 2019).

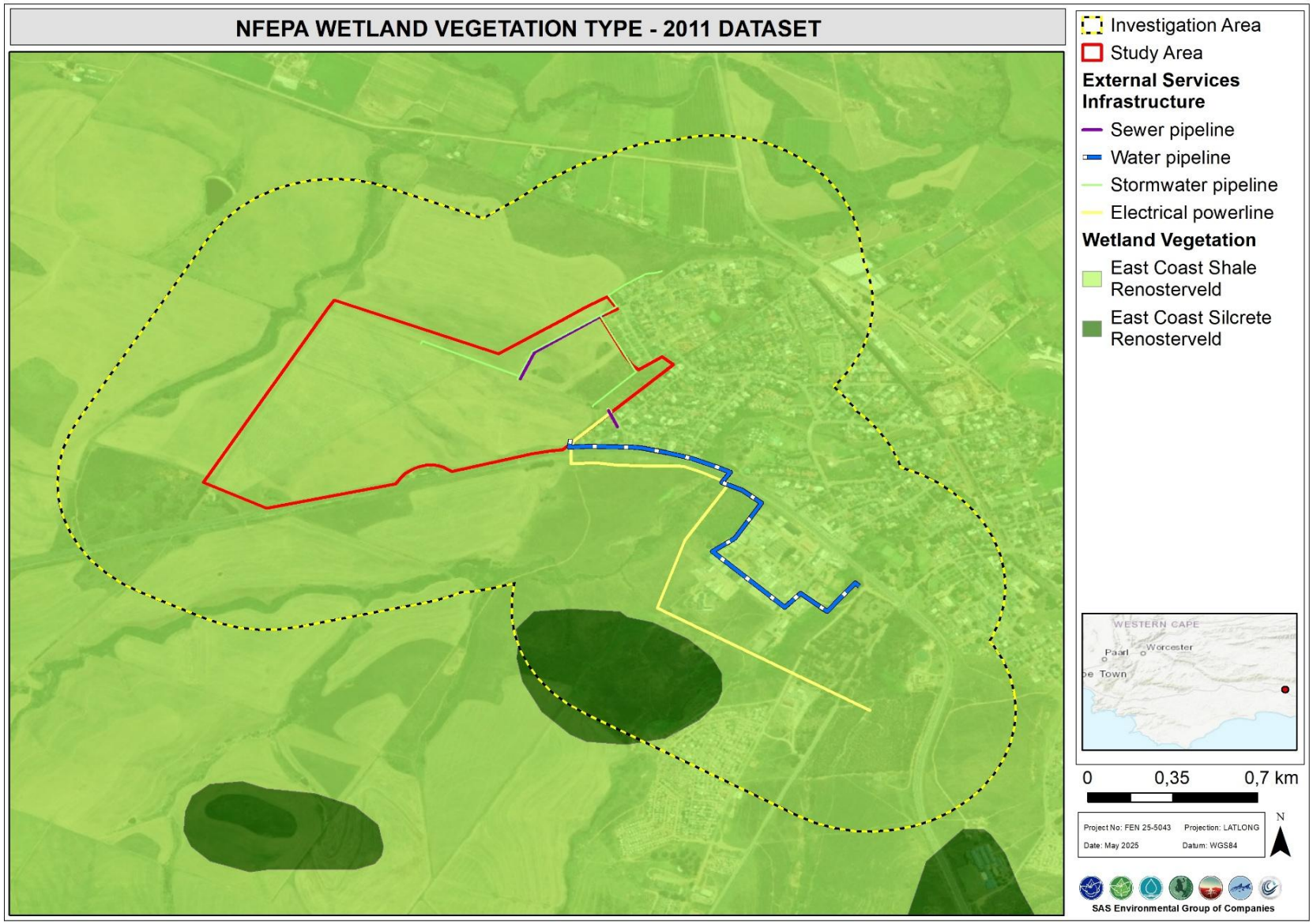


Figure 9: Study and investigation areas in relation to Wetland Vegetation Type (Mbona *et al.*, 2015).

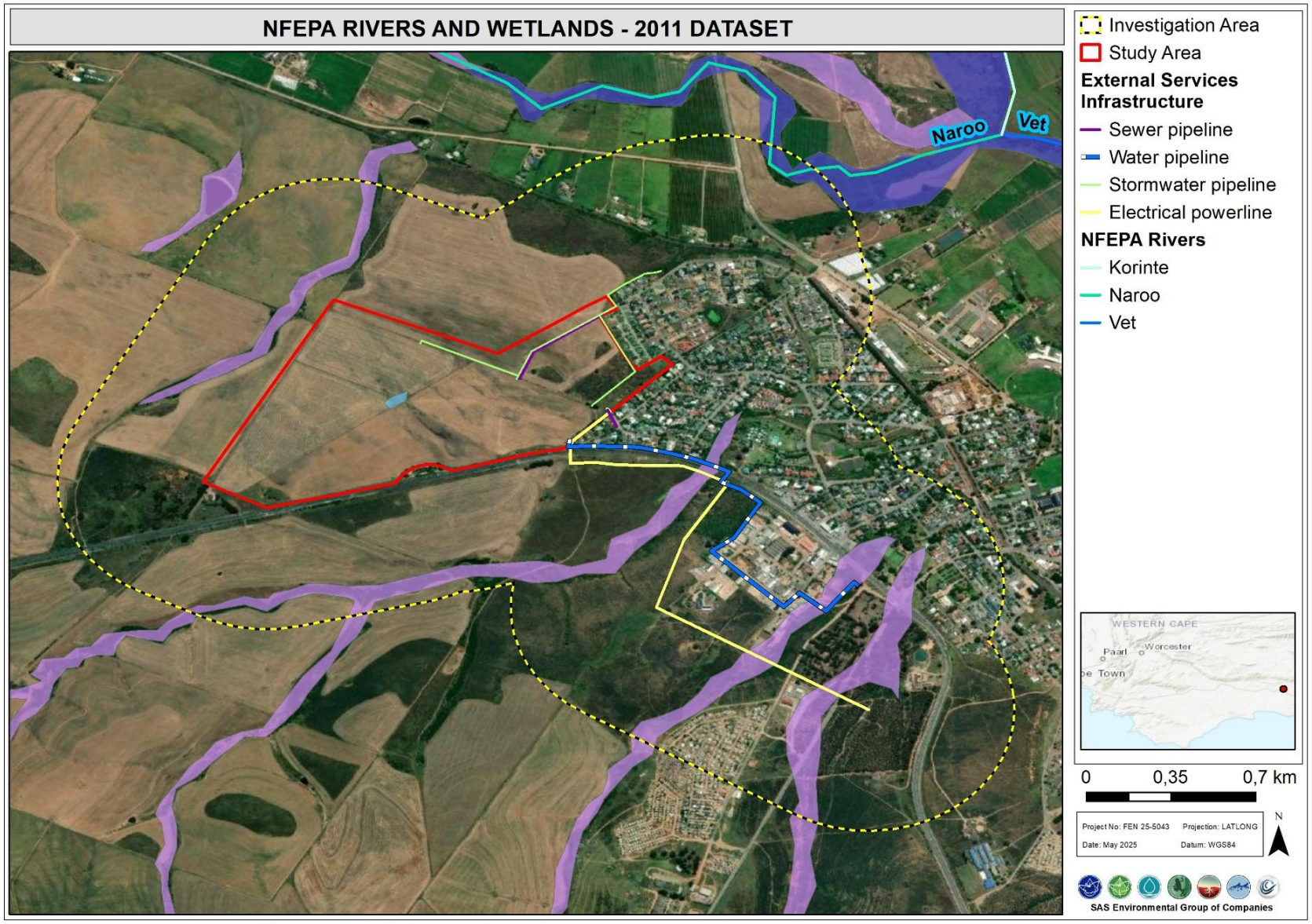


Figure 10: Wetlands and rivers associated with the study and investigation areas as indicated by the NFEPA database (NFEPA, 2011).

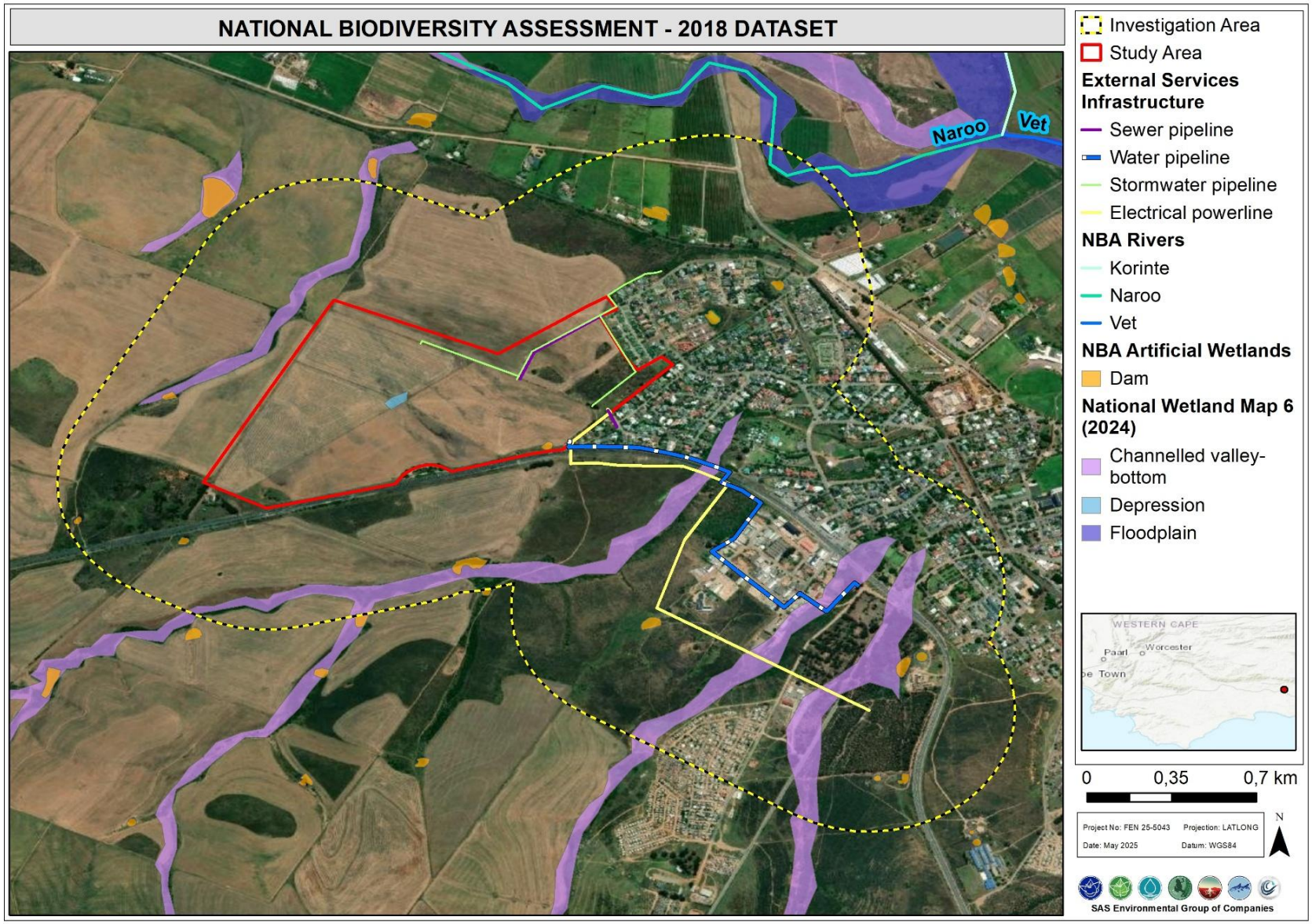


Figure 11: Natural and artificial wetlands associated with the study and investigation areas as indicated by the NBA databases (NBA, 2018).

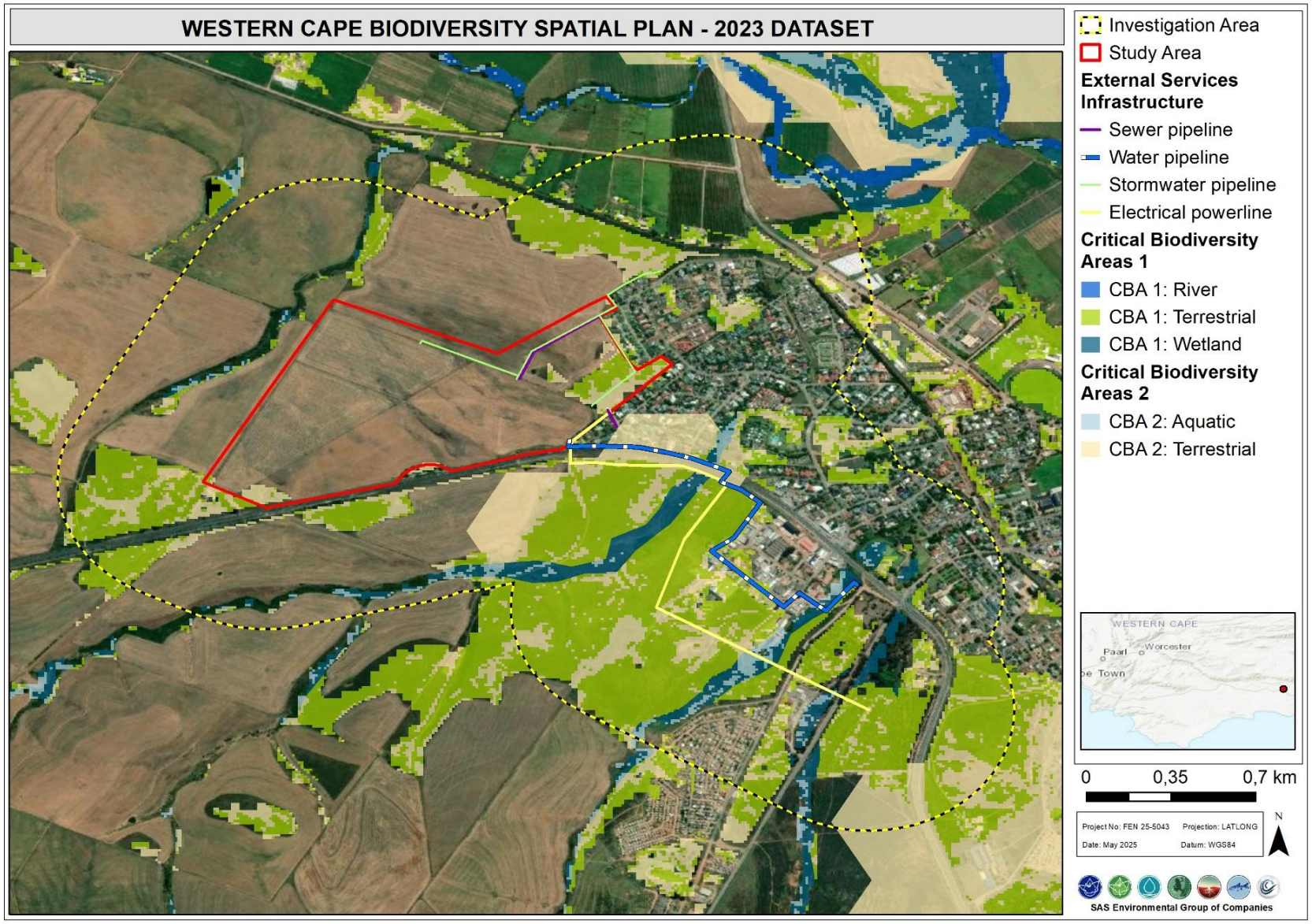


Figure 12: Conservation areas within the study and investigation area as identified by the Western Cape Biodiversity Spatial Plan (2023).

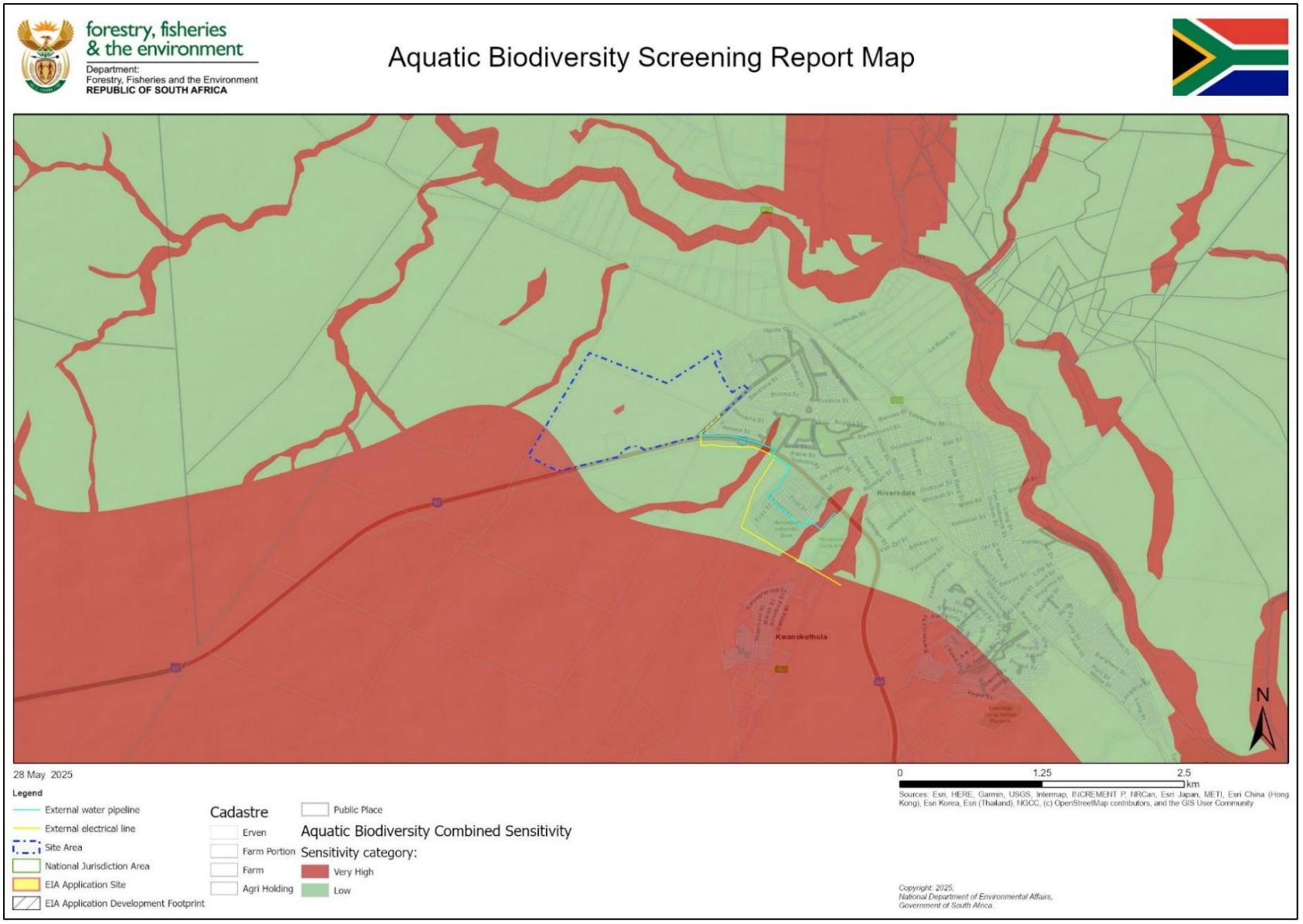


Figure 13: Aquatic Biodiversity Sensitivity designation as per the NEMA Environmental Screening Tool (2020).

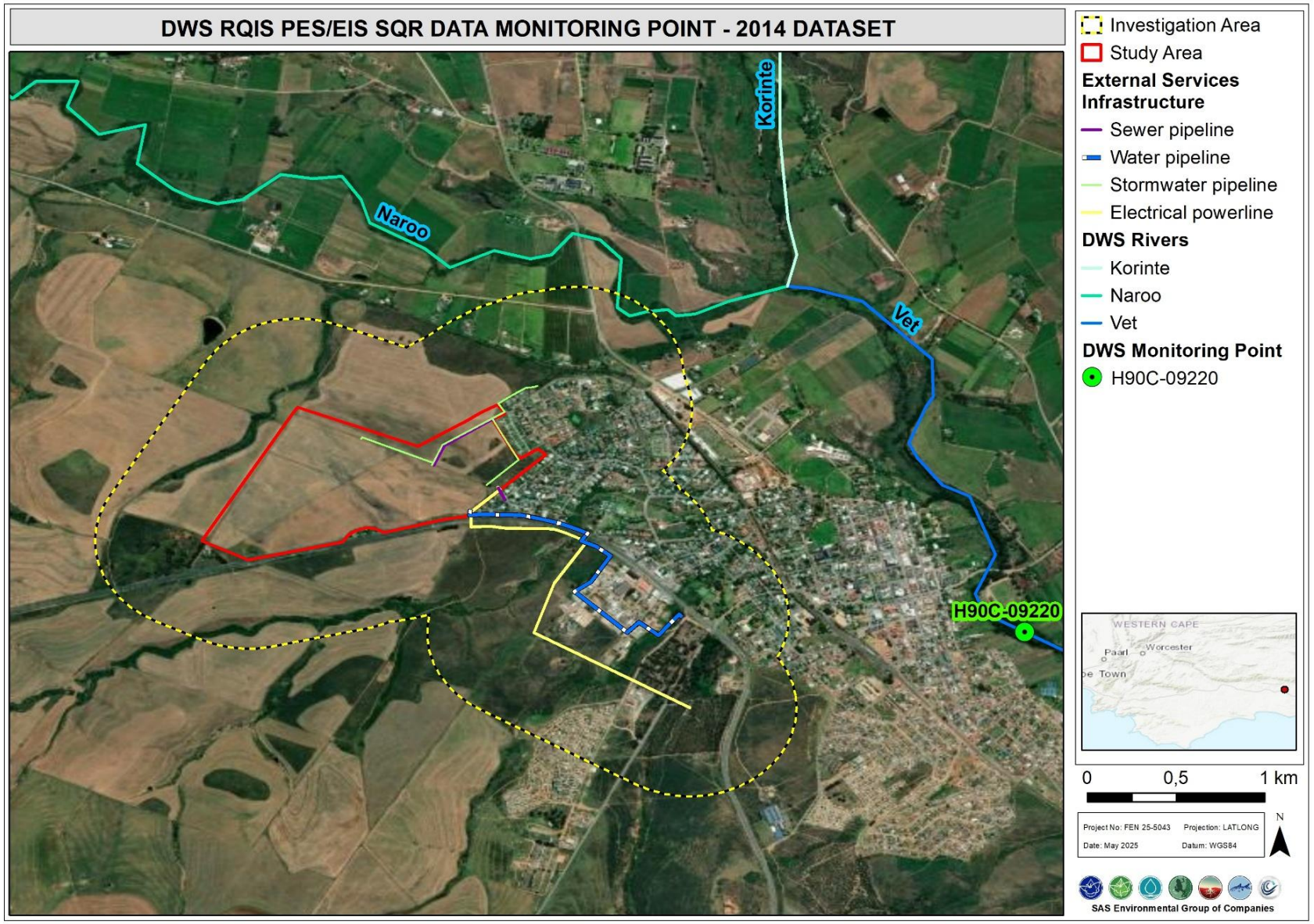


Figure 14: DWS RQIS PES/EIS SQR monitoring point in relation to the study and investigation areas.

DESKTOP VERIFICATION RESULTS

A desktop assessment was undertaken, during which the presence of any areas presenting with wetland or riparian characteristics as defined by the DWAF (2008) or freshwater ecosystems as defined by the NWA were identified.

For the purposes of this memorandum, the definition of a watercourse, wetland and riparian habitat was taken as per that in the NWA. The definitions are as follows:

A **watercourse** means:

(a) a river or spring;

(b) a natural channel in which water flows regularly or intermittently;

(c) a wetland, lake, or dam into which, or from which, water flows; and

(d) any collection of water which the Minister may, by notice in the *Gazette,* declare to be a watercourse, and a reference to a watercourse includes where relevant, its bed and banks.

Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soil, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure **distinct** from those of adjacent areas.

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

For the purposes of this memorandum, the term “freshwater ecosystem” carries the same meaning as “watercourse.”

Key observations:

- *Terrain units are used to determine in which parts of the landscape a freshwater ecosystem is most likely to occur;*
- *Surface water and/or saturated soil/alluvial soil can be used to determine if there is a permanent zone and to define the outer boundaries (temporary zone) of a freshwater ecosystem;*
- *Soil form indicators are used to determine the presence of soil that are associated with prolonged and frequent saturation and a fluctuating water table within 50 cm of the land surface; and*
- *Obligate and facultative vegetation species could be used in conjunction with terrain units as well as the point where a distinct change in the vegetation composition was observed, to determine the boundary of a freshwater ecosystem.*

It should be noted that for an area to be identified as a freshwater ecosystem, at least two (2) of the above indicators should be present (pers comm Prof. F. Ellery).

The freshwater ecosystem identified and delineated within the concerned development area, corresponds to the delineations as provided by the previous assessor, although the ecological databases labels this freshwater ecosystem as a depression wetland, however, ground truthing indicated this system to be a hillslope seep wetland.

The freshwater ecosystem delineation map is illustrated visually in **Figures 15** overleaf.

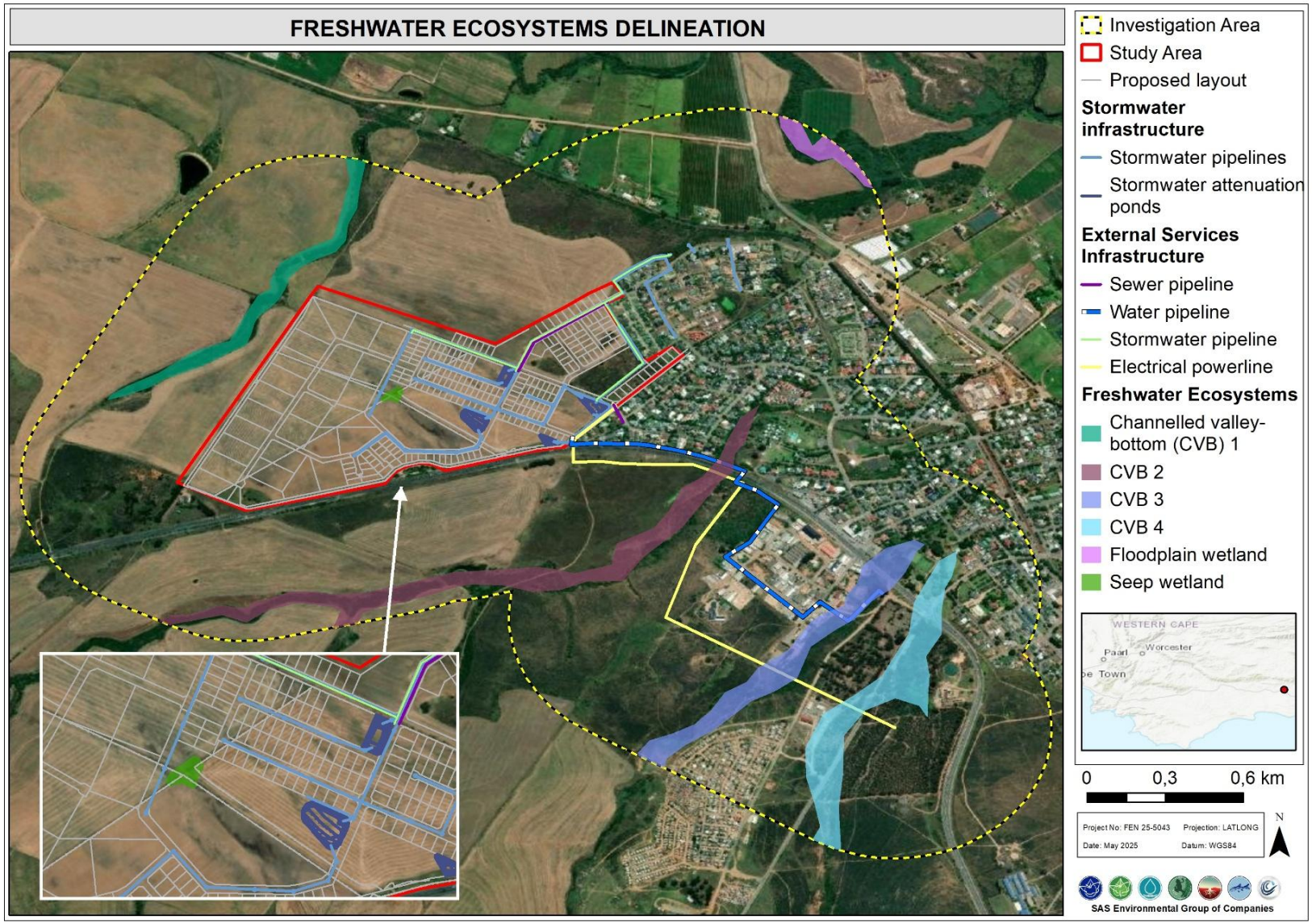


Figure 15: Delineation of the freshwater ecosystems associated with the study and investigation areas.

LEGISLATIVE REQUIREMENTS

The following legislative requirements were considered:

- The Constitution of the Republic of South Africa, 1996[1];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA);
- Environmental Impact Assessment Regulations, 2014, (GNR 982 in GG 38282 of 4 December 2014) as amended;
- The National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA); and
- Government Notice (GN) 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the NWA.

LEGISLATIVE ZONES OF REGULATION

Certain articles of legislation related to the above Acts and legislation impose potential zones of regulation on freshwater ecosystems in both a national and provincial context. The Zones of Regulation (ZoR) are not necessarily development exclusion zones, rather areas in which EIA and Water Use Authorisation (WUA) legislative tools have been introduced for the protection and sustainable use of freshwater resources by requiring that certain types of activities within a freshwater ecosystem, or within a certain distance of a freshwater ecosystem require authorisation. The definition and motivation for a regulated zone of activity for the protection of freshwater ecosystems can be summarised as follows:

Table 4: Articles of legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). **Department of Water and Sanitation (DWS)**	Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the National Water Act, 1998 (Act No.36 of 1998) as amended. In accordance with GN4167, a regulated area of a watercourse in terms of water uses as listed in Section 21(c) and 21(i) is defined as: • the outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam; • in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or • In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended.	Activities of Listing Notice 1 (GN 983) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) **Activity 12**: *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* (ii) infrastructure or structures with a physical footprint of 100 square metres or more. *where such development occurs—* *a) **within a watercourse**;*

[1] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

Regulatory authorisation	Zone of applicability
	b) in front of a development setback; or *c) if no development setback exists, within **32 metres of a watercourse**, measured from the edge of a watercourse.* **Activity 19** The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse. but excluding where such infilling, depositing, dredging, excavation, removal or moving— a) will occur behind a development setback; b) is for maintenance purposes undertaken in accordance with a maintenance management plan; c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies. Activities of Listing Notice 3 (GN 985) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended)

In terms of the NEMA EIA Regulations, if the development of new structures and/or infrastructure were to trigger Listing Notice 1 Activity 12 and 19 due to the development occurring within 32 m from the identified freshwater ecosystems, and exceeding the 100 m^2 and 10m^3 thresholds contained within the activities respectively, then the enviro-legal process requirements relating to the freshwater environment would require Environmental Authorisation (EA) in terms of the NEMA EIA Regulations of 2014 as amended.

Should the development fall within the 100m or 500 m ZoR of the identified watercourses or wetlands respectively, as per GN4167, then the proposed development is also likely to trigger certain water uses as defined by Section 21 of the NWA, most pertinently Section 21 (c) – impeding or diverting the flow of water in a freshwater ecosystem and Section 21 (i) – altering the bed, banks, course or characteristics of a freshwater ecosystem.

Under Section 28 of the NWA the water uses associated with the development are required to be licenced, either in the form of a Water Use Licence (WUL), or via means of a General Authorisation (GA). GN4167 of December 2023 details the requirements for the Section 21(c) and (i) water use GA.

The GA defines the regulated area of a freshwater ecosystem – i.e. the area in which a licence or GA in terms of Section 21 (c) and (i) would apply and provides the template for a risk assessment that must be undertaken when a development constitutes a Section 21 (c) and (i) water use within the regulated area of a freshwater ecosystem. The degree of risk to the environment as identified through the risk assessment will determine whether a WUL or GA will apply to the proposed development.

The identified freshwater ecosystems associated with the study and investigation areas are subject to the following Zones of Regulation (ZOR) (Figures 16-17 overleaf):

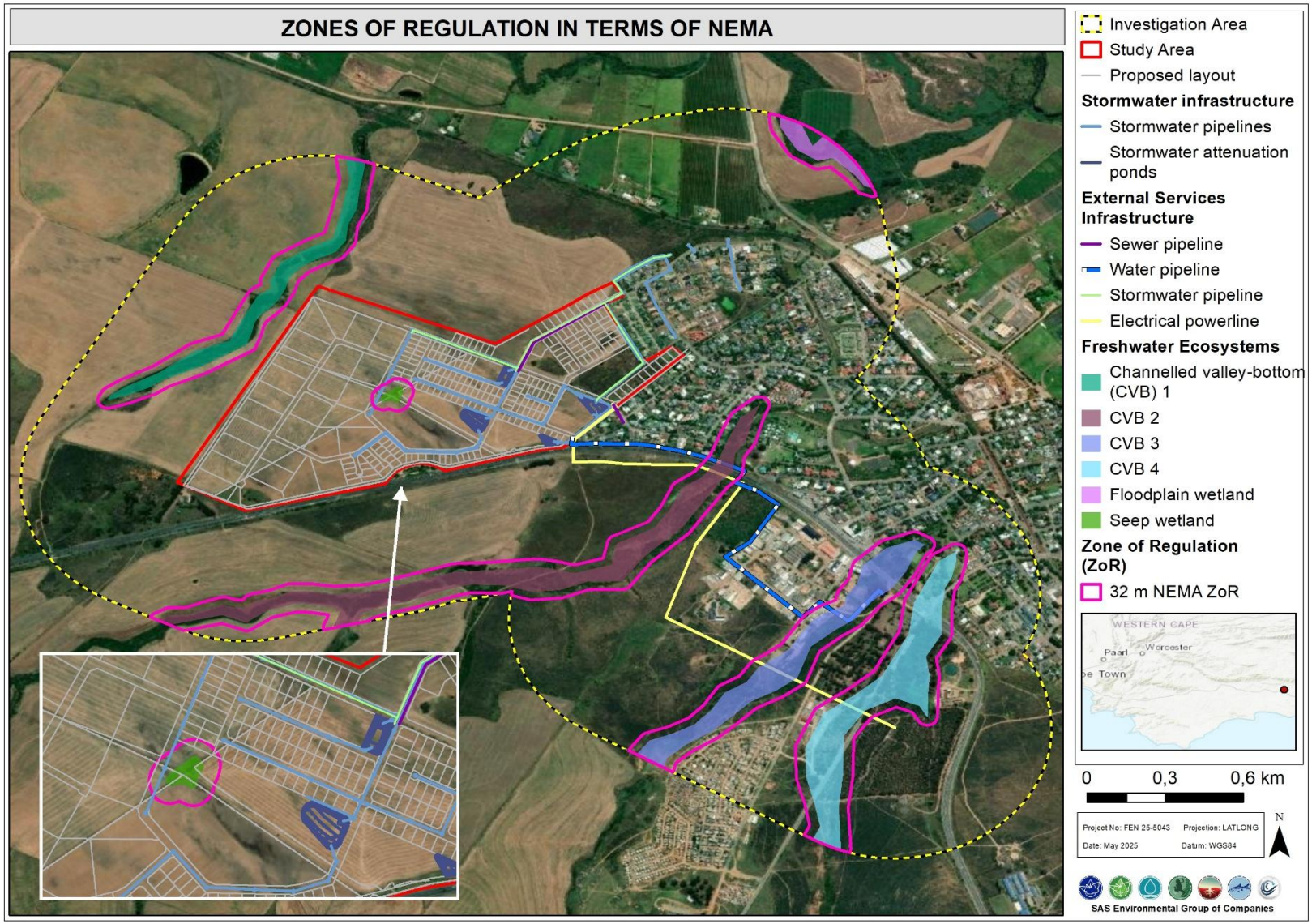


Figure 16: Legislative Zone of Regulation in terms of NEMA in relation to the study and investigation areas.

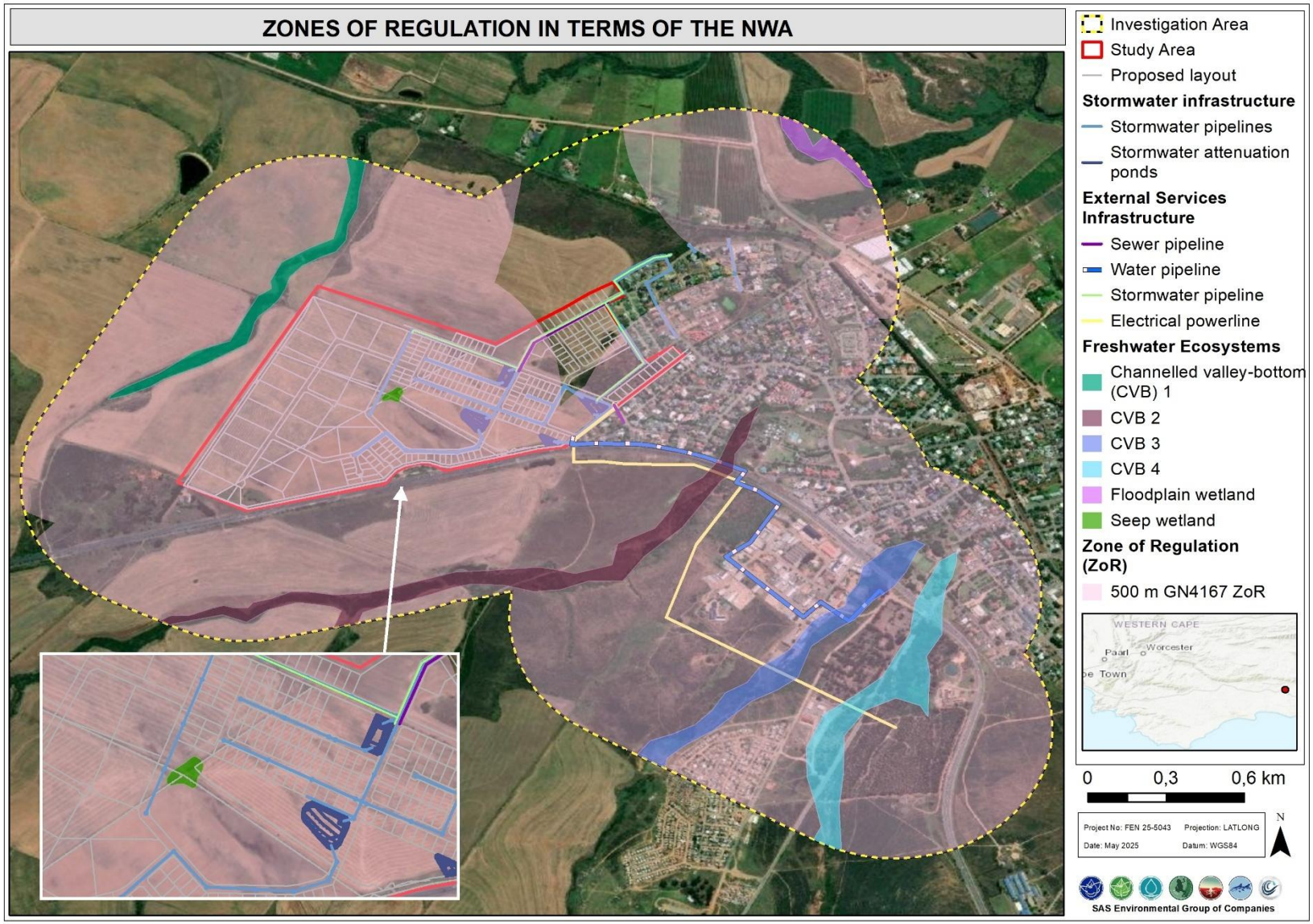


Figure 17: Legislative Zone of Regulation in terms of GN 4167 as it pertains to the NWA in relation to the study and investigation areas

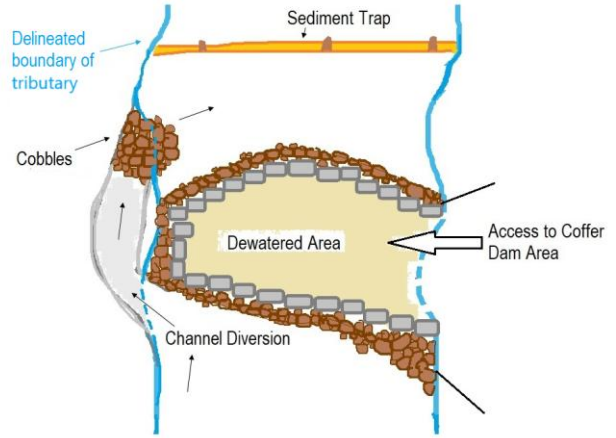
DWS RISK ASSESSMENT MATRIX

- The risk assessment was applied considering the risk significance of the proposed development as described above;
- There are four key ecological risks to the assessed freshwater ecosystems that were assessed, namely:
  - Loss of surface freshwater ecosystem habitat and ecological structure resulting in impacts to biota;
  - Changes to the socio-cultural and service provision;
  - Impacts on the hydrology and sediment balance of the freshwater ecosystems; and
  - Impacts on water quality;
- In applying the DWS Risk Assessment Matrix (2023), it was assumed that the mitigation hierarchy as advocated by the DEA *et al*. (2013) would be followed, i.e., the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- Thus, the DWS Risk Assessment Matrix (2023) was applied assuming that all listed mitigation measures are implemented, therefore the results of the DWS risk assessment provided in this report presents the perceived impact significance post-mitigation;
- The proposed development and the associated risk it poses is highly site specific, not of a significant extent relative to the area of the freshwater ecosystems assessed, and therefore have a limited spatial extent (i.e. within the investigation areas);
- The artificial systems identified are not deemed to be natural freshwater ecosystems and hence none of these systems were further discussed or assessed;
- While the operational phase of the proposed development will be a permanent activity, the construction thereof is envisioned to take no more than a couple of years. However, the frequency of the construction phase impacts may, however, be daily during this time;
- Most impacts are considered to be easily detectable and mitigation measures thereof are considered to be easily practicable; and
- The considered control measures are easily practicable.

The results of the risk assessment are summarised in Table 5 that follows, including key mitigation measures for each activity that must be implemented to reduce the impacts of the proposed development.

Table 5: Summary of the results of the DWS Risk Assessment applied considering the significance of the proposed development.

Activity	Impact	Potentially affected watercourses		Significance (max = 100)	Risk Rating	Confidence level	Mitigation Measures
		Name/s	PES				
CONSTRUCTION PHASE							
Site access clearing and preparation for civil works. (Vegetation Clearing)	Disturbances of soils leading to increased alien vegetation proliferation, and in turn to altered freshwater ecosystem habitat;	Hillslope Seep	E	**9,6**	**L**	High	•Clearing of indigenous vegetation within the study area should be kept to a minimum and only within areas under active construction; • All cleared vegetation must be disposed of at a licensed refuse facility and may not be mulched or burned on site; • No stockpiling, equipment storage or construction laydown areas may be planned within 15 metres of the freshwater ecosystem(s); • Dust suppression measures must be implemented throughout construction to prevent excessive dust which may smother freshwater ecosystem(s) and alter water quality; • All vehicles must remain at least 15 metres from the delineated extent of the freshwater ecosystem(s), unless required as part of a specific construction activity and then only for a short period of time; and • Any AIPs within the study area should ideally be removed prior to soil stripping to reduce seed loads within the topsoil. This will assist in reducing the long-term AIP management requirements.
		Channelled Valley Bottom Wetlands (1-4)	C/D	**19,2**	**L**	High	
	Dust generation from exposed soils potentially leading to the smothering of the watercourses and altering surface water quality.	Hillslope Seep	E	**6,4**	**L**	High	
		Naroo River Floodplain Wetland	C	**4,8**	**L**	High	
		Channelled Valley Bottom Wetlands (1-4)	C/D	**19,2**	**L**	High	
	Increased runoff and erosion leading to sedimentation and potential hydrocarbon contamination of the freshwater ecosystems	Hillslope Seep	E	**12,8**	**L**	High	
		Naroo River Floodplain Wetland	C	**6,4**	**L**	High	
		Channelled Valley Bottom Wetlands (1-4)	C/D	**25,6**	**L**	High	
Construction building activities (hardened structures) within the applicable Zones of Regulation.	Earthworks involving excavations, removal of topsoil and creation of stocklpiles: Altered Hydrology, Geomorphology as well as potential sedimentation and	Hillslope Seep	E	**16**	**L**	High	• Excavated materials may not be contaminated, and the stockpiles may not exceed 2 metres in height; • Topsoil should be stockpiled separately from deeper soil layers to ensure that topsoil gets backfilled last which will facilitate growth of new vegetation; • All exposed soils must be protected for the duration of the construction phase with a suitable geotextile (e.g. hessian sheeting) to prevent potential sedimentation into the freshwater ecosystem(s);
		Naroo River Floodplain Wetland	C	**4,8**	**L**	High	

Activity	Impact	Potentially affected watercourses		Significance (max = 100)	Risk Rating	Confidence level	Mitigation Measures
		Name/s	PES				
	altered water quality of the surface water features.	Channelled Valley Bottom Wetlands (1-4)	C/D	**25,6**	**L**	High	• Adequate sediment/erosion protection measures such as silt traps and silt fences is to be installed downstream of all construction works to further reduce the potential impacts on freshwater ecosystem(s). • The delineated extent of the freshwater ecosystems outside the construction footprint areas are to be strictly treated as a no-go areas and demarcated as such. • The construction works are to be audited for compliance by a suitably qualified Environmental Control Officer (ECO) in accordance with an approved Environmental Management Plan (EMP) which is to be approved by the Competent Authority.  **Figure A:** Schematic drawing of a coffer dam, sediment trap and channel diversion recommended to be implemented around the construction area associated with activities within or in close proximity to the freshwater ecosystems. These structures are specifically to be utilised when trenching through the freshwater ecosystems for the installation of bulk civil infrastructure, to ensure continued free movement of water downstream within these systems.

Activity	Impact	Potentially affected watercourses		Significance (max = 100)	Risk Rating	Confidence level	Mitigation Measures
		Name/s	PES				  **Figure B**: Examples of silt traps to be used during the construction phase, to limit additional sediment from entering the downstream reaches of the freshwater ecosystem(s).
	Concrete works pertaining to construction of residential, industrial, commercial, and/or educational facilities: Possible contamination of soil and surface water as a result of concrete works and runoff from the construction site, leading to a reduced ability to support biodiversity.	Hillslope Seep	E	**16**	**L**	High	• Concrete and cement-related mortars can be toxic to aquatic life due to the high alkalinity associated with cement which can contaminate both soil, surface and groundwater. <u>The following recommendations must be adhered to</u>: • Proper handling and disposal should minimise or eliminate discharges into the freshwater ecosystem(s); • Fresh concrete and cement mortar may only be mixed within the authorized construction footprint (limited to the study area). Mixing of cement may be done within the construction camp, may not be mixed on bare soil, and must be within a lined, bound or bunded portable mixer. Consideration must be given to the use of ready mix concrete;
		Naroo River Floodplain Wetland	C	**4,8**	**L**	High	
		Channelled Valley Bottom Wetlands (1-4)	C/D	**24**	**L**	High	

Activity	Impact	Potentially affected watercourses		Significance (max = 100)	Risk Rating	Confidence level	Mitigation Measures
		Name/s	PES				• No mixed concrete shall be deposited directly onto the ground. A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing; • Cement bags must be disposed of in the demarcated hazardous waste receptacles and the used bags must be suitably disposed of; • Spilled or excess concrete must be disposed of at a suitable registered landfill site. • It is highly recommended that construction activities are limited to the dry summer months to avoid potential wet concrete runoff directly into the freshwater ecosystem(s); • It is highly recommended that excavation activities occur during the dry summer months as far as feasibly possible to limit erosion, sedimentation, freshwater contamination/collection and thereby flow manipulation and the potential for the slumping of the trench walls on site. Trench walls must be stabilised if necessary.
Excavations & trenching associated with the construction/installation of the civil services infrastructure including bulk potable water pipelines and electrical cabling together with stormwater management infrastructure.	Involving excavations and trenching causing vegetation removal and disturbance of soils leading to altered runoff patterns, increased erosion and sedimentation of the freshwater ecosystems with subsequent impacts to biota.	Hillslope Seep	E	**9,6**	L	High	• It is highly recommended that excavation activities occur during the dry summer months as far as feasibly possible to limit erosion, sedimentation, freshwater contamination/collection and thereby flow manipulation and the potential for the slumping of the trench walls on site. Trench walls must be stabilised if necessary; • Excavated soil to be stockpiled to a height no greater than 2 metres to minimize dust generation and be deposited on the upgradient side of the trench as far as possible as a failsafe to catch sedimentation should it become mobilized to avoid deposition into downgradient freshwater ecosystems; • Excavated materials to be safeguarded from all forms of contamination; • Topsoil to be stored separately from deeper soil and all soil protected from weathering and wind transport by covering with a suitable geotextile such as hessian sheeting and stockpiling period to be minimized to effect backfilling;
		Naroo River Floodplain Wetland	C	**4,8**	L	High	
		Channelled Valley Bottom Wetlands (2,3,4)	C/D	**24**	L	High	

Activity	Impact	Potentially affected watercourses		Significance (max = 100)	Risk Rating	Confidence level	Mitigation Measures
		Name/s	PES				
Excavation and trenching associated with the installation of the proposed bulk 200mm potable water pipeline and the proposed 300A, 3P, 11kV underground electrical cable through the freshwater ecosystems via conventional trenching methods.	Involving excavations and trenching causing vegetation removal and disturbance of soils leading to altered runoff patterns, increased erosion and sedimentation of the freshwater ecosystems with subsequent impacts to biota.	Channelled Valley Bottom Wetlands (2,3,4)	C/D	**28,8**	L	High	• Excess soil and waste generated through the construction process must be disposed of at an appropriate and registered waste disposal facility; • The duration of impacts within the freshwater ecosystems should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. Therefore, the construction period should be kept as short as possible; • Protect exposed soils and stockpiles from wind, and limit the time in which soils are exposed, by covering with a suitable geotextile such as hessian sheeting; and • All excavated trenches must be compacted to natural soil compaction levels to prevent the formation of preferential surface flow paths and subsequent erosion. Conversely, areas compacted as a result of construction activities.
Installation of the proposed bulk 200mm potable water pipeline and the proposed 300A, 3P, 11kV underground electrical cable underneath the freshwater ecosystems via directional drilling methods.	Involving minor vegetation removal and disturbance of soils leading to potential altered runoff patterns, increased erosion and sedimentation of the freshwater ecosystems with subsequent impacts to biota.	Channelled Valley Bottom Wetlands (2,3,4)	C/D	**22,4**	L	High	
Backfilling of trenches associated with proposed scope of works (Civil Infrastructure).	Backfilling of trenches: Potential Incorrect order of backfilling such that topsoil and associated seedbanks are deposited too deep to germinate; and Backfilling with foreign soil material which could introduce invasive vegetation.	Hillslope Seep	E	**8**	L	High	• Backfilling to take place as soon as construction activities have been completed, ensuring that topsoil is backfilled last according to the last-out-first-in backfilling principle; • Soil must be appropriately compacted according to the natural soil characteristics of the area to preserve future surface and subsurface drainage through the previously trenched areas – this will require supervision by a suitably competent individual; and • The topsoil must be ripped for reestablishment of vegetation. However, to account for subsidence of the soil level over time, allowance for a slightly higher soil level within backfilled trench (depending on the soil type) may be made. Therefore, monitoring post construction activities is required.
		Channelled Valley Bottom Wetlands (2,3,4)	C/D	**16**	L	High	
OPERATIONAL PHASE							
Operation of the proposed development inclusive of additional traffic loads on internal road network. .	Potential leakage of toxicants (hydrocarbons) into the freshwater ecosystems leading to contamination and subsequent impacts to water quality and biota, either through general	Hillslope Seep	E	**4,8**	L	High	• An Operational Maintenance Management Plan (OMMP) which includes all mitigation/management measures as contained in the Risk Assessment Matrix (RAM) is to be compiled as part of the legally binding Environmental Management Plan (EMPr) or the mitigation/management measures should be added to the existing OMMP; • The OMMP is to specifically refer to operational maintenance requirements for all civil service infrastructure, including timelines as per
		Naroo River Floodplain Wetland	E	**3,6**	L	High	
		Channelled Valley Bottom Wetlands (1-4)	C/D	**10,4**	L	High	

Activity	Impact	Potentially affected watercourses		Significance (max = 100)	Risk Rating	Confidence level	Mitigation Measures
		Name/s	PES				
	operation or failure of bulk service infrastructure.						the relevant civil engineer's recommendations and/or operational service manual. This operational maintenance is also to include visual and physical inspection of the service infrastructure for any defect and/or leaks and must include replacement is deemed necessary for adequate operation; • The OMMP is to be audited for compliance by a suitably qualified Environmental Control Officer (ECO) at intervals stipulated by the competent authority, for the operational maintenance of all infrastructure proposed. <u>Additional control/mitigation measures applicable during the operational phase and to be included in the OMMP</u>: • No vehicles are permitted to enter the freshwater ecosystems. Any maintenance works must be undertaken by foot or the relevant authorisations obtained beforehand; • Stormwater management must not adversely affect downgradient freshwater ecosystems. Accordingly, the SWMP for the proposed development must ensure that stormwater drainage inputs to the freshwater ecosystems mimic the baseline as far as feasibly possible; • In order to achieve this, it is strongly recommended that the principles of Sustainable Urban Drainage Systems (SUDS) be implemented into stormwater design and attenuation facilities associated with the proposed development, in order to be able to effectively filter and polish the stormwater runoff; • Polishing of stormwater by trapping sediments and by removing pollutants that could contaminate downgradient freshwater ecosystems, and in order to allow for the attenuated release of stormwater into the catchments of the downgradient freshwater ecosystems following rainfall events; • As such the use of 'soft' engineering features such as riprap, vegetated with suitable indigenous vegetation that is tolerant of both wet and dry conditions is strongly recommended; • The use of stone pitching to reduce velocity of stormwater is strongly recommended; • Stormwater infrastructure must be regularly inspected for litter, debris and excess sediment must be regularly flushed;
Operational Maintenance associated with the development proposal including the operational maintenance of civil infrastructure. This includes future maintenance activities which can also include a like-for-like replacement of civil infrastructure should it be required.	Disturbances of soils leading to increased alien vegetation proliferation, and in turn to altered freshwater ecosystem habitat. Altered hydrology, geomorphology as well as potential sedimentation and altered water quality of the surface water features. Potential leakage of proposed bulk sewer pipelines and discharge into the freshwater ecosystems leading to contamination and subsequent impacts to water quality and biota.	Hillslope Seep	E	**4,8**	**L**	High	
		Naroo River Floodplain Wetland	C	**4,8**	**L**	High	
		Channelled Valley Bottom Wetlands (1-4)	C/D	**19,2**	**L**	High	
Discharge of stormwater from the proposed development into the freshwater ecosystems.	Increased sediment loads entering the freshwater ecosystems; and possible incision and alteration of the hydroperiod.	Hillslope Seep	E	**16**	**L**	High	
	Potential eutrophication of water as a result of enriched water draining into the freshwater ecosystems; and proliferation of AIP plants within the stormwater system, which could lead to dispersal of AIP seeds.	Hillslope Seep	E	**9,6**	**L**	High	
Potential failing of internal & bulk civil infrastructure pipelines resulting in discharge into the freshwater ecosystems.	Potential leakage of proposed bulk sewer pipelines and discharge into the freshwater ecosystems leading to contamination and subsequent	Hillslope Seep	E	**4**	**L**	High	
		Naroo River Floodplain Wetland	C	**6,4**	**L**	High	

Activity	Impact	Potentially affected watercourses		Significance (max = 100)	Risk Rating	Confidence level	Mitigation Measures
		Name/s	PES				
	impacts to water quality and biota.	Channelled Valley Bottom Wetlands (1-4)	C/D	**6,4**	L	High	• The design of the stormwater infrastructure must incorporate energy dissipating structures to prevent erosion and incision downstream towards the freshwater ecosystems; • It is recommended that the integrity of civil infrastructure be tested at least once every five years or more often should there be any sign of a fault or leak; • It must be ensured that the hydrological regime and water quality of the freshwater ecosystem(s) is not impacted as a result of failure or leakage of bulk infrastructure, and that an emergency response plan must be compiled to ensure a quick response and attendance to the matter in case of failure or leakage; • Should repair of bulk infrastructure be required, control measures as defined above for the construction phase, especially pertaining to excavations and trenching is to be implemented depending upon the location of the required repairs; • Regular inspection of the stormwater infrastructure must be undertaken (specifically after large storm events) in order to monitor the occurrence of erosion. If erosion has occurred, it must immediately be rehabilitated through stabilisation of the embankments and revegetation; • The stormwater channels, inlets and outlets must be regularly cleaned to ensure there no debris buildup/blockages occur; • It is recommended that the integrity of all proposed civil service pipelines be tested at least once every five years or more often should there be any sign of a leak; • It is considered imperative that all works be undertaken during the drier summer months to limit surface water contamination and the need for any surface water diversion during the construction works (diverting the flow of water through a pipe or an excavated channel was not included as part of this risk assessment); • A suitable Alien Invasive Management Plan (AIMP) must be developed, implemented and managed by the property managers or Homeowner Association (HOA) for all open space areas, to ensure that AIPs do not become established within the areas. This AIMP is to include adequate control/management of AIPs which might proliferate as a result of the potential eutrophication of the freshwater ecosystems as a result of contaminated stormwater runoff.

RISK ASSESSMENT DISCUSSION

The risk assessment determined ***Low Risk Significance*** for anticipated impacts during the construction and operational phases of the proposed development.

Assuming that strict enforcement of cogent, well-developed control/mitigation measures takes place, as per **Addendum C**), the significance of impacts arising from the proposed development can be adequately managed. Furthermore, with potential rehabilitation/landscaping and long-term management of alien and invasive plant species, the overall PES of the freshwater ecosystems is unlikely to be negatively impacted by the proposed development.

IMPACT ASSESSMENT

The section presents the outcome of a pre-defined impact assessment undertaken as part of the NEMA EIA regulations, 2014 (as amended) process. Table 7 to Table 9 below present a summary of the expected impacts (direct and indirect) as part of the construction and operational phases and includes the impact assessment summary for the 'no-go' impacts and cumulative impacts. The impact assessment methodology is provided in **Addendum B**.

The colour scheme presented in Table 6 (below) was used to clarify the hierarchy of severity for the various activities and aspects relating to the proposed development. The more severe (orange to red) coloured cells were used to focus the overall consideration of risk and to focus the development of mitigatory recommendations to ensure that opportunities are presented to reduce the impacts as far as possible.

Table 6: Colour scale used to qualify the hierarchy of severity for the various activities and aspects relating to each proposed impact.

Very Low	Low	Medium Low	Medium High	High	Very High

A description of the phases presented in the impact assessment is as follows:

- **Construction phase:** This phase relates to activities associated with site preparation prior to construction works and groundbreaking activities during construction works associated with the installation of service and building infrastructure. The focus of this phase is on the disturbances of soil during construction and alteration of the natural geomorphological and hydrological regime, as well as water quality;

- **Operational Phase:** This phase relates to the operation and future maintenance of the service infrastructure. Potential impacts associated with this phase are on the hydrology, geomorphology and water quality on downstream freshwater ecosystems as well as potential failure of infrastructure; and

- **Rehabilitation/Landscaping Phase:** This phase relates to the rehabilitation of the disturbed areas following construction activities, with will include rehabilitation of the wetland areas. While the long-term impacts of this phase are considered to be low/negligible, the active works thereof may result in disturbances to soil resulting in compaction and erosion, and water quality impacts downstream within the watercourses.

<u>IMPACT 1</u>: MODIFICATION OF THE FRESHWATER ECOSYSTEM HYDROLOGICAL FUNCTIONING AND WATER QUALITY.

The increased impermeable surfaces due to the presence of hardened surfaces as a result of the proposed development, will result in an increased catchment yield and altered flow regime, leading to changed hydrological zonation. Table 7 below summarises the activities and potential impacts during the construction, operational and rehabilitation/Landscaping phases.

Table 7: Activities register leading to impact on hydrology and water quality.

Construction phase	Operational phase	Rehabilitation/Landscaping Phase
Site preparation prior to construction activities, involving vehicular movement (transportation of construction materials) and associated disturbances to soil.	Discharge of stormwater from the proposed development into the freshwater ecosystems.	Vehicular access to site and associated disturbances to soil.
Removal of topsoil and creation of topsoil stockpiles, and increased likelihood of dust generation due to exposed soil.	Potential fertilizers and hydrocarbons from hardened surfaces entering the freshwater ecosystems through stormwater run-off.	Alien and invasive plant removal which may impact on water quality as a result of the application of herbicides.
Movement of construction equipment and personnel within close proximity to the freshwater ecosystems.	Operational maintenance of the service infrastructure, which can include vegetation removal, excavations and installation of new service infrastructure.	
Earth works involving removal of topsoil and creation of soil stockpiles for the construction of activities related to building activities within 32 m from the delineated extent of the freshwater ecosystems.		
Groundbreaking including excavation and stockpiling of soil for the construction activities.		
Groundbreaking: installation of service infrastructure within the 32 m NEMA ZoR.		
Mixing and casting of concrete associated with the building infrastructure within the 32 m NEMA ZoR of the freshwater ecosystems.		

IMPACT 2: CHANGES TO THE GEOMORPHOLOGICAL PROCESSES (SEDIMENT BALANCE, EROSION AND SEDIMENTATION).

The activities associated with the proposed development will result in the disturbance of geomorphological processes of the freshwater ecosystems through the removal of vegetation and excavations associated with the installation of the service infrastructure as well as operational buildings, resulting in altered runoff patterns and increased erosion and sedimentation within the freshwater ecosystems. Table 8 below summarises the activities and potential impacts during the construction, operational and rehabilitation phases.

Table 8: Activities register leading to changes to the geomorphological processes and sedimentation.

Construction phase	Operational phase	Rehabilitation/Landscaping Phase
Site preparation prior to construction activities, involving vehicular movement (transportation of construction materials) and associated disturbances to soil.	Potential indiscriminate movement of vehicles in close proximity to the freshwater ecosystems for inspections/ maintenance.	Site preparation including removal of alien invasive vegetation (manual labour) and subsequent preparation of soil for rehabilitation/landscaping activities.
Earth works involving excavation, trenching and the creation of soil stockpiles for the construction/installation of service and building infrastructure within the 32 m NEMA ZoR of the freshwater ecosystems.	Operational maintenance of the service infrastructure, which can include vegetation removal, excavations and installation of new service infrastructure.	Possible disturbance and compaction of soil during removal of AIP's and soil preparation.
		Potential for soil compaction and trampling due to introduction of machinery and manual labour into the delineated boundaries of the freshwater ecosystems.

IMPACT 3: ALTERED FRESHWATER HABITAT AND IMPACTS ON BIOTA

Disturbances of soil and removal of vegetation during site preparation, and the construction and rehabilitation/landscaping phases of the proposed development may result in increased alien vegetation proliferation, and in turn to altered vegetation habitat. Concrete and cement-related mortars can be toxic to aquatic life, thus concrete works and runoff from the construction site (if unmitigated) may lead to a reduced ability of the freshwater features to support biodiversity. Table 9 below summarises the activities and potential impacts during the construction, operational and rehabilitation/landscaping phases.

Table 9: Activities register leading to changes in freshwater habitat and impacts to biota.

Construction phase	Operational phase	Rehabilitation Phase
Site preparation prior to construction activities, involving vehicular movement (transportation of construction materials) and associated disturbances to soil.	Operation of the proposed development and associated service infrastructure.	Alien and invasive plant removal and rehabilitation/landscaping of the disturbed areas.
Removal of topsoil and creation of topsoil stockpiles.	Anthropogenic disturbance including noise and physical degradation of aquatic habitat reducing available feeding, drinking, breeding and migratory habitat for biota.	Potential harm to biota (such as those occupying burrows/soil profile).
Earth works involving excavation, trenching and the creation of soil stockpiles for the construction of service and building infrastructure within the 32 m NEMA ZoR of the freshwater ecosystems.	Potential fertilizers and hydrocarbons entering the freshwater ecosystems through stormwater run-off.	
Mixing and casting of concrete associated with the building infrastructure within the 32 m NEMA ZoR of the freshwater ecosystems.	Operational maintenance of the service infrastructure, which can include vegetation removal, excavations and installation of new service infrastructure.	

A summary of the outcome of the impact assessment is provided in the Table 10 overleaf. All mitigation measures as stipulated in the Risk Assessment Matrix and **Addendum C** are deemed applicable for the post-mitigation scoring.

Table 10: Summary scores rated for unmitigated and mitigated phases.

UNMANAGED								MANAGED							
Probability of Impact	Sensitivity of receiving	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
CONSTRUCTION PHASE: SITE PREPARATION AND CONSTRUCTION OF SERVICE AND BUILDING INFRASTRUCTURE WITHIN THE 32 M NEMA ZOR OF THE FRESHWATER ECOSYSTEMS WITHIN THE STUDY AREA.															
Impact on Hydrological Function and Water Quality															
4	3	2	2	2	7	6	42 Low	4	3	1	2	2	7	5	35 Low
Impact to Geomorphological Processes (Sediment Balance, Erosion and Sedimentation)															
4	3	4	2	2	7	8	56 Medium-Low	4	3	2	2	2	7	6	42 Low
Altered Freshwater Habitat and Impacts to Biota															
4	3	4	2	2	7	8	56 Medium-Low	4	3	3	2	2	7	7	49 Low
OPERATIONAL PHASE: OPERATION AND ACTIVE MAINTENANCE OF THE PROPOSED DEVELOPMENT															
Impact on Hydrological Function and Water Quality															
2	3	1	2	4	5	7	35 Low	1	3	1	2	4	4	7	28 Low
Impact to Geomorphological Processes (Sediment Balance, Erosion and Sedimentation)															
2	3	1	2	4	5	7	35 Low	1	3	1	2	4	4	7	28 Low
Altered Riparian Habitat and Impacts to Biota															
2	3	1	2	4	5	7	35 Low	1	3	1	2	4	4	7	28 Low
REHABILITATION/LANDSCAPING PHASE: REHABILITATION/LANDSCAPING OF THE DISTURBED AREAS ASSOCIATED WITH THE CONSTRUCTION/INSTALLATION OF THE SERVICE INFRASTRUCTURE AND BUILDINGS															
Impact on Hydrological Function and Water Quality															
3	3	1	2	1	6	4	24 Very Low	1	3	1	2	1	4	4	16 Very Low
Impact to Geomorphological Processes (Sediment Balance, Erosion and Sedimentation)															
3	3	1	2	1	6	4	24 Very Low	1	3	1	2	1	4	4	16 Very Low
Altered Riparian Habitat and Impacts to Biota															
3	3	1	2	1	6	4	24 Very Low	1	3	1	2	1	4	4	16 Very Low

CUMULATIVE IMPACTS

Cumulative impacts arise from activities whose impacts persist long after the activity has ceased due to the self-perpetuating nature of such impacts (e.g. erosion). Cumulative impacts cease with human intervention or when the trajectory of ecosystem imbalance cause by such an impact is complete.

Typical cumulative impacts pertaining to the proposed development comprise:

- disruption of hydrological connectivity in the landscape;
- disruption of the hydrological regime due to catchment hardening and discharge of stormwater
- on-going sedimentation and eventual smothering of wetlands; and
- establishment of alien and invasive species.

Therefore, cumulative impacts are expected but the significance thereof is expected to be diminished considering the largely modified condition of the freshwater ecosystems associated with study area, subject to adequate rehabilitation/landscaping of the disturbed areas.

It is thus highly recommended that a Rehabilitation/Landscaping Plan be compiled by suitably qualified, in order to minimise the impacts of the development proposal on the identified and delineated freshwater ecosystems. This Rehabilitation/Landscaping Plan is to be submitted to the Competent Authority for approval and is to be audited for compliance by a suitably qualified Environmental Control Officer (ECO) for the duration of the proposed rehabilitation/landscaping activities and compliance audit reports should be submitted to the CA at intervals specified by the CA.

CONCLUSION

Based on the desktop assessment undertaken by FEN Consulting (Pty) Ltd and the findings thereof presented in this report, several wetlands were identified within the study and investigation area. The aquatic biodiversity for the study area, following the desktop assessment, is deemed to be Very High which aligns with the DFFE's National Environmental Screening Tool classification.

The DWS risk assessment determined a ***Low Risk Significance*** for anticipated impacts during the construction and operational phases of the proposed development, assuming the strict enforcement of cogent, well-developed control/mitigation measures, as per **Addendum C**).

The pre-defined impact assessment determined that the activities associated with the development proposal (all phases) will have a ***Low – Very Low Impact*** on freshwater ecosystems in terms of hydrology, geomorphology, water quality and biota subject to the recommended mitigation measures being strictly enforced and the disturbance areas within the footprint of the delineated freshwater ecosystems are suitably rehabilitated/landscaped.

Additionally, it is expected that given these recommended mitigation measures are strictly enforced and audited for compliance, that the cumulative impact of the development proposal would not be significant from a water resource management perspective.

Based on the findings contained in this Specialist Technical Opinion Memorandum, there is no reason from a freshwater ecosystem management perspective why the proposed development and associated bulk service infrastructure (with the implementation of the recommended mitigation measures as well as rehabilitation/landscaping of the impacted areas) should not be authorised.

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ADDENDUM A: RISK ASSESSMENT METHODOLOGY

For the proponent to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- **Environmental impacts** are the consequences of these impacts on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Intensity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial scale** refers to the geographical scale of the impact; and
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The intensity, spatial scale and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 75. The likelihood of the impact occurring is determined by assigning a likelihood score of between 20% and 100%. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[2].

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

"RISK ASSESSMENT KEY" (Based on DWS 2023 publication: Section 21 c and i water use Risk Assessment Protocol) GN4167 of December 2023 published in Government Gazette 49833 of 8 December 2023) (p208).

[2] Some risks/impacts that have low significance will however still require mitigation

Table B1: Intensity (What is the intensity of the impact on the resource quality - hydrology, water quality, geomorphology, biota?)

Negative impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large deterioration in PES (by one class or more)	+4
Very high / critically harmful; critical deterioration in PES (to E/F or F class)	+5
Positive impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection status	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5

*PES of affected watercourses must be considered when scoring Impact Intensity

Table B2: Spatial Scale (How big is the area that the activity is impacting on, relative to the size of the impacted watercourses).

Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5

Table B3: Duration (How long does the aspect impact on the resource quality).

Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5

Table B4: Likelihood of impact (What is the probability that the activity will impact on the resource quality).

Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

Table B5: Rating Classes.

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 29	(L) Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA

Table B6: Calculations.

Intensity = Maximum Intensity Score (negative value for positive impact)	MAX = 5
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 15 (MIN = -15 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 75
Significance\Risk = (Consequence X Likelihood) X (100/75)	MAX = 100

ADDENDUM B: IMPACT ASSESSMENT METHODOLOGY

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/ impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/ impacts have been assessed. The method to be used for assessing risks/ impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. Direct, indirect and cumulative impacts of the issues identified through the study, as well as all other issues identified in the EIA phase must be assessed in terms of the following criteria:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - medium-term (5–15 years) – assigned a score of 3;
  - long term (> 15 years) - assigned a score of 4; or
  - permanent - assigned a score of 5;
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  - 0 is small and will have no effect on the environment
  - 2 is minor and will not result in an impact on processes
  - 4 is low and will cause a slight impact on processes
  - 6 is moderate and will result in processes continuing but in a modified way
  - 8 is high (processes are altered to the extent that they temporarily cease)
  - 10 is very high and results in complete destruction of patterns and permanent cessation of processes
- The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the **status**, which will be described as either positive, negative or neutral.
- the degree to which the impact can be reversed.
- the degree to which the impact may cause irreplaceable loss of resources.
- the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

S= (E+D+M) x P

S = Significance weighting

E = Extent

D = Duration

M =Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
  > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Assessment of Cumulative Impacts

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[3].

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section should address whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment or sense of place
- Unacceptable increase in impact

The specialist is required to conclude if the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area.

[3] Unless otherwise stated, all definitions are from the 2014 EIA Regulations, GNR 982

ADDENDUM C: MITIGATION MEASURES TO BE IMPLEMENTED

The following mitigation measures are required to reduce the potential freshwater ecosystem impacts to low:

Site Clearing / Vegetation Removal:

- Clearing of indigenous vegetation within the study area must be kept to a minimum and only within areas under active construction and within the approved activity footprint;
- All cleared vegetation must be disposed of at a licensed refuse facility and may not be mulched or burned on site;
- No stockpiling, equipment storage or construction laydown areas may be planned within 10 m of the freshwater ecosystems;
- Dust suppression measures must be implemented throughout construction to prevent excessive dust which may smother the freshwater ecosystems and alter water quality;
- •All vehicles must remain at least 10 m from the delineated extent of the freshwater ecosystems, unless required as part of a specific authorised construction activity for a short period of time;
- •Any AIPs within the study area should ideally be removed prior to soil stripping to reduce seed loads within the topsoil (which will be used to revegetate with indigenous vegetation post construction). This will assist in reducing the long-term AIP management requirements; and
- •No stockpiling, equipment storage or construction laydown areas may be planned within the delineated boundary of the freshwater ecosystems.

Construction Activities:

- Excavated materials may not be contaminated, and the stockpiles may not exceed 2m in height;
- Topsoil should be stockpiled separately from deeper soil layers to ensure that topsoil gets backfilled last which will facilitate growth of new vegetation;
- All exposed soils must be protected for the duration of the construction phase with a suitable geotextile (e.g. hessian sheeting) to prevent potential sedimentation into the freshwater ecosystems;
- Adequate sediment/erosion protection measures such as silt traps or silt fences are to be installed downstream of all construction works to further reduce the potential impacts on freshwater ecosystems;
- The delineated extent of the freshwater ecosystems is to be strictly treated as a no-go area and demarcated as such, except in approved footprint areas; and
- The construction works is to be audited for compliance by a suitably qualified Environmental Control Officer (ECO) in accordance with an approved Environmental Management Plan (EMP) which is to be approved by the Competent Authority.

Concrete Works:

Concrete and cement-related mortars can be toxic to aquatic life due to the high alkalinity associated with cement which can contaminate both soil, surface and groundwater. The following recommendations must be adhered to:

- Proper handling and disposal should minimise or eliminate discharges into the freshwater ecosystems;
- Fresh concrete and cement mortar may only be mixed within the authorized construction footprint (limited to the study area). Mixing of cement may be done within the construction camp, but may not be mixed on bare soil, and must be within a lined, bound or bunded portable mixer. Consideration must be given to the use of ready-mix concrete;

- No mixed concrete shall be deposited directly onto the ground. A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing;
- Cement bags must be disposed of in the demarcated hazardous waste receptacles and the used bags must be suitably disposed of;
- Spilled or excess concrete must be disposed of at a suitable registered landfill site; and
- It is highly recommended that construction activities are limited to the dry summer months to avoid potential wet concrete runoff directly into the freshwater ecosystems.

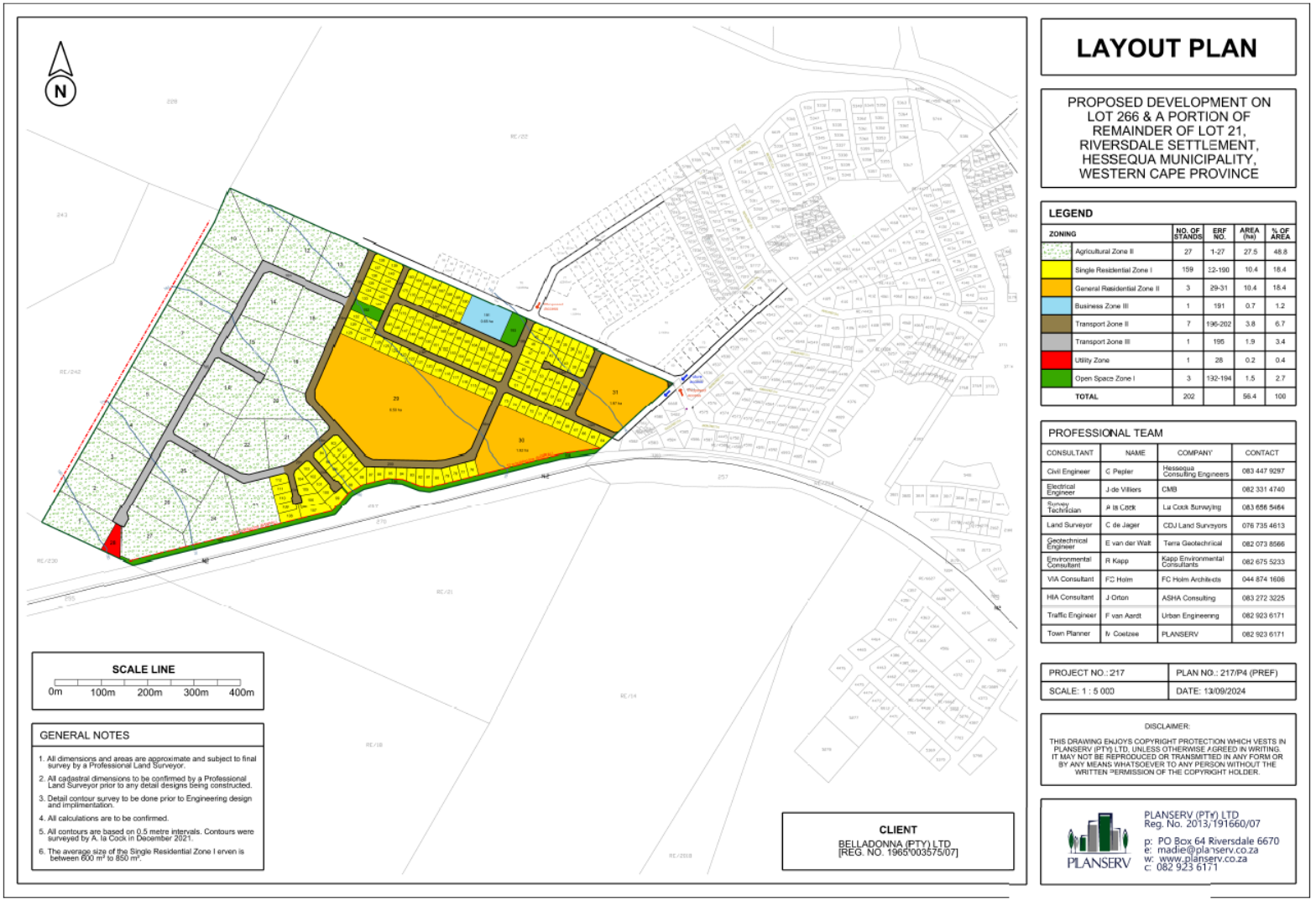
Excavation & Trenching:

- It is highly recommended that excavation activities occur during the dry summer months as far as feasibly possible to limit erosion, sedimentation, freshwater contamination/collection and thereby flow manipulation and the potential for the slumping of the trench walls on site. Trench walls must be stabilised if necessary;
- Excavated soil to be stockpiled to a height no greater than 2m to minimize dust generation and be deposited on the upgradient side of the trench as far as possible as a failsafe to catch sedimentation should it become mobilized to avoid deposition into downgradient freshwater ecosystems;
- Excavated materials to be safeguarded from all forms of contamination;
- Topsoil to be stored separately from deeper soil and all soil protected from weathering and wind transport by covering with a suitable geotextile such as hessian sheeting and stockpiling period to be minimized to effect backfilling;
- Excess soil and waste generated through the construction process must be disposed of at an appropriate and registered waste disposal facility;
- The duration of impacts within the freshwater ecosystems should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. Therefore, the construction period should be kept as short as possible;
- Protect exposed soils and stockpiles from wind, and limit the time in which soils are exposed, by covering with a suitable geotextile such as hessian sheeting; and
- All excavated trenches must be compacted to natural soil compaction levels to prevent the formation of preferential surface flow paths and subsequent erosion. Conversely, areas compacted as a result of construction activities should be adequately loosened to resemble the surrounding uncompacted areas.

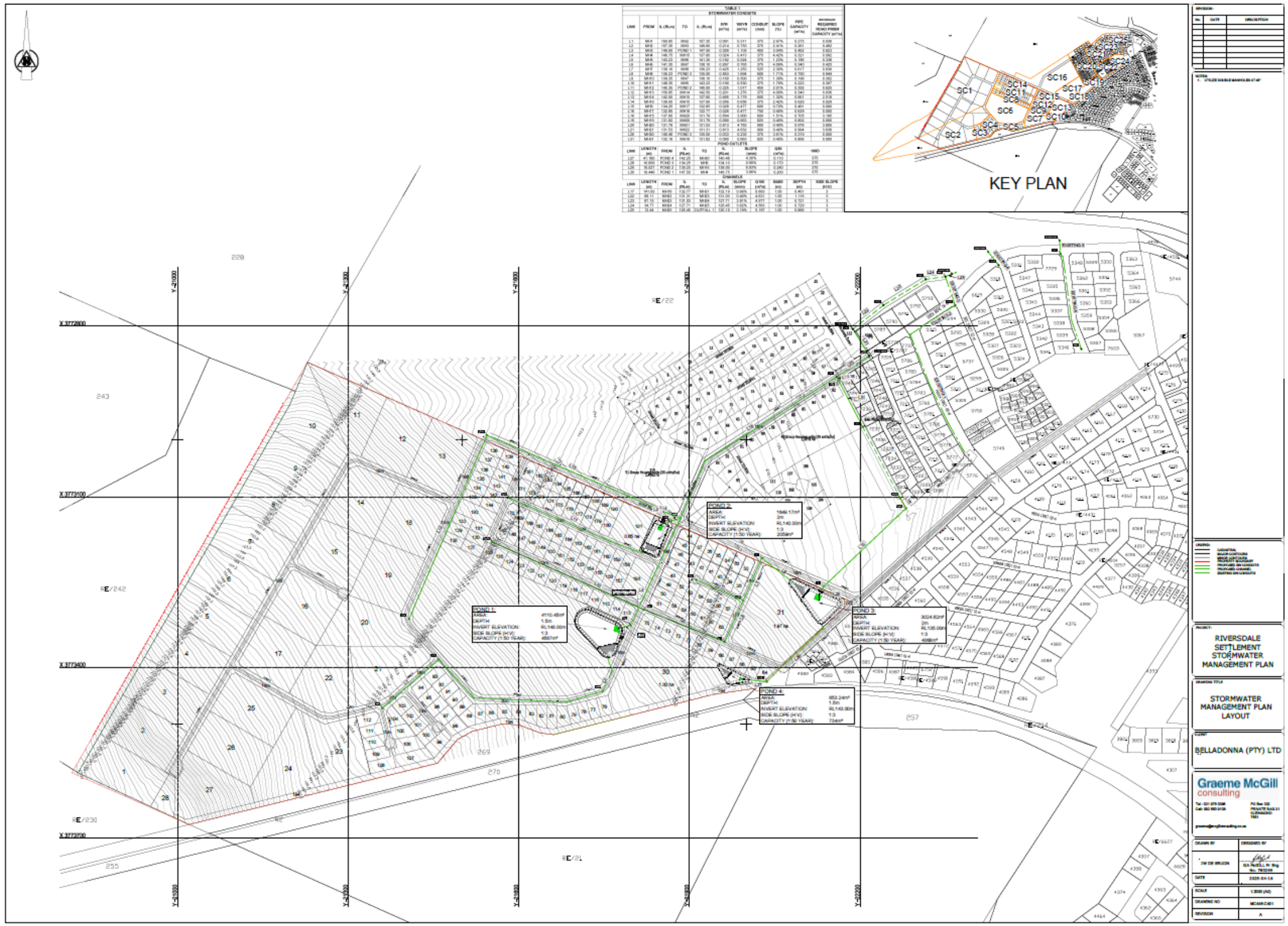
Backfilling of Trenches:

- Backfilling to take place as soon as construction activities have been completed, ensuring that topsoil is backfilled last according to the last-out-first-in backfilling principle;
- Soil must be appropriately compacted according to the natural soil characteristics of the area to preserve future surface and subsurface drainage – this will require supervision by a suitably competent individual; and
- The topsoil must be ripped for reestablishment of vegetation. However, to account for subsidence of the soil level over time, allowance for a slightly higher soil level within backfilled trench (depending on the soil type) may be made. Therefore, monitoring post construction activities is required.

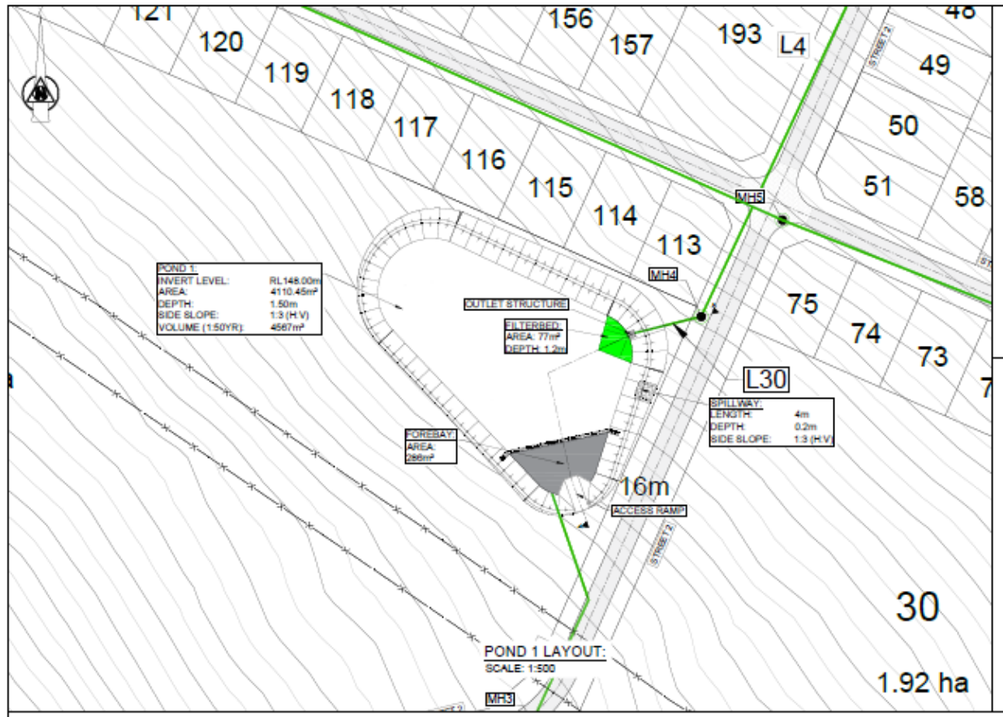
ADDENDUM D: SPATIAL DEVELOPMENT PLAN



ADDENDUM E: STORMWATER MANAGEMENT PLAN LAYOUT



ADDENDUM F: STORMWATER ATTENUATION PONDS DETAIL



POND 1 LAYOUT:
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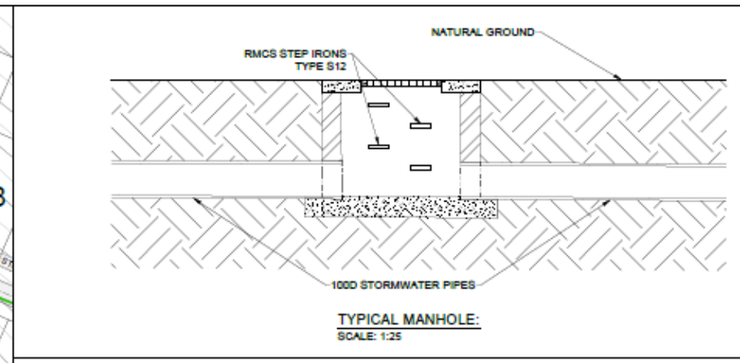

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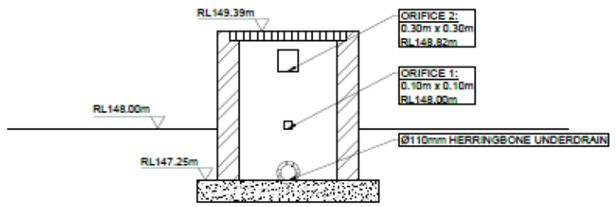

POND 1 OUTLET STRUCTURE:
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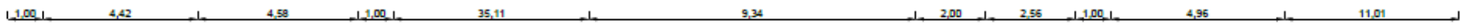

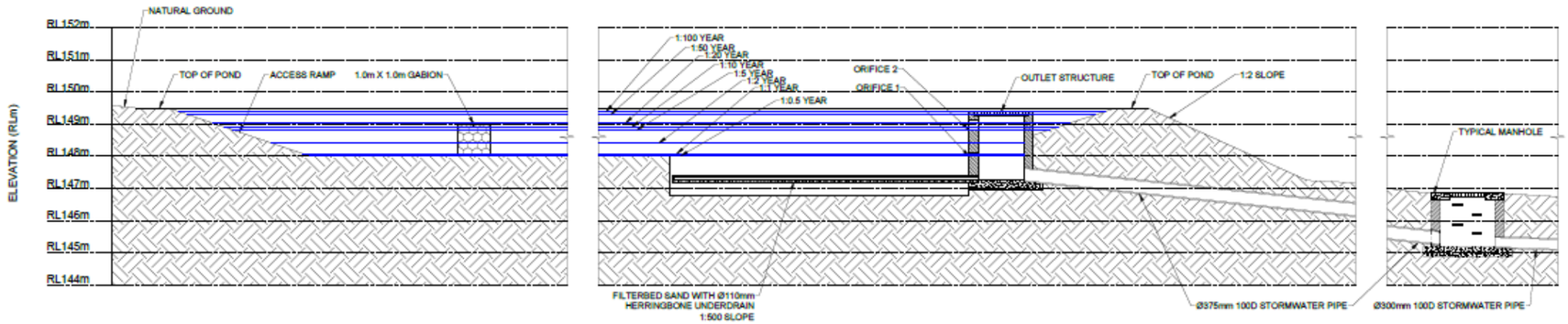

SECTION A-A:
SCALE: 1:50

RIVERSDALE SETTLEMENT STORMWATER MANAGEMENT PLAN

POND 1 INFRASTRUCTURE DETAILS

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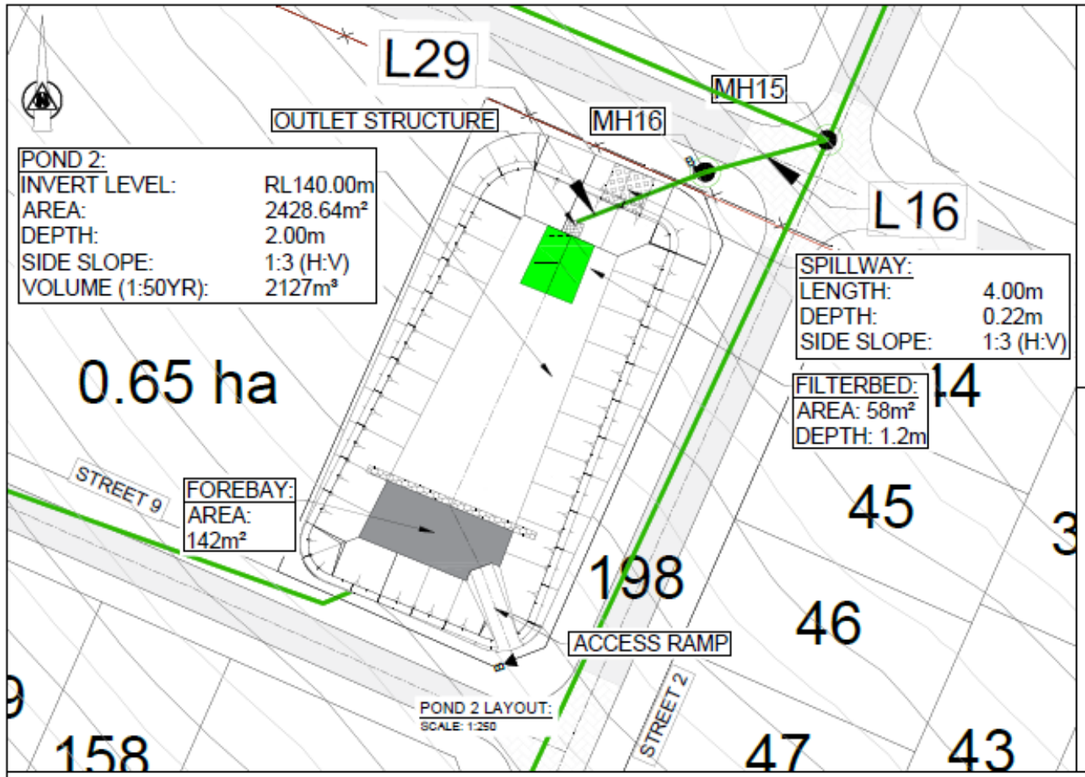

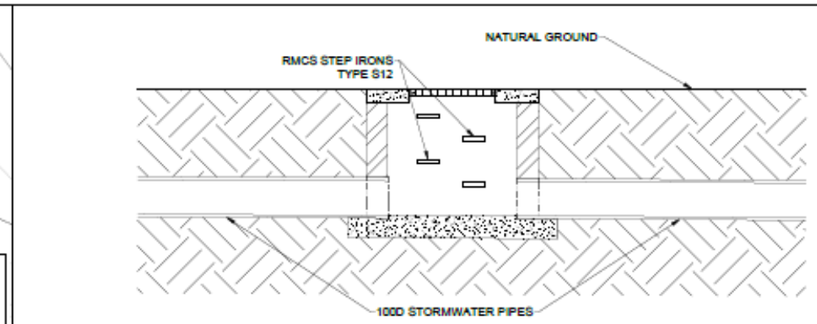

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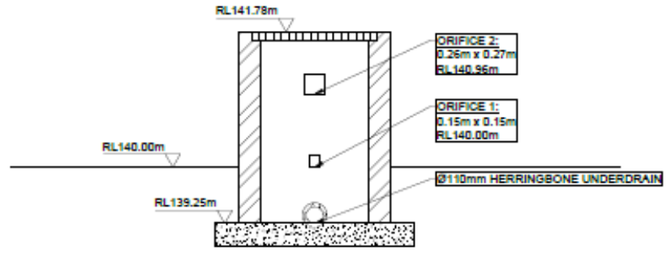

POND 2 OUTLET STRUCTURE:
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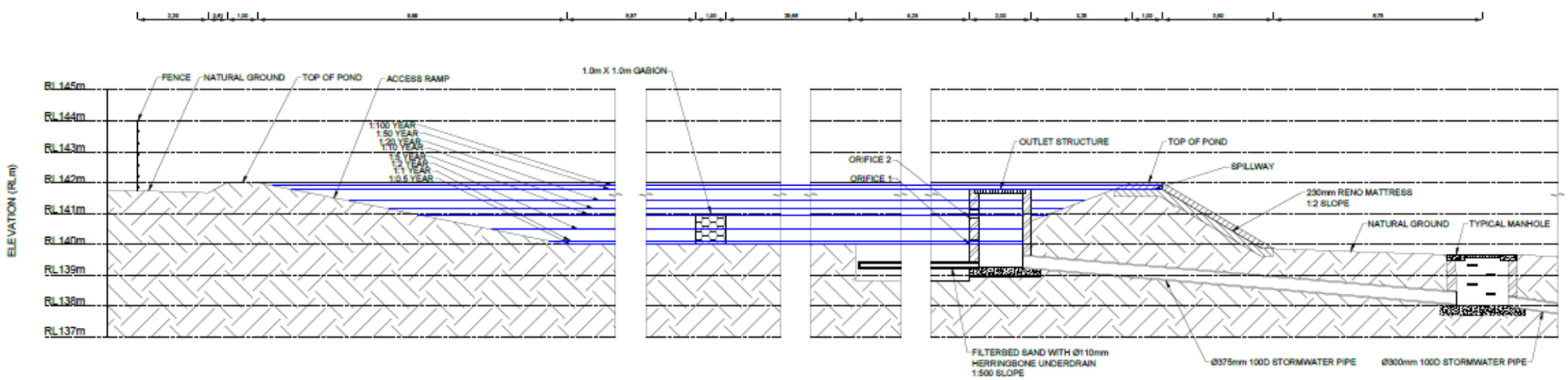


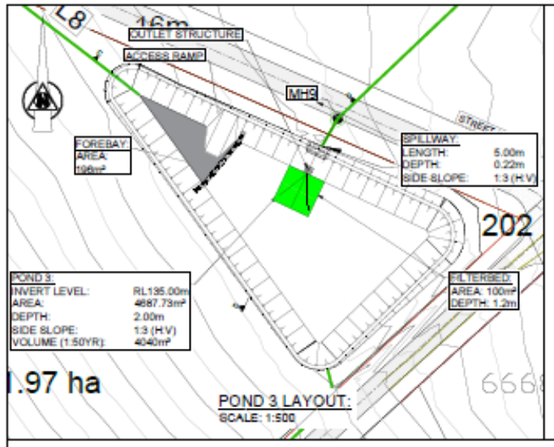
SECTION B-B:
SCALE: 1:50

RIVERSDALE SETTLEMENT STORMWATER MANAGEMENT PLAN

POND 2 INFRASTRUCTURE DETAILS

BELLADONNA (PTY) LTD

Graeme McGill consulting



POND 3 LAYOUT:
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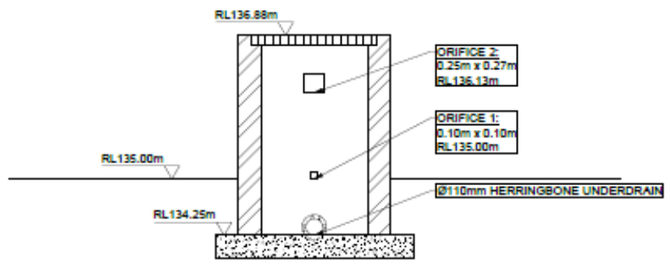

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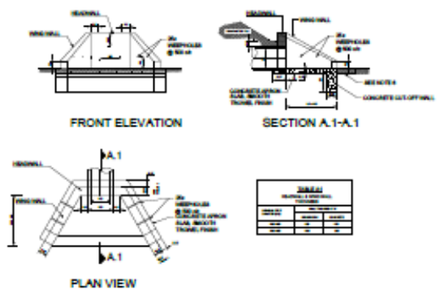

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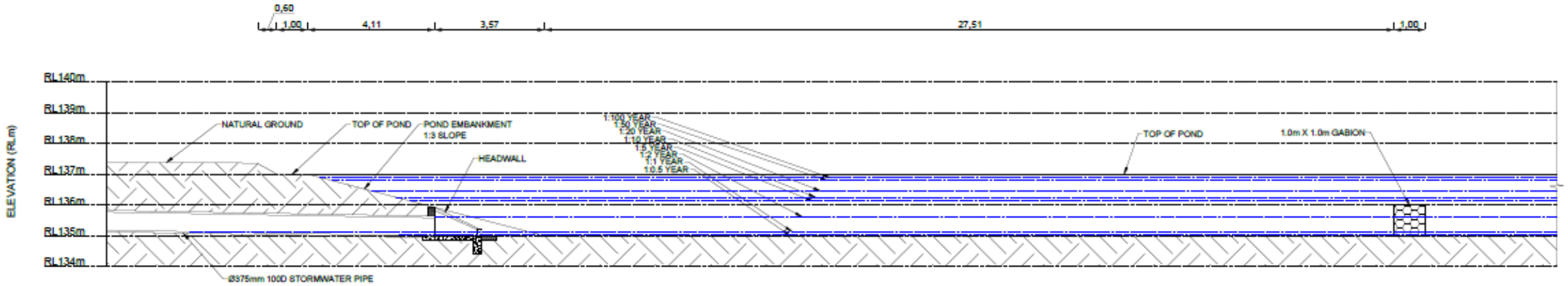

SECTION C-C: POND 3 FOREBAY
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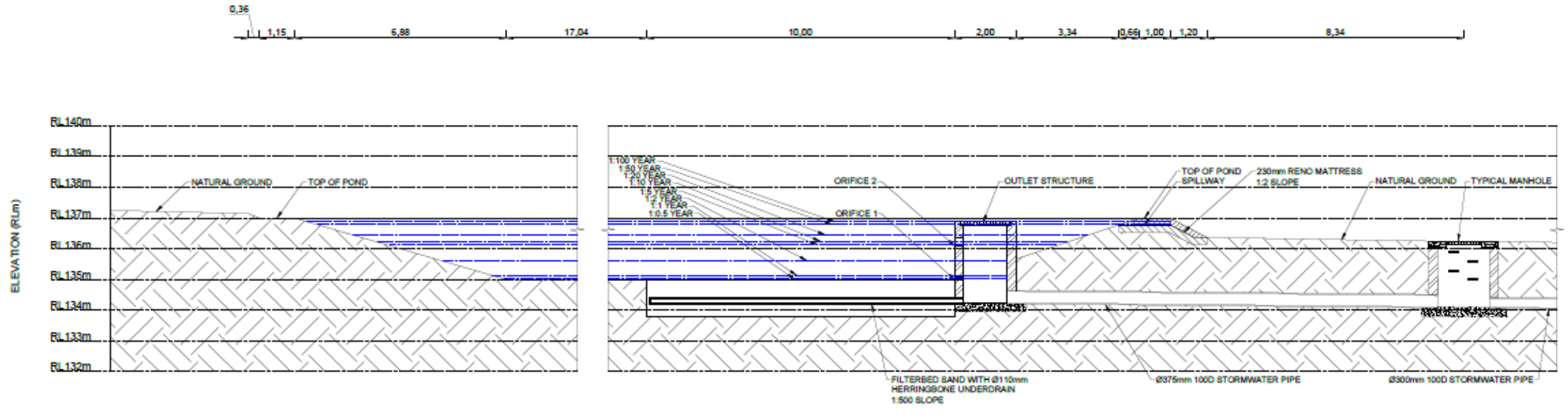


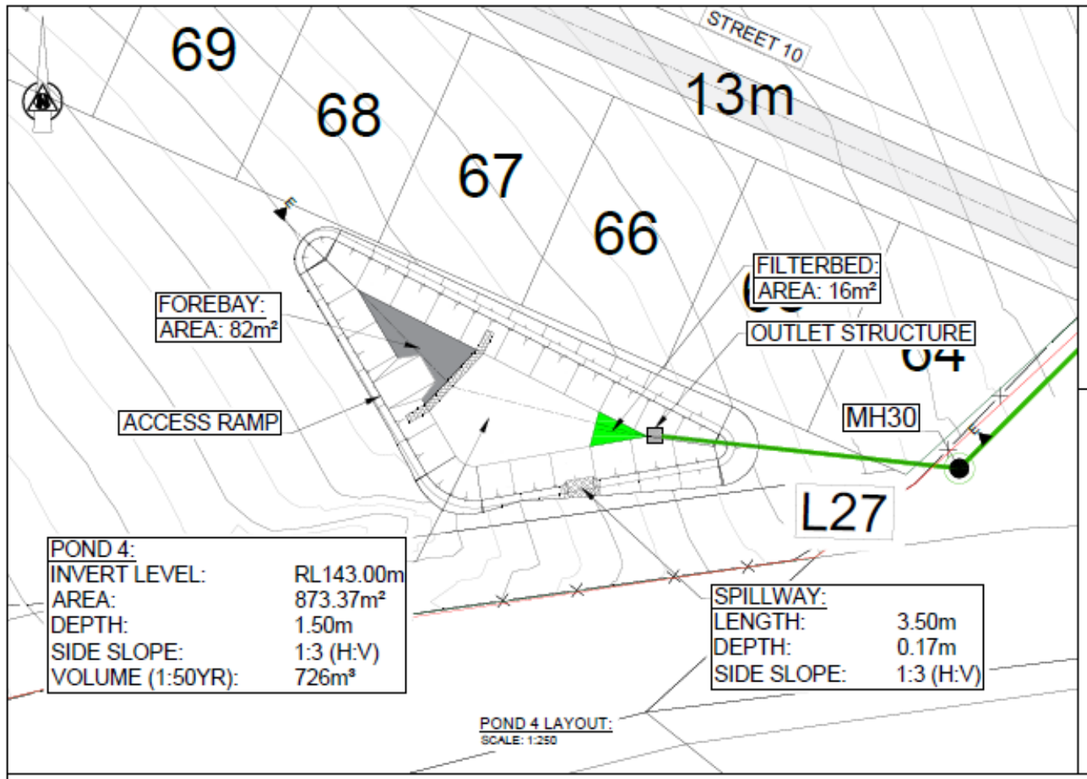
SECTION D-D:POND 3 FILTERBED AND OUTLET CHAMBER
SCALE: 1:50

RIVERSDALE
SETTLEMENT
STORMWATER
MANAGEMENT PLAN

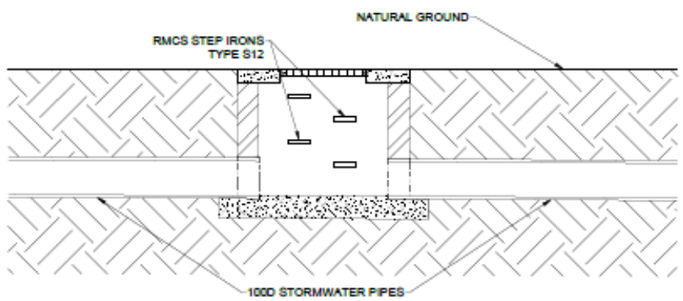
POND 3
INFRASTRUCTURE
DETAILS

BELLADONNA (PTY) LTD

Graeme McGill
consulting



POND 4 LAYOUT:
SCALE: 1:250



TYPICAL MANHOLE:
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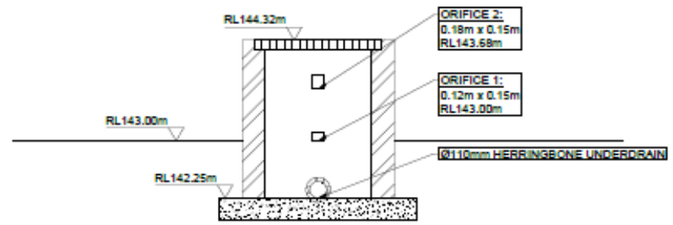
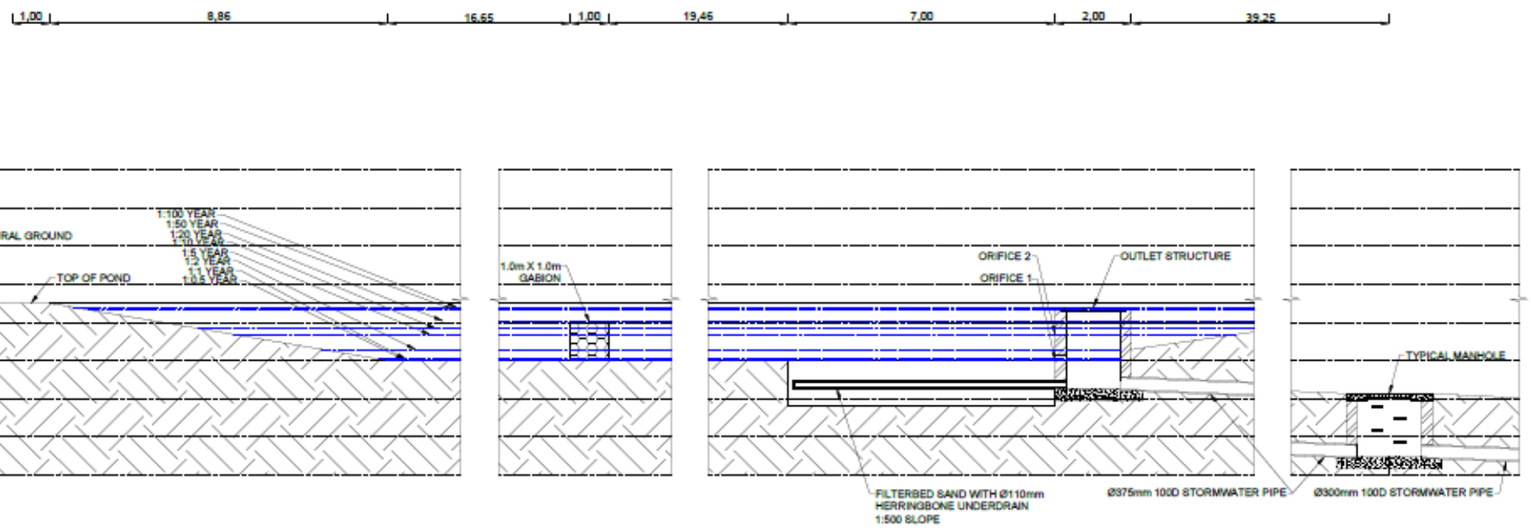


POND 4 OUTLET STRUCTURE:
SCALE: 1:25



SECTION E-E:
SCALE: 1:50

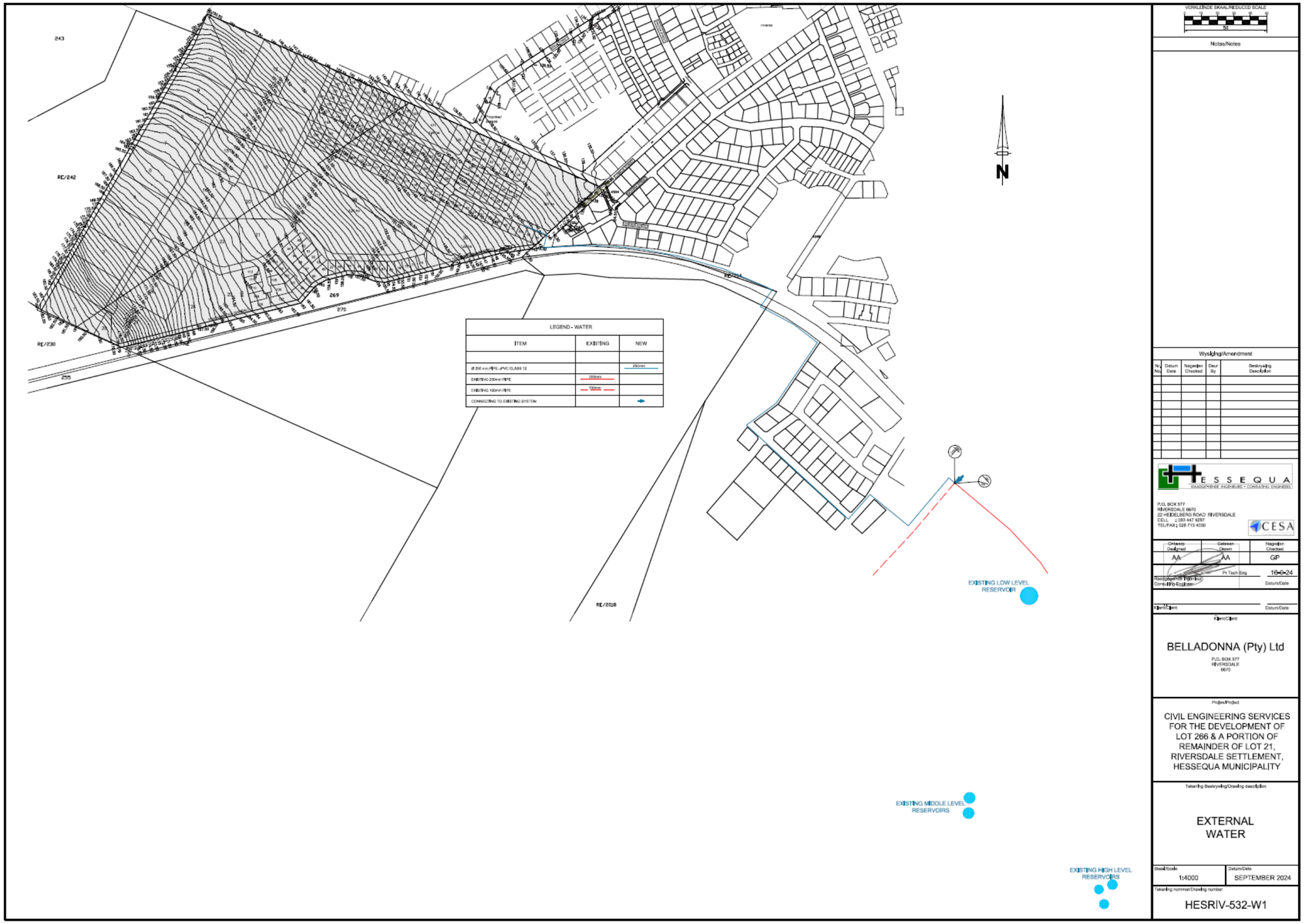
RIVERSDALE SETTLEMENT STORMWATER MANAGEMENT PLAN

POND 4 INFRASTRUCTURE DETAILS

BELLADONNA (PTY) LTD

Graeme McGill consulting

ADDENDUM G: EXTERNAL POTABLE WATER INFRASTRUCTURE



ADDENDUM H: BULK ELECTRICAL SERVICES LAYOUT