Proposed rezoning and subdivision of a Portion of Erf 134, Infanta for the establishment of a residential development

WATER USE LICENCE APPLICATION SUMMARY REPORT

In terms of the National Water Act, 1998 (Act No. 36 of 1998) and the Water Use Licence Application and Appeals Regulations, 2017

Erf 134 Infanta

September 2026

Prepared for:
Westerhelling Investments CC

Department of Water and Sanitation Reference: WU42464

DJEC Project Number:
2010/14

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REPORT DETAILS

Project Title:	Proposed rezoning and subdivision of a portion of Erf 134, Infanta for the establishment of a residential development.
Water Use Authorisation / Process:	Water Use Licence Application
Report Type:	Water Use Licence Application Summary Report
Report Date:	September 2026
Applicant:	Westerhelling Investments CC
Environmental Assessment Practitioner (EAP):	Doug Jeffery Environmental Consultants (Pty) Ltd
DWS / eWULAAS Reference:	WU42464
DJEC Reference:	2010/14

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Professional Registrations & Affiliations:	Reg. EAP (EAPASA): 2022/4550 Professional Environmental Scientist (SACNASP): 151023 Member of IAIAsa

ABBREVIATIONS AND ACRONYMS

BOCMA	Breede-Olifants Catchment Management Agency
DWS	Department of Water and Sanitation
NWA	National Water Act
PPP	Public Participation Process
WUA	Water User Association
WUL	Water Use Licence
WULA	Water Use Licence Application

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1. APPLICANT DETAILS

Table 1: Applicant details

Name of applicant	Westerhelling Investments CC
Postal address	P.O. Box 10071, The Falls, Northmead, Benoni, 1522
Office number	011 425 2420
E-mail address	jarjininv@gmail.com

2. PERSON SUBMITTING APPLICATION

This document was compiled by Lian Roos, an Environmental and Water Consultant with over seven years of experience in environmental and water resource management. He holds a BSc Hons (App Sci) in Water Utilisation and a BSc in Environmental Science from the University of Pretoria. Lian is a registered Professional Natural Scientist with SACNASP (151023) and a Registered Environmental Assessment Practitioner with EAPASA (Reg. No. 2022/4550). He specialises in Water Use Authorisations, including Water Use Licence applications and General Authorisation registrations, supporting developments across agricultural, residential, mining, and renewable sectors.

3. BACKGROUND AND PURPOSE

Westerhelling Investments CC proposes to rezone a 3.04-hectare portion of Erf 134, Infanta, from Agricultural Zone (AZ) to Subdivisional Area in terms of Section 15(2)(a) of the Swellendam Municipal Planning By-law (November 2020). This rezoning will allow for the establishment of 20 additional single-dwelling units, resulting in a total of 21 units on the property. The units will require potable water and sanitation. As the proposed development involves water-related infrastructure and activities that constitute a water use in terms of the National Water Act (Act No. 36 of 1998), a Water Use Licence application was submitted to the Department of Water and Sanitation to obtain the necessary authorisation.

4. LOCATION OF WATER USES

Table 2: Location details

Province	Western Cape	
Magisterial district	Swellendam RD	
Nearest town/city/township	Infanta	
Property description	Erf 134	
Quaternary catchment	H70K	
Water Management Area (WMA)	Breede-Gouritz Water Management Area	
Property size (ha)	87.07	
Coordinates (latitude and longitude)	34.418464°S	20.853553°E
Access to the site	Access to Erf 134 is gained from Main Road 268 (the district road).	

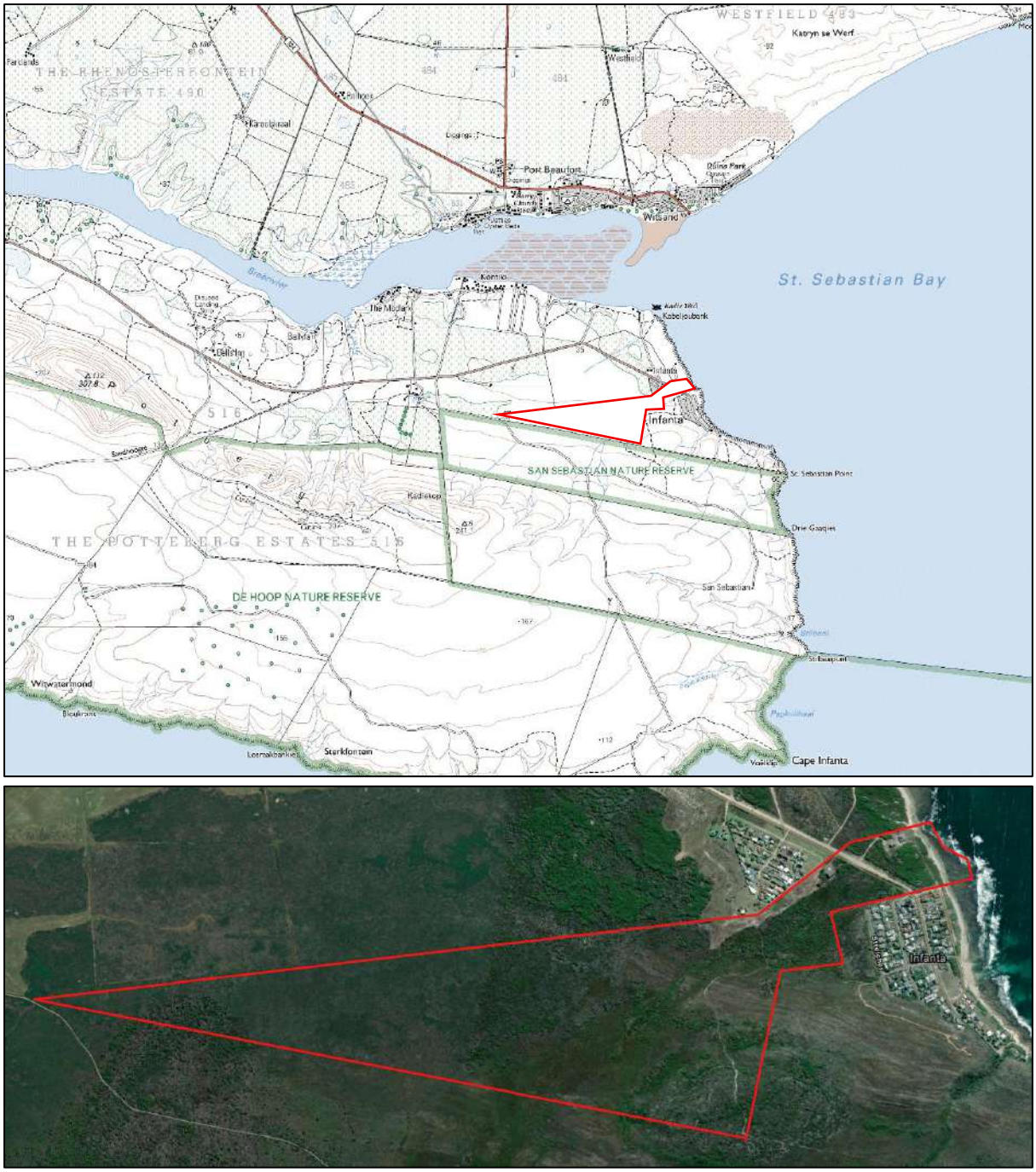


Figure 1: Locality Map

Table 3: Property details

Property description	Title Deed number	Owner
Erf 134, Swellendam RD	T43211/1980	Westerhelling Inv Cc



Figure 2: Development layout on a portion of Erf 134. High-level footprint indicated by the white polygon in the image above

5. PROJECT DESCRIPTION

The applicant, Westerhelling Investments CC, proposes the rezoning and subdivision of a 3.04 ha portion of Erf 134, Infanta, situated within the Swellendam Municipal area, to facilitate the establishment of a residential development.

The application area forms part of the larger Erf 134 (approximately 87 ha), with the remaining portion of the property remaining zoned for agricultural purposes and excluded from the proposed development. The subdivision further provides for Natural Resource Zone, Public Open Space, Private Open Space and public road portions, with approximately 53% of the application area retained as protected open space and natural areas.

The proposed development comprises twenty (20) new single residential erven together with the existing dwelling on the property, resulting in a total of twenty-one (21) residential dwelling units. Fifteen (15) single-storey and five (5) double-storey dwellings are proposed, while the existing reservoir, dwelling, braai area and grave will be retained.

Vehicular access will be obtained via the existing access from Main Road (MR268) serving the northern portion of the development, while the five (5) residential erven south of the watercourse will be accessed via Hoek Street. Internal roads will comprise 8 m road reserves accommodating 4.5 m wide paved carriageways with associated stormwater infrastructure.

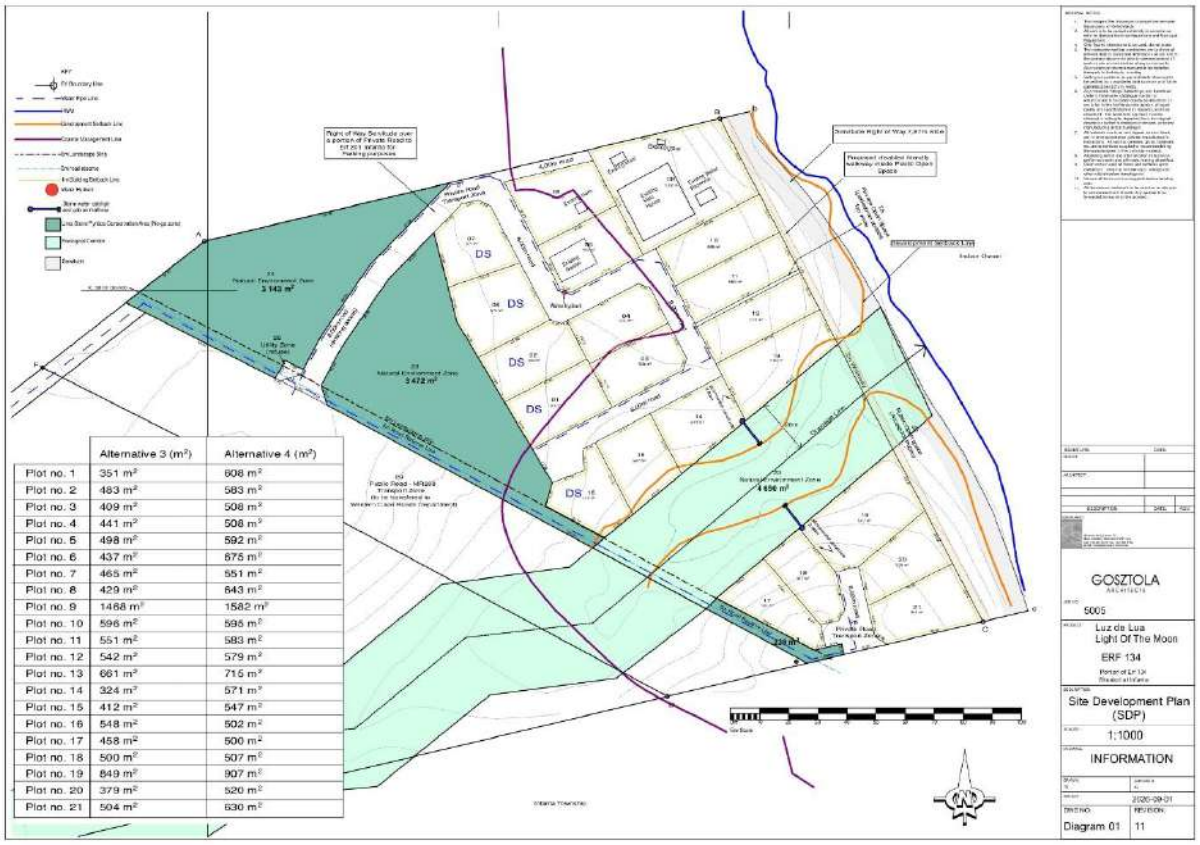
The proposed development will be supplied with water through a dual-source water supply system comprising groundwater abstracted from Borehole 134C and rainwater harvesting. Groundwater abstracted from the borehole will be stored within a proposed 140 m³ reservoir located adjacent to the existing borehole infrastructure before being conveyed to the development by means of a proposed 125 mm bulk water main, crossing MR268 via a steel sleeve under a registered servitude. Each residential dwelling will further be equipped with a 5 m³ rainwater harvesting tank to supplement domestic water supply.

Hydrogeological investigations confirmed that the borehole is capable of supplying the projected development water demand, subject to appropriate treatment prior to potable use.

Domestic wastewater generated by the proposed development will be managed through individual on-site package wastewater treatment plants, with one treatment unit servicing each of the twenty (20) proposed residential erven. The development comprises twenty (20) new residential dwelling units in addition to the existing dwelling on the property, resulting in a total of twenty-one (21) residential dwellings. The existing dwelling will remain connected to its current existing system. The activated sludge treatment systems are designed to produce treated effluent complying with the Department of Water and Sanitation (DWS) General Standards. The treated effluent water will be discharged to a soak-away as the surrounding sandy soil is very porous.

Stormwater generated by the development will be managed through an integrated stormwater management system incorporating rainwater harvesting, landscaped swales, underground soakaways and controlled discharge via engineered stormwater infrastructure. The proposed development has been designed to avoid the mapped 1:100-year flood line by retaining a 40 m ecological corridor (20 m buffer from centreline) associated with the on-site watercourse, thereby limiting potential impacts on surrounding freshwater resources. Notwithstanding the above, the current Site Development Plan (SDP) indicates that certain stormwater management infrastructure are proposed within the delineated watercourse buffer corridor.

Refer to the Site Development Plan indicated in Figure 3 below.



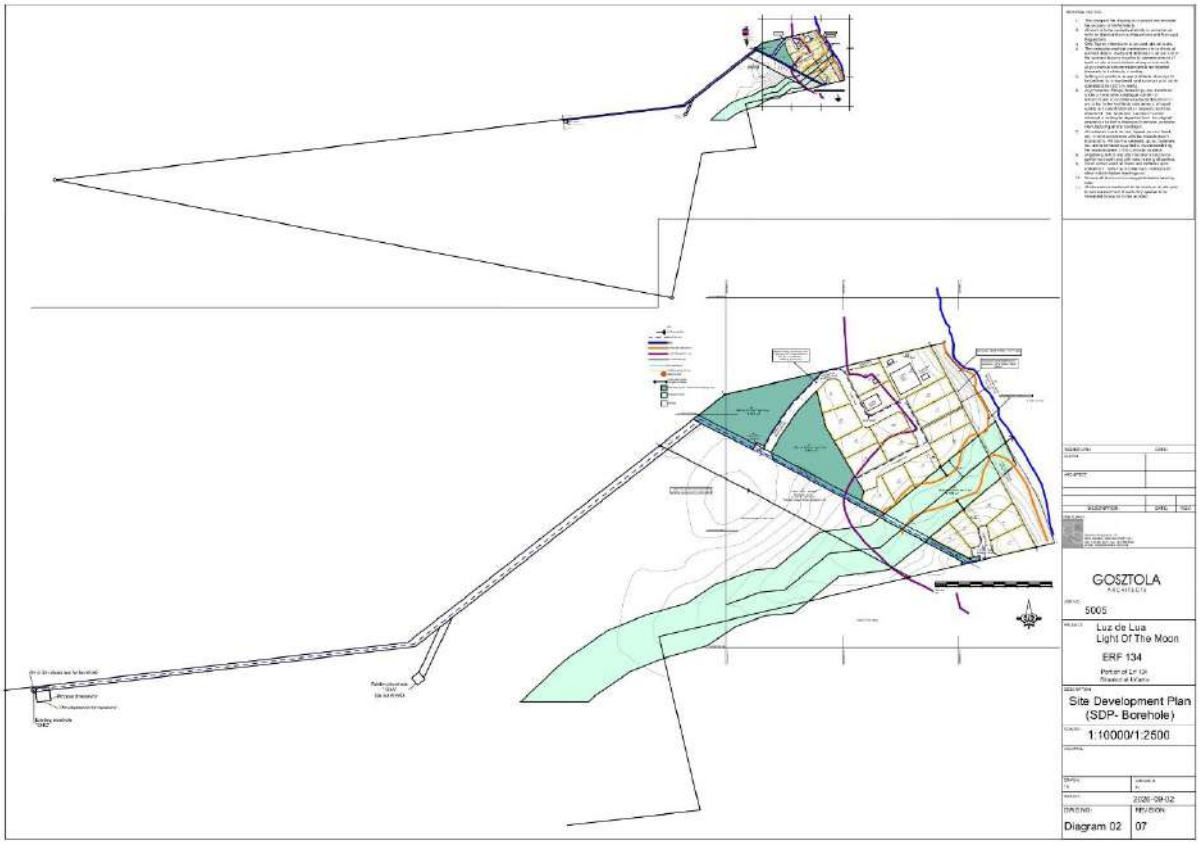


Figure 3: The Site Development Plan (SDP) indicated in the image above is attached as Appendix A.

Water Demand and Supply

Groundwater

The estimated **Annual Average Daily Demand (AADD)** for the development is:

- **21 single residential dwellings (small):** 800 ℓ/unit/day = 16.8 m³/day ; where 1 kL = 1 m³

Two (2) boreholes (134A and 134C) are located on Erf 134 as indicated in below.

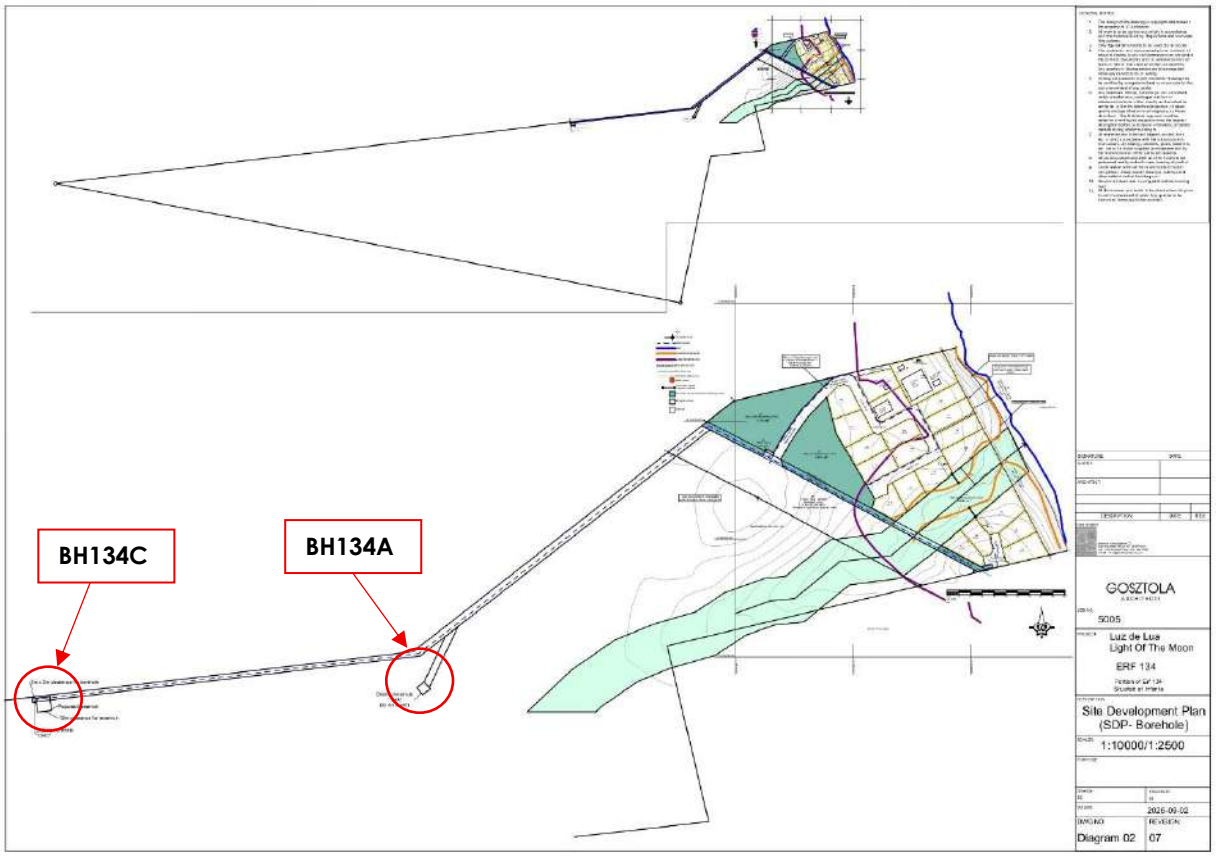


Figure 4: Borehole (BH) localities in relation to the Site Development Plan

A 48-hour pumping test was conducted on borehole BH134C in June 2020 to assess the borehole's productivity, determine the hydraulic characteristics of the aquifer, and calculate a sustainable groundwater abstraction rate.

The testing programme comprised:

- A Stepped Discharge Test - during which the borehole was pumped at progressively increasing rates to assess borehole performance and determine an appropriate pumping rate for further testing.
- A Constant Discharge Test - where the borehole was pumped at a single, constant rate over an extended period to evaluate the aquifer's response to groundwater abstraction.
- Recovery Monitoring - undertaken after pumping ceased to assess the recovery characteristics of the borehole and aquifer system and to provide additional information on groundwater availability.

Data obtained from the pumping test were analysed using the Flow Characterisation (FC) Method. Refer to Section 7 – Aquifer Testing of the Hydrogeological Study attached as Appendix B for more information.

The test results indicated that borehole BH134C has a sustainable yield of approximately 32.4 m³/day , based on a pumping regime of 15 hours per day. The borehole has a depth of 79.4 m, a static water level of 15.47 m below ground level, and an available drawdown of 30 m.

Based on the assessment, it was concluded that a total volume of 32.4 m³/day can be sustainably abstracted from the borehole without adversely affecting the aquifer or causing water levels to decline

below the primary water-bearing fracture zone. This sustainable yield exceeds the development's The projected Average Annual Daily Demand (AADD) is 16.8 m³/day, which equates to an annual water demand of approximately 6,312 m³/annum (16.8 m³/day × 365 days/year).

When provision is made for fire-fighting water requirements, the total annual water demand increases to approximately 7,665 m³/ annum. This total annual water demand remains below the sustainable abstraction yield of 32.4 m³/day (equivalent to 11,826 m³/a) determined for borehole BH134C, indicating that the borehole is capable of supplying the anticipated water requirements of the proposed development on a sustainable basis.

Additional information relating to the hydrogeological environment of the proposed development is provided in Section 5(b) of this report.

Rainwater

Based on a Mean Annual Precipitation (MAP) of 430 mm/year for the area, an average roof area of 215 m² per residential dwelling, and a rainwater harvesting efficiency of 80%, each residential unit is expected to harvest approximately 74 m³ of rainwater per annum. To supplement the groundwater supply and promote water conservation, each household will be required to install a 5.0 m³ rainwater harvesting tank for the collection and storage of roof runoff.

Applicable water use activity – Section 21 (a)

The property, Erf 134, from which groundwater abstraction is proposed, is situated within the H70K quaternary catchment. In terms of the General Authorisation for the Taking and Storing of Water (Government Gazette No. 40243 of 15 September 2016), groundwater abstraction of up to 150 m³/ha/annum is permitted within this catchment.

Based on the extent of Erf 134 (approximately 87 ha), the maximum allowable groundwater abstraction under the General Authorisation is 12,975 m³/annum. This exceeds the proposed development's estimated annual water demand of 7,665 m³/annum.

The available groundwater resource is therefore considered sufficient to meet the anticipated water requirements of the proposed development.

The abstraction of groundwater from borehole BH134C for supply to the proposed development constitutes a Section 21(a) water use in terms of the National Water Act, 1998 (Act No. 36 of 1998), namely the taking of water from a water resource. Under these circumstances, the following water use is considered applicable to the proposed development:

Section 21(a) – Taking water from a water resource.

Reservoir

The proposed reservoir will have a storage capacity of approximately 140.0 m³ and will be located in close proximity to the groundwater abstraction borehole (BH134C) on Erf 134. Positioned adjacent to the borehole, the reservoir will serve as the primary storage facility for groundwater abstracted from BH134C prior to distribution to the proposed residential development.

The reservoir will measure approximately 7.5 m × 7.5 m × 3.0 m and will be constructed partially below ground level, extending approximately 2 m below the natural ground level. A 500 mm freeboard will be provided to accommodate operational requirements and fluctuations in water levels. The reservoir will be fitted with a reinforced concrete roof slab to protect water quality and minimise evaporation losses. To reduce its visual impact and facilitate integration with the surrounding landscape, the upper 1 m of the structure will be clad with natural stone. Construction activities will be confined to a disturbance footprint of approximately 12 m × 12 m, which will also define the perimeter of the proposed fencing infrastructure surrounding the reservoir and borehole installation.

Groundwater abstracted from the borehole will be stored within a proposed 140 m³ reservoir located adjacent to the existing borehole infrastructure before being conveyed to the development by means of a proposed 125 mm bulk water main, crossing MR268 via a steel sleeve under a registered servitude.

Pipeline (water main)

From the proposed reservoir, water will be conveyed to the residential development via a proposed 125 mm diameter Class 9 uPVC bulk water main. The pipeline will cross Main Road 268 (MR268) within a registered servitude and will be installed beneath the road through a steel sleeve. The bulk water main will be fitted with isolating valves, fire hydrants, and individual erf connections. The pipeline will be located entirely within Erf 134 and will provide potable water to the proposed residential dwellings within the development.

The water main will cross MR268 before branching at designated locations to service the individual residential dwellings. The pipeline alignment will be located entirely within the boundaries of the rezoned 3.04 ha portion of Erf 134, within the fence line, rather than within the road reserve. This revised alignment was confirmed following a site visit with officials from the Breede-Olifants Catchment Management Agency (BOCMA) and was adopted to avoid the potential risk of infrastructure damage or service interruptions resulting from routine road maintenance activities or possible future upgrades to MR268.

Applicable water use activity – Section 21 (c) & Section 21 (i)

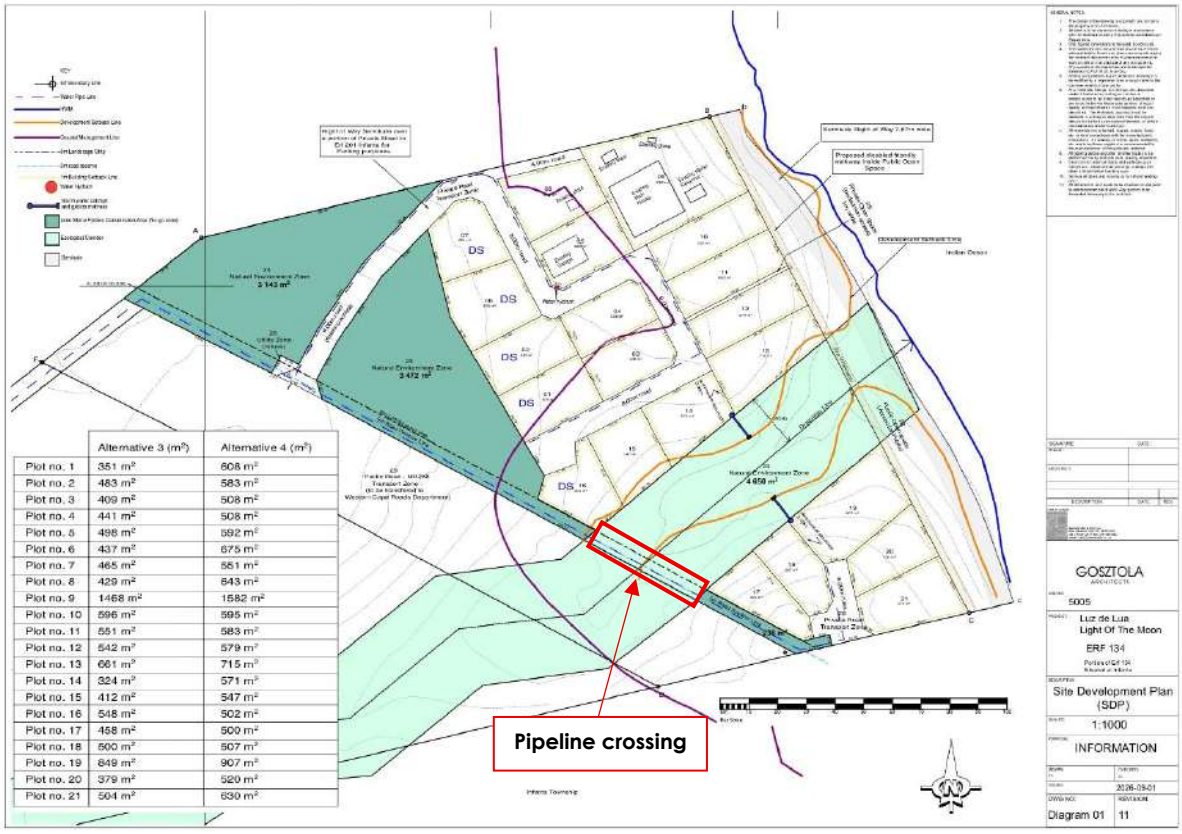
A watercourse (drainage line) traverses the development area. Of the twenty (20) proposed residential dwellings, fifteen (15) are situated north of the watercourse and five (5) south thereof. An existing residential dwelling, located north of the watercourse, will be retained as part of the development. In order to provide water to all residential dwellings, the proposed water main will cross the watercourse at a designated crossing point within the boundaries of the rezoned 3.04 ha portion of Erf 134.

To protect the ecological integrity and functioning of the watercourse, an ecological corridor of 20 m is recommended on either side of the watercourse, measured from the centreline of the drainage feature. This setback is proposed due to the absence of a clearly defined channel and is intended to provide a buffer that maintains the ecological and hydrological functions of the watercourse and its associated riparian habitat.

The construction and operation of the water main crossing within the watercourse will result in the disturbance of the bed and banks of the watercourse and has the potential to impede or divert the flow of water during the construction phase. Under these circumstances, the following water uses, as defined in Section 21 of the National Water Act, 1998 (Act No. 36 of 1998), are considered applicable to the proposed pipeline crossing:

- Section 21(c): Impeding or diverting the flow of water in a watercourse; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

Refer to Figure 5 below which illustrates the location of the proposed pipeline crossing within the watercourse. Additional information relating to the watercourse and freshwater environment of the proposed development is provided in Section 5(b) of this report.



	Alternative 3 (m²)	Alternative 4 (m²)
Plot no. 1	351 m²	608 m²
Plot no. 2	483 m²	583 m²
Plot no. 3	409 m²	508 m²
Plot no. 4	441 m²	508 m²
Plot no. 5	498 m²	592 m²
Plot no. 6	437 m²	675 m²
Plot no. 7	465 m²	551 m²
Plot no. 8	429 m²	843 m²
Plot no. 9	1468 m²	1582 m²
Plot no. 10	596 m²	595 m²
Plot no. 11	551 m²	583 m²
Plot no. 12	542 m²	579 m²
Plot no. 13	661 m²	715 m²
Plot no. 14	324 m²	571 m²
Plot no. 15	412 m²	547 m²
Plot no. 16	548 m²	502 m²
Plot no. 17	458 m²	509 m²
Plot no. 18	500 m²	507 m²
Plot no. 19	849 m²	907 m²
Plot no. 20	379 m²	520 m²
Plot no. 21	504 m²	630 m²

Figure 5: Water main layout, with the section of pipeline crossing the watercourse highlighted in red

Water treatment

Water quality analyses undertaken on BH134C indicate that the groundwater does not currently comply fully with the requirements of SANS 241:2015 Drinking Water Standards.

The main exceedances relate to elevated salinity indicators (EC, TDS, sodium and chloride), iron concentrations, and total coliform bacteria. The groundwater is therefore not suitable for potable use without prior treatment. While regular abstraction may improve the elevated iron and coliform concentrations, treatment and ongoing monitoring will remain necessary to ensure compliance with drinking water standards.

To ensure a safe and reliable potable water supply, an end-point filtration and disinfection system will be installed at each of the 21 residential dwellings. These treatment units will be designed to treat the groundwater to a standard suitable for domestic consumption and compliant with the requirements of SANS 241:2015 and ongoing water quality monitoring will be undertaken.

Wastewater

Once operational, the proposed development will generate wastewater, which the applicant proposes to treat on-site using small-scale package wastewater treatment plants. One treatment unit will be allocated to each residential dwelling to facilitate the treatment wastewater generated within the development.

A total of 20 small-scale package wastewater treatment plant units are proposed, with one unit to be installed for each of the 20 new residential dwellings. These units will be used to treat wastewater generated by the proposed development. The existing dwelling on the property will continue to utilise its existing septic tank system for the management of sewage, as has historically been the case.

Based on the estimated water demand of 16.8 m³/day, it is anticipated that approximately 13.44 m³/day of wastewater will be generated, assuming that 80% of water consumed is returned as wastewater. This equates to an estimated annual wastewater volume of approximately 4,905.6 m³/annum.

The proposed treatment units will treat wastewater to the applicable Department of Water and Sanitation (DWS) standard limits. Treated effluent will be discharged to a soak-away as the surrounding sandy soil is very porous.

Applicable water use activity – Section 21 (g)

Each new residential dwelling will operate its own package treatment plant, but all units will be registered collectively under a single Section 21(g) water use activity to be managed by the Homeowners' Association (HOA) in terms of its constitution. Under these circumstances, the following water use, as defined in Section 21 of the National Water Act, 1998 (Act No. 36 of 1998), is considered applicable to the proposed development:

- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource.

Stormwater

The proposed residential development has been designed to incorporate an integrated stormwater management system that will safely collect, convey and discharge stormwater runoff generated within the development footprint. Stormwater runoff from the proposed residential dwellings, internal roads and other hardened surfaces will be managed through a network of stormwater infrastructure designed to maintain pre-development drainage patterns as far as reasonably possible. The site is traversed by a watercourse and associated ecological corridor, which forms part of the natural drainage system and ultimately conveys runoff towards the coastline and the sea.

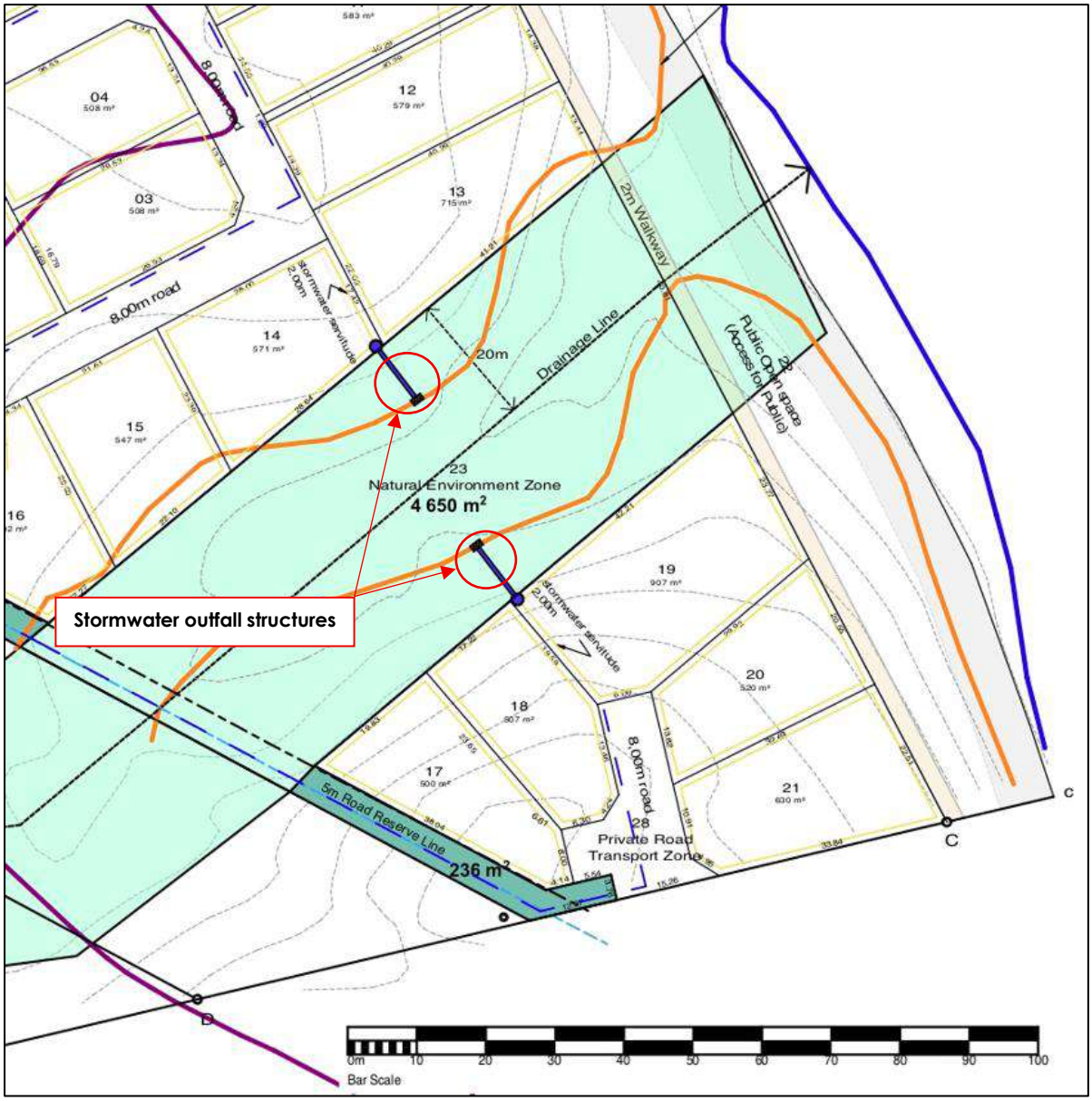
A 1:100-year floodline delineation was undertaken as part of the planning and design process for the development. The delineation informed the layout of the proposed development, with all residential dwellings and associated infrastructure being located outside of the 1:100-year floodline. As a result, the development avoids encroachment into areas susceptible to flooding, thereby reducing the potential risk of flood damage, bank erosion and impacts on the functioning of the watercourse and its associated riparian habitat.

To facilitate the controlled discharge of stormwater from the development area, two stormwater outfall structures are proposed within the ecological corridor associated with the watercourse. These outfall structures will convey stormwater generated within the development footprint into the ecological corridor, from where it will continue along the natural drainage pathway towards the sea. Appropriate erosion protection and energy dissipation measures will be incorporated into the design of the outfall structures to minimise the potential for scour, erosion and sedimentation within the receiving environment.

Applicable water use activity – Section 21 (c) & (i)

The construction and operation of the proposed stormwater outfall structures within the ecological corridor may result in the disturbance of the bed and banks of the watercourse and could impede, divert or alter the flow characteristics of the watercourse. Under these circumstances, the following water uses, as defined in Section 21 of the National Water Act, 1998 (Act No. 36 of 1998), are considered applicable to the proposed stormwater infrastructure:

- Section 21(c): Impeding or diverting the flow of water in a watercourse; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.



Additional information relating to the stormwater environment, stormwater management measures, and the design of the proposed stormwater infrastructure is provided in the Civil Engineering Services Report attached as Appendix C.

Pedestrian walkway

The proposal also includes a public pedestrian walkway along the eastern boundary of the residential development. The walkway is intended to provide safe, well-defined, and wheelchair-accessible public access along the coastline, while minimising pedestrian movement and the associated impacts on coastal habitats and natural areas. Construction of the walkway will be undertaken by the applicant, while its ongoing maintenance and management will be the responsibility of the Homeowners' Association (HOA).

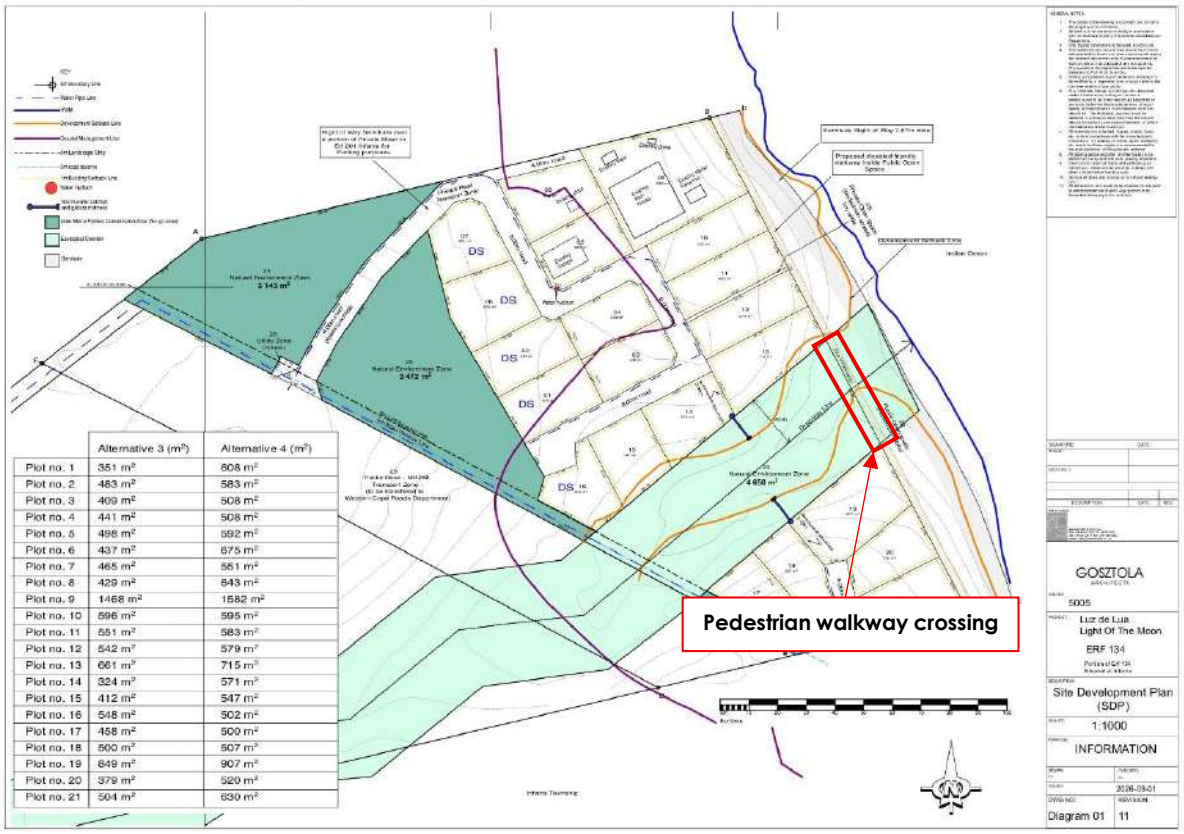
A section of the proposed walkway are located across the ecological corridor associated with the watercourse. The construction and operation of the walkway may result in disturbance within the watercourse buffer area. However, only the supporting poles of the walkway will be located within the buffer area. The installation of these support structures may have the potential to disturb the bed and banks of the watercourse during the construction phase, and could result in the temporary impediment or diversion of flow, as well as alterations to the characteristics of the watercourse.

Applicable water use activity – Section 21 (c) & (i)

Under these circumstances, the following water uses, as defined in Section 21 of the National Water Act, 1998 (Act No. 36 of 1998), are considered applicable to the proposed walkway:

- Section 21(c): Impeding or diverting the flow of water in a watercourse; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

Refer to Figure 6 below, which illustrates the location of the proposed pedestrian walkway in relation to the watercourse and associated ecological corridor.



	Alternative 3 (m²)	Alternative 4 (m²)
Plot no. 1	351 m²	608 m²
Plot no. 2	483 m²	583 m²
Plot no. 3	409 m²	508 m²
Plot no. 4	441 m²	508 m²
Plot no. 5	498 m²	592 m²
Plot no. 6	437 m²	675 m²
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Plot no. 18	500 m²	507 m²
Plot no. 19	849 m²	907 m²
Plot no. 20	379 m²	520 m²
Plot no. 21	504 m²	630 m²

Figure 6: Pedestrian walkway crossing the watercourse highlighted in red

Coastal environment

The proposed development has been designed to minimise its impact on the coastal environment by concentrating development within a defined footprint while retaining more than half of the rezoned 3.04 ha portion of Erf 134 in a natural state. The site falls within the Coastal Protection Zone; however, the residential component is located outside the 1:100-year floodline and incorporates a coastal setback line to avoid encroachment into the Littoral Active Zone and reduce exposure to coastal erosion and flooding risks.

A public pedestrian walkway is proposed along the eastern edge of the residential erven to provide managed, safe, and wheelchair-accessible public access along the coastline. The development has also considered the relevant biodiversity and estuarine management frameworks applicable to the area and seeks to minimise potential indirect impacts on the nearby Breede Estuary, surrounding natural habitats and adjacent conservation areas.

Overall, the development aims to balance residential use with the protection of the coastal environment through the retention of substantial natural open space, the application of coastal setback measures, and the provision of controlled public coastal access.

Solid Waste Removal

Solid waste generated by the proposed development will be managed through a formal waste collection and removal system. During the operational phase, homeowners will be required to dispose of household waste at a dedicated Waste Transfer Station that will be established at one of the development entrances. Swellendam Municipality will service the transfer station on a weekly basis and transport the collected waste to the Swellendam Municipal Solid Waste Disposal Site. No waste treatment or disposal activities will take place within the development area.

During the construction phase, solid waste will be temporarily stored in designated waste collection areas and removed regularly to a licensed waste disposal facility. Construction rubble will either be reused where appropriate and legally permissible, or disposed of at an approved disposal facility. The burning or burying of waste on site will not be permitted, and waste disposal records will be maintained by the contractor.

These waste management measures are included in the Environmental Management Programme (EMPr), which requires the implementation of appropriate waste storage, collection, recycling, transportation, and disposal practices to ensure that impacts on the surrounding environment and water resources are avoided and minimised.

Water Use Licence Application

As the proposed development involves water-related infrastructure and activities that constitute water uses in terms of the National Water Act (Act No. 36 of 1998), a Water Use Licence Application was submitted to the Department of Water and Sanitation to obtain the necessary authorisation.

a. Administrative Documents

Administrative documents, including identity documents, title deeds, company registration documents, etc., will be submitted along with the Water Use Licence application (WULA):

b. Reports and other technical documents

The following technical documents will be submitted along with the WULA. A brief summary of the findings from each assessment or required document is provided below. The associated impacts and proposed mitigation measures are discussed in more detail in **Section 10 – Impacts and Mitigation Measures** of this report.

Geohydrological Impact Assessment & Aquifer testing (pump test)

The Geohydrological Impact Assessment conducted in September 2025 by Geo Pollution Technologies (Pty) Ltd (GPT) is attached as Appendix B for reference. A brief summary of its contents is provided below.

Hydrogeology

The site is underlain by fractured rock aquifers that can store and transmit groundwater. Water from deeper Table Mountain Group rocks is usually very good, while the shallower Bokkeveld Group, which is mostly at the site, tends to be moderately salty, likely due to past marine influence. Local testing of boreholes shows that borehole 134C can provide between 25,000 and 48,000 litres per day, which is more than enough for the development's needs of 16,800 litres per day. This borehole is also located away from other groundwater users, making it a preferred source. Overall, the site has a reliable but moderately saline groundwater source. Borehole 134C alone can meet the development's water needs without affecting surrounding users.

Hydrocenus

A hydrocensus in July 2025 found seven (7) boreholes and two (2) springs within 1 km radius of the site, with groundwater levels averaging 4.35 m below ground and flowing generally northeast toward the ocean. Water quality tests on three boreholes showed moderately saline conditions, with sodium and chloride above aesthetic limits. BH07 also had elevated iron and E. coli, while BH05 and BH07 showed

high total coliform counts, likely from soil or nearby drainage. Overall, the groundwater is usable with treatment, but some localized bacterial contamination and salinity need to be managed.

Aquifer testing

Borehole BH134C at the site was tested in June 2020 with a 48-hour pumping program, including a Stepped Discharge Test, Constant Discharge Test, and Recovery Monitoring, to assess its productivity and aquifer properties. The tests determined the sustainable yield, calculated using the FC-Method, at 32.4 m³/day (11,826 m³/year). Water quality analysis showed elevated salinity (Na, Cl, EC, TDS) typical of the Bokkeveld Group and total coliforms above operational limits, indicating microbial contamination. The borehole can supply sufficient water for the development but requires treatment for potable use.

Borehole 134C Water Quality

Two groundwater samples were taken from the borehole—one in June 2020 and a second on 12 September 2025—for major anion, cation, and microbial analysis, with the latter sample including additional micro-determinants. Results were compared against the SANS 241-1:2015 drinking water standards.

Key observations from the September 2025 results include:

- Electrical conductivity (EC) & total dissolved solids (TDS): exceeded aesthetic limits
- Sodium (Na) & Chloride (Cl): exceeded aesthetic limits, indicating saline water typical of the Bokkeveld Group
- Iron (Fe): exceeded aesthetic limits, likely from steel casing corrosion
- Total coliforms: exceeded operational limits, likely due to stagnant borehole conditions

Overall, water quality has remained stable and similar to the 2020 results. Elevated iron and coliforms are expected to decrease with regular borehole use.

Reserve determination

The reserve determination assesses how much groundwater can be used from the site while still meeting basic human needs and protecting the environment. The property falls within the H70K quaternary catchment, which is currently classified as low-stress, meaning water use is well below recharge levels. The planned water demand for the development is 6,132 m³ per year, well within the general authorisation limit of 12,975 m³/year and below the sustainable yield of 11,826 m³/year. Recharge on the property is estimated at 12,283 m³/year. Resource Quality Objectives ensure that abstraction does not reduce groundwater levels for neighbouring users or compromise base flow to local rivers.

Monitoring

A groundwater monitoring network is proposed to monitor groundwater levels, abstraction volumes, and groundwater quality on a quarterly basis. The primary objective of the monitoring programme is to identify any potential impacts associated with groundwater abstraction and wastewater disposal, while ensuring the sustainable use and protection of the underlying aquifer.

Borehole BH134C is proposed as the principal abstraction and monitoring borehole. Additional monitoring will be undertaken at boreholes BH134A, BH05, BH06, BH07, and BH09, which will be used for groundwater level and water quality assessments. Monitoring parameters will include groundwater levels, abstraction volumes, major ion chemistry, pH, electrical conductivity (EC), total dissolved solids (TDS), and potential contaminants such as hydrocarbons and microbiological indicators (including coliform bacteria). The monitoring network should remain adaptable to accommodate future development requirements or emerging groundwater risks.

Groundwater quality results obtained during the investigation indicate that groundwater within the study area is not consistently suitable for potable use without treatment. Exceedances of selected SANS 241 drinking water quality parameters were identified at several monitoring locations. Consequently, any groundwater intended for domestic consumption should be appropriately treated prior to use.

Continued groundwater quality monitoring is recommended to assess long-term trends and verify the effectiveness of any treatment measures implemented.

The proposed package wastewater treatment plants and associated soakaways represent the primary potential source of groundwater contamination associated with the development. Although the treatment systems are designed to produce effluent that complies with the applicable Department of Water and Sanitation (DWS) General Standards, residual contaminants may remain in the discharged effluent. These may include microbiological constituents, as well as nutrients such as ammonia, nitrate, nitrite, orthophosphate (phosphate), and total phosphorus. Given the presence of permeable sandy soils and relatively shallow groundwater conditions, appropriate operation and maintenance of the treatment facilities are critical. Regular inspection and maintenance of the soakaways, together with ongoing groundwater quality monitoring, are therefore recommended to minimise the risk of adverse impacts on the aquifer.

The recommended monitoring programme should be established prior to commencement of operations. Groundwater-level monitoring should be conducted on a weekly basis during the first three months of operation to assess short-term responses to abstraction. Should no significant decline in groundwater levels be observed during this period, the monitoring frequency may subsequently be reduced to monthly measurements. Alternatively, automated water-level monitoring equipment, such as pressure transducers, may be installed to provide continuous groundwater-level records and improve monitoring efficiency. Flow meter readings should be recorded and maintained in a dedicated logbook, with flow meters read and documented at least once per month.

Table 4: Details of the monitoring boreholes

Borehole ID	Latitude (S)	Longitude (E)	Requirement	Frequency	Existing/New
BH134C	34° 25' 15.35"	20° 50' 40.01"	Abstraction, Water Level & Groundwater Quality Monitoring	Quarterly	Existing
BH134A	34° 25' 14.3040"	20° 50' 57.0624"	Abstraction, Water Level & Groundwater Quality Monitoring	Quarterly	Existing
BH05	34° 25' 12.3060"	20° 50' 55.8096"	Abstraction, Water Level & Groundwater Quality Monitoring	Quarterly	Existing
BH06	34° 25' 12.1548"	20° 50' 55.4644"	Abstraction, Water Level & Groundwater Quality Monitoring	Quarterly	Existing
BH07	34° 25' 15.6952"	20° 51' 17.9658"	Abstraction, Water Level & Groundwater Quality Monitoring	Quarterly	Existing
BH09	34° 25' 12.2236"	20° 51' 16.4459"	Abstraction, Water Level & Groundwater Quality Monitoring	Quarterly	Existing



Figure 7: Hydrocensus Map

Freshwater Impact Assessment

The Freshwater Impact Assessment, prepared by Freshwater Consulting (Pty) Ltd in December 2024, is attached as Appendix C for reference. A brief summary of the key findings is provided below.

Hydrology and Watercourse Characteristics

A small, unnamed ephemeral (temporary/seasonal) stream crosses Erf 134, entering along the south-eastern boundary and flowing approximately 4 km to the sea. The stream forms part of the Breede River catchment (Lower Breede River sub-WMA, quaternary catchment H70K) and is dry most of the time, flowing only after heavy rainfall. Within the property, the stream channel is sandy, while upstream it includes bedrock and cobble. The stream is heavily invaded by *Acacia cyclops*, and surrounding vegetation comprises De Hoop Limestone Fynbos and Overberg Dune Strandveld, both of which are least threatened due to protection within De Hoop Nature Reserve.



Figure 8: Aerial photograph of Infanta, showing the watercourse (blue line) and its recommended ecological buffer (purple outline). The 1:100 year floodline falls within the buffer.

The ecological condition and sensitivity of the stream were assessed following the Department of Water and Sanitation's (DWS) Resource Directed Measures (RDM) and EcoClassification approaches. These methods evaluate the Present Ecological State (PES), which reflects the system's integrity compared to its natural condition, and the Ecological Importance and Sensitivity (EIS), which indicates its biodiversity value and vulnerability to disturbance.

Results show that the stream is in a natural condition (PES Category A) for both instream (94%) and riparian (91%) habitats, indicating minimal human modification. Its ecological importance and sensitivity (EIS) are rated as High (2.5), reflecting its sensitivity to changes in flow and water quality and its connection to the De Hoop Nature Reserve. The stream's ecological management class is B, meaning only minimal alteration should be permitted.

Recommend ecological buffer

To protect the stream, a 20 m ecological buffer is recommended on both sides, measured from the centreline of the watercourse due to the absence of a clearly defined channel. This buffer was determined using the MacFarlane and Bredin (2017) method and is based on the stream's PES and EIS results. The existing sparse, shrubby vegetation within the buffer provides some protection, although denser vegetation such as grasses or sedges would enhance sediment and pollutant filtration. Maintaining this buffer during both construction and operational phases is considered sufficient to safeguard the stream and prevent deterioration of its current ecological condition.

Development layout

The preferred development layout for Erf 134 comprises 21 erven, all positioned outside the 40 m-wide ecological corridor that includes the 20 m stream buffer and the 1:100-year floodline. This corridor protects the stream, surrounding dune habitat, and associated terrestrial biodiversity. A conservation area of just over 6,000 m² in the north-western corner preserves sensitive limestone fynbos.

Freshwater ecology & impact significance

From a freshwater ecological perspective, the preferred layout provides multiple benefits. Open spaces allow infiltration of runoff and precipitation, the hardened footprint is minimised to reduce stormwater generation, and the watercourse corridor maintains habitat connectivity for fauna and flora. Construction impacts, such as the potential introduction of alien plants, are mitigated through careful sourcing of topsoil and adherence to the Environmental Management Programme (EMPr).

Operational impacts, including stormwater, wastewater management, and groundwater abstraction, are considered low to medium in significance before mitigation and low after mitigation. Mitigation measures include proper placement of package treatment plants or septic systems outside the corridor, use of rainwater tanks, and planting of indigenous species to maintain ecological connectivity. Overall, the preferred layout balances development needs with protection of freshwater and terrestrial habitats on site.

6. METHODS STATEMENT (ONLY FOR C AND I ACTIVITY)

A Method Statement for Section 21 (c) & (i) water use activities on Erf 134 is attached as Appendix F.

7. STORMWATER MANAGEMENT PLAN

The Civil Engineering Services Report, prepared by G. Pepler in March 2024, is attached as Appendix D for reference. A summary of the key findings is provided below. The report details the proposed Stormwater Management Plan for the portion of Erf 134, including post-development runoff estimates, attenuation measures, stormwater discharge design, and compliance with Swellendam Municipality's standards. It also incorporates the floodline determination and associated infrastructure specifications.

The 100-year floodline, as determined by Pr. Eng. A.L. Fraser, is located outside the proposed development footprint, confirming that the development area lies above the flood-prone zone and will not be directly affected by flood events. the 1:100-year floodline delineation was incorporated and the proposed development is confined outside this zone thus minimising risks of flooding and erosion.

8. REHABILITATION PLAN

The rehabilitation plan seeks to ensure the restoration and long-term ecological stability of areas disturbed during the construction of the development, with particular focus on the ecological buffer surrounding the watercourse. By adhering to the recommended 20 m buffer, no development activities will occur within this zone, with the exception of the installation of the water pipeline, the construction of stormwater management infrastructure, including outlet structures and associated erosion protection measures, and limited sections of the public pedestrian walkway where crossings or edge treatments are required. Trenching for the pipeline, earthworks associated with stormwater structures, and the construction of the pedestrian walkway may temporarily disturb vegetation and result in the mobilisation of sediment into the watercourse and potentially downstream to the ocean, particularly during heavy

rainfall events. The rehabilitation plan therefore provides guidance for the restoration of all disturbed areas under the supervision of a qualified botanist, including the reinstatement of indigenous vegetation, stabilisation of disturbed soils, rehabilitation and blending of stormwater infrastructure with the surrounding landscape, and the revegetation and rehabilitation of areas affected by walkway construction. These measures aim to prevent erosion, minimise long-term impacts on the watercourse and adjacent coastal habitats, and maintain the ecological function and integrity of the watercourse corridor.

8.1 Ecological buffer control

Management Outcome:	Protect the 20 m ecological buffer along the watercourse to maintain ecological function, biodiversity
Management Actions:	
a) Maintain a strict 20 m buffer from the watercourse centreline; no activities should occur within this zone except for the pipeline crossing. b) During pipeline installation, minimise disturbance by hand-excavating the trench and backfilling promptly to reduce soil exposure and sediment mobilisation. c) Replant indigenous vegetation along the disturbed pipeline corridor and within the buffer to restore high basal cover and stabilise soils. d) Prevent encroachment, dumping, or other disturbances in the buffer outside of the pipeline area. e) Monitor and control alien or invasive plant species within the buffer, including areas disturbed by the pipeline. f) Limit pedestrian access; provide boardwalks or designated pathways if access is required. g) Ensure the buffer protects not only the watercourse but also surrounding slopes that supply runoff from rainfall and upstream areas.	
Implementation:	
Responsible party:	License holder
Timeframe for implementation:	After construction and throughout the operational phase
Monitoring:	
Method of monitoring:	Bi-annual inspections to assess buffer condition, vegetation health, and the effectiveness of rehabilitation along the pipeline corridor.
Frequency of monitoring:	Bi-annually
Mechanism for monitoring compliance:	The license holder will be required to do annual internal audits on the conditions of the license as well as appoint an independent consultant to undertake external audits.

8.2 Alien vegetation control

Management Outcome:	Maintain and restore indigenous vegetation within the 20 m ecological buffer and prevent the establishment or spread of alien species.
Management Actions:	
a) Identify and remove alien or invasive plants, prioritising manual methods (pulling, cutting, digging) to minimise disturbance to native vegetation. If unsure, please contact a qualified botanist or CapeNature for assistance; b) Replant cleared areas with appropriate indigenous species. c) Monitor regrowth regularly and remove seedlings before they mature to prevent seed spread. d) Ensure existing indigenous vegetation along the watercourse and buffer is retained. e) Prohibit the use of invasive species in landscaping, e.g., Kikuyu grass.	
Implementation:	
Responsible party:	License holder

Timeframe for implementation:	After construction and throughout the operational phase
Monitoring:	
Method of monitoring:	Conduct site inspections or vegetation surveys bi-annually with a Botanist or Vegetation Specialist.
Frequency of monitoring:	Bi-annually
Mechanism for monitoring compliance:	The license holder will be required to do annual internal audits on the conditions of the license as well as appoint an independent consultant to undertake external audits.

8.3 Erosion control

Management Outcome:	Ensure soil stability, prevent erosion, and protect the ecological integrity of the 20 m watercourse buffer.
Management Actions:	
a) Replant indigenous vegetation on bare or eroded areas (pipeline trenches and around units) to stabilise soil and reduce runoff. b) Cover exposed soil with biodegradable mats (jute or coir) to support vegetation growth. c) Maintain or enhance dense vegetation along watercourse edges to slow water and trap sediment. d) Apply mulch and fast-growing indigenous seed to quickly stabilise eroded areas.	
Implementation:	
Responsible party:	License holder
Timeframe for implementation:	After construction and throughout the operational phase
Monitoring:	
Method of monitoring:	Conduct site inspections or vegetation surveys bi-annually with a Botanist or Vegetation Specialist.
Frequency of monitoring:	Bi-annually
Mechanism for monitoring compliance:	The license holder will be required to do annual internal audits on the conditions of the license as well as appoint an independent consultant to undertake external audits.

8.4 Fire control

Management Outcome:	Reduce the risk of fire and protect residents, infrastructure, and natural areas.
Management Actions:	
a) Maintain cleared firebreaks around residential units and along the ecological buffer. b) Keep vegetation in open spaces and along watercourse edges well-managed to reduce fuel load. c) Ensure all residents are aware of fire safety procedures. d) Prohibit burning of waste or garden material on site. e) Maintain access for emergency vehicles throughout the development.	
Implementation:	
Responsible party:	License holder
Timeframe for implementation:	After construction and throughout the operational phase
Monitoring:	

Method of monitoring:	Conduct regular inspections to ensure firebreaks and vegetation management are maintained.
Frequency of monitoring:	Bi-annually
Mechanism for monitoring compliance:	Annual internal audits by the license holder, supported by independent external audits as required.

9. WATER USES APPLIED FOR

Any activity listed under Section 21 of the National Water Act (Act 36 of 1998) constitutes a water use. Such water use activities must be authorised through a Water Use Licence or other relevant Water Use Authorisation issued by the Department of Water and Sanitation before the activity can legally proceed. Below is a concise table summarising the Section 21 water use activities under the National Water Act (Act 36 of 1998):

Table 5: Section 21 Water Use Activities under the National Water Act

Water Use	Description
21(a)	Taking water from a water resource.
21(b)	Storing water.
21(c)	Impeding or diverting the flow of water in a watercourse.
21(d)	Engaging in a stream flow reduction activity (reducing water flow in a watercourse).
21(e)	Engaging in a controlled activity identified as such in section 37(1) or declared under section 28(1) of the NWA.
21(f)	Discharging waste or water containing waste into a water resource.
21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource.
21(h)	Disposing of waste in a manner which contains waste from or which has been heated in any industrial or power generation process.
21(i)	Altering the bed, banks, courses or characteristics of a watercourse.
21(j)	Removing, discharging or disposing of water found underground if it is necessary of the efficient continuation of an activity or for the safety of the people.
21(k)	Using water for recreational purpose.

Table 6: Water Use Applied for

Water Use Activities	Purpose	Capacity/Volume (m^3, tonnes and/or m^3/annum)/ dimension	Property description	Coordinates
Section 21 (a)				
Abstraction of groundwater through borehole (BH134C)	To supply water for domestic use and for fire-fighting capacity	7,665 m³/annum	Erf 134	34° 25' 15.35" S 20° 50' 40.01" E
Section 21 (c) & (i)				
Constructing and operating a water main that crosses a watercourse within the property	To convey water for domestic use to the development's units	125 mm Ø Class 9 uPVC water main	Erf 134	34° 25' 9.98" S 20° 51' 12.86" E
Constructing and operating a stormwater outfall structure no. 1	To convey stormwater runoff from the development into the receiving watercourse	Stormwater outfall structure	Erf 134	34°25'8.90"S 20°51'14.46"E
Constructing and operating a stormwater outfall structure no. 2	To convey stormwater runoff from the development into the receiving watercourse	Stormwater outfall structure	Erf 134	34°25'9.26"S 20°51'14.58"E
Constructing and operating a pedestrian walkway	To give access to the public along the coast and across the watercourse while protecting the ecological buffer from pedestrian impacts.	Pedestrian walkway	Erf 134	34°25'8.19"S 20°51'16.14"E
Section 21 (g)				
Each of the 20 new residential units will have its own small-scale wastewater package treatment plant, collectively	To treat domestic sewage from each unit for safe reuse and/or disposal	4,905.6 m³/annum	Erf 134	34° 25' 7.59"S 20° 51' 13.22"E

Water Use Activities	Purpose	Capacity/Volume (m^3, tonnes and/or m^3/annum)/ dimension	Property description	Coordinates
registered under a single Section 21(g) water use activity				

10. IMPACT AND MITIGATION MEASURES

The potential impacts and mitigation measures that are expected from the proposed activities are presented in the table below:

Table 7: Summary of impacts and mitigation measures

Water Use Activity	Possible Cause Of Impacts Of The Activities To The Water Resource	Possible Impacts To The Water Resource And Other Water Users	Mitigation Measures
Construction phase			
S21 (c) & (i) Trenching within the ecological corridor for laying of bulk water pipeline. Constructing and operating a water main that crosses a watercourse within the property.	Mobilisation of sediment into the watercourse or ocean, especially during high rainfall events; short-term loss of natural vegetation within the working area	Negative impact on ecological corridor and stream habitat; deterioration in stream Present Ecological State; sedimentation in the tidal zone and smothering of vegetation in the watercourse	○ Keep construction footprint to a minimum ○ Excavate trenches by hand, not machinery ○ Conduct trenching during the dry season ○ Fill opened trenches as quickly as possible; avoid opening within three days of predicted heavy rainfall ○ The watercourse corridor must be well marked during the pre-construction phase. ○ Rehabilitate disturbed areas with input from a botanist
S21 (c) & (i) Construction and operation of two stormwater outfall structures within the ecological corridor	Construction of the stormwater outfall structures will require localised excavation, pipe installation, earthworks and the placement of outlet and erosion protection structures within the ecological corridor. These activities may temporarily disturb the bed and banks of the watercourse and expose soils to erosion. During operation, concentrated stormwater discharges at the outlet	The proposed activities may result in temporary sediment mobilisation and increased turbidity within the watercourse during construction, as well as localised disturbance of riparian habitat and vegetation. During operation, inadequate management of stormwater flows could lead to erosion, scour and alteration of the watercourse's bed and banks, potentially affecting the ecological functioning of the corridor and downstream receiving environments.	○ Restrict construction activities to the minimum area required. ○ Clearly demarcate the ecological corridor and construction footprint prior to commencement of works. ○ Schedule construction activities during the dry season where practicable. ○ Implement erosion and sediment control measures throughout the construction period. ○ Stabilise exposed soils immediately following construction.

Water Use Activity	Possible Cause Of Impacts Of The Activities To The Water Resource	Possible Impacts To The Water Resource And Other Water Users	Mitigation Measures
	points may alter local flow patterns and increase flow velocities within the receiving environment.		o Incorporate energy dissipation measures at all outlet structures to reduce flow velocities. o Install appropriate scour protection measures, such as riprap, rock aprons, reno mattresses or gabions. o Minimise disturbance to the bed, banks and natural flow characteristics of the watercourse. o Rehabilitate all disturbed areas using suitable indigenous vegetation upon completion of construction. o Conduct regular inspections and maintenance of the outfall structures to ensure their continued effectiveness and stability.
S21 (c) & (i) Construction and operation of a pedestrian walkway crossing within the ecological corridor and watercourse	Construction of the pedestrian walkway will require limited vegetation clearance, installation of support structures and localised excavation within the ecological corridor. Although the walkway is designed to minimise disturbance, construction activities may temporarily affect the surrounding riparian habitat and, where support structures are installed near the watercourse, may result in minor disturbance to the bed and banks.	The proposed activities may result in temporary disturbance of vegetation, soils and habitat within the ecological corridor during construction. If not appropriately managed, these disturbances could lead to localised erosion, sediment mobilisation and minor impacts on the ecological functioning of the watercourse. However, due to the lightweight design and elevated nature of the structure, long-term impacts on water flow are expected to be minimal.	o Restrict construction activities to the minimum footprint required. o Clearly demarcate the ecological corridor and all no-go areas prior to construction. o Utilise manual construction methods within sensitive areas where practicable. o Position support structures outside the active drainage path where feasible. o Minimise disturbance to the bed, banks and riparian vegetation of the watercourse. o Implement erosion and sediment control measures during construction. o Design the walkway to allow unobstructed passage of

Water Use Activity	Possible Cause Of Impacts Of The Activities To The Water Resource	Possible Impacts To The Water Resource And Other Water Users	Mitigation Measures
			stormwater flows beneath the structure. o Rehabilitate all disturbed areas with suitable indigenous vegetation upon completion of construction. o Regularly inspect and maintain the walkway to ensure its structural integrity and prevent environmental degradation.
S21 (g) Earthworks for installation of 20 small-scale wastewater package treatment plants, each serving a residential unit	Disturbance of land and soil during installation; potential accidental spillage of construction materials	Localised contamination of soil or nearby watercourses; short-term disturbance to vegetation and habitats	o Install package plants outside the recommended ecological buffer zones o Follow proper construction procedures to avoid spills o Limit soil disturbance and footprint of construction o Immediate clean-up of any accidental spills o Protect nearby watercourses with sediment control measures
Operational phase			
Section 21 (a) Lowering of groundwater levels (drawdown of water table)	Pumping of groundwater from the borehole for operational use	Decline in groundwater levels; potential reduced availability for other users; temporary ecological impacts	o Monitor groundwater levels according to the monitoring plan o Record pumped water volumes at production boreholes monthly o Record water levels monthly; reduce pumping if declining trends are observed until stabilized o Adhere to recommended yields and pumping cycles o Record rainfall readings

Water Use Activity	Possible Cause Of Impacts Of The Activities To The Water Resource	Possible Impacts To The Water Resource And Other Water Users	Mitigation Measures
Section 21 (a) Spread of groundwater contamination	Contaminants like stormwater, etc entering boreholes	Contamination of groundwater; reduced water quality for other users; potential health and ecological risks	o Design and install sewerage systems according to development demand o Maintain sewerage systems to prevent contamination o Divert stormwater away from abstraction boreholes o Line contamination sources (workshops, etc.) to prevent groundwater contamination o Conduct water quality sampling as specified in the monitoring requirements
S21(g) On-site treatment of wastewater (package plants and septic tanks)	Pollution of watercourse, groundwater, and coastline due to operation of on-site wastewater treatment systems	Deterioration of water quality in watercourse, groundwater, and coastal areas; potential minor ecological impacts	o The treated effluent water will be discharged to a soak-away as the surrounding sandy soil is very porous. o Place all septic tanks and package plants outside the 40 m ecological corridor o Inspect package plants, septic tanks, and soakaways at least annually to ensure proper functioning o Educate residents on appropriate use of household chemicals, detergents, and solvents to avoid impairing septic tank efficiency (e.g., avoid bleaches that destroy bacterial communities)

11. WATER DEMAND AND SUPPLY

The proposed development will comprise a total of 21 residential dwellings, with an estimated Annual Average Daily Demand (AADD) of 16.8 m³/day (equivalent to 6,312 m³/annum). Water for the development will be supplied from groundwater abstracted from borehole BH134C, located on Erf 134.

A comprehensive hydrogeological assessment, including a 48-hour pumping test undertaken in June 2020, was conducted to assess the productivity of the borehole and determine a sustainable abstraction rate. The results indicated that borehole BH134C has a sustainable yield of approximately 32.4 m³/day (equivalent to 11,826 m³/annum), which is substantially greater than the development's projected water demand. Even when provision is made for fire-fighting water requirements, increasing the total annual water demand to approximately 7,665 m³/annum, the demand remains well below the sustainable yield of the borehole. The assessment therefore confirmed that sufficient groundwater resources are available to sustainably supply the proposed development without adversely affecting the underlying aquifer.

To supplement the groundwater supply and promote water conservation, a rainwater harvesting system will also be incorporated into the development. Based on a Mean Annual Precipitation (MAP) of 430 mm/year, an average roof area of 215 m² per dwelling, and a collection efficiency of 80%, each residential unit is expected to harvest approximately 74 m³ of rainwater per annum. In addition, every dwelling will be equipped with a 5.0 m³ rainwater harvesting tank for the collection and storage of roof runoff, thereby reducing reliance on groundwater supplies and enhancing the overall water sustainability of the development.

12. PUBLIC PARTICIPATION

The public participation process is undertaken in accordance with Section 41(4) of the National Water Act, 1998 (Act No. 36 of 1998). The Water Use Licence application (WULA) Summary Report and its supporting appendices will be made available to the public, including adjacent landowners, relevant authorities, organs of state, and other interested and affected parties, for review and comment.

The 60-day public commenting period required for the Water Use Licence application process was divided into two 30-day phases to align with the public participation requirements of the NEMA Environmental Impact Assessment (EIA) Regulations, as the Water Use Licence application process is being undertaken concurrently with the Environmental Authorisation process.

The first 30-day public review period was undertaken as part of the pre-application Draft Basic Assessment Report (BAR) process conducted by PHS Consulting, the Environmental Assessment Practitioner (EAP) responsible for the NEMA application, from 12 November 2025 to 12 December 2025.

A second 30-day public commenting period will be undertaken as part of the Water Use Licence Application process, thereby completing the required 60-day public participation period.

The application was advertised in a local newspaper, and site notices containing details of the public participation process will be placed at or near the site. Following the commenting periods, all submissions received will be captured and addressed in a Comment and Response Report, compiled either as an appendix table or as a stand-alone document.

13. SECTION 27 OF THE NATIONAL WATER ACT, 1998 (ACT 36 OF 1998)

The requirements contained in Section 27(1) of the National Water Act, 1998 (Act 36 of 1998) have been considered and are discussed in the **Section 27 Motivation Report** attached as **Appendix E.**

APPENDICES

Appendix A: Site Development Plan (SDP)

Appendix B: Hydrogeological Study

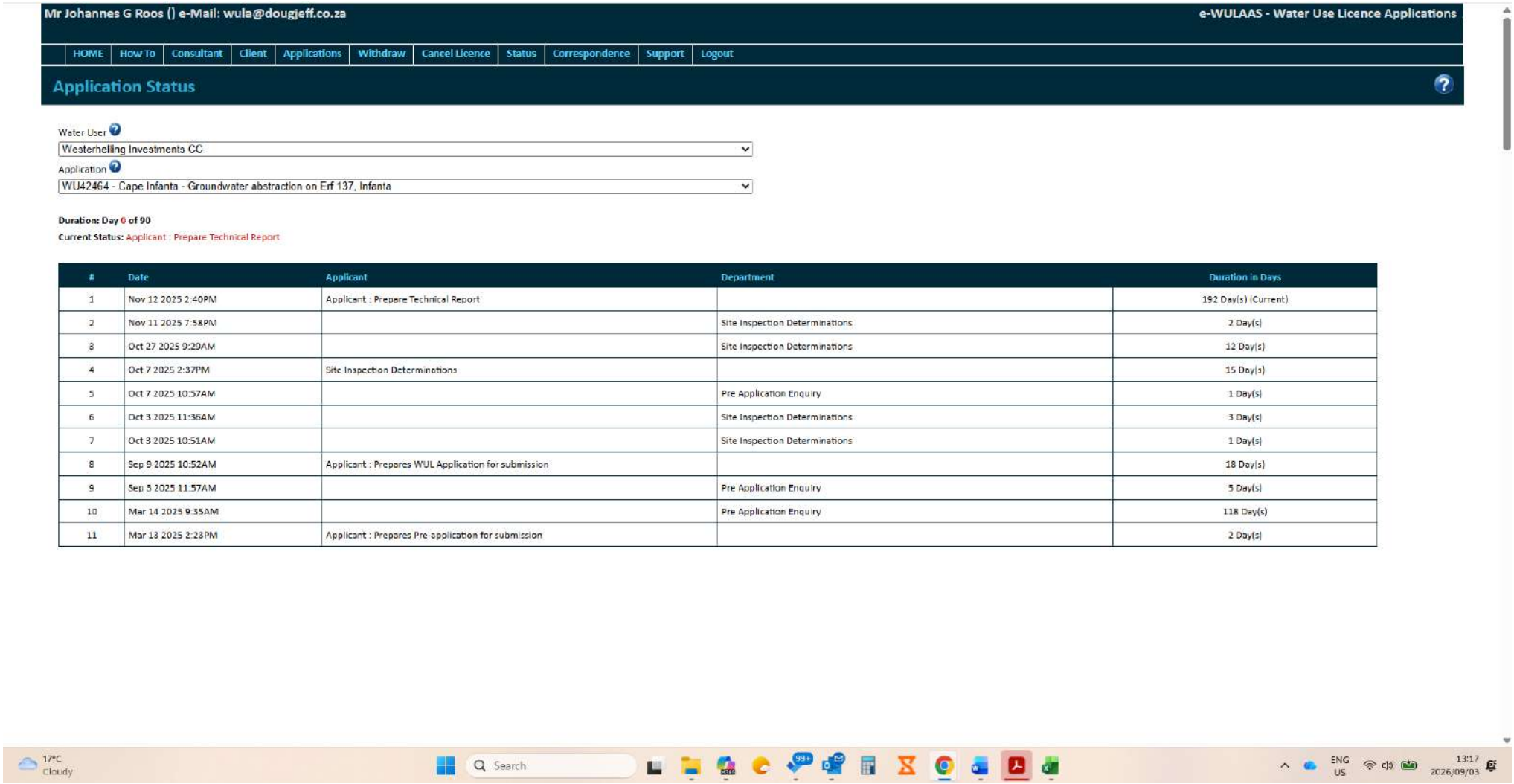
Appendix C: Freshwater Impact Assessment/Report

Appendix D: Civil Engineering Services Report

Appendix E: Section 27 Motivation Report

Appendix F: Method Statement for Section 21 (c) & (i) water use activities on Erf 134, Infanta

WULA Application Status



Mr Johannes G Roos () e-Mail: wula@dougjeff.co.za

e-WULAAS - Water Use Licence Applications

HOME | How To | Consultant | Client | Applications | Withdraw | Cancel Licence | Status | Correspondence | Support | Logout

Application Status

Water User

Westerhelling Investments CC

Application

WU42464 - Cape Infanta - Groundwater abstraction on Erf 137, Infanta

Duration: Day 0 of 90

Current Status: Applicant : Prepare Technical Report

#	Date	Applicant	Department	Duration in Days
1	Nov 12 2025 2:40PM	Applicant : Prepare Technical Report		192 Day(s) (Current)
2	Nov 11 2025 7:58PM		Site Inspection Determinations	2 Day(s)
3	Oct 27 2025 9:29AM		Site Inspection Determinations	12 Day(s)
4	Oct 7 2025 2:37PM	Site Inspection Determinations		15 Day(s)
5	Oct 7 2025 10:57AM		Pre Application Enquiry	1 Day(s)
6	Oct 3 2025 11:36AM		Site Inspection Determinations	3 Day(s)
7	Oct 3 2025 10:51AM		Site Inspection Determinations	1 Day(s)
8	Sep 9 2025 10:52AM	Applicant : Prepares WUL Application for submission		18 Day(s)
9	Sep 3 2025 11:57AM		Pre Application Enquiry	5 Day(s)
10	Mar 14 2025 9:35AM		Pre Application Enquiry	118 Day(s)
11	Mar 13 2025 2:23PM	Applicant : Prepares Pre-application for submission		2 Day(s)

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WATER USE LICENCE APPLICATION
SUMMARY REPORT

ERF 134, INFANTA

APPENDIX A

Site Development Plan (SDP)

KEY

- Erf Boundary Line
- Water Pipe Line
- HWM
- Development Setback Line
- Coastal Management Line
- 8m Landscape Strip
- 5m road reserve
- 1m Building Setback Line
- Water Hydrant
- Storm water catchpit and gabion mattress
- Lime Stone Fynbos Conservation Area (No-go zone)
- Ecological Corridor
- Servitude

Right of Way Servitude over a portion of Private Road to Erf 201 Infanta for Parking purposes

Servitude Right of Way 7,87m wide

Proposed disabled friendly walkway inside Public Open Space

Development Setback Line

Indian Ocean

24 Natural Environment Zone **3 143 m²**

23 Natural Environment Zone **3 472 m²**

23 Natural Environment Zone **4 650 m²**

26 Utility Zone (refuse)

27 Private Road Transport Zone

28 Private Road Transport Zone **236 m²**

29 Public Road - MR268 Transport Zone (to be transfered to Western Cape Roads Department)

25 Private Open Space (pedestrian access) 1m wide

Public Open Space (Access for Public)

4,00m road

8,00m road

8,00m road (existing access)

Existing store

Existing Garage

Existing graai

Existing grave

Existing Main House

Existing Water Reservoir

Water hydrant

2m Walkway

Drainage Line

20m

Stormwater servitude 2,00m

8m Landscaping strip

5m Road Reserve Line

X: 3810100.000

Infanta Township

	Alternative 3 (m²)	Alternative 4 (m²)
Plot no. 1	351 m²	608 m²
Plot no. 2	483 m²	583 m²
Plot no. 3	409 m²	508 m²
Plot no. 4	441 m²	508 m²
Plot no. 5	498 m²	592 m²
Plot no. 6	437 m²	675 m²
Plot no. 7	465 m²	551 m²
Plot no. 8	429 m²	643 m²
Plot no. 9	1468 m²	1582 m²
Plot no. 10	596 m²	595 m²
Plot no. 11	551 m²	583 m²
Plot no. 12	542 m²	579 m²
Plot no. 13	661 m²	715 m²
Plot no. 14	324 m²	571 m²
Plot no. 15	412 m²	547 m²
Plot no. 16	548 m²	502 m²
Plot no. 17	458 m²	500 m²
Plot no. 18	500 m²	507 m²
Plot no. 19	849 m²	907 m²
Plot no. 20	379 m²	520 m²
Plot no. 21	504 m²	630 m²

0m 10 20 30 40 50 60 70 80 90 100
Bar Scale

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ARCHITECT:

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GOSZTOLA ARCHITECTS

JOB NO: 5005

PROJECT: Luz de Lua
Light Of The Moon

ERF 134

Portion of Erf 134
Situated at Infanta

DESCRIPTION: Site Development Plan (SDP)

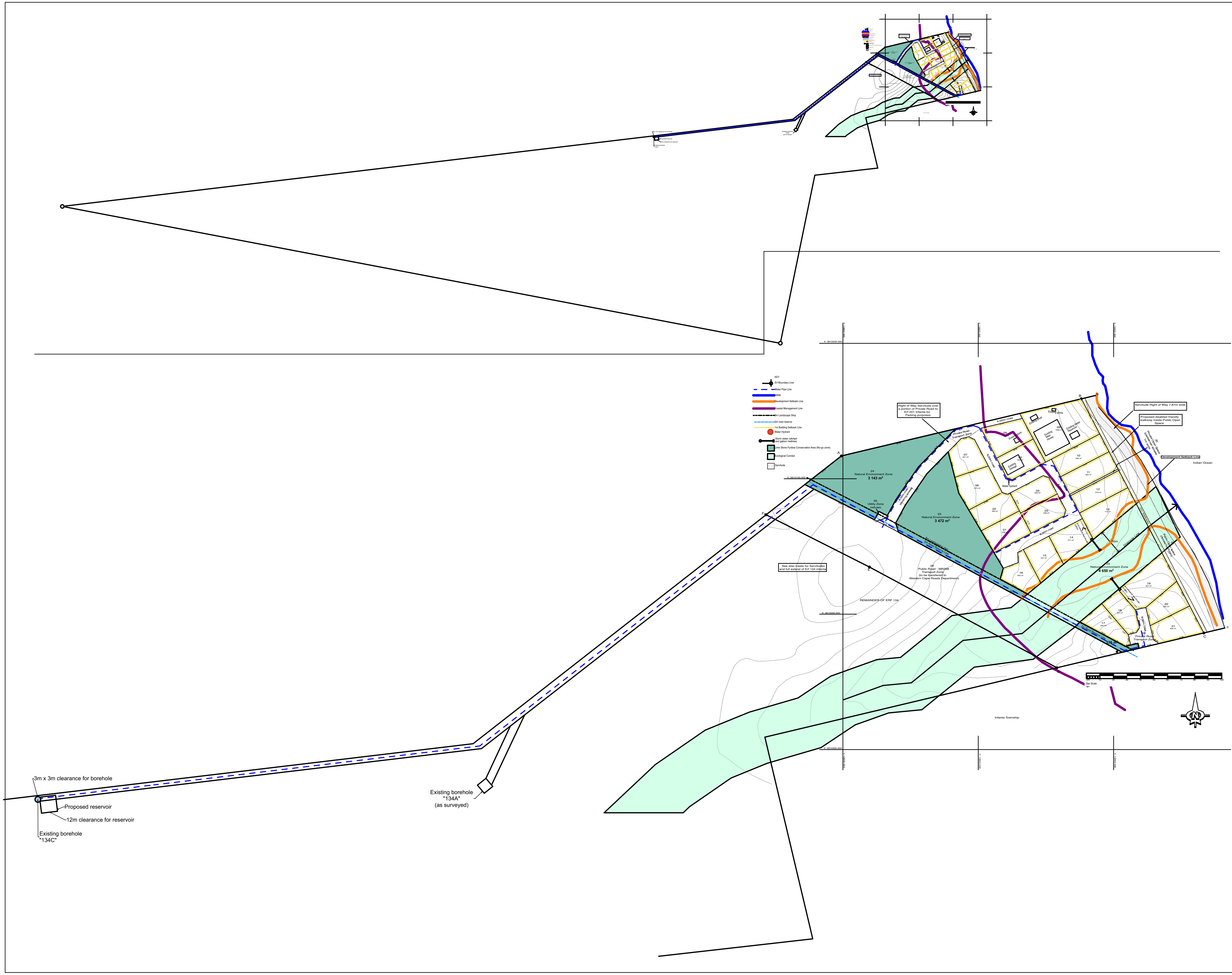
SCALES: 1:1000

PURPOSE: INFORMATION

DRAWN:	CHECKED:
TE	IG

ISSUED: 2026-09-01

DWG NO:	REVISION:
Diagram 01	11



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11. All dimensions and levels to be checked on site prior to commencement of work. Any queries to be forwarded timeously to the architect.

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GOSZTOLA ARCHITECTS

JOB NO: 5005

PROJECT: Luz de Lua
Light Of The Moon

ERF 134

Portion of Erf 134
Situated at Infanta

DESCRIPTION

Site Development Plan
(SDP- Borehole)

SCALES: 1:10000/1:2500

PURPOSE:

DRAWN: TE	CHECKED: IG
ISSUED:	2026-09-02
DWG NO: Diagram 02	REVISION: 07

WATER USE LICENCE APPLICATION
SUMMARY REPORT

ERF 134, INFANTA

APPENDIX B

Hydrogeological Study

Consulting Environmental Scientists

ISO 9001:2015 | B-BBEE Level Two

www.gptglobal.com

Department:

Inorganic Business Unit

Project Name:

Hydrogeological Update for the Infanta Development

Client:

Doug Jeffery Environmental Consultants

GPT Ref No:

DJINF-26-14645

Version:

DRAFT

Offices in: Gauteng, Western Cape, KwaZulu-Natal & Mozambique

Report Type:	Hydrogeological Study for Water Use Licence Application
Project Title:	Hydrogeological Update for the Infanta Development
Site Name:	Infanta
Site Location:	Infanta, Western Cape
Compiled For:	Doug Jefferies Consulting (Pty) Ltd
Compiled/ Updated By:	Mr H.C. Dreyer, Ms C Schmidt
GPT Reference:	DJINF-26-14645
Client Reference:	N/A
Version:	DRAFT
Date:	August 2026
Distribution List (Current Version):	Mr Lian Roos
Reviewed by:	Marius Terblanche

Disclaimer:

The results and conclusions of this report are limited to the Scope of Work agreed between GEM-GPT and the Client for whom this investigation has been conducted. All assumptions made and all information contained within this report and its attachments depend on the accessibility to and reliability of relevant information, including maps, previous reports and word-of-mouth, from the Client and Contractors.

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- I have no bias with regard to this project or towards the various stakeholders involved in this project.
- I have not received, nor have I been offered, any significant form of inappropriate reward for compiling this report.



(*electronic signature)*

H.C. Dreyer, B.Sc. Hons; Pr. Sci. Nat (138930)



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M. Terblanche, MSc. Pr.Sci.Nat. Professional Natural Scientist (No 400081/17)**Geo Pollutions Technology – Gauteng (Pty) Ltd –GPT office: Pretoria**



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C. Schmidt; MSc; Pr.Sci.Nat (118749)

Customer Satisfaction:

Feedback regarding the technical quality of this report (i.e. methodology used, results discussed and recommendations made), as well as other aspects, such as timeous completion of project and value of services rendered, can be posted onto GPT's website at www.gptglobal.com.

EXECUTIVE SUMMARY

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed by Doug Jeffery Environmental Consultants (Pty) Ltd to undertake a hydrogeological study in support of the proposed Infanta Development and the associated water use licence application. The proposed development is located in Infanta, near Witsand in the Western Cape, and comprises 20 new residential dwellings together with an existing dwelling.

The study was undertaken to assess the local hydrogeological conditions, groundwater availability and quality, aquifer characteristics and vulnerability, and the potential impact of the proposed residential development. The assessment further considered the sustainable groundwater yield of the proposed abstraction borehole and provided recommendations for groundwater management and monitoring.

The site is underlain predominantly by sandy soils and the Table Mountain Group, including the Skurweberg and Rietvlei Formations, with the Robberg Formation of the Uitenhage Group also occurring regionally. The local aquifer is structurally controlled, with groundwater occurrence and movement associated primarily with fractures, joints and other secondary features within the competent sandstone formations.

A hydrocensus identified seven operational boreholes and two springs within 1 km of the site. Groundwater levels measured during the investigation ranged from 3.60 to 5.04 m below ground level (mbgl), with an average groundwater level of 4.35 mbgl. The general groundwater flow direction is towards the northeast, in the direction of the ocean. Groundwater quality sampling indicated exceedances of selected parameters relative to the SANS 241-1:2025 drinking water standard, indicating that groundwater at the site is not consistently suitable for potable use without prior treatment.

A stepped discharge test, constant discharge test and recovery monitoring were undertaken on borehole 134C. Based on the available test data and sustainable yield assessment, the borehole can support an abstraction rate of approximately 32.4 m^3/day, equivalent to approximately 11 826 m^3/year if abstracted continuously at this rate.

The proposed development has an estimated water demand of approximately 6 132 m^3/year, which is below the calculated General Authorisation allowance of 12 975 m^3/year. The proposed abstraction therefore falls within the calculated General Authorisation volume. Furthermore, the estimated sustainable yield of borehole 134C (11 826 m^3/year) exceeds the anticipated annual water demand, indicating that the proposed groundwater source has sufficient estimated capacity to meet the development's water requirements, subject to the applicable regulatory requirements and implementation of the recommended abstraction and monitoring controls.

Domestic wastewater generated by the proposed development will be managed through individual package wastewater treatment plants, with one treatment unit serving each of the 20 new residential dwellings. Treated effluent will be discharged to soakaways. Given the permeable sandy soils and relatively shallow groundwater levels, the treated wastewater represents a potential source of groundwater contamination and should therefore be appropriately managed and monitored. Regular servicing and maintenance of the package treatment plants, inspection of the associated soakaways, monitoring of the surrounding groundwater quality are recommended.

Recommendations:

The following actions are recommended to be implemented during the construction and the operational phases:

- Groundwater quality exceedances the SANS 241 drinking water standards indicating that the groundwater at the site is not suitable for use as potable water without prior treatment. The exceedances in total coliforms can be addressed by improving sanitation systems and ensuring human or animal wastes are properly disposed of.
- The monitoring as recommended in the report should be established prior to operation. The water level monitoring should be conducted weekly for the first three months of operation and if no significant water level decline is observed, the monitoring can be conducted on a monthly basis. Alternatively, automatic water level measurement in the form of pressure transducers can be installed to aid in this process. Logs of flow meter readings should also be kept and the flowmeter should also be read once per month.
- Seawater intrusion may become a concern during extended abstraction periods and should be monitored.
- Maintenance and regular servicing of the individual package wastewater treatment plants and associated soakaways to ensure effective treatment and disposal of domestic wastewater.
- Installation of a rainfall gauge and maintenance of an electronic database containing groundwater levels, abstraction volumes, rainfall and groundwater-quality data.
- The recommended pump cycle for the borehole is 12 hours per day. If the pump cycle is to be extended, the maximum daily volume for each borehole must not be exceeded and the pumping rate must be reduced to sustainable rates. Refer to management recommendations in Table 22.
- It is recommended that the hydrocensus be repeated once every 2 years to ensure that no new groundwater users are affected. The hydrocensus should extend to a 1km radius around the site boundary.
- The regional groundwater table must be maintained to:
    - Ensure that schedule 1 water users adjacent to the site have adequate water supply to basic human need.
    - Ensure that adequate water is available to maintain base flow in the tributaries of the Breede River.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
EC	Electrical Conductivity
km^2	Square kilometre
L/s	Litres per second
GRDM	Groundwater Resource Directed Measures
mamsl	Metres above mean sea level
Mm^3/a	Milicubes per year
m	metre
mm	Millimetre
mm/a	Millimetres per annum
mS/m	Millisiemens per metre
m^3	Cubic metre
MAP	Mean Annual Precipitation
NWA	National Water Act (Act No. 36 of 1998)
RDM	Resource Directed Measures
RQO	Resource Quality Objective
TDS	Total Dissolved Solids
WMA	Water Management Area
WMP	Water Management Plan

DEFINITIONS

Definition	Explanation
Aquifer	A geological formation which has structures or textures that hold water or permit appreciable water movement through them. Source: National Water Act (Act No. 36 of 1998).
Borehole	Includes a well, excavation, or any other artificially constructed or improved underground cavity which can be used for the purpose of intercepting, collecting or storing water in or removing water from an aquifer; observing and collecting data and information on water in an aquifer; or recharging an aquifer. Source: National Water Act (Act No. 36 of 1998).
Drawdown	The distance between the static water level and the surface of the cone of depression.
Fractured Aquifer	An aquifer that owes its water-bearing properties to fracturing.
Groundwater	Water found in the subsurface in the saturated zone below the water table.
Groundwater Flow	The movement of water through openings in sediment and rock; occurs in the zone of saturation in the direction of the hydraulic gradient.
Hydraulic Conductivity	Measure of the ease with which water will pass through the earth's material; defined as the rate of flow through a cross-section of one square metre under a unit hydraulic gradient at right angles to the direction of flow (m/d).
Intergranular Aquifer	A term used in the South African map series referring to aquifers in which groundwater flows in openings and void spaces between grains and weathered rock.
Monitoring	The regular or routine collection of groundwater data (e.g. water levels, water quality and water use) to provide a record of the aquifer response over time.
Observation Borehole	A borehole used to measure the response of the groundwater system to an aquifer test.
Production Borehole	A borehole specifically designed to be pumped as a source of water supply.
Recharge	The addition of water to the saturated zone, either by the downward percolation of precipitation or surface water and/or the lateral migration of groundwater from adjacent aquifers.
Transmissivity	Transmissivity is the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is expressed as the product of the average hydraulic conductivity and thickness of the saturated portion of an aquifer.
Unsaturated Zone (Also Termed Vadose Zone)	That part of the geological stratum above the water table where interstices and voids contain a combination of air and water.
Watershed (Also Termed Catchment)	Catchment in relation to watercourse or watercourses or part of a watercourse means the area from which any rainfall will drain into the watercourses or part of a watercourse through surface flow to a common point or points. Source: National Water Act (Act No. 36 of 1998).
Water Table	The upper surface of the saturated zone of an unconfined aquifer at which pore pressure is equal to that of the atmosphere.

HYDROGEOLOGICAL STUDY

INFANTA

1 INTRODUCTION

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed by Doug Jefferies Consulting (Pty) Ltd to update a hydrogeological study for a proposed residential development. The proposed development comprises 21 residential dwelling units, consisting of 20 new residential dwellings and one existing dwelling. Each of the 20 new dwellings will be serviced by an individual package wastewater treatment plant, while the existing dwelling will continue to utilise its existing septic tank system. The proposed development will be supplied with water through a dual-source water supply system comprising groundwater abstracted from Borehole 134C and rainwater harvesting.

The report is structured according to the requirements of the National Water Act, 1998 Regulations regarding the procedural requirements for water use licence applications and appeals 24 March 2017, Act No. R. 267.

The following water uses were investigated:

- Section 21(a) of the Act: Taking water from a water resource.
- Section 21(g) of the Act: Disposing of waste in a manner which may detrimentally impact on a water resource.

2 SCOPE OF WORK

Within the scope of work included:

- Hydrocensus within a 1 km radius;
- Groundwater quality assessment;
- Aquifer classification and vulnerability assessment;
- Determination of sustainable yield of water supply borehole;
- Reserve determination; and
- Risk assessment.

3 Project Background and Description

It is proposed to rezone a portion of Erf 134, Infanta, from Agricultural Zone to Subdivisional Area in terms of Section 15(2)(a) of the Swellendam Municipal Planning By-law (November 2020). This rezoning will allow for the establishment of a residential development. Each unit in the residential development will require potable water and sanitation. As the proposed development involves water-related infrastructure and activities that constitute a water use in terms of the National Water Act (Act No. 36 of 1998), a Water Use Licence application was submitted to the Department of Water and Sanitation to obtain the necessary authorisation.

The proposed development comprises 20 new single residential erven together with the existing dwelling on the property, resulting in a total of 21 residential dwelling units. A total of 15 single-storey and 5 double-storey dwellings are proposed, while the existing reservoir, dwelling, braai area and grave will be retained.

Vehicular access will be obtained via the existing access from Main Road (MR268) serving the northern portion of the development, while the five (5) residential erven south of the watercourse will be accessed via Hoek Street. Internal roads will comprise 8 m road reserves accommodating 4.5 m wide paved carriageways with associated stormwater infrastructure.

The proposed development will be supplied with water through a dual-source water supply system comprising groundwater abstracted from Borehole 134C and rainwater harvesting. Groundwater abstracted from the borehole will be stored within a proposed 140 m^3 reservoir located adjacent to the existing borehole infrastructure before being conveyed to the development by means of a proposed 125 mm bulk water main, crossing MR268 via a steel sleeve under a registered servitude. Each residential dwelling will further be equipped with a 5 m^3 rainwater harvesting tank to supplement domestic water supply.

Domestic wastewater generated by the proposed development will be managed by means of individual on-site package wastewater treatment plants, with one treatment unit allocated to each residential dwelling. The activated sludge treatment systems are designed to produce treated effluent complying with the Department of Water and Sanitation (DWS) General Standards. The treated effluent water will be discharged to soakaways.

Stormwater generated by the development will be managed through an integrated stormwater management system incorporating rainwater harvesting, landscaped swales, underground soakaways and controlled discharge via engineered stormwater infrastructure. The proposed development has been designed to avoid the mapped 1:100-year flood line by retaining a 40 m ecological corridor (20 m buffer from centreline) associated with the on-site watercourse, thereby limiting potential impacts on surrounding freshwater resources.

4 METHODOLOGY

4.1 Desk Study

This entailed the gathering of information through the collation, scrutiny and evaluation of available and relevant meteorological, geographical, geological, hydrogeological and water quality data.

4.2 Hydrocensus

A hydrocensus was conducted within a 1km radius of the site boundary to gather data of legitimate groundwater users in the area.

5 GEOGRAPHICAL SETTING

5.1 Site Location, Topography and Drainage

The site is located near Witsand, in the Western Cape. (Figure 1).

The area (shown in Figure 2) is characterised by a gently undulating topography and in the area of the site the slope is more or less in the order of 3% (0.03).

Locally drainage is towards the Indian Ocean as well as the Breede River that flows from northwest to southeast to the north of the site.

The site development plan is shown in Figure 3.

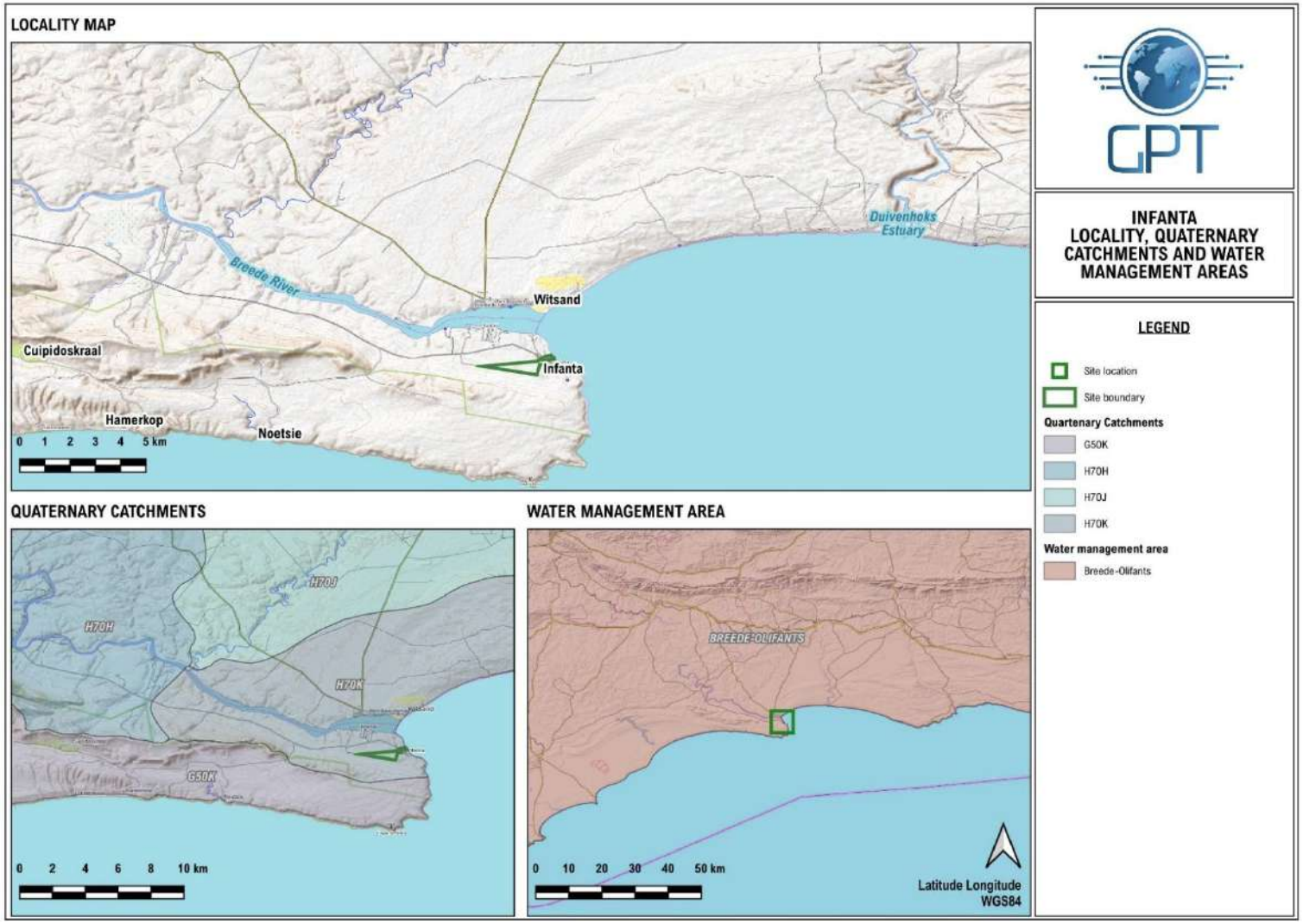


Figure 1: Site Location and Quaternary Catchment Boundaries.

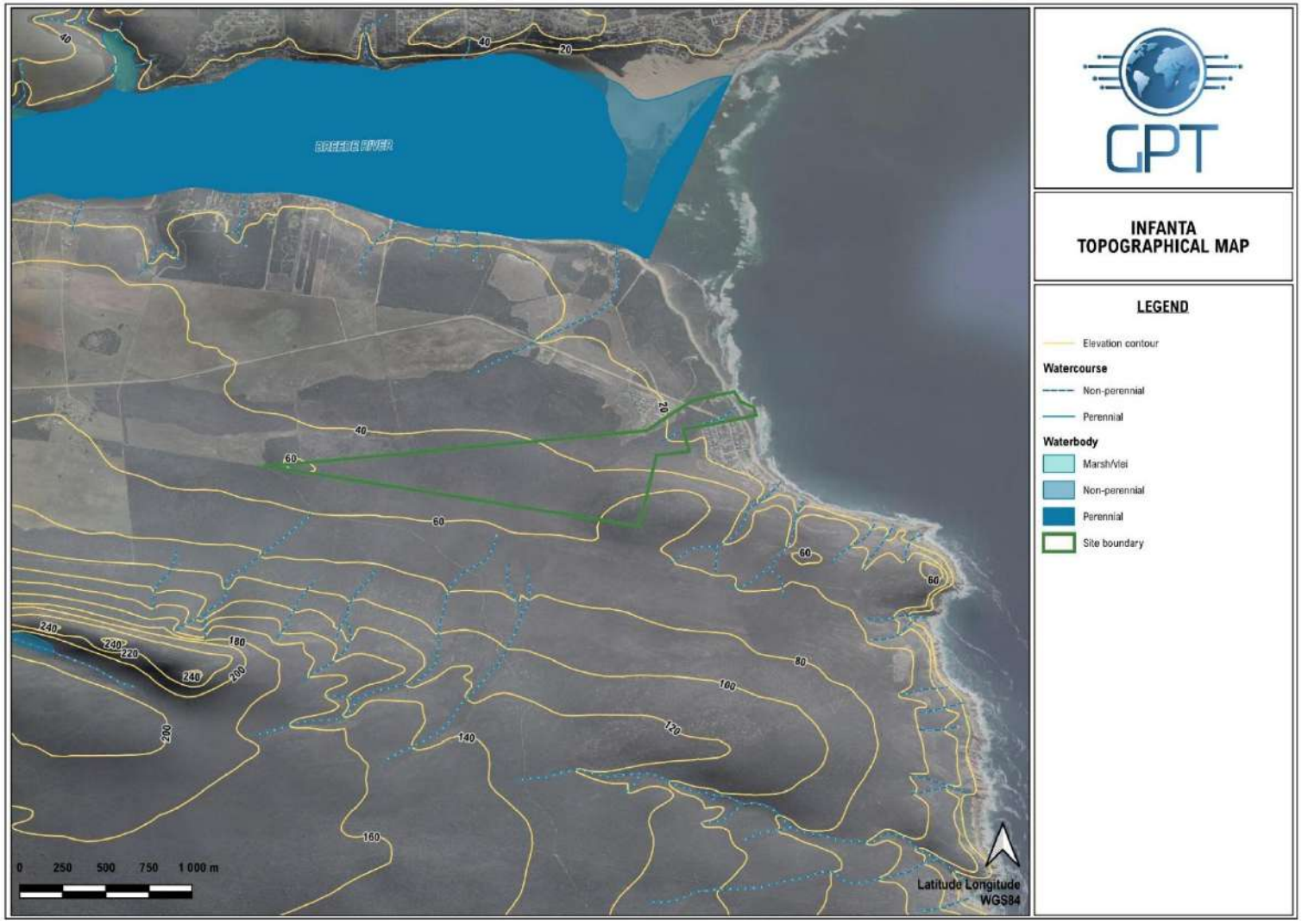


Figure 2: Site Topography.



Figure 3: Site Development Plan.

5.2 Climate

Climatic data was obtained from the GRDM V4.0 database as developed by the DWA and FET Water[1]. The average annual rainfall is approximately 458mm/a.

6 PREVAILING GROUNDWATER CONDITIONS

6.1 Geology

6.1.1 Regional Geology

The investigated area falls within the 1:250 000 series geology map (3420 Riverdale). An extract of this map is shown in Figure 4. According to the map the site is underlain by light grey to red sandy soil and calcrete with alluvium deposits to the coastline. Furthermore, the underlying geology in the region consists of the Skurweberg Formation as well as the Rietvlei Formation of the Nardouw Subgroup, Table Mountain Group, as well as the Robberg Formation of the Uitenhage Group. The Skurweberg Formation mainly comprises of light grey quarzitic sandstone. The Rietvlei Formation consists of light grey feldspathic sandstone with occasional thin siltstone and shale beds. The Robberg Formation consists of silicified sandstone and conglomerate. These formations all strike in an east west direction with a northward dip of between 30 and 40 degrees.

6.1.2 Local Geology

Based on the published data and the Parsons (2006) report[2], the site is underlain by Quaternary soil with unknown thicknesses. Underneath these recent sediments the Rietvlei and Skurweberg Formations of the Table Mountain Group can be found. The latter formation is regarded as an extensive aquifer that could support large scale abstraction. However, the 1:250 000 series maps are not detailed enough to accurately represent the geology of the site as it is evident that the site is underlain by the shales of the Bokkeveld Group. Outcrops of the Bokkeveld geology can be seen along the shoreline of the property, where it underlies the younger conglomerate and calcrete lithologies found at the site.

6.2 Hydrogeology

6.2.1 Regional Hydrogeology

According to the 1:500 000 hydrogeological map (3317 Cape Town), the site is underlain by a fractured aquifer. The mean yield for a successful borehole in this aquifer is between 0.5 and 2 l/s and this was confirmed by previous reports that included drilling of a new borehole. The previous work by Parsons and Associates (2006) estimates the sustainable yield from 134A at 0.7 l/s when pumped for 12 hours a day, with 134C yielding 1 l/s when pumped for 18 hours a day.

As the Bokkeveld Group overlies the Table Mountain Group, the hydrogeology of the Table Mountain Group (TMG), could be relevant at deeper depths. According to Meyer[3], the TMG notably the often fractured arenaceous components, is largely anisotropic and thus does not display uniform aquifer characteristics. An intricate network of fissures, joints, fractures and even cavities govern the

[1] Groundwater Reserve Directed Measured. Department of Water Affairs (2010), developed by FetWater.

[2] Parsons, 2006. Geohydrological Assessment of the Planned Development at Erf 124, Infanta. Parsons and Associates.

[3] Meyer P.S (2001), An explanation of the 1:500 000 general hydrogeological map Cape Town 3317

infiltration, storage and transmission of groundwater in the largely competent and brittle natured arenaceous units of the TMG. The TMG generally constitutes the mountainous areas which, in turn influence precipitation to a significant extent. An abundance of springs is a further characteristic of the TMG. Three kinds of springs can be distinguished:

1. Fault and major structure controlled, generally deep circulating springs, often with large constant supplies

2. Lithologically controlled, relatively shallow circulating springs. These springs issue due to the presence of impeding shale layers such as the Cederberg Shale Formation. Yields from these springs are less constant and seasonal yield fluctuations are a distinctive feature. The bulk of the perennial springs issuing from the TMG are likely to be lithologically controlled.

3. Springs are seeping from numerous small fractures and joints. They are very evident during and shortly after rainy periods and are responsible for the myriad of springs in the TMG. They are however highly seasonal and cease to exist with the onset of dry weather conditions.

The quality of groundwater from the TMG is excellent with electrical conductivity (EC) generally ranging between 5 and 70mS/m. However, groundwater with EC of up to 180mS/m can occasionally be procured from boreholes drilled into interbedded shaly layers. Groundwater is generally of a sodium chloride nature.

In the case of the Bokkeveld Group which is found predominantly at the site, the groundwater found within this lithology is generally poor in terms of high TDS[4] and typically has EC values between 70-300 mS/m. The groundwater found in this unit at Cape Infanta has been found to be moderately saline with EC values between 133-222 mS/m, which has been attributed to possible marine influence[5].

6.2.2 Local Hydrogeology

The previous work by Parsons and Associates (2006) estimates the sustainable yield from 134A at 0.7 l/s when pumped for 12 hours a day, with 134C yielding 1 l/s when pumped for 18 hours a day. These yields are aligned with the published information and support the statement in the Parsons and Associates report that the initial pumping tests that indicated 5 l/s yields were an overestimation.

Following a request from the then Breede Overberg Catchment Management Agency (BOCMA) in 2014, a 72-hour pumping test was conducted on borehole 134C to determine the sustainable yield. A stepped discharge test was conducted to determine the required pumping rate for a constant discharge test. The first step was pumped at 0.32 l/s for one hour yielding a drawdown of 4.9 m. The second step was pumped at 0.78 l/s and resulted in a final drawdown of 20.81 m, while the third step was conducted at 1.48 l/s with a final drawdown of 56.03 m after another hour. The 72-hour constant discharge test was then conducted at a pumping rate of 0.92 l/s.

The data was analysed using the FC method as detailed in the update of 18 August 2014. The average sustainable yield was determined to be 0.29 l/s for pumping 24 hours per day every day for 100 years. This is regarded as being a very conservative approach, since the use of the borehole is likely to be seasonal. The sustainable conservative yield of the borehole is calculated to be 25000 l/day. For the

[4] Hartnady, C.J.H. and Jones, M.Q.W., 2007. Geothermal studies of the Table Mountain Group aquifer systems. Water Research Commission, Report, (1403/1), p.07.

[5] Papini G, 2002. Groundwater Assessment for the Breede River Basin Study. Department of Water Affairs and Forestry.

best case scenario the yield goes up to 48 000 l/day. This relates to between 750 and 1 440 m^3/month. The development is designed to use 690 m^3/month. This test once again shows that sufficient water is available in borehole 134C for the whole development, without using borehole 134A.

Using the proposed pumping rates the sustainable yield exceeds the required 23 m^3/day requirement as stated by Fraser (2014). The current proposal is to use 134C, since this borehole will have sufficient yield for the planned 21 units and it is situated further away from any other groundwater users.

The Parsons (2006) report estimated the use of groundwater in the vicinity of the proposed development to be 15 300 m^3/a. The harvest potential for Erf 134 was calculated as 48 700 m^3/a. Using the reported harvest potential and a 2 km radius around the site an approximate 4 km^2 is available and this would equate to 226 400 m^3/a being available through the groundwater resource in the area.

Parsons (2006) cites a 1999 study by Toens and Partners recorded 37 boreholes in Infanta Village but found no threat due to saline intrusion at the time of the study. Bacteriological contamination was only observed where TMG rock outcrops were found. Water quality was found to be acceptable for human consumption with EC levels ranging from 170 to 220 mS/m.

6.3 Groundwater Recharge Calculations

Recharge to the shallow, unconfined aquifer was calculated using the RECHARGE program developed by the Institute for Groundwater Studies at the University of the Free State, South Africa. The calculated recharge excluded the recharge indicated by the soil information and the geology and Vegter maps due to the low uncertainty; the recharge percentage equates to approximately 3.1%.

Table 1: Recharge calculation for the aquifer.

Recharge Estimation			
Method	**mm/a**	**% of rainfall**	**Certainty (Very High = 5; Low = 1)**
Soil	126.0	29.4	1
Geology	33.9	7.9	2
Vegter	32.0	7.5	2
Acru	15.0	3.5	4
Harvest Potential	12.0	2.8	4

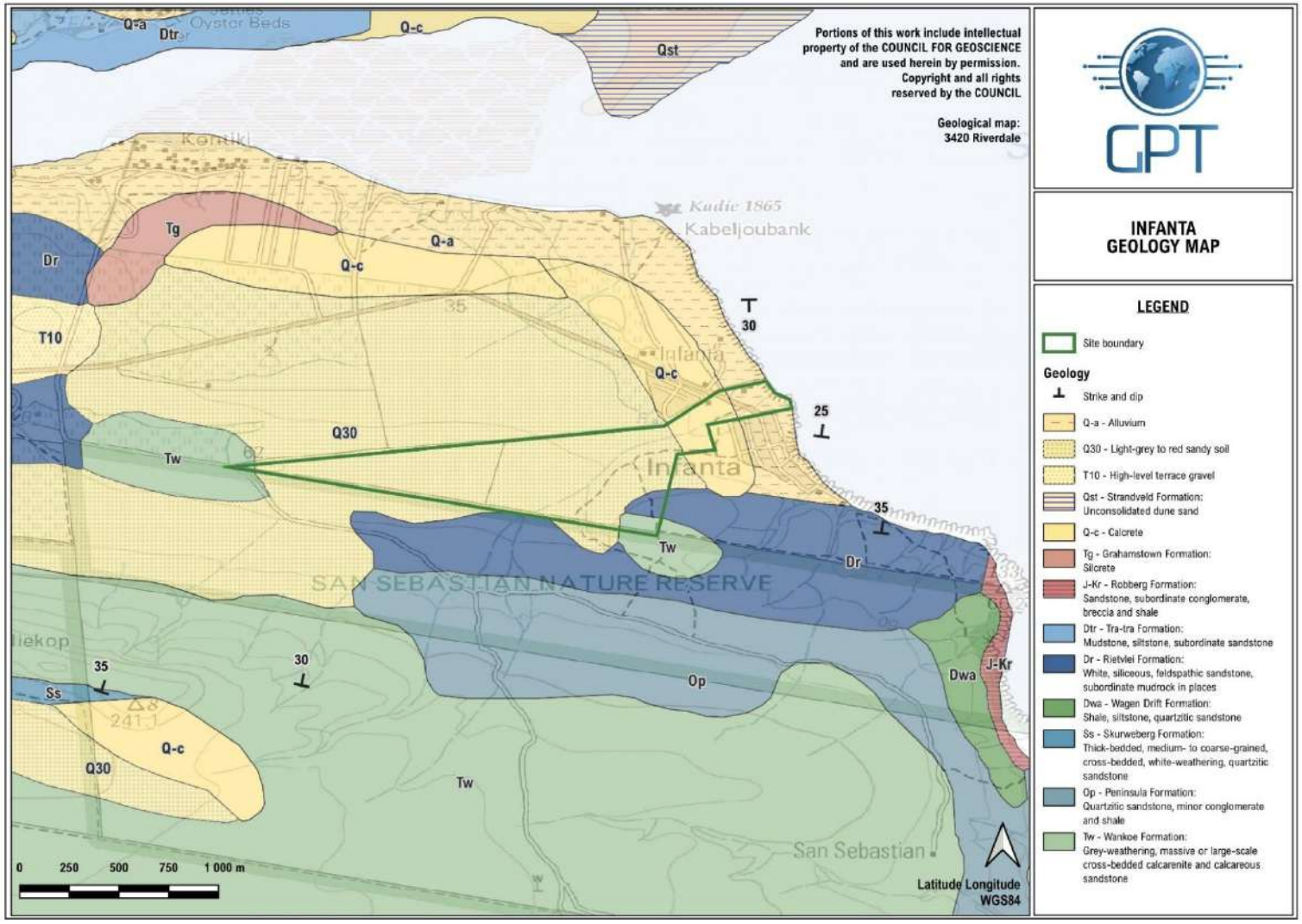


Figure 4: Regional Geology Map (1:250 000 geology series map).

7 Hydrocensus

7.1 Hydrocensus Findings and Groundwater Flow Direction

A hydrocensus was conducted on the 28 & 29th of July 2025 within a 1km radius form the property boundary. Seven (7) operational boreholes were located as well as two (2) springs. The majority of homeowners in Infanta village was not home during the hydrocensus and a number of residents use rainwater as a water supply for domestic use. A summary of the field data is presented in Table 2 below. The hydrocensus data is also plotted on a map presented in Figure 5.

The hydrocensus recorded an average groundwater level of 4.35 m below ground level (mbgl), with measured depths ranging from 3.60 mbgl to 5.04 mbgl. In addition, two free-flowing springs were identified. One spring was heavily overgrown and inaccessible for direct measurement, while another could only be visually confirmed. It is possible that these springs represent artesian discharges resulting from historical drilling into a confined aquifer with a high-pressure head; however, this could not be confirmed. Regional hydrogeological data indicate the natural occurrence of springs in the area, and the observed features may also be attributed to these natural conditions.

A groundwater flow direction map was created from the boreholes and can be seen in Figure 6. The general groundwater flow direction at Infanta is towards the northeast, in the direction of the ocean, while groundwater flow further inland is generally towards the north.

Table 2: Details of the hydrocensus boreholes.

New Label	LONGITUDE	LATITUDE	Owner	WL (mbcl)	Collar	WL (mbgl)	Pump Installed	Water use	Notes
BH05	20° 50' 55.8096" E	34° 25' 12.3060" S	Infant Park	4.51	0.15	4.36	Submersible	Domestic & Garden	Supplies Infanta Park with water, up to 18 families.
BH06	20° 50' 55.4644" E	34° 25' 12.1548" S	Infant Park	3.71	0.11	3.6	Submersible	Domestic, Garden, Livestock & Agriculture	Water also sold to municipality for ablutions
BH07	20° 51' 17.9658" E	34° 25' 15.6952" S	Sea Cottage Trust	-	-	-	Submersible	Garden	No Access through pump capping.
BH08	20° 51' 17.6683" E	34° 25' 16.3768" S	Ika van Niekerk	4.81	-0.23	5.04	No pump	No Use	No pump installed
BH09	20° 51' 16.4459" E	34° 25' 12.2236" S	Unknown	4.2	-0.23	4.43	Submersible	Unknown	Permission granted for data gathering from neighbour
BH10	20° 51' 10.4005" E	34° 25' 13.4005" S	Elsa	-	-	-	Submersible	-	Could not collect data, nobody home, BH seen from the fence
BH134C	20° 50' 40.03" E	34° 25' 14.84" S	Mark De Agrella	11.07	0.3	10.77	No pump	Proposed Domestic Use Supply	Test pumped in June 2020.
BH11	20° 50' 57.0156" E	34° 25' 15.8592" S	Abandoned borehole, blocked @ 1.5mbgl						
BH134A	20° 50' 57.0624" E	34° 25' 14.3040" S	No Access (pump house locked) & Owner not present						
SP01	20° 51' 10.3680" E	34° 25' 20.1468" S	Artesian Well						
SP02	20° 51' 26.0136" E	34° 25' 25.9140" S	Artesian Well						

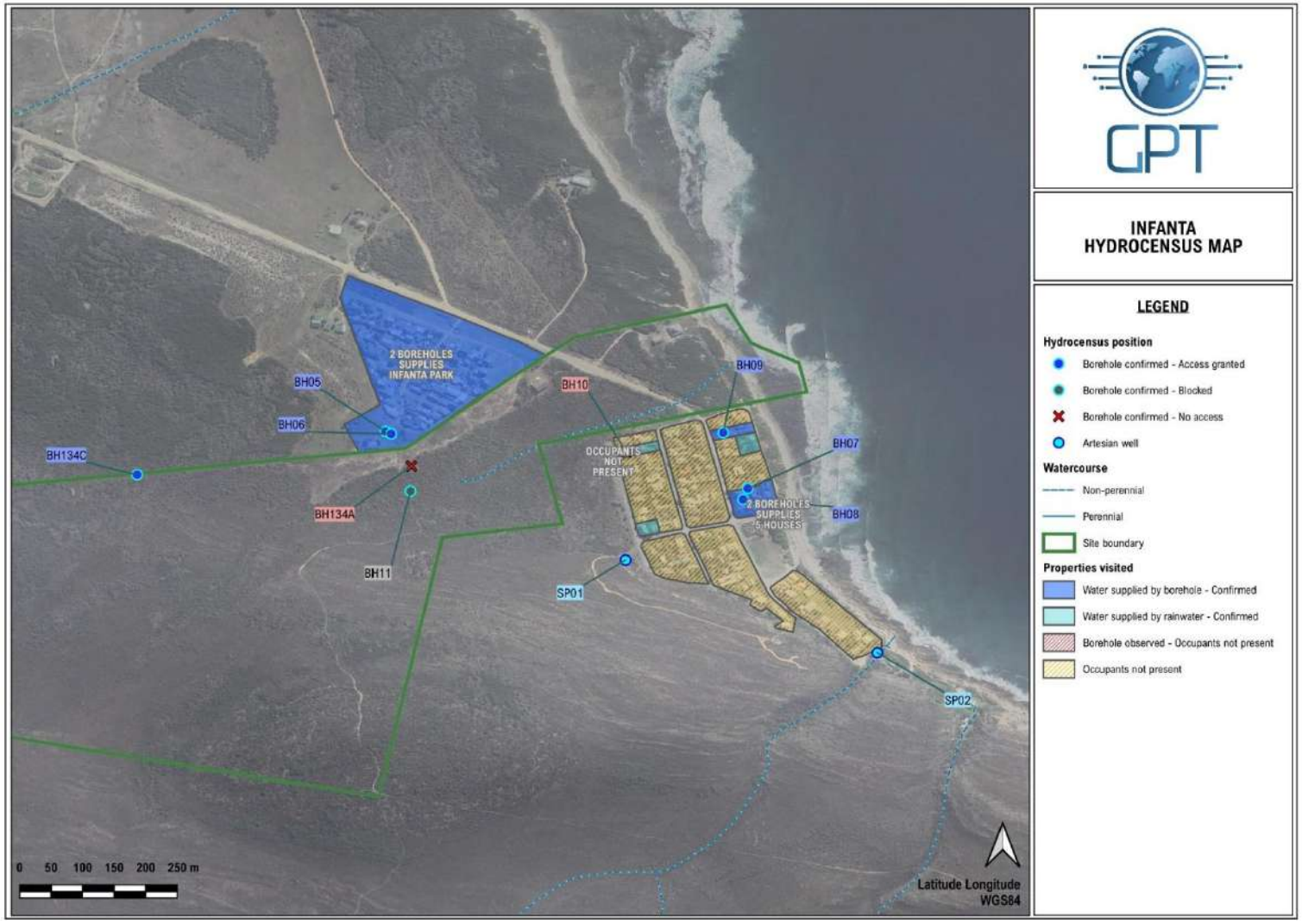


Figure 5: Hydrocensus Map.

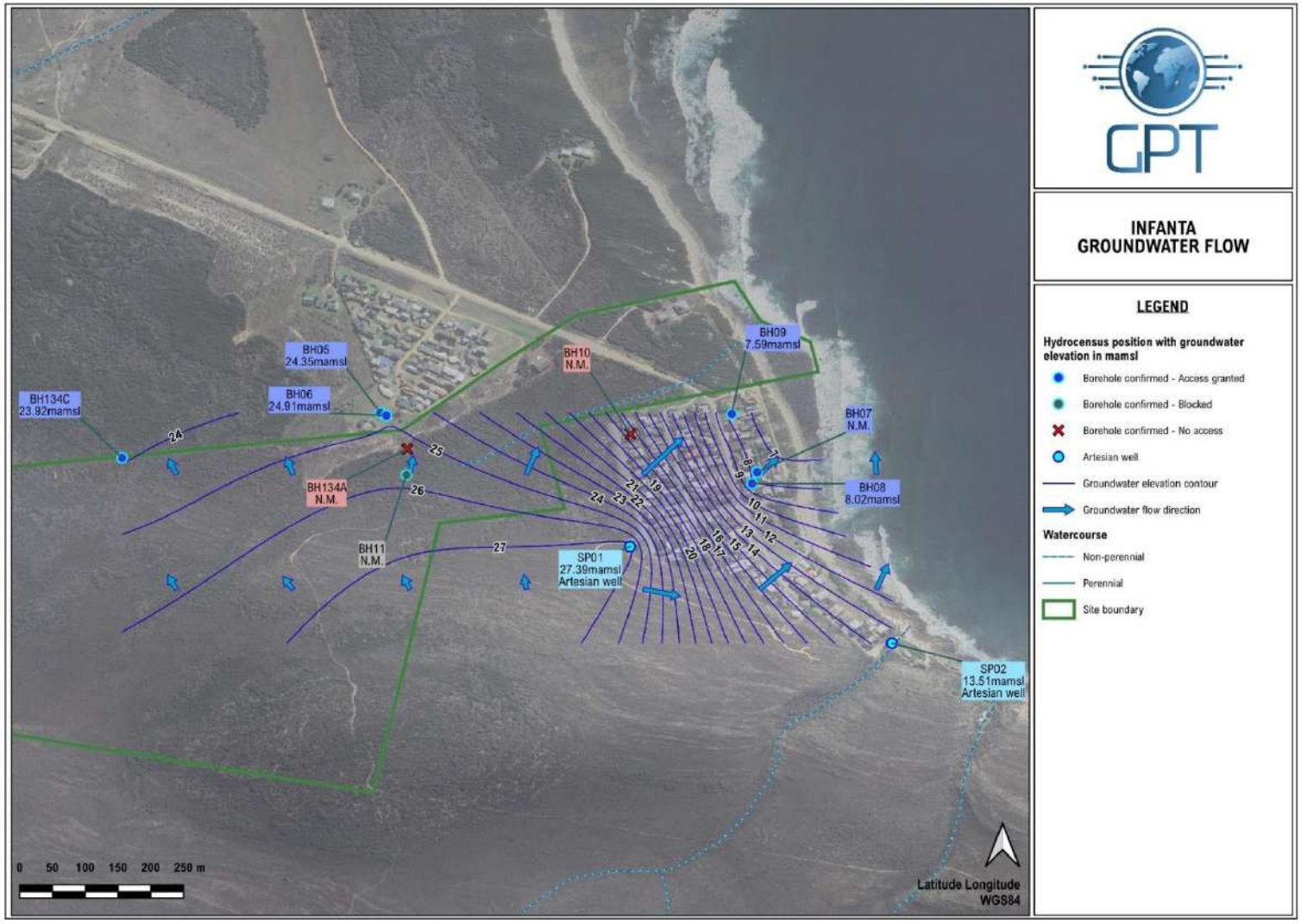


Figure 6: Groundwater Flow Direction Map

7.2 Hydrocensus Groundwater Quality

Three (3) boreholes were selected from the operational boreholes to be tested for groundwater quality. Boreholes BH05, BH07 and BH09 were selected from the hydrocensus. Borehole 134C was also sampled after the hydrocensus, and the results are provided in Section 8.3. The samples were submitted to a SANS accredited laboratory for major anion and cation analysis as well as microbial analysis. The water quality results are compared with the standard limits for drinking water as defined by the SANS 241-1: 2025. The SANS 241-1: 2025 standard is applicable to all water services institutions and sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is acceptable for lifetime consumption.

The results of the screening for groundwater are presented in Table 3 and the following exceedances are observed:

- Electrical conductivity (EC) in all three boreholes exceeded the aesthetic limits.
- The Sodium (Na) and Chloride (Cl) concentrations exceeded the aesthetic limits in all three boreholes.
- The iron concentration in BH07 exceeds the aesthetic limit.
- The aluminium concentration in BH05 exceeds the operational limit.
- *E. coli* in BH07 exceeds the acute health limit.
- Total coliform counts in BH05 and BH07 exceeded the operational limits.

The exceedances of Na and Cl are indicative of saline water which is associated with the Bokkeveld Group. The high EC and total dissolved solids (TDS) in turn can be related to the high salt load in the groundwater. Total coliforms are bacteria that are found in soils. *E. coli* is associated with soils and groundwater that has been affected by the faecal matter of warm-blooded animals, possibly due to french drains.

Table 3: Hydrocensus Boreholes Water Quality compared to SANS 241-1:2025 Standard.

Determinant	Risk	Unit	Standard limits	BH05	BH07	BH09
Physical and aesthetic determinants						
Conductivity at 25 °C	Aesthetic	mS/m	170	238.8	197.3	181.9
Total dissolved solids	Aesthetic	mg/L	-	1672	1381	1273
pH at 25 °C [b]	Operational	pH units	5 to 9.7	7.94	7.3	8.06
Chemical determinants – macro-determinants						
Nitrate as N (NO_3 - N)	Acute health	mg/L	11	BDL	BDL	BDL
Nitrite as N (NO_2 - N)	Acute health	mg/L	0.9	BDL	BDL	BDL
Sulfate as SO_4^{2-}	Aesthetic	mg/L	250	53.57	44.46	56.5
Fluoride as F^-	Chronic health	mg/L	1.5	0.15	0.26	0.29
Ammonia as N	Operational	mg/L	0.3	0.14	BDL	0.08
Chloride as Cl^-	Aesthetic	mg/L	250	582.1	457.4	427.9
Sodium as Na	Aesthetic	mg/L	200	287.7	237.4	230.8
Zinc as Zn	Aesthetic	mg/L	3	BDL	BDL	0.1
Chemical determinants – micro-determinants						
Arsenic as As	Chronic health	mg/L	0.01	BDL	BDL	BDL
Boron as B	Chronic health	mg/L	2.4	0.62	BDL	0.59
Total chromium as Cr	Chronic health	mg/L	0.05	BDL	BDL	BDL
Copper as Cu	Chronic health	mg/L	2	BDL	BDL	BDL
Iron as Fe	Aesthetic	mg/L	0.3	0.06	0.44	BDL
Lead as Pb	Chronic health	mg/L	0.01	BDL	BDL	BDL
Manganese as Mn	Aesthetic	mg/L	0.1	BDL	0.09	BDL
Nickel as Ni	Chronic health	mg/L	0.07	BDL	BDL	BDL
Aluminium as Al	Operational	mg/L	0.2	0.2	0.08	0.16
Microbiological determinants						
E. coli [a] or faecal coliforms [b]	Acute health	cfu/100 mL	0	0	6	0
Total coliforms [d]	Operational	cfu/100 mL	10	16	900	0
BDL = Below Detection Limit						

8 AQUIFER TESTING

A 48-hour pumping test was conducted on borehole BH134C, located on the site, by Pumpcor from Riversdale in June 2020.

A Stepped Discharge Test, Constant Discharge Test & Recovery Monitoring was performed on the borehole. Background information on the details of pump testing is presented in the following paragraphs.

8.1 Description of a Pump Test

The efficient operation and utilisation of a borehole requires insight into and an awareness of its productivity and that of the groundwater resource from which it draws water. This activity, which is also known as test pumping, provides a means of identifying potential constraints on the performance of a borehole and on the exploitation of the groundwater resource. It also provides data to calculate aquifer parameters such as Transmissivity (T) values.

The following tests were performed on the boreholes: (1) Stepped Discharge Test; (2) Constant Discharge Test and (3) Recovery Monitoring.

8.1.1 Stepped Discharge Test

Also known as a step drawdown test, it is performed to assess the productivity of a borehole. It also serves to more clearly define the optimum yield at which the borehole can be subjected to constant discharge testing. The test involves pumping the borehole at three or more sequentially higher pumping rates each maintained for an equal length of time, generally not less than 60 minutes. The magnitude of the water level drawdown in the borehole in response to each of these pumping rates is measured and recorded in accordance with a prescribed time schedule.

8.1.2 Constant Discharge Test

A constant discharge test is performed to assess the productivity of the aquifer according to its response to the abstraction of water. This test entails pumping the borehole at a single pumping rate which is kept constant for an extended period of time. The test duration is usually between 8 and 72 hours.

8.1.3 Recovery Monitoring

This test provides an indication of the ability of a borehole and groundwater system to recover from the stress of abstraction. This ability can again be analysed to provide information with regards to the hydraulic properties of the groundwater system and arrive at an optimum yield for the medium to long term utilisation of the borehole.

8.2 Calculating the Sustainable Yield of the Borehole

Data acquired during pump testing of the borehole was used to calculate the sustainable yield of the tested borehole. The sustainable yield of a borehole can be defined as the discharge rate that will not cause the water level to drop below the major fracture network supplying water to the borehole. The distance between the static water level and this position is also generally referred to as the available drawdown (AD). The major water strike is obtained through observation during drilling supervision or can be more accurately detected from diagnostic plots compiled from the pumping test data. The water level in the borehole should never drop below the position of the main fracture.

The Flow Characterisation Method (more commonly referred to as the "FC-Method") developed by the Institute of Groundwater Studies at the University of the Free State was used to calculate the sustainable yield of the boreholes. The FC-Method calculates the sustainable yield of a borehole by using recharge, derivatives, boundary information and error propagation. The results of the calculation of the sustainable yield are presented in Table 4.

Table 4: Results of the sustainable yield calculations.

Borehole nr.	Coordinates (WGS 84)	Depth (m)	Static Water Level (m)	Available Drawdown (m)	Sustainable Yield (l/h) Pumping 15 hours/day	Volume/day (m^3)
BH 134C	S34.420930° E20.844446°	79.4	15.47	30	2 160	32.4
				TOTAL VOLUME/DAY (m^3)		**32.4**

Based on the available data, it can be concluded that a total volume of 32.4 **m^3/day** can be abstracted from the tested borehole.

8.3 Groundwater Quality of BH134C

A water sample was taken at the end of the pump tests (June 2020) and submitted to a SANS accredited laboratory for major anion and cation analysis as well as microbial analysis. A second sample was taken during on the 12th of September 2025 and submitted for major anion and cation analysis as well as microbial analysis. A number of micro determinants were also analysed in the most recent sampling that was not analysed for during the first sampling.

The water quality results are compared with the standard limits for drinking water as defined by the SANS 241-1: 2025. The SANS 241-1: 2025 standard is applicable to all water services institutions and sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is acceptable for lifetime consumption.

The results of the screening for groundwater are presented in Table 4. Exceedances and observations for the most recent results (Sep 2025) are discussed in the section below:

- EC conductivity & TDS exceeded aesthetic limits.
- Na & Cl exceeded aesthetic limits.
- Fe and ammonia exceeds aesthetic limits.
- Total Coliforms exceeded operational limits.

The exceedances of Na and Cl are indicative of saline water which is associated with the Bokkeveld Group. The high EC and TDS in turn can be related to the high salt load in the groundwater. Total coliforms are bacteria that are found in soils.

Overall, constituent concentrations have remained stable and are within similar ranges to those observed in the June 2020 analysis. The increase in total coliforms is most likely due to the stagnant conditions in the borehole, which has not been in use since the test pumping. The newly elevated iron concentration may also be attributed to rust formation on the steel casing. In both cases, these higher concentrations are expected to decrease once regular abstraction takes place.

Table 5: BH134C Water Quality Compared to SANS 241-1:2025.

Determinant	Risk	Unit	Standard limits	134C June 2020	134C September 2025
Physical and aesthetic determinants					
Conductivity at 25 °C	Aesthetic	mS/m	170	189	224.4
Total dissolved solids	Aesthetic	mg/L	-	1230	1571
pH at 25 °C [b]	Operational	pH units	5 to 9.7	7.9	7.39
Chemical determinants — macro-determinants					
Nitrate as N (NO_3 - N)	Acute health	mg/L	11	0.21	<0.5
Nitrite as N (NO_2 - N)	Acute health	mg/L	0.9	<0.03	<0.13
Sulfate as SO_4^{2-}	Aesthetic	mg/L	250	44.3	46.2
Fluoride as F^-	Chronic health	mg/L	1.5	<0.20	0.09
Ammonia as N	Aesthetic	mg/L	0.3	<0.05	0.67
Chloride as Cl^-	Aesthetic	mg/L	250	422	497.5
Sodium as Na	Aesthetic	mg/L	200	220	272.5
Zinc as Zn	Aesthetic	mg/L	3	<0.17	<0.05
Chemical determinants — micro-determinants					
Arsenic as As	Chronic health	mg/L	0.01	NA	<0.05
Boron as B	Chronic health	mg/L	2.4	0.2	<0.5
Copper as Cu	Chronic health	mg/L	2	<0.04	<0.05
Iron as Fe	Aesthetic	mg/L	0.3	0.12	1.36
Lead as Pb	Chronic health	mg/L	0.01	NA	<0.05
Manganese as Mn	Aesthetic	mg/L	0.1	<0.04	<0.05
Nickel as Ni	Chronic health	mg/L	0.07	NA	<0.05
Aluminium as Al	Operational	mg/L	0.2	NA	0.07
Microbiological determinants					
E. coli [or] faecal coliforms [b]	Acute health	cfu/100 mL	0	<1	0
Total coliforms [d]	Operational	cfu/100 mL	10	33	9400
< = Below Detection Limit					
NA = Constituent not analysed.					

9 AQUIFER CHARACTERISATION

The term aquifer refers to a strata or group of interconnected strata comprising of saturated earth material capable of conducting groundwater and of yielding usable quantities of groundwater to boreholes and /or springs (Vegter, 1994). In the light of South Africa's limited water resources, it is important to discuss the aquifer sensitivity in terms of the boundaries of the aquifer, its vulnerability, classification and finally protection classification, as this will help to provide a framework in the groundwater management process.

9.1 Aquifer Vulnerability

Aquifer vulnerability assessment indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. Stated in another way, it is a measure of the degree of insulation that the natural and manmade factors provide to keep contamination away from groundwater.

- Vulnerability is high if natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Vulnerability is low if natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation.

The following factors have an effect on groundwater vulnerability:

- Depth to groundwater: Indicates the distance and time required for pollutants to move through the unsaturated zone to the aquifer.
- Recharge: The primary source of groundwater is precipitation, which aids the movement of a pollutant to the aquifer.
- Aquifer media: The rock matrices and fractures which serve as water bearing units.
- Soil media: The soil media (consisting of the upper portion of the vadose zone) affects the rate at which the pollutants migrate to groundwater.
- Topography: Indicates whether pollutants will run off or remain on the surface allowing for infiltration to groundwater to occur.
- Impact of the vadose zone: The part of the geological profile beneath the earth's surface and above the first principal water-bearing aquifer. The vadose zone can retard the progress of the contaminants.

The Groundwater Decision Tool (GDT) was used to quantify the vulnerability of the aquifer underlying the site using the below assumptions.

- Depth to groundwater below the site was estimated from water levels measured during the hydrocensus inferred to be at mean of ~4.35 mbgl.
- Groundwater recharge of ~12.87 mm/a (~3.1% recharge),
- Sandy vadose zone
- Gradient of 3% were assumed and used in the estimation.

The aquifer vulnerability for a contaminant released from surface to a specified position in the groundwater system after introduction at some location above the uppermost aquifer was determined using the criteria described below and assuming a worst-case scenario:

- Highly vulnerable (> 60), the natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Medium Vulnerable = 30 to 60%, the natural factors provide some protection to shield groundwater from contaminating activities at the land surface, however based on the contaminant toxicity mitigation measures will be required to prevent any surface contamination from reaching the groundwater table.
- Low Vulnerability (< 30 %), natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation
- The GDT calculated a vulnerability value of 58%, which is medium.

9.2 Aquifer Classification

The aquifer(s) underlying the subject area were classified in accordance with "A South African Aquifer System Management Classification, December 1995."

The main aquifers underlying the area were classified in accordance with the Aquifer System Management Classification document[6]. The aquifers were classified by using the following definitions:

- Sole Aquifer System: An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
- Major Aquifer System: Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (Electrical Conductivity of less than 150 mS/m).
- Minor Aquifer System: These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers.
- Non-Aquifer System: These are formations with negligible permeability that are regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Based on information gathered during the desktop review and hydrocensus investigation, the aquifer system in the study area can reasonably be classified as a "Minor Aquifer System".

In order to achieve the Aquifer System Management and Second Variable Classifications, as well as the Groundwater Quality Management Index, a points scoring system as presented in Table 6 and Table 7 was used.

[6] Department of Water Affairs and Forestry & Water Research Commission (1995). A South African Aquifer System Management Classification. WRC Report No. KV77/95.

Table 6: Ratings – Aquifer System Management and Second Variable Classifications

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 – 6	
Second Variable Classification (Weathering/Fracturing)		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

Table 7: Ratings - Groundwater Quality Management (GQM) Classification System

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 – 6	
Aquifer Vulnerability Classification		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

As part of the aquifer classification, a Groundwater Quality Management (GQM) Index is used to define the level of groundwater protection required. The GQM Index is obtained by multiplying the rating of the aquifer system management and the aquifer vulnerability. The GQM index for the study area is presented in Table 8.

The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above, is classified as **medium.**

The level of groundwater protection based on the Groundwater Quality Management Classification:

GQM Index = Aquifer System Management x Aquifer Vulnerability

=2 x 2 = 4

Table 8: GQM Index for the Study Area

GQM Index	Level of Protection	Study Area
<1	Limited	
1 – 3	Low Level	
3 – 6	Medium Level	4
6 – 10	High Level	
>10	Strictly Non-Degradation	

9.3 Aquifer Protection Classification

A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for the Aquifer System Management Classification. According to this estimate a **medium level of groundwater protection** is required for the aquifer. Reasonable and sound groundwater protection measures based on the modelling will therefore be recommended to ensure that no cumulative pollution affects the aquifer, even in the long term.

DWA's water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that measures must be taken to limit the risk to the following environments.

- The protection of the underlying aquifer.

10 RESERVE DETERMINATION

10.1 Introduction

Definition of Reserve: *"The quantity and quality of water required to supply basic needs of people to be supplied with water from that resource and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of water resources".*

To be able to quantify the groundwater component of the Reserve, the following relationship has to be solved:

$$GW_{allocate} = (Re + GW_{in} - GW_{out}) - BHN - GW_{Bf}$$

where:

$GW_{allocate}$	=	groundwater allocation
Re	=	recharge
GW_{in}	=	groundwater inflow
GW_{out}	=	groundwater outflow
BHN	=	basic human needs
GW_{Bf}	=	groundwater contribution to baseflow

Under the National Water Act (Act No. 36 of 1998) the bulk water uses at Infanta must be authorised. The water will be abstracted from boreholes and used for irrigation and construction purposes. Under these circumstances, the following (ground) water use is recognised as being relevant to the licence application:

- Section 21 (a) – taking water from a resource.

10.2 Approach

The assessment was done on a "rapid" level using the software GRDM version 4.0.0.0. The data used for the calculation was derived from the WRC90 dataset contained in the "GRDM" software driven by the Resource Directed Measures from the Department of Water Affairs and FET Water. The local catchment falls within the H70K quaternary catchment as shown in Figure 1. The default values were used in the assessment in order to develop some guidance on the potential impact of the proposed abstraction on the overall groundwater use in the catchment.

10.3 Description of the Study Area

The property, hereafter referred to as Infanta, has a total area of 10ha. The local catchment within which the site is located falls within the H70K quaternary catchment. The quaternary catchment has a total area of 207.3 km^2 and the catchment falls within the Breede River Water Management Area.

The dominant vegetation type is mountain Fynbos. Locally drainage is towards the Indian Ocean as well as the Breede River that flows from northeast to southwest to the north of the site.

10.4 Present Water Demand

A maximum projection of the planned water demand from the borehole is 16.8m^3/day (0.194 l/s) or 6132 m^3/annum.

10.5 Reserve Directed Measures Assessment

10.5.1 Classification

Groundwater classification is currently based on a Stress Index which relates water use to recharge. The quaternary catchments in which the study area falls is classified as category B which indicates low levels of stress in terms of abstraction/recharge (respectively). The resource is unstressed or slightly stressed. At this stage Classification is not directly linked to potential abstraction but is only indicative of the current situation.

Table 9: Catchment Stress Index Table

Present Status Category	Description	Stress Index (abstraction/recharge)
A	Unstressed or slightly stressed	<0.05
B		0.05-0.2
C	Moderately Stressed	0.2-0.4
D		0.4-0.65
E	Highly Stressed	0.65-0.95
F	Critically Stressed	>0.95

10.5.2 Reserve

The following table summarises the most salient parameters relevant to this catchment:

Table 10: Most salient parameters relevant to the catchment.

Quaternary Catchment	Area km^2	Population (2010)	General Authorisation (m^3/ha/a)	Rainfall (mm/a)	Recharge (mm/a)	Current Use (2010) (Mm^3/a)
H70K	207.3	500	150	458	14.2	0.06

*Groundwater recharge calculated as 3.1% of rainfall, see section 6.3.

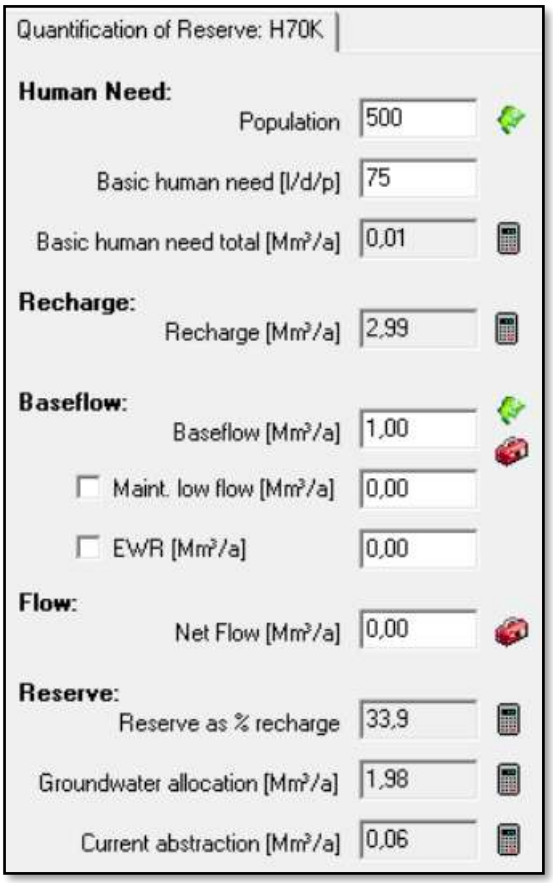
If the recharge is calculated on the actual area of the property within the affected quaternary catchments, the following emerges:

Table 11: Recharge to the property

Catchment	Actual area (ha) of property	Recharge in Quartenary Catchment (mm/a)	Recharge on property	
H70K	86.5	14.2	12283	m^3/a
Total	*86.5*	14.2	12283	m^3/a
			0.012	Mm^3/a
			34	m^3/day
			0.39	l/second

The following tables summarizes the Reserve for the catchment.

Table 12: A summary of the Reserve for the quaternary catchment H70K



10.5.3 Water Use Authorization

The table below estimated the general authorization allowance.

Actual area of property (ha)	General Authorisation (m3/ha/a)	General Authorisation Volume Allowance on property (m3/a)
86.5	150	12975

The general authorisation volume for the area is calculated at 12 975 m^3/year, while the planned water demand is 6 132 m^3/year. Therefore, it can be concluded that the proposed demand falls within the scope of a general authorisation.

If the maximum volume that can be abstracted, according to the sustainable yield calculations (Section 8.2) of 32.4 m^3/day or 11 826 m^3/year, is applied for, this volume still remains within the general authorisation allowance.

10.5.4 Resource Quality Objectives

The Resource Quality Objectives are numerical or descriptive limits set out to maintain and protect the groundwater resource while also taking into account the need to develop and use a water resource[7].

Maintain regional groundwater table to:

- Ensure that schedule 1 water users adjacent to the site have adequate water supply to basic human need.
- Ensure that adequate water is available to maintain base flow in the tributaries of the Breede River.

[7] Department of Water Affairs and Forestry (DWAF). 2007. Resource directed management of water quality: management instruments. Volume 4.2.2: guideline for determining Resource Water Quality Objectives (RWQOs), allocatable water quality and the stress of the water resource. Training manual. Pretoria.

11 POTENTIAL CONTAMINATION SOURCES

The potential sources of groundwater contamination associated with the proposed development are primarily related to domestic wastewater generation, residential activities and the use of fuels and other household chemicals. Once operational, the proposed development will generate wastewater, which will be treated on-site using small-scale package wastewater treatment plants. One treatment unit will be allocated to each of the 20 new residential dwellings. The existing dwelling on the property will continue to utilise its existing septic tank system for the management of sewage. Based on the estimated water demand of 16.8 m^3/day, approximately 13.44 m^3/day of wastewater is anticipated to be generated, assuming that 80% of water consumed is returned as wastewater. The package treatment plants will treat the wastewater to the applicable Department of Water and Sanitation (DWS) General Standards. Treated effluent will be discharged to soakaways.

The following potential sources of groundwater contamination have been identified:

- Treated effluent from the individual package wastewater treatment plants, which will be discharged to soakaways and infiltrate into the subsurface. Although the wastewater will be treated to the applicable DWS General Standards, residual microbiological contaminants and constituents such as ammonia, nitrate, nitrite, orthophosphate/phosphate and total phosphorus may remain in the treated effluent and could potentially affect the underlying aquifer.
- Hydrocarbon-related contaminants associated with vehicles, parking areas and general residential activities, including fuels, oils and lubricants.
- Domestic solid waste and waste storage areas, which may generate contaminated runoff or leachate if waste is improperly stored or disposed of.

The primary potential source of groundwater contamination associated with the proposed development is considered to be the on-site treatment and disposal of domestic wastewater through the package wastewater treatment plants and existing septic tank system. These sources will be assessed as part of the groundwater risk assessment.

12 RISK ASSESSMENT

The groundwater risk assessment methodology is based on defining and understanding the three basic components of the risk, i.e. the source of the risk (source term), the pathway along which the risk propagates, and finally the target that experiences the risk (receptor). The risk assessment approach is therefore aimed at describing and defining the relationship between cause and effect. In the absence of any one of the three components, it is possible to conclude that groundwater risk does not exist.

12.1 Current Groundwater Conditions

The current groundwater conditions at the site are described in sections 6 to 9.

12.2 Risk Assessment

12.2.1 Assessment Criteria

The criteria for the description and assessment of groundwater impacts were drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the NEMA[8].

In order to determine the significance of an impact, the following criteria would be used: extent, duration, intensity and probability. The extent and probability criteria have five parameters, with a scaling of 1 to 5. Intensity also has five parameters, but with a weighted scaling.

The assessment of the intensity of the impact is a relative evaluation within the context of all the activities and other impacts within the framework of the project. The intensity rating is weighted as 2 since this is the critical issue in terms of the overall risk and impact assessment (thus the scaling of 2 to 10, with intervals of 2). The intensity is thus measured as the degree to which the project affects or changes the environment.

The level of detail as depicted in the EIA regulations was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes, each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. An explanation of the impact assessment criteria is defined below in Table 13.

[8] Guideline document EIA regulations (April 1998): Implementation of sections 21, 22 and 26 of the environment conservation act.

Table 13: Explanation of the EIA criteria

Criteria	Description
Nature	Includes a description of what causes the effect, what will be affected and how it will be affected.
Extent	The physical and spatial scale of the impact.
Duration	The lifetime of the impact is measured in relation to the lifetime of the proposed development.
Intensity	Examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself.
Probability	This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the lifecycle of the activity, and not at any given time.
Status	Description of the impact as positive, negative or neutral.
Significance	A synthesis of the characteristics described above and assessed as low, medium or high. A distinction will be made for the significance rating without the implementation of mitigation measures and with the implementation of mitigation measures.
Confidence	This is the level of knowledge/information that the environmental impact practitioner or a specialist had in his/her judgement.
Reversibility	Examining whether the impacted environment can be returned to its pre-impacted state once the cause of the impact has been removed.
Replaceability	Examining if an irreplaceable resource is impacted upon
Cumulative	Synthesis of different impacts in concert, considering the knock-on impacts thereof.

12.2.2 Nature and Status

The nature of the impact is the consideration of what the impact will be and how it will be affected. This description is qualitative and gives an overview of what is specifically being considered. That is, the nature considers what is the cause, what is affected, and how is it affected. The status is thus given as being positive, negative or neutral, and is deemed to be either direct or indirect in impact.

12.2.3 Extent

The physical and spatial scale of the impact is classified in Table 14.

12.2.4 Duration

The lifetime of the impact is measured in relation to the lifetime of the project, as per Table 15.

12.2.5 Intensity

This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project, as per Table 16.

12.2.6 Probability

This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the lifecycle of the activity, and not at any given time. The probability classes are rated in Table 17.

12.2.7 Level of Significance

The level of significance is expressed as the sum of the area exposed to the risk (extent), the length of time that exposure may occur over in total (duration), the severity of the exposure (intensity) and the likelihood of the event occurring (probability). This leads to a range of significance values running from 'no impact' to 'extreme'.

The significance of the impacts has been determined as the consequence of the impact occurring (reflection of chance of occurring, what will be affected (extent), how long will it be affected, and how intense is the impact) as affected by the probability of it occurring, this translates to the following formula:

Significance value = (Extent + Duration + Intensity) x Probability

Each impact is considered in turn and assigned a rating calculated using the results of this formula and presented as a final rating classification according to Table 16. A distinction will be made for the significance rating of (a) without the implementation of mitigation measures, and, (b) with the implementation of mitigation measures.

12.2.8 Identifying Potential Impacts with Mitigation Measures

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact. Significance with mitigation is rated on the following scale as contemplated in Table 16 below.

Low (L): The impact is mitigated to the point where it is of limited importance.

Medium (M): Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.

High (H): The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

12.2.9 Impact Assessment

Based on the impact assessment criteria as detailed in the preceding paragraph an impact rating is given in Table 18. The table also summarises all the groundwater related EMP's and should be implemented during the operation of the development.

Table 14: Impact Extent

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1	3	2
Site	The impact could affect the whole, or a significant portion of the site.	2		
Local	Impact could affect the adjacent landowners.	3		
Regional	Impact could affect the wider area around the site, that is, from a few kilometres, up to the wider Council region	4		
National	Impact could have an effect that expands throughout a significant portion of South Africa – that is, as a minimum has an impact across provincial borders.	5		
With Mitigation (WM)				
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1	1	1
Site	The impact could affect the whole, or a significant portion of the site.	2		
Local	Impact could affect the adjacent landowners.	3		
Regional	Impact could affect the wider area around the site, that is, from a few kilometres, up to the wider Council region	4		
National	Impact could have an effect that expands throughout a significant portion of South Africa – that is, as a minimum has an impact across provincial borders.	5		

Table 15: Impact Duration

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than any of the development phases (i.e. less than 2 years).	1	4	4
Short to Medium term	The impact will be relevant through to the end of the construction phase (i.e. less than 5 years).	2		
Medium term	Impact will last up to the end of the development phases, where after it will be entirely negated (i.e. related to each phase development thus less than 10 years).	3		
Long term	The impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter (i.e. during decommissioning) (i.e. more than 10 years, or a maximum of 60 years).	4		
Permanent	This is the only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient (i.e. will remain once the site is closed).	5		
With Mitigation (WM)				
Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than any of the development phases (i.e. less than 2 years).	1	4	4
Short to Medium term	The impact will be relevant through to the end of the construction phase (i.e. less than 5 years).	2		
Medium term	Impact will last up to the end of the development phases, where after it will be entirely negated (i.e. related to each phase development thus less than 10 years).	3		
Long term	The impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter (i.e. during decommissioning) (i.e. more than 10 years, or a maximum of 60 years).	4		
Permanent	This is the only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient (i.e. will remain once the site is closed).	5		

Table 16: Impact Intensity

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.	2	4	4
Low-Medium	The impact alters the affected environment in such a way that the natural processes or functions are slightly affected.	4		
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.	6		
Medium-High	The affected environment is altered, and the functions and processes are modified immensely.	8		
High	Function or process of the affected environment is disturbed to the extent where the function or process temporarily or permanently ceases.	10		
With Mitigation (WM)				
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.	2	2	2
Low-Medium	The impact alters the affected environment in such a way that the natural processes or functions are slightly affected.	4		
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.	6		
Medium-High	The affected environment is altered, and the functions and processes are modified immensely.	8		
High	Function or process of the affected environment is disturbed to the extent where the function or process temporarily or permanently ceases.	10		

Table 17: Impact Probability

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience (less than 24% chance of occurring).	1	3	3
Possible	The possibility of the impact occurring is very low, either due to the circumstances,	2		
Likely	There is a possibility that the impact will occur to the extent that provisions must	3		
Highly likely	It is most likely that the impacts will occur at some stage of the Development. Plans must be drawn up before carrying out the activity (70 – 89%).	4		
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied upon (90 – 100%).	5		
With Mitigation (WM)				
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience (less than 24% chance of occurring).	1	2	2
Possible	The possibility of the impact occurring is very low, either due to the circumstances,	2		
Likely	There is a possibility that the impact will occur to the extent that provisions must	3		
Highly likely	It is most likely that the impacts will occur at some stage of the Development. Plans must be drawn up before carrying out the activity (70 – 89%).	4		
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied upon (90 – 100%).	5		

Table 18: Impact Significance

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
No Impact	There is no impact.	0-9	33	30
Low	The impacts are less important, but some mitigation is required to reduce the negative impacts.	10 - 24		
Medium	The impacts are important and require attention; mitigation is required to reduce the negative impacts.	30 - 49		
Medium to High	The impacts are of medium to high importance; mitigation is necessary to reduce negative impacts.	50 - 74		
High	The impacts are of high importance and mitigation is essential to reduce the negative impacts	75 - 89		
Extreme	The impacts present a fatal flaw, and alternatives must be considered.	90 - 100		
With Mitigation (WM)				
No Impact	There is no impact.	0-9	14	14
Low	The impacts are less important, but some mitigation is required to reduce the negative impacts.	10 - 24		
Medium	The impacts are important and require attention; mitigation is required to reduce the negative impacts.	30 -49		
Medium to High	The impacts are of medium to high importance; mitigation is necessary to reduce negative impacts.	50 - 74		
High	The impacts are of high importance and mitigation is essential to reduce the negative impacts	75 - 89		
Extreme	The impacts present a fatal flaw, and alternatives must be considered.	90 - 100		

12.3 Mitigation Measures

The suggested mitigation measures for the operation are summarised in the following paragraphs based on the risk assessment performed.

12.3.1 Lowering of Groundwater Levels

The mitigation measures/management measures applicable to the lowering of groundwater levels during operations are listed in Table 19.

Table 19: Mitigation Measures for the Management of Lowering of Groundwater Level

Lowering of Groundwater Levels			
Significance Rating (WOM)	**Impact**	**Management Options**	**Significance Rating (WM)**
33	Drawdown of water table	Groundwater levels should be monitored on the frequency as specified in the monitoring plan.	14
		Pumped water volumes should be recorded at the production boreholes on a monthly basis.	
		Water levels in production boreholes should be recorded on a monthly basis. If a declining trend in water levels is observed, the pumping volumes should be reduced until the water level is stabilized.	
		Recommended yields and pumping cycles should be adhered to.	
		Rainfall readings should be recorded.	

12.3.2 Spread of Groundwater Pollution

The mitigation measures/management measures applicable to the spread of groundwater contamination after operations are listed in Table 20.

Table 20: Mitigation Measures for the Management of the Spread of Groundwater Contamination

Groundwater Contamination			
Significance Rating (WOM)		**Management Options**	**Significance Rating (WM)**
30	Groundwater contamination	Adhere to the six- monthly service plan as well as maintenance plan required for the package wastewater treatment plants to ensure proper functioning and prevent discharge of untreated or inadequately treated wastewater to the soakaways.	14
		Inspect package plants, septic tanks, and soakaways at least annually for signs of failure, including ponding, surfacing of effluent, excessive saturation, clogging or reduced infiltration capacity. Any signs of failure should be investigated and rectified promptly.	
		Educate residents on the appropriate use of household chemicals, detergents and solvents to avoid impairing the biological treatment processes within the package wastewater treatment plants and septic tank system. (e.g., avoid excessive use of bleach and other chemicals that may adversely affect the biological treatment process).	
		Water quality sampling should be conducted as specified in the monitoring requirements (Section 13).	
		The water quality results should be interpreted by a hydrogeologist on an annual basis to ensure the groundwater quality of the surrounding groundwater users is not being impacted.	

13 GROUNDWATER MONITORING SYSTEM

13.1 Groundwater Monitoring Network

A groundwater monitoring system has to adhere to the criteria mentioned below. As a result, the system should be developed accordingly.

13.1.1 Impact and Background Monitoring

A groundwater monitoring network should contain monitoring positions which can assess the groundwater status at certain areas. The boreholes can be grouped classification according to the following purposes:

- **Impact monitoring:** Monitoring of possible impacts of contaminated groundwater on sensitive ecosystems or other receptors. These monitoring points are also installed as early warning systems for contamination break-through at areas of concern.
- **Background monitoring:** Background groundwater levels is essential to evaluate the impact of a specific action on the groundwater level.

13.1.2 System Response Monitoring Network

Groundwater levels: The response of water levels to abstraction is monitored. Static water levels are also used to determine the flow direction and hydraulic gradient within an aquifer. Where possible all of the above-mentioned borehole's water levels need to be recorded during each monitoring event.

13.1.3 Monitoring Frequency

Quarterly monitoring of groundwater quality, levels and measurement of pumped volumes is recommended. It is important to note that a groundwater-monitoring network should also be dynamic. This means that the network should be extended over time to accommodate the migration of potential contaminants through the aquifer as well as the expansion of infrastructure and/or addition of possible pollution sources.

13.2 Monitoring Parameters

Physical Parameters:

- Groundwater levels
- Pumping volumes

Chemical Parameters:

- Laboratory analyses:
    - Anions and cations (Ca, Mg, Na, K, NO_3, NO_2, NH_3, NH_4, PO_4, Cl, SO_4, F, Fe, Mn, Al, & Alkalinity)
    - Other parameters (pH, EC, TDS)
    - microbiological related contaminants (*E.coli*, faecal coliforms and total coliforms)

13.3 Monitoring Network

DWAF (1998) states that "A monitoring hole must be such that the section of the groundwater most likely to be polluted first, is suitably penetrated to ensure the most realistic monitoring result."[9]

The abstraction borehole located on the Infanta site as well as the hydrocensus boreholes will serve as monitoring points. The details for the borehole can be seen in Table 21 below.

Table 21: Details of the monitoring boreholes

ID	Latitude (South)	Longitude (East)	Requirement	Frequency	Existing/New
BH134C	34° 25′ 15.35″	20° 50′ 40.01″	Abstraction, water level & groundwater quality monitoring	Quarterly	Existing
BH134A	34° 25' 14.3040"	20° 50' 57.0624"	Water level & groundwater quality monitoring	Quarterly	Existing
BH05	34° 25' 12.3060"	20° 50' 55.8096"	Water level & groundwater quality monitoring	Quarterly	Existing
BH06	34° 25' 12.1548"	20° 50' 55.4644"	Water level & groundwater quality monitoring	Quarterly	Existing
BH07	34° 25' 15.6952"	20° 51' 17.9658"	Water level & groundwater quality monitoring	Quarterly	Existing
BH09	34° 25' 12.2236"	20° 51' 16.4459"	Water level & groundwater quality monitoring	Quarterly	Existing

[9] Department of Water Affairs and Forestry (DWAF). (1998). Minimum Requirements for the Water Monitoring at Waste Management Facilities. CTP Book Printers. Cape Town.

14 CONCLUSIONS AND RECOMMENDATIONS

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed by Doug Jefferies Consulting (Pty) Ltd to conduct a hydrogeological study in support of the water use licence to be applied for the by the client on behalf of the proposed Infanta Development.

The hydrogeological assessment indicates that groundwater is a viable water source for the proposed Infanta Development, subject to implementation of the recommended groundwater management and monitoring measures. The estimated development water demand of 6132 m^3/year is below the calculated General Authorisation allowance of 12 975 m^3/year, while the sustainable yield assessment for borehole 134C indicates an estimated sustainable abstraction capacity of approximately 32.4 m^3/day (11 826 m^3/year). The available groundwater resource is therefore considered sufficient to meet the anticipated water requirements of the proposed development.

The groundwater system is classified as a Minor Aquifer System with medium vulnerability, and a medium level of groundwater protection is required. Although groundwater abstraction at the proposed rate is not expected to place significant pressure on the aquifer, the relatively shallow groundwater levels and proximity of the development to the coast warrant continued monitoring of groundwater levels and quality. In particular, potential seawater intrusion should be monitored during prolonged abstraction, and abstraction volumes should remain within the recommended sustainable limits.

Groundwater quality results indicate that the groundwater is not consistently suitable for potable use without treatment, with exceedances of selected SANS 241 drinking water parameters identified during the investigation. The groundwater quality should therefore be appropriately treated prior to potable use, and continued groundwater-quality monitoring should be undertaken.

The proposed individual package wastewater treatment plants and associated soakaways represent the primary potential source of groundwater contamination associated with the proposed development. While the package treatment plants are designed to produce treated effluent complying with the applicable DWS General Standards, residual microbiological contaminants and constituents such as ammonia, nitrate, nitrite, orthophosphate/phosphate and total phosphorus may remain in the treated effluent. Given the permeable sandy soils and relatively shallow groundwater, appropriate operation and maintenance of the treatment systems, regular inspection of the soakaways and ongoing groundwater-quality monitoring are considered important to minimise the potential for impacts to the underlying aquifer.

14.1 Recommendations

The following actions are recommended to be implemented during the construction and the operational phases:

- Groundwater quality exceedances the SANS 241 drinking water standards indicating that the groundwater at the site is not suitable for use as potable water without prior treatment. The exceedances in total coliforms can be addressed by improving sanitation systems and ensuring human or animal wastes are properly disposed of.
- The monitoring as recommended in the report should be established prior to operation. The water level monitoring should be conducted weekly for the first three months of operation and if no significant water level decline is observed, the monitoring can be conducted on a monthly basis. Alternatively, automatic water level measurement in the form of pressure transducers can be installed to aid in this process. Logs of flow meter readings should also be kept and the flowmeter should also be read once per month.

- Seawater intrusion may become a concern during extended abstraction periods and should be monitored.
- Maintenance and regular servicing of the individual package wastewater treatment plants and associated soakaways to ensure effective treatment and disposal of domestic wastewater.
- Installation of a rainfall gauge and maintenance of an electronic database containing groundwater levels, abstraction volumes, rainfall and groundwater-quality data.
- The recommended pump cycle for the borehole is 12 hours per day. If the pump cycle is to be extended, the maximum daily volume for each borehole must not be exceeded and the pumping rate must be reduced to sustainable rates. Refer to management recommendations in Table 22.
- It is recommended that the hydrocensus be repeated once every 2 years to ensure that no new groundwater users are affected. The hydrocensus should extend to a 1km radius around the site boundary.
- The regional groundwater table must be maintained to:
    - Ensure that schedule 1 water users adjacent to the site have adequate water supply to basic human need.
    - Ensure that adequate water is available to maintain base flow in the tributaries of the Breede River.

Table 22: Management Recommendations for the Infanta Production Borehole

Borehole nr.	Coordinates (WGS84)		Depth (m)	Static Water Level (m)	#Dynamic WL (m)	Diameter (mm)	Sustainable Yield (l/h) Pumping 16 hours/day	Volume/day (m^3)	Proposed depth of pump installation (m)	Maximum Volume per Day (m^3)
	S	E								
BH134C	25.79058	29.48482	74.5	15.47	45	165	2160	34.6	60	34.6
					Total Volume/Day (m^3)			**34.6**		

 # Dynamic water level - Level at which the water level in the borehole stabilises after continuous pumping. To be used to calculate hydraulic heads when sizing submersible pumps.

APPENDIX I: HYDROCENSUS DATA

GEO POLLUTION TECHNOLOGIES
SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Title:	Hydrocensus of Groundwater	Doc No., Rev No.:	5.4.3.9, Rev 01
Department:	Inorganics	Page No.:	Page 1 of 1
Project Name:	Infanta Impact Assessment Update Infanta	Project Number:	DJINF/25/13509
Census date:	25/07/2025	Project Manager:	Christoff Dreyer
Borehole Nr:	~~BH06~~ BH05	Field Technician:	D Andrew
Alternative Borehole Number:			

Site Information

Owner:	David Klaas		
Address:	18 Infanta park	Tel:	Klaas
		Fax:	~~Klaas~~ D4@gmail.com
		Cell:	081 363 6194

Borehole / Monitoring Well Info

Field Measurements

Coordinates	Lat (S):	-34.620085					
	Long (E):	20.484836					
Static water level (mbcl):		4.31m					
Borehole depth (m):		7.20 est					
Casing installed (Mark with an X):	PVC		Steel				
	None		Both	Unkn			
Casing Depth (m):	Unkn						
Borehole Diameter OD (mm):	170mm						
Collar height (magl):	15cm						

Borehole Condition

Headworks	Yes	No	Comment
Marker pole:	✓		Box
Concrete Plinth:	✓		
Casing cap:	✓		
Blocked:		✓	

Comment:

Sampling

Sampled (Mark with an X):	Yes		✓	No				
Sampling Method:	**Bailed**		**Purge**		**Pumped**			
	Tap	✓	**Tank**					
Sampling depth:	Tap							
Sampling time:	14:11							
Sampling volume:	1.75L							
Type of sample (Mark with an X):	Full cations and Anion analysis			Bacteriological analysis			Hydrocarbon Analysis	
	Other							

Water Use

Select the applicable option:				Volume usage (l/day)
Domestic:	✓	No. of Households:	62	
Garden/Landscape:	✓	Watering cycle (Daily, Monthly, Weekly):		
Live stock:		No of:		
Agricultural:		Size of land (ha):		

Additional Borehole Information

Storage:							Pump size (kW):	Unkn	
Reservoir:	Yes	✓	Unknown				Pump make and model nr:	Unkn	
Tank type and volume:	60000						Yield (l/s):	Unkn	
Dam type and volume:							How often pumped:	As needed	✓
Borehole equipped with a pump:	Yes	✓	No					Auto level control	✓
Pump Type:	Subm	✓	Mono		Wind				

Notes

Very Bookish
18 permanent families

Photo

UnKn=UnKnown

GEO POLLUTION TECHNOLOGIES
SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Title:	Hydrocensus of Groundwater	Doc No., Rev No.:	5.4.3.9, Rev 01
Department:	Inorganics	Page No.:	Page 1 of 1
Project Name:	Infanta Impact Assessment Update Infanta	Project Number:	DJINF/25/13509
Census date:	28/01/2025	Project Manager:	Christoff Dreyer
Borehole Nr:	~~BH05~~ BH06	Field Technician:	Andrea
Alternative Borehole Number:			

Site Information

Owner:	David Klaas (Grandson)		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Field Measurements						Borehole Condition			
Coordinates	Lat (S):	-34.420043				**Headworks**	**Yes**	**No**	**Comment**
	Long (E):	20.848741				Marker pole:	✓		Base
Static water level (mbcl):		3.71				Concrete Plinth:	✓		
Borehole depth (m):		65ft				Casing cap:	✓		
Casing installed (Mark with an X):	PVC		Steel	✓		Blocked:		✓	
	None		Both			Comment:			
Casing Depth (m):	Unkn								
Borehole Diameter OD (mm):	180mm								
Collar height (magl):	1cm								

Sampling

Sampled (Mark with an X):	Yes		✓	No			
Sampling Method:	**Bailed**		**Purge**		**Pumped**		
	Tap		**Tank**	✓			
Sampling depth:	Tap						
Sampling time:	14:41						
Sampling volume:	1.1L						
Type of sample (Mark with an X):	Full cations and Anion analysis		Bacteriological analysis		Hydrocarbon Analysis		
	Other						

Water Use

Select the applicable option:				**Volume usage (l/day)**
Domestic:	✓	No of Households:		
Garden/Landscape:	✓	Watering cycle (Daily, Monthly, Weekly):		
Live stock:	✓	No of:		
Agricultural:	✓	Size of land (ha):		

Additional Borehole Information

Storage:						Pump size (kW):	Unkn	
Reservoir:	Yes	✓	Unknown			Pump make and model nr:	Unkn	
Tank type and volume:	5000 Tank					Yield (l/s):	Unkn	
Dam type and volume:						How often pumped:	As needed	
Borehole equipped with a pump:	Yes	✓	No				Auto level control	✓
Pump Type:	Subm	✓	Mono		Wind			

Notes	Photo
Need to be less brakish Sells water to government for toilets	

UnKn=UnKnown

GEO POLLUTION TECHNOLOGIES
SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Title:	Hydrocensus of Groundwater	Doc No., Rev No.:	5.4.3.9, Rev 01
Department:	Inorganics	Page No.:	Page 1 of 1
Project Name:	Infanta Impact Assessment Update Infanta	Project Number:	DJINF/25/13509
Census date:	28/07/2025	Project Manager:	Christoff Dreyer
Borehole Nr:		Field Technician:	0
Alternative Borehole Number:			

Site Information

Owner:	~~[illegible]~~ Elsa		
Address:	52 Schreiches Street	Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Field Measurements								Borehole Condition			
Coordinates	Lat (S):	-34.1220933						**Headworks**	**Yes**	**No**	**Comment**
	Long (E):	20.8527552						Marker pole:		✓	
Static water level (mbcl):								Concrete Plinth:	✓		
Borehole depth (m):		90m						Casing cap:	✓		
Casing installed (Mark with an X):		PVC		Steel	✓			Blocked:		✓	
		None		Both				Comment:			
Casing Depth (m):											
Borehole Diameter OD (mm):											
Collar height (magl):											

Sampling

Sampled (Mark with an X):	Yes			No				
Sampling Method:	**Bailed**		**Purge**		**Pumped**			
	Tap		**Tank**					
Sampling depth:								
Sampling time:								
Sampling volume:								
Type of sample (Mark with an X):	Full cations and Anion analysis		Bacteriological analysis			Hydrocarbon Analysis		
	Other							

Water Use

Select the applicable option:				**Volume usage (l/day)**
Domestic:		No of Households:		
Garden/Landscape:		Watering cycle (Daily, Monthly, Weekly):		
Live stock:		No of:		
Agricultural:		Size of land (ha):		

Additional Borehole Information

Storage:							Pump size (kW):		
Reservoir:	Yes		Unknown				Pump make and model nr:		
Tank type and volume:							Yield (l/s):		
Dam type and volume:							How often pumped:	As needed	
Borehole equipped with a pump:	Yes		No					Auto level control	
Pump Type:	Subm		Mono		Wind				

Notes	Photo
Nobody home.	

UnKn=UnKnown

GEO POLLUTION TECHNOLOGIES
SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Title:	Hydrocensus of Groundwater	Doc No., Rev No.:	5.4.3.9, Rev 01
Department:	Inorganics	Page No.:	Page 1 of 1
Project Name:	Infanta Impact Assessment Update Infanta	Project Number:	DJINF/25/13509
Census date:		Project Manager:	Christoff Dreyer
Borehole Nr:	BH07	Field Technician:	0
Alternative Borehole Number:			

Site Information

Owner:			
Address:	Sea College Trust	Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Field Measurements

Coordinates	Lat (S):	-34.420958			
	Long (E):	20.554969			
Static water level (mbcl):		unkn			
Borehole depth (m):		unkn			
Casing installed (Mark with an X):	PVC		Steel	✓	
	None		Both		
Casing Depth (m):		unkn			
Borehole Diameter OD (mm):		unkn			
Collar height (magl):		42cm			

Borehole Condition

Headworks	Yes	No	Comment
Marker pole:		✓	
Concrete Plinth:	✓		
Casing cap:	✓		
Blocked:		✓	
Comment:			

Sampling

Sampled (Mark with an X):	Yes			No				
Sampling Method:	**Bailed**		**Purge**		**Pumped**			
	Tap	✓	**Tank**					
Sampling depth:	Tap							
Sampling time:	16:26							
Sampling volume:								
Type of sample (Mark with an X):	Full cations and Anion analysis		Bacteriological analysis		Hydrocarbon Analysis			
	Other							

Water Use

Select the applicable option:				**Volume usage (l/day)**
Domestic:		No of Households:	4	
Garden/Landscape:	✓	Watering cycle (Daily, Monthly, Weekly):		
Live stock:		No of:		
Agricultural:		Size of land (ha):		

Additional Borehole Information

Storage:						Pump size (kW):		
Reservoir:	Yes	✓	Unknown			Pump make and model nr:	unkn	
Tank type and volume:	Jojo 10000L					Yield (l/s):		
Dam type and volume:						How often pumped:	As needed	
Borehole equipped with a pump:	Yes	✓	No				Auto level control	
Pump Type:	Subm	✓	Mono		Wind			

Notes	Photo

UnKn=UnKnown

Sea Cottage Estate

GEO POLLUTION TECHNOLOGIES
SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Title:	Hydrocensus of Groundwater	Doc No., Rev No.:	5.4.3.9, Rev 01
Department:	Inorganics	Page No.:	Page 1 of 1
Project Name:	Infanta Impact Assessment Update Infanta	Project Number:	DJINF/25/13509
Census date:		Project Manager:	Christoff Dreyer
Borehole Nr:	BH05	Field Technician:	0
Alternative Borehole Number:			

Site Information

Owner:	Jean van Niekerk Trust - Sea Cottage		
Address:	ERF 149, LABYRINTH, RUTLEY ST, Infanta	Tel:	prop@7744.co.za
		Fax:	
		Cell:	0721735705

Borehole / Monitoring Well Info

Field Measurements

Coordinates	Lat (S):	-34, 421 199			
	Long (E):	20. 53 4932			
Static water level (mbcl):		4.81m			
Borehole depth (m):		13.0m+-			
Casing installed (Mark with an X):	PVC		Steel	✓	
	None		Both		
Casing Depth (m):		Unkn			
Borehole Diameter OD (mm):		170			
Collar height (magl):		23cm			

Borehole Condition

Headworks	Yes	No	Comment
Marker pole:			
Concrete Plinth:			
Casing cap:			
Blocked:			
Comment:			

Sampling

Sampled (Mark with an X):	Yes			No			
Sampling Method:	**Bailed**		**Purge**		**Pumped**		
	Tap		**Tank**				
Sampling depth:	2.6m						
Sampling time:	16:53						
Sampling volume:							
Type of sample (Mark with an X):	Full cations and Anion analysis		Bacteriological analysis		Hydrocarbon Analysis		
	Other						

Water Use

Select the applicable option:				Volume usage (l/day)
Domestic:		No of Households:		
Garden/Landscape:	✓	Watering cycle (Daily, Monthly, Weekly):		
Live stock:		No of:		
Agricultural:		Size of land (ha):		

Additional Borehole Information

Storage:						Pump size (kW):			
Reservoir:	Yes		Unknown			Pump make and model nr:			
Tank type and volume:						Yield (l/s):			
Dam type and volume:						How often pumped:	As needed		
Borehole equipped with a pump:	Yes		No				Auto level control		
Pump Type:	Subm		Mono		Wind				

Notes	Photo

UnKn=UnKnown

GEO POLLUTION TECHNOLOGIES
SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Title:	Hydrocensus of Groundwater	Doc No., Rev No.:	5.4.3.9, Rev 01
Department:	Inorganics	Page No.:	Page 1 of 1
Project Name:	Infanta Impact Assessment Update Infanta	Project Number:	DJINF/25/13509
Census date:	29/07/2025	Project Manager:	Christoff Dreyer
Borehole Nr:	BH09	Field Technician:	O
Alternative Borehole Number:			

Site Information

Owner:	unknown		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Field Measurements

Coordinates	Lat (S):	-34.120032			
	Long (E):	20.554542			
Static water level (mbd):		4.2m Below ground level			
Borehole depth (m):		unkn			
Casing installed (Mark with an X):	PVC		Steel	✓	
	None		Both		
Casing Depth (m):		unkn			
Borehole Diameter OD (mm):		170mm			
Collar height (magl):	Below ground	23cm			

Borehole Condition

Headworks	Yes	No	Comment
Marker pole:		✓	
Concrete Plinth:	✓		
Casing cap:	✓		
Blocked:		✓	
Comment:			

Sampling

Sampled (Mark with an X):	Yes		✓	No			
Sampling Method:	**Bailed**		**Purge**		**Pumped**		
	Tap	✓	**Tank**				
Sampling depth:							
Sampling time:							
Sampling volume:							
Type of sample (Mark with an X):	Full cations and Anion analysis		Bacteriological analysis		Hydrocarbon Analysis		
	Other						

Water Use

Select the applicable option:				Volume usage (l/day)
Domestic:		No of Households:	1	
Garden/Landscape:		Watering cycle (Daily, Monthly, Weekly):		
Live stock:		No of:		
Agricultural:		Size of land (ha):		

Additional Borehole Information

Storage:						Pump size (kW):		
Reservoir:	Yes	✓	Unknown			Pump make and model nr:	unkn	
Tank type and volume:	5000l	Jojo				Yield (l/s):		
Dam type and volume:						How often pumped:	As needed	
Borehole equipped with a pump:	Yes	✓	No				Auto level control	
Pump Type:	Subm	✓	Mono		Wind			

Notes	Photo

UnKn=UnKnown

GEO POLLUTION TECHNOLOGIES
SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Title:	Hydrocensus of ~~Groundwater~~ Ground water Surface	Doc No., Rev No.:	5.4.3.9, Rev 01
Department:	Inorganics	Page No.:	Page 1 of 1
Project Name:	Infanta Impact Assessment Update Infanta	Project Number:	DJINF/25/13509
Census date:	29/07/2025	Project Manager:	Christoff Dreyer
Borehole Nr:	SP01 (Spring)	Field Technician:	0
Alternative Borehole Number:			

Site Information

Owner:			
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Field Measurements

Coordinates	Lat (S):	-34 [illegible]					
	Long (E):	20 [illegible]					
Static water level (mbcl):		UNKN					
Borehole depth (m):		UNKN					
Casing installed (Mark with an X):	PVC		Steel				
	None		Both				
Casing Depth (m):		UNKN					
Borehole Diameter OD (mm):							
Collar height (magl):		45cm above ground					

Borehole Condition

Headworks	Yes	No	Comment
Marker pole:		✓	
Concrete Plinth:		✓	
Casing cap:	✓		
Blocked:		✓	
Comment:			

Sampling

Sampled (Mark with an X):	Yes		✓	No				
Sampling Method:	**Bailed**		**Purge**		**Pumped**			
	Tap		**Tank**		Surface ✓			
Sampling depth:	Surface							
Sampling time:	11:35							
Sampling volume:	1,75l							
Type of sample (Mark with an X):	Full cations and Anion analysis		Bacteriological analysis		Hydrocarbon Analysis			
	Other							

Water Use

Select the applicable option:				Volume usage (l/day)
Domestic:		No of Households:		
Garden/Landscape:		Watering cycle (Daily, Monthly, Weekly):		
Live stock:		No of:		
Agricultural:		Size of land (ha):		

Additional Borehole Information

Storage:							Pump size (kW):		
Reservoir:	Yes		Unknown				Pump make and model nr:		
Tank type and volume:							Yield (l/s):		
Dam type and volume:							How often pumped:	As needed	
Borehole equipped with a pump:	Yes		No					Auto level control	
Pump Type:	Subm		Mono		Wind				

Notes

Artesian well

Photo

UnKn=UnKnown

GEO POLLUTION TECHNOLOGIES
SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Title:	Hydrocensus of Groundwater	Doc No., Rev No.:	5.4.3.9, Rev 01
Department:	Inorganics	Page No.:	Page 1 of 1
Project Name:	Infanta Impact Assessment Update Infanta	Project Number:	DJINF/25/13509
Census date:	29/07/2025	Project Manager:	Christoff Dreyer
Borehole Nr:	SP02	Field Technician:	0
Alternative Borehole Number:			

Site Information

Owner:			
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Field Measurements

Coordinates	Lat (S):	-34.623865					
	Long (E):	20.857226					
Static water level (mbcl):							
Borehole depth (m):							
Casing installed (Mark with an X):	PVC	✓	Steel				
	None		Both				
Casing Depth (m):							
Borehole Diameter OD (mm):							
Collar height (magl):							

Borehole Condition

Headworks	Yes	No	Comment
Marker pole:		✓	
Concrete Plinth:		✓	
Casing cap:		✓	
Blocked:		✓	
Comment:			

Sampling

Sampled (Mark with an X):	Yes			No	✓			
Sampling Method:	**Bailed**		**Purge**		**Pumped**			
	Tap		**Tank**					
Sampling depth:								
Sampling time:								
Sampling volume:								
Type of sample (Mark with an X):	Full cations and Anion analysis		Bacteriological analysis		Hydrocarbon Analysis			
	Other							

Water Use

Select the applicable option:				Volume usage (l/day)
Domestic:		No of Households:		
Garden/Landscape:	✓	Watering cycle (Daily, Monthly, Weekly):		
Live stock:		No of:		✓
Agricultural:	✓	Size of land (ha):		

Additional Borehole Information

Storage:						Pump size (kW):		
Reservoir:	Yes		Unknown	✓		Pump make and model nr:		
Tank type and volume:						Yield (l/s):		✓
Dam type and volume:						How often pumped:	As needed	
Borehole equipped with a pump:	Yes		No				Auto level control	
Pump Type:	Subm		Mono		Wind			

Notes	Photo
Artesian well Strong flow	

UnKn=UnKnown


Legend
Infanta
Untitled Map
Write a description for your map.
Infanta
900 ft
Google Earth

APPENDIX II: WATER QUALITY DATA

EPL
ENVIRONMENTAL POLLUTION LABORATORY

sanas
Testing Laboratory

TEST REPORT
59641A

Client and Project Information

Client:	Geo Pollution Technologies				
Address:	Unit B 203, Buchanan Square, 160 Sir Lowry Cape Town 7925	**Attention:** **Tel:** **Email:**	Willem van Biljon (021) 462-6822 willem@gptglobal.com	**Project number:** **Project name:**	DJINF/25/13509 Infanta Impact Assessment

Sample Information

Sample ID:	**DJINFBH05**	**Matrix:**	Water	**Date Received:**	2025/07/31
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass & Plastic	**Date Analysed:**	2025/08/04
				Date Issued:	2025/08/12

Cations and Metals

Al	0.20	**Cu**	<0.05	**Na**	287.70
As	<0.05	**Fe**	0.06	**Ni**	<0.05
B	0.62	**K**	6.17	**Pb**	<0.05
Ca	121.10	**Mg**	38.13	**Si**	5.57
Cr	<0.05	**Mn**	<0.05	**Zn**	<0.05

Anions (Discrete Analyser)

Cl	582.10	**NO2**	<0.43	**SO4**	53.57	**NO2 as N**	<0.13	**NO3 + NO2 as N***	<0.5
F	0.15	**NO3**	<2.22	**PO4**	<0.61	**NO3 as N**	<0.5		

Other Parameters

pH	7.94	**P-Alk as CaCO3**	<0.6	**E.coli (colonies/100ml)***	0
EC (µs/cm)	2388	**M-Alk as CaCO3**	274.90	**Total Coliforms (colonies/100ml)***	16
TDS by calc*	1672	**CO3***	0.00		
NH3*	0.14	**HCO3***	335.40		

Disclaimers

Miche Kannemeyer
Authorised Signatory

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2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Page 1 of 3

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TEST REPORT
59641A

Client and Project Information

Client:	Geo Pollution Technologies				
Address:	Unit B 203, Buchanan Square, 160 Sir Lowry Cape Town 7925	**Attention:** **Tel:** **Email:**	Willem van Biljon (021) 462-6822 willem@gptglobal.com	**Project number:** **Project name:**	DJINF/25/13509 Infanta Impact Assessment

Sample Information

Sample ID:	**DJINFBH07**	**Matrix:**	Water	**Date Received:**	2025/07/31
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass & Plastic	**Date Analysed:**	2025/08/04
				Date Issued:	2025/08/12

Cations and Metals

Al	0.08	**Cu**	<0.05	**Na**	237.40
As	<0.05	**Fe**	0.44	**Ni**	<0.05
B	<0.5	**K**	6.98	**Pb**	<0.05
Ca	103.70	**Mg**	26.80	**Si**	6.94
Cr	<0.05	**Mn**	0.09	**Zn**	<0.05

Anions (Discrete Analyser)

Cl	457.40	**NO2**	<0.43	**SO4**	44.46	**NO2 as N**	<0.13	**NO3 + NO2 as N***	<0.5
F	0.26	**NO3**	<2.22	**PO4**	<0.61	**NO3 as N**	<0.5		

Other Parameters

pH	7.30	**P-Alk as CaCO3**	<0.6	**E.coli (colonies/100ml)***	6
EC (µs/cm)	1973	**M-Alk as CaCO3**	231.10	**Total Coliforms (colonies/100ml)***	900
TDS by calc*	1381	**CO3***	0.00		
NH3*	<0.02	**HCO3***	281.90		

Disclaimers

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4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Page 2 of 3

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TEST REPORT
59641A

Client and Project Information

Client:	Geo Pollution Technologies				
Address:	Unit B 203, Buchanan Square, 160 Sir Lowry Cape Town 7925	**Attention:** **Tel:** **Email:**	Willem van Biljon (021) 462-6822 willem@gptglobal.com	**Project number:** **Project name:**	DJINF/25/13509 Infanta Impact Assessment

Sample Information

Sample ID:	**DJINFBH09**	**Matrix:**	Water	**Date Received:**	2025/07/31
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass & Plastic	**Date Analysed:**	2025/08/04
				Date Issued:	2025/08/12

Cations and Metals

Al	0.16	**Cu**	0.07	**Na**	230.80
As	<0.05	**Fe**	<0.05	**Ni**	<0.05
B	0.59	**K**	7.17	**Pb**	<0.05
Ca	93.87	**Mg**	25.12	**Si**	6.88
Cr	<0.05	**Mn**	<0.05	**Zn**	0.10

Anions (Discrete Analyser)

Cl	427.90	**NO2**	<0.43	**SO4**	56.50	**NO2 as N**	<0.13	**NO3 + NO2 as N***	<0.5
F	0.29	**NO3**	<2.22	**PO4**	<0.61	**NO3 as N**	<0.5		

Other Parameters

pH	8.06	**P-Alk as CaCO3**	<0.6	**E.coli (colonies/100ml)***	0
EC (µs/cm)	1819	**M-Alk as CaCO3**	204.30	**Total Coliforms (colonies/100ml)***	0
TDS by calc*	1273	**CO3***	0.00		
NH3*	0.08	**HCO3***	249.20		

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3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Page 3 of 3

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bemlab Part of PathCare Laboratories

sanas Testing Laboratory T0654

CERTIFICATE OF ANALYSIS

Client : Geo Pollution Technologies

Address	: PO Box 38384	Report No	: WT2020-03237	Delivery Date	: 15/06/2020
Phone	: 012 804 8120	Samples	: 3	Delivery Time	:
Contact	: Camila	Sample Type	: Water	Order No/Ref	: N/A
Email	: camila@gptglobal.com; chemres@gptglobal.com; ryan@gptglobal.com				

Sample Information				
Lab Number		WT20-06539	WT20-06540	WT20-06541
Sampling Date		11/06/2020	11/06/2020	11/06/2020
Sampling Time		12:22	14:47	14:28
Sample Temperature °C:		16.7	18.0	17.6
Sample ID:		DJINF134C	DJINFBH05	DJINFBH06
Physical & Aesthetic Determinands	**Unit**		**Result**	
Total Dissolved Solids (Calc)	mg/L	1230	1270	1270
pH (Titrando Method) (20°C)	pH Units	7.9	7.9	7.1
Electrical Conductivity (Titrando)	mS/m (25°C)	189	195	195
Alkalinity as CaCO3 (Titrando)	mg/L	242	243	240
Langelier Index		0.7	0.7	-0.1
Chemical Determinands - Macro Determinands	**Unit**		**Result**	
Sulphur as S	mg/L	14.8	15.0	15.8
Chloride as Cl (Titrando)	mg/L	422	434	435
Ammonia NH4 as N	mg/L	<0.05	<0.05	<0.05
Nitrate (NO3) as N	mg/L	0.21	0.23	<0.18
Nitrite (NO2) as N	mg/L	<0.03	<0.03	<0.03
Sodium as Na	mg/L	220	226	227
Calcium as Ca	mg/L	105	108	109
Magnesium as Mg	mg/L	26.1	26.9	27.3
Potassium as K	mg/L	4.7	5.0	5.1
Sulphate as SO4	mg/L	44.3	45.1	47.5
Total Phosphorus as P	mg/L	0.15	<0.12	<0.12
Chemical Determinands - Micro Determinands	**Unit**		**Result**	
Iron as Fe (Dissolved)	mg/L	<0.06	<0.06	<0.06
Iron as Fe (Total)	mg/L	0.12	0.09	<0.06
Manganese as Mn (Dissolved)	mg/L	<0.04	<0.04	<0.04
Manganese as Mn(Total)	mg/L	<0.04	0.07	<0.04
Boron as B(Total)	mg/L	0.20	0.27	0.17
Zinc as Zn(Total)	mg/L	<0.17	<0.17	<0.17
Copper as Cu(Total)	mg/L	<0.04	0.07	<0.04
Fluoride as F	mg/L	<0.20	<0.20	<0.20
Microbiology Determinands	**Unit**		**Result**	
Heterotrophic Plate Count	CFU/1mL	2680	70	126
Total Coliforms	MPN/100mL	33	5	<1
E coli	MPN/100mL	<1	<1	<1

Report NO: WT2020-03237 Date reported: 19-06-2020 Page 1 of 2

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CERTIFICATE OF ANALYSIS

Client : Geo Pollution Technologies

Address	: PO Box 38384	Report No	: WT2020-03237	Delivery Date	: 15/06/2020
Phone	: 012 804 8120	Samples	: 3	Delivery Time	:
Contact	: Camila	Sample Type	: Water	Order No/Ref	: N/A
Email	: camila@gptglobal.com; chemres@gptglobal.com; ryan@gptglobal.com				

Comments

Project no: DJINF/20/5181
Project Name: M:\Doug Jeffrey\DJINF-20-5181
Project Manager: Doug Jeffrey Envoronmental
Client: Marius Terblanche

Terms and Conditions

The reported results may be applied only to samples received. Any recommendations included with this report are based on the assumption that the samples were representative of the source from which they were taken. To ensure sample integrity, samples are stored only for sever days after release of the report. Thereafter it is disposed of and a fresh sample will be required if additional analyses are requested. Client supplied information; client details, sample reference, the date and time of sampling, the sampler, and transportation of the sample to the testing laboratory. The information supplied by the client (or lack thereof) may affect the validity of the results.
Results marked with "Not SANAS Accredited" or "Subcontracted" in this report are not included in the SANAS Schedule of Accreditation for this laboratory. These results relate to the items tested. This test report shall not be reproduced except in full, without written approval of the laboratory. Uncertainty of Measurement and method references available on request.

Sample condition:

Samples for analysis must be kept cool (<10°C) and reach the laboratory within 24 hours of sampling. Chemical parameters that can be affected by exceeded temperature and sampling times includes: Acidity, Alkalinity, BOD, CO2, Chlorine, Chlorophyll, Cyanide, Chromium VI, Dissolved Oxygen, Odor, pH & Turbidity. The effect on the microorganisms is unknown, treat microbiological results with reserve.

Additional Information including: Testing date & time for all analysis are available on request

**** - Not SANAS Accredited*** ***** - Outstanding*** ****** - Insufficient Sample*** ***# - Subcontracted***

Shaun Salie
Technical Signatory
(Water Chemistry)

Lauren Megan Briers
Technical Signatory
(Microbiology)

Report NO: WT2020-03237 Date reported: 19-06-2020 Page 2 of 2

EPL
ENVIRONMENTAL POLLUTION LABORATORY

sanas
Testing Laboratory

TEST REPORT
60757A

Client and Project Information

Client:	Geo Pollution Technologies				
Address:	Unit B 203, Buchanan Square, 160 Sir Lowry Cape Town 7925	**Attention:** **Tel:** **Email:**	Willem van Biljon (021) 462-6822 willem@gptglobal.com	**Project number:** **Project name:**	DJINF/25/13509 Infanta Impact Assessment

Sample Information

Sample ID:	**DJINF134C**	**Matrix:**	Water	**Date Received:**	2025/09/16
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Plastic	**Date Analysed:**	2025/09/17
				Date Issued:	2025/09/22

Cations and Metals

Al	0.07	**Cu**	<0.05	**Na**	272.50
As	<0.05	**Fe**	1.36	**Ni**	<0.05
B	<0.5	**K**	5.79	**Pb**	<0.05
Ca	122.70	**Mg**	30.99	**Si**	4.35
Cr	<0.05	**Mn**	<0.05	**Zn**	<0.05

Anions (Discrete Analyser)

Cl	497.50	**NO2**	<0.43	**SO4**	46.20	**NO2 as N**	<0.13	**NO3 + NO2 as N***	<0.5
F	0.09	**NO3**	<2.22	**PO4**	<0.61	**NO3 as N**	<0.5		

Other Parameters

pH	7.39	**P-Alk as CaCO3**	<0.6	**E.coli (colonies/100ml)***	0
EC (µs/cm)	2244	**M-Alk as CaCO3**	332.60	**Total Coliforms (colonies/100ml)***	9400
TDS by calc*	1571	**CO3***	0.00		
NH3*	0.67	**HCO3***	405.80		

Disclaimers

Zelma Weideman
Authorised Signatory

1) The results only relate to the test items provided, in the condition as received.
2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
4) A = Concentration outside calibration range, "* = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

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APPENDIX III: PUMP TESTING FIELD DATA

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Fax: 028-7132916
Cell: 082-5598265

Pumpcor

PO Box 501
RIVERSDALE
6670

CONSTANT DISCHARGE TEST

PROJECT: Infanta	PUMPING BH NAME: Production
CLIENT: Mark De Agrella	OBSERVATION BH'S: Production
LOCATION:	DISTANCE TO OBSERVATION BH:
CONTRACTOR: Pumpcor	BOREHOLE DEPTH: 79.4 meters
RECORDER:	STATIC WATER LEVEL: 15.470 meters
PUMP TYPE: Vansan 404-18	AVAILABLE DRAWDOWN:
PUMP INLET DEPTH: 75 meters	PUMP RATE (Steps l/s): 4; 0.82; 0.9; 1.07 l/sec
CASING HEIGHT (above ground):	BASE OF AQUIFER:
DATUM (above ground):	

Date	Time	Elapsed Time (min)	Drawdown (m)	Remarks / Discharge (l/s)	Date	Time	Elapsed Time (min)	Drawdown (m)	Remarks / Discharge (l/s)
		0.5	2.550				700	33.520	
		1	3.730				800	33.594	
		1.5	4.820				900	33.614	
		2	5.888				1000	33.662	
		2.5	6.702				1100	33.752	0.84 l/sec
		3	7.416				1175	33.866	
		4	8.782				1300	#N/A	
		5	9.892				1400	33.750	
		6	10.978				1440	33.882	
		7	11.918				1440	34.006	
		8	12.858				1700	34.402	
		9	13.592				1800	34.254	
		10	14.386	0.85 l/sec			1900	34.292	
		12	15.702				2000	34.392	
		15	17.336				2100	34.404	
		20	19.189				2200	34.530	
		25	21.268				2300	34.546	
		30	23.112				2365	34.844	
		35	24.414				2500	35.060	
		40	25.420				2600	35.204	
		45	26.170				2700	35.264	
		50	27.100						
		60	29.100						
		70	30.200						
		80	30.872						
		90	31.274						
		100	31.514						
		120	31.780						
		150	#N/A						
		180	32.092						
		250	#N/A						
		300	32.514						
		360	32.662						
		400	32.762						
		450	32.883						
		500	32.170						
		600	#N/A						

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RECOVERY DATA SHEET

PROJECT: Infanta	PUMPING BH NAME: Production
CLIENT: Mark De Agrella	OBSERVATION BH'S: Production
LOCATION:	DISTANCE TO OBSERVATION BH:
CONTRACTOR: Pumpcor	BOREHOLE DEPTH: 79.4 meters
RECORDER:	STATIC WATER LEVEL: 15.470 meters
PUMP TYPE: Vansan 404-18	AVAILABLE DRAWDOWN:
PUMP INLET DEPTH: 75 meters	PUMP RATE (Steps l/s): 4; 0.82; 0.9; 1.07 l/sec
CASING HEIGHT (above ground):	BASE OF AQUIFER:
DATUM (above ground):	

Date	Time	Time Since Pumping Stopped (min)	Time Since Pumping Started (min)	Residuel Drawdown (m)	Date	Time	Time Since Pumping Stopped (min)	Time Since Pumping Started (min)	Residuel Drawdown (m)
		0.0	35.224				180	#N/A	
		0.5	33.952				250	#N/A	
		1	32.778				300	#N/A	
		1.5	31.546				350	#N/A	
		2	29.412				400	#N/A	
		2.5	29.290				450	#N/A	
		3	28.248				500	#N/A	
		4	26.122				600	#N/A	
		5	24.096				700	#N/A	
		6	22.198				800	#N/A	
		7	20.310				900	#N/A	
		8	18.562				1700	#N/A	
		9	16.998						
		10	15.600						
		12	13.042						
		15	9.942						
		20	6.484						
		25	4.738						
		35	3.070						
		40	2.650						
		50	2.204						
		60	2.018						
		70	#N/A						
		80	1.984						
		90	N/A						
		100	1.640						
		120	1.518						
		150	#N/A						

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RECOVERY AFTER STEPS

PROJECT: Infanta	PUMPING BH NAME: Production
CLIENT: Mark De Agrella	OBSERVATION BH'S: Production
LOCATION:	DISTANCE TO OBSERVATION BH:
CONTRACTOR: Pumpcor	BOREHOLE DEPTH: 79.4 meters
RECORDER:	STATIC WATER LEVEL: 15.470 meters
PUMP TYPE: Vansan 404.18	AVAILABLE DRAWDOWN:
PUMP INLET DEPTH: 75 meters	PUMP RATE (Steps l/s): 4; 0.82; 0.9; 1.07 l/sec
CASING HEIGHT (above ground):	BASE OF AQUIFER:
DATUM (above ground):	

Date	Time	Time Since Pumping Stopped (min)	Time Since Pumping Started (min)	Residuel Drawdown (m)	Date	Time	Time Since Pumping Stopped (min)	Time Since Pumping Started (min)	Residuel Drawdown (m)
		0.0	52.068				180	#N/A	
		0.5	50.456				250	#N/A	
		1	48.724				300	#N/A	
		1.5	47.528				350	#N/A	
		2	45.500				400	#N/A	
		2.5	44.018				450	#N/A	
		3	42.806				500	#N/A	
		4	40.192				600	#N/A	
		5	37.290				700	#N/A	
		6	34.774				800	#N/A	
		7	32.154				900	#N/A	
		8	29.632				1700	#N/A	
		9	27.210						
		10	24.948						
		12	20.864						
		15	15.642						
		20	9.262						
		25	5.450						
		35	2.402						
		40	1.748						
		50	1.162						
		60	#N/A						
		70	#N/A						
		80	#N/A						
		90	#N/A						
		100	#N/A						
		120	#N/A						
		150	#N/A						

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STEP DRAWDOWN TEST

PROJECT: Infanta	PUMPING BH NAME: Production
CLIENT: Mark De Agrella	OBSERVATION BH'S: Production
LOCATION:	DISTANCE TO OBSERVATION BH:
CONTRACTOR: Pumpcor	BOREHOLE DEPTH: 79.4 meters
RECORDER:	STATIC WATER LEVEL: 15.470 meters
PUMP TYPE: Vansan 404-18	AVAILABLE DRAWDOWN: 63.93 meters
PUMP INLET DEPTH: 75 meters	PUMP RATE (Steps l/s): 4; 0.82; 0.9; 1.07 l/sec
CASING HEIGHT (above ground):	BASE OF AQUIFER:
DATUM (above ground):	

STEP 1					STEP 2				
Date	Time	Elapsed Time (min)	Drawdown (m)	Remarks / Discharge (l/s)	Date	Time	Elapsed Time (min)	Drawdown (m)	Remarks / Discharge (l/s)
09.06.20	11:45	0.5	1.472			0.53	0.5	8.936	
		1	2.020				1	9.430	
		1.5	2.422				1.5	10.030	
		2	2.714				2	10.572	
		2.5	3.004				2.5	11.326	
		3	3.272				3	11.972	
		4	3.770				4	13.076	
		5	4.140				5	14.036	
		6	4.522				6	15.088	
		7	4.814				7	15.908	0.82 l/sec
		8	5.102				8	16.654	
		9	5.390	0.4 l/sec			9	17.386	
		10	5.680				10	18.028	
		12	6.240				12	19.190	
		15	6.942				15	20.614	
		20	7.694				20	22.566	
		25	8.184				25	24.064	
		30	8.288				30	25.258	
		35	8.376				35	26.134	
		40	8.446				40	26.814	
		45	8.534	0.41 l/sec			45	27.314	
		50	8.640				50	27.726	0.82 l/sec
		60	8.768				60	28.284	
		70	#N/A				70	#N/A	
		80	#N/A				80	#N/A	
		90	#N/A				90	#N/A	
		100	#N/A				100	#N/A	
		120	#N/A				120	#N/A	
		150	#N/A				150	#N/A	

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Pumpcor

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STEP DRAWDOWN TEST

PROJECT: Infanta	PUMPING BH NAME: Production
CLIENT: Mark De Agrella	OBSERVATION BH'S: Production
LOCATION:	DISTANCE TO OBSERVATION BH:
CONTRACTOR: Pumpcor	BOREHOLE DEPTH: 79.4 meters
RECORDER:	STATIC WATER LEVEL: 15.470 meters
PUMP TYPE: Vansan 404-18	AVAILABLE DRAWDOWN: 63.93 meters
PUMP INLET DEPTH: 75 meters	PUMP RATE (Steps l/s): 4; 0.82; 0.9; 1.07 l/sec
CASING HEIGHT (above ground):	BASE OF AQUIFER:
DATUM (above ground):	

STEP 3					STEP 4				
Date	Time	Elapsed Time (min)	Drawdown (m)	Remarks / Discharge (l/s)	Date	Time	Elapsed Time (min)	Drawdown (m)	Remarks / Discharge (l/s)
	13:46	0.5	28.648			14:48	0.5	38.260	
		1	28.982				1	38.692	
		1.5	29.230				1.5	39.108	
		2	29.588				2	39.512	
		2.5	29.886				2.5	39.966	
		3	30.174				3	40.342	
		4	30.708				4	41.112	1.08 l/sec
		5	31.216				5	41.830	
		6	31.686				6	42.468	
		7	32.138				7	43.112	
		8	32.560				8	43.670	
		9	32.932				9	44.214	
		10	33.274				10	44.748	
		12	33.912				12	45.668	
		15	34.692				15	46.880	
		20	35.694				20	48.368	
		25	36.368				25	49.418	
		30	36.852				30	50.190	
		35	37.092				35	50.772	
		40	37.216	0.91 l/sec			40	51.158	1.07 l/sec
		45	37.524				45	51.484	
		50	37.718				50	51.666	
		60	37.884				60	51.908	
		70	#N/A				70	#N/A	
		80	#N/A				80	#N/A	
		90	#N/A				90	#N/A	
		100	#N/A				100	#N/A	
		120	#N/A				120	#N/A	
		150	#N/A				150	#N/A	

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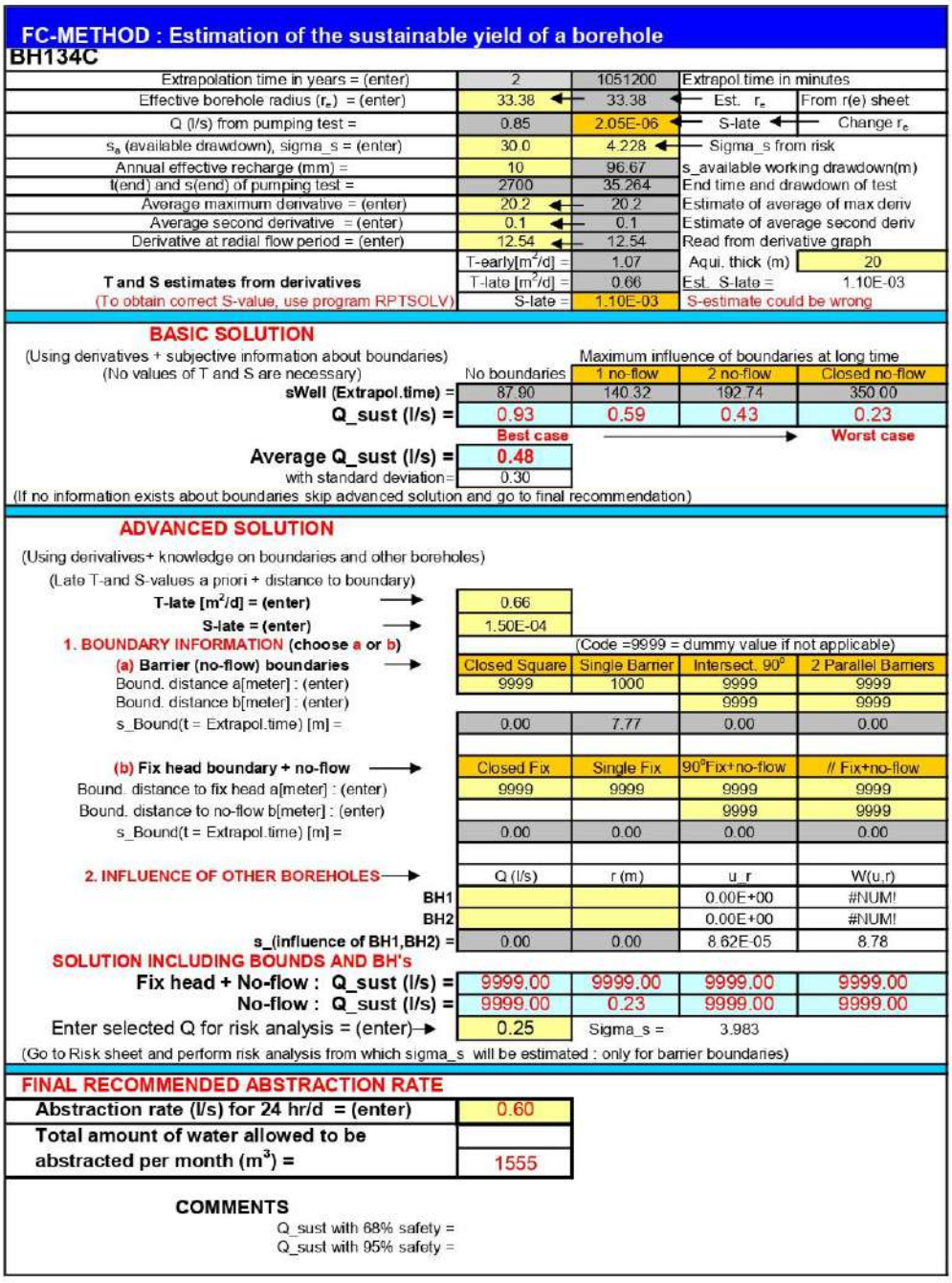
Pumpcor

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STEP DRAWDOWN TEST

PROJECT: Infanta	PUMPING BH NAME: Production
CLIENT: Mark De Agrella	OBSERVATION BH'S: Production
LOCATION:	DISTANCE TO OBSERVATION BH:
CONTRACTOR: Pumpcor	BOREHOLE DEPTH: 79.4 meters
RECORDER:	STATIC WATER LEVEL: 15.470 meters
PUMP TYPE: Vansan 404-18	AVAILABLE DRAWDOWN: 63.93 meters
PUMP INLET DEPTH: 75 meters	PUMP RATE (Steps l/s): 4; 0.82; 0.9; 1.07 l/sec
CASING HEIGHT (above ground):	BASE OF AQUIFER:
DATUM (above ground):	

APPENDIX IV: FC INTERPRETED PUMP TEST DATA



FC-METHOD : Estimation of the sustainable yield of a borehole

BH134C

Extrapolation time in years = (enter)	2	1051200	Extrapol.time in minutes	
Effective borehole radius (r_e) = (enter)	33.38	33.38	Est. r_e	From r(e) sheet
Q (l/s) from pumping test =	0.85	2.05E-06	S-late	Change r_e
s_a (available drawdown), sigma_s = (enter)	30.0	4.228	Sigma_s from risk	
Annual effective recharge (mm) =	10	96.67	s_available working drawdown(m)	
t(end) and s(end) of pumping test =	2700	35.264	End time and drawdown of test	
Average maximum derivative = (enter)	20.2	20.2	Estimate of average of max deriv	
Average second derivative = (enter)	0.1	0.1	Estimate of average second deriv	
Derivative at radial flow period = (enter)	12.54	12.54	Read from derivative graph	
	T-early[m^2/d] =	1.07	Aqui. thick (m)	20
T and S estimates from derivatives	T-late [m^2/d] =	0.66	Est. S-late =	1.10E-03
(To obtain correct S-value, use program RPTSOLV)	S-late =	1.10E-03	S-estimate could be wrong	

BASIC SOLUTION

(Using derivatives + subjective information about boundaries)
(No values of T and S are necessary)

	Maximum influence of boundaries at long time			
	No boundaries	1 no-flow	2 no-flow	Closed no-flow
sWell (Extrapol.time) =	87.90	140.32	192.74	350.00
Q_sust (l/s) =	0.93	0.59	0.43	0.23
	Best case	→		Worst case

Average Q_sust (l/s) = 0.48
with standard deviation= 0.30

(If no information exists about boundaries skip advanced solution and go to final recommendation)

ADVANCED SOLUTION

(Using derivatives+ knowledge on boundaries and other boreholes)
(Late T-and S-values a priori + distance to boundary)

T-late [m^2/d] = (enter) → 0.66
S-late = (enter) → 1.50E-04

1. BOUNDARY INFORMATION (choose a or b) (Code =9999 = dummy value if not applicable)

(a) Barrier (no-flow) boundaries →	Closed Square	Single Barrier	Intersect. 90°	2 Parallel Barriers
Bound. distance a[meter] : (enter)	9999	1000	9999	9999
Bound. distance b[meter] : (enter)			9999	9999
s_Bound(t = Extrapol.time) [m] =	0.00	7.77	0.00	0.00

(b) Fix head boundary + no-flow →	Closed Fix	Single Fix	90°Fix+no-flow	// Fix+no-flow
Bound. distance to fix head a[meter] : (enter)	9999	9999	9999	9999
Bound. distance to no-flow b[meter] : (enter)			9999	9999
s_Bound(t = Extrapol.time) [m] =	0.00	0.00	0.00	0.00

2. INFLUENCE OF OTHER BOREHOLES →

	Q (l/s)	r (m)	u_r	W(u,r)
BH1			0.00E+00	#NUM!
BH2			0.00E+00	#NUM!
s_(influence of BH1,BH2) =	0.00	0.00	8.62E-05	8.78

SOLUTION INCLUDING BOUNDS AND BH's

Fix head + No-flow : Q_sust (l/s) =	9999.00	9999.00	9999.00	9999.00
No-flow : Q_sust (l/s) =	9999.00	0.23	9999.00	9999.00

Enter selected Q for risk analysis = (enter) → 0.25 Sigma_s = 3.983

(Go to Risk sheet and perform risk analysis from which sigma_s will be estimated : only for barrier boundaries)

FINAL RECOMMENDED ABSTRACTION RATE

Abstraction rate (l/s) for 24 hr/d = (enter)	0.60
Total amount of water allowed to be abstracted per month (m^3) =	1555

COMMENTS

Q_sust with 68% safety =
Q_sust with 95% safety =

FC-Method (Version 2.0): Developed by Gerrit van Tonder, Harald Kunstmann and Yongxin Xu

WATER USE LICENCE APPLICATION
SUMMARY REPORT

ERF 134, INFANTA

APPENDIX C

Freshwater Impact Assessment Report

Freshwater Consulting

Environmental Impact Assessment for erf 134, Cape Infanta: Inland Aquatic Ecosystems and Aquatic Biodiversity

DECEMBER 2024



DRAFT FOR DISCUSSION

Compiled by: K. Snaddon,
The Freshwater Consulting Group, P O Box 43935, Scarborough, 7975

Submitted to: Doug Jeffery Environmental Consultants

Freshwater Consulting cc trading as **"The Freshwater Consulting Group" (FCG)**
Partners: J L Ewart-Smith and C D Snaddon
Reg. No. 2007/064216/23

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1 INTRODUCTION

1.1 Background and Approach

The Freshwater Consulting Group (FCG) was commissioned by Doug Jeffery Environmental Consultants to undertake an environmental impact assessment (EIA) of the inland aquatic ecosystems potentially affected by the proposed residential development of a portion of erf 134 at Cape Infanta, Western Cape. Erf 134 is located in the Stellenbosch Municipality and the Overberg District Municipality; the erf is currently zoned Agriculture 1, and is 3.04 ha in area.

Three alternative development layouts are proposed. Alternative 1 (13th April 2012) comprises 23 erven, 16 of which would be single storey and 7 double storey, Alternative 2 (26th August 2013) comprises 21 erven, 15 of which are single storey and 5 double storey and lastly, Alternative 3 (9th May 2023, updated November 2024) also with 21 erven.

The specific aims of the inland aquatic ecological input to the EIA, and our approach, were as follows:

Phase 1: Baseline study

- Assess the opportunities and constraints on and outside the site for development and depict these visually (if appropriate). In order to do this, the site was visited on the 25th August 2010 (winter). All inland aquatic ecosystems (watercourses and wetlands) on and surrounding (within 1km) the site were mapped on an aerial photograph of the area, and ground-truthed for those ecosystems directly impacted by the development (i.e. within the development footprint). The present ecological status (PES) and ecological importance and sensitivity (EIS) of the affected inland aquatic ecosystems was assessed, using accepted methods. The local context of the inland aquatic ecosystems was taken into account in this assessment, including interaction with groundwater. The watercourse passing through the site was dry at the time of the field visit, and there is anecdotal evidence that it flows only after major rain events. Collection of primary data (such as water quality and macroinvertebrates) from such ephemeral systems is challenged by the fact that they are seldom inundated for any length of time. The precautionary principle is advised in these circumstances, and the assumption made that water quality is good, and the aquatic fauna sensitive and important.
- Compile a baseline report describing and briefly assessing the extent and severity of the expected impacts of the development, to be used in Phase 2 (Environmental Impact Assessment), that will highlight concerns, and make recommendations regarding mitigation measures required. Opportunities for the incorporation of the stream into the development, while not impacting on riverine functioning, will be proposed.
- Attend meetings of the project team for integration purposes; and
- Prepare for and attend the public open house in order to present the summary of the baseline report.

Phase 2: Aquatic Biodiversity Specialist Assessment

- A site sensitivity verification was done for erf 134, in order to determine the sensitivity of the site with regards to aquatic biodiversity. The site is almost entirely rated as “very high sensitivity”, thus an Aquatic Biodiversity Specialist Assessment was deemed to be necessary for the development.
- The baseline report was updated to an Aquatic Biodiversity Specialist Assessment report, including a detailed assessment of the significance of the impacts associated with the three

development layouts, and the no development option. Specific management and monitoring requirements, to be used as the basis of conditions for the Environmental Authorisation (should it be granted), and a subsequent Environmental Management Programme, are provided.

1.2 Assumptions and limitations

The stream that crosses erf 134 is an ephemeral stream and was dry at the time of the site visit in 2010. It appears that the stream flows only after heavy rains. Collection of primary data (such as water quality and macroinvertebrates) from such ephemeral systems is challenged by the fact that they are seldom inundated for any length of time. The precautionary principle is advised in these circumstances, and the assumptions made that water quality is good, and the aquatic fauna sensitive and important. This elevates the overall sensitivity and importance of the stream, in the absence of data to prove otherwise.

1.3 Use of this Report

This report reflects the professional opinions of its author. It is the policy of FCG that the full and unedited contents of this report should be presented to the client, and that any summary of the findings should only be produced in consultation with the first author.

1.4 Declaration of Independence

This is to confirm that Kate Snaddon, the specialist consultant who is responsible for undertaking this study and preparing this environmental impact assessment report, is independent, and has no vested interests, financial or otherwise, in the proposed activity under consideration.

1.5 Specialist Details

The author of this report is an independent specialist consultant, with 25 years of experience in the field of freshwater ecology, registered with the South African Council for Natural Scientific Professions (registration number 400225/06).

2 DESCRIPTION OF THE AFFECTED INLAND AQUATIC ECOSYSTEMS

2.1 Overview

A small, unnamed ephemeral stream crosses the property, entering erf 134 along its south-eastern border. The stream flows along the southern portion of the property before entering the sea. At the time of the site visit, the stream was dry and, by all accounts, it flows only rarely, after heavy rains. The stream lies in the Breede River catchment and Breede River Water Management Area (WMA) (Lower Breede River sub-WMA), in quaternary catchment H70K, which incorporates the lower Breede River and some of the coastline to the east of the Breede River mouth. Erf 134 lies in the Overberg District Municipality, and within the Southern Coastal Belt Level 1 ecoregion, which has the following characteristics (from Kleynhans *et al*., 2005):

Closed hills and mountains with moderate to high relief are characteristic of this ecoregion, but plains are also significant. South and Southwest Coast Renosterveld vegetation types are dominant.

- MAP (mm): 300 to 1000
- Coefficient of Variation (% of annual precipitation): <20 to 40
- Rainfall concentration index: <15 to 50
- Rainfall seasonality: Winter to all year
- Mean annual temp. (°C): 10 to 20
- Mean daily max. temp. (°C): February - 22 to 30
- Mean daily max. temp. (°C): July - 12 to 20
- Mean daily min. temp. (°C): February - 10 to 18
- Mean daily min temp. (°C): July - 4 to 10
- Median annual simulated runoff (mm) for quaternary catchment: 10 to >250

The stream is short, rising on the slopes of the Potberg Mountain, just to the east of Kadiekop (Figure 2.1) and flowing for approximately 4 km to the sea. To the west of the site, the stream channel comprises bedrock and some cobble but mostly sand, but once the stream enters erf 134, the channel comprises only sand. The stream is supposed to flow under the road in a single pipe, but this pipe was completely blocked by sand and silt at the time of the site visit. Stormwater runoff from the road enters the property at several points. The stream channel is heavily invaded by *Acacia cyclops*.



Photo 1 Dirt road to Cape Infanta, showing one of the stormwater "swales" carrying runoff from the road onto erf 134.

The surrounding vegetation on erf 134 is either De Hoop Limestone Fynbos (least threatened) and Overberg Dune Strandveld (least threatened) along the coast (Mucina & Rutherford, 2006; Rebelo *et al*., 2006). The

least threatened status of these vegetation types is largely due to the protection of large tracts within the De Hoop Nature Reserve.

Electrical conductivity of the local groundwater varies between 130 and 410 mS/m, with EC increasing towards the coastline as one moves from groundwater originating in the Skurweberg Formation (composed of inert quartzitic rocks resistant to weathering) through to that originating from the Rietvlei Formation (consisting of occasional siltstone and shale beds) (Parsons, 2005). Groundwater was found by Parsons (2005) to be virtually uncontaminated, despite the use of septic tanks and soakaways in Cape Infanta and Infanta Park. It is likely that the groundwater resources of the area are separated from surface runoff by relatively impermeable shale in the vicinity of the town (Parsons, 2005). An exception to this was found by Toens & Partners (1999) to be bacterial contamination in areas where Table Mountain Group formations outcrop, as the quartzites in the TMG formations are more permeable than shale.

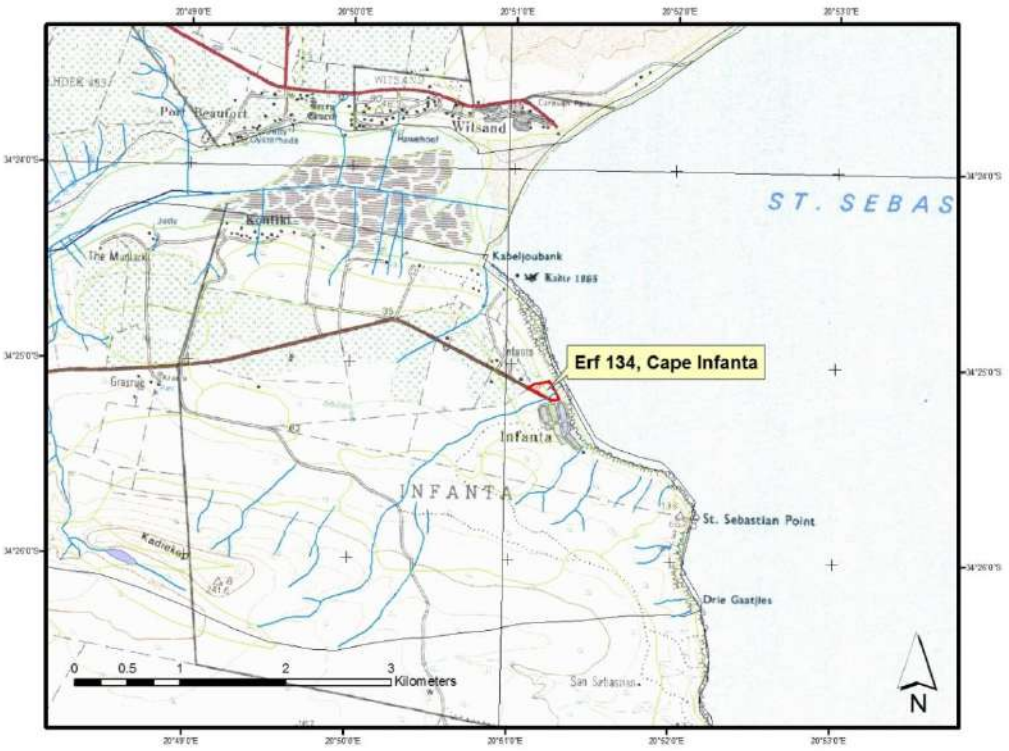


Figure 2.1 Location of erf 134 near the mouth of the Breede River, with rivers and streams shown as blue lines. The site is in the Overberg District Municipality.

2.2 Watercourse delineation

The stream as it flows over erf 134 does not have a clear riparian area around the edges of the channel. The channel itself is not visible, as flow along the channel is insufficient to create a defined channel. The riparian area around the watercourse has been heavily invaded by *Acacia cyclops*, and the soils in the riparian area are sandy soils, with no visible alluvial indicators. In the absence of soil and vegetation indicators (as per the national delineation guidelines (DWAF, 2005), delineation of the riparian area was not possible. Nonetheless, the centreline of the watercourse was surveyed, and is shown in Figure 2.2.



Figure 2.2 Aerial photograph of Cape Infanta, showing the watercourse (blue line) and its recommended ecological buffer (purple outline). The 1:100 year floodline falls within the buffer.

3 SITE SENSITIVITY VERIFICATION

The Environmental Impact Assessment Screening Tool of the Department of Forestry, Fisheries and the Environment (DFFE) shows that the site is within an area of very high aquatic biodiversity sensitivity. This is based on the fact that the site lies within a national Freshwater Ecosystem Priority Area (FEPA) sub-quaternary catchment. The status of the sub-catchment is such due to the known locations of populations of the fish species *Sandelia capensis* (Cape kurper) and *Pseudobarbus burchelli* cf. Breede (Breede River Redfin). As such the rivers in this catchment (in particular the mainstem of the lower Breede River) are considered "fish sanctuaries", requiring protection from negative impacts. It is, however, unlikely that these species occur in the short watercourses flowing off east-facing slopes of Potberg.

The presence of a watercourse on site does mean that this portion of the site is of very high sensitivity with regards to aquatic biodiversity, hence the need for an Aquatic Biodiversity Specialist Assessment (this report).

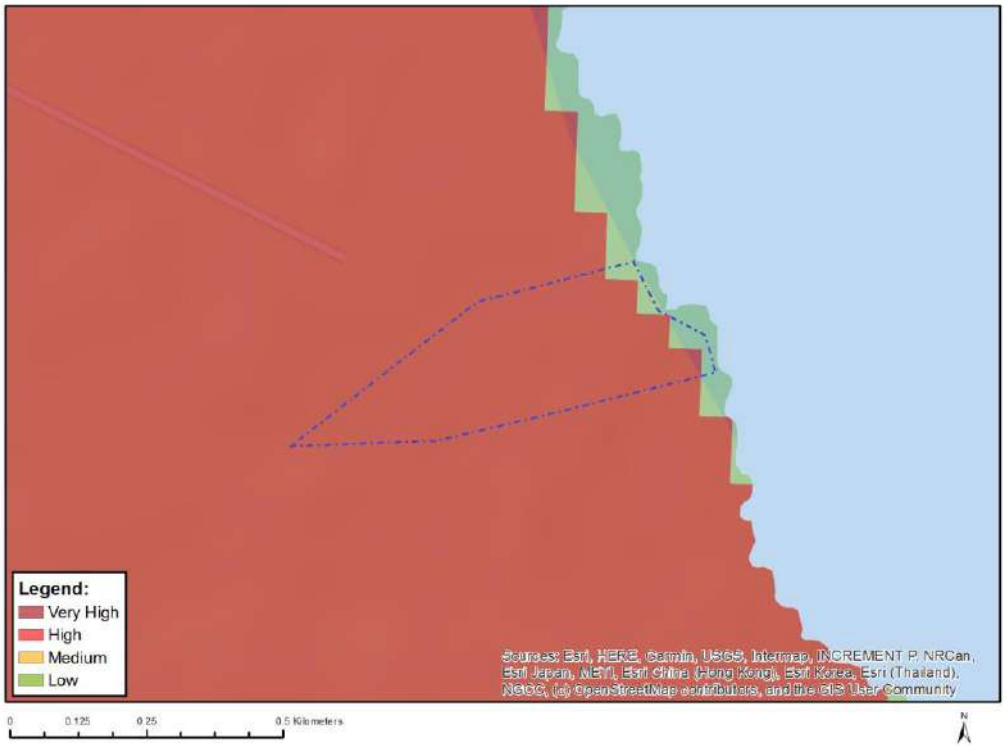


Figure 3.1 Sensitivity rating for erf 134, Cape Infanta (blue outline), according the DFFE's EIA Screening Tool.

4 ASSESSMENT OF THE CONDITION AND SENSITIVITY OF THE STREAM

4.1 Introduction

An assessment of the conservation importance or status of an inland aquatic ecosystem should combine assessments of both the current ecological integrity of the ecosystem and its perceived ecological importance and sensitivity. The *ecological integrity* of an ecosystem is defined as its ability to support and maintain a balanced, integrated composition of physico-chemical and habitat characteristics, as well as biotic components on temporal and spatial scales that are comparable to the natural characteristics of ecosystems of the region. The integrity of a system is directly influenced by its current state, and how much the system has been altered from the reference or unimpacted condition. The *ecological importance* of a river or stream is an expression of its importance to the maintenance of ecological diversity (i.e. both species and habitat diversity) and functioning on local and wider scales. *Ecological sensitivity* (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Resh *et al.,* 1988; Milner, 1994). Both abiotic and biotic components of the system are taken into consideration in an assessment of ecological importance and sensitivity. It is strongly biased towards the potential importance and sensitivity of a particular section of a stream or river, as it would be expected under *unimpaired* conditions.

DWA's Resource Directed Measures (RDM) approach provides methods for the assessment of ecological integrity and of ecological importance and sensitivity, in the context of the determination of the ecological management class for riverine ecosystems as part of the Reserve Determination procedure (DWAF, 1999). This procedure can be followed at different levels of detail – desktop, rapid, intermediate and comprehensive. The rapid approach was followed for this study. Determination of the appropriate ecological management class for a river reach is useful in the context of an EIA, as this class, in conjunction with the attainable (or desired) ecological management class, provides an indication of the extent to which a river reach can be further modified (or not) by human activities that impact on that river reach. This will have a direct bearing on the significance of proposed impacts, and will guide the mitigation (if possible and relevant) of such impacts.

4.2 Methods

In 2005, DWS revised the methods for the determination of the PES of watercourses, through the development of the EcoClassification approach (Kleynhans *et al.*, 2005b). EcoClassification refers to the determination and categorisation of the Present Ecological State (PES; health or integrity) of various biophysical attributes of rivers relative the natural or close to the natural reference condition. This approach also allows for different levels of assessment, depending on time and budget, and the requirements of the assessment.

The rapid approach was followed for this study. Essentially this approach was based on assessment of existing impacts on two components of the stream - the **riparian** zone and the **instream** habitat, using visual information.

Assessments were made separately for both components, but data for the riparian zone were interpreted primarily in terms of their potential impact on the instream component. Criteria within each component are pre-weighted according to the importance of each, and each criterion is scored between 0 and 25, with six descriptive categories ranging from 0 (no impact), 1 to 5 (small impact), 6 to 10 (moderate impact), 11 to 15 (large impact), 16 to 20 (serious impact) and 21 to 25 (critical impact). The criteria are provided in Table 4.1.

The total scores for the instream and riparian zone components were used to place the stream in a habitat integrity or Present Ecological State (PES) category (A – F) for both components.

Table 4.1 Criteria used in the assessment of Present Ecological Status of watercourses (from Kleynhans, 1996).

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments.
Water quality modification	Originates from point and diffuse point sources. Measured directly or agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Flow modification – floods and low flows	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic fauna	Invasion by exotic fauna will influence indigenous biodiversity, with possible knock-on effects for habitat quality and availability.
Solid waste disposal	This refers to litter and any other solid waste, i.e. a direct anthropogenic impact which may alter habitat structurally, obstruct flow, or have a direct impact on biota. Also a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the vegetated buffer will reduce its ability to protect the river from sediment and polluted runoff from the surrounding catchment. Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Riparian area habitat diversity is reduced, and timing and quality of food source (leaves, wood, etc) for aquatic biota altered.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

The DWS-recommended method for the determination of the **Ecological Importance and Sensitivity** for watercourses of a particular ecosystem considers the following ecological aspects of watercourses (DWAF, 1999):

- Rare and endangered instream and riparian biota;
- Unique instream and riparian biota;
- Intolerant instream and riparian biota;
- Species richness, both riparian and instream;
- Diversity of habitat types or features;
- Refuge value of habitat types;
- Sensitivity of habitat to flow changes;
- Sensitivity to water quality changes;
- Migration route/corridor for instream and riparian biota, and
- Presence of Protected Areas and conservation areas.

Each criterion is scored between 1 and 5, and the medians of these scores are calculated to derive the EIS category (Table 4.3).

Table 4.2 PES categories for watercourses (from Kleynhans, 1996).

Category	Description	Score (%)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

4.3 Results of assessment

In terms of both riparian and instream integrity, the stream is considered to be a **Category A (natural)** stream, as there is no significant abstraction of water from the stream, little modification to the channel and stream bed, and the surrounding vegetation is largely intact, with the exception of the section of stream flowing through erf 134 (Table 3.4).

In terms of ecological importance and sensitivity, only the abiotic component could be assessed, placing the stream in the '**high**' EIS category (Table 3.4). Due to its ephemeral nature, the stream is highly sensitive to changes in water quantity and quality, as any change will alter the characteristics of the stream. The stream is not highly important in terms of the provision of aquatic or semi-aquatic habitat, or as refuge for aquatic and semi-aquatic fauna and flora, due to the fact that the stream corridor is primarily a terrestrial feature,

except during the days when there is flow in the stream. The stream flows off mountains that lie within the De Hoop Nature Reserve, which elevates its ecological importance.

Table 4.3 Ecological importance and sensitivity categories for watercourses.

Ecological Importance and Sensitivity Categories	General Description
Very high (score >3 and ≤4)	Reaches or rivers that are considered to be unique on a national or even international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to channel / bed modifications and have no or only a small capacity for use.
High (score >2 and ≤3)	Reaches or rivers that are considered to be unique on a national scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to channel / bed modifications but in some cases, may have a substantial capacity for use.
Moderate (score >1 and ≤2)	Reaches or rivers that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually not very sensitive to channel / bed modifications and often have a substantial capacity for use.
Low/marginal (score >0 and ≤1)	Reaches or rivers that are not unique at any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to channel / bed modifications and usually have a substantial capacity for use.

According to the DWA (1999), for a rapid determination of the ecological management class of a river, the "high" category equates to the default ecological management class of B – these are sensitive systems, where only a small risk of modifying the natural abiotic characteristics of the river should be allowed.

In summary, the **PES of the stream is Category A**, while the ecological management class for the stream is Class B. Future development in the stream's catchment and management of the stream must ensure that the stream remains in its current state, with no deterioration in management class. Overall, the stream can be considered to be of **very high conservation importance**. Due to the largely terrestrial nature of the stream corridor, it is important to also consider the conservation importance of the surrounding dunes and vegetation, and the requirements of any fauna that may use the stream corridor for dispersal, refuge, etc.

Table 4.4 Summary of the results of the assessments of HI and EIS for the stream entering erf 134, Cape Infanta.

Ecosystem	Habitat Integrity		Ecological Importance and Sensitivity
	Instream	*Riparian*	
Stream entering erf 134	94 CATEGORY A	91 CATEGORY A	2.5 HIGH

5 DESCRIPTION OF THE PROPOSED DEVELOPMENT

5.1 General description of the development

Three alternative development layouts are proposed. **Alternative 1** (13th April 2012) comprises 23 erven, 16 of which would be single storey and 7 double storey (Figure 5.1), **Alternative 2** (26th August 2013) comprises 21 erven, 15 of which are single storey and 5 double storey (Figure 5.2) and lastly, **Alternative 3** (19th May 2021, updated November 2024) also with 21 erven (Figure 5.3). The main material differences between Alternatives 2 and 3 are the location of the entrance roads and a shift in the configuration of the erven. All three development alternatives incorporate a conservation area in the north-western corner of the property. The location of the conservation area on Alternatives 2 and 3 takes account of the limestone sensitive area, as delineated in the botanist specialist report, and in both layouts the conservation area is just over 6 000 m^2.

The total cover of developable erven for all three alternatives is roughly 50%. All alternatives allow for the existing Main House and stoep, braai area and graveyard to remain as is, incorporated into the development as a separate erf. The existing garage and store will remain for all alternatives.

The final alternative is the **no development option**. This represents the status quo in terms of zoning – Agriculture 1 – and in terms of current permissible uses - primary use is for cultivation of land for crops and plants or the breeding of animals, or the operation of a game farm on an extensive basis on natural veld or land. The latter use includes activities and buildings that are reasonably connected with the main farming activities of the farm. Consent uses include additional dwelling units (a maximum of an additional five units), farm store, farm stall, intensive feed farming, riding school, nursery, service trade, and/or tourist facilities.

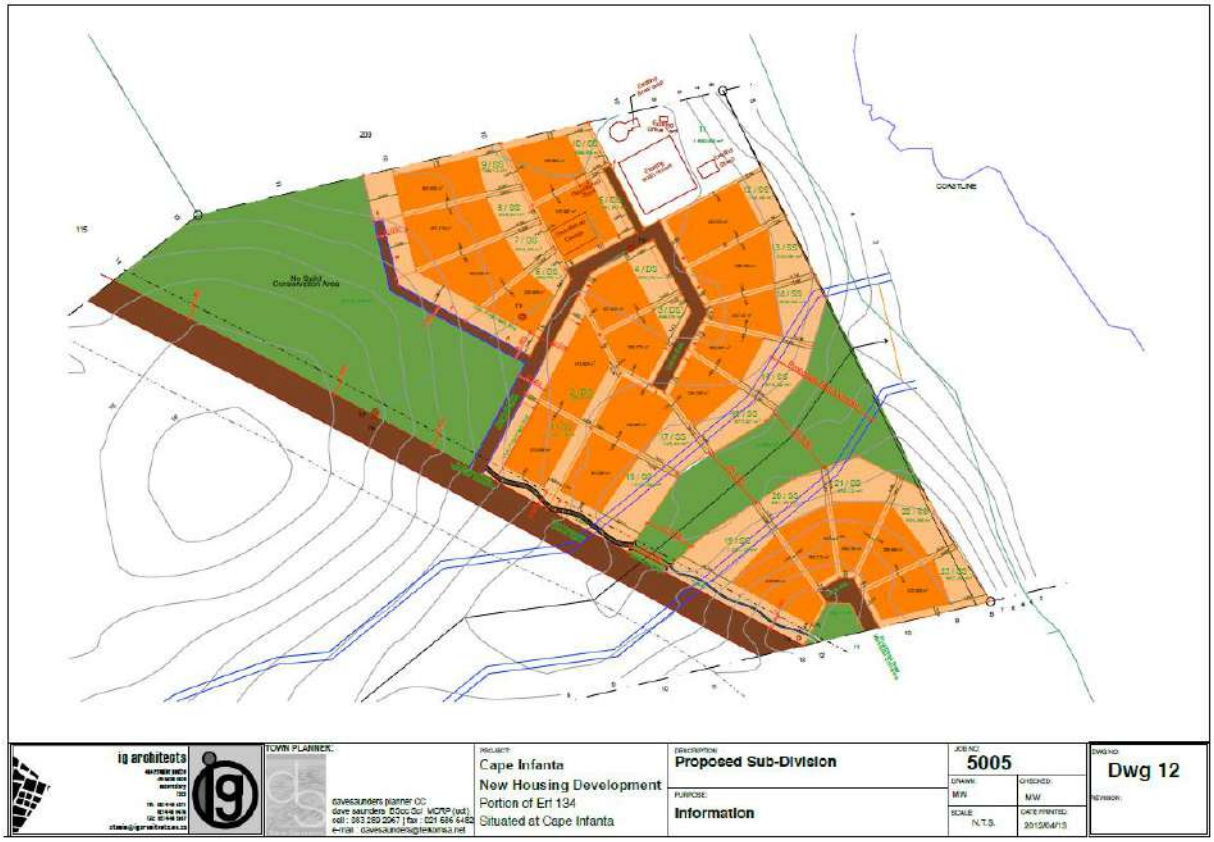


Figure 5.1 Alternative 1 layout for erf 134 Cape Infanta, comprising 23 erven and a conservation area in the north-western corner.

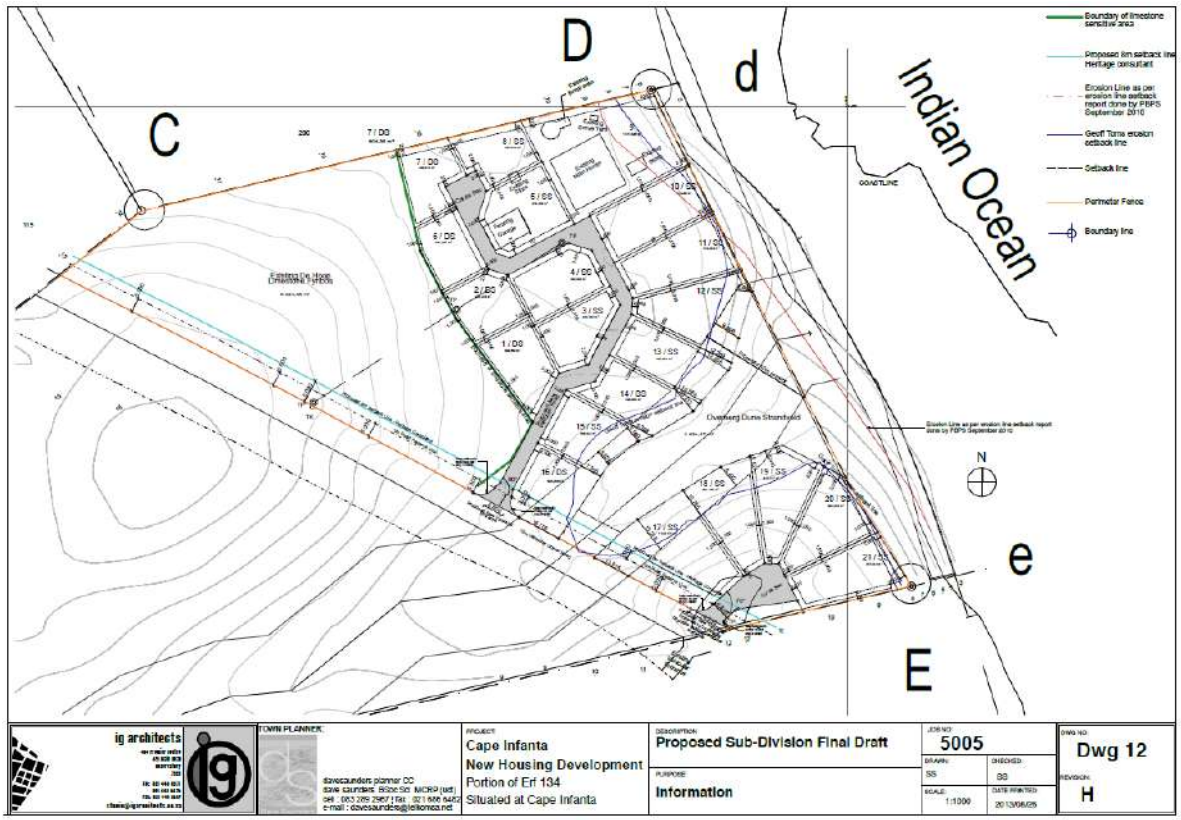


Figure 5.2 Alternative 2 layout for erf 134 Cape Infanta, comprising 21 erven and a conservation area in the north-western corner.

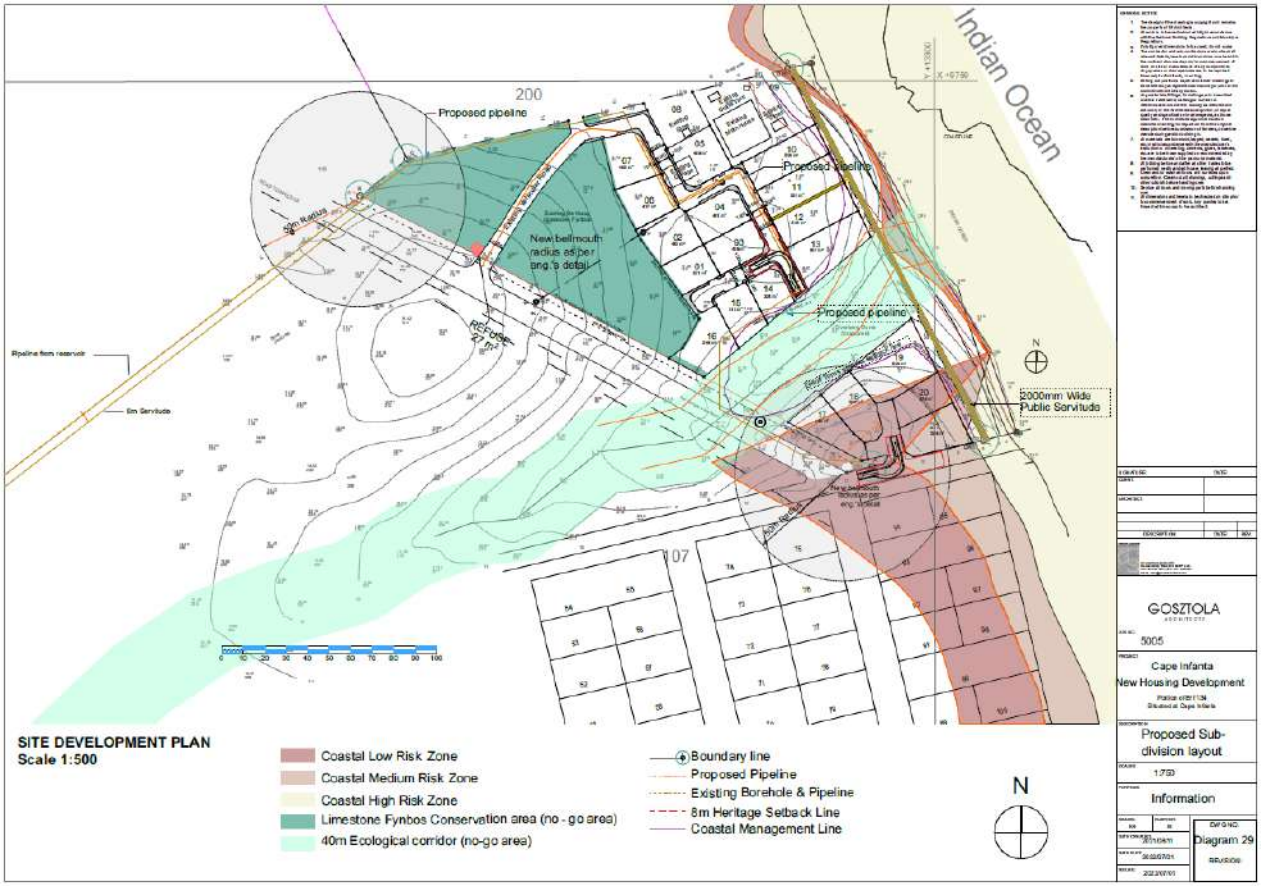


Figure 5.3 Alternative 3 layout proposed for erf 134 Cape Infanta, comprising 21 erven and a conservation area in the north-western corner. The main differences between Alternatives 2 and 3 are the location of the entrance roads, and the configuration of the erven.

Alternatives 1, 2 and 3 were developed through an iterative process, whereby the concerns of all specialists involved in the assessment phase were addressed and accommodated. The following specific concerns were raised from a freshwater ecological perspective:

- More open space within the development for the infiltration of runoff and precipitation;
- Smaller hardened footprint, and so less stormwater generated, and
- A sufficiently wide (40m) corridor around the watercourse is accommodated by the development layouts. The establishment of such a corridor will protect the watercourse/stream and the surrounding dunes that contribute runoff to the stream during rainfall.

5.2 Internal Roads

There will be two access roads onto the property for all Alternatives. For Alternative 3, the northern entrance road will run along the existing vehicular track. All internal roads are proposed to be 3m wide, with a 5m-wide road reserve (Fraser, 2014, 2020). This will accommodate mixed vehicular and pedestrian use. The roads will be surfaced with pavers, tar or 700mm wide concrete strips and the 1m-wide road reserve on either side will be grassed swales with some landscaping with indigenous vegetation to intercept runoff and allow infiltration.

5.3 Water supply

Water will be supplied from rainwater harvesting and storage structures, and boreholes. Water demand is expected to be in the order of 21 000 litres per day (Fraser, 2023). Rainwater storage tanks (most likely to be located underground in order to minimise the visual impact) of 5 kl capacity have been recommended for the houses, as it is expected that none of the houses will be occupied for more than 4 months of the year. Rainwater will be collected via roofs and guttering, and stored in tanks.

Parsons (2006) reported that there would be sufficient borehole water for 80 housing units, and that the water is of sufficient quality for drinking purposes, although it has been reported as being brackish. A Water User Licence would not be necessary, as a total of 1 m^3/day can be abstracted from each borehole before a Licence becomes necessary, and this quantity is more than sufficient to augment the rainwater supply. All boreholes are located to the west of the gravel road adjacent to the property, and it has been recommended (Fraser, 2023) that a reservoir be built close to one of the boreholes, and water transferred to the development via an existing pipeline (Figure 5.4). A new water pipeline would need to be constructed to take water into the development, and this pipe would be placed within the ecological buffer recommended for the watercourse (see Section 7.2) and will cross the watercourse within the roadway embankment, at 1m depth in a steel sleeve. The pipe will be located between the road edge and the culvert headwall at the crossing over the watercourse.

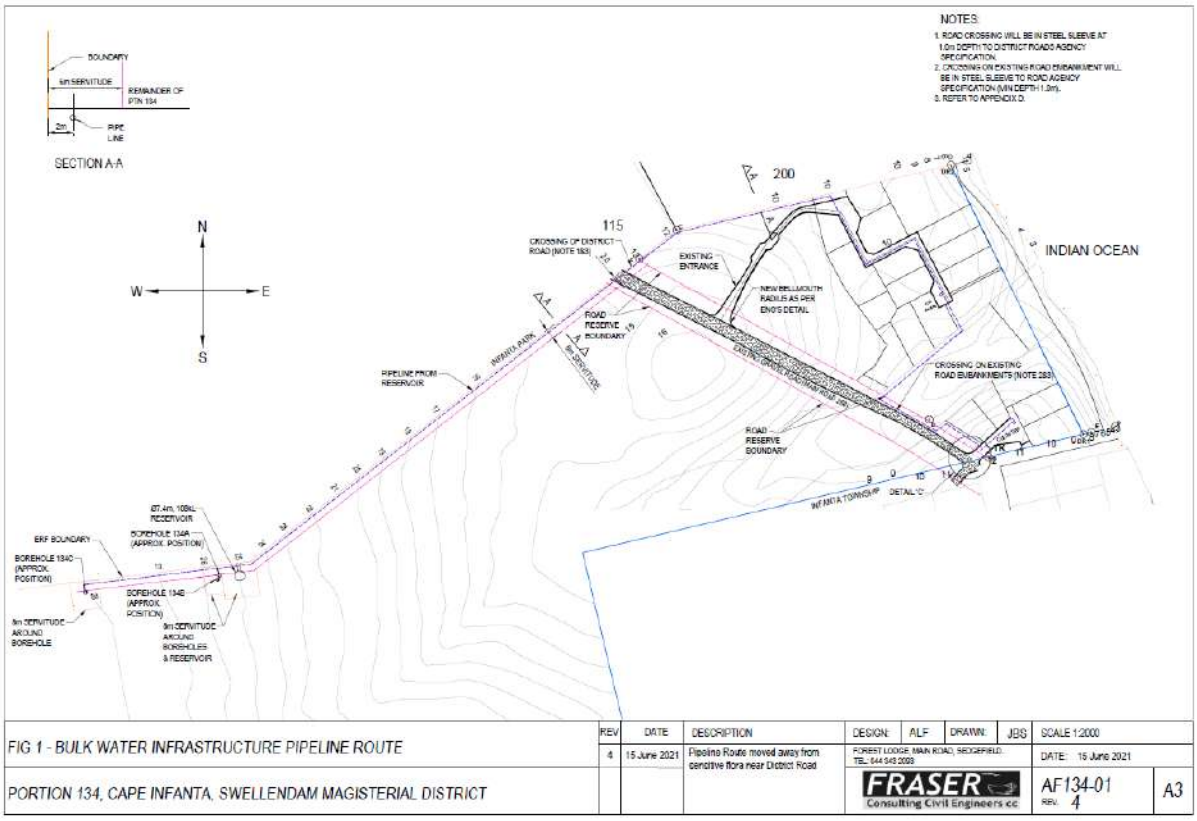


Figure 5.4 Location of the borehole, water supply pipeline and proposed 108 kl reservoir to the west of the site.

5.4 Stormwater Management

The stormwater management system has been designed using the principles of Sustainable Urban Drainage Systems (SUDS), which aim to mimic the natural (pre-development) system as far as possible. The natural state of runoff on the property is that 80% of natural runoff would flow towards the watercourse, and 20% towards the ocean (Fraser, 2014), and that the vegetated and rough characteristics of the surrounding catchment imply that most precipitation will be held on the land rather than flow overland into the watercourse or ocean.

The construction of hardened surfaces on the property would change this situation. In order to avoid this unnatural change, it is proposed that all roof runoff be directed into rainwater tanks, and that overflow from the tanks, and water running off all other hardened surfaces (e.g. roads) would be conveyed towards areas where water will be retained and allowed to filter into the ground, e.g. localised water sinks and soakaways (sand pits), rain gardens (essentially landscaped (i.e. not hardened) areas that lie immediately adjacent to the hard surfaces, such as roads, parking areas), grass swales and other permeable surfaces.

5.5 Sewage Management

The development is likely to produce roughly 17 kl sewage per day, at full occupancy (Fraser, 2023). The **primary option** for the treatment of sewage is a household package treatment plant, as supplied by Maskam Water™. The recommended option is the Fusion Series Treatment System. The treated effluent from such a plant complies with DWS's General Limits. The system requires a 6 monthly service, and it is recommended that each household takes care of its own effluent, instead of one or two plants for the whole development.

The process includes:

- A sedimentation chamber;
- An anaerobic chamber;
- A aerator filter media chamber; and
- A treated water storage chamber.

The water can be recycled for non-potable use such as flushing toilets, with the remaining effluent being used for irrigation or being discharged underground to a soak-away. Alternatively, all the effluent can be discharged to a soak-away as the surrounding soil is sand and is very porous.

An **alternative option** is the use of septic tanks and soak aways, a method that has been successful for many decades in Cape Infanta and which carries a low risk for groundwater and surface water pollution in the area (Parsons, 2020; Ross, 2020). The water will typically be conveyed to a 2500 litre tank, and will use either a single or two-tank system. There is the option of splitting grey water from black water. Only clean water is allowed to leave the final tank, leaving solids, oil and grease behind, where bacteria break down the matter. Recommendations for septic tank operation are made by Fraser (2023), thus ensuring that this sewage manage system will operate at the highest standards of hygiene and at the same time reduce the likelihood of negative impacts, such as overflow and pollution. Treatment is to also to DWS General Limits (Fraser, 2020).

6 LEGISLATION GOVERNING THE CONSERVATION AND MANAGEMENT OF WETLANDS AND RIVERS IN SOUTH AFRICA

The following sections briefly summarise those sections of the South African legislation and guidelines documents that pertain to the conservation and management of rivers and wetlands.

6.1 National Environmental Management Act (Act 107 of 1998, as amended by Act 62 of 2008)

The National Environmental Management Act of 2008 (NEMA), outlines measures that…."prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

Of particular relevance to this assessment is Chapter 1(4r), which states that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

The Environmental Impact Assessment Regulations are stipulated in Government Notice R. 543 of 18th June 2010.

6.2 Conservation of Agricultural Resources Act (Act 43 of 1983)

Key aspects include legislation that allows for:

Section 6: Prescription of control measures relating to the utilisation and protection of vleis, marshes, water sponges and water courses. These measures are described in regulations promulgated in terms of the Act, as follows:

Regulation 7(1): Subject to the Water Act of 1956 (since amended to the Water Act 36 of 1998), no land user shall utilise the vegetation of a vlei, marsh or water sponge or within the flood area of a water course or within 10 m horizontally outside such flood area in a manner that causes or may cause the deterioration or damage to the natural agricultural resources.

Regulation 7(3) and (4): Unless written permission is obtained, no land user may drain or cultivate any vlei, marsh or water sponge or cultivate any land within the flood area or 10 m outside this area (unless already under cultivation).

6.3 Cape Nature Conservation Ordinance (Ordinance 19 of 1974; amended in 2000)

This ordinance provides measures to protect the natural flora and fauna, as well as listing nature reserves in the Western Cape that are managed by the Western Cape Nature Conservation Board (WCNCB). This ordinance, with the Western Cape Nature Conservation Board Act of 1998 was amended in 2000 to become the Nature Conservation Laws Amendment Act. Lists of endangered flora and fauna can be found in this act.

6.4 National Water Act (1998)

The following non-consumptive water uses relate to activities that may impact on the integrity and function of water resources and the overall quality of the resource:

a. Taking water from a water resource;

b. Storing water;

c. Impeding or diverting the flow of water in a watercourse;

d. Engaging in a stream flow reduction activity;

e. Engaging in a controlled activity identified and declared as such in terms of the Act;

f. Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;

g. Disposing of waste in a manner which may detrimentally impact on a water resource;

h. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

i. Altering the bed, banks, course or characteristics of a watercourse;

j. Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

k. Using water for recreational purposes.

DWA have issued a number of **General Authorisations (GA)** in terms of Section 39 of the National Water Act.

6.5 Western Cape Provincial Spatial Development Framework (March, 2014)

Policies regarding the protection of biodiversity and ecosystem services in the Western Cape are:

- The Western Cape's Critical Biodiversity Area (CBA) mapping, which CapeNature have updated and refined as the Western Cape Biodiversity Spatial Plan (see Section 6.6), together with the draft priority climate change adaption corridors, comprise the spatial extent of the Western Cape's biodiversity network. This must inform spatial planning and land use management decisions throughout the province.
- Using the latest available CBA mapping as a primary informant, regional, district and municipal SDFs must delineate Spatial Planning Categories (SPCs) that reflect suitable land use activities in the different CBA categories.
- To complement CapeNature's protected area expansion strategy and their Stewardship programme, SDFs should highlight priority areas outside the protected area network that are critical for the achievement of the province's conservation targets.

Policies regarding the management, repair and optimisation of inland water resources are:

- Given current water deficits, which will be accentuated by climate change, a 'water wise' planning and design approach in the Western Cape's built environment is to be mainstreamed.
- Rehabilitation of degraded water systems is a complex inter-disciplinary intervention requiring built environment upgrading (i.e. infrastructure and the built fabric), improved farming practises, as well as the involvement of diverse stakeholders.
- Introduce and retrofit appropriate levels of water and sanitation systems technologies in informal settlements and formal neighbourhoods with backyard shacks as a priority.

- An overarching approach to water demand management is to be adopted – firstly efficiencies must be maximised, storage capacity sustainably optimised and ground water extraction sustainably optimised, with the last resort option of desalination being explored, if necessary.
- Protection and rehabilitation of river systems and high yielding groundwater recharge areas, particularly in areas of intensive land use (i.e. agricultural use, industry, mining and settlement interactions) should be prioritised.
- Regional Plans to be developed for Water Management Areas to ensure clear linkages and interdependencies between the natural resource base (including water resources) and the socio-economic development of the region are understood and addressed.
- Agricultural water demand management programmes to be developed with an emphasis on the Breede Valley and Oliphants / Doorn agricultural areas. Industrial water demand management programmes to be developed with an emphasis on Saldanha, Southern Cape and Cape Town. Settlement water demand management programmes to be developed with an emphasis on the Cape Town functional region.
- Government facilities (inclusive of education, health and public works facilities) to lead in implementing effective and efficient water demand management programmes.
- Continue with programmes (such as Working for Water) which reduce the presence of alien vegetation along river systems.

6.6 Western Cape Biodiversity Spatial Plan (2017)

The Western Cape Biodiversity Spatial Plan (WCBSP) is the product of a systematic biodiversity planning assessment that delineates Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) which require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and freshwater realms. These spatial priorities are used to inform sustainable development in the Western Cape Province. This product replaces all previous systematic biodiversity planning products and sector plans with updated layers and features.

6.7 Swellendam Spatial Development Framework (2020)

The Swellendam Municipality SDF is informed by the Provincial Spatial Development Framework Plan and the Western Cape Spatial Plan. One of the key objectives under the goal “Promote inter-municipal co-ordination to support sustainable use of natural resources and infrastructure” is to manage and protect water resources, catchments and dams. The promotion of conservation of biodiversity and sustainable environmental management based on bioregional planning objectives is identified as a critical issue.

With regard to Infanta, the local spatial development principles are to:

- Promote conservation of the surrounding natural environment and setting;
- Restrict inappropriate residential development;
- Maintain the pristine natural environment and rural coastal character, and
- Contain the urban footprint of Infanta within a clearly demarcated urban edge (see Figure 6.1).

Specifically, the following is included in the Framework:

Conservation of Sensitive Biophysical Environment: Sensitive areas of the biophysical environment should be managed with conservation objectives in mind, and should be protected from urban development. In this regard, the following areas are of particular importance:

- The urban edge areas immediately adjacent to areas of natural vegetation.

- The coastline, natural drainage system and areas immediately adjacent thereto.
- Any dune systems, particularly any frontal dunes along, the coastline.

Corridors of Linear Open Spaces:

- The functioning of the drainage line (see Figure 6.1) which effectively separates Infanta from Infanta Park should be protected and managed with conservation objectives in mind to ensure that both its ecological and hydraulic functionality is optimised and maintained.
- The existing coastal setback line, which is, in effect, the demarcated urban edge, should be maintained. No development should be permitted in this setback area, thereby ensuring that a continuous coastal corridor is maintained.

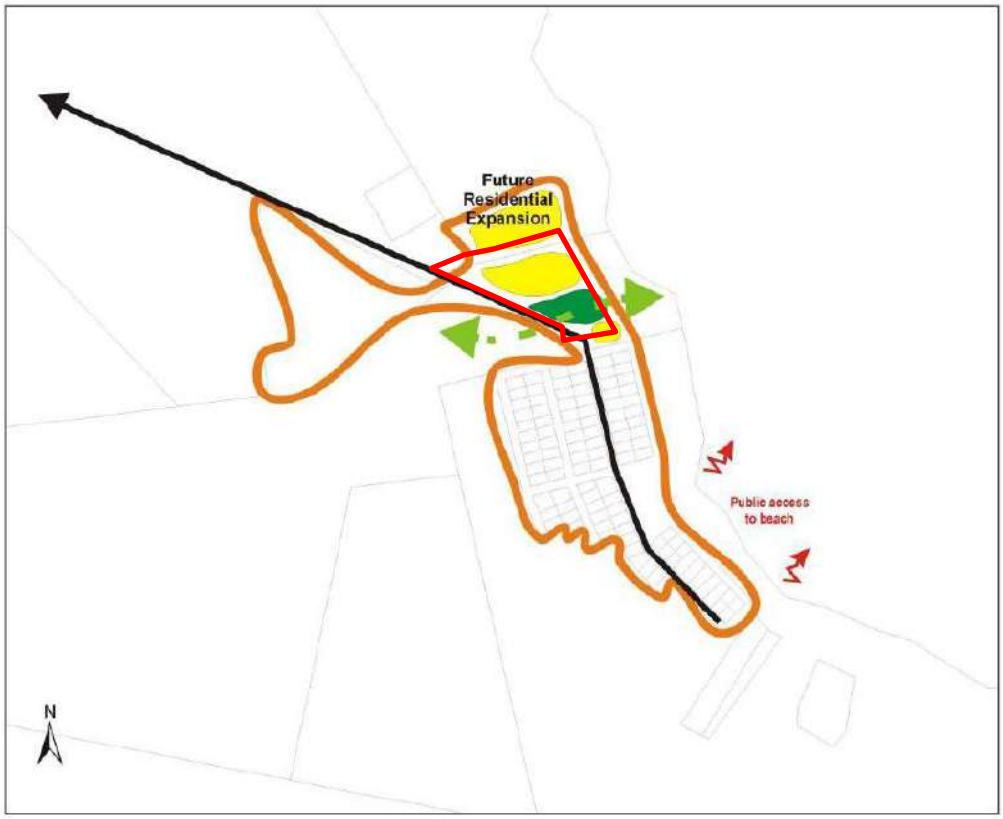


Figure 6.1 Spatial management model for Infanta (Swellendam SDF). The red boundary is erf 134 and the green dashed line is the watercourse corridor.

6.8 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The Act aims to:

- Provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act of 1998;
- Protect the species and ecosystems that warrant national protection;
- Ensure the sustainable use of indigenous biological resources;
- Ensure the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; and
- Describe the establishment and functions of a South African National Biodiversity Institute.

7 DESCRIPTION AND ASSESSMENT OF EXPECTED IMPACTS

The impacts that are expected to be associated with the proposed development (Alternatives 1, 2 and 3 – see Section 5.1) can be divided into those associated with the proposed layout, the construction phase (including pre-construction) and the operational phase.

7.1 Description of impacts and mitigation measures

7.1.1 Development Phase (design and construction)

A detailed construction environmental management programme (CEMPr) must be completed before the construction phase commences. The CEMPr must have input from all relevant specialists, and must contain detailed guidance on the minimization of disturbance during construction.

Trenching within the ecological corridor for laying of bulkwater pipeline – this may lead to mobilisation of sediment into the watercourse, or ocean, especially during high rainfall events, and may lead to the short-term loss of natural vegetation within the working area.

Mitigation:

- Ideally, the pipeline should be located outside of the ecological corridor.
- The width of the construction footprint must be kept to a minimum.
- Trenches must be excavated by hand, and not using machinery.
- Excavation of the pipeline trench must be done during the dry season.
- Opened trenches must be filled as quickly as possible after trenching is initiated. This is to keep the disturbed areas open and unstabilised for the shortest period possible. No trenches must be opened within three days of predicted heavy rainfall.
- The disturbed pipeline area must be rehabilitated, with input from a botanist, in order to snrue that the area recovers from the impacts of construction.

Storage or dumping of building materials (sand, soil, bricks etc.) or temporary lay-down of equipment close to the watercourse and its corridor – such dumping would damage the soil structure, and would destroy or shade out plants growing in and around the stream. Building materials, particularly fine material such as sand, dumped near the stream may gradually flow down the slope and enter the stream corridor.

Mitigation:

- Ensure that all building materials and equipment are stored at least 50m away from the watercourse corridor, as demarcated prior to construction.
- Materials should be stored in piles that do not exceed 1.5m in height and should be protected from the wind, to prevent spread of fine materials across the site.

Pollution of the stream corridor through leakage of fuels, oils, etc. from construction machinery, from washing of instruments or flushing of concrete mixers and other vehicles as well as sediments from de-watering of excavations. The ephemeral nature of the stream means that such pollutants would accumulate, and would flush into the sea only after heavy rains, which may lead to significant pollution of the coastal zone.

Mitigation:

- Any construction activities close to the stream cease during periods of heavy rain, to reduce the risks of contamination of the stream and ocean through rainfall and runoff.
- Machinery prone to oil or fuel leakage must be located at least 50 m away from any sensitive ecosystem, and the area bunded in order to contain leakages.
- Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly.
- Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities.

Destruction or deterioration of freshwater habitat as a result of foot and vehicular traffic – access across and around the stream corridor onto the building site is likely to lead to damage of soils and vegetation.

Mitigation:

- The watercourse corridor must be well marked during the pre-construction phase.
- Pathways and access roads must be routed away from the stream corridor and coastline.

Disturbance of freshwater fauna and flora – the presence of construction teams and their machinery will lead to noise and light pollution in the area, which will disturb the local fauna and flora.

Mitigation:

- The construction site and access pathways should avoid sensitive areas, which must be demarcated during the pre-construction phase. If lights are used, these should be directed away from the stream corridor and coastline.
- Any animals found during site preparation or construction must be recorded and handed to the ECO.
- An education programme for all employees must be run at the start of construction, and when new contractor teams start on site.

Introduction and spread of alien invasives – top material brought onto the site, for filling and landscaping can lead to the introduction of alien or invasive seedbanks.

Mitigation:

- All soils and top material must be bought from a reliable source, and must be free of alien seeds or alien grass runners.

Cumulative impacts associated with construction:

All of the impacts described above will have a cumulative effect on the local environment, even if these are mitigated against. This activity would happen in the context of an urban environment close to the ocean and Breede River mouth, and thus all construction impacts would have an additive effect, i.e. each construction impact has the potential to harm the environment, to a lesser or greater extent, depending on the likelihood and effectiveness of mitigation. The impacts of greatest significance are those that are likely to create a disturbance or lead to the pollution of natural areas, or those that may persist for some time.

7.1.2 Operational Phase

A detailed environmental management programme (EMPr) must be compiled for the ongoing management of the development, and especially of its natural open spaces and conservation areas. The EMP must have input from all relevant specialists, and must contain detailed guidance on the minimization of disturbance and maximisation of conservation efforts.

The main points of the EMPr should be published as notices within every home so that all residents and visitors are aware of the sensitive environment in which the development is placed.

All development Alternatives will result in the hardening of the property and loss of terrestrial open space. This would impact on the movement of flora and fauna both in and out of the stream corridor, and across the erf to the coast or up the slopes. The whole of erf 134 to the east of the gravel road lies within a "coastal protection zone", as defined in the Integrated Coastal Management Act (2009). The purpose of this type of protection zone is to ensure protection of ecosystems associated with the coastline, which would include the mouths of rivers and streams meeting the sea. While development is allowed in coastal protection zones, this should be done in such a way as to avoid negative impacts on the ecosystems affected.

Mitigation:

While the open spaces within the development – in the north-western corner and around the watercourse – will mitigate to some extent against the impacts associated with the loss of open space and hardening of the property, there is limited connectivity between these two areas. These spaces are connected by a fairly narrow corridor along the western edge of the property adjacent to the gravel road. The movement of fauna and flora across the site would be improved through not constructing fences between the houses, thus allowing fauna to move between the houses. If fences must be constructed, these must be designed to allow the free movement of small mammals. A further mitigation would be through ensuring that all gardens are planted with locally indigenous plant species.

The open spaces provided for in all Alternatives, and the proposed SUDS infrastructure should allow for sufficient area for the infiltration of runoff across the site. No further mitigation measures are recommended in this regard.

All three Alternatives will result in the setting aside of a considerable portion of the site as conservation area. While there is no detail on how this area will be managed, this represents a positive impact that it is unlikely would apply to the no development alternative, due to the uncertainties associated with this option.

Cumulative impacts associated with the layout:

The activity will happen within a context of existing and possible future coastal development and hardening of the urban area of Cape Infanta (roads and houses). Thus, there is a cumulative effect of the loss of open space, which can be mitigated, but which is assumed to be of the same significance as the impacts of this development assessed on its own. This impact would have an additive effect over the long-term, i.e. each development will add to the effect to a lesser or greater extent, depending on mitigation, but always with a negative impact on the environment.

One of the main concerns about the operational phase of the residential development (Alternatives 1, 2 and 3) is the generation and management of stormwater. The stream is ephemeral and any change in hydrology will change the nature of the system, and lead to a deterioration in the quality of habitat provided within the corridor.

Mitigation:

- The proposed stormwater management system, if implemented in full, would adequately mitigate against the negative impacts associated with the generation, storage and discharge of stormwater on the site. It is understood that all stormwater generated by the development will be minimised at the point of accumulation, with only high discharge volumes and natural runoff being directed towards the watercourse and coastline.
- The pipe carrying water under the road must be cleaned out, so that this does not pose a flood risk for the proposed development. In addition, stormwater runoff from the dirt road into Cape Infanta must be formalised.

There will be on-site treatment of waste water, through the use of small package plants or septic tanks and soak-aways. Neither of these options for treatment of waste water will discharge treated effluent water directly into the watercourse, however, over time, these systems do release water which may contain nutrients into the soil. Due to the sandy nature of the soil, these will filter into the ground and may contaminate the groundwater, and ultimately may enter the river corridor. The risk of this occurring is low, however.

Mitigation:

- Treated waste water should not be used for irrigation, but can be used for flushing of toilets.
- All septic tanks and package plants are to be placed outside the 40m ecological corridor.
- Package plants, septic tanks and soak-aways must be checked to ensure that they are working, at least annually.
- Residents of the development must be educated in the use of household chemicals, detergents and solvents. It is inappropriate to use substances that could affect the efficiency of the septic tanks. Certain chemicals, such as bleaches, can destroy the bacterial communities in the septic tank.

The development will need to abstract water from groundwater resources in the area. This may lead to local drawdown of groundwater resources.

Mitigation:

- Both permanent residents and occasional visitors must be encouraged to use water sparingly, as groundwater is a precious resource, and the impacts of increased abstraction relatively unknown.
- Use of rainwater must be facilitated through construction of rainwater tanks, and use of rainwater encouraged.
- Only locally indigenous plants shall be allowed in gardens and landscaped areas. Grassed lawns must be of indigenous species, such as *Cynodon dactylon* (kweekgras).

Disturbance of fauna and flora - the proximity of the residential units and roads to the stream corridor and coastal zone will lead to an increase in disturbance in the form of noise, light, and physical disturbance from trampling by people and pets. The proposed buffer zone around the watercourse will provide some protection for the fauna and flora.

Mitigation:

- Residential and road lights should be directed away from the stream corridor and coastline.

- Residents, visitors and their pets should be discouraged from walking into and through the stream corridor. Boardwalks can be used to allow pedestrian access into the corridor, while protecting the fauna and flora.

Spread of alien invasives - landscaped areas may introduce exotic species that easily invade into natural areas, thus outcompeting indigenous species, and leading to a loss of diversity.

Mitigation:

- The stream corridor should be planted with appropriate indigenous vegetation, where necessary, and a barrier provided between landscaped areas (gardens or roadsides) and the corridor (e.g. a pathway).
- Kikuyu grass should not be allowed on the site.
- Road reserves can be grassed with indigenous species such as *Cynodon dactylon* (kweekgras).
- The spread of alien plant species into the natural areas must be prevented and monitored.

Removal of alien vegetation - this is an opportunity to remove all alien and invasive plant species that inhabit the site, and so increase the local biodiversity of flora as well as the depending on the vegetation.

All three alternatives will result in the management of a considerable portion of the site as a conservation area. While there is no detail on how this area will be managed, this represents a positive impact that it is unlikely would apply to the no development alternative, due to the uncertainties associated with this option.

Cumulative impacts associated with operation:

All of the above operational impacts will have an additive cumulative effect on the natural environment, either negative or positive (in the case of alien vegetation removal). The impacts of most concern would be the loss of open space, generation of stormwater, on-site treatment of waste water, and the use of groundwater resources. There may currently be the capacity for this particular development, but should there be further development in the area, the additive effect may exceed the capacity.

7.2 Recommended ecological buffer for the watercourse

In determining a development footprint that will have the least impact on an inland aquatic ecosystem, it is essential to establish the recommended development setback, or ecological buffer for each ecosystem. It is important to note that in order to protect a water resource, the development setback or buffer should be used instead of the blanket 32m, 500m or 100m setback requirements of the NEMA/National Water Act. For watercourses, the 1:100 year floodline should preferably be within the recommended buffer.

The buffer for the watercourse was determined using the site-based protocol for buffer determination of MacFarlane and Bredin (2017). The assessment is based on the PES and EIS of the watercourse (see Section 4), and the assumed quality of the buffer during both phases of the project. In this case, it was assumed that the current vegetation (i.e. fairly sparse, shrubby vegetation) will remain within the buffer. The density of vegetation within a buffer plays a major role in determining its effectiveness – a well-vegetated buffer, with a high basal cover (such as grass or sedges) is the most effective, due to the ability of the plants and their roots to trap sediments, toxins and other pollutants before they reach the wetland.

The recommended buffer for the watercourse is 20m, for both the construction and operational phases. Due to the lack of a clearly defined channel, the buffer was measured from the centreline of the watercourse, as shown in Figure 2.2. In this instance, this was considered more than adequate for the protection of the

watercourse, due to its intermittent nature, and thus the lack of sensitive riverine fauna and flora. The main aim of the buffer is to protect the riverine corridor, and the surrounding slopes, which supply water to the watercourse (from rainfall), in addition to supply from upstream.

7.3 Methods for the assessment of impacts

The evaluation of impacts was done using the criteria supplied in the EIA Regulations published by the Department of Environmental Affairs, in terms of the National Environmental Management Act (Act 107 of 1998), on 4th December 2014, and amended on the 7th April 2017. The criteria are listed in Table 7.1.

Table 7.1 Criteria used for the assessment of impacts associated with the proposed Cape Infanta development.

	Criterion	Description
a)	**Nature of Impact**	Define or describe the type of effect (**negative** or **positive**) that a proposed activity would have on the environment. This description includes **what is to be affected**.
b)	**Extent**	Describe whether the impact occurs on a scale limited to the **site** area, **local** area (i.e. limited to the site and within 10 km of the site), **regional** (covers an entire region or extends into another region) or **national** (national implications or crosses over national boundaries) scale.
c)	**Duration**	Predict whether the lifespan of the impact will be **short term** (0 to 5 years); **medium term** (5 to 15 years); **long term** (i.e. beyond the operational phase but not permanently), or **permanent** (i.e. mitigation through natural processes or human intervention will not occur in such a way or in such time span that the impact can be considered transient).
d)	**Consequence**	Indicate how the activity will affect the environment.
e)	**Probability**	Describe the probability of the impact actually occurring as **definite** (impact will occur regardless of mitigations), **highly probable** (most likely), **probable** (distinct possibility), or **improbable** (low likelihood).
f)	**Irreplaceable loss of resources**	Describes the degree to which resources will be irreplaceably lost due to the proposed activity. It can be **no loss of resources**, **marginal loss**, **significant loss** or **complete loss** of resources.
g)	**Reversibility**	The degree to which an impact can be reversed, from **fully reversible**, to **partly reversible** to **irreversible**.
h)	**Indirect impacts**	Indirect impacts are secondary impacts and usually occur at a different place or time. Specialists will need to elaborate on any indirect or secondary impacts of proposed activities. If there are no indirect impacts specialist will need to briefly explain so.
i)	**Cumulative impact**	An effect which in itself may not be significant but may become significant if added to other existing or potential impacts that may result from activities associated with the proposed development. Cumulative impacts prior to and post mitigation must be assessed. The cumulative effect can be: **negligible** (the impact would result in negligible to no cumulative effect), **low** (the impact would result in insignificant cumulative effects), **medium** (the impact would result in minor cumulative effects) or **high** (the impact would result in significant cumulative effects).
j)	**Degree to which the impact can be avoided**	This indicates the degree to which an impact can be avoided. The degree of avoidance can either be **high** (impact is completely avoidable), **moderate** (impact is avoidable with moderate mitigation), **low** (the impact is difficult to avoid and will require significant mitigation measures) or **unavoidable** (the impact is cannot be avoided even with significant mitigation measures).
k)	**Degree to which impact can be managed**	This indicates the degree to which an impact can be managed. The degree of management can either be **high** (impact is completely manageable), **moderate** (impact is manageable with moderate mitigation), **low** (the impact is difficult to manage and will require significant mitigation measures) or **unmanageable** (the impact is cannot be managed even with significant mitigation measures).

	Criterion	Description
l)	**Residual impacts**	Residual impacts are those impacts that remain following the implementation of mitigation measures. Residual impacts must be identified and discussed. If there are no residual impacts, the specialist will need to briefly explain that the activity will have no residual impacts.
m)	**Degree to which an impact can be mitigated**	The impact can be **high** (fully mitigated), **moderate** (partly mitigated) or **not mitigated**.
n)	**Significance**	The significance of impacts shall be assessed with and without mitigations. The significance of identified impacts on components of the affected environment shall be described as: • **Very high negative or positive**: A negative impact will have highly significant effects which are unlikely to be mitigated adequately. A positive impact will have a highly significant positive effect on the environment. • **High negative or positive**: A negative impact will have significant effects and will require significant mitigation measures to achieve an accepted level of impact. A positive impact will have significant positive effects. • **Medium positive or negative**: The impact would have a moderate effect on the environment, requiring moderate mitigation (if negative). • **Low negative or positive**: The impact will have negligible effect on the environment and will require little or no mitigation (if negative). • **No impact**: Where the impact will not have an influence on the environment.

7.4 Results of Assessment

7.4.1 Development phase (design and construction)

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Trenching within the ecological corridor for laying of bulkwater pipeline, leading to mobilisation of sediment into the watercourse, or ocean, especially during high rainfall events, and may lead to the short-term loss of natural vegetation within the working area**	
Nature of impact:	Negative impact on the condition of the ecological corridor and stream habitat	N/A
Extent and duration of impact:	Local and short term	N/A
Consequence of impact or risk	Deterioration in stream Present Ecological State	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Fully reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A
Indirect Impacts:	Sedimentation in the tidal zone, and smothering of vegetation in the watercourse	N/A
Cumulative impact prior to mitigation:	Low to medium negative	N/A
Significance rating of impact prior to mitigation	Low to medium negative	N/A

	Alternatives 1, 2 and 3	No-Go
Degree to which the impact can be avoided:	Medium	N/A
Degree to which the impact can be mitigated:	Medium (assuming the pipeline cannot be moved out of the ecological corridor)	N/A
Proposed mitigation:	Assuming that the pipeline cannot be moved out of the ecological corridor, the following mitigation measures apply: • The width of the construction footprint must be kept to a minimum. • Trenches must be excavated by hand, and not using machinery. • Excavation of the pipeline trench must be done during the dry season. • Opened trenches must be filled as quickly as possible after trenching is initiated. This is to keep the disturbed areas open and destabilised for the shortest period possible. No trenches must be opened within three days of predicted heavy rainfall. • The disturbed pipeline area must be rehabilitated, with input from a botanist, in order to ensure that the area recovers from the impacts of construction.	N/A
Residual Impacts:	None	N/A
Cumulative impact post mitigation:	Low	N/A
Significance rating of impact after mitigation	Low	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Damage the soil structure, and destroy or shade out plants growing in and around the stream**	
Nature of impact:	Negative impact on the condition of the stream habitat	N/A
Extent and duration of impact:	Local and short term	N/A
Consequence of impact or risk	Deterioration in stream Present Ecological State	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Fully reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A
Indirect Impacts:	No indirect impacts due to low intensity and local scale of the impact	N/A
Cumulative impact prior to mitigation:	Low to medium negative	N/A
Significance rating of impact prior to mitigation	Low to medium negative	N/A

	Alternatives 1, 2 and 3	No-Go
Degree to which the impact can be avoided:	High	N/A
Degree to which the impact can be mitigated:	High	N/A
Proposed mitigation:	• Ensure that all building materials and equipment are stored at least 50m away from the watercourse corridor, as demarcated prior to construction. • Materials must be stored in piles that do not exceed 1.5m in height and must be protected from the wind, to prevent spread of fine materials across the site.	N/A
Residual Impacts:	None	N/A
Cumulative impact post mitigation:	Negligible	N/A
Significance rating of impact after mitigation	Negligible	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Pollution of the stream corridor through leakage of fuels, oils, etc. from construction machinery**	
Nature of impact:	Negative impact on the water quality within the stream and coastline	N/A
Extent and duration of impact:	Regional and Long term	N/A
Consequence of impact or risk	Deterioration in water quality in the stream	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Partially reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	N/A
Indirect Impacts:	This may impact negatively on water quality on the coastline (intertidal and tidal zone), which may manifest during or after construction.	N/A
Cumulative impact prior to mitigation:	Medium negative	N/A
Significance rating of impact prior to mitigation	Low to medium negative	N/A
Degree to which the impact can be avoided:	Medium	N/A
Degree to which the impact can be mitigated:	Medium	N/A
Proposed mitigation:	• Any construction activities close to the stream cease during periods of heavy rain, to reduce the risks of contamination of the stream and ocean through rainfall and runoff. • Machinery prone to oil or fuel leakage must be located at least 50 m away from any sensitive ecosystem, and the area bunded in order to contain leakages.	N/A

	Alternatives 1, 2 and 3	No-Go
	• Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly. • Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities.	
Residual Impacts:	Even with mitigation, there may be some soil contamination around the construction site, which will slowly wash into the stream and the sea. The intensity is likely to be low.	N/A
Cumulative impact post mitigation:	Low to medium negative	N/A
Significance rating of impact after mitigation	Low negative	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Destruction or deterioration of freshwater habitat as a result of foot and vehicular traffic**	
Nature of impact:	Negative impact on stream habitat	N/A
Extent and duration of impact:	Local and Short term	N/A
Consequence of impact or risk	Deterioration in condition of stream habitat	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Fully reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A
Indirect Impacts:	Unlikely to be any indirect impacts due to the low intensity and local scale of the impact	N/A
Cumulative impact prior to mitigation:	Low negative	N/A
Significance rating of impact prior to mitigation	Low negative	N/A
Degree to which the impact can be avoided:	High	N/A
Degree to which the impact can be mitigated:	High	N/A
Proposed mitigation:	• The watercourse corridor must be well marked during the pre-construction phase. • Pathways and access roads must be routed away from the stream corridor and coastline.	N/A
Residual Impacts:	None	N/A
Cumulative impact post mitigation:	Negligible	N/A
Significance rating of impact after mitigation	Negligible	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Disturbance of freshwater fauna and flora due to light and noise pollution**	
Nature of impact:	Negative impact on biodiversity - stream fauna and flora	N/A
Extent and duration of impact:	Local and Short term	N/A
Consequence of impact or risk	Movement of fauna off site, and deterioration in condition of plant communities leading to loss of biodiversity on the site	N/A
Probability of occurrence:	Definite	N/A
Degree to which the impact can be reversed:	Partially reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A
Indirect Impacts:	Fauna may move off the site and onto other properties, increasing inter-species interactions elsewhere. This is likely to be of low intensity, as the neighbouring areas to the north and west of the site can probably accommodate the number of individuals that may be impacted in this manner.	N/A
Cumulative impact prior to mitigation:	Medium negative	N/A
Significance rating of impact prior to mitigation	Low to Medium negative	N/A
Degree to which the impact can be avoided:	Medium	N/A
Degree to which the impact can be mitigated:	Medium	N/A
Proposed mitigation:	• The construction site and access pathways should avoid sensitive areas, which must be demarcated during the pre-construction phase. If lights are used, these should be directed away from the stream corridor and coastline. • Any animals found during site preparation or construction must be recorded and handed to the ECO. • An education programme for all employees must be run at the start of construction, and when new contractor teams start on site.	N/A
Residual Impacts:	This impact is difficult to mitigate completely, so there is likely to be a residual impact, although of low intensity.	N/A
Cumulative impact post mitigation:	Low to Medium negative	N/A
Significance rating of impact after mitigation	Low negative	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Introduction and spread of alien invasives – top material brought onto the site, for filling and landscaping can lead to the introduction of alien or invasive seed banks.**	
Nature of impact:	Negative impact on biodiversity, condition of the stream habitat, and hydrology (uptake of water by IAPs)	N/A
Extent and duration of impact:	Regional and Long term	N/A

	Alternatives 1, 2 and 3	No-Go
Consequence of impact or risk	Deterioration in condition of the stream habitat, and altered hydrology.	N/A
Probability of occurrence:	Highly Probable	N/A
Degree to which the impact can be reversed:	Partially reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	N/A
Indirect Impacts:	Altered hydrology over the long-term may be considered an indirect impact, but has been included here as a direct impact.	N/A
Cumulative impact prior to mitigation:	Medium negative	N/A
Significance rating of impact prior to mitigation	Medium negative	N/A
Degree to which the impact can be avoided:	Medium	N/A
Degree to which the impact can be mitigated:	Medium	N/A
Proposed mitigation:	• All soils and top material must be bought from a reliable source, and must be free of alien seeds or grass runners.	N/A
Residual Impacts:	It is virtually impossible to rid soils of all IAP seed, so it is likely that there will be some residual impact after implementation of all mitigation measures recommended here.	N/A
Cumulative impact post mitigation:	Low to Medium negative	N/A
Significance rating of impact after mitigation	Low to Medium negative	N/A

7.4.2 Operational Phase

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Development of open space**	
Nature of impact:	Negative impact on **movement and health of local fauna and flora**	N/A
Extent and duration of impact:	Local and permanent	N/A
Consequence of impact or risk	Fragmentation of landscape connectivity could lead to deterioration in habitat condition within the watercourse corridor, and loss of biodiversity as fauna move off the site.	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Irreversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A

	Alternatives 1, 2 and 3	No-Go
Indirect Impacts:	Flora and fauna may move off the site and search for habitat elsewhere, which may place pressure on habitat, communities and populations elsewhere	N/A
Cumulative impact prior to mitigation:	Medium negative	N/A
Significance rating of impact prior to mitigation	Medium negative	N/A
Degree to which the impact can be avoided:	Low	N/A
Degree to which the impact can be mitigated:	High	N/A
Proposed mitigation:	• While the open spaces within the development – in the north-western corner and around the watercourse – will mitigate to some extent against the impacts associated with the loss of open space and hardening of the property, there is limited connectivity between these two areas. These spaces are connected by a fairly narrow corridor along the western edge of the property adjacent to the gravel road. The movement of fauna and flora across the site would be improved through not constructing fences between the houses, thus allowing fauna to move between the houses. A further mitigation would be through ensuring that all gardens are planted with locally indigenous plant species. • The open spaces provided for in Alternatives 1, 2 and 3, and the proposed SUDS infrastructure should allow for sufficient area for the infiltration of runoff across the site. No further mitigation measures are recommended in this regard. • Alternatives 1, 2 and 3 will result in the setting aside of a considerable portion of the site as conservation area. While there is no detail on how this area will be managed, this represents a positive impact that it is unlikely would apply to the no development alternative, due to the uncertainties associated with this option.	N/A
Residual Impacts:	There will be a residual impact on the flora and fauna around the watercourse, due to the change in the local landscape, despite mitigation. This will be low of low intensity, due to the available open space surrounding the property.	N/A
Cumulative impact post mitigation:	Low to medium negative	N/A
Significance rating of impact after mitigation	Low negative	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Pollution of the watercourse and coastline from stormwater**	
Nature of impact:	Negative impact on water quality in the stream and coastline	
Extent and duration of impact:	Regional and Permanent	Regional and Permanent

	Alternatives 1, 2 and 3	No-Go
Consequence of impact or risk	Deterioration in water quality in the stream and the sea along the coastline	
Probability of occurrence:	Probable	Unlikely
Degree to which the impact can be reversed:	Partly reversible	Partly reversible
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	Irreplaceable
Indirect Impacts:	No indirect impacts likely	No indirect impacts likely
Cumulative impact prior to mitigation:	Low to medium negative	Low negative
Significance rating of impact prior to mitigation	Low to medium negative	Low negative
Degree to which the impact can be avoided:	High	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	• The proposed stormwater management system, if implemented in full, would adequately mitigate against the negative impacts associated with the generation, storage and discharge of stormwater on the site. It is understood that all stormwater generated by the development will be minimised at the point of accumulation, with only high discharge volumes and natural runoff being directed towards the watercourse and coastline. • The stormwater pipe carrying water under the road must be cleaned out, so that this does not pose a flood risk for the proposed development. In addition, stormwater runoff from the dirt road into Cape Infanta must be formalised.	N/A
Residual Impacts:	None	N/A
Cumulative impact post mitigation:	Low to medium negative	Negligible
Significance rating of impact after mitigation	Low negative	Negligible

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Pollution of the watercourse, groundwater and coastline through on-site treatment of waste water**	
Nature of impact:	Negative impact on water quality in the stream, groundwater and coastline	
Extent and duration of impact:	Regional and Permanent	Regional and Permanent
Consequence of impact or risk	Deterioration in water quality in the stream, groundwater and the sea along the coastline	
Probability of occurrence:	Probable	Unlikely
Degree to which the impact can be reversed:	Partly reversible	Partly reversible

	Alternatives 1, 2 and 3	No-Go
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	Irreplaceable
Indirect Impacts:	No indirect impacts likely	No indirect impacts likely
Cumulative impact prior to mitigation:	Low to medium negative	Low negative
Significance rating of impact prior to mitigation	Low to medium negative	Low negative
Degree to which the impact can be avoided:	Moderate	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	• Treated waste water should **not** be used for irrigation, but can be used for flushing of toilets. • All septic tanks and package plants are to be placed outside the 40m ecological corridor. • Package plants, septic tanks and soak-aways must be checked to ensure that they are working, at least annually. • Residents of the development must be educated in the use of household chemicals, detergents and solvents. It is inappropriate to use substances that could affect the efficiency of the septic tanks. Certain chemicals, such as bleaches, can destroy the bacterial communities in the septic tank.	N/A
Residual Impacts:	It is likely that there will be low intensity negative residual impacts associated with the treatment of waste water, as there is always slow leakage of organic pollutants from these systems over time.	Although there may also be some pollution from the existing septic tank, this is likely to have a negligible effect on the local environment.
Cumulative impact post mitigation:	Low to medium negative	Negligible
Significance rating of impact after mitigation	Low negative	Negligible

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Increased volumes of stormwater runoff**	
Nature of impact:	Negative impact on hydrology of the coastline	
Extent and duration of impact:	Regional and Permanent	Regional and Permanent
Consequence of impact or risk	Deterioration in condition of the stream due to altered hydrology	
Probability of occurrence:	Probable	Probable
Degree to which the impact can be reversed:	Fully reversible	Fully reversible

	Alternatives 1, 2 and 3	No-Go
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	Irreplaceable
Indirect Impacts:	No indirect impacts likely	No indirect impacts likely
Cumulative impact prior to mitigation:	Medium negative	Low to medium negative
Significance rating of impact prior to mitigation	Low to medium negative	Low negative
Degree to which the impact can be avoided:	High	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	See above	N/A
Residual Impacts:	There is likely to be some residual amount of stormwater flowing into the watercourse as a result of the development, even with the proposed mitigation. This will be of low intensity and so of low significance.	N/A
Cumulative impact post mitigation:	Low to medium negative	Low
Significance rating of impact after mitigation	Low negative	Negligible

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Abstraction of water from groundwater resources with risk of drawdown of local water table**	
Nature of impact:	Negative impact on local ecosystems dependent on groundwater, due to drawdown of local water table	
Extent and duration of impact:	Regional and Permanent	Regional and Permanent
Consequence of impact or risk	Deterioration in condition of ecosystems dependent on groundwater, leading to loss of biodiversity and altered hydrology.	
Probability of occurrence:	Probable	Unlikely
Degree to which the impact can be reversed:	Fully reversible	Fully reversible
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	Irreplaceable
Indirect Impacts:	No indirect impacts likely	No indirect impacts likely
Cumulative impact prior to mitigation:	Medium negative	Low negative
Significance rating of impact prior to mitigation	Low negative	Low negative
Degree to which the impact can be avoided:	Medium	Medium
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated

	Alternatives 1, 2 and 3	No-Go
Proposed mitigation:	• Both permanent residents and occasional visitors must be encouraged to use water sparingly, as groundwater is a precious resource, and the impacts of increased abstraction relatively unknown. • Use of rainwater must be facilitated through construction of rainwater tanks, and use of rainwater encouraged. • Only locally indigenous plants shall be allowed in gardens and landscaped areas. Grassed lawns must be of indigenous species, such as *Cynodon dactylon* (kweekgras).	N/A
Residual Impacts:	Water will be consumed and this cannot be avoided. Mitigation should reduce the likelihood of there being a negative consequence of water use down to low.	None
Cumulative impact post mitigation:	Low to medium negative	Negligible
Significance rating of impact after mitigation	Low negative	Low negative

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Disturbance of fauna and flora through noise light and trampling**	
Nature of impact:	Negative impact on biodiversity - stream fauna and flora	
Extent and duration of impact:	Local and Permanent	Local and Permanent
Consequence of impact or risk	Movement of fauna off site, and deterioration in condition of plant communities leading to loss of biodiversity on the site	
Probability of occurrence:	Probable	Improbable
Degree to which the impact can be reversed:	Fully reversible	Fully reversible
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	Partly replaceable
Indirect Impacts:	Fauna may move off the site and onto other properties, increasing inter-species interactions elsewhere. This is likely to be of low intensity, as the neighbouring areas to the north and west of the site can probably accommodate the number of individuals that may be impacted in this manner.	
Cumulative impact prior to mitigation:	Medium negative	Low negative
Significance rating of impact prior to mitigation	Medium negative	Low negative
Degree to which the impact can be avoided:	High	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	• Residential and road lights must be directed away from the stream corridor and coastline. • Residents, visitors and their pets must be discouraged from walking into and through the stream corridor.	N/A

	Alternatives 1, 2 and 3	No-Go
	• Boardwalks can be used to allow pedestrian access into the corridor, while protecting the fauna and flora.	
Residual Impacts:	This impact is difficult to mitigate completely, so there is likely to be a residual impact, although of low intensity.	N/A
Cumulative impact post mitigation:	Low to medium negative	Low negative
Significance rating of impact after mitigation	Low negative	Negligible

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Introduction and spread of alien invasives through landscaping activities and gardening**	
Nature of impact:	Negative impact on biodiversity, condition of the stream habitat, and hydrology (uptake of water by IAPs)	
Extent and duration of impact:	Regional and Long-term	Regional and Long-term
Consequence of impact or risk	Deterioration in habitat condition, and reduced water availability.	
Probability of occurrence:	Highly Probable	Probable
Degree to which the impact can be reversed:	Partly reversible	Partly reversible
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	Partly replaceable
Indirect Impacts:	No indirect impacts are likely. All impacts are direct.	
Cumulative impact prior to mitigation:	Medium negative	Low negative
Significance rating of impact prior to mitigation	Medium negative	Low negative
Degree to which the impact can be avoided:	High	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	• The stream corridor must be planted with appropriate indigenous vegetation, where necessary, and a barrier provided between landscaped areas (gardens or roadsides) and the corridor (e.g. a pathway). • Kikuyu grass must not be allowed on the site. • The spread of alien plant species into the natural areas must be prevented and monitored.	N/A
Residual Impacts:	It is virtually impossible to rid soils of all IAP seed, so it is likely that there will be some residual impact after implementation of all mitigation measures recommended here.	
Cumulative impact post mitigation:	Low to medium negative	Low negative
Significance rating of impact after mitigation	Low negative	Low negative

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Clearing alien vegetation from the site**	
Nature of impact:	Positive impact on biodiversity and ecosystem functioning	
Extent and duration of impact:	Regional and Long-term	Regional and Long-term
Consequence of impact or risk		
Probability of occurrence:	Definite	Improbable
Degree to which the impact can be reversed:	Fully reversible	Fully reversible
Degree to which the impact may cause irreplaceable loss of resources:	N/A	N/A
Indirect Impacts:	None	
Cumulative impact prior to mitigation:	Medium positive	Low to medium positive
Significance rating of impact prior to mitigation	Medium positive	Low to medium positive
Degree to which the impact can be avoided:	Low	Low
Degree to which the impact can be mitigated:	N/A	N/A
Proposed mitigation:	N/A	N/A
Residual Impacts:	N/A	N/A
Cumulative impact post mitigation:	N/A	N/A
Significance rating of impact after mitigation	N/A	N/A

8 SUMMARY AND CONCLUSIONS

- Three feasible development layouts have been proposed for erf 134, Cape Infanta. **Alternative 1** (13th April 2012) comprises 23 erven, 16 of which would be single storey and 7 double storey, **Alternative 2** (26th August 2013) comprises 21 erven, 15 of which are single storey and 5 double storey and lastly, **Alternative 3** (9th May 2023) also with 21 erven. The main material differences between Alternatives 2 and 3 are the location of the entrance roads and a shift in the configuration of the 21 erven. All three development alternatives incorporate a conservation area in the north-western corner of the property and a 40m-wide corridor following the watercourse, which incorporates the 1:100 year floodline for the ephemeral stream. The total cover of developable erven for all alternatives is approximately 50%.
- Alternatives 1, 2 and 3 address the following specific concerns from a freshwater ecological perspective:
    - More open space within the development for the infiltration of runoff and precipitation;
    - A smaller hardened footprint, and so less stormwater generated, and
    - A sufficiently wide (40 m) corridor around the watercourse is accommodated by the layout. The establishment of such a corridor will protect the stream and the surrounding dunes that contribute runoff to the stream during rainfall. The erven in Alternative 3 are all outside of the proposed watercourse corridor. There may be a low negative impact associated with the construction of the bulkwater supply pipeline within the ecological corridor. Mitigation measures to ensure that this impact is contained within a small footprint are provided in this report.
- The width of the watercourse corridor was determined, as is best practice, according to the width of the channel, its flow patterns (ephemeral, in this case), condition of the watercourse (good condition) and the vegetation adjacent to the watercourse, and the nature of the proposed activity surrounding the river (the nature of the impact influences the width of the buffer required to protect the system from the impact). The ecological buffer recommended for the protection of the ephemeral watercourse on the site is 20m, which should be measured from the edge of the channel (MacFarlane and Bredin, 2017), and it must include the 1:100 year floodline. In this case, the edge of the channel was difficult to identify due to the very ephemeral nature of surface flow within the system, but the recommended ecological buffer of 20m measured from the centreline is considered to be adequate for protection of the watercourse. The boundary of the recommended buffer is outside of the 1:100 year floodline, creating an adequate ecological corridor through the development.
- The 40m-wide watercourse corridor is of an adequate width to allow for sufficient terrestrial habitat on either side of the stream to create a buffer against the proposed activity, as required by the Swellendam SDF. This will protect an adequate zone of dune habitat adjacent to the stream, off which rainfall runs into the stream. The corridor will also allow for the movement of fauna and flora through the site.
- The location of the conservation area on Alternatives 2 and 3 takes account of a limestone fynbos sensitive area, as delineated in the botanist specialist report, and in both layouts the conservation area is just over 6 000 m^2.
- Alternatives 2 and 3 comprise fewer erven and less road surface than Alternative 1. However, this difference does not translate into a difference in the significance of the impacts associated with the three alternatives, at least from a freshwater ecological perspective.
- The impacts of Alternatives 1, 2 and 3 were assessed against the no development alternative.

- The no development alternative represents the status quo in terms of zoning – Agriculture 1 – and in terms of current permissible uses - primary use is for cultivation of land for crops and plants or the breeding of animals, or the operation of a game farm on an extensive basis on natural veld or land. The latter use includes activities and buildings that are reasonably connected with the main farming activities of the farm. Consent uses include additional dwelling units (a maximum of an additional five units), farm store, farm stall, intensive feed farming, riding school, nursery, service trade, and/or tourist facilities.
- There are several negative impacts associated with the construction of Alternatives 1, 2 and 3, the most significant of which is the introduction of alien plant species through the use of topsoil for filling and landscaping on the site. Topsoil must be obtained from a reliable source, and local topsoil made use of wherever possible. All of the construction impacts can be minimised through the implementation of several mitigation measures, which must be detailed in an environmental management plan for the site, prior to the commencement of construction.
- There are no construction impacts associated with the no development option, however the current zoning of the property does allow for the construction of a further 5 units.
- Alternatives 1, 2 and 3 will result in the hardening of the property and the loss of terrestrial open space. This would impact on the movement of flora and fauna both in and out of the stream corridor, and across the erf to the coast or up the slopes. While the open spaces within the development – in the north-western corner and around the watercourse – will mitigate to some extent against the impacts associated with the loss of open space and hardening of the property, there is limited connectivity between these two areas. These spaces are connected by a fairly narrow corridor along the western edge of the property adjacent to the gravel road. The movement of fauna and flora across the site would be improved through the absence of any fences between the houses, thus allowing fauna to move between the houses. A further mitigation would be through ensuring that all gardens are planted with locally indigenous plant species. With mitigation, this impact was assessed as being of medium negative significance for both development alternatives.
- This negative impact is balanced by the positive impact of the creation of a conservation area in the north-western portion of the site. While there is no detail on how this area will be managed, this represents a positive impact that it is unlikely would apply to the no development option, due to the uncertainties associated with this option.
- Other concerns about the operational phase of the residential development (all three Alternatives) are the generation and management of stormwater and water from the package treatment units and / or septic tanks and soak-aways. The stream is ephemeral and any change in hydrology or pollution of the watercourse due to the introduction of residential stormwater runoff, the seepage from septic tanks and soak-aways, or the use of treated effluent for irrigation will change the nature of the system, and lead to a deterioration in the quality of habitat provided within the corridor. This may also lead to a cumulative effect over time, should more developments occur in the area. This impact was assessed as being of low to medium significance before mitigation, and of low significance with mitigation. Treated effluent from package plants may not be discharged directly to the watercourse or coastline, and should not be used for on-site irrigation of open areas, due to the risk of pollution. Treatment plants, septic tanks and soak-aways must be located outside of the 40m ecological corridor, and checked regularly.
- While the abstraction of groundwater may lead to the drawdown of local groundwater resources, this is likely to be of low intensity and so of low significance. However, the cumulative effect of this impact may increase in significance should further developments be proposed in the area. Rainwater tanks must be constructed and residents encouraged to use rainwater.

- These operational phase impacts may also be associated with the no development option, but this is unlikely due to the low density of units allowed.
- Detailed environmental management programmes (EMPr) must be compiled for the construction phase and ongoing management of the development, and especially of its natural open spaces and conservation areas. The EMPr's must have input from all relevant specialists, and must contain detailed guidance on the minimization of disturbance and maximisation of conservation efforts.
- The no development option is likely to lead to fewer ecological impacts of significance, and so is the preferred overall option from a freshwater ecological perspective. However, Alternatives 1, 2 and 3 do take into account the concerns raised throughout the project, specifically with regard to the watercourse on the site.
- Alternative 3 is the preferred development layout from a freshwater ecological impact, as all of the erven are located outside of the watercourse corridor.
- With sensitive management of the natural areas on the site, and the implementation of the mitigation measures recommended here, the impacts of this proposed development could be minimised.

9 REFERENCES

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WATER USE LICENCE APPLICATION
SUMMARY REPORT

ERF 134, INFANTA

APPENDIX D

Civil Engineering Services Report

ERF 134

SERVICES REPORT FOR
CIVIL ENGINEERING SERVICES FOR THE DEVELOPMENT OF ERF 134, CAPE INFANTA, SWELLENDAM MUNICIPALITY

HESRIV-573

March 2025

PREPARED BY:

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1. INTRODUCTION

Hessequa Consulting Engineers CC has been appointed by Westerhelling Investments for the planning of civil engineering services for the proposed development of Erf 134, Cape Infanta, Swellendam Municipality.

The provision of civil engineering services will be in accordance with the guidelines and requirements of the *Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development* as published by the CSIR and that of the Swellendam Municipality.

This report indicates, discusses and elaborates on the design criteria and specifications to be applied in the detail design of the internal and external infrastructure including roads, stormwater, water and Waste Water Treatment, Solid Waste Management, flood lines as well as requirements for the provision of electrical sleeves.

The concept design is based on a site survey completed by Pieter Houterman (Land Surveyor).

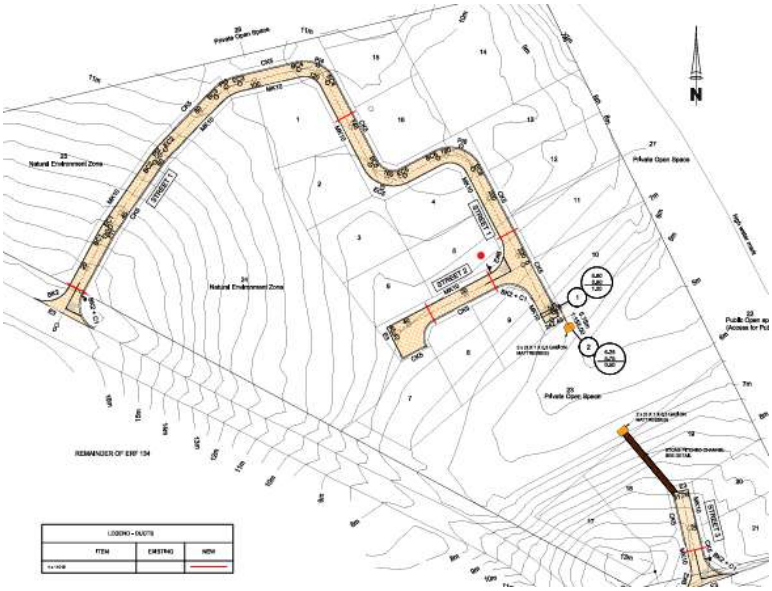
This report indicates, discusses and elaborates on the design criteria and specifications to be applied in the detail design of the internal and external infrastructure. The supply and distribution of electrical services and bulk supply will be discussed in a separate Electrical Services Report.

2. LOCATION

Infanta is situated west of the Breede River mouth and 60km south-east of Swellendam. Erf 134 Infanta is 86 ha in extent and currently has one residential unit. The project entails the development of an additional 20 units on erf 134.

The development is located north-east of Main Road 268. There is a dry watercourse that passes through the development site. Fifteen of the new units will be located north of the watercourse and the remainder 5 units to the south of the watercourse.





3. ACCESS ROADS

Access to the original dwelling and the additional 15 erven will be via an existing entrance, from main road 268, to erf 134. The five erven south of the water course will gain access from Hoek Street (gravel road).

The existing road network has sufficient spare capacity to accommodate the proposed development. The expected additional trips to and from the proposed development will have an insignificant impact on the surrounding road network. No upgrading of existing road network is envisaged.

4. ENGINEERING SERVICES

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 Swellendam Municipality.

4.1. MASS EARTHWORKS

No mass earthworks will be required.

4.2. ROADS

The internal road reserves are 8m wide. The access road as well as the internal road network will consist of 4,5m wide road surfaces. Road finishing will consist of 60mm Interlocking segmented paving with stormwater pipework, open stone pitched channel and inlet- and outlet structures.

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.* Suitable commercial sources for the construction materials are available within Swellendam municipal area and surrounding towns.

Table 1: Road Design Criteria

Parameter	**Residential Access way (Class 5d)**
Category	UC
Traffic Class	E0
Structural Design Traffic	$< 0.2 \times 10^6$
Surface Treatment	60mm Interlocking Segmented Paving
Sub-base from commercial sources	150mm G5 (95% MAASHTO) on 150mm Upper Selected (93% MAASHTO) on 150mm Roadbed prep in-situ Material (90% MAASHTO)
Carriage Way Width	4,5m
Design Speed	30 km/h
Minimum Gradient	0.5%
Cross Fall	2%
Bell mouths	8m Radius

4.3. STORMWATER

4.3.1. Stormwater Management Strategy

It is estimated that stormwater runoff, depending on erf coverage, will increase by approximately 25% post development.

The following measures are proposed to mitigate the impact of post development stormwater runoff downstream from the proposed development:

- Installation of 5,0 kℓ water tanks on each residential erf will contribute to the attenuation of initial runoffs. The tank overflow will be directed to underground soakaways. With the expected Mean Annual Precipitation (MAP) of 430mm/year, an average roof size of 215m² and 80% efficiency rate the expected annually rainwater harvesting per unit will be around 74 kℓ/household.
- The runoff from any hardened surface, within the developed plots, will be directed towards gardens using strategic landscaping with native vegetation to intercept the runoff.
- The concentration of stormwater runoff will be minimised through the application of landscaping techniques, i.e. by creating grass lined swales, undulations and depressions. These cutoff swales will intercept any overland flow, which will discourage erf runoff to road surfaces.
- Stormwater from road surfaces will be released into the water course through energy dissipating Reno Mattresses structures.

4.3.2. Stormwater Design

Stormwater infrastructure will be constructed in accordance with the standard requirements and specifications as agreed with the Swellendam Municipality. The 100-year floodlines were determined by Mr A.L.Fraser (Pr Eng) and falls outside the development area. See outcome of the floodline study attached to Annexure B.

Design criteria adopted for the development regarding stormwater infrastructure is summarised as follows:

Runoff rates will be determined according to the Rational Method.

Flood recurrence interval	:	2 years
Pipe material	:	Concrete
Pipe class	:	75D
Pipe diameters	:	Minimum 375mm Ø up to diameter as required
Bedding	:	Class C

Inlets	:	Kerb and grid inlet structure for the northern erven.
	:	Open stone pitched channel, in stormwater servitude, for the southern erven.
Manholes	:	Point of deflections on pipes

4.4. WATER

4.4.1. Water Demand

The estimated Annual Average Daily Demand (AADD) for the development is as follows:

21 Single Residential Erven (small) - 800 ℓ/unit/day	16,8 kℓ/day
Total AADD	**16,8 kℓ/day or 0,194 ℓ/s**

4.4.2. Availability of sufficient Water Sources

With the expected Mean Annual Precipitation (MAP) of 430mm/year, an average roof size of 215m² and 80% efficiency rate the expected annually rainwater harvesting per unit will be around 74 kℓ/household. It is proposed that the harvesting of rainwater be used for potable water consumption. Each household will be required to have a 5,0 kℓ water tank for rainwater harvesting.

There are boreholes (134: 134A and 134C) located on erf 134, north of the district road. Van Biljon (2014-a) undertook a 72-hour pumping test on borehole 134C. The 72-hour pumping test established that borehole 134C can produce 25 m³/day, every day, for 100 years. For the best-case scenario, the yield goes up to 48m³/day. According to van Biljon (2014), borehole 134C's daily yield is 25 m³/day which is more than the daily demand which has been estimated as 16,8 m³/day. There is therefore sufficient borehole water for the proposed development of 21 units on erf 134. The calculations are conservative because the houses are unlikely to be occupied throughout the year.

4.4.3. Water Storage and Fire Fighting

The proposed development, with houses of floor area over 200 m², is classified, with respect to firefighting, as low-risk group 1 by the Red Book (2004). To achieve the minimal low risk group 1 residual water pressure of 7m and the firefighting flow rate of 900 ℓ/minute, a 125mm Ø water supply pipeline is required from the reservoir to the development.

Borehole 134C is located to the south of Main Road 268. It is recommended that a 130 kℓ SBS Tank reservoir be constructed near (the unused) borehole 134 A (Drawing HESRIV-573-W2). The size of

the reservoir is determined by the required firefighting capacity (108 kℓ) plus the daily demand of 16,8kℓ/day.

To ensure that sufficient firefighting capabilities exist, the supply pipeline from the reservoir to the development will consist of a 125mm Ø Class 9 uPVC water main complete with isolating valves, fire hydrants and erf connections. (Drawing HESRIV-573-W1 Rev 1). A servitude should be registered for the pipeline route.

4.4.4. Water Link Services

A new 125mm Ø, Class 9, uPVC water main will be constructed between the reservoir and development complete with isolating valves, fire hydrants and erf connections. A 200mm Ø corrosion protected steel sleeve will cross Main Road 268 between the two fence lines. A 125mm Ø HDPE fusion welded water main will be constructed through the steel sleeve. Water mains parallel to Main Road 268 will be constructed within the 5m building line. Confirmation that the District Roads Engineer support the proposal is attached under Annexure C of this report.

Erf connections will consist of HDPE PE80 PN12,5 pipes and terminated with endcaps.

The basis of the water reticulation design for the proposed development is summarised in the table below:

Table 2: Water Reticulation Design Criteria

PARAMETER	GUIDELINE
Pipe materials for erf connections	HDPE PE80 PN12,5
Pipe materials for reticulation mains	uPVC (Class 9)
Minimum diameter for reticulation mains	125mm
Minimum diameter for erf connections serving two erven	25mm branching to 2 x 20mm
Minimum diameter for erf connections serving one erf	20mm
Valves	125mm AVK (open clockwise)
Fire Hydrants	AVK London V on respective pipe Ø
Water meters	20mm Elster Kent (Water meter to be installed by Swellendam Municipality with Building Plan approvals.)

4.5. SEWERAGE

4.5.1. Sewage Management

Both the existing Infanta and the existing Infanta Park use septic tanks for sewage treatment. The septic tanks at Infanta Village are scattered amongst the potable water boreholes within the Village. A few new houses have conservancy tanks which are serviced by Swellendam Municipal tankers.

One of three alternatives are available for consideration and approval by Swellendam Municipality namely Conservancy Tanks, Septic Tanks with Soakaways or small household WWT Package Plants. The nearest Waste Water Treatment Works is 74 km (Swellendam) from site. The use of Conservancy tanks is in our opinion not economically viable and not recommended.

It is proposed that each erf be fitted with an on-site WWTW Package Plant to handle the expected sewage flow. The factory built activated sludge sewage treatment plant will produce effluent that meets the Department of Water Affairs General Standards.

According to the Manufacturer's (Maskam Water) design criteria the system consists over the following qualities:

- Odourless and quiet.
- The installed is underground.
- Has a small footprint.
- Effluent meets the South African DWS General Standard.
- Includes nitrification and de-nitrification cycles.

The smallest available model is the ZF450 which has a capacity to treat 1,500 ℓ/day which is well above the expected 640 ℓ/day sewage flow per household. The water can be recycled for non-potable usage such as flushing toilets, with the remaining effluent being used for irrigation or being discharged underground to a soak-away. Alternatively, all the effluent can be discharged to a soak-away as the surrounding soil is sand and very porous. See Maskam Water Brochure and Process Description under Annexure D

4.5.2. Sewer Design Flows

In accordance with the *Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development* it is expected that 80% of the Average annual water daily demand will end up in the wastewater system.

The annual average dry weather flow (AADWF) equals 80% of 16,8 kℓ/d = 13,44 kℓ/d (640 ℓ/household/day) = 0,156 ℓ/s.

To determine the Peak Wet Weather Flow (PWWF) a peak factor of 2,5 were taken in consideration with an expected stormwater infiltration of 15%. The PWWF equals 0,447 ℓ/s.

4.6. ELECTRICAL SLEEVES

The position of electrical sleeves (110mm Class 34 PVC) will be determined in consultation with the Electrical Engineer.

5. SOLID WASTE

The expected volume of solid waste generated, for the specific development, will be seasonable. The highest volume of solid waste will be generated during the December-January period with other peaks around school holidays. Low volumes of waste will be generated during winter months. It is expected that between 0,15 to 0,25 m³/household/week, solid waste, will be generated.

Homeowners will be expected to deliver household solid waste to a Waste Transfer Station that will be located at one of the two entrances to the development. Swellendam Municipality will service the transfer station on Tuesday's and transport the un-compacted solid waste to the Swellendam Municipal Solid Waste Site.

A letter from Swellendam Municipality accepting this proposal is shown as Annexure E. The final decision/position of the solid waste transfer station will be made in association with the Swellendam Municipality.

6. CONCLUSION

We trust that the information included in this report will provide insight to the level of services required for the proposed development.



G PEPLER Pr Tech Eng
HESSEQUA CONSULTING ENGINEERS

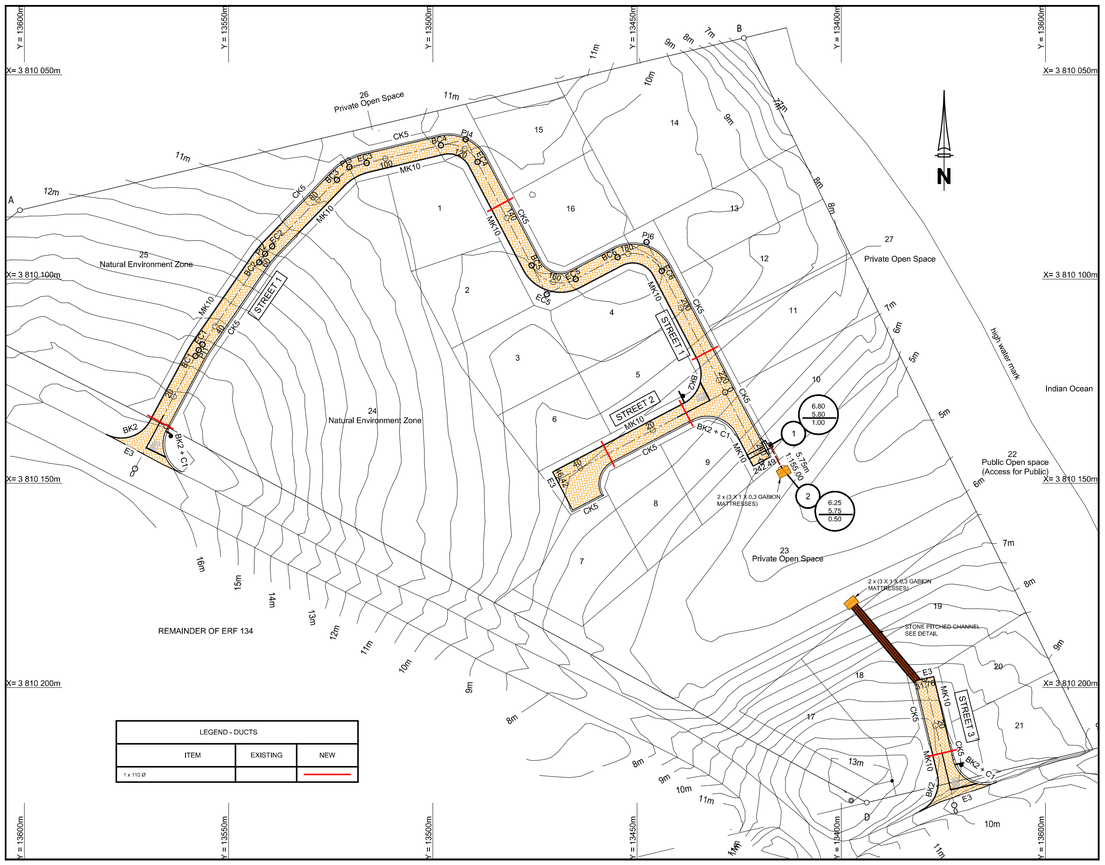
12 March 2025

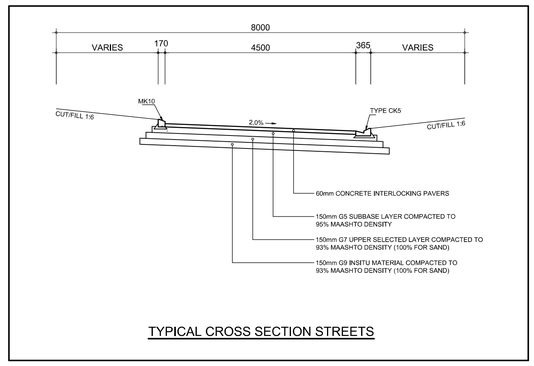
ANNEXURE A - DRAWINGS

HESRIV-573-R1 : Proposed street and stormwater layout with longitudinal sections

HESRIV-573-W1 Rev A : Water layout and typical sections

HESRIV-573-W2 : External water layout



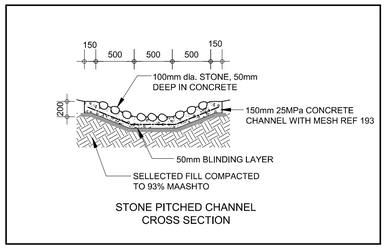


TYPICAL CROSS SECTION STREETS

CO-ORDINATE LIST FOR STORMWATER

POINT No.	COORDINATE : Lo19°/WGS84 Y +0,000	X +0,000
1	13417.447	3810145.853
2	13414.778	3810150.722

KEY
BK2 = BARRIER KERB TYPE BK2
BK2 + C1 = BARRIER KERB TYPE BK2 & CHANNEL TYPE C1
CK5 = MOUNTABLE KERB TYPE CK5
MK10 = EDGING TYPE MK10
"R1" = STOP SIGN



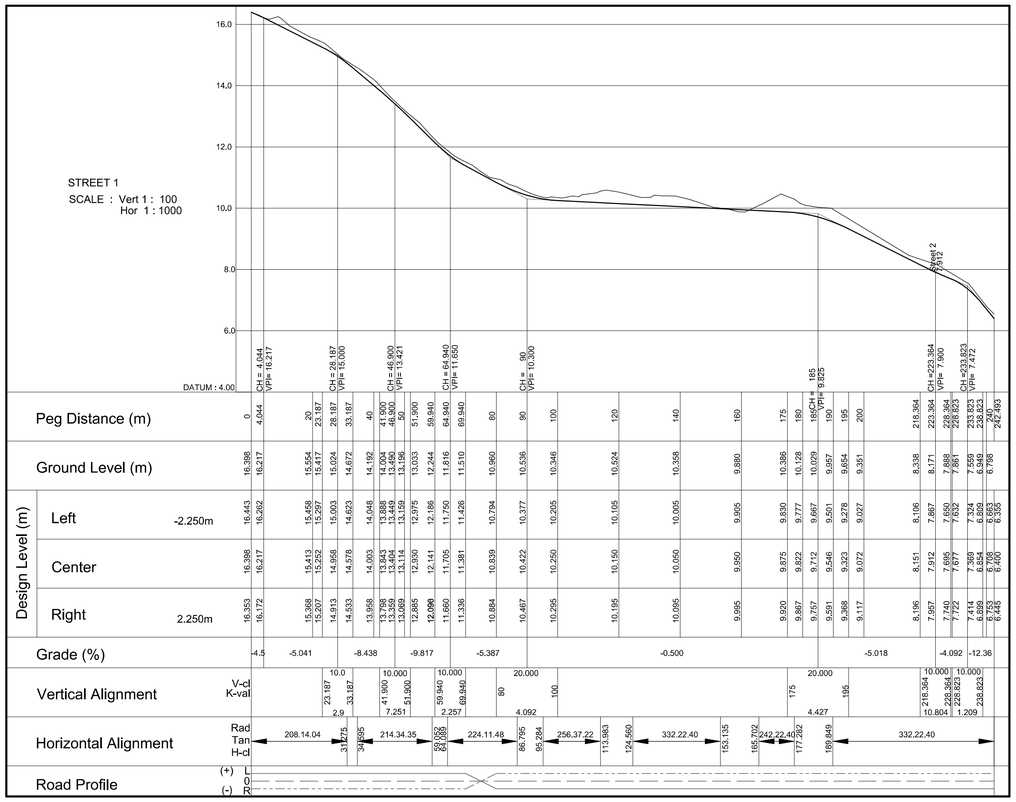
STONE PITCHED CHANNEL
CROSS SECTION

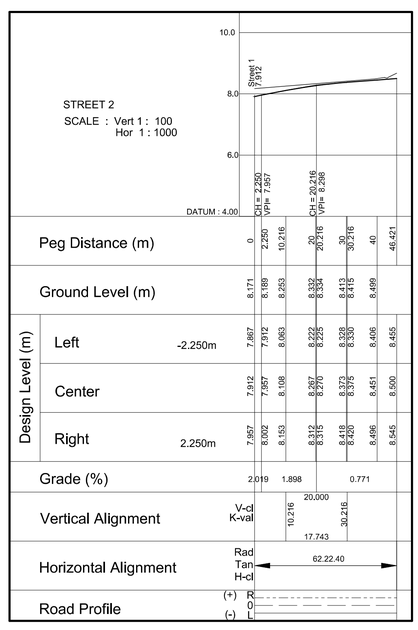
LEGEND - STORMWATER

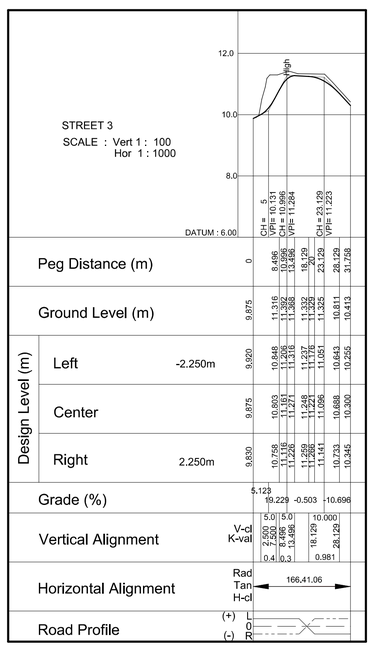
ITEM	EXISTING	NEW
Ø 375 STORMWATER PIPE (OGEE 100D)		
MANHOLE	○	●
GRID INLET STRUCTURE SEE DRAWING HESRIV-573-R2		
OUTLET STRUCTURE SEE DRAWING HESRIV-573-R1		
DISTANCE GRADIENT		56.00m 1:102.00
MANHOLE WITH PIPE		
MANHOLE NUMBER		SW02
COVER LEVEL INVERT LEVEL DEPTH		00.00 00.00 0.00

SETTING OUT DATA

POINT No.	CHAINAGE DISTANCE ON ROAD	COORDINATE : Lo19°/WGS84 Y -0,000	X +0 000 000,00	RADIUS
STREET 1 (4.5m WIDE)				
START	0,00	13572.914	3810146.400	
BC1	31.27	13558.118	3810118.847	
PI1		13557.332	3810117.382	30.00
EC1	34.59	13556.389	3810116.014	
BC2	59.05	13542.510	3810095.877	
PI2		13541.077	3810093.798	30.00
EC2	64.08	13539.317	3810091.988	
BC3	86.79	13523.488	3810075.709	
PI3		13520.448	3810072.582	15.00
EC3	95.27	13516.204	3810071.573	
BC4	113.98	13498.013	3810067.247	
PI4		13491.959	3810065.807	8.00
EC4	124.56	13489.074	3810071.321	
BC5	153.13	13475.825	3810096.639	
PI5		13472.116	3810103.728	8.00
EC5	165.69	13465.028	3810100.019	
BC6	177.29	13454.768	3810094.649	
PI6		13447.679	3810090.940	8.00
EC6	189.85	13443.970	3810098.029	
END	242.49	13419.562	3810144.673	
STREET 2 (4.5m WIDE)				
START	0,00	13428.431	3810127.724	
END	46.42	13469.561	3810149.247	
STREET 3 (4.5m WIDE)				
START	0.00	13372.312	3810228.776	
END	31.76	13379.626	3810197.871	







VERKLEINDE SKAAL/REDUCED SCALE
0 10 20 30 40 50
50

Notas/Notes

Wysiging/Amendment

Nr. No.	Datum Date	Nagesien Checked	Deur By	Beskrywing Description

ESSEQUA
RAADGEWENDE INGENIEURS • CONSULTING ENGINEERS
P.O. BOX 577
RIVERSDALE 6670
22 HEIDELBERG ROAD RIVERSDALE
CELL : 083 447 9297
TEL/FAX : 028 713 4030
CESA

Ontwerp Designed	Geteken Drawn	Nagesien Checked
AA	AA	GP

Raadgewende Ingenieur/Consulting Engineer — Pr Tech Eng — 12-03-2025 Datum/Date

Klient/Client — Datum/Date

Klient/Client

CAPE INFANTA DEVELOPMENT

Erf 134
CAPE INFANTA
6740

Projek/Project

PROPOSED DEVELOPMENT OF ERF 134 : CAPE INFANTA

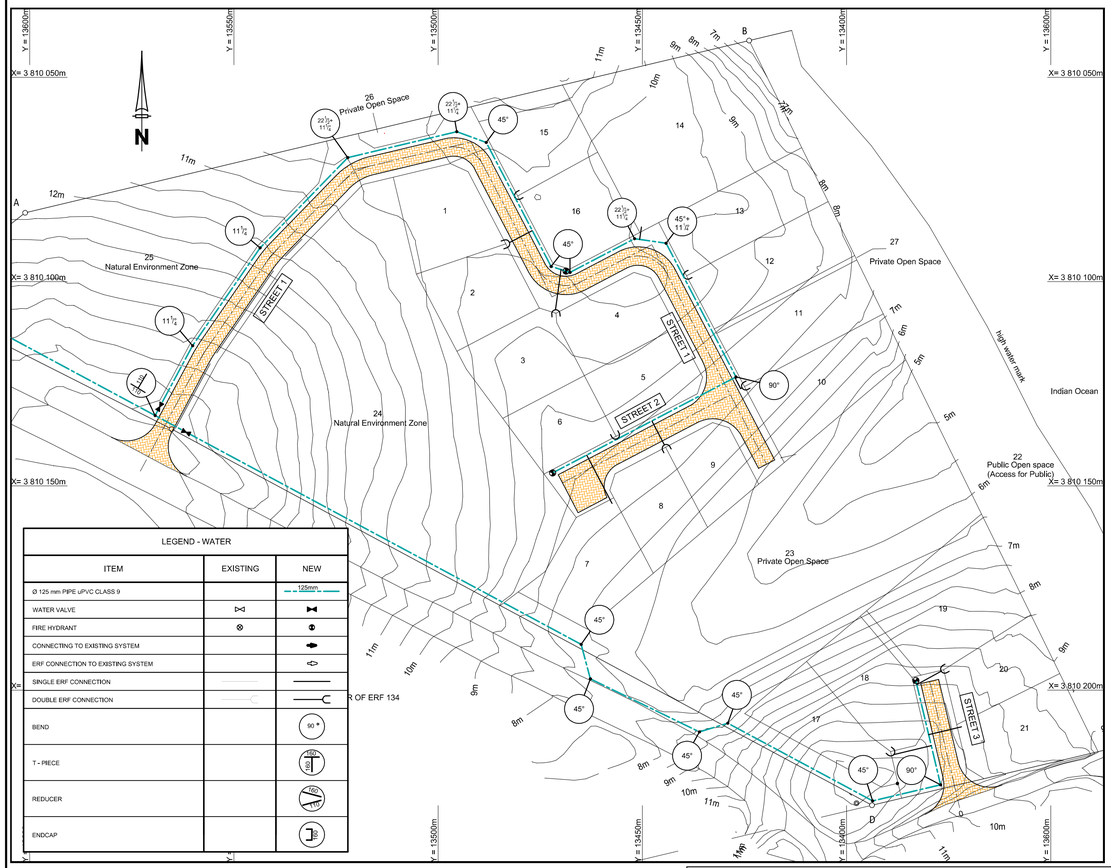
Tekening Beskrywing/Drawing description

PROPOSED STREET AND STORMWATER LAYOUT WITH LONGITUDINAL SECTIONS

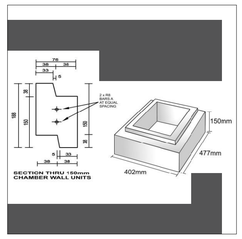
Skaal/Scale	Datum/Date
1:750	FEBRUARY 2025

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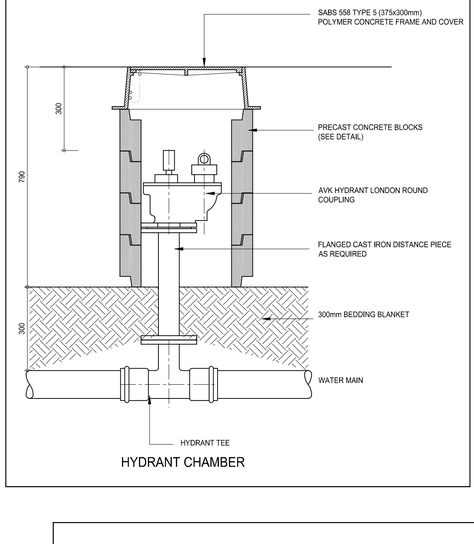
HESRIV-573-R1



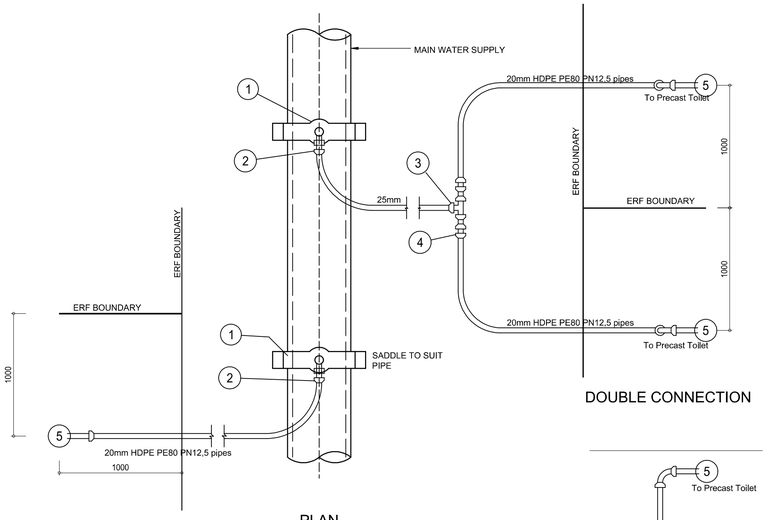
LEGEND - WATER		
ITEM	EXISTING	NEW
Ø 125 mm PIPE uPVC CLASS 9		125mm
WATER VALVE		
FIRE HYDRANT		
CONNECTING TO EXISTING SYSTEM		
ERF CONNECTION TO EXISTING SYSTEM		
SINGLE ERF CONNECTION		
DOUBLE ERF CONNECTION		
BEND		90 °
T - PIECE		160 x 160 x 160
REDUCER		160 x 110
ENDCAP		160



PRECAST CONCRETE BLOCK



HYDRANT CHAMBER



DOUBLE CONNECTION

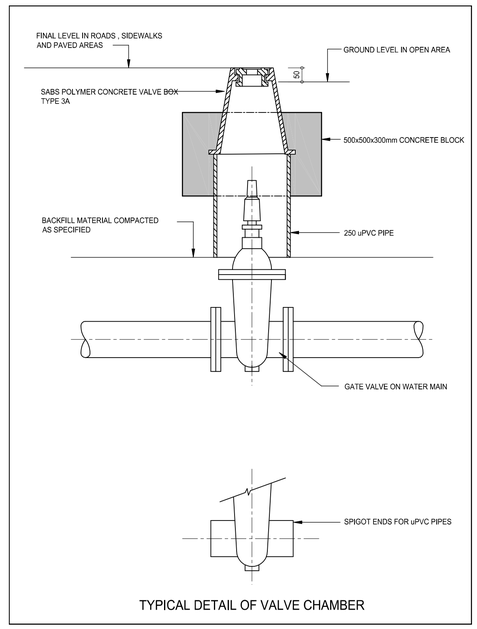
PLAN

SINGLE CONNECTION

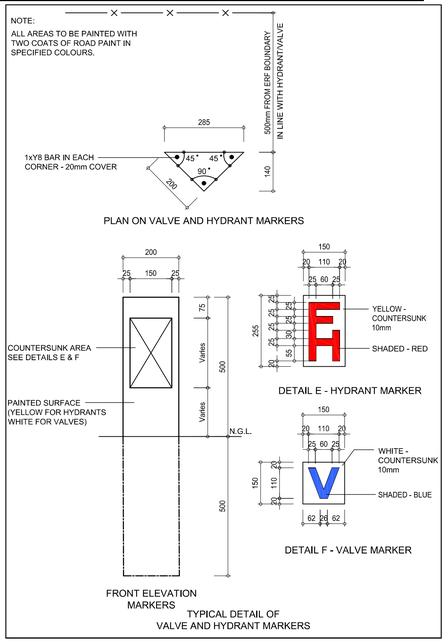
SECTION

NOTES
1 90° MALE TO FEMALE ELBOW
2 PLASSON MALE COUPLING
3 25 x 25mm T-PIECE
4 25 x 20mm REDUCER
5 WATER METER

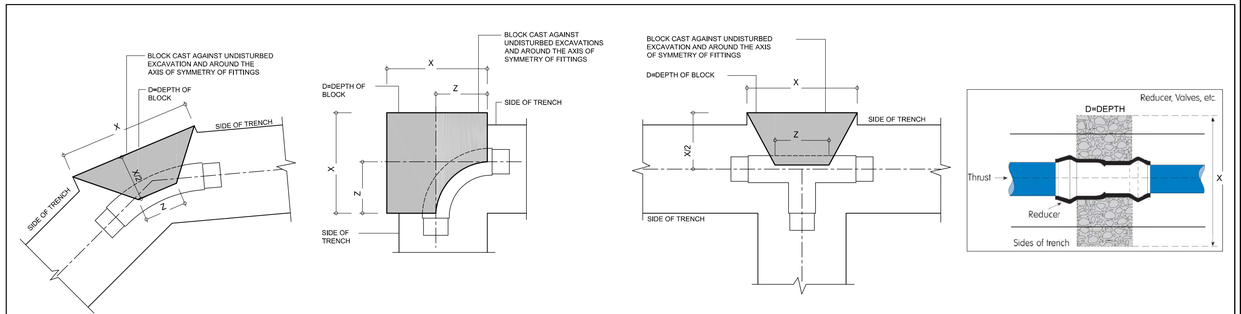
TYPICAL DETAIL OF
WATER CONNECTION ON ERVEN (25/20mm)



TYPICAL DETAIL OF VALVE CHAMBER



TYPICAL DETAIL OF
VALVE AND HYDRANT MARKERS



TYPICAL THRUST BLOCK DETAILS
SANDY SOIL
BEARING CAPACITY 200-400kPA

NOTE: COUPLINGS AND FLANGES MUST BE LEFT FREE OF CONCRETE

PIPE	11¼° BEND			22½° BEND			45° BEND			90° BEND			T-JUNCTION			END CAPS/VALVES REDUCERS	
DIAM.	Xmm	Dmm	Zmm	Xmm	Dmm	Zmm	Xmm	Dmm	Zmm	Xmm	Dmm	Zmm	Xmm	Dmm	Zmm	Xmm	Dmm
75	200	100	100	200	150	150	250	200	150	300	220	180	300	210	150	700	300
100	200	150	100	250	200	150	350	250	200	350	300	250	350	300	200	1000	400
150	250	200	200	350	300	200	500	450	350	550	450	400	600	400	280	1050	500
200	350	250	250	500	350	250	650	500	450	750	550	480	700	600	350	1100	600
250	400	350	300	600	450	300	800	600	500	1000	650	530	900	700	450	1150	700
300	500	400	350	700	550	350	950	750	550	1200	770	580	1150	800	550	1200	800
350	600	500	400	900	700	400	1200	900	600	1480	950	630	1550	900	550	1500	800

Wysiging/Amendment

Nr. No.	Datum Date	Nagesien Checked	Deur By	Beskrywing/Description
A	11-02-26			WATER LAYOUT AMENDED

VERKLEINDE SKAAL/REDUCED SCALE
0 10 20 30 40 50
50

Notas/Notes

ESSEQUA
RAADGEWENDE INGENIEURS • CONSULTING ENGINEERS
P.O. BOX 577
RIVERSDALE 6670
22 HEIDELBERG ROAD, RIVERSDALE
CELL: 083 447 9297
TEL/FAX: 028 713 4030
CESA

Ontwerp Designed	AA
Geteken Drawn	AA
Nagesien Checked	GP

Pr Tech Eng
Raadgewende Ingenieur
Consulting Engineer
Datum/Date 12-03-2025

Klient/Client
Datum/Date

Klient/Client
CAPE INFANTA DEVELOPMENT
Erf 134
CAPE INFANTA
6740

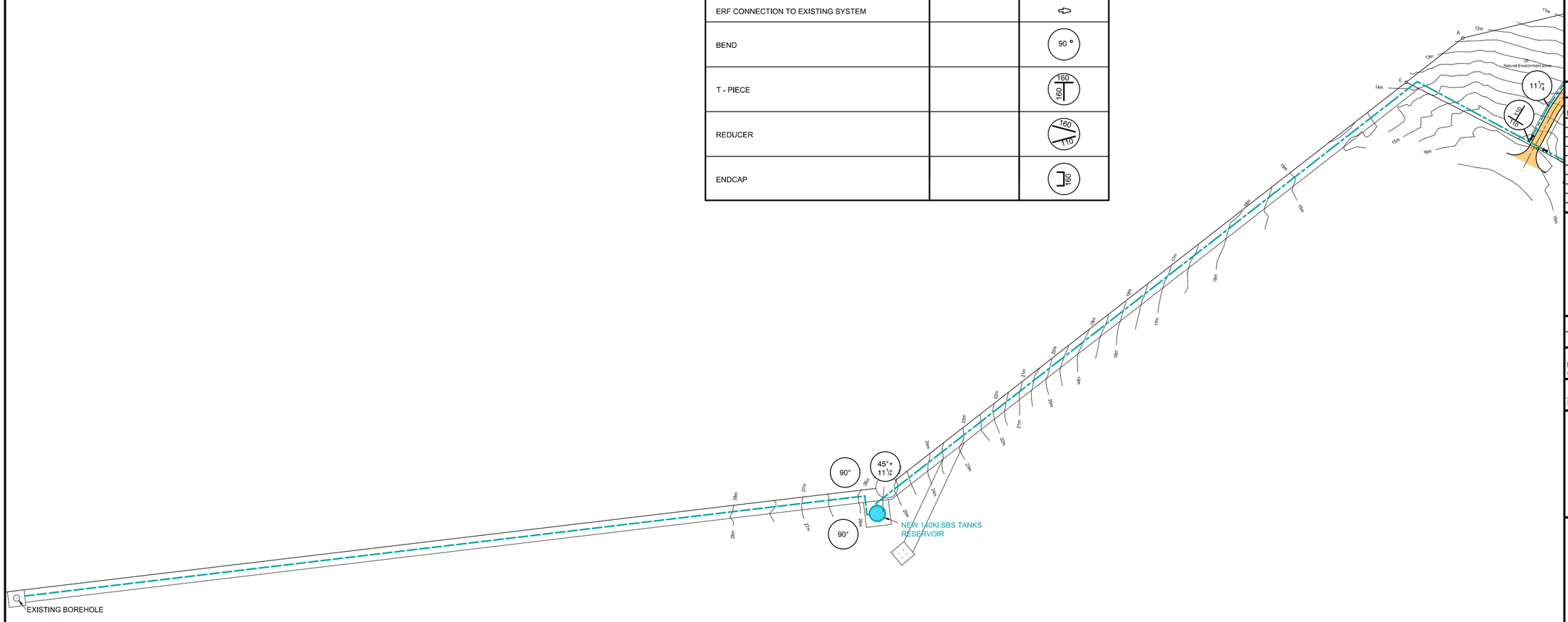
Projek/Project
PROPOSED DEVELOPMENT OF ERF 134 : CAPE INFANTA

Tekening Beskrywing/Drawing description
WATER LAYOUT AND TYPICAL DETAILS

Skaal/Scale
N.T.S
Datum/Date
FEBRUARY 2025
Tekening Nommer/Drawing number
HESRIV-573-W1 A

11 Feb 2026

LEGEND - WATER		
ITEM	EXISTING	NEW
Ø 75 mm PIPE uPVC CLASS 9		75mm
Ø 125 mm PIPE uPVC CLASS 9		125mm
WATER VALVE	⋈	⋈
CONNECTING TO EXISTING SYSTEM		
ERF CONNECTION TO EXISTING SYSTEM		
BEND		90 °
T - PIECE		160 / 160
REDUCER		160 / 110
ENDCAP		160



VERKLEINDE SKAAL/REDUCED SCALE

0 10 20 30 40 50

50

Notas/Notes

Wysiging/Amendment

Nr. No	Datum Date	Nagesien Checked	Deur By	Beskrywing Description

ESSEQUA
RAADGEWENDE INGENIEURS • CONSULTING ENGINEERS

P.O. BOX 577
RIVERSDALE 6670
22 HEIDELBERG ROAD RIVERSDALE
CELL : 083 447 9297
TEL/FAX : 028 713 4030

CESA

Designed	Drawn	Checked
AA	AA	GP

Pr Tech Eng
Raadgewende Ingenieur
Consulting Engineer

12-03-2025
Datum/Date

Klient/Client

Datum/Date

Klient/Client

CAPE INFANTA DEVELOPMENT

Erf 134
CAPE INFANTA
6740

Projek/Project

PROPOSED DEVELOPMENT OF ERF 134 : CAPE INFANTA

Tekening Beskrywing/Drawing description

EXTERNAL WATER LAYOUT

Skaal/Scale	Datum/Date
1:1500	MARCH 2025

Tekening nommer/Drawing number

HESRIV-573-W2

ANNEXURE B

100-Year floodlines as calculated by AL Fraser (Pr Eng)

LEGEND:

RS 20 - RIVER STATION 20

- 100 YEAR RI FLOODLINE

47m - CONTOUR LEVEL

-10 -5 0 5 10 15

SCALE BAR:

GENERAL NOTES:

1. Floor levels should be located 300mm above indicated flood levels as additional safety.
2. Table of Key Information:
   Catchment Area 291ha
   100 Year rainfall 130mm/day
   Time of Concentration 3h
   100year Peak flow 5m^3/s

REV	DATE	DESCRIPTION
3	15 June 2021	Note 1 removed, Drawing Number changed

Table of Floodline Information for 100 yr RI floods

RS	WSL	EGL
70	6.59	6.69
60	6.19	6.21
50	5.98	6.03
40	5.64	5.69
30	5.07	5.14
20	4.32	4.43
10	3.40	3.44

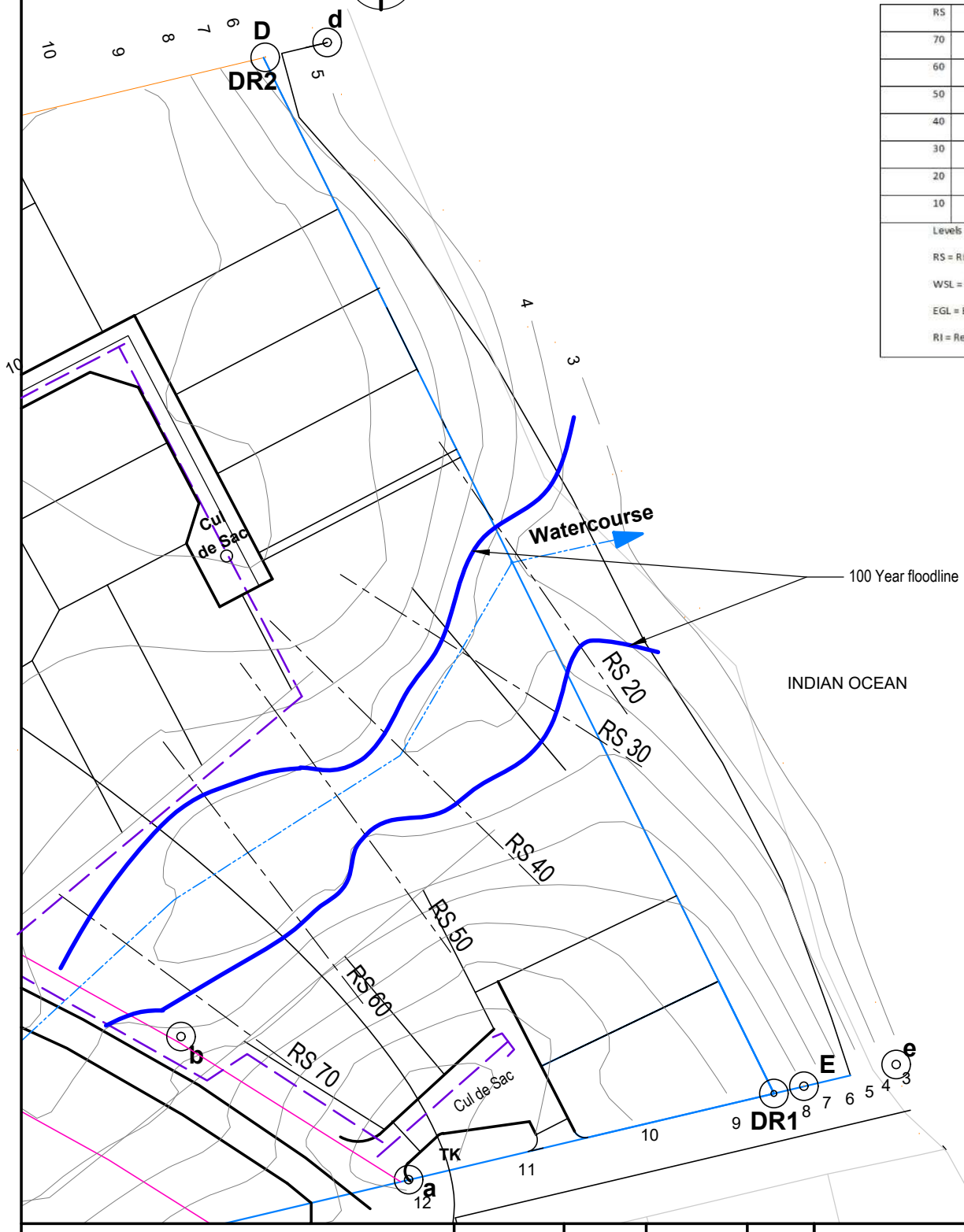
Levels are to m amsl.

RS = River Station

WSL = Water Surface Level

EGL = Energy Grade Line

RI = Recurrence Interval



PORTION 134, CAPE INFANTA, SWELLENDAM MAGISTERIAL DISTRICT - FLOODLINES

DESIGN:	ALF	DRAWN:	JBS	SCALE 1:1000	
FOREST LODGE, MAIN ROAD, SEDGEFIELD. TEL: 044 343 2093				DATE: 12 Dec. 2020	
FRASER Consulting Civil Engineers cc				AF134-04 REV. 3	A4

ANNEXURE C

Confirmation from Western Cape Road Network Management in support of the water main crossing of Main Road 268

Western Cape Government
Transport and Public Works

ROAD NETWORK MANAGEMENT
Email: Grace.Swanepoel@westerncape.gov.za
tel: +27 21 483 4669
Rm 335, 9 Dorp Street, Cape Town, 8001
PO Box 2603, Cape Town, 8000

REFERENCE : 16/9/6/1-27/24 (Job 23035)
ENQUIRIES : Ms GD Swanepoel
DATE : 10 August 2017

Fraser Consulting Civil Engineers
PO Box 178
SEDGEFIELD
6573

Attention: Mr A Fraser

Dear Sir

REQUEST FOR INFORMATION: CROSSING MAIN ROAD 268

1. Your e-mail of 24 May 2017 to Mr Van Eeden at Overberg District Municipality refers.

2. Your application for information affects Main Road 268, of which this Branch is the Road Authority, as follows:

2.1 With a crossing at ±km68.58.

2.2 Parallel to that road and outside of the road reserve, but within the adjacent 5m Building Line (Roads Ordinance 19 of 1976), between ±km68.58 LHS and km68.82 (end of Proclaimed Main Road).

3. This Branch will support your proposal, provided that the steel sleeve pipe, which must be installed from fence line to fence line, is sufficiently protected against corrosion and provided that the sleeve pipe is at least 1000mm below the lowest point across the cross-section (side drains; which should be allowed to be at least 800mm in depth).

4. Upon receipt of such a detail design this Branch will act accordingly.

Yours faithfully

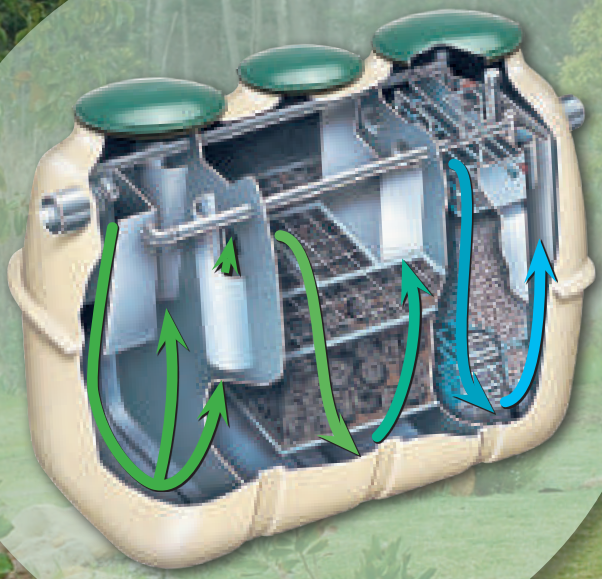
ML WATTERS
For CHIEF DIRECTOR: ROAD NETWORK MANAGEMENT

ANNEXURE D

Maskam Water brochure and process description

SAVE WATER: Treat and re-use all your BLACK and GREY water on-site

Fusion Series Waste Water Treatment



- Odourless
- Installed underground
- Lowest cost of ownership
- Quiet
- Small Footprint
- Effluent meets South African DWS General Standard
- Nitrification & De-nitrification cycles
- Developed for urban and rural use

Save money – treating your waste water on-site for re-use is cheaper than buying municipal water

MASKAM WATER

maskamwater.com

Applications:

- Households and grouped housing
- Schools
- Hotels
- Office blocks
- Lodges & guest houses
- Farms
- Factories
- Informal settlements
- Commercial wastewater secondary treatment

  Waste strength reduction:

  <75 mg/l COD

  <25 mg/l TSS
- Commercial wastewater pre-treatment before discharging to municipal sewer network (COD reduction)

Material:

- All materials are noncorrosive in the septic environment.

Easy to install or retrofit:

Save water - Treat your waste water on-site and re-use for:

- Toilet flushing
- Irrigation
- Cleaning of hard landscaping
- Water features
- Other non-potable uses (potable use is possible through further treatment)

Maintenance:

- System will be provided with maintenance contract.
- Maintenance provider is dependent upon geographical location.
- 6 Monthly service required.
- No check-ups needed between service intervals.

Disinfection:

- Chlorine / UV / Ozone



Electrical Panel

- Monitors the system 24/7
- Warning light and siren will notify user if a problem occurs
- IP65 enclosure
- Power supply to Blower and UV (disinfection)
- Indicator lights on front of panel for each alarm condition
- Optional: GSM module



Air Pump

- Feeds oxygen to aeration chamber and powers recirculation/sludge return





Available models

Clarus Model	Daily Treatment Capacity * (litres per day)	Length (mm)	Width (mm)	Height (mm)	Power consumption (Watts) Excluding disinfection
ZF 450	1500	2160	1120	1580	58
ZF 800	3000	2500	1450	1880	58
ZF 1120	4000	3020	1750	2000	95
ZF 1440	5000	3380	1840	12150	115
ZF 2000	7500	3960	1990	2270	125
ZF 2400	9000	4670	1990	2270	210
ZF 3200	12000	4560	2260	2420	340
ZF 4000	15000	4660	2440	2540	340

* Daily treatment capacity is based on influent values equal to or less than domestic sewage (grey and black water combined). The influent values below is the maximum organic loading for the above treatment capacities. For influent with heavier loadings, please contact our office or your nearest Maskam Water Dealer to assist with sizing the correct plant for your application.

COD	400	BOD	250	Ammonia	20

Financing available

The saving in your water bill can cover the instalment

CLARUS ENVIRONMENTAL
Zoeller Family of Water Solutions

www.maskamwater.com

CLARUS ENVIRONMENTAL
Zoeller Family of Water Solutions™

3649 Cane Run Road • Louisville, KY 40211-1961, USA
1-800-928-7867 • 1-502-778-2731 • Fax: 1-502-774-3624
www.clarusenvironmental.com

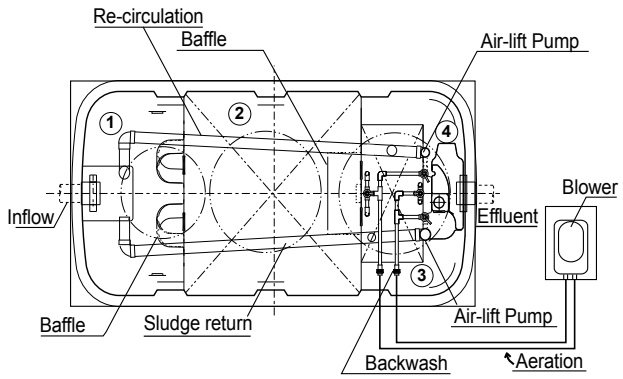
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CL0053
1215
Supersedes
0214

Fusion® Series Treatment Systems

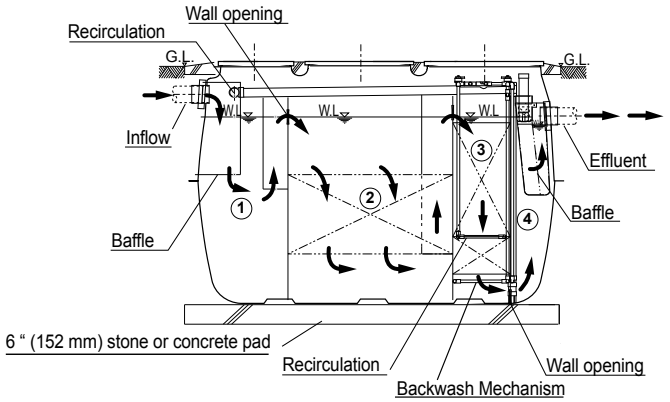
PROCESS DESCRIPTION

How the **Fusion®** system works

NSF Certified to NSF/ANSI Standard 40 Class 1 Performance Designation



Top View



Side View

Numbers correspond to the explanations below.

1. **Sedimentation Chamber**
   This chamber is designed to physically separate solids (sludge) and fat/grease (scum) from the incoming water.

2. **Anaerobic Chamber**
   This chamber contains a spherical-skeleton type of filter media (4.3 inch diameter). Through fixed film processes on the surface of the filter media, biological anaerobic treatment thrives while suspended solids are captured. Furthermore, the microorganisms in this chamber convert nitrates in the recirculated water returning from the aerobic chamber to gaseous nitrogen. The nitrogen then escapes to the atmosphere.

3. **Aerobic Filter Media Chamber**
   The aerobic floating and circulating filter media chamber consists of an aeration upper section and a filter media lower section. The chamber is filled with hollow, cylindrical filter media (0.6 inch diameter and 0.55 inches long). Biological treatment takes place with the help of the fixed film growth on the filter media surface. Aeration is continuous. Residual suspended solids are captured by the filter media circulating in this section.

   The filter media in the Aeration chamber are backwashed regularly (5 or 10 minute cycle, twice a day) by the backwash system located at the bottom of the chamber. The backwashed water is transferred by an air lift pump back into the sedimentation chamber for further digestion.

4. **Treated Water Storage Chamber**
   During normal operation, a recirculation line transfers a portion of the treated water back into the sedimentation chamber by way of an air lift pump. This chamber is designed to temporarily store treated water coming out of the aerobic filter media chamber. The treated water in the storage chamber is ready for discharge.

All Clarus Environmental products must be installed and maintained in accordance with all applicable codes.
Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.

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ANNEXURE E

Swellendam Municipality acceptance letter to collect solid waste from the site transfer station.

+27 28 514 8500
info@swellenmun.co.za
swellenmun
www.swellenmun.co.za
+27 28 514 2694

49 Voortrek Street, Swellendam | P.O Box 20, Swellendam 6740

Date: 28 September 2020

Enquiries: B. Burger

Attention: A. Fraser

Reference Number: 16/5/2/2

Per e-mail: fraser@fcce.co.za

Sir,

DEVELOPMENT OF ERF 134, INFANTA: SOLID WASTE REMOVAL

Your request regarding the update on our previous letter concerning solid waste collection in Infanta, has reference.

The solid waste facility was indeed upgraded during 2019, as mentioned in Dr. Clayton's letter, dated 20 February 2012. The facility, which only excepts demolition and garden waste, is also equipped with a household (wet waste) and recyclables container unit. These containers are serviced weekly by an external service provider – all of the household refuse is then hauled to the Bontebok solid waste facility in Swellendam.

Should the abovementioned development go forth, a transfer station, which must be able to accommodate the volume of refuse generated internally, should be established at the entrance gate of the proposed development. This station shall then be serviced by either the contractor collecting the waste in Infanta, or the contractor hauling the waste to Swellendam. Details of such a station shall be considered during the civil services or the building plan application process.

I hope this will clarify the status quo of the current solid waste disposal function.

Please do not hesitate to contact us for any additional information.

Best regards

F. ERASMUS Pr. (Tech.) Eng.

DIRECTOR: INFRASTRICTURE SERVICES

WATER USE LICENCE APPLICATION
SUMMARY REPORT

ERF 134, INFANTA

APPENDIX E

Section 27 Motivation Report

DOUGJEFFERY
ENVIRONMENTAL CONSULTANTS

High Acres Farm, Simondium Road, Klapmuts
P.O. Box 44, Klapmuts, 7625
021 875 5272 083 269 0496
dougjeff.co.za doug@dougjeff.co.za

MOTIVATION IN TERMS OF SECTION 27 OF THE NWA

PROPOSED INFANTA DEVLOPMENT'S WATER USE ACTIVITIES ON ERF 134, INFANTA

Section 27 of the NWA, 1998 (Act No. 36 of 1998) sets out factors that should be considered by the DWS before issuing water use licenses. This section of the report will describe in detail the relevancy of the above-mentioned factors in relation to the water uses that are applied for and how Westerhelling Investments CC complies with them.

BACKGROUND

Westerhelling Investments CC proposes to rezone a 3.04-hectare portion of Erf 134, Infanta, from *Agricultural Zone (AZ)* to *Subdivisional Area* in terms of Section 15(2)(a) of the Swellendam Municipal Planning By-law (November 2020). This rezoning will enable the establishment of 20 additional single-dwelling units, resulting in a total of 21 units on the property.

1. Water Demand and Supply

The estimated **Annual Average Daily Demand (AADD)** for the development is:

- **21 single residential erven (small):** 800 ℓ/unit/day = 16.8 m³/day

With a Mean Annual Precipitation (MAP) of 430 mm/year, an average roof size of 215 m², and an 80% efficiency rate, each unit is expected to harvest approximately **74 m³ of rainwater annually.** Each household will be required to install a **5.0 m³rainwater harvesting tank** for additional potable use.

Two boreholes (134A and 134C) are located on Erf 134 north of the district road. A 72-hour pumping test on borehole 134C (Van Biljon, 2014) confirmed a sustainable yield of **25 m³/day** (up to **48 m³/day** in the best case). This yield exceeds the development's potable demand of **16.8 m³/day** (≈ **6,312 m³/a**). The development's total annual water demand, including provision for fire-fighting, is estimated at **7,665 m³/a.**

The property falls within the **H70K catchment**, where the General Authorisation allows abstraction of **150 m³/ha/a.** For Erf 134 (≈ 87 ha), this equates to a maximum abstraction of **13,050 m³/a,** well above the development's requirement. This confirms that sufficient groundwater resources are available, particularly as the dwellings are unlikely to be occupied year-round.

2. Wastewater Management

A total of **21 wastewater package treatment plants (WWTPs)**, one per unit, is proposed instead of conservancy tanks. These units will treat domestic sewage generated by the development. Of the 16.8 m³/day water demand, approximately **13.44 m³/day of sewage** (≈ **4,905.6 m³/a**) will be produced collectively.

Each residential unit will operate its own WWTP, but all units will be registered collectively under a **single Section 21(g) water use activity** to be managed by the **Homeowners' Association (HOA)** in terms of its constitution.

Treated effluent will be:

- Recycled for non-potable uses (e.g. toilet flushing); and/or
- Used for irrigation or discharged underground via soak-aways.

3. Water Infrastructure

A new **125 mm Ø Class 9 uPVC water main** will be constructed between the reservoir and the development, fitted with isolating valves, fire hydrants, and erf connections. A **200 mm Ø corrosion-**

protected steel sleeve will cross Main Road 268, carrying a **125 mm Ø HDPE fusion-welded water main.**. This water main will cross a watercourse and will be placed within the existing road reserve.

---

4. SECTION 27(A) - EXISTING LAWFUL WATER USE

No existing lawfull water use.

---

5. SECTION 27(B) - REDRESSING PAST DISCRIMINATION

The proposed water use activities will contribute to job creation and skills development, particularly for historically disadvantaged individuals. The maintenance of wastewater management infrastructure, and pipeline crossings, will provide employment opportunities during both construction and operational phases.

---

6. SECTION 27(C) - EFFICIENT AND BENEFICIAL USE OF WATER IN THE PUBLIC INTEREST

The proposed development promotes efficient and beneficial water use by incorporating rainwater harvesting, on-site wastewater treatment, and the reuse of treated effluent for non-potable purposes. Groundwater abstraction will remain within authorised limits, ensuring sustainability and availability for other users. These measures reduce pressure on freshwater resources and support responsible, equitable use of water in the public interest.

---

7. SECTION 27(D) - SOCIO-ECONOMIC IMPACT OF THE PROPOSED WATER USE

The proposed water use will support the development by providing a reliable supply for domestic needs while ensuring that water resources are managed sustainably. Efficient use, rainwater harvesting, and reuse of treated effluent will limit environmental impact and secure long-term availability. This contributes to local economic activity, property value, and community wellbeing without compromising the water needs of other users.

---

8. SECTION 27(E) - APPLICABLE CATCHMENT MANAGEMENT STRATEGY

The proposed water use falls within the jurisdiction of the Berg-Olifants Catchment Management Agency (BOCMA). The development's approach aligns with regional water management objectives by ensuring sustainable abstraction, responsible use, and compliance with water quality standards. Measures such as rainwater harvesting, on-site wastewater treatment, and effluent reuse further support catchment-level water sustainability.

---

9. SECTION 27(F) - IMPACT ON THE WATER RESOURCE AND OTHER WATER USERS

The proposed water use has minimal impact on the water resource and other users. Groundwater abstraction will remain within sustainable limits, and wastewater will be treated and reused for irrigation or non-potable purposes.

---

10. SECTION 27(G) - CLASS AND RESOURCE QUALITY OBJECTIVES OF THE WATER RESOURCE

The proposed development will comply with the applicable resource quality objectives for the Berg-Olifants catchment. Groundwater abstraction and wastewater management have been planned to ensure that water quality is maintained, and treated effluent will be reused or disposed of in a manner that prevents contamination, supporting the long-term ecological and domestic use of the water resource.

---

11. SECTION 27(H) - INVESTMENT ALREADY MADE

Investment to date includes the development and assessment of boreholes, including pump tests, as well as planning and technical assessments to ensure sustainable water supply. These steps demonstrate proactive measures to manage water resources responsibly and support the proposed development.

---

12. SECTION 27(I) - STRATEGIC IMPORTANCE OF THE WATER USE

The proposed water use is strategically important as it provides a reliable supply of water for domestic purposes, supporting the residential development. By ensuring sustainable abstraction from boreholes, integrating rainwater harvesting, and planning for responsible wastewater management, the development safeguards water resources while meeting household needs efficiently and in the public interest.

SECTION 27(J) - WATER RESOURCE QUALITY REQUIREMENTS FOR THE RESERVE

The proposed water uses will be managed in a manner that does not compromise the ecological reserve. Monitoring measures will ensure that groundwater and wastewater meets environmental quality standards.

---

13. SECTION 27(K) - PROBABLE DURATION OF THE WATER USE AUTHORISATION

Given the long-term nature of the development, it is recommended that the WUL be issued for the maximum allowable period under the National Water Act.

WATER USE LICENCE APPLICATION
SUMMARY REPORT

ERF 134, INFANTA

APPENDIX F

Method Statement for Section 21 (c) & (i) water use activities on Erf 134, Infanta

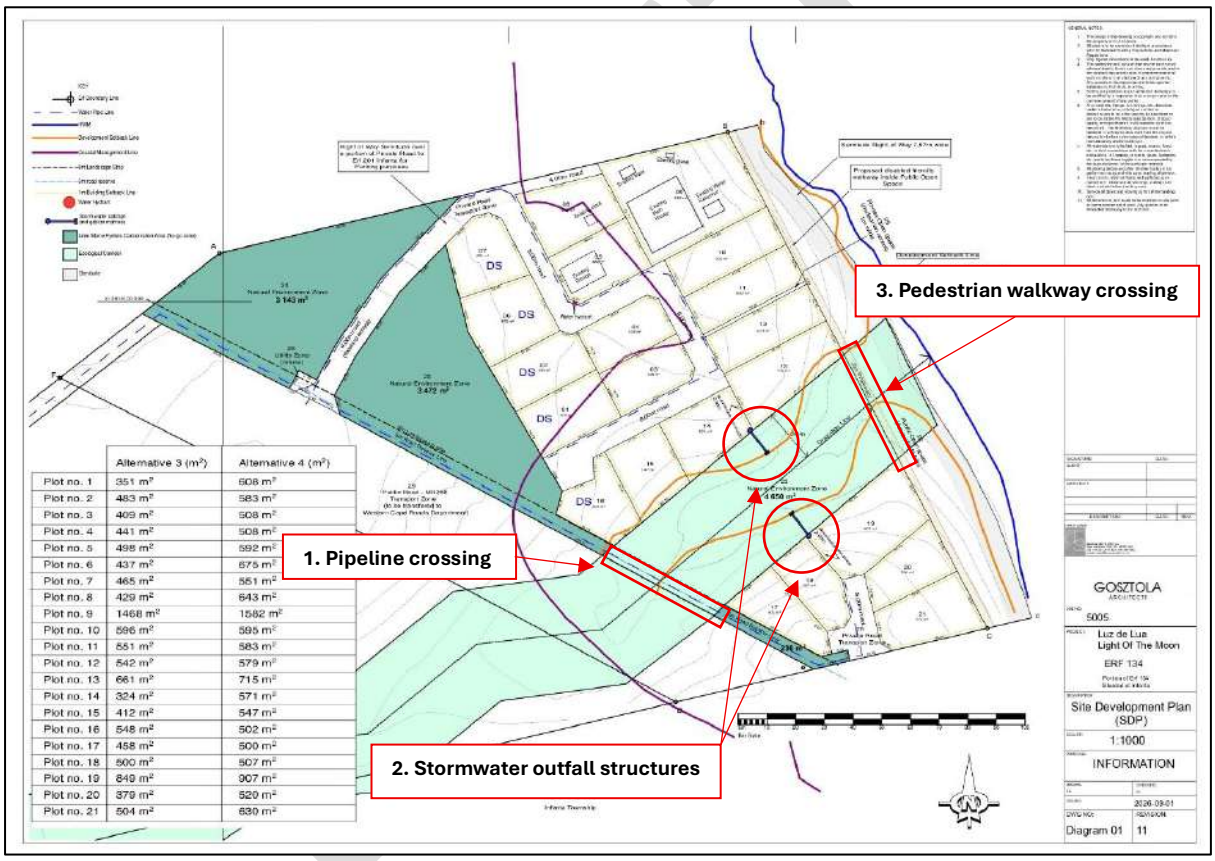
METHOD STATEMENT FOR SECTION 21 (C) AND SECTION 21 (I) WATER USE ACTIVITIES ON ERF 134, INFANTA

1. Introduction

1.1 Background

The proposed residential development on Erf 134, Infanta will comprise 21 residential erven together with associated civil infrastructure, including a potable water supply network, stormwater management infrastructure and a pedestrian walkway.

A small unnamed ephemeral watercourse traverses the property from east to west before discharging to the ocean. The watercourse is considered to be in a natural condition (PES Category A) and of high ecological importance and sensitivity. A 40 m ecological corridor has therefore been incorporated into the development layout, comprising a 20 m buffer on either side of the centreline of the watercourse. The Site Development Plan is attached as an appendix to the WULA summary report. A Freshwater Impact Assessment is also attached as an appendix to the WULA summary report.



	Alternative 3 (m²)	Alternative 4 (m²)
Plot no. 1	351 m²	508 m²
Plot no. 2	483 m²	583 m²
Plot no. 3	409 m²	508 m²
Plot no. 4	441 m²	508 m²
Plot no. 5	498 m²	592 m²
Plot no. 6	437 m²	575 m²
Plot no. 7	465 m²	551 m²
Plot no. 8	429 m²	643 m²
Plot no. 9	1468 m²	1582 m²
Plot no. 10	596 m²	595 m²
Plot no. 11	551 m²	583 m²
Plot no. 12	542 m²	579 m²
Plot no. 13	661 m²	715 m²
Plot no. 14	324 m²	571 m²
Plot no. 15	412 m²	547 m²
Plot no. 16	548 m²	502 m²
Plot no. 17	458 m²	500 m²
Plot no. 18	500 m²	507 m²
Plot no. 19	849 m²	907 m²
Plot no. 20	379 m²	529 m²
Plot no. 21	504 m²	630 m²

The following infrastructure components will be located within or cross the watercourse and associated ecological corridor:

1. A 125 mm Ø Class 9 uPVC water main (pipeline) crossing;
2. Two stormwater outfall structures; and
3. A pedestrian walkway crossing of the watercourse.

The construction and operation of this infrastructure trigger the following water uses in terms of Section 21 of the National Water Act, 1998 (Act No. 36 of 1998):

- Section 21(c): Impeding or diverting the flow of water in a watercourse; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

2. Description of the Water Use Activities

2.1 Water Pipeline Crossing

A 125 mm Ø Class 9 uPVC water main is proposed to convey potable water from the proposed reservoir to the residential development on Erf 134. The water main will cross Main Road 268 before branching to service the individual residential dwellings within the development.

North of Main Road 268, the pipeline alignment will be located entirely within the boundaries of the rezoned 3.04 ha portion of Erf 134 and within the property fence line, rather than within the road reserve. This alignment was selected to minimise the risk of infrastructure damage or service interruptions that may result from routine road maintenance activities or potential future upgrades to Main Road 268.

The development area is traversed by an ephemeral watercourse (drainage line), with fifteen (15) residential dwellings located north of the watercourse and the remaining five (5) dwellings situated to the south. In order to provide a potable water supply to all residential dwellings, the proposed water main will cross the watercourse at a designated crossing point within the boundaries of Erf 134.

The pipeline crossing will be constructed beneath the watercourse by means of trench excavation, pipe installation, backfilling and rehabilitation of the disturbed area. Upon completion of the installation works, the affected bed and banks of the watercourse will be reinstated to their pre-construction condition and rehabilitated with appropriate indigenous vegetation where necessary.

The crossing has been designed to provide the required water supply infrastructure while minimising disturbance to the watercourse and maintaining the ecological and hydrological functioning of the associated ecological corridor.

2.2 Stormwater Outfall Structures

Two stormwater outfall structures are proposed within the ecological corridor to facilitate the controlled discharge of stormwater runoff generated from the proposed residential dwellings, internal roads and other hardened surfaces within the development.

The structures are anticipated to comprise buried stormwater pipes discharging into engineered outlet structures constructed from concrete, stone pitching, riprap or similar erosion-resistant materials. Energy dissipation and scour protection measures will be incorporated at each outlet to reduce flow velocities and minimise erosion and sediment mobilisation. The outfalls may include headwalls, wingwalls, rock aprons, reno mattresses, gabions or similar erosion protection measures.

Construction of the outfall structures will involve localised excavation, placement of pipes and outlet structures, installation of erosion protection measures, backfilling and rehabilitation of disturbed areas. On completion of construction, all disturbed areas will be stabilised and rehabilitated to ensure that the ecological and hydrological functioning of the watercourse corridor is maintained. The final design will seek to minimise disturbance to the bed, banks and natural flow characteristics of the watercourse.

2.3 Pedestrian Walkway Crossing

A pedestrian walkway is proposed to provide safe and controlled public access through the development and across the watercourse while limiting uncontrolled pedestrian movement through sensitive ecological areas. The walkway will form part of the broader public access network proposed for the development and will be located within the ecological corridor at a designated crossing section.

The crossing is anticipated to comprise a raised timber boardwalk or similar lightweight pedestrian structure designed to span the watercourse and surrounding sensitive areas with minimal disturbance to the underlying bed and banks. The structure may consist of timber decking supported on timber, steel or concrete support posts positioned outside of the active drainage path where practicable. The walkway will be designed to allow the unobstructed passage of stormwater flows beneath the structure during rainfall events and to maintain the ecological connectivity and hydraulic functioning of the watercourse.

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Construction will involve the establishment of a limited construction footprint, installation of support structures, assembly of the boardwalk components and rehabilitation of any disturbed areas. Where feasible, manual construction methods will be utilised within sensitive areas to reduce vegetation disturbance and minimise impacts on the watercourse. The final design will seek to avoid direct modification of the watercourse bed and banks as far as practicable while providing safe pedestrian access across the drainage line. Following construction, all disturbed areas will be rehabilitated with indigenous vegetation to ensure the continued functioning of the ecological corridor.

3. Construction Methodology

3.1 Pre-Construction Activities

Prior to commencement of construction:

1. The boundaries of the ecological corridor shall be surveyed and demarcated on site.
2. All no-go areas shall be clearly marked.
3. Contractors shall undergo environmental induction training.
4. Temporary erosion and sediment control measures shall be installed.
5. The ECO shall inspect and approve the demarcation before construction commences.

3.2 Water Pipeline Crossing

The following methodology will be implemented:

1. The crossing location will be pegged and demarcated.
2. Trenching shall be undertaken during the dry season.
3. Trench width shall be limited to the minimum width required for installation.
4. Open trenches shall be kept to the shortest practicable length.
5. Excavated material shall be stockpiled separately from topsoil.
6. The pipeline shall be installed and immediately backfilled.
7. Original bed and bank profiles shall be reinstated.
8. Disturbed areas shall be rehabilitated using indigenous vegetation.

Consistent with the freshwater specialist recommendations:

- The construction footprint shall be minimised.
- Open trenches shall not remain exposed ahead of forecast rainfall events.
- Rehabilitation shall commence immediately after pipe installation.

3.3 Stormwater Outfall Structures

The following methodology shall be followed:

1. Outfall locations shall be surveyed and pegged.
2. Excavation shall be restricted to defined construction footprints.
3. Outfall structures shall be installed in accordance with approved engineering drawings.
4. Energy dissipation measures such as rock riprap, reno mattresses or equivalent scour protection shall be installed.
5. Disturbed areas shall be stabilised and rehabilitated immediately following construction.

Stormwater discharge points shall be aligned with natural drainage paths to avoid the concentration of flows and erosion.

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3.4 Pedestrian Walkway Crossing

The pedestrian crossing shall be constructed as a low-impact crossing structure.

Construction shall include:

1. Demarcation of the approved footprint.
2. Installation of supports outside the active flow path where possible.
3. Manual construction methods within sensitive areas where practicable.
4. Rehabilitation of all disturbed areas following completion.

The walkway shall not obstruct flow and shall be designed to allow the unhindered passage of stormwater during rainfall events.

4. Construction Environmental Controls

4.1 Erosion and Sediment Control

The following controls shall be implemented:

- Silt fences, sediment socks or similar barriers shall be installed downslope of disturbed areas.
- Disturbed areas shall be stabilised as soon as practicable.
- Construction shall cease during heavy rainfall events.
- No excavations shall be left open when significant rainfall is forecast.
- Erosion damage shall be repaired immediately.

These measures are consistent with the recommendations of the Freshwater Impact Assessment.

4.2 Prevention of Water Pollution

The following controls shall apply:

- No fuel storage shall occur within 50 m of the watercourse.
- Refuelling shall take place in designated areas only.
- Spill kits shall be available on site at all times.
- Cement mixing shall be undertaken outside the ecological corridor.
- Concrete wash water shall be contained and disposed of appropriately.
- Machinery shall be regularly inspected for leaks.
- Drip trays shall be used beneath stationary equipment.

4.3 Materials Storage

- No stockpiling of soil, sand, gravel or construction materials shall occur within the ecological corridor.
- Construction materials shall be stored at least 50 m from the watercourse.
- Stockpiles shall be protected against erosion by wind and rain.

4.4 Access Control

- Construction vehicles shall only use approved access routes.
- No vehicle movement shall occur within the watercourse except where specifically authorised.
- The ecological corridor shall remain demarcated throughout construction.

5. Rehabilitation

Following construction:

- All temporary construction materials shall be removed.

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- Disturbed ground shall be re-profiled to original contours.
- Topsoil shall be replaced.
- Indigenous vegetation shall be re-established.
- Any erosion gullies or scour features shall be repaired.
- Rehabilitation success shall be monitored by the ECO.

No alien invasive plant species shall be introduced during rehabilitation. All imported topsoil shall be sourced from reputable suppliers and be free of invasive plant material.

6. Operational Phase Management

To protect the ecological functioning of the watercourse:

- Stormwater outfalls shall be inspected after major rainfall events.
- Scour protection structures shall be maintained.
- The pedestrian crossing shall be inspected annually.
- The pipeline crossing shall be inspected if erosion or exposure occurs.
- Alien invasive vegetation shall be monitored and removed.
- The ecological corridor shall remain undeveloped and managed as a conservation area.
- Any erosion, instability or infrastructure damage shall be repaired immediately.

7. Monitoring

The ECO shall undertake inspections during construction to verify compliance with the approved method statement and EMPr.

Monitoring shall focus on:

- Sediment control measures;
- Erosion within the watercourse;
- Pollution incidents;
- Rehabilitation progress;
- Alien invasive species establishment; and
- Compliance with corridor demarcation requirements.

8. Conclusion

The proposed water pipeline crossing, stormwater outfall structures and pedestrian walkway crossing are required to service the proposed residential development. Although these activities trigger Sections 21(c) and 21(i) of the National Water Act, the impacts on the ephemeral watercourse can be effectively managed through implementation of the mitigation and management measures outlined above. The approach is consistent with the recommendations of the Freshwater Impact Assessment, which concluded that impacts on the watercourse can be reduced to a low significance through careful design, construction controls, rehabilitation and long-term management of the ecological corridor.

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