POISE

STRUCTURAL & CIVIL ENGINEERING DESIGN CONSULTANTS

PROPOSED NEW RESIDENTIAL AND TOURISM DEVELOPMENT PORTIONS 59 AND 62, BRAKKLOOF 443

BULK SERVICES AND CIVIL ENGINEERING INFRASTRUCTURE REPORT

Project No 25 G141

Version 3 April 2026

CONSULTING ENGINEER:
Poise Consulting Engineers
12 Boston Light Drive
Plettenberg Bay
6600

PROPOSED NEW RESIDENTIAL AND TOURISM DEVELOPMENT PORTIONS 59 AND 62, BRAKKLOOF 443

BULK SERVICES AND CIVIL ENGINEERING INFRASTRUCTURE REPORT

1. INTRODUCTION

Portion 59 and 62 of the Farm Brakkloof, Plettenberg Bay are to be rezoned to General Residential and Open Space III with consent use for Tourist accommodation and facilities.

The total area of Portions 59 and 62 are 13,55 hectares and 20.81 hectares respectively. A 20 meter municipal road servitude accommodates Whale Rock Drive along the north eastern boundary of both Portions. The net development areas excluding the road servitude are 12.22 hectares and 20.01 hectares.

The development on Portion 59 will comprise 121 Single Residential units of sizes varying from 200 to 300 square meters and a community building which will house administrative, recreational and health care facilities.

The development on Portion 62 will comprise up to 20 self catering accommodation units and mixed use commercial and cultural/museum area covering a total of approximately 1.2 hectare plus an amphitheatre area covering approximately 0.6 hectare.

The development can not be supplied with water or sewerage connections from Bitou Municipality and will therefore be dependent on its own off grid water supply and sewerage treatment infrastructure,

The Developer has appointed Poise Consulting Engineers to attend to the design of the civil engineering services for the development.

This report addresses the following civil engineering requirements for the development:

- The internal road layouts and standards
- The internal stormwater management layouts and principals
- The internal sewerage and water reticulation layouts, capacities and standards
- The access layouts and standards
- The bulk water supply and sewerage treatment requirements.

This report is submitted for Re-Zoning and Environmental approval purposes.

2 SITE DESCRIPTION

Portion 59 is situated on the southwestern side of Whale Rock Drive, Bitou Municipality, approximately 1 kilometre from its intersection with Robberg Road.

Access to the site will be centrally off Whale Rock Drive

The approximate coordinate of the centre of the site is 34° 05' 35" S and 23° 21' 31" E.

Portion 62 is approximately 300m to the east and the centre of the site is 34° 05' 50" S and 23° 32' 55" E.

Portions 59 and 62 are separated by Portion 63 between them.

Topography:

Portion 59 falls from northwest to southeast at an average gradient of approximately 9 percent.

Portion 62 is divided by a watercourse falling from west to east. The development area will be north of the watercourse and falls from north to south at an average gradient of approximately 11 percent.

Soils:

The upper profile of the sites to be developed are characterized by silty fine alluvium (topsoil) overlying sandy silty clay . The soil drainage characteristics are of low permeability.
Insitu materials are unsuitable for road layerworks or engineered fills and cut materials will be filled to landscaped mounds or removed off site.

Vegetation:

The sites are covered by South Outeniqua Sandstone Fynbos.

3. DESIGN STANDARDS

The following design standards will be applicable:

- Guidelines for Human Settlement Planning and Design, compiled for the Department of housing by the CSIR (Red Book)
- The Neighbourhood Planning and Design Guidelines, Department of Human Settlements (NPDG) Section J Water and Section K Sanitation
- SANRAL Drainage Manual
- The South African Guidelines for Sustainable Drainage Systems
- CIRIA Suds Manual 2015
- CoCT 2009 Management of Urban Stormwater Impacts Policy (SUDS)
- Relevant specific specifications of the Bitou Engineering Services Department

4. WATER RETICULATION

Water Supply

There is no municipal source of water available to the site.

The Bitou Municipality have confirmed that they will support the utilization of an off grid water supply, subject to the provision that the Development water will be connected to the Bitou Municipal water reticulation system, at such time in the future when the Bitou system has sufficient capacity to supply the Development demand.

4.1 Borehole Supply

The primary water supply to the site will be from a new borehole to be established on Portion 59.

Following groundwater study undertaken by consulting Hydrogeologist, Ruaan Van Jaarsveld of GlobiWell Borehole and Groundwater Specialists the borehole has been drilled at position W1 as indicated on on Drawing 25G141 S01.

The borehole Yield Report report is attached as Annexure A. The Yield Report states a maximum yield of 7257 kilolitres per month, therefore an average maximum of 238 kilolitres per day. This is in excess of double the projected daily demand.

On completion of the installation, the borehole water quality will be tested by an accredited laboratory. The necessary filtration and chemical dosing requirements will be determined to ensure the delivery of potable water compliant with the SANS 241-1 -2015 standard for domestic drinking water.

The General Authorisation limit for the locality of the site, DWAS Drainage Area G50B, for Portions 59 is calculated as follows:

Portion 59	13.55 Hectares	
Portion 62	20.81 Hectares	
Total	34.36 Hectares @ 275m3 per annum	= 9449 m3 per annum = 25.89m3 average per day

The borehole abstraction will be maximum 107m3 per day and a Water Use Licence Application will be undertaken.

4.2 Rainwater Harvesting

As a secondary source of supply, roof rainwater harvesting will be implemented for all building units.

Harvested roof runoff will be pre-treated by means of gutter guards and first flush diverters before being stored in the rainwater tank for each structure.

Toilet supply and garden taps will be directly from the rainwater storage tank.

The remainder of the household water points will be fed from the borehole supply reservoir.

The reservoir supply will also feed the top up to the rainwater storage tanks as and when required.

Storage Allowance is proposed as follows:

Portion 59	
Per Housing Unit	10 000 liter
Community Admin Recreational and Healthcare Building	30 000 liters

Portion 62
To be determined on finalization of building footprints.

4.3 Water Demand

The projected water demand takes consideration of the daily water consumption as per NPDG Section J, Table J4, and with discretionary rational assessment.

The daily water demand is calculated as follows:

Portion 59

Residential Retirement Units	121 @ 600 litres per day	73.2 kl
Community Admin Recreational and Healthcare Building	Allow 500m2 @ 650 l/100m2	3.25 kl

Portion 62

Self Catering Accommodation Units	20 @ 600 litres per day	12.0 kl
Mixed use Commercial/Cultural Area	1 Ha @ 15 kl per day	15.0 kl
Total Daily Consumption		103.45 kl

Based on a peak factor of 4 the maximum peak flow demand will be 4.8 litres per second.

The fire flow criteria is Low Risk Group 1 which requires provision for a fire flow of 15 litres per second with a minimum residual head of 10 meters.

The area of the site has all year round rainfall, which allows for more efficient rainwater harvesting than areas of seasonal rainfall. The estimated potential supply by means of rainwater harvesting is up to 30 percent.

4.4 Water Storage

The borehole will feed a bulk storage reservoir to be positioned at the north western corner, the highest position of the site. The reservoir will be sized to provide storage

based on 48 hours domestic demand and 2 hours fire flow demand. The reservoir capacity will be minimum 325 kilolitres.

4.5 Internal Reticulation

The proposed Water supply infrastructure is indicated on attached drawing 25G141 S01

The internal water pipes will remain the property of the development and will not be taken over by Bitou Municipality. The domestic internal water reticulation system will be of Class 12 UPVC pipes of up to 160mm diameter. Minimum cover to watermains will be 800mm.
Fire Hydrants will be provided at maximum 180m intervals
The reticulation system will be designed to provide for a minimum residual head of 24m under peak domestic flow conditions, and 10m under peak domestic plus fire flow conditions.

The water supply to Portion 62 will be by means of a 110mm trunk main routed through Portion 63 in a servitude along it's the northern boundary.

In order to provide the necessary residual pressures the Portion 59 area of the reticulation will require in line solar powered pressurization.

Construction of all watermains and connections will be in accordance with Bitou Municipality and SABS 1200 specifications.

5. SEWER RETICULATION

5.1 Sewer Connection

There is no municipal sewer connection available and a package sewerage treatment plant (STP) is therefore proposed. The STP will be regulated under the National Water Act 36 of 1998 and any requirements of the Bitou Municipality.

The Bitou Municipality have confirmed that they will support the utilization of a STP subject to the provision that the Development sewerage will be connected to the Bitou Municipal sewerage system, at such time in the future when the Bitou system has sufficient capacity to accept the Development discharge.

5.2 Sewerage Discharge

The projected average daily sewerage discharge is calculated on 80% of the water demand as per the recommendation of NPDG Section K, Sanitation,

Average Daily Discharge: 83 kl

Based on a peak factor of 2.5 the maximum peak discharge will be 1.8 liters per second.

5.3 Internal Reticulation

The internal sewer pipes will be the property of the development and will not be taken over by Bitou Municipality.

The internal sewer reticulation system will be of 160mm Class 34 UPVC sewer pipes. Manholes will be of precast concrete ring structures, in accordance with SABS 1200D standards. Manholes will be provided at a maximum of 80meter intervals.

Minimum cover to sewers will be 1000mm under roadways and 800mm elsewhere.

The internal system will drain to the south eastern corner of Portion 59 from where the sewer outfall will be routed through Portion 63 to the position of the Sewerage Treatment Plant on Portion 62.

A servitude for the sewer outfall and treatment plant will be registered over Portions 62 and 63 in favour of Portion 59.

Construction of all sewers, connections and manholes will be in accordance with SABS 1200 specifications.

5.4 Sewerage Treatment Plant (STP):

A Design and Supply STP awill be installed by a reputable supply company with a proven successful track record meeting the following criteria:

- Effluent must be to the DWAS General Standard.
- The Plant must be environmentally friendly, robust and have been proven to be reliable and simple and easy to maintain.
- Sludge disposal solution must be practical and economical and without environmental risk
- The Plant supplier must have the in house resources and skills to provide a reliable and competent plant maintenance programme

The supplier currently under consideration for the supply of the STP is Alveo Water (Pty) Ltd, a South African specialist water and wastewater treatment company. At the time of implementation proposals will also be considered from other similar approved companies.

The Alveo Water plant components will comprise pre-treatment screening, an underground buffer/flow equalization tank, followed by containerized sequential anoxic and aerobic zones, plus secondary treatment comprising membrane filtration and disinfection.

A detailed description of the process is attached as Annexure C.

The buffer/flow equalization tank will be the only underground component of the Plant. The tank will be constructed of reinforced concrete including Penetron Admixture. The durability will therefore be in excess of 50 years, but effectively infinite.

This tank will be designed to be suited to later conversion to a pump station when connection to the Bitou system becomes available.

The Alveo Water system discharges very low sludge volumes. Sludge buildup is monitored in the system, with sludge wasted to the drying bed as and when required. The projected sludge discharge volume will be about 1-2m3 once a month. Of this, a significant portion will immediately drain through drying bed media and return to the plant. The final dried material will be about 10 percent of the volume and will be disposed of as compost.

The wastewater treatment plant is designed with a significant sludge age, which ensures that the discharged sludge is stable with significant (>99.9%) reduction in pathogens. The discharged sludge is thus odourless and safe for use as compost.

5.4.1 Plant Effluent:

The treated effluent from the plant will be discharged to the existing non perennial stream which traverses Portion 62, and crosses Portions 118 and 119 and discharges to the sea approximately 1 kilometer downstream of the STP discharge point. The effluent will comply with the DWAS General Standard and the discharge thereof will comply with General Authorisation criteria of Section 21 f of the National Water Act.

The effluent quality will be regularly tested and the quantity will be metered in terms of the requirements of Section 21f.

Notwithstanding the General Authorisation qualification, the Plant and discharge will be included in a WULA application.

5.4.2 Plant Maintenance

The development Homeowners Association will enter into a contract with the plant supplier to render an ongoing plant maintenance programme.

The pretreatment screening non biodegradables will be removed and stored on site in sealed plastic wastebags, prior to removal by private contractor to a registered waste disposal site.

The buffer tank will require suction cleaning by private contractor every 6 to 12 months.

Essential spares will be kept on site to enable immediate emergency repairs if necessary

Effluent quality will be tested on a monthly basis.

The plant will be powered by a combination Solar and Eskom system with a backup generator for emergency supply in the event of extended electrical down time.

5.4.3 Plant Approvals:

The detailed designed of the overall system will be to Bitou Engineering Department approval

The preliminary positioning of the plant is indicated on attached DWG No: 23G210 S01.

6. INTERNAL ROADS

Internal roads will be private roads and will not be taken over by Council

Pavement and Geometric Standards
The development will include the following roads which will be classed as follows:

Description	Width	Category/Class
Main Access Collector	5,5m	UC/ES1
Internal Access Roads	5.0m	UC/ES0,3

The minimum bellmouth radii will be 7.5m

Kerbs
The main access will have standard Figure 3 barrier kerbs with a channel on the low side. The internal access roads will have edgings on the high side and Figure 8 combination kerb and channel on the low side of the crossfall.

Pavement Structure
The following pavement structure will be utilised for internal roads:

80mm Interlocking Block paving on 20mm sand bedding
125mm G5 Subbase compacted to 95% Mod AASHTO
150mm Imported G7 upper subgrade compacted 95% Mod AASHTO
150mm Imported G7 lower subgrade compacted 93% Mod AASHTO
150mm Insitu treatment compacted to 90% Mod AASHTO

The Parking Area to Portion 62 will be designed with a one direction entrance from Whale Rock Drive on the western end and a one direction exit to Whale Rock Drive at its eastern end. The configuration will provide for the comfortable accommodation of buses.

The parking area layout will comprise the standard 17.5m module with 2.5m x 5m bays. Handicapped Bays will be provided in accordance with Bitou Regulations.

The Parking area will have the same pavement specification as the roads. A grassed overflow parking area will also be provided.

7 STORMWATER MANAGEMENT

7.1 Portion 59

The site falls from northwest to southeast at an average slope of approximately 11 percent.

As the contours approach the southern boundary of Portion 59 they converge to form a valley. The site stormwater runoff discharges toward the valley line and to a stream which forms immediately south of the southern boundary.

Stormwater will be managed within two catchment areas, a Northern and a Southern catchment, each of which will have a detention pond.

The stormwater will be managed such that developed land areas will discharge to the road surfaces or to stormwater swales positioned between the developed strips. The road and swale area runoff will discharge through grid inlets and be piped to the attenuation ponds.

The Stormwater catchment areas are indicated on attached Figure 1.

Sustainable Drainage Systems (SUDS)

The City of Cape Town norms for SUDS are adopted for projects located in the Western Cape. The Stormwater Detention and Quality Improvement designs will be based on The South African Guidelines for Sustainable Drainage Systems and the CIRIA Suds Manual 2015.

Stormwater Detention:

The detention criteria is that stormwater be detained to reduce the post-development runoff rates to not exceed the pre-development rates for the 1 in 10 year and 1 in 50 year return storm intervals.

The reduction of the post- development runoff to the pre-development rates will be achieved by the detention of post development runoff in the detention ponds to be provided.

Quality Improvement

The target reductions of total suspended solids (TSS) and total phosphates (TP) are 80% and 45% respectively. Reduction factors will be achieved by the detention of runoff within the stormwater swales and attenuation ponds to be provided.

Both swales and ponds will be surfaced with a 150mm clean topsoil layer, planted to the Environmental Consultants recommendation and underlain by a subsurface herringbone type drainage system consisting of 110mm perforated pipes in 19mm stone, 150mm cover all round, bidim wrapped. The subsurface drains will convey the discharge to the pond outlet control.

The filtration substructure can be expected to substantially enhance the reductions of the TSS and TP to the target levels.

<u>Pre-development:</u>

In calculating the run-off coefficient for the site in its natural state the following factors were used:

- Slope C_S 0.08 Average 8%

- Permeability C_P 0.16 Semi Permeable
- Vegetation C_V 0.15 Fynbos

Using an adjustment factor of 0.90 the coefficient C for the 50 year storm is 0,35.
Using an adjustment factor of 0.75 the coefficient C for the 10 year storm is 0,29.
.
The Pre development time of concentration Tc is calculated using the Kirby Formula for overland flow as follows:

Hydraulic Length of Runoff	565m
Average Slope	7.2%
Roughness Coefficient	0.4
Tc	33 minutes

Post-development

In the post development state 40% of the site will be covered by impermeable roads surfaces and roofing and the remainer of the site will be landscaped. Utilising the pre-development discharge coefficients for landscaped areas and 100% runoff from impermeable areas, the post development coefficients of discharge are 0.58 and 0.61 for the 1 in 10 and 1 in 50 year storms respectively.

Stormwater Modelling

The runoff and retention calculations have been done utilising the CBA Hydrograph Generation Reservoir Routing program of Chris Brooker and Associates.
The mean annual precipitation is 890mm.

The post-development runoff time of concentration is 15 minutes. The generated runoff data is however based on a storm duration of 25 minutes, which is the duration which renders the maximum required retention conditions.

Rainfall Volumes and Retention Data

The attached Annexure C, Stormwater Management Data Table, indicates the areas of the 2 catchments, the pre-development flows, the post-development attenuated flows and the attenuation data, for the 1in 10 and 1 in 50 year return interval storms.

The data indicates that the attenuation ponds will have sufficient capacity to detain discharge so that the post development discharge does not exceed the pre development discharge for the 1 in 10 and 1 in 50 year storm intervals.

Final Discharge

The final discharge from the site is from Detention Pond No 2 to the stream which starts immediately downstream of the Pond and continues in a southerly direction through Portions 63 and 62, and eventually discharges to the sea.

The discharge from the attenuation pond will be released by means of a dissipation structure designed to limit the velocity of discharge to less than 0.5 meters per second, thereby avoiding any significant erosion.

7.2 Portion 62

The detailed layout of the Portion 62 structures is not yet available. Rainwater will be drained by surface channels and discharge to the detention berms to be provided on the slope on the southern side of the development area. The detained runoff will be released through throttled outlets and energy dissipation aprons to ensure erosion does not occur.

The berms and throttled outlets will be designed to ensure that the post development discharge does not exceed the pre development discharge for the 1 in 10 and 1 in 50 year storm intervals.

8. ACCESS

Access to Portion 59 will be centrally off Whale Rock Drive.

The site access will comprise 2No. 3.5m incoming lanes and a 4m wide egress lane. The incoming access control boom will be positioned approximately 24m from the edge of Whale Rock Drive, thus providing ample stacking distance for incoming traffic.

Access to Portion 62 will be off Whale Rock Drive to the carpark at the eastern end of Portion 62. A dedicated 5m ingress and egress will be provided at the western and eastern ends respectively.

A Traffic Impact Study will be undertaken by a specialist Traffic Engineering Consultant. This study will determine the extent of road widening/turning lane upgrades which may be required at the access positions on Whale Rock Drive, and at the intersection of Whale Rock Drive and Robberg Road.

9. STORMWATER MANAGEMENT DURING CONSTRUCTION

The permanent detention ponds and swales which are specified will be constructed on commencement of construction and a low temporary berm will be constructed along the southern site boundary. The initial construction of these stormwater management features will contain all concentrated and silt contaminated stormwater flow from running off to the underlying property during the construction period.

The desilting maintenance of these facilities will be undertaken on a regular basis.

10. REFUSE MANAGEMENT

The requirements for domestic waste collection as per the National Domestic Waste Collection Standards 2011 will be applicable to the development.

Quantity:
Based on an average of 1 kilograms per person day, and an average of 2 people per unit the estimated total weekly quantity per unit will be 15 kilograms per week. The total for the 121 units will be 1,82 tons per week.

Storage:
Arrangement will be made by the Development Home Owners Association for the transport of refuse from the individual units to the storage chamber to be provided. The storage chamber will be sized to accommodate the required number of 240 liter refuse bins to accommodate the total weekly refuse volume, including allowance for separation of organic and recyclable waste. The storage chamber will be constructed to the specifications as per the Bitou Municipality REFUSE STORAGE DESIGN GUIDELINES.

Removal:
The solid waste from the development will be collected by the Bitou refuse removal trucks from a waste storage area which will be provided at the main access to the site.

11. SERVICES AGREEMENT

A pre-requisite for implementation of the Development will be the conclusion of a Services Agreement with the Bitou Municipality.

The services agreement will define the applicable development parameters and the responsibilities of the Developer and The Bitou Municipality relating to engineering services, stormwater management, internal roads and access.

The current and future responsibilities with respect to off grid sewer and water solutions, their ongoing maintenance, and their future link service connections to Bitou Municipal infrastructure will also be defined.

In addition the services agreement will define the augmentation charges and any appropriate Development Charges.

12. ATTACHMENTS

DWG No: 25G141 R01	General Layout: Roads and Stormwater
DWG No: 25G141 R01	Road and Stormwater Details
DWG No: 25G141 S01	General Layout: Sewer and Water Reticulation Sheet 1
Figure 1:	Stormwater Catchment Areas
Annexure A	Borehole Yield Report
Annexure B	Stormwater Management Data Table
Annexure C	Alveo Water Wastewater Treatment Plant Proposal

Prepared By: Date: 12 April 2026

D Botes Pr.T Eng.

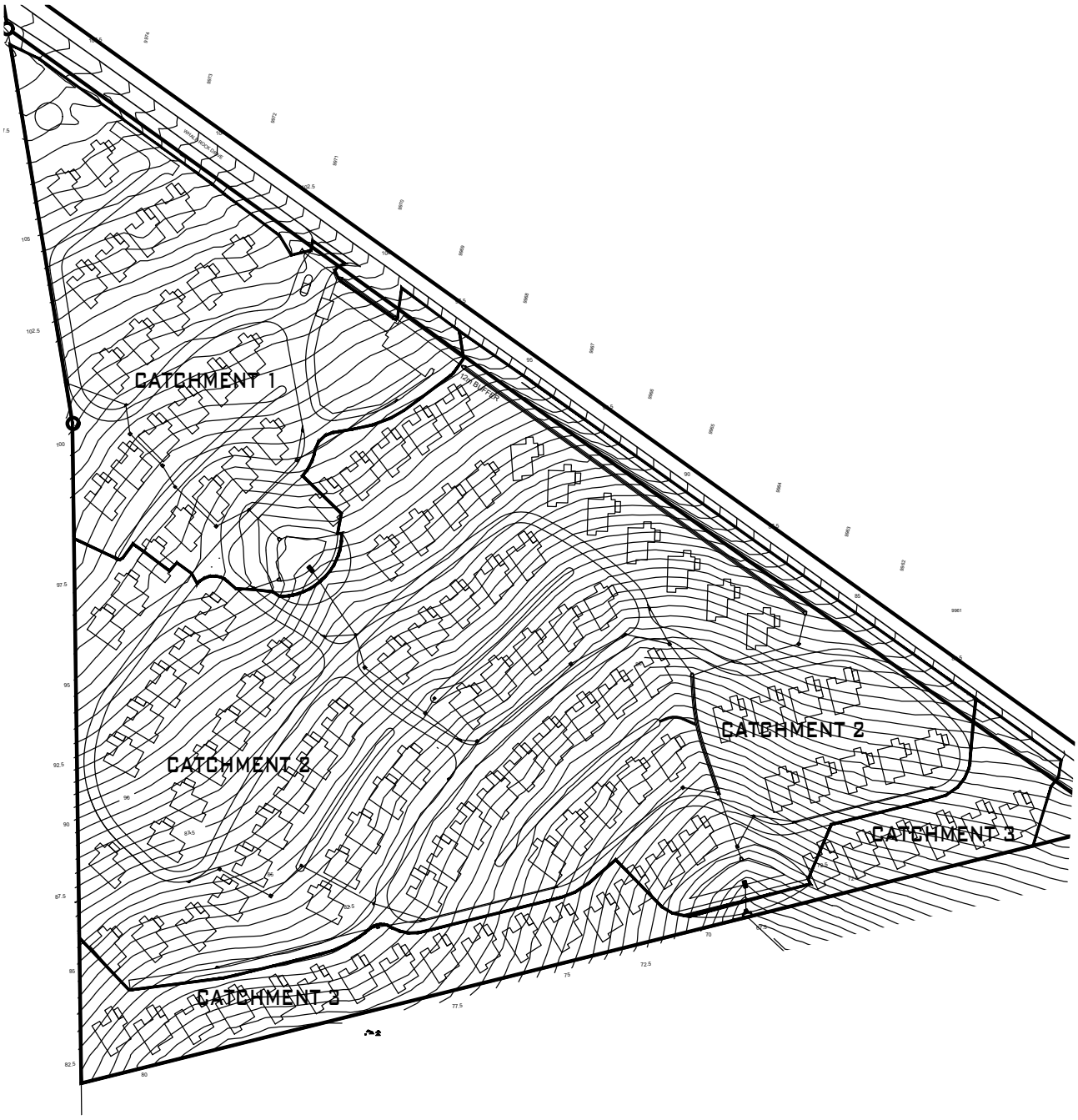


FIGURE 1

STORMWATER CATCHMENT AREAS
PORTION 59 BRAKKLOOF 443

GlobiWell
Borehole and Groundwater Specialists

Borehole Yield Recommendations: Stargate – Globi 1

March 2026

Mr. R. van Jaarsveld,
Hydrogeologist,
Pr.Sci.Nat
GlobiWell

GlobiWell
19 Frykenhuis Steet
Summerstrand
Port Elizabeth

Cell: 084 80 79166
Email: ruan@globiwell.com
Web: www.globiwell.co.za

INTRODUCTION

GlobiWell Consulting Hydrogeologists undertook a comprehensive borehole yield analysis based on test pumping data obtained from a single borehole on Brakkloof, Farm 443, Plettenberg Bay. The test pump data, which served as the basis for this analysis, was provided by the test pump contractor, Welltek Services, who conducted the test pumping from 27-29 March 2026.

The yield testing process consisted of the following components:

- 4 x 1 hour Step Test
- 1 x 24-hour Constant Discharge Test (CDT)
- 1 x Recovery Test

The primary objective of the yield analysis was to calculate the sustainable pumping yield of the borehole and to provide informed recommendations regarding the equipping and utilisation of the borehole. These pumping recommendations are intended to guide the sizing and selection of an appropriate borehole pump. Selecting the correct pump is critical, as an unsuitable pump can result in borehole, aquifer, or pump failure.

Sustainable yields for the borehole were calculated using established methods: the Fracture Characteristic method and the Cooper Jacobs Approximation of the Theis method. Graphs illustrating the results of the constant discharge test are included in this report.

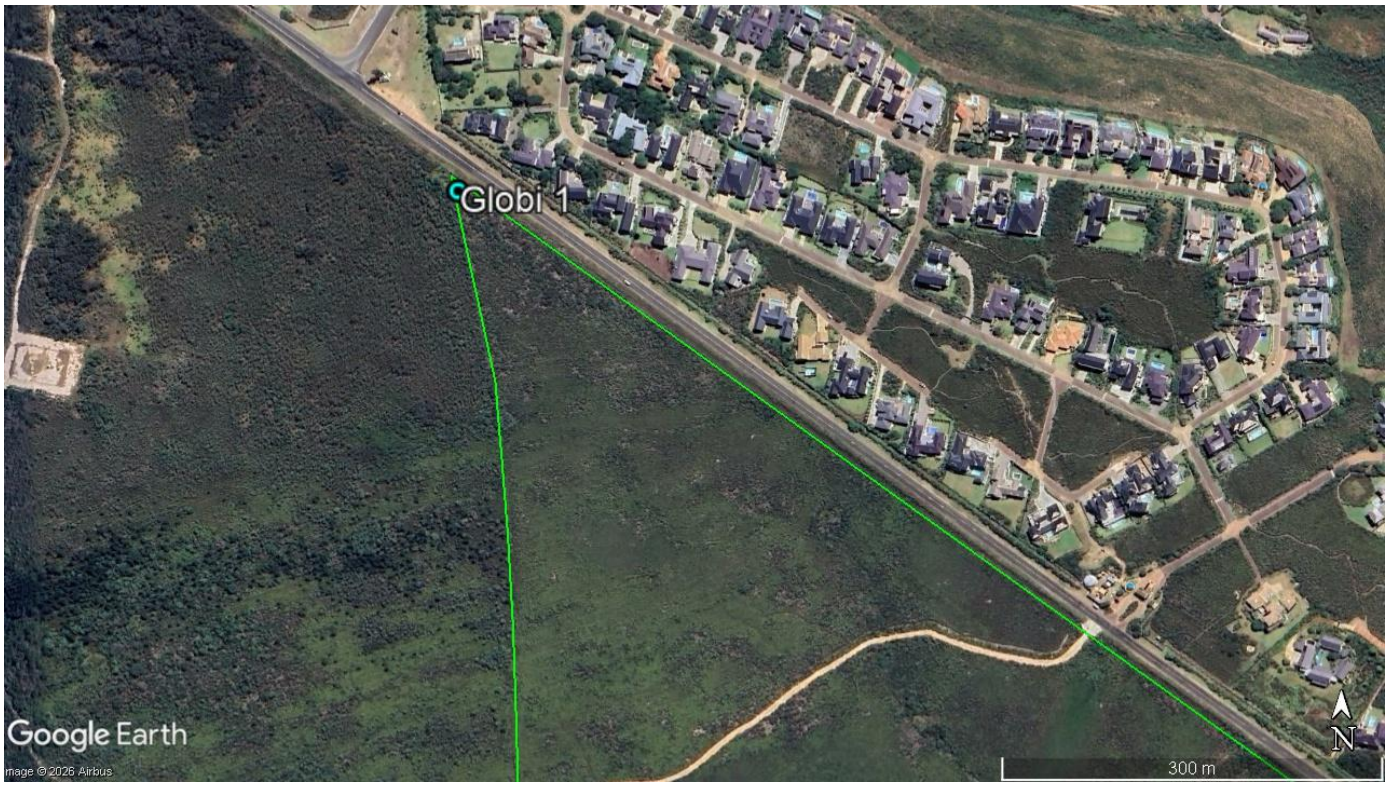
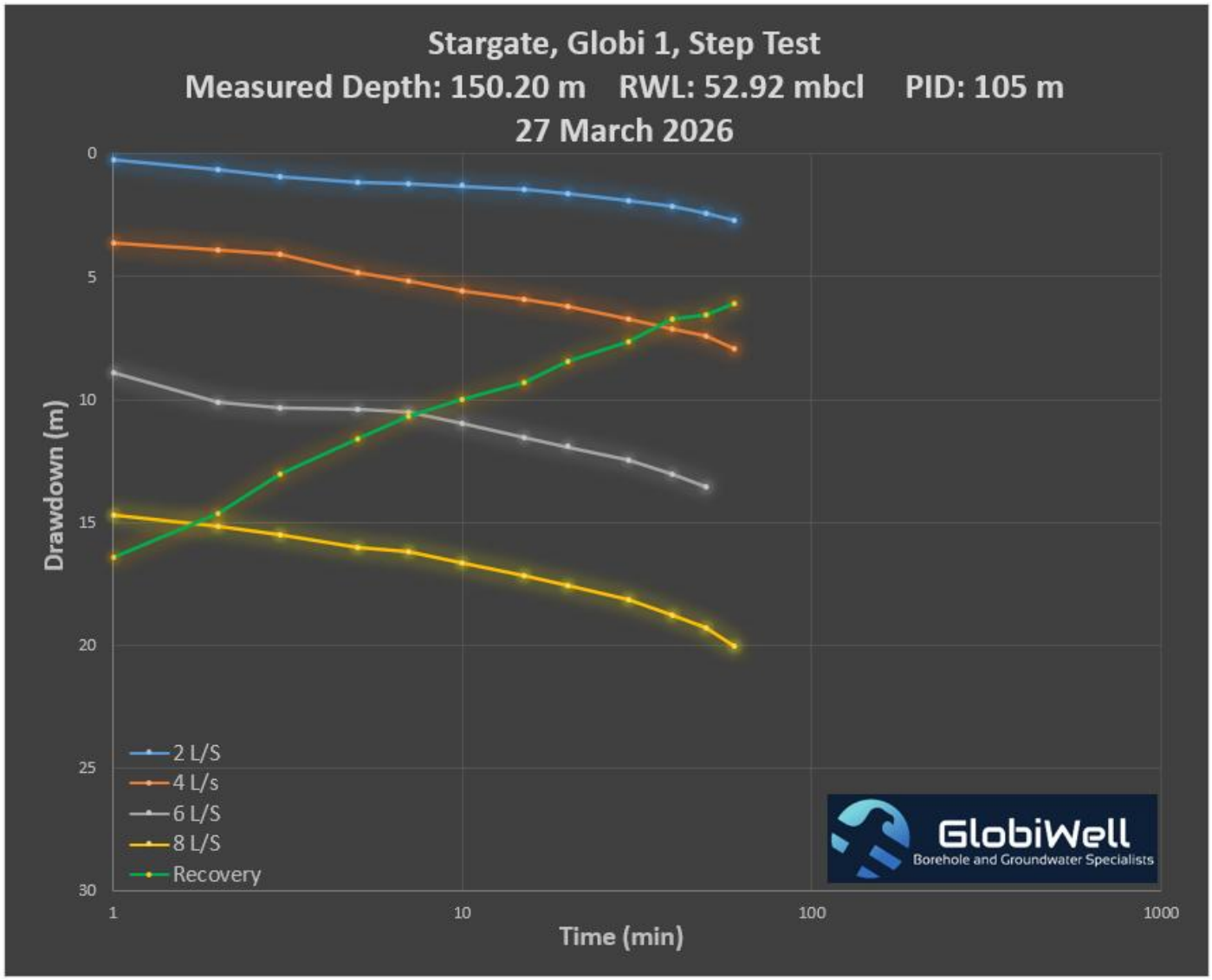


Figure 1: *Indicates the approximate location of the borehole that was utilised for the test pumping and subsequent yield analysis. The borehole is marked with a blue dot on the map and named BH1.*

TEST PUMPING RESULTS

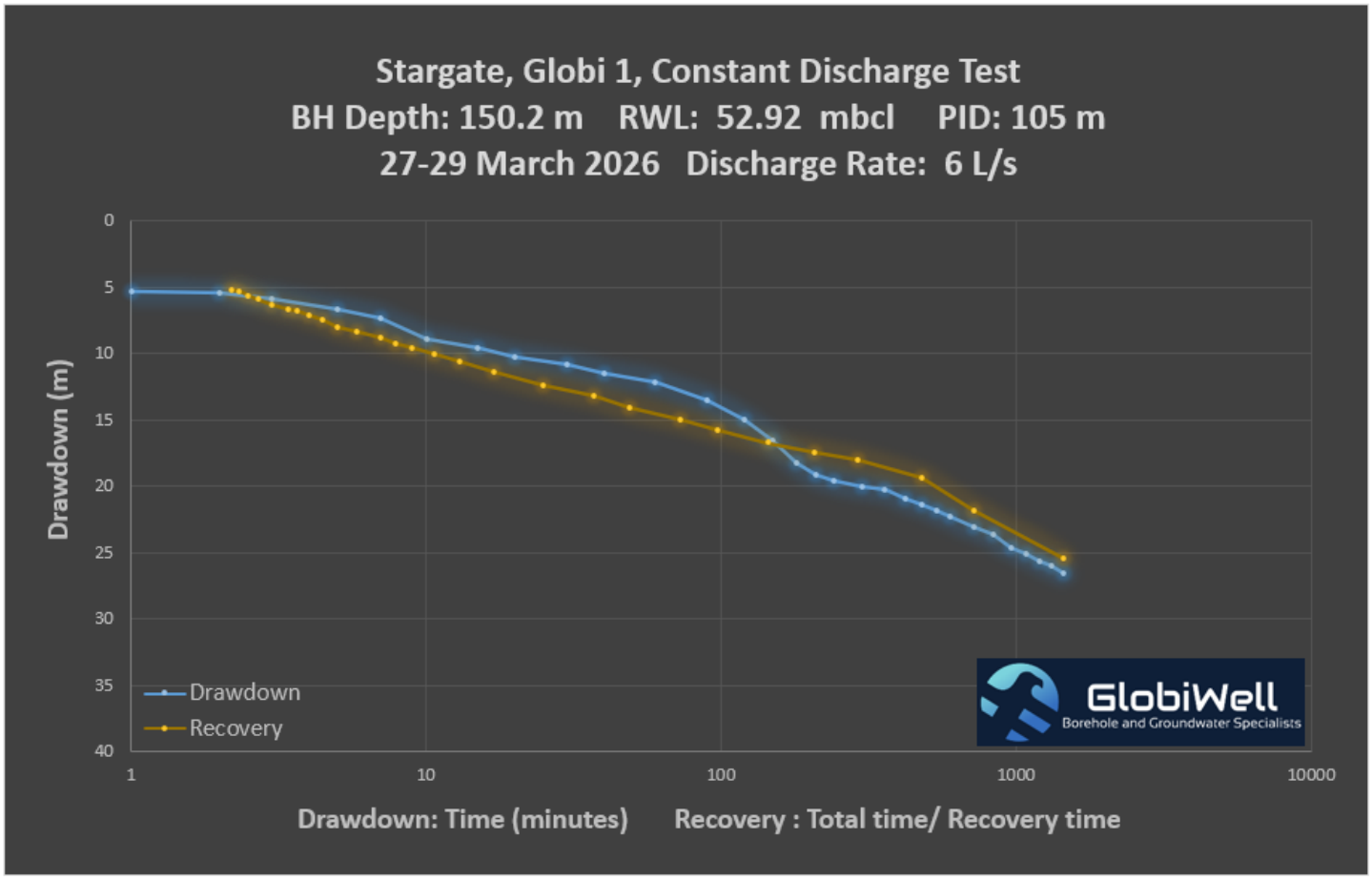
The field data was graphed and is shown below.

Graph: Step Test Data. The x-axis which plots time duration is represented in log format. The y-axis shows the drawdown/recovery in meters. Zero drawdown is equal to the rest water level, prior to testing (52.92 meters below ground level). During the step test the borehole was pumped for 4 hours, after each hour the discharge rate was increased; followed by 60 min of recovery readings.



Graph: Constant Discharge Test Data. The results of the constant discharge test are presented in the following graph. The x-axis of the graph represents the time duration and is displayed in a logarithmic format. The y-axis indicates the drawdown and recovery in meters. Notably, the recovery data is plotted in reverse; early recovery measurements appear on the right side of the graph, while later recovery data are shown on the left. The point of zero drawdown corresponds to the rest water level, which was recorded at 52.92 meters below ground level, prior to the commencement of the test.

During the constant discharge test, the borehole was pumped at a steady rate of 6 litres per second for a period of 24 hours. This was immediately followed by 24 hours of recovery measurements. The borehole did not fully recover of the test and 5 m short from full recovery. The data obtained from the constant discharge test was used to determine the aquifer parameters as well as the sustainable pumping yield.



Comment on the data:

- The borehole has a good recovery rate
- Transmissivity: 25 m^2/Day
- No inflection points are identified from the data indicating that the major water strikes are below the maximum drawdown reached in the constant discharge test.

YIELD RECOMMENDATIONS

Table 1: *Borehole Yield Recommendations*

Borehole Information	**Globi 1**
Latitude	-34.090696°
Longitude	23.356360°
Measured depth before pumping (m)	150.2
Borehole casing ID (mm)	~176
Rest water level (mbcl)	52.92
Electrical conductivity (mS/m)	195
Drilling yield (L/s)	12
Yield Recommendations	
Recommended rate (L/s) for 8 hours per day of pumping	4.85
Recommended rate (L/s) for 24 hours per day of pumping	2.8
Maximum amount of water allowed to be abstracted per month (m^3)	7257
Recommended PID & max. pumping water level	
Recommended PID (m)	130
Critical depth that water level must not exceed (m)	85
Pump cut off switch (m)	127
Dynamic water level (mbcl) at 4.3 L/s	68-73
Dynamic water level (mbcl) at 2.5 L/s	60-68

Note:

The borehole did not fully recover after the test pumping; this was considered when recommending the sustainable yield.

The borehole installation depth is 130 m below ground level to reduce iron oxidation at the borehole pump.

Due to the depth of the installation its recommended that the borehole is equipped with Raksha pvc pipes and not HDPE pipe.

BOREHOLE EQUIPPING & MONITORING RECOMMENDATIONS

It is essential to monitor both the static and dynamic water levels of the borehole on a weekly basis. Regular monitoring allows for the early detection of any significant declines in water levels, ensuring that appropriate measures can be taken in a timely manner.

If the recorded water levels fall below the expected static and dynamic values, as outlined in Table 1, it is necessary to contact a hydrogeologist. The hydrogeologist will assess the situation and recommend adjustments to the pumping rates or modify the pump and rest cycles to prevent further decline in water levels and to protect the borehole's integrity. It is also important to note that recovery rates may fluctuate with seasonal changes. These variations can either increase or decrease the available abstraction volumes from the borehole. However, such trends and their effects can only be accurately identified through the collection and analysis of long-term groundwater monitoring data. For effective and sustainable operation of the borehole, long-term groundwater monitoring is recommended. GlobiWell offers support in this regard, assisting in the ongoing monitoring of the borehole to ensure its sustainable use and to maintain the health of the underlying aquifer.

Monitoring and installation:

The borehole should be equipped with:

- HDPE or equivalent piezometer tube with an ID of 35 mm, installed to pump inlet depth.
- Flow meter correctly installed (manufacturers specifications), at the borehole.
- Gate valve with a pressure gauge installed to the borehole manifold.
- A discharge point at the borehole to dispose water when the borehole is operated after rest periods (non-pumping). The water must be pumped to waste until it is clear (to remove iron oxides, sand etc. that may precipitate in the borehole and rising main while standing).
- Install borehole logger to piezo tube to monitor water levels electronically.
- It is recommend that GlobiWell assist with long term monitoring of the groundwater levels to ensure the borehole is being operated in a sustainable manner for many years to come.
- Regular water sampling is advised.
- Water use license application.

Ruan van Jaarsveld, Hydrogeologist, Pr. Sci. Nat, GlobiWell Hydrogeologists

ANNEXURE B

PORTION 59 BRAKKLOOF 443: STORMWATER MANAGEMENT DATA TABLE

CATCHMENT AREAS, PRE-DEVELOPMENT AND POST-DEVELOPMENT FLOWS, ATTENUATION DATA

CATCHMENT AREA No	AREA Ha	PRE DEV FLOW m3/sec		ATTENUATION CONTROL NO	TYPE	POST DEV ATTENUATED OUTFLOW m3/sec		ATTENUATION VOLUME m3		OUTFLOW CONTROLS		
		10 yr	50 yr			10 yr	50 yr	10 yr	50 yr	ORIFACE	WEIR	
											WIDTH	HEIGHT
1	2,819	0,552	1,075	P1	POND	0,076	0,097	331,000	606,00	1 x 240mm	2	1,4
2	7,881	Incl	Incl	P2	POND	0,282	0,703	623,000	1231,00	2 x 240mm	1,3	1,8
3	1,495	Incl	Incl	n/a	n/a	0,140	0,267	n/a	n/a	n/a	n/a	n/a
TOTAL	12,195	0,552	1,075			0,498	1,067	954,000	1837,000			

ANNEXURE C

Alveo Water

Presents a

MBR Wastewater Treatment Plant

For

Plettenberg Bay Retirement Village

March 2026

APPROVALS				
Revision	Date	Issued to	Prepared by	Approved by
0	27/01/2026	Peter Becker	B. Aspeling	M. de Villiers

ALVEO WATER

Disclaimer

Table of Contents

1 INTRODUCTION

This document provides a technical description of the proposed 80kl/day Containerised Membrane Bioreactor (MBR) Wastewater Treatment Plant (WWTP) to be constructed at the Plettenberg Bay Retirement Village, Western Cape. It is prepared to support the Environmental Impact Assessment (EIA) and Water Use Licence Application (WULA) processes as required under the National Environmental Management Act (NEMA, Act 107 of 1998) and the National Water Act (NWA, Act 36 of 1998).

The proposed plant will treat all domestic sewage effluent generated by the retirement village development to the General Limits prescribed by the Department of Water and Sanitation (DWS). The treated effluent is planned for discharge to the environment, with overflow piping to a watercourse to be provided by others.

The plant will be designed, manufactured, and commissioned by Alveo Water (Pty) Ltd, a specialist South African water and wastewater treatment company. The Containerised MBR solution is a compact, space-efficient, and low-odour system well suited to residential developments and sensitive environments.

2 REGULATORY CONTEXT AND DESIGN STANDARDS

The wastewater treatment plant has been designed to comply with the general effluent discharge requirements set by the Department of Water and Sanitation (DWS) under South African legislation.

2.1 Design Influent Quality

No site-specific wastewater sample analysis was available at the time of design. The plant design is therefore based on typical medium-strength domestic wastewater influent parameters as tabulated below. Actual influent quality shall be confirmed during commissioning.

Table 1: Wastewater influent quality assumption

Parameter	Maximum Value
Influent COD (mg COD/l)	800
Influent BOD (mg BOD/l)	350
Influent TKN (mg N/l)	50
Influent Total Phosphorus (mg P/l)	12
Total Suspended Solids (mg TSS/l)	400
Ammonia (mg/l as NH_4)	35
FOG (mg/l)	30
Alkalinity as $CaCO_3$	250 - 300

2.2 Required Effluent Quality (Discharge Limits)

The plant is designed to treat the wastewater to the DWS General Limits to allow discharge to the environment. The required effluent quality parameters are summarised in Table 2 below.

Table 2: General Discharge Limits

Parameter	General Limit
COD (mg COD/l)	75
Ammonia as Nitrogen (mg N/l)	6
Nitrate as Nitrogen (mg N/l)	15
Orthophosphates (mg P/l)	10
Total Suspended Solids (mg TSS/l)	25
pH	5.5 – 9.5

Faecal Coliforms (CFU per 100ml)	1000
Free Chlorine (mg/l)	0.25
FOG (mg/l)	2.5

3 TECHNOLOGY OVERVIEW: MEMBRANE BIOREACTOR (MBR)

The proposed treatment technology is a Containerised Membrane Bioreactor (MBR), which combines biological wastewater treatment with advanced membrane microfiltration. This represents a significant advancement over conventional activated sludge (CAS) systems and is particularly well suited for sensitive receiving environments such as the one proposed at Plettenberg Bay.

3.1 Conventional Activated Sludge (CAS) vs MBR

Conventional Activated Sludge (CAS) systems use naturally occurring bacteria to biologically degrade organic matter in wastewater. The three functional bacterial zones employed in both CAS and MBR systems are:

- Anaerobic bacteria: Active in the buffer/anaerobic zone; digest organic matter in the absence of oxygen, reducing COD by approximately 20%.
- Anoxic bacteria: Active in the anoxic chamber; convert nitrate through denitrification to release nitrogen gas (N_2).
- Aerobic bacteria: Active in the aeration chamber; oxidise residual organic compounds and convert ammonia to nitrate (nitrification).

MBR technology enhances this biological process by coupling it with physical microfiltration membranes. This delivers two key advantages over CAS alone: firstly, effluent quality is largely independent of influent variability; and secondly, the concentration of active biomass can be maintained up to four times higher than in a conventional plant, resulting in a significantly smaller footprint with superior treatment performance.

3.2 Containerised System Design

Alveo Water's Containerised MBR WWTP houses all mechanical and electrical plant equipment within converted standard shipping containers positioned above an underground reinforced concrete buffer tank. This configuration provides the following environmental and operational benefits:

- Noise attenuation: All mechanical equipment (blowers, pumps) is enclosed within the containers.
- Odour control: The bioreactor tanks are fully enclosed HDPE vessels with sealed manhole lids. All inlet screening areas are fitted with rubber-lined GRP covers to contain odorous air. An optional odour extraction and scrubbing system is available should a fully odour-free installation be required.
- Compact footprint: The entire plant, including the bioreactor and equipment room, fits within a standard 12-meter shipping container footprint.
- Aesthetic integration: The containerised form is suitable for residential estates and is visually unobtrusive compared to open civil treatment works.
- Decentralised operation: The system is designed for remote, decentralised deployment with optional remote monitoring capability via a PLC/HMI and EWON communication module.

4 TREATMENT PROCESS DESCRIPTION

The following sections describe each stage of the wastewater treatment process in detail, from raw sewage collection through to final effluent discharge. The treatment train comprises five principal stages: sewage collection and conveyance, primary treatment (biological), secondary treatment (membrane filtration and disinfection), and sludge handling.

4.1 Sewage Collection and Conveyance (by others)

All raw domestic sewage from the retirement village development drains by gravity via the reticulation network to the inlet works of the wastewater treatment plant. The gravity sewer network and all conveyance infrastructure to the plant inlet channel are the responsibility of the client and fall outside the scope of Alveo Water's supply. The inflow enters the treatment plant through an inlet works channel, which houses the primary screening equipment described below.

4.2 Preliminary Treatment: Screening and Flow Equalisation

4.2.1 Coarse and Fine Bar Screens

Incoming raw sewage passes through a series of mechanically raked bar screens to remove coarse and medium-sized non-biodegradable solid material that could otherwise damage downstream equipment or foul the membranes. The screening sequence is as follows:

- 20 mm aperture coarse bar screen: The first stage of screening, removing large solids such as rags, plastics, and other debris by manual raking.
- 10 mm aperture medium bar screen: A second manual rack screen providing intermediate-level solids removal.
- 6 mm basket screen: Installed on the submersible buffer pump intakes to provide further in-line protection.
- 3 mm parabolic (wedge-wire) screen: A fine screen installed after the buffer tank on the pump discharge line. This screen is mounted on the roof of the container in the standard configuration.

Screened solids are deposited onto a drip tray to drain and are collected periodically for disposal as solid waste.

4.2.2 Buffer/Flow Equalisation Tank

A 39 kL underground reinforced concrete buffer tank receives the screened influent and performs two critical functions:

- Flow equalisation: Domestic sewage flows are highly variable throughout the day, with peak flows typically two to three times the average daily flow. The buffer tank absorbs these peak flows and delivers a constant, controlled flow rate to the downstream biological reactors via submersible buffer pumps (duty/standby configuration). This protects the biological system from hydraulic shock loads.
- Preliminary sedimentation and grease separation: The dual-baffled design of the buffer tank promotes gravity settling of heavy grit and suspended solids in the first compartment, while a second baffle prevents floating oily material (FOG) from passing through to the bioreactor. The first section of the buffer tank requires suctioning clean every 6 to 12 months, depending on influent conditions.

In certain configurations, the buffer tank can additionally be operated as an anaerobic pre-treatment zone by maintaining a minimum liquid level to sustain an anaerobic bacterial community. This further reduces the organic load (COD) entering the bioreactor.

4.3 Primary Treatment: Biological Reactor (Anaerobic/ Anoxic/ Aerobic zone)

The biological treatment process consists of three sequentially integrated zones housed within HDPE tanks inside the shipping container. Together these zones achieve organic carbon removal, nitrification, and denitrification.

4.3.1 Phase 1_ Anaerobic Zone (Buffer Tank)

Where the buffer tank is configured as an anaerobic zone, a maintained minimum liquid level retains an active anaerobic bacterial population. These bacteria digest organic matter in the complete absence of dissolved oxygen, breaking down complex organic compounds and reducing the influent COD by approximately 20% before the wastewater enters the anoxic zone. This reduces the oxygen demand on the downstream aeration system.

4.3.2 Phase 2_ Anoxic Zone

Screened wastewater from the buffer tank enters the anoxic zone at the average daily flow rate. This zone is maintained in a low-oxygen, nitrate-rich environment by the return of nitrate-laden

mixed liquor from the aerobic zone via the Returned Activated Sludge (RAS) recycle pump. The primary biochemical process in this zone is denitrification: anoxic bacteria use the oxygen bound in nitrate (NO3) as an electron acceptor, reducing nitrate through nitrite to nitrogen gas (N_2), which is released to atmosphere. This process simultaneously consumes residual carbon from the influent. Mixing is maintained by submerged jet nozzles or vertical shaft mixers at the RAS discharge point.

4.3.3 Phase 3 Aerobic Zone

The aerobic zone receives mixed liquor from the anoxic zone and provides the oxygen-rich environment required for two key biological reactions:

- Carbonaceous BOD removal: Aerobic heterotrophic bacteria oxidise remaining dissolved organic compounds to carbon dioxide (CO_2) and water, completing the removal of BOD and COD initiated in the anaerobic and anoxic zones.
- Nitrification: Autotrophic nitrifying bacteria (Nitrosomonas and Nitrobacter) oxidise ammonia (NH_3) first to nitrite and then to nitrate (NO_3^-) in a two-step process. Adequate pH and alkalinity must be maintained to support this reaction.

Fine-bubble membrane diffusers located at the base of the aerobic tank deliver both the dissolved oxygen required for aerobic metabolism and the upward mixing energy needed to maintain the biomass in suspension. The aerobic zone is operated as a Mixed Liquor Suspended Solids (MLSS) system, with MLSS concentrations in an MBR plant typically maintained at 8 000 to 12 000 mg/l — significantly higher than the 2 000 to 4 000 mg/l typical of a conventional CAS plant. This elevated MLSS concentration enables a smaller reactor volume and superior treatment performance.

4.4 Secondary Treatment: Membrane Filtration and Disinfection

4.4.1 MBR Membrane Filtration

In a conventional CAS plant, separation of treated water from the activated sludge biomass is achieved by gravity settling in a secondary clarifier. This process is subject to variability and can result in solids carryover to the final effluent in the event of settling upsets. In the MBR system, physical separation is achieved through submerged flat-sheet ultrafiltration membranes with pore sizes smaller than 0.04 micron.

The membranes are arranged in cassettes housed in stainless-steel support frames within the aeration tank. Treated permeate water is drawn through the membrane surfaces by suction applied by the permeate pumps (duty/standby configuration). The activated sludge biomass and all suspended solids are retained on the feed side of the membranes and remain within the biological reactor.

A dedicated MBR scour blower provides intermittent coarse-bubble aeration beneath the membrane cassettes. This scouring action keeps the membrane surfaces clean by creating turbulence that dislodges accumulated biofilm and prevents irreversible fouling. Periodic Chemical-in-Place (CIP) cleaning using citric acid and sodium hypochlorite solutions is performed by the service team to maintain membrane flux performance over the long term.

A recycle pump returns a portion of the concentrated mixed liquor from the membrane zone back to the anoxic zone, maintaining the required RAS ratio and ensuring denitrification efficiency. If phosphorus removal is required, a coagulant (e.g. ferric chloride or aluminium sulphate) can be dosed into the mixed liquor to precipitate dissolved phosphate onto the activated sludge. The phosphorus-laden sludge is then removed during the waste activated sludge (WAS) process.

4.4.2 Disinfection

The permeate leaving the membrane filtration system has already achieved very high levels of pathogen removal as a result of the physical barrier provided by the membranes. Final disinfection is achieved through a two-stage advanced oxidation process to ensure compliance with the DWS General Limits for faecal coliforms and free chlorine:

- Chlorination: An automated sodium hypochlorite dosing pump injects a controlled dose of chlorine into the permeate stream. The chlorine provides residual disinfection and suppresses regrowth of pathogens in the effluent storage or conveyance system.
- UV irradiation: The chlorinated permeate passes through an in-line ultraviolet (UV) irradiation unit.

The final treated effluent meets or exceeds the DWS General Limits as outlined in Table 2 of this document.

4.5 Sludge Treatment and Disposal

Biological treatment produces Waste Activated Sludge (WAS) as a by-product of the bacterial growth process. Sludge must be periodically removed from the system to maintain the target

MLSS concentration in the reactor. The WAS pump (shared with the RAS recycle pump via a manual three-way valve diversion) transfers excess sludge to a sludge thickening silo, where the biomass is allowed to gravity-settle and thicken before discharged to the sludge drying beds.

5 PLANT COMPONENTS SUMMARY

The complete mechanical, electrical, and civil scope of the Containerised MBR WWTP is summarised below. All components are designed, manufactured, integrated, installed, and commissioned by Alveo Water.

5.1 Mechanical and Process Equipment

- 20 mm coarse front-rake bar screen
- 10 mm medium front-rake bar screen
- 6 mm basket screens on submersible buffer pumps
- Buffer pumps (duty/standby) with duckfoot bends, guiderails, isolation and non-return valves
- 3 mm aperture parabolic (wedge-wire) fine screen
- Vertical shaft mixers and/or jet mixing nozzles (anoxic zone)
- Fine-bubble membrane diffuser discs with PVC distribution pipework (aerobic zone)
- Submersible A-recycle (RAS) pump with non-return valve and pump stand
- MBR flat-sheet membrane cassettes in stainless-steel support frames
- Aeration blower with non-return valves, intake filters, discharge manifolds, and pipework
- MBR scour blower (coarse bubble) with non-return valves, intake filters, and pipework
- Permeate pumps (duty/standby) with non-return valves and stainless-steel fittings
- WAS/RAS combined pump with three-way manual diversion valve
- Sludge thickening silo with associated pipework
- Automated sodium hypochlorite dosing pump and storage tank
- In-line UV disinfection unit
- Flow measurement system (calibrated water meter)
- Pressure measurement (gauges and transducers)
- Level control float switches in all process chambers
- All process pipework: minimum Class 9 uPVC or PN 10 HDPE; fittings minimum PN 16 uPVC; blower outlet pipework in Grade 316 dairy stainless steel

5.2 Electrical and Control Equipment

- IP-55 rated main control panel (MCC) with signage and emergency stop
- Siemens Programmable Logic Controller (PLC) for automated process control
- Human Machine Interface (HMI) touchscreen for local operator control and process visualisation
- Overload and phase-failure protection on all motors
- Dry-run protection on all pumps via level float switches
- EWON remote monitoring module (optional; mandatory if Alveo Water operates the plant)

5.3 Civil Works

The following underground and surface civil structures are required to complete the installation:

- Inlet channel for screening equipment
- 40 kL underground waterproof reinforced concrete buffer sump with double baffle wall
- Concrete plinths for container placement
- Concrete platform for sludge thickening silo, dewatering equipment, treated water storage tank, and standby generator (where applicable)
- Sludge drying beds

5.4 Electricity consumption

The table below summarises the anticipated electrical power requirements for the plant, based on a 23-hour daily operating period. These values are preliminary and may be refined following detailed design.

Table 3: Electricity Consumption

Electricity Consumption for 20kℓ/day MBR Plant			
Section	Description	Installed kW	kW.h per day
	POWER REQUIREMENT FOR MBR WWTP (400V)		
1	Buffer Pumps	2 x 0.5	6.75
2	Anoxic Mixers	None	0
3	RAS Pump	1 x 0. 5	9
4	Permeate Pump	2 x 0.75	13
5	Aeration Blower	1 x 3	64.8

6	Scour Blower	1 x 4	86.4
7	CIP Pump (temporary equipment for service team)	1 x 0.75	0.02
8	UV Light/Dosing pumps/Sludge drying	0.5	2.4
Total		**12**	**186**

6 CONCLUSION

The proposed 80 kL/day Containerised MBR Wastewater Treatment Plant represents a technically robust, environmentally appropriate, and operationally reliable solution for managing the domestic wastewater generated by the Plettenberg Bay Retirement Village development.

The MBR technology delivers consistently high effluent quality that meets or exceeds the DWS General Limits for discharge to a watercourse, regardless of influent variability. The containerised configuration minimises the environmental footprint of the installation, provides effective noise and odour containment, and is visually suitable for integration into a residential estate setting.

This document has been prepared to provide the EIA and WULA application process with a clear and comprehensive description of the proposed treatment process and its key components. All required regulatory authorisations, including the Environmental Authorisation (EA) under NEMA and the Water Use Licence (WUL) under the NWA, remain the responsibility of the client and fall outside the scope of Alveo Water's supply.

PORTION 59

PORTION 63

PORTION 62

443/63

443/20

MATCH

12m BUFFER

5m FIREBREAK

WHALE ROCK DRIVE

RESERVOIR MAINTENANCE

225 Kl

COMMUNITY BUILDINGS

REFUSE

GH

PARKING

TRAPEZ. DRAIN

SW SWALE

DET. POND P1

DET. POND P2

ENERGY DISSIPATION OUTLET

15m GREENBELT

EXISTING NON PERENNIAL STREAM

service block 200m2

AMPHITHEATRE

wetland

GRASSED OVERFLOW PARKING 130 cars

CARPARK 220 cars

ENTRANCE

stp

DET. BERM

DISS. OUTLET

ACCOMODATION UNITS/RETAIL/ CULTURAL MUSEUM/ AREA

stream

BUFFER

5m road

5.5m road

6m road

Ø375

Ø300

Ø450

Ø600

Y -32850

X 3774150

-33750

Y

X

N

DETENTION POND DATA

DET. POND	P1	P2
TOP OF WALL	93.00	71.10
INVERT LEVEL	91.40	68.70
WER LEVEL	92.70	70.60
CAPACITY	700m3	1300m3

LEGEND:

- ROADWAYS – WIDTH AS SHOWN
- PROPOSED STORMWATER PIPES
- STORMWATER MANHOLE
- GRID INLET
- STORMWATER HEADWALL
- GRASSED TRAPEZOIDAL DRAIN
- STORMWATER SWALE (SW SWALE)
- POND CONTROL OUTLET
- POND DISSIPATION OUTLET
- STORMWATER DETENTION BERM
- BERM DISSIPATION OUTLET

NOTES : ROADS.

1. ROAD SETTING OUT TO BE IN ACCORDANCE WITH THE DIMENSIONS AND COORDINATES INDICATED ON DRAWING.
2. ALL IMPORTED MATERIAL TO BE TO SPECIFICATION, MATERIAL CLASSIFICATION, CBR AND UCS TESTS TO BE PROVIDED.
3. KERBING, LAYERWORKS AND SURFACING TO BE CONSTRUCTED TO SABS 1200 SPECIFICATIONS. LEVEL TOLERANCES SHALL BE TO DEGREE OF ACCURACY 'S'.
4. ALL ROAD LEVEL INDICATED EQUALS FINISHED ROAD SURFACE LEVELS.
5. COMPACTION TESTS:
   TESTING OF COMPACTION AND MATERIALS SHALL BE UNDERTAKEN AT THE FOLLOWING RATES OF FREQUENCY:
   - FIELD DENSITY TESTING: 1 TEST FOR EVERY 150m² FOR EACH LAYER. A MINIMUM OF 3 TESTS SHALL BE TAKEN PER LOT OF DAYS WORK. CALIBRATION OF TESTING EQUIPMENT MUST BE CERTIFIED BY AN INDEPENDENT LABORATORY.
   - MOD AASHTO DENSITY: 3 TESTS FOR EVERY 500 CUBIC METERS OF SIMILAR MATERIAL
   - NATURAL CBR AND INDICATOR TESTS: 1 TEST FOR EVERY 500 CUBIC METERS OF SIMILAR MATERIAL

NOTES : STORMWATER

1. ALL CONSTRUCTION AND MATERIALS TO BE IN ACCORDANCE WITH SABS 1200 SPECIFICATIONS.
2. ALL CONCRETE STORMWATER PIPES TO BE SOCKET JOINTS AND RUBBER RING TYPE, CLASS 100D UNLESS OTHERWISE SHOWN.
3. PIPE BEDDING TO BE TO SABS 1200 LBI – CLASS C
4. ALL KERB INLETS AND MANHOLES TO BE STANDARD PROJECT DETAILS.
5. CONTRACTOR TO ACQUIRE ALL NECESSARY WAYLEAVES PRIOR TO CONSTRUCTION OF EXTERNAL WORKS.

REV.	DESCRIPTION	DATE
C	PORTION 62 LAYOUT REVISIONS	13 04 26
B	LEGEND REVISIONS	11 03 26
A	ISSUED FOR EIA REPORT	24 11 25

DESIGN BY: D BOTES Pr Tech Eng — CELL:

POISE

STRUCTURAL- & CIVIL CONSULTING ENGINEERS

CAPE TOWN
103 RODDEBLOEM RD
CAPE TOWN
8001
021 422 0822

GARDEN ROUTE
26 PACHENA POINT DR
PLETTENBERG BAY
6600
044 533 9087

SOUTH AFRICA
ENGINEERING@POISE.CO.ZA
WWW.POISE.CO.ZA

Client: STARGATE INNOVATIONS PTY LTD

Project: PORTION 59 OF FARM BRAKKLOOF 443

Description: ROADS AND STORMWATER LAYOUT

JOB No.	DRW No.	REV.	DATE
25/G/141	R01	C	13 04 2026

NOTES : SEWER

1. SEWERS TO BE 160mm uPVC CLASS 400.
2. MINIMUM COVER TO SEWER TO BE 1,2m UNDER ROADS, 0,90m ELSEWHERE, UNLESS OTHERWISE SPECIFIED ON PLAN OR LONGITUDINAL SECTIONS.
3. PIPE BEDDING TO BE IN ACCORDANCE WITH S.A.B.S. 1200 LB DETAIL LB2 (FOR FLEXIBLE PIPE)
4. ALL CONSTRUCTION TO BE TO SABS 1200 SPECIFICATIONS
5. CONSTRUCTION DETAILS TO BE IN ACCORDANCE ISSUED CONTRACT DETAILS
6. ALL PIPES TO BE PRESSURE TESTED IN ACCORDANCE WITH SABS 1200D

NOTES : WATER

1. WATERMAINS TO BE CLASS 12 UPVC WITH Z-LOK COUPLINGS
2. ERF CONNECTIONS TO BE CLASS 10 HDPE WITH PLASSON OR SIMILAR FITTINGS
3. MINIMUM COVER TO WATERMAINS TO BE 900mm
4. COVER TO ERF CONNECTION LEADERS TO BE 700mm, 900mm UNDER ROAD SURFACES
3. PIPE BEDDING TO BE IN ACCORDANCE WITH S.A.B.S. 1200 LB DETAIL LB2 (FOR FLEXIBLE PIPE)
4. ALL CONSTRUCTION TO BE SABS 1200 SPECIFICATIONS
5. FIRE HYDRANT COUPLINGS TO COMPLY WITH LOCAL AUTHORITY STANDARD SPECIFICATION
6. GATE VALVES TO BE PIV TO SABS 664, ANTICLOCKWISE CLOSING WITH NON RISING SPINDLE, FLANGED
5. CONSTRUCTION DETAILS TO BE IN ACCORDANCE WITH ISSUED CONTRACT DETAILS
6. PIPES TO BE TESTED IN ACCORDANCE WITH SABS 1200D

LEGEND:

- #160 CLASS 400 UPVC SEWER
- SEWER MANHOLE
- CLASS 12 UPVC WATERMAIN
- GATE VALVE
- FIRE HYDRANT

N

Y -32850
X 3774150

PORTION 63
PORTION 62
PORTION 59
443/63
443/74

A
FILTRATION PLANT
BOREHOLE
325 Kl RESERVOIR
MAINTENANCE
REFUSE
COMMUNITY BUILDINGS
PARKING
DET. POND
WHALE ROCK DRIVE
12m BUFFER
5m FIREBREAK
30m BUFFER
MATCH
Ø160 SEWER OUTFALL
service block
wetland
"AMPHITHEATRE"
SEWERAGE TREATMENT PLANT
CARPARK
ACCOMODATION UNITS/RETAIL/ CULTURAL MUSEUM AREA
12m GREENBELT

scale 1000A0

REV	DESCRIPTION	DATE
A	PORTION 62 LAYOUT REVISED	14.04.26
A	ISSUED FOR DA REPORT	31.07.26

DESIGN BY: D BOTES Pr Tech Eng — CELL:

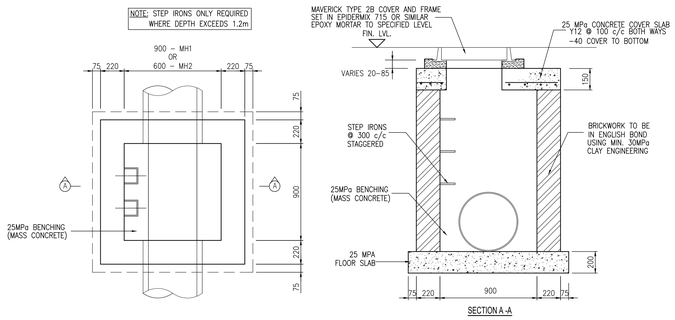
Client: STARGATE INNOVATIONS PTY LTD

Project: PORTION 59 OF FARM BRAKKLOOF 443

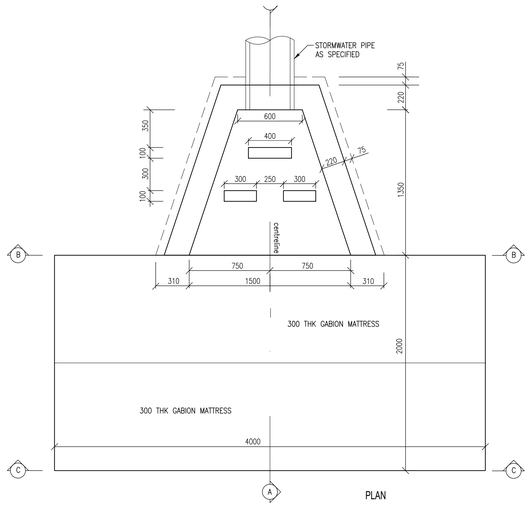
Description: SEWER AND WATER RETICULATION LAYOUT

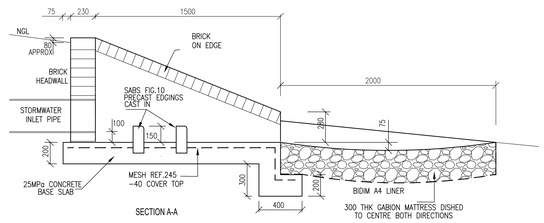
POISE
STRUCTURAL- & CIVIL CONSULTING ENGINEERS
CAPE TOWN
103 RODDEBLOEM RD
CAPE TOWN
7405
021 422 0822
4600
GARDEN ROUTE
26 PACHENA POINT DR
PLETTENBERG BAY
6600
044 533 2087
SOUTH AFRICA
ENGINEERING@POISE.CO.ZA
WWW.POISE.CO.ZA

JOB No	DRW No	REV	DATE
25/G/141	S01	B	14 04 2026



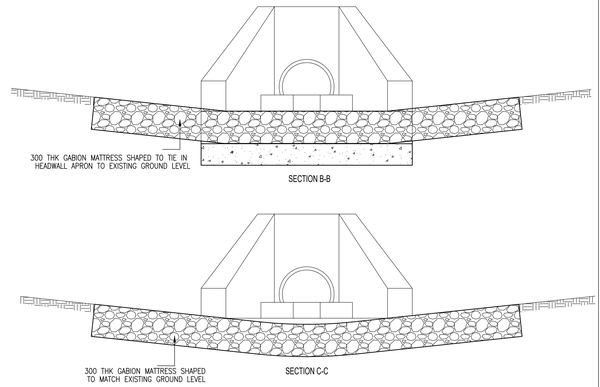
STORMWATER MANHOLE DETAIL MH

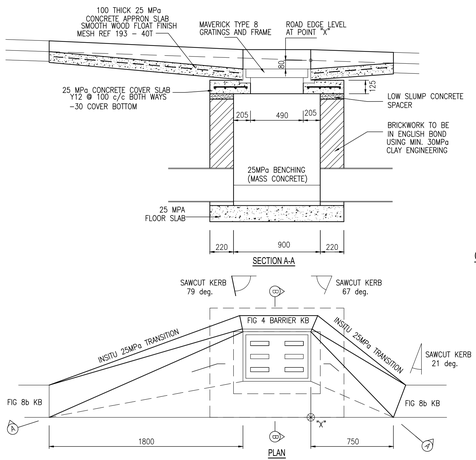




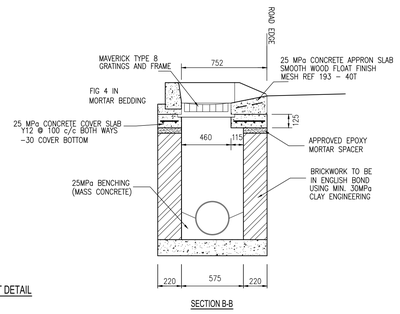
1. THE MATERIAL FOR A DEPTH OF 150mm UNDER THE APRON SLAB MUST BE COMPACTED TO A MINIMUM DENSITY OF 90 % OF THE MOD. AASHTO DENSITY.
2. ALL CONCRETE TO BE 25MPa
3. Min. 30Mpa ENGINEERING CLAY BRICKS,FLUSH JOINTED.

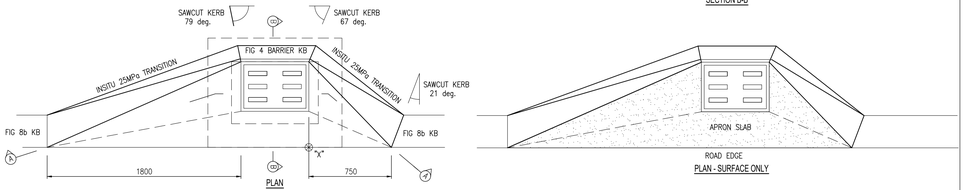
DETENTION POND OUTLET HEADWALL DETAIL

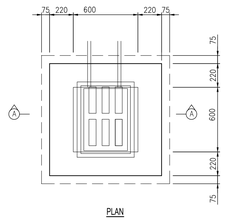


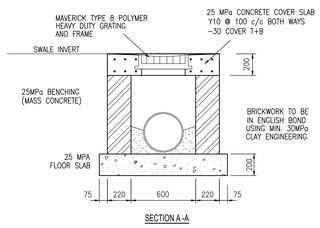


GRID INLET DETAIL

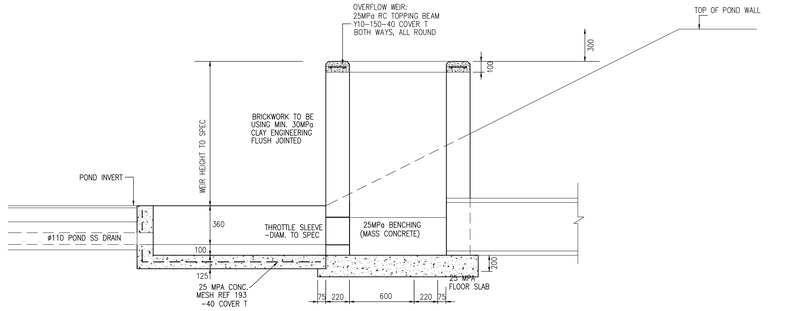


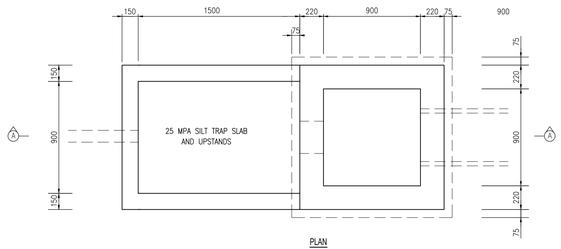




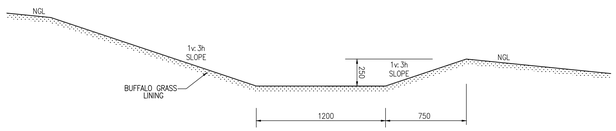


SWALE GRID INLET DETAIL

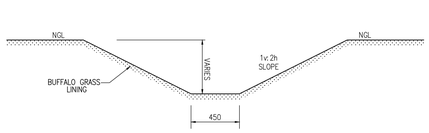




DETENTION POND POND OUTLET MANHOLE DETAIL



TYPICAL SECTIION: STORMWATER SWALE



TYPICAL SECTIION: TRAPEZOIDAL DRAIN

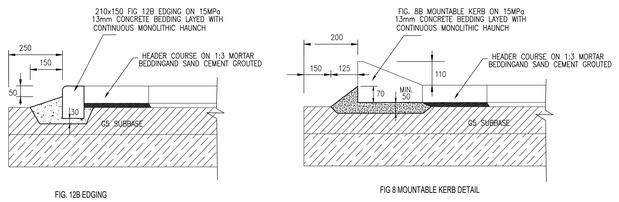
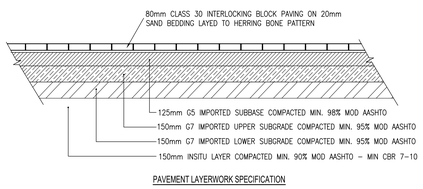
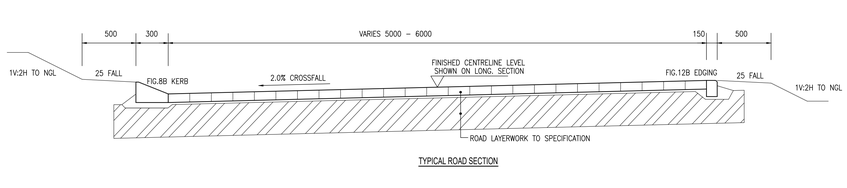


FIG. 12B EDGING

FIG 8 MOUNTABLE KERB DETAIL



PAVEMENT LAYERWORK SPECIFICATION



TYPICAL ROAD SECTION

REV	DESCRIPTION	DATE
A	ISSUED FOR EIA REPORT	13 03 26

DESIGN BY: D WATES Pr T Eng CELL:

Client: STARGATE INNOVATIONS PTY LTD

Project: PORTION 59 OF FARM BRAKKLOOF 443

Description: ROADS AND STORMWATER DETAILS

POISE
STRUCTURAL- & CIVIL CONSULTING ENGINEERS
CAPE TOWN
103 RODDEBLOEM RD
CAPE TOWN
7405
021 422 0822
6600
GARDEN ROUTE
26 PACHENA POINT DR
PLETTENBERG BAY
6633
044 533 9057
SOUTH AFRICA
ENGINEERING@POISE.CO.ZA
WWW.POISE.CO.ZA

JOB No	DRW No	REV	DATE
25/G/141	R02	A	13 03 2026